



# INFRASTRUCTURE

A showcase of the most interesting projects from around the world, proudly presented by:



The *Infrastructure100* is a publication of Infrastructure Journal and Emap Ltd located at Greater London House, Hampstead Road, London NW1 7EJ.  
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It is published in association with KPMG International.

The publication was researched by John Kjorstad, Sabrina Kernbichler, Yoann Rey and Muhabbat Mahmudova with additional insight provided by professionals from KPMG's Global Infrastructure practice, *MEED*, *Construction News*, *New Civil Engineer* and *The Architect's Journal*. It was edited by Angus Leslie Melville, John Kjorstad and Gaurav Sharma. Marketing and management support was provided by Kate Algar, Ada Neylan and Daniella Carneiro Nicklin. Design and layout by Kelly Lowe and Joanne Jones.

**Publication Date:** June 2010

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The concept of the *Infrastructure100* is a simple one.

We are living through an age of unprecedented investment in infrastructure around the world. It is vital to long-term economic growth and to some of the greatest global challenges of today, such as meeting energy demand, coping with the impact of urbanisation, and providing for an aging population. In many ways, the infrastructure projects of today are shaping the world of future generations.

Yet, as an industry, we do not spend enough time explaining ourselves or celebrating the full diversity of ambition and achievement in what we do.

The aim of this publication is to showcase one hundred examples of the great work that is underway globally in infrastructure. We hope that the *Infrastructure100* will make industry professionals proud of the work they do and, for those less familiar with the world of infrastructure, it may inform, or even inspire.

This is not an “awards” publication, although we have sought the help of a distinguished group of judges to help select the 100 projects from the many hundreds nominated. Also, we have selected one project from each sector to examine in greater detail.

The conclusions are intended to provoke discussion. The judges have considered projects of many different sizes, across different markets, at different stages of realisation. Inevitably, this has led to lengthy debates. This has been a fascinating process, which we at *Infrastructure Journal* and *KPMG* have thoroughly enjoyed hosting.

We would like to thank all the judges who helped make this publication come to life and we hope you enjoy reading about the 100 projects selected.

**ANGUS LESLIE MELVILLE**  
EDITOR  
INFRASTRUCTURE JOURNAL



A handwritten signature in white ink on a blue background, reading "Angus Leslie Melville".

**NICK CHISM**  
PARTNER & GLOBAL HEAD OF  
INFRASTRUCTURE, KPMG



A handwritten signature in white ink on a blue background, reading "Nick Chism".

-  AgriBio Centre for AgriBioscience La Trobe - Australia
-  ARC Trans-Hudson PR Tunnel - USA
-  ARCOSOL TERMESOL - Spain
-  ASAP New Schools - Canada
-  Atotonilco Wastewater Treatment Plant - Mexico
-  Autopistas de La Montaña - Columbia
-  BELB Schools & Facilities - UK
-  Berlin-Brandenburg International Airport - Germany
-  Braga Hospital - Portugal
-  Bridgepoint Hospital P3 - Canada
-  Burj Khalifa - UAE
-  Canada Line Rapid Transit - Canada
-  Cape Wind - Canada
-  Cascade and Chinook Subsea Development - USA
-  Cebu Power Project - Philippines
-  Centro de Rehabilitación Infantil Teletón - Mexico
-  Cidade Administrativa do Estado de Minas Gerais - Brazil
-  Coca Codo-Sinclair Hydropower Plant - Ecuador
-  CRCHUM P3 - Canada
-  Disi Water Conveyance Project - Jordan
-  Dunhuang 10MW PV Project - China
-  EEEL Building University of Calgary - Canada
-  Empire State Building Retrofit - USA
-  Evelyn Grace Academy - UK
-  Falcón Matamoros - Mexico
-  Flamanville 3 - France
-  Four Rivers Restoration Project - South Korea
-  Gate LNG Terminal - Netherlands
-  Gautrain Rapid Rail Link - RSA
-  Golar/Petrobras FLNG - Brazil
-  Gorgon Gas Project - Australia
-  Gotthard Base Tunnel - Switzerland
-  Greater Manchester Waste D.A. PFI - UK
-  Greater New Orleans HSDRRS - USA
-  Green Power Express - USA
-  Guangzhou Television and Sightseeing Tower - China
-  Guangzhou-Shenzhen-Hong Kong Express Link - SAR Hong Kong/China
-  Haneda Airport Expansion - Japan
-  Haramain High Speed Rail - KSA
-  Hidromaule Lircay - Chile
-  Hong Kong-Zhuhai-Macau Bridge - SAR Hong Kong/China
-  Hydro One Smart Grid - Canada
-  IGI Airport Expansion - India
-  IH 635 (LBJ) Managed Lanes P3 - USA
-  Incheon Tidal Power Project - South Korea
-  ITE College West PPP - Singapore
-  Java & Sumatra Transmission Link - Indonesia
-  Jinghu Beijing-Shanghai HSR - China
-  KenGen 280MW Geothermal Project - Kenya
-  Keystone Oil Pipeline Extension - USA/Canada
-  KG-D6 Gas Development & East-West Pipeline - India
-  King Abdullah University of Science & Technology - KSA
-  London Array Offshore Wind - UK
-  London Crossrail - UK
-  London Gateway Port - UK
-  London Olympic Park - UK
-  Long Beach Courthouse P3 - USA
-  M25 Widening PPP - UK
-  Madeira Hydroelectric Complex - Brazil
-  Mafraq-Ghweifat Highway PPP - UAE
-  Metro Cable San Agustín - Venezuela
-  Middle Harbor Redevelopment Project - USA
-  Mundra UMPP - India
-  Nanjing Yangtze Tunnel Crossing - China
-  Nelson Mandela Children's Hospital - RSA
-  Neotel - RSA
-  New Cairo Wastewater PPP - Egypt
-  New Karolinska Solna Hospital - Sweden
-  New Port of Aqaba - Jordan
-  New Royal Adelaide Hospital - Australia
-  New York City Water Tunnel No.3 - USA
-  Next Generation Broadband Network - Singapore
-  NextGen Air Traffic Control System - USA
-  Nhon Hoi International Port - Vietnam
-  Nord Stream Pipeline - Russia/Germany
-  NYU Abu Dhabi Campus - UAE
-  Ontario Wind & Solar Clusters - Canada
-  Panama Canal Expansion - Panama
-  Parc Eolien Taiba Ndiaye - Senegal
-  Parque Eólico Talinay - Chile
-  Pernambuco Prison PPP - Brazil
-  Peru LNG - Peru
-  PNG LNG - PNG
-  Project Mthombo - RSA
-  Qatar-Bahrain Causeway - Qatar/Bahrain
-  R1 Expressway - Slovakia
-  San Luis Potosí University PPP - Mexico
-  Santo Domingo Metro - Dominican Republic
-  São Paulo Ring-Road - RodoAnel Oeste - Brazil
-  Sidra Medical and Research Centre - Qatar
-  Sino-German Friendship Hospital - China
-  St. Petersburg Flood Barrier - Russia
-  TAV - Brazil
-  Turks & Caicos Is. Hospital PPP - Turks & Caicos Is.
-  UAE Nuclear Energy - UAE
-  Université des Métiers d'Artisanat Guadeloupe PPP - Guadeloupe Is.
-  Vattenfall Jämschwalde CCS Plant - Germany
-  Venice MOSE Flood Barrier - Italy
-  Victorian Desalination Plant - Australia
-  Windsor-Essex Parkway / Detroit River Int. Crossing - Canada/USA

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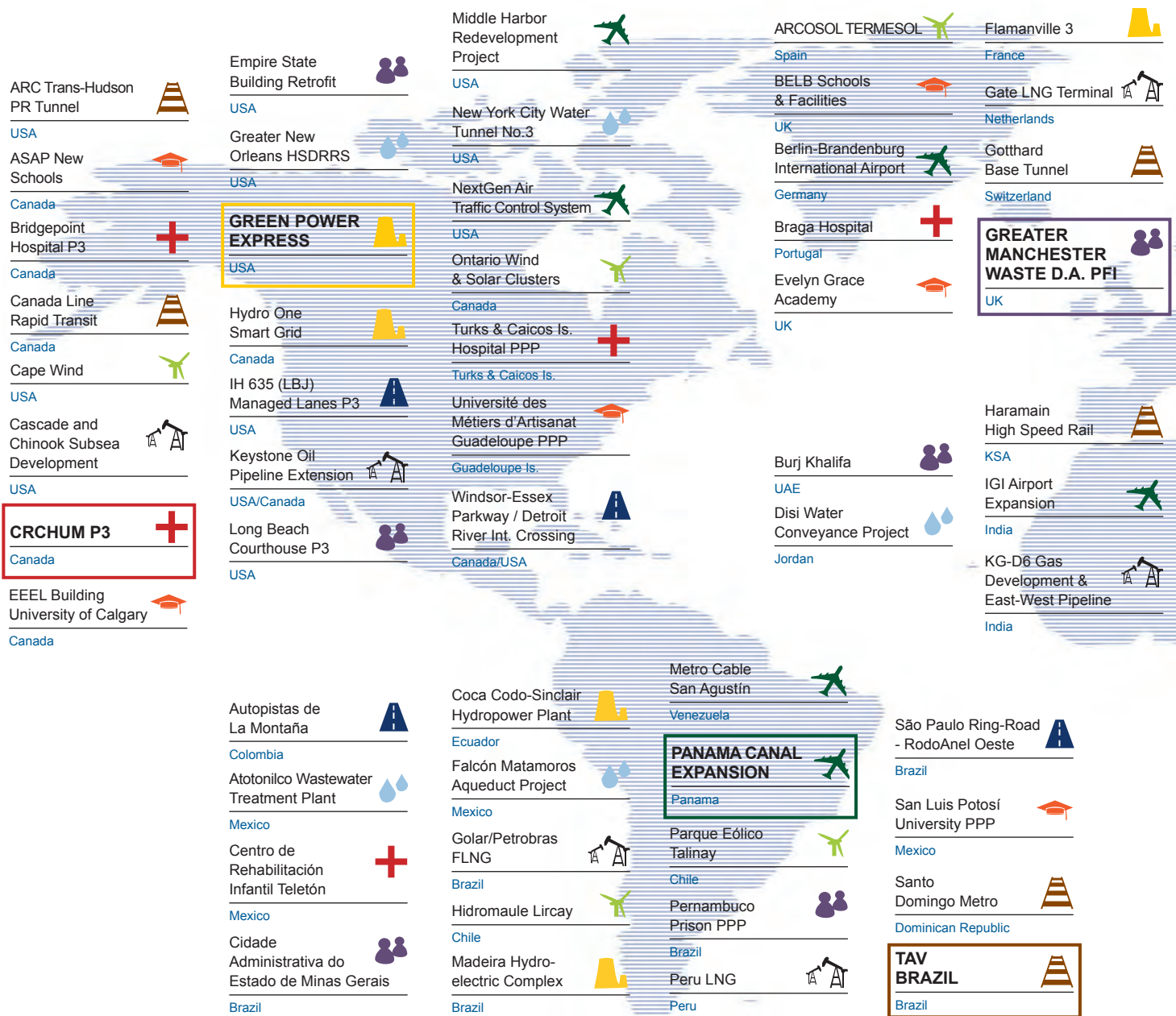
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# The Infrastructure 100



## Scale, feasibility, complexity, innovation and impact on society...

These five objective elements are the core of the criteria used to shape the *Infrastructure 100*.

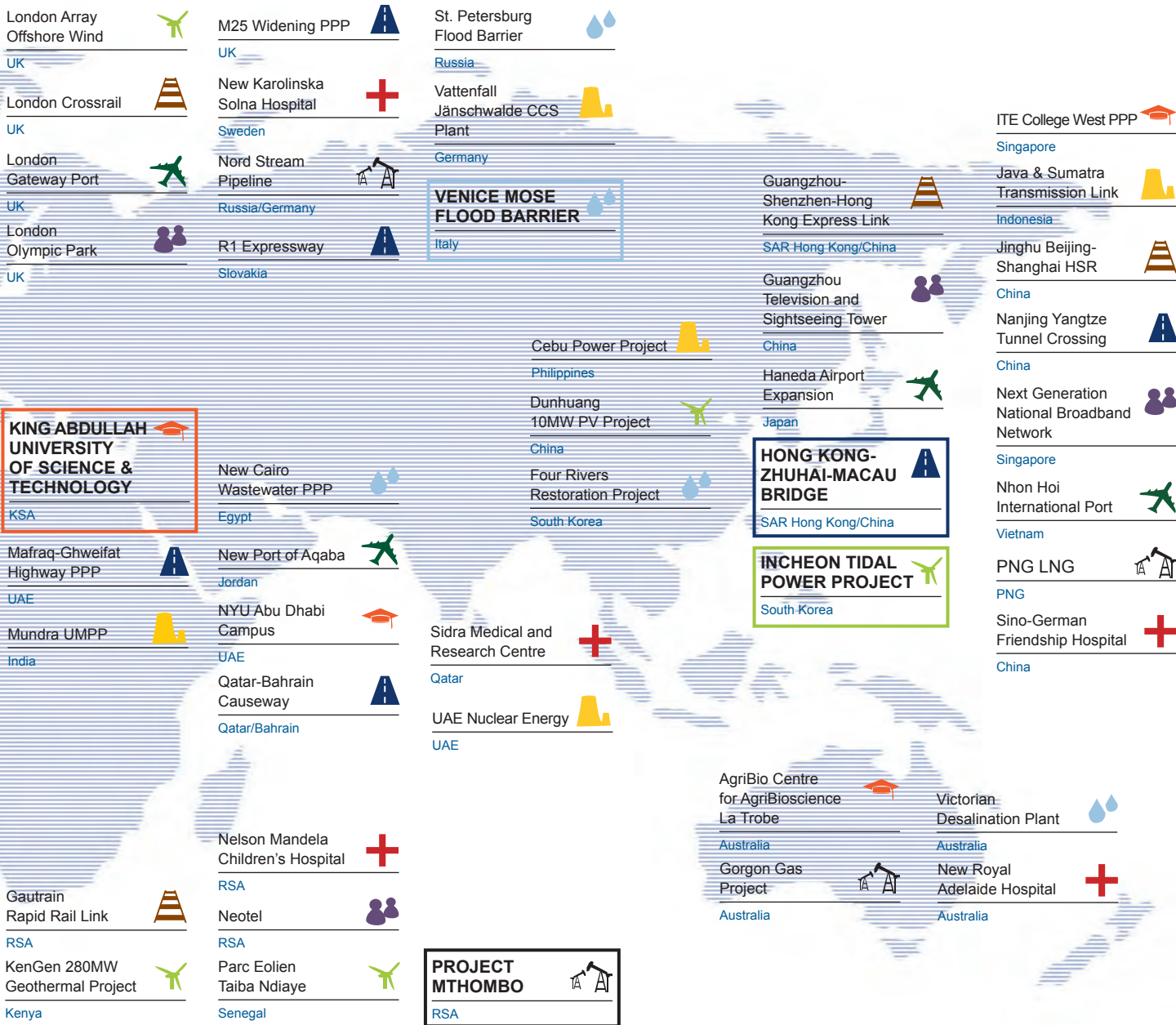
With the help of specialists and professionals from around the world, IJ and KPMG compiled this list through months of research and debate. The end result is a subjective reflection of culture, politics, economics and insight from some of the best minds in architecture, engineering, construction, finance, law, public policy and academia.

This list reveals compelling trends, brilliant design and essential industrial development. I am proud of the diversity reflected here. We imagined the *Infrastructure 100* to have wide geographical and technological representation with

inspirational projects at various stages of development. Our judges delivered just that.

To compile the one hundred, we reached beyond our readership and networks to draw in hundreds of exceptional nominations from people who share a passion for infrastructure. With careful consideration, IJ weighed the merits of each nomination and selected a diverse shortlist to present to our regional judging panels.

It was a daunting and unenviable task. We intentionally asked judges to weigh and debate projects that in many ways cannot be compared like for like. The shortlists often included small, but significant, projects up against widely-publicised mega



projects. These choices were not easy.

Within each sector, judges were asked to measure projects based on our simple criteria points. *Which will have a greater impact on society?* Subjective responses often depended on one's definition of 'impact', the location of the project, and the demands of the society it will serve. Ultimately a final conclusion had to be made and the winners emerged, some with caveats.

Several countries are well represented here – notably the UK and some Middle Eastern Gulf States. Was there a Sterling or Petro-dollar bias? We hope not. If anything, the number of selected projects from these locations emphasizes the strong need for better infrastructure in these locations. It's also a nod to the quality and ambition of the projects currently under development there.

We hope that what you find over the coming pages is a unique snapshot of the world's best infrastructure. In a sense, these projects provide a vision for the future, and reflect the ongoing evolution of our global society.

For more information about the criteria, visit our website [www.infrastructure100.com](http://www.infrastructure100.com).



**John Kjorstad**  
Head of Research & Analysis  
Infrastructure Journal

# Around the World in 100 Projects

## Roundtable discussion with global judging panel

Aspiration, inspiration and execution – this is what we were looking for in the *Infrastructure 100*. The projects that we've identified are all exemplary for different reasons. After concluding the panel debates, we polled the global judges to get more insight from the selection process. We also wanted to hear their views on the present and future state of infrastructure development.

**Q:** What, in your opinion, have we achieved from this process?

**A: Vincent Connor:** The research behind this process identified a number of impressive infrastructure projects around the world on a staggering scale. Many of these are exceptionally well-known on the global stage whereas others are better known in their sectors or particular regions. Capturing and examining them has ensured that all projects are given the 'world class' status they deserve. Furthermore, this process has the essential qualities of fairness and consistency in assessment. IJ's initiative has produced 10 exemplary projects from which procurers, funders, sponsors and advisers around the world may take inspiration for future projects.

**Thomas Barrett:** Over the course of this process, I was really impressed by IJ's procedure of short-listing and the scale of the exercise. Furthermore, what surprises me is the high degree of commonality in the priorities that we have expressed as colleagues on the *Infrastructure 100* judging panel.

**Eddie O'Sullivan:** The discussion was ultimately about what makes a great project and it always came down, time and again, to discussing its broader impact. The subjective was always an element of it – i.e. how people felt about the projects. However, I also have reservations about projects that have not even been started being discussed and compared. Maybe IJ needs to divide this exercise into projects that are complete, projects that are underway and projects that have been conceived. I think some projects nearing completion were snowed by projects that have not been started but are so fantastically impressive that you just have to go for them (e.g. Green Power Express).

**Ricardo De Vecchi (on behalf of Federico Patiño):** During discussions the judges focussed on both - engineering and financial aspects of the projects. The judges looked beyond their own professional remit and focussed on wider aspects of the projects making the process interesting and engaging. However, I also feel that there has to be a distinction between projects which have just been planned, are on the way to completion and or have just reached completion. I say so because I fear that given the nature of the infrastructure business; IJ may end up recognising a project that may (never) be completed.

**Peter Luchetti:** The process provides an important competitive benchmark for everyone involved in the industry

globally about how much is actually being done in an innovative procurement format. The scope and scale of the global effort is very encouraging at a time when there are many challenges involved in moving the infrastructure agenda forward. Being from the US, I found it heartening to view the world through the lens of what's being accomplished elsewhere and this process says so much about what is not being accomplished in the US on a comparative basis.

**Q:** Governments around the world have talked about investing in infrastructure to create jobs during the economic downturn; is that investment happening? If so, what impact has it had; if not, when do you think we will see that investment?

**A: vc:** In an Asian context, investment via government stimulus packages is certainly happening. Jobs have been created and more will have to be. In places like Hong Kong, a skills capacity gap is opening up. Government indecision, prior to the global financial crisis, meant that little was procured. As a result the country now has a glut of projects in the next 10 years, which is putting considerable delivery pressure on procuring authorities themselves to say nothing of contractors tendering for and in many cases, winning railway and other packages. The additional pressure to come may well be funding versus a growing budget deficit. Some equity participation from the private sector would have been helpful but the HK Government remains resolutely unenthused by that model at present.

**TB:** There is a certain amount of artificiality in government debates at least on the European side that "greater government investment leads to more jobs." The time scale of investment and planning, of new infrastructure projects that would not have otherwise happened, is such that benefits would be felt over the longer-term not the short-term. Hence, such an argument is one of presentation and far removed from what is happening in the market. We are looking at a reduction of 30 to 40 per cent by value and number of projects on average coming to a financial close since the end of 2008 through to 2010. This is clear evidence of fiscal constraint in Europe. So we may be facing a new trend in government financing, wherein governments will have to procure greater capital market funding for infrastructure. Different forms of procurement, regulation and management demands would be needed (and met in some cases). A much more concentrated government debate about affordability of 'priority' and 'essential' infrastructure that is also environmentally



attractive will take place. Substantial change and refinement on infrastructure procurement side of things in Europe would be partially driven by fiscal constraints and perceptions of lower medium-term economic growth. A realisation of things that really matter to electors who put Governments in power are things like social projects, health and education and priorities may be switched to these areas.

**EO:** The Middle East and Africa, especially the latter, face the greatest infrastructure challenge of all. In certain parts of Africa there is an abject lack of transport infrastructure. This is seizing-up economies. An opportunity to invest in infrastructure was missed by governments in the developing world over the last decade. As a consequence, they are paying the price in terms of efficiencies – energy security and transport being the notable ones. Additionally, the private sector has simply not got the capital or the inclination to invest the kind of money that was required. This resulted in 25 wasted years of private finance models which are simply not big or robust enough to deliver the infrastructure needs of the region. In the Middle East, the only nations who have come remotely close addressing the infrastructure challenge are UAE, Qatar, Saudi Arabia and Kuwait who have the budget surpluses to commence projects directly. Everywhere else in the region from North Africa to even India, infrastructure varies from reasonable to lamentable but nowhere near well enough. This needs to change.

**RDV:** Over the last decade, Latin America saw a number of countries promoting investment in infrastructure lead by Brazil and Mexico. Mexico's national infrastructure project allocated US\$25 billion to make it bankable while Brazil's national infrastructure development plan is a crucial regional initiative. Across the region, we presently see a lot of PPPs in complete contrast to 30 years ago when governments were the only funding source. Chile, Colombia, Peru and Argentina, despite going through a hard phase at the start of this decade, are also seeing a number of projects of note. Private sector involvement is being improved by participation from European, mainly Spanish companies, courtesy of historic ties that bind them to Latin America. However, some problems are now arising mainly in the initial stages of the project. These are not as much about the financial structure, but rather about bidding processes. The market has often seen a number of companies losing a bid and immediately opting to challenge it via legal channels. This has hampered projects in the region and ensures that the progress is not spectacular. Slowly but surely, the projects are going ahead and have not been stopped following the economic crisis.

**PL:** Most of the stimulus dollars failed to make it into the infrastructure space. In the US only about 10 - 15 per cent of the stimulus capital went to what could be defined as infrastructure. Other than China, the story is not much better globally. China's infrastructure investment agenda was already solid coming into the recession. So adding to an already moving process was much easier for them, than say the US where the pace of investment was not as fast to begin with. Right now unfunded entitlements and budget deficits are the issues of the day and these are very big issues. It's hard to say when infrastructure and related job creation potential will return to the forefront of everyone's thinking.

## JUDGING PROFILES

### VINCENT CONNOR PINSENT MASONS



Asia Pacific Judging Panel

Vincent Connor is Head of Asia Pacific and also Head of Office in Hong Kong. He specialises in contentious construction law, providing clients with strategic advice during projects and representing them in arbitration & litigation. In addition to his strong reputation for advocacy, Vincent has considerable experience of Adjudication under Security of Payment legislation. Currently, he is advising on a HK\$250 million civil engineering arbitration case in Hong Kong, complex claims on a light rail project in Singapore and significant financial issues arising from a power plant project in Vietnam.

### THOMAS BARRETT EUROPEAN INVESTMENT BANK



Europe Judging Panel

Thomas Barrett is the Director responsible for the EIB's Structured Finance and Advisory Activities throughout the European Union. He is currently also the Director of the EIB's Centres of Expertise on Trans-European Networks (TENs) and Public Private Partnerships (PPPs); on Energy and Environment and on the Knowledge Economy / Lisbon Agenda. Thomas was previously EIB Director for North Western Europe before which he was responsible for project financing of the aerospace; oil and gas and satellite telecommunication sectors. He was also, inter alia, a member of TENs Policy Groups led by Commissioners Van Miert, Christophersen, Kinnock and De Palacio. He was Chairman of European Industry PPP Task Force on the Galileo GPS satellite navigation project and also a member of the UK Government's Steering Group on Partnerships UK (PUK/PFI).

### EDMUND O'SULLIVAN MEED EVENTS



Africa, the Middle East and India Judging Panel

Edmund O'Sullivan is Chairman of *MEED Events*, the conferences and networking division of *MEED*, the Middle East business intelligence service provider. An economist and a business person, O'Sullivan has been observing developments in the Middle East region since 1979 and was previously editor and publishing director of *MEED*. His career has also encompassed business development work in Russia and consultancy projects in southern Africa for the Brenthurst Foundation, which focuses on developing economic strategies for Africa. O'Sullivan has also acted as a consultant for a host of blue-chip international firms operating in the Middle East. His work in broadcasting includes frequent contributions to radio and television about Middle East issues. The second edition of his book *The New Gulf*, a modern history of Arabia, is due to be published by the end of 2010.

# JUDGING PROFILES

## FEDERICO PATIÑO BANOBRAS

Latin America Judging Panel



Federico Patiño was born in Mexico City and studied at the Law School of the National University of Mexico (UNAM). He specialized in development banking at The World Bank Development Banking Institute in Washington DC and worked in Mexico's development bank Nacional Financiera (Nafinsa) for 28 years from 1980 to 2008. There he occupied different positions as, Deputy General Director of Credit, Deputy General Director of Treasury, Deputy General Director of Development and Deputy General Director, Investment Banking. In May 2007, he was appointed Deputy General Director in Investment Banking and Corporate Financing at Banco Nacional de Comercio Exterior (BANCOMEXT), having maintained his position in Nafinsa at the same time. He was responsible for the creation of the Corporacion Mexicana de Inversiones de Capital (CMIC); Coordinator of the initial public offering process for the government's position in the Mexican airport groups; responsible for structuring the finance for the Terminal 2 for Mexico City's International Airport; and the selling process of the FARAC's first package of toll roads. In 2008, Mr. Patiño was appointed Investment Banking Director of Banobras, in charge of The Mexican Infrastructure Fund.

## PETER LUCHETTI TABLE ROCK CAPITAL

North America Judging Panel



Peter Luchetti is a founding Partner and leads TRC's Business & Investment Development Group. His experience includes advisory and capital-raising roles covering a wide range of transactions in the transportation, social infrastructure, water & waste, energy and communications sectors. Prior to forming TRC, Peter was Managing Director and Global Head of Project & Structured Finance for Bank of America. In this role he was responsible for a 140-person team transacting in over 30 countries on the origination and execution of project and structured finance, advisory and capital-raising activities. Prior to assuming leadership of the Project & Structured Finance Group, Peter started and ran Bank of America's first distressed loan trading desk and also worked for J. Aron Goldman Sachs. He received a BA in economics from Hobart & William Smith Colleges and an MA in economics from Duke University. He also serves as a Board member of the Bay Area Council Economic Institute.

**Q:** What is the greatest infrastructure challenge you think will need to be addressed in the next ten years?

**A: VC:** Capturing opportunity and delivering the need of our communities for sustainable and effective energy solutions is the greatest challenge going forward. Furthermore, the associated challenges regionally, either in engaging government on sensible and ambitious programmes (e.g. Hong Kong, China) or establishing an environment in which infrastructure investment and development can be carried out with a degree of confidence (e.g. Thailand, Indonesia), are equally daunting. Ultimately, they are well worth the effort.

**TB:** We need to put infrastructure into perspective as neither governments nor consumers are uniquely focussed on it. Focus is on finding a balance between economic growth, competitiveness, environment and overall sustainability. Looking at this issue from a European standpoint, we are talking in essence about maintaining standards of living and competitiveness. So we do not need to improve competitiveness of infrastructure in an absolute sense but need it to be competitive with other countries for the purposes of international trade. A lack of infrastructure is not the general problem faced by Europe, other than in respect of some Eastern European countries. So looking ahead, efforts are likely to be focussed on finding a balance between smart growth, green growth and overall the regional integration between all of the countries of Europe. Infrastructure is part of a balanced set of initiatives covering all of these areas. Managing its inclusion in the bigger picture is our biggest challenge.

**EO:** There are three major challenges. First of all, Governments need to realise that infrastructure projects would not be built just because the concession fee is changed or the project model is altered. The world faced up to the carbon challenge but it is just not waking up to the infrastructure challenge. There is an assumption in the developing world and beyond that somehow the problem is going to fix itself by merely getting legislation in place. Secondly, it should be recognised that finance via conventional financial sources, i.e. banks or private investors, is either not going to arrive or it will at a price deemed impossible for low income countries to deal with. Finally, transport infrastructure – which as a sub-sector is underrated as a source of potential employment in the Middle East region – must be addressed with the seriousness it deserves. If this happens, in less than three decades, transport (and logistics) sector could be the largest employer in the region overtaking oil, gas and finance.

**RDV:** Energy sector diversification, environment and managing natural resources are the biggest challenges from a Latin and Central American standpoint, especially as South America has the biggest rain forest in the world and is growing exponentially led by the Brazilian economy. It is crucial to address these concerns. For instance Brazil's dependence on hydropower coupled with all the environmental and social problems is a hurdle. So their initiatives and that of other countries in favour of renewable energy are a step in the right direction. Combined cycle gas-fired power plants, and emergent technology should play a part. My expectation is for the number of wind farms to increase and clear moves in this direction are visible in Chile. However, the regional challenges are manifold. In Mexico and Central America, a major concern

is getting access to clean water, especially in Northern Mexico. Central America faces transportation issues. On the financial side, consolidation of PPPs in the area should be a priority. This must take place via innovations, with specific structures that adapt better to Latin America's business and thought processes.

**PL:** Upgrading the global development and asset formation model and the procurement process, so that it can work in a timelier manner incorporating the elements and benefits of multi-party funding would be a challenge. This is the code for reconciling the process around infrastructure procurement productivity, value for money and multilateral financing. If we can get the procurement model to move into the 21st century, billions and billions of dollars of asset formation will be realised and the world will benefit in many ways.

**Q:** What's your vision for the future and how do you think infrastructure will shape society by 2050?

**A:** **vc:** Globalisation is regarded as a dirty word in some quarters. However, in its most positive sense, the geographical stretch of Asian businesses and SOEs into technology development, infrastructure investment and delivery will increasingly enhance the provision of cleaner water, more effective sewage treatment, sustainable power supply and improve transportation links to more communities around the world. This would lead to the improvement of both living standards as well as economic development.

**TB:** The public and the industry have very high expectations of the infrastructure world. For both, infrastructure investment can be a potential vehicle for technological development, employment and social inclusion. So in this sense, infrastructure investment does become a vehicle delivering all of the above. Additionally, it could also be a driver for future development of financial and capital markets in a way that will actually utilise those capacities which we have already created to help deliver some of the medium and long-term plans we have. So in essence, infrastructure investment will be perceived as a vehicle for delivering higher standards of living that correspond to people's aspirations in terms of sustainability, social welfare and education.

**EO:** The tension in this debate will express itself as governments face difficult choices between spending now and spending in the future. In some respects, society was better at this in the past. Previously, if 100 years were required for a project to be completed, people were prepared to be patient. Now it seems that capacity has been eliminated. The pressure to seek an instantly popular policy has taken precedence over long-term investments in vital infrastructure. Transport, water and electricity projects will deliver more long-term economic benefit globally than anything else the governments of the world can conjure up. A deeply political, intellectual and ideological shift is needed and this is the massive challenge for governments over the coming decades.

**RDV:** The future trajectory of progress in Europe, the US or Asia Pacific will be subtly different from Latin America and Africa. Latin America will be seeing a lot more investment from the public and private sector with synergies which will create a renaissance in society. Debate is likely to be about the role of the private sector

in infrastructure development. Increased private investment will create problems within a society of nations because of the historical context of colonialism embedded into the idiosyncrasy of the peoples of Latin America and a reticence to use the private sector in infrastructure projects. However, governments do not have any other way to finance investments without involving the private sector despite the friction between society and government. That said the decades ahead could also see inter-country projects. Infrastructure holds the potential to bring the region together, even though it is conventionally a region with a lot of historical differences within it.

**PL:** Infrastructure investment is the key to resolving a host of wider public policy issues that affect our economic productivity and quality of life. We have the opportunity to address transportation, water, waste management, energy, communications and social infrastructure asset formation in a manner that fundamentally enables our ability to achieve sustainability on the planet. Governments cannot accomplish this on its own in the absence of a true global public private partnership. It will take great skill and leadership to affect the kind of institutional change that is necessary to assure a positive outcome.

Turn to page 68 for more Q&A with our other judges.

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# FEATURED GLOBAL PROJECT

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King Abdullah  
University of Science &  
Technology

## EDUCATION

By Kiel Porter  
PPP/PFI Reporter  
Infrastructure Journal



King Abdullah University of Science & Technology (KAUST), KSA

The Holy Quran states *"Say thou how would those who know would be equal to those who do not know?"* It is this principle of seeking knowledge and enlightenment that has guided the rapid transformation of education in the Middle East over the past decade.

The judging panel was keen for the featured project in the education sector to have a transformative effect not just on the local community but also on the wider society. The King Abdullah University of Science & Technology (KAUST) in Saudi Arabia is such a project.

The official opening of the centre in September 2009 marked the realisation of a long-held vision of the Custodian of the Two Holy Mosques – King Abdullah Bin Abdulaziz Al Saud – to create a graduate research institution of global recognition.

Spread over 36 square kilometres along the Red Sea coast at Thuwal, about 80 kilometres north of Jeddah, KAUST is an international, graduate-level research institute dedicated to inspiring a new age of scientific achievement in the Kingdom.

The new institution is the first mixed-sex university campus in Saudi Arabia with women allowed to mix freely with men and drive on campus. They will not be required to wear veils during classes and religious police will not operate on site.

KAUST, which is supported by a US\$10 billion endowment, is capable of offering up to 20,000 students a year degrees across 11 fields of study broadly within four strategic research thrusts. All courses at the university are taught in English. Furthermore, the courses have been designed to be flexible in order to



KAUST Campus

ensure that programmes are accepted by other universities around the world thereby aiding its ambitions of becoming a leading international institution.

The campus' architecture and design was designed specifically to maximise the benefits of the unique site microclimate and ecosystem while mitigating the detriments of the sun's movement and the harsh climate. For example, the roof housing the North and South Laboratory buildings features nearly 12,000 square meters of solar-thermal and photovoltaic arrays capable of producing up to 3,300 megawatt hours of clean energy annually.

The campus is also home to two sensitive marine habitats - the Red Sea coral reef and a mangrove forest - and every effort has been made to conserve biodiversity. Strict development limits were put in place alongside comprehensive storm water, construction erosion and sedimentation plans to avoid pollution. However, even allowing for such considerations construction of the project took less than a year, involving 40,000 workers at its peak.



Island and Harbour District - each of which incorporate interesting initiatives devoted to reducing their environmental impact. For example, all residences have integral chutes for the collection of recycling and composting materials. All food waste - from both the KAUST campus and residential areas - is recycled and incorporated into an organic landscape mulch programme outside the city.

The campus and community use an electric Segway sharing program for short-distance travel and an electric vehicle sharing program for longer-distance travel requiring climate control.

The university follows the United States Green Building Council's LEED rating system for establishing performance criteria in a sustainable development.

In conclusion, the scheme's intention to create an enduring model for advanced education and scientific research while providing a strong foundation for all aspects of work and life, has in effect also created a living laboratory, demonstrating that environmentally responsible methods of energy use, materials management and water consumption are viable in a region that at best has been ambivalent to such issues.

Diffused natural daylight and exterior views as well as improved ventilation and indoor air quality play an integral role throughout the building. Because of the intensity of the sun in the region, all daylight will be diffused to decrease solar heat gain intensity while all outdoor air intakes and interior spaces are monitored with CO2 sensors to ensure that appropriate levels of ventilation and fresh air are being supplied to building users.

The energy efficiency systems are state-of-

the-art with a particularly interesting lighting system. The centralised astronomic time-clock system calculates sunrise and sunset times each day based on longitude and latitude. Occupancy sensors and sensor-based daylight harvesting are used in appropriate locations such as offices, conference rooms, and restrooms although manual dimming is available.

All staff and students have the opportunity of staying in one of the KAUSTs residential neighbourhoods - Safaa Gardens, Safaa



KAUST Campus

# EDUCATION OUTLOOK

## KPMG's view

By Bob Griggs

Education is a vital part of the social infrastructure needed by countries around the world if they are to compete effectively and maintain social cohesion. While the economic downturn has certainly impacted many infrastructure projects, investment into the education sector has stayed on track with a steady stream of new projects and investments underway around the world.

In particular, the global pace of Public-Private Partnerships (PPPs) in the education sector has grown with new schemes closing or under development in the UK, Europe, Asia and the Americas.

However, the UK remains the global leader in education PPPs with its ongoing Building Schools for the Future (BSF) programme that aims to invest more than £45 billion over 15 years. Significantly, the programme is unique in that it provides for the rebuilding of new infrastructure and the refurbishment of existing facilities, ongoing maintenance of facilities, inclusion of new ICT kit and services, etc.

It also layers on partnership requirements that encourage community and economic regeneration as well as numerous spin-off benefits that stretch far beyond the secondary-school age pupils' core education.

The success of the UK programme has prompted other jurisdictions to explore the potential for PPPs to drive school infrastructure renewal. For example, Puerto Rico has been aggressively

soliciting partners to participate in a rehabilitation programme worth some US\$1.4 billion, and the New Zealand government is thought to be looking at ways to mimic the UK programme to renew its ageing education estate.

Elsewhere, there is significant incentive to bundle a number of schools projects together in order to maximise efficiencies, manage costs, create scale and ensure long-term value for money is achieved. Belgium recently closed a €1 billion scheme that involved a whole region's school estate, some 211 schools. Other large grouped school deals have also been closed this year in Canada and Ireland.

It remains to be seen how these programmes will stand up to political pressure. The recent change of government in the UK, for example, could impact programmes like BSF which may be scaled back to reduce cost resulting in projects that are perhaps less ambitious in a transformational sense and buildings that are more standardised.

In an effort to shore up public finances, some education authorities are instead exploring alternative financing arrangements (for example the new Scottish Schools Investment Programme) that allow for more long-term flexibility. At the other end of the spectrum, speculation is rising about the potential for transactions that further reduce the State's long-term liabilities by including the provision of teaching staff into the overall contracting structure or

further devolving individual schools from public sector control.

Underpinning the drive towards PPPs is a growing body of evidence linking PPP-led school renewal with an increased rate of educational attainment for students. In a series of statistical research reports, KPMG has found that students attending classes in new buildings that were procured, built and operated under a PPP structure statistically achieve a faster rate of improvement in educational attainment than those that attend schools that were conventionally procured.

Looking ahead, we see a deepening disparity between the education infrastructure of countries with national programmes and those who follow a more 'patchwork' approach. The US, for example, requires a major overhaul of its school estate but relies on individual states to plan, fund and procure education infrastructure. With no centralised plan and inconsistent state-level legislation governing PPPs, the US has not started any schools PPP projects to date and now lags behind most other developed nations.

Overall, the outlook for the education sector is strong and should provide a long-term safe haven for investment. And while the University sector may attract a greater share of international attention due to a number of high-profile schemes – many of which are included in this report – we believe that globally school projects will continue to see the highest level of activity and investment.

# LEADERS IN THE FIELD

AgriBio Centre for AgriBioscience  
La Trobe

ASAP New Schools

BELB Schools & Facilities

EEEL Building University of Calgary

Evelyn Grace Academy

ITE College West PPP

NYU Abu Dhabi Campus

San Luis Potosí University PPP

Université des Métiers d'Artisanat  
Guadeloupe PPP



Energy Environment Experiential Learning (EEEL) Building, University of Calgary, Canada

Unlike many of the other sectors, education featured a relatively narrow field of candidates, in part due to the fact that such schemes are smaller in scale than their counterparts and in part due to the tendency of authorities the world over to replicate simple, cost effective designs.

Nevertheless, the shortlisted projects were full of innovative features with several strong candidates – particularly in the universities segment – impressing the judges with their green credentials, research capabilities and social impact.

The **Université des Métiers d'Artisanat** in Guadeloupe is one such project. The University was praised by the judges for its green design features which incorporated the extensive use of solar panels and shading.

The 6,577 square metres facility - built by a consortium including Semsamar and Icade - will accommodate 825 local trainees who will be trained in optimal conditions of the BTS CAP in the areas of food trade, health, personal services and crafts. However, while the project remains a vital local resource that will provide tangible benefits to the local community, the panel felt that its reach and impact were not as great as its innovative design.

The judges took a similar view on the **Energy Environment Experiential Learning (EEEL) Building** on the University of Calgary campus in Canada. The project's outstanding feature is the architects' use of the sun as a pillar of their illumination design whereby the building's façade redirects rays. The manipulation allows for the maximum amount of natural light to reach within the building's hub while dramatically improving energy efficiency.

Combined with the earth-tube stem to regulate heating, it is hoped the building will be 50 to 60 per cent more efficient than a typical lab building. A consortium including CGI Ellis Don, architects Cohos Evamy & Busby Perkins and Will (in a joint venture) and general contractor Ellis Don were awarded the contract in 2009 on a design assist basis.

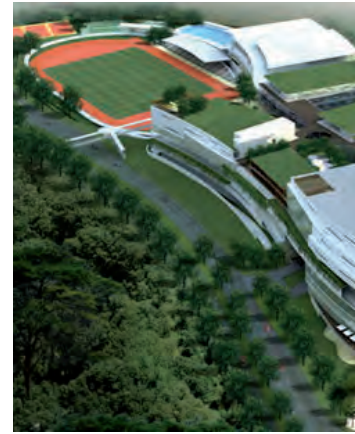


While the LEED Gold standard project was popular, both the financing structure and level of societal impact was felt to be less than other projects in the field. No such concerns were noted by the judges whilst considering **ITE College West PPP** in Singapore. The scheme set new standards as the first availability-based social infrastructure PPP project to reach financial close in the country.

The judges were particularly impressed by the fact that the construction programme began prior to contract award in order to meet the inflexible school term start date. Furthermore, the relative ease with which it reached financial close, considering both the state of the market and the authority's notoriously strict value for money guidelines, was also commendable.



Ashfield Girls' High School, UK



ITE College West, Singapore



Forecourt, Tamarack Public School, Alberta, Canada

The scheme will see the consolidation of ITE's five existing "West campuses" into one single new mega-campus. Gammon Capital - a JV of Jardine Matheson and Balfour Beatty - is the project sponsor for the 25-year operating period.

The **San Luis Potosí University PPP** in Mexico was judged similarly by the panel. The project – which is currently under construction – was praised for being the country's first education PPP where activity had previously been restricted to the roads sector. The project is expected to accommodate up to 5,000 students and 500 academic staff – providing a major boost to higher education in the country.

Acciona closed the concession in September 2009 having seen off competition from a consortium involving Marhnos and Currie & Brown. The new campus will be located across 16 hectares and include teaching, research, administration, sports and ancillary accommodation facilities. It has the potential to serve as a marker for a series of regional polytechnic universities currently in the pipeline.

The **AgriBio, Centre for AgriBioscience at La Trobe University** in Australia was similarly praised for its ambition to develop existing local expertise while retaining a global outlook. It will accommodate around 400 people, including scientists, students and support personnel from the Australian Government Department of Primary Industries.

The centre will work towards improving detection and eradication of both plant and animal disease outbreaks and complement Victoria State's Aus\$205 million Future Farming Strategy. Plenary Research – consisting of Plenary Group, Grocon and Honeywell Services – will design, construct, finance and provide facility management services required for the operation of the premises over a 25-year period.





Evelyn Grace Academy, UK

The judges were impressed by the facility's design and the speed of procurement in a tight market - noting that Victoria remains the state most amenable to PPP procurement in Australia. The final university project to be included in the shortlist is the **NYU Abu Dhabi Campus**. Judges were impressed by the plans for development believing it to have the potential to be an outstanding facility from a technical standpoint while also having a transformative effect on education in the region.

The project is intended to be the first comprehensive liberal arts and science campus in the Middle East to be operated abroad by a major American research university. The development is intended to form part of a wider scheme in Abu Dhabi with plans for a central business district, ecological zone, and cultural district alongside housing for 150,000 people (also in the preliminary stages).

The project was felt to be strong across all the judging criteria. However, with plans still being at a relatively preliminary stage, the potential outweighed the more tangible benefits already being pursued by other schemes.

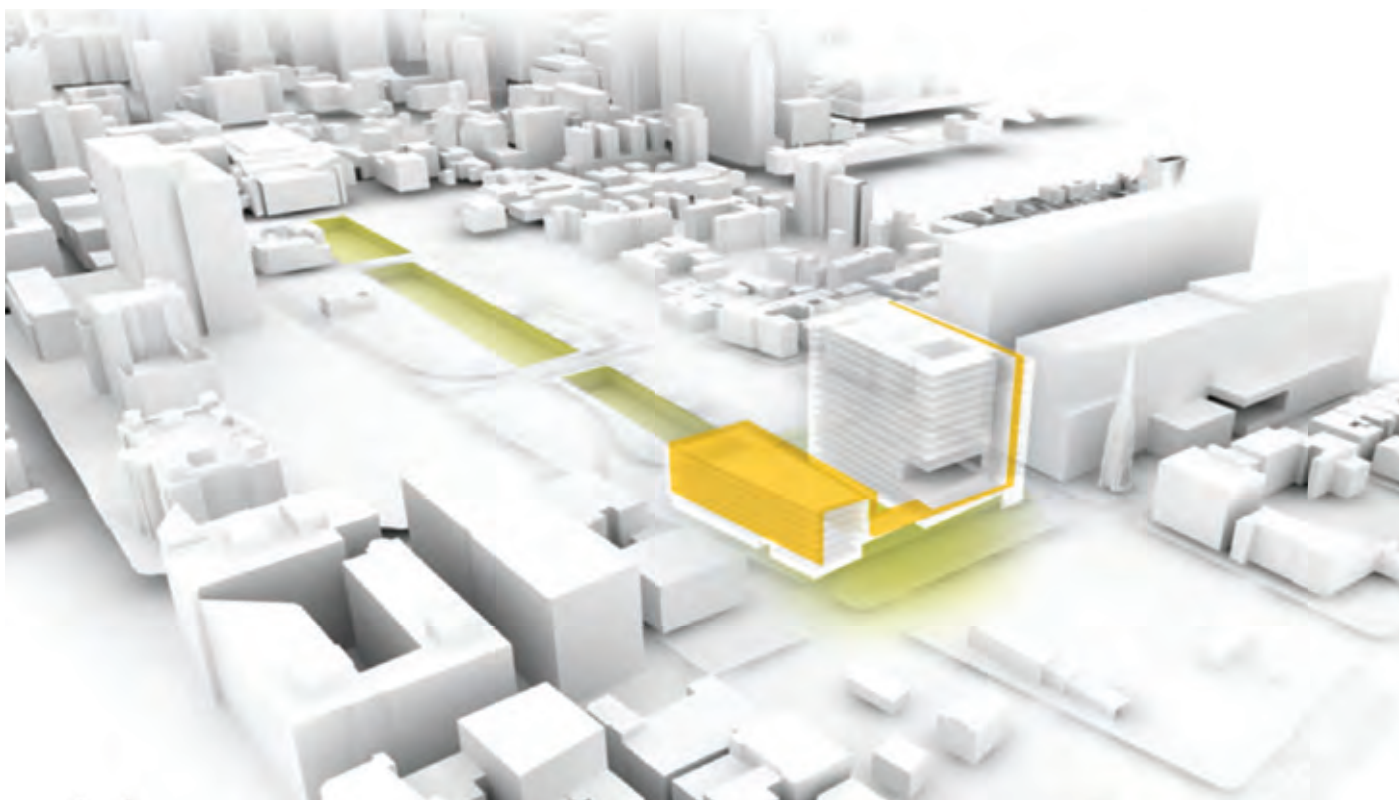
The final three projects shortlisted were outside of the university sector and were widely acknowledged to be among the strongest in terms of a transformative impact on society. The first (**noted as BELB Schools and Facilities**) comprises the **North Belfast City Learning Centre** coupled with the **Belfast Model School for Girls** and **Ashfield Girls' High School**.

The respective centres are located in a region, Northern Ireland, associated with high levels of political tension, violence, and socioeconomic deprivation. These projects were submitted separately, but the judges felt they should be combined and noted together for the positive social impact they are having in the region.

The **Evelyn Grace Academy** located in Brixton, South London attracted similar plaudits but was also given credit for its unique architectural features. For example, the main body of the building is purposely set back from the street frontage to minimise the impact of the building on the streetscape and angled to provide 'landscaped' open play spaces. Furthermore, visual relief of the single building massing has been provided by breaking down the building into visually distinct elements conforming to the schools within schools organisation.

The final shortlisted project is the **Alberta Schools Alternative Procurement (ASAP) New Schools** (Phase II). The judges were particularly impressed by the scale of the P3 project and by extension its impact on education in the state. The project involves the construction of 14 additional new schools in the Calgary and Edmonton Capital regions.





CRCHUM, Quebec, Canada

The project has received a rating of silver in LEED design from the USBGC. Details of the project's environmental credentials include a pledge to divert a minimum of 75 per cent of construction waste away from landfill sites and source a minimum of 20 per cent of construction materials locally.

Secure bicycle parking, shower and changing facilities will also be provided. Storm water retention tanks will be included in the facilities basement to reduce peak flows into the public sewer system. Work on the project is scheduled to start in late May 2010, with delivery of the facilities expected by September 30, 2013. Up to 3000 jobs will be created during construction period.

The 30-year service phase commences the day substantial completion is achieved and ends at the expiry of the project

agreement which is 30 September 2043. This stage of the project primarily entails routine maintenance of the facility and electromechanical equipment - excluding clinical equipment.

Ancillary services such as help desk services, ground maintenance, pest control and security services are also within the sponsors remit, as well as monitoring and reporting to CHUM on service performance. However, the authority retains energy price risks.

Excluding general management and insurance responsibilities, all of the sponsors obligations related to the service phase have been subcontracted to Honeywell Limited; a firm with considerable experience in the sphere of clinical PPPs and lifecycle maintenance.

The institution has spent decades developing predictive criteria for risk and

change in diseases while pursuing new therapies and strategies for disease prevention. It is hoped the development will allow research activities to be grouped into eight areas to ensure the effective use of human and equipment resources, namely – cancer, cardio-metabolic, infection, immune system, inflammation, musculoskeletal diseases, neuroscience and health risks.

The potential growth of the cardio-metabolic group is particularly prized. The institution - alongside the Maisonneuve Rosemont Hospital - is evaluating the safety, feasibility and efficacy of injecting stem cells into the hearts of patients undergoing coronary bypass surgery. Such a breakthrough treatment could potentially revolutionise the treatment of heart diseases.

# HEALTH OUTLOOK

## KPMG's view

By Matt Custance

**T**he recent debate in the US over healthcare clearly illustrates how close the sector is to the hearts of governments and populations around the world.

For the most part, three basic priorities are now central to the current healthcare agenda: improving access to healthcare; coping with an ageing and more informed population; and responding to the pressures of the global financial crisis.

How these competing priorities impact the outlook for healthcare infrastructure differs from country to country. Unlike many other sectors, infrastructure typically represents less than 20 per cent of the total operating costs for hospitals, and substantially less for community-based services. As a result, the outlook for health infrastructure will be increasingly dominated by these evolving priorities for service delivery.

### Access

In healthcare, access is about delivering high quality and comprehensive services to all (or most) of the population. In the US, this debate has largely centred on improving access to insurance rather than the development of health infrastructure or the recruitment of skills.

Many other countries are also focused on delivering universal care through enhanced access to insurance. In Abu Dhabi, for example, all but the smallest

employers have recently been required to provide comprehensive insurance for their employees and their families. This has created fresh demand on the system, which in turn has spawned a number of new infrastructure projects in the region, as well as a strong demand for clinicians and skilled managers.

With universal healthcare already in existence in the UK, health authorities are instead seeking to improve access by bringing care out of hospitals and closer to patients. This means that the long list of hospital-based infrastructure opportunities is now ending and being replaced by a larger number of smaller community-based infrastructure projects.

### Ageing, more informed population

In most countries, the ageing population will also have a direct impact on the quantity and type of healthcare infrastructure needed. As governments struggle with the scale of services required, most are looking to more effective and efficient home and community-based services as a potential solution.

At the same time, a more informed patient population is also influencing the delivery of healthcare infrastructure and services. For example, informed cancer patients are increasingly demanding new drugs and new forms of treatment. There are currently 29 proton beam therapy centres in operation globally with at least as many currently being planned. At a cost of £100-150

million per centre, this is a significant infrastructure requirement driven to a great degree by patient demand. Responding to these types of demands naturally creates funding pressure on other parts of the system.

### Global Financial Crisis

The constraints of the financial crisis have also forced many governments to rethink their long- and short-term healthcare budgets. The UK's NHS, for example, has been instructed to deliver more than 20 per cent efficiency savings over the next three years which will inevitably delay or force the cancellation of some infrastructure developments.

This urgent drive for efficiency may also mean a re-examination of the role that the private sector plays in the operation, rather than just the construction, financing and maintenance of new healthcare infrastructure. While countries with socialised healthcare delivery (such as the UK, Australia and Western Europe) have generally stopped short of including clinical operations within hospital projects, there are strong indications that this kind of private sector involvement can result in significant efficiency savings.

Given this, the days ahead may leave the infrastructure industry with the burning question of whether it can both secure robust financing as well as deliver effective operating solutions at the same time.

# LEADERS IN THE FIELD

Braga Hospital

Bridgepoint Hospital P3

Centro de Rehabilitación Infantil Teletón

Nelson Mandela Children's Hospital

New Karolinska Solna Hospital

New Royal Adelaide Hospital

Sidra Medical and Research Center

Sino-German Friendship Hospital

Turks & Caicos Islands Hospital PPP



Sidra Medical & Research Center, Qatar

The health sector was in many ways the most difficult to judge. By virtue of their function, all of the projects provide at least a measure of positive social impact which led the judges to place a greater focus on technical excellence alongside teaching and research.

Looking first at technical excellence, the **Sidra Medical and Research Center** in Qatar is a shining example of what can be achieved when cutting-edge technology is combined with an incandescent design that both reflects and celebrates the environment.

Spectacular atriums serving as indoor healing gardens are the centrepieces of the design allowing patients to benefit from fresh air during the cooler months. The building also incorporates water features in the lobby and drop-off areas and a comprehensive art collection.

Similar praise was heaped upon the **Centro de Rehabilitación Infantil Teletón** in Mexico. The centre – dedicated to treating disabled children – comprises six interconnected structures, and is characterised by its spaciousness, use of outdoor space. The use of colour throughout the facility is playful and geometric, making it easy for the children to relate to and has been credited as being complementary to the physical therapy. The judging panel was also impressed by the financing structure which saw considerable support from Non-Governmental Organisations.

The **Nelson Mandela Children's Hospital** in South Africa also shares the non-profit ethos. The paediatric facility will have 200 beds, 8 surgery theatres complemented by state-of-the-art diagnostics capabilities. It is intended to be the second dedicated children's hospital in the Southern African Development Community (SADC) – which has a population of nearly 240 million.

The hospital's ethos of "no child will be turned away" was recognised as having the potential to have a tremendous societal impact. However, the scheme's long gestation period, relative procurement uncertainty and lack of technical detail counted against it.

Australia's **New Royal Adelaide Hospital** follows a chequered history of procuring via PPP structures in South Australia. Despite the project being in its inception phase, judges opined that plans were sufficiently developed for them to appreciate its research and clinical strengths. The facility is expected to be able to accommodate 80,000 same day and overnight admissions per year while also building on the hospitals historic excellence in teaching and research.

The environmental standards being proposed and regeneration of the surrounding areas was also praised – particularly the return of three hectares of parklands public use and the creation of the site as a regional transport hub. It was felt that such an approach would “hard wire” the new facility to the community.



New Karolinska University Hospital, Sweden



Nelson Mandela Children's Hospital, RSA



Braga Hospital, Portugal

Community ties were also a significant factor in the inclusion of **Braga Hospital** in Portugal. The project—which reached financial close in February 2009 – will replace the Sao Marcos Hospital, which is sprawled across several locations in the city and a psychiatric department located 3km from the city.

Moving all hospitals specialties and teaching units under a single roof in the heart of the city is expected to provide a tangible boost to teaching and clinical care standards thereby enhancing the institution's impact locally and nationally.

The **Turks & Caicos Hospital PPP** in the West Indies also has an SPV providing its clinical services. The new hospital will operate a total of 60 beds – 20 on Grand Turk and 40 on the island of Providenciales in the Caicos – delivering a range of primary and secondary clinical care services to the local population from April 2010.

Interestingly, while the project has been initially envisaged to meet needs of the islanders, many in the industry believe that there is real scope for developing health tourism along the lines of Cuba. Tourist numbers – particularly from North America – have grown steadily over the past decade and there have been a number of recent luxury developments on the islands.

Despite its relatively small size, the judges found the project to be financially innovative and of massive benefit to the local population. It was hoped that it could serve as a pathfinder for PPP procurement in the region.



Turks & Caicos Islands Hospital, Turks & Caicos Islands

Pathfinder hopes are shared by authorities procuring the **New Karolinska Solna Hospital**. This new 335,000 sq. metre 800-bed facility in Stockholm is expected to include 300 dedicated beds on top of a further 100 in a patient hotel. It is based on research, evidence-based design, to reduce the spread of infection and promote rapid recovery. The hospital will have a distinct environmental profile and will be one of the first university hospitals in the world to be environmentally certified.

The goal is to achieve the gold level of the Swedish certification system *Miljöklassad Byggnad* (environmentally classified building) and a minimum of LEED Gold, the second highest level in the LEED international certification system.

Environmental credentials are central to the **Bridgepoint Hospital P3** development in Toronto. The 680,000 square foot state-of-the-art facility will have 472 beds over 10 floors and will include a dedicated Ambulatory Care Centre.

Of particular interest is the preservation of the neighbouring Don Jail. The historic building will be preserved and linked to the new hospital by a modern glass bridge. On the interior, the main focal point of the building, the rotunda, will be restored to its original architectural beauty including a renovation of a glass floor and skylight.

Judges appreciated that this LEED-certified project incorporated an existing building into its design. The result will be an exceptional fusion of traditional and modern designs.

The final shortlisted project is the **Sino-German Friendship Hospital** facility located in Shanghai International Park of Medicine in Nanhui. It will provide high-end services to both the Chinese and foreign nationals using the latest medical equipment and IT technology. The project is the first health PPP project in China – providing a shop window for Chinese authorities to assess the effectiveness of western procurement methods. A joint venture including Siemens and German hospital operator Asklepios Kliniken completed the project in May 2010.

# FEATURED GLOBAL PROJECT

## Project Mthombo

OIL & GAS

By Josh Posaner  
Oil & Gas Reporter  
Infrastructure Journal

The project selected as the featured project in the Oil & Gas category - Project Mthombo oil refinery in South Africa - is a prime example of an energy development initiative connected seamlessly to cross-sector infrastructure with an impact on the host country's socioeconomic framework that far outweighs the base financial rewards available.

It is a development of huge economic significance to the region and a project that is set to ease the country's reliance on external imports modernising its long out-dated energy infrastructure in the process.

Set to cost a total US\$11 billion, this state-owned oil company PetroSA sponsored refinery will be located at the Coega industrial centre near Port Elizabeth on the Eastern Cape; a region with the lowest economic activity in South Africa. Mthombo, meaning 'river source' in

the native isiZulu language, will be the largest refinery in Africa once construction finishes in 2016 and looks likely to become the biggest project financing deal ever completed on the continent.

The project will have a vast catchment area able to supply Port Elizabeth, Cape Town and East London over local shipping routes, both the Free State and North Cape over internal rail and Durban and Gauteng using an existing pipeline. It will produce 360,000 barrels of oil per day once at full production capacity.

Through the project, PetroSA aims to address the growing gap between supply and demand of refined fuel in the country; a fact not only exacerbated by its geographical distance from key suppliers but also from years of international sanctions. Without Project Mthombo, by 2015, South Africa would have to import approximately 20 per cent of its oil consumption from abroad.



Project Mthombo, RSA





Project Mthombo, RSA

Significantly for the judging panel, the project will also form an economic bridge providing much needed financial benefits and the associated transformation of community attached to a projected permanent job creation of 18,500 post-completion in a region beset with 50 per cent unemployment.

Selected as the featured project primarily for its socioeconomic impact, the project's location on the Eastern Cape, where 67.3 per cent of the population live in poverty, is seen as key. During a period when South Africa has undergone much investment for the 2010 Soccer World Cup, no other infrastructure project is better placed to balance the unstable economic distribution in the country than Mthombo.

Eddie O'Sullivan, a judging panel member from MEED,

said of Project Mthombo, "This is one project designed to create something out of nothing including a supply chain and to catch up with the damage done to the energy sector of [South Africa]."

The judging panel generally favoured the projects in developing countries with India's KG-D6 Development close to being the featured project and receiving praise from the judges for the similar socioeconomic and transformative effect it is projected to have.

However, Project Mthombo was seen to be particularly vital in modernising South Africa's energy infrastructure overall. The country has an existing set of refineries that have not received a significant upgrade since they were launched almost 50 years ago and subsequently suffer from the associated lack of efficiency and

negative environmental impact. PetroSA has issued assurances that the Coega development will produce to Euro V emission standards and meet Clean Fuel specifications.

Alongside the oil refinery, a power station capable of producing 800MW of electricity a year would be built. The plant would be enough to fully supply the 200MW necessary for Project Mthombo and feed the remaining 600MW back into the national grid. This project will use petroleum coke, a by-product of the refining process, further easing its environmental impact.

Political backing is further justified by the projected figure of R12.6 billion (US\$1.68 billion) per annum that South Africa will save in energy costs once the refinery is onstream and the stability of supply attained

once domestic production is assured. Project Mthombo is also fully in line with the government's Energy Security Masterplan established to pull the country's energy infrastructure up to contemporary standards.

The project will also produce enough oil to export across Africa providing extra revenue streams and alternative supply routes for importers. This helps identify Mthombo as a regional trailblazer which distinguishes itself apart from a cast of strategically substantial projects in the way it eases the relationship between supply and demand, boosts the regional economy and hopes to modernise South Africa into a continental energy sector powerhouse.

# OIL & GAS OUTLOOK

## KPMG's view

By Anthony Lobo

Security of supply and energy prices continue to feature prominently in the world's agenda and are expected to stay firmly there. For the Oil & Gas sector, some of the answers lie in the increased connectivity between producing and consuming markets, opening up of new exploration frontiers and accessing previously uneconomical resources such as unconventional gas and tar sands.

Despite the recent global financial crisis and the complex geopolitical landscape major pipelines such as those connecting hydrocarbon-producing regions in Russia and Central Asia to energy hungry consumers in Europe and beyond continue to be developed. The same goes for natural gas liquefaction and regassification facilities in countries as far apart as Papua New Guinea and the US, which will ultimately provide enhanced access and source/destination flexibility between consuming and producing markets.

In the Upstream sector, supply sources are becoming more diversified as new exploration frontiers are opened up, existing fields are expanded and unconventional hydrocarbon resources become a viable economic option. Parts of Africa and Brazil are becoming hotspots for new and expanded development. In Africa, both Ghana's Jubilee field and the Kingfisher field in Central Africa have recently been found to possess more reserves than expected, and hopes are high for offshore and deepwater projects planned for the coast of West Africa.

A similar story is shaping up in Brazil at the Guar and the Abar West fields. However, many of these finds will require advanced technology to exploit and may

require a combination of deep water drilling and innovative technologies to successfully increase recoveries. In parallel to that, the recent realisation that shale gas can now be economically produced has materially changed the North American supply/demand equation and Europe is keen to follow suit.

Meanwhile, China continues to lead the quest for security of supply, particularly through joint ventures and direct investments. In the past year, China has injected close to US\$20 billion into Russia's Rosneft and US\$1 billion into Singapore Petroleum, completed a US\$7 billion acquisition of Addax and created joint ventures with emerging leaders such as KazMunaiGas. The increasing influence of China's state owned Oil & Gas companies will also continue to grow, supported by the deep pockets of China Investment Corp (CIC), one of the world's largest sovereign funds.

The improving security situation in Iraq and Kurdistan will also put a renewed focus on the Middle East. Though the political situation continues to remain uncertain, many of the major International Oil Companies (IOCs) have already secured territory through field auctions, including Shell, Lukoil, Gazprom, CNPC, Petronas, Exxon and BP. Industry watchers will be paying particular attention to Kurdistan, where uncertainty still remains over the quality and accessibility of that region's reserves.

The continued rise of National Oil Companies (NOCs) is also likely to have a significant impact on the sector as well as the potential for joint ventures between NOCs and IOCs such as the recent Shell/PetroChina bid for Arrow Energy. The Oil & Gas service sector will also continue to see considerable merger

activity in an effort to create/maintain scale and expand internationally.

For the Downstream sector, the focus will be on more mature economies with significant overcapacity in the retail market. In Europe, for example, companies are seeking to dispose of refineries and retail outlets due to reduced refining margins and dampened demand. While recent bond issues tentatively signal the potential improvement of margins, many of the independent players are struggling, such as LyondellBassel which has been forced into Chapter 11 in the US. As failures increase and the majors divest of downstream assets to focus on upstream operations, the industry will witness a strong rise in corresponding M&A activity.

The volatility of oil and gas prices, global financing and the selection of the best investment opportunities – whether LNG, coal bed methane, deep water drilling or tar sands – will continue to heat up the debate. At the end of the day, the key issue will continue to be the struggle to secure supply and thereby (relative) independence in the world energy scenario, which might also bring (relative) energy price certainty that will make investment decisions less risk for governments and investors.

What is clear is that Oil & Gas exploration, production, transportation, processing and distribution are both fosterers and results of economic activity and from multi-billion to more modest budget projects the corresponding social impact cannot be overlooked – as illustrated by the selection of Mthombo Project for the *Infrastructure 100* top spot in the sector.

BY JOSH POSANER

# LEADERS IN THE FIELD

Cascade and Chinook Subsea Development

Gate LNG Terminal

Golar / Petrobras FLNG

Gorgon Gas Project

Keystone Oil Pipeline Extension

KG-D6 Gas Development and East-West Pipeline

Nord Stream Pipeline

Peru LNG

PNG LNG



Prospective Natural Gas Field, Russia

The Oil & Gas sector remains unrivalled in terms of sheer vision and scale of projects shortlisted with more multilateral and cross-jurisdictional developments than any other sphere. Each of the projects selected were perceived as central to the economies of their hosts whilst significantly overlapping into the increasingly blurred axis between export distances, supply and demand.

Two major trends are reflected in each of the ten regional projects selected. First of all, the increase in unconventional gas sources and the subsequent globalised nature of energy trade as LNG becomes a cross-continental traded commodity. Secondly, a series of new projects that are helping to economically boost developing countries were given particular praise as increased export feasibility allows developing countries to better monetise their resource reserves.

Projects in the developing world were favoured by the judging panel who selected the Project Mthombo oil refinery complex in South Africa as the featured project largely due to its socioeconomic impact. For similar reasons India's **KG-D6 development** became a clear candidate worthy of particular note for its impact on the fast developing South Asian economy. The project, and accompanying **East-West Pipeline**, will provide India with 50 per cent of its current gas consumption. Consisting of 22 subsea wells in water up to 3,937 feet deep alongside an onshore processing plant the 1440km pipeline will then transport the gas product to India's national grid acting as a real transformative 'game changer'.

Not only does the project set new standards in integrated gas infrastructure projects but it also launches an innovative approach to the sale and transportation of energy, helping to accelerate India's economic growth.

Another project with a comparable social impact is the **Papua New Guinea LNG (PNG LNG)** project, the single largest project financing deal of all time, coming in at US\$15 billion. The exploration and production project is the first large scale infrastructure development to be planned for PNG. Although implementation has not been without trouble, the substantial import appetite from key Asian utilities has kept the ExxonMobil sponsored project financially viable.



This kind of development has only been made practical through the increased exportability of liquefied gas coupled with the increased energy demand in Asia that cannot be satiated through either domestic production or a single exporter. Another project, Singapore LNG, typifies this change in energy import. Unlucky not to be selected, the US\$1 billion, 3.5 million tonnes per year facility is strategic for Asia's security of supply with its unique geography fashioning it as a key storage hub between the Far East and Middle East.

Similarly, **Peru LNG** was a project selected for just this reason as the first liquefied gas terminal in Latin America. Currently under construction, both the facility and associated pipeline will have a capacity of 4.4 million metric tonnes per year generating significant economic benefits for the Pampa Melchorita region, around 170km south of Lima.



FPSO Cascade Chinook

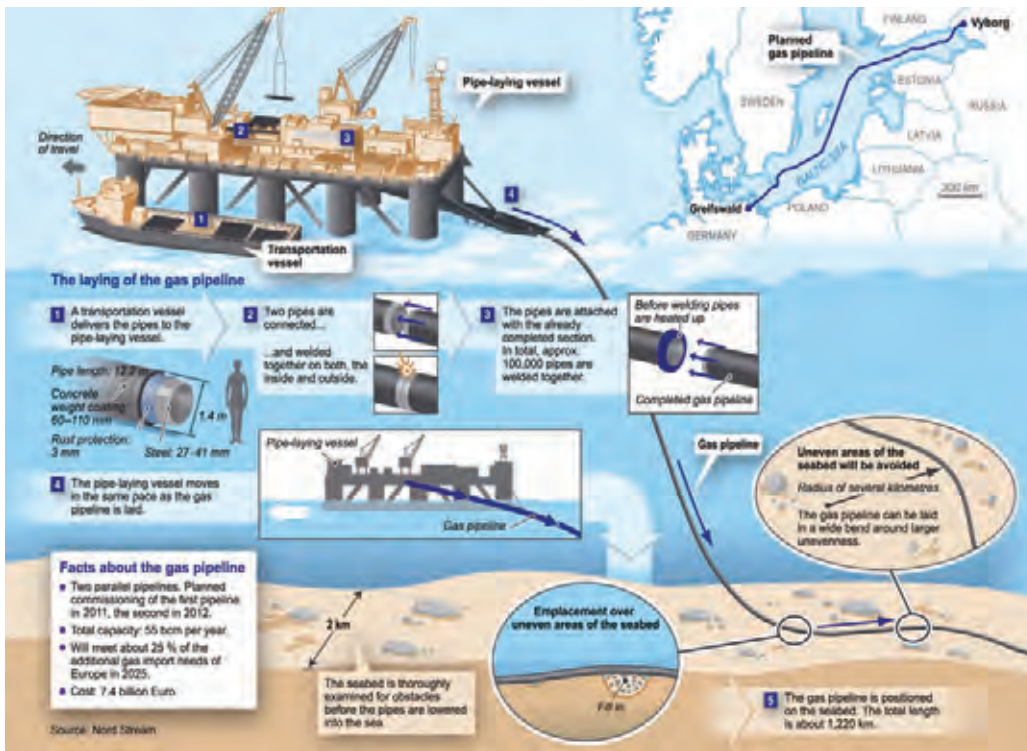


Gas Pipeline, Stock Image

Over in Europe, the politically controversial **Nord Stream** project made waves as the first pipeline to fully bypass the former Soviet space that acts as conduit for much Western Europe's gas flow from Gazprom's Siberian fields. The dual onshore/offshore pipeline will cross an unprecedented five state jurisdictions to reach its German terminus. Carrying a total 55 billion cubic metres (bcm) of gas per annum, the €7.4 billion (US\$9.3 billion) pipeline is seen as key to plugging the 120bcm supply gap set to drain Europe over the coming years.

Holland's US\$1.26 billion **Gate LNG** regasification project was also highlighted for the role it is set to play in converting distant supply from Qatar, PNG, Peru and Western Australia into consumable gas for European off-takers. Once completed in 2011, the project will aim for a total capacity of 16bcm, taking in up to 180 shipments per year.

The selectors chose the Rotterdam-based terminal over similar projects such as South Hook LNG site on the British south coast because of its central location in Europe, providing it with easy transit across the Channel or further into mainland Europe. It is also seen as a visionary project planned to accommodate the future level of supply from Qatar that will help regulate Europe's seasonal gas supply.



Nord Stream Gas Pipeline Illustration

Another project included for its forward focus is the **Golar / Petrobras Floating LNG (FLNG) Project**, a technologically advanced development that utilises floating regasification terminals offshore Brazil. Its potential for replication elsewhere was a major reason for its selection, as the project provides an economically viable alternative to port connected facilities. It is set to streamline the LNG delivery process. The technology, often referred to as floating storage and regasification unit (FSRU), is expected to be deployed globally with plans already well underway to implement it offshore Western Australia.

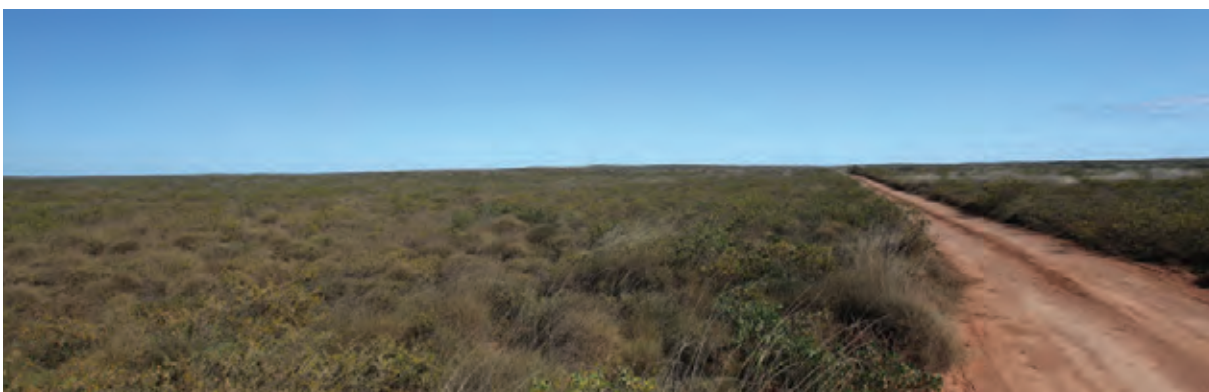
Already in development in Australia, the US\$40 billion **Gorgon Gas** project is making an impact on the financing market. Its sheer scale has led some to question its future in an increasing crowded Australasian LNG project market. However, it certainly warrants a place here.

The project includes development of the Greater Gorgon gas fields, beginning with the Gorgon and Jansz-Lo sites – the largest gas discoveries to date in Australia – with development facilities installed directly on the ocean floor at a depth of 1,300 metres. Two subsea pipelines with a combined length

of 240km will carry the gas to facilities on Barrow Island for further production and export.

The two projects selected from North America are key examples of standalone energy infrastructure developed to increase domestic supply and circulation in the US. Shortlisted before the recent oil spill, the **Cascade and Chinook Subsea Development** in the Gulf of Mexico has attracted much attention for its pioneering use of a floating production, storage and offloading (FPSO) unit. Doubts over the projects long-term economic viability will inevitably now be joined by questions over the safety of deep-sea drilling.

Finally, the **Keystone Oil Pipeline Extension** was shortlisted in favour of the more expensive LNG and gas pipeline projects currently in development in Canada. Set to transfer 1.1 million barrels per day by 2012 the project will span 3,134km from Alberta, Canada through Saskatchewan, Montana, South Dakota and Nebraska before reaching its terminus in Oklahoma. This project is seen as key to improving US energy security and easing any future reliance on external supply.



Gorgon LNG Site Landscape, Australia

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# FEATURED GLOBAL PROJECT

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## Green Power Express

POWER

By Tom Bowker  
Power Reporter  
Infrastructure Journal

The Green Power Express (GPE) will be a transmission network stretching 3,000 miles across the northern United States. It is designed to move up to 21,000MW of renewable energy from the Great Plains of America's Midwest to big population centres of the north central US, such as Chicago.

The project takes the featured spot in the Power sector and will be a true game-changer in the way the world's largest consumer of energy sources its electricity. That fact gives it a strong claim to be the most important project in the world in terms of its impact in the global fight against climate change.

Transmission issues continue to hamper efforts across the globe to switch to renewable energy, as the natural energy to produce power – and in particular wind – is generally at its strongest outside of urban areas, where the energy need is greatest. Other countries are grappling with connecting offshore wind farms to their grids; in the US, a vast expanse of country must be traversed. GPE aims to do exactly that.

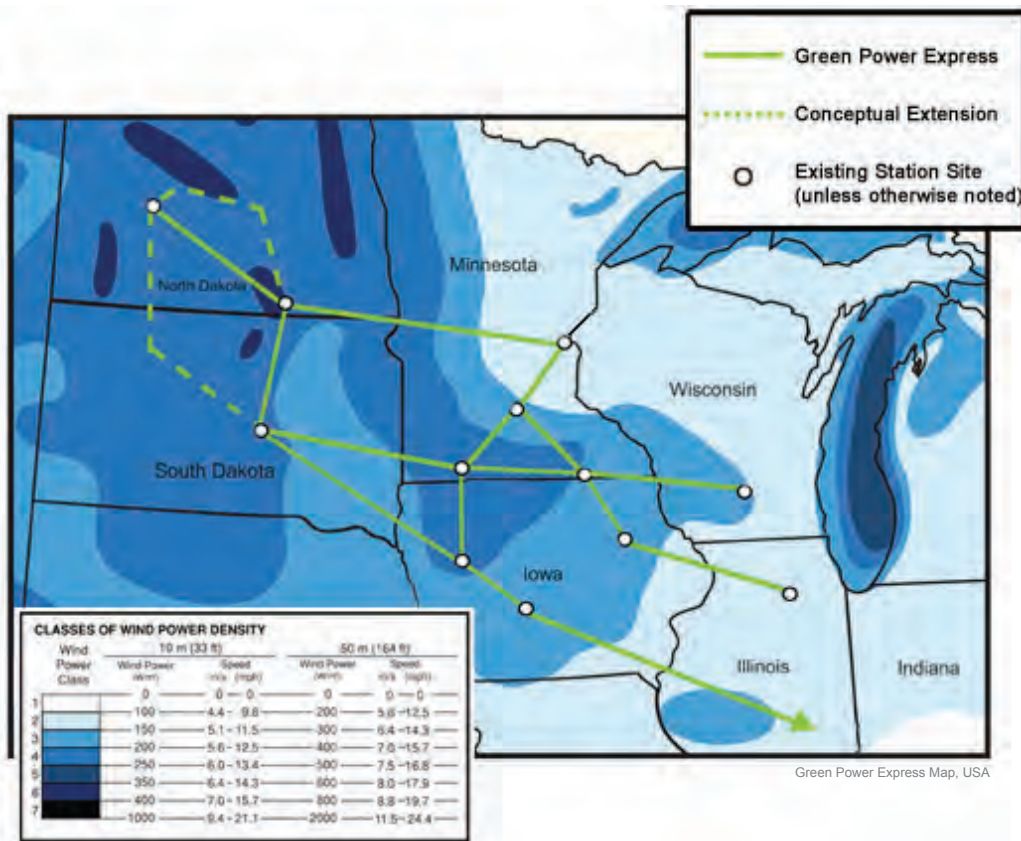
The project is the first of its kind. It will directly address this lack of electric transmission infrastructure needed to integrate wind energy from resource-rich regions with load centre communities. The transmission plan is also expected further to propel wind energy development in the Upper Great Plains region of the Midwest, potentially resulting in a reduction of 34 million metric tons of carbon emissions.

The plan is expected to cost between US\$10 billion and US\$12 billion. The network will use 765kV transmission lines and traverse an area 3,000 miles across, covering portions of seven states: North Dakota, South Dakota, Minnesota, Iowa, Wisconsin, Illinois and Indiana.

Despite an inclination among the global *Infrastructure100* judges to feature a generation project, rather than a transmission project, they finally agreed that The Green Power Express was the most impressive and significant project to recognise in this list.



Power Lines, Stock Image



Green Power Express Map, USA

Backing the project's credentials, Peter Luchetti, managing partner of US-based private equity infrastructure investor Table Rock Capital, said "[GPE] enables massive wind farm implementation on a scale that really does move the needle."

He said: "If you look at renewable energy adoption in the US over the last 50 years, we've stayed about the same percentage of production – about 6.2 per cent renewables. That was true in the '70s, and it's still true today. We have got to do some of these larger infrastructure implementations to really move the needle here. We are the largest consumer of energy in the world, so this could have more impact here than just about anywhere."

Ricardo De Vecchi of Mexican state development bank Banobras emphasised that "the sheer amount of the energy it will move is amazing. In a country such as the US there's definitely a need for big infrastructure projects, and big electricity projects." He said GPE is

a "great project that will help the US reduce its carbon emissions and be an example for other countries in the world."

GPE is promoted by ITC, the US' largest independent electric transmission company. Other supporters of the project include NextEra Energy (formerly FPPE), Iberdrola Renewables, Generation Energy, Montgomery and Denali Power Partners, National Wind, Crownbutte Wind Power, and Acciona Energy North America.

The project will propel vast amounts of wind energy to population centres in a reliable, efficient, and environmentally conscious manner. GPE will facilitate much-needed power infrastructure and improve long-term energy reliability for customers in the Midwest region's load centres – Chicago, Detroit, the Twin Cities, Cleveland, Cincinnati, Columbus, Indianapolis, and Pittsburgh.

Taking a wider viewpoint, GPE will open an economic bridge between rural

energy providers and high consumption load centres, building profit on one end and providing clean, reliable energy on the other.

Judges also noted that the project has the potential to enhance the ability of the market it aspires to serve in its bid to reduce energy costs by alleviating bottlenecks of generator interconnection requests at the Midwest ISO. Furthermore, extra high-voltage lines mean that power can be carried greater distances with availability of over 99 per cent of the time. The targeted 765kV provides the greatest capacity with the least land consumption as consistent extra-high voltage lines reduce losses over the grid.

This transformational project will facilitate further development of renewable resources in the Midwest and align with the goals of the Upper Midwest Transmission Development Initiative. Finally, by building the system with extra high-voltage lines, the GPE will make the most of the clean energy produced.

# POWER OUTLOOK

## KPMG's view

By Dr. Tim Stone

**W**hat drives energy policy today? Is it Greenhouse Gas (GHG) emissions reduction, security of supply or the age-old raw economic drivers? The answer is debatable, but what is clear is that the past decade has seen a marked rise in cleaner technologies (including renewables), the resurgence of nuclear and an increasing focus on energy efficient technologies. Security of supply concerns also influence the market as energy-hungry economies, more often than not, cannot produce the hydrocarbons that traditional power generation requires. But how does that all equate into sound economic returns that motivate investors?

Clean energy is expensive. My personal estimates are that – absent any global carbon taxes – the long-term cost of solar and off-shore wind generation is anywhere from two to four or more times more expensive than nuclear power and that nuclear sources are already about a third more expensive than the cheapest form of gas-fired generation.

So the financials don't always stack up in an intuitive way. Paradoxically, this helps previously uneconomical hydrocarbon resources become a more viable investment option, as demonstrated by the recent game-changing development of shale gas in North America and now Europe and beyond. But it also makes new forms of clean technologies such as carbon capture and storage (CCS) – which albeit more expensive than nuclear – are cheaper than wind and more attractive to investors and governments.

And let's not forget the indigenous hydrocarbon sources of major emerging

markets such as China, where (cleaner) coal technologies are – and will remain – a key source of energy. Unconventional gas may also give a quick, cheap way of reducing carbon emissions by replacing coal fired electricity generation with gas fired generation.

At the same time, long geographic distances between power generation and consumption centres increasingly require gigantic new grids, especially where renewable power - whose energy is only transmittable in the form of electrons - is a key component of the energy mix. Many renewable power sources also provide only an intermittent supply which has implications for their long-term market structure if price volatility is to be reduced.

Efforts are also underway to tackle the problem of scarcity of generating capacity through use of technological solutions like smart meters and 'intelligent' grids, though suitable investment incentives are yet to be put in place. And the challenges do not stop there. As a result of globalisation, investors' and sponsors' choice of projects is wider than ever and specialised human resources are increasingly mobile and more challenging to retain. Countries are competing for capital to an unprecedented extent.

The huge scale of the financial investment is also daunting, especially for offshore wind and nuclear power. With project/asset-backed finance for projects of such size currently effectively unavailable, serious challenges for financing markets remain in achieving this scale of development. And while nuclear developers currently have to resort to their balance sheets to fund

such investments, this, alone, is not sustainable in the longer term.

The environment also continues to be a key concern for politicians and consumers. Ironically, while the public increasingly demands cleaner sources of energy, there has been a corresponding backlash to the development of wind, solar and nuclear plants within existing communities. Today, "not in my backyard" protest groups around the world pose significant challenges to obtaining planning permissions that will allow projects to get off the ground.

But the key point remains: we're going to need more electricity in the future – a lot more. By 2020, global electricity consumption is estimated to grow by some 40 per cent, and will nearly double in many emerging economies. And by 2050, most economies will need to more than double their current generation capacity in order to meet their CO2 emissions reduction goals and respond to the growing concern of society over global warming. Governments, investors and society in general are responding to this need in varying and creative ways, including the consideration of appropriate market frameworks and implementing a wide range of fuels and technologies, as you can see in this study.

One thing is certainly clear: electricity generation and transmission, and the wider energy markets, are likely to undergo a pace and scale of change not seen since the Second World War or the Industrial Revolution. While communities in general should be the overall winners here, some dramatic winners and losers will also emerge along the way.



# LEADERS IN THE FIELD

Cebu Power Project

Coca Codo-Sinclair Hydropower Plant

Flamanville 3

Hydro One Smart Grid

Java and Sumatra Transmission Link

Madeira Hydroelectric Complex

Mundra UMPP

UAE Nuclear Energy

Vattenfall Jämschwalde CCS Plant



Flamanville 3, France

This sector threw up a number of impressive and innovative projects, reflecting the massive investment in power currently underway across the world as countries invest in ramping up their generation capacity at the same time as trying to move away from traditional, polluting methods of electricity generation.

Reflecting a widespread shift towards nuclear power, two atomic energy projects made the final shortlist. The **United Arab Emirates Nuclear Energy project** was a very strong contender to be featured, being seen by certain of the judges as a truly “transformative” project.

It will be the first nuclear power project in the Gulf region, potentially opening the flood-gates for other countries in the Middle East to launch nuclear power projects. The US\$20 billion turn-key contract is also the world’s largest nuclear power contract ever announced.

One of the main pillars of the programme is the UAE’s decision to develop it with safety and non-proliferation as its core principles and to forego domestic enrichment and reprocessing of nuclear fuel, the two parts of the nuclear fuel cycle that can most readily be used for non-peaceful purposes. International observers and non-proliferation experts have called the UAE model the “gold standard” for developing a nuclear energy programme.

The project will be built by a Korean consortium – heralding a new international player for the sector, coming on the scene in time for what is set to be a big wave of nuclear new-build worldwide.

The big push for nuclear will see many more emerging markets embrace nuclear, and the Abu Dhabi project is indicative of that – making it of significance not just for the Gulf, but also emerging markets elsewhere which have never used nuclear power.

Big projects are also underway, however, in traditional nuclear powerhouses. One example of that is EDF’s **Flamanville 3** nuclear reactor in France, a flagship project for the European Pressurised Reactor, a third generation of nuclear design jointly developed by EDF and energy firm Areva.

The new design will help to reduce chemical and radioactive releases to the environment by at least 30 per cent per kWh during the operating phase. The 1,650MW reactor consumes 17 per cent less fuel due to the use of more efficient assemblies and higher turbine efficiency. Compared to current reactors, Flamanville 3 will be able to increase annual output by 36 per cent.

Another technology to reduce carbon emissions being piloted in Europe is carbon capture and storage (CCS), exemplified in our shortlist by the **Vattenfall Jämschwalde** plant in Germany.

This US\$1.5 billion project is for a demonstration plant to provide the link between Vattenfall's pilot plant and the commercial concept that is to be developed. As such, it will take the development of CCS several steps closer to a commercial breakthrough.

The concept behind the project is both innovative and groundbreaking. The idea is to capture carbon dioxide from the power plant's flue gases, compress it into a liquid, and permanently store it deep underground in geological formations. Most of the carbon dioxide will dissolve in the reservoir water, and then very slowly mineralise. The project is designed to achieve secure, cost-effective and feasible technologies for an almost complete elimination of carbon dioxide emissions, producing energy that does not contribute to global warming.

The Latin American representatives on the shortlist are the **Madeira River Hydroelectric Complex** in Brazil, comprising two enormous hydro power plants, and an Ecuadorian hydro plant set to be the largest in the country. **Coca Codo-Sinclair hydropower project**, at US\$2.3 billion, will be the largest overseas hydropower project undertaken by a Chinese company. It is to be built by Sinohydro and funded by Chinese Ex-Im Bank funds. The plant will consist of eight generation units, totalling in 1.5GW of power generating capacity which equals 35 per cent of Ecuador's electricity needs.

That is, however, dwarfed by the Jirau and Santo Antonio hydro projects being developed on the Madeira River in Brazil. They will have a combined installed capacity of 6,450MW and cost up to US\$13 billion to build.

The projects have aroused controversy in Brazil due to fears of their impact on the region's biodiversity. However, the Madeira River Hydroelectric Complex will help to address Brazil's looming electricity shortage. When completed, the scheme will generate about an eighth of the total amount of energy provided by hydropower in Brazil. The project will also create a waterway that will reduce shipping costs for Brazil's agriculture exports.

Significant design features of the plants are its bulb type generating units, which are especially suitable for low head and run-of-river hydropower schemes such as this one. The units are highly efficient as they are fully submerged in the water and thus able to handle significant variations in water discharge, as is the case for the Amazon region.

The Madeira projects are set to be followed in Brazil by the enormous – and enormously controversial – Belo Monte hydro, with a generating capacity of some 11GW. The controversy over the plant, versus the rights of indigenous peoples who live in the area, reflects tensions common to all the world's fast-growing emerging markets.

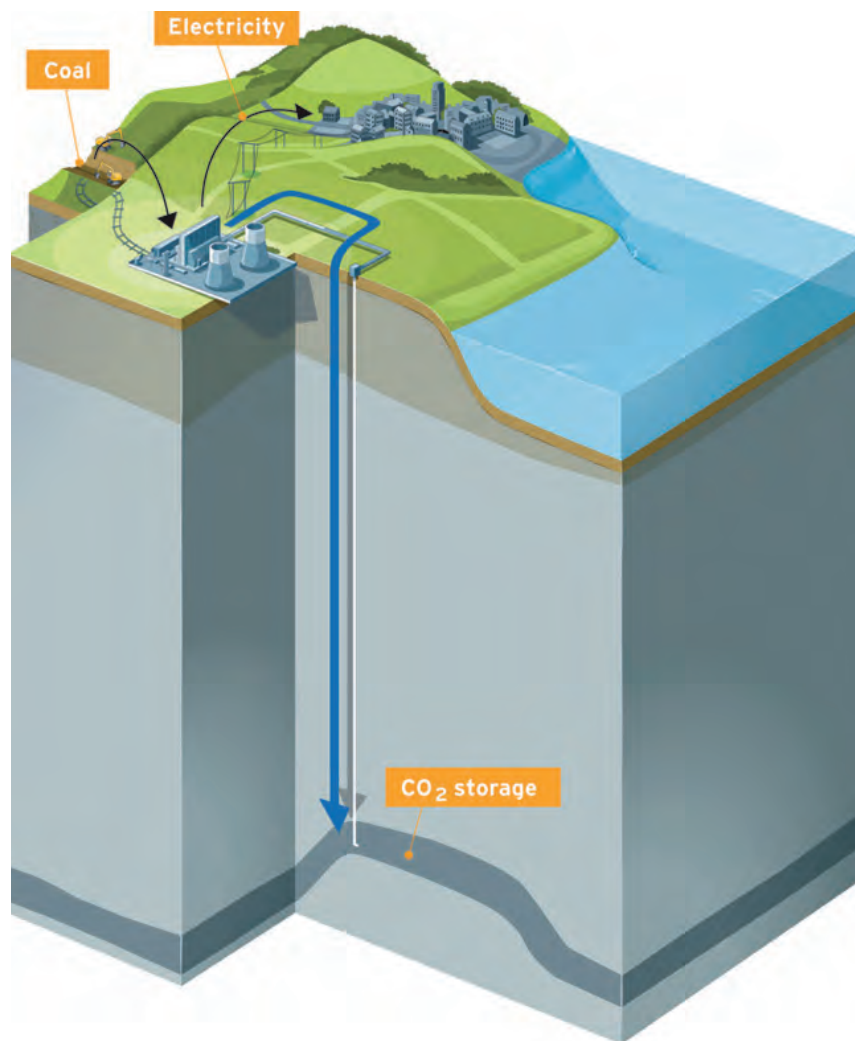
Brazil is one of the BRIC group of four big emerging markets expected to lead global growth in the 21st Century, the others being Russia, India and China. Massive economic growth must inevitably be accompanied by a similar growth in power generation – so it's no accident that another BRIC project makes our list.

India's series of Ultra Mega Power Plants (UMPP) was always going to feature, and the 4,000MW **Mundra plant** is singled out here for honour. It is one of nine UMPPs being planned and built in India, and though they use unfashionable coal they will be the most energy efficient plants in the country – and are vital to India's continuing economic development.

The successful financing of the Mundra IPP, in the shadow of the Enron's Dabhol debacle, was a major achievement. The challenging debt market at the time also forced the IFC to abandon plans to syndicate a US\$300 million B loan. Funding is now provided on a rough 75:25 debt-equity split, with nearly US\$2 billion funded by the ADB, IFC and South Korean's ECAs.



Power Lines, Stock Image



Vattenfall Jämschwalde, Germany

But beyond simply demonstrating that the UMPP projects are capable of reaching financial close – and within the pre-agreed timescale – Mundra’s financial close signalled that the Indian power sector had matured from the lessons of Dabhol and is now open for international business.

In East Asia, the 200MW **Cebu coal-fired plant** in the Philippines impressed our judges. This was the first power project in the Philippines to be entirely financed by international lenders. Coal-based generation is the most practical option in Cebu Province since further use of geothermal resources cannot provide enough immediate, reliable, and low-cost power. It is an important project for the Philippines, a jurisdiction which finds it hard to attract foreign investment, and so getting it done with international lenders only was a true achievement.

Two more transmission and distribution projects – besides the overall winner, The Green Power Express – made the shortlist. In Indonesia, state utility PT Perusahaan Listrik Negara plans to invest US\$2.2 billion in an

electricity-transmission network in Sumatra, including an **underwater link, connecting the Sumatra and Java grids** for the first time. The network will be 700km long and will link six power plants in South Sumatra, with a total capacity of 3,600MW.

A feasibility study indicated that the submarine cables would be a cheaper option than other methods of transmitting power to Java from coal-rich South Sumatra. Japan International Cooperation Agency will provide 85 per cent of the financing for the project, with state utility PLN providing the rest.

The connection would help meet rising demand from the Bali-Java grid, which is Indonesia’s biggest power consumer. Consequently, the project will contribute hugely to secure the region’s energy supply.

The judges thought this project was aspirational, but important. If it happens it will be significant, and an engineering challenge. What it aims to achieve is great, but the question seemed to linger, “Will it get off the ground?”

The final project is Ontario’s **Hydro One Smart Grid**. The utility Hydro One has directed all local distribution companies to install smart meters in every home and small business in the province – a combined 1.3 million customers. Smart meters, when teamed with time-of-use pricing, are expected to build a culture of conservation across the province and achieve significant reductions in peak demand through load shifting.

The project is to be completed in 2010. The network will integrate energy efficiency, demand response, automation, and distributed generation to enable the grid to operate more efficiently and reliably. A WiMAX solution has been designed to enable remote meter reading.

Smart grids are widely accepted to be the way forward to efficient energy consumption, and hence the judges agreed it should feature in the *Infrastructure 100*. However, they noted that they were voting more for the idea than for this specific project.





TAV Brazil planned locomotive

according to some of the judges. Officially, the tendering process should be completed in early 2010 and the signing of the contract is forecast for May/June 2010. Construction work is scheduled to begin in the second half of 2010 with completion slated for 2014 in time for the soccer World Cup which Brazil will host that year.

However, the judges, near unanimously, noted that the project would not be completed in time for the Cup. Speaking in May, Dilma Rousseff, future presidential candidate and President Lula da Silva's former chief of staff, confirmed the judges' suspicion. She said the likely plan was now to have the rail link running in time for Rio de Janeiro's hosting of the Olympic Games in 2016.

A relevant point to be considered in the project is the bidding model designed for TAV. Bidders will be requested to present the main parameters of the service to be provided – such as safety, speed, and capacity. However, there will be no pre-defined construction works. Bidders must prepare their own projects and meet the minimum performance levels.

Cost increases, environmental impact studies and delays in launching the tender have put the government under pressure. Further delays may occur if potential bidders are granted leeway to extend the statutory 60

days in which to present their plans, according to local media reports. Ultimately, any timetable, even a presently-mooted (albeit delayed) one of 2016, depends on the *Tribunal de Contas de União*, the federal auditing body, signing off on the cost aspects of the project.

The belief in certain quarters is that the government might end up footing larger costs than it had anticipated. However, lack of interest is hardly an issue. Domestic companies, most notably Bertin Group, as well as South Korean, Japanese, Chinese, German, French and Italian companies have shown considerable interest in building the rail link, according to the *Ministério dos Transportes*. Apart from France's Alstom, Asian companies have been the most aggressive so far in their attempts to secure the contract. A consortium of companies is the most likely outcome if the ambition of building a *trem bala* or bullet train between Brazil's two biggest cities is to be realised.

A lot is riding, regionally and nationally, on the success of the TAV project which is a truly remarkable endeavour as well as a centrepiece of outgoing President Lula da Silva's first accelerated growth programme (PAC) initiated in 2008. It is time for Brazil and Latin America to prove the sceptics wrong and overcome the initial hurdles.

ra Mansa

Galeão

Rio de Janeiro

# RAIL OUTLOOK

## KPMG's view

By Jonathan Moseley

Very few sectors command the intense government focus and potential scale of investment that the global rail sector does. Around the world, governments are looking to rail projects as key steps towards decarbonising the global economy. Faced with growing urban populations and growing congestion on roads and existing rail networks, governments also view rail infrastructure as a vital component of their national economic sustainability strategies.

The scale of investment will be extraordinary. According to the *International Railway Journal*, in 2010, China will step up its already vast railway expansion programme, with investment set to reach a record high of US\$120 billion. In the US, interest in high speed rail is also growing, with routes being proposed in almost every corner of the country. Just one of these projects, in California, is budgeted at almost US\$40 billion, and while uncertainty still remains regarding the outlook and timing of some schemes, tangible steps are being made on others.

Similar projects are being developed around the world. Proposals for new high speed railway lines linking major city centres in England and Scotland are estimated to cost approximately

£15-20 billion, which is in addition to the £16 billion Crossrail programme that is already underway. In the Middle East, the UAE's Union Railways scheme proposes a major mixed-use project with an initially estimated cost in excess of US\$10 billion.

With such active project intensity, competition will not be limited to the pursuit of private finance. The great technical and engineering complexity involved in several cases means that governments, promoters and developers will face increasingly significant competition to secure the private sector expertise and resources that will be needed to deliver their projects.

In this reality, the schemes that stand the strongest chance of proceeding swiftly (or at all) will be those whose delivery, funding and financing structures have been carefully designed. Optimisation of the balance between risk transfer, market attractiveness and "bankability" will be key.

While there will be continued opportunities for private financing of projects, there will be constraints on the availability of private capital and increasing global competition to secure it. More fundamentally, the economics of most schemes will mean that significant public sector funding is likely to be a requirement. The focus will therefore shift to capturing the private

sector disciplines and incentives that underlie PPP approaches and finding ways of applying these to cases where the major proportion of project funding is government-provided.

With this in mind, any major schemes will likely need to involve multiple delivery and funding/financing structures – or a "patchwork quilt" of approaches. In these cases, success will depend on creating an effective commercial "mesh" across the various components and structures, thereby ensuring the integration and alignment of commercial interests across all of the various stakeholders.

Approaches must also be designed that achieve effective risk transfer and protect taxpayer value for money while at the same time ensuring a viable market proposition. This will demand careful commercial analysis and design to establish appropriate contract packaging and procurement approaches, and creative expertise to design detailed payment and performance regimes tailored to the specific needs and circumstances of each project.

For governments, developers, promoters and their advisors, it is these commercial skills – rather than the well-established project financing techniques of the past – that will receive the greatest emphasis in the future.

# LEADERS IN THE FIELD

- ARC Trans-Hudson PR Tunnel
- Canada Line Rapid Transit
- Gautrain Rapid Rail Link
- Gotthard Base Tunnel
- Guangzhou-Shenzhen-Hong Kong Express Link
- Haramain High Speed Rail
- Jinghu Beijing-Shanghai HSR
- London Crossrail
- Santo Domingo Metro



Haramain High Speed Rail station, KSA

In 1867, en route from St. Louis onboard the North Missouri Railroad, American author and humorist Mark Twain wrote, “A railroad is like a lie - you have to keep building to it to make it stand.”

In the years that followed, the global fraternity kept building railroads despite logistical hurdles, economic pressures, two World Wars and a relatively recent threat from civil aviation. Railroads have made far flung corners of nations more accessible. So if the inimitable Twain felt railroads were all about continuous building, then 21st century projects are certainly on the right track.

Projects, highlighted in *Infrastructure 100*, are potential bellwethers of how rail transit might shape out over the next decade as carbon emissions reduction becomes a priority for nations and states. Brazil's TAV Project was featured among equals but accompanying it are others adjudged to be leaders in the field of innovation, ambition, project delivery, scale and above all their potential social impact on communities they aspire to serve.

In recognising them, the judges felt passenger projections and an ability to transform lives should matter most. Dominican Republic's **Santo Domingo Metro** is one such initiative, prompted by a need for reduction of heavy road congestion in a city of over three million inhabitants. Commercial operations commenced in January 2009 linking the city's northern district of Villa Mella to La Feria in the south. Daily commuter numbers are about 200,000 for the first Metro line which is 14.5km long with 16 stations. Five further transit lines have been planned.

In North America, long distance high-speed rail networks remain an aspiration. Policymakers, most notably US President Barack Obama, believe such networks, akin to European railways, are viable alternatives to short-haul air travel. However, current focus largely remains on urban transit systems.



Among them, **Canada Line Rapid Transit** project in Vancouver, BC stood out. This 19.2km rapid transit line, with 16 stations, is designed to carry 15,000 passengers per hour per. It has three water crossings, bored and cut-and-cover tunnels, elevated and at-grade level components.

Its North Arm Bridge is North America's first extra-dosed, cable-stayed bridge. The Premier of BC Gordon Campbell confirmed on March 27, 2009 that the project was under budget and ahead of schedule. It joined the Vancouver SkyTrain grid in August 2009.

Judges also felt the **ARC Trans-Hudson Passenger Rail Tunnel** is indicative of the seriousness with which US states are addressing urban commuter congestion issues. The century-old New York – New Jersey passenger rail system under the Hudson River has reached capacity, and is impeding the region's mobility and economic future.



Gotthard Tunnel Construction Works, Switzerland

Aiming to eliminate the impediment, this project includes two new tracks under the Hudson and New Jersey Palisades. A new six-track passenger station, under auspices of the New York Pennsylvania Station Expansion (NYPSE) programme, will also be built under 34th Street encompassing the historic Penn Station. Tunnelling will begin this year, with other major works, expected to follow.

In Asia Pacific, a number of impressive projects were observed from Vietnam to Australia. However, it is hard to ignore China's plans with a staggering US\$100 billion per year earmarked for rail infrastructure investment between 2010 and 2012. No other nation in the region has rail projects as ambitious and socioeconomically transforming as China's. Flag-bearers are **Jinghu (Beijing-Shanghai) Rail Link** and **Guangzhou-Shenzhen-Hong Kong Express Link**.

Jinghu is a 1,310km long high speed railway between Beijing and Shanghai. Over 80 per cent of the track will be laid on 244 bridges; one of which – the 164km bridge between Danyang and Kunshan – will be the longest in the world. Future commuters will also travel through 22 tunnels totalling 16.1km in length. Locomotives achieving speeds of 186mph (300kmph) are slated to reduce journey times between the two cities from 14 hours to just five. Despite market scepticism, the Chinese government says the construction would be completed by 2011. Judges agreed that the project's importance for China from a strategic and economic standpoint cannot be understated.

The Guangzhou-Shenzhen-Hong Kong Express Link, covering a distance of 142km, is nothing compared to the Jinghu project and others across mainland China. However, it is critical for Hong Kong to remain competitive with huge economic and social implications. It is also expected to enhance Hong Kong's links with China. Judges noted the slow progress made by this project, financed directly by the Hong Kong government, but were moved by its transformational capacity.



Crossrail's proposed station at Canary Wharf, London, UK





ARC Trans-Hudson PR Tunnel, USA

The Africa, Middle East and India region also has several dynamic projects. Impressive projects were scrutinised in Bahrain, Kuwait, Qatar, UAE and India but Saudi Arabia's **Haramain High Speed Rail** and South Africa's **Gautrain Rapid Rail** projects were chosen for their dynamism and potential to transform regional mobility.

The Haramain High Speed Rail project is among the most ambitious transport projects on a global scale. Its competitive tender commenced in January 2010. This 440km double line, inter-city rail service aspires to provide a safe and comfortable transport solution for up to three million passengers per year. Locomotives with speeds of 186mph per hour would cut journey times between Mecca and Medina to two hours, and shorten travel times between Jeddah and Mecca to half an hour.

Gautrain Rapid Rail Link is the largest infrastructure PPP in Africa and also the largest rail infrastructure project under construction in the world. The judges commended the project for its size, scope and socioeconomic dimension. This state of the art 80km rapid rail network will impact a large population in South Africa upon completion. Dual links connect Pretoria and Johannesburg and Tambo International Airport and Sandton with Phase I scheduled for completion in 2010. A socioeconomic development strategy has ensured that previously disadvantaged groups will benefit from the project.

There is no paucity of projects to consider in Europe and the judges had an unenviable task of short-listing from over twenty projects from 13 countries. No other continent relies on its rail infrastructure more and perhaps benefits as much. Several noteworthy projects were up for consideration including Lisbon-Poceirao TTT (Portugal), GSM-R (France), HS2 (UK) and Marmaray Cross-Bosphorus Tunnel (Turkey). In the end, the impressive list was whittled down to the **AlpTransit Gotthard tunnel** and **London Crossrail**.

AlpTransit Gotthard is creating a flat rail link for future travel through the Alps by cutting journey times between Zurich and Milan by an hour via a transalpine tunnel. Once completed, it will be the world's longest tunnel with a length of 57km. Tunnelling through the Alps has always been an engineering challenge. This Swiss project takes that challenge to a new level as engineers create tracks suitable for high speed trains, aiming to improve rail travel in the heart of Western Europe.

As Europe's largest civil engineering construction project, London Crossrail would be a high-frequency, convenient and accessible railway for the continent's financial capital and the wider South East of England. It will ease commuter congestion by linking Heathrow Airport, West End, City of London and Canary Wharf financial district. Preparation work has started and the line is expected to be operational in 2017.

# FEATURED GLOBAL PROJECT

## Incheon Tidal Power Project

### RENEWABLES

By John McKenna  
Energy Editor  
Infrastructure Journal

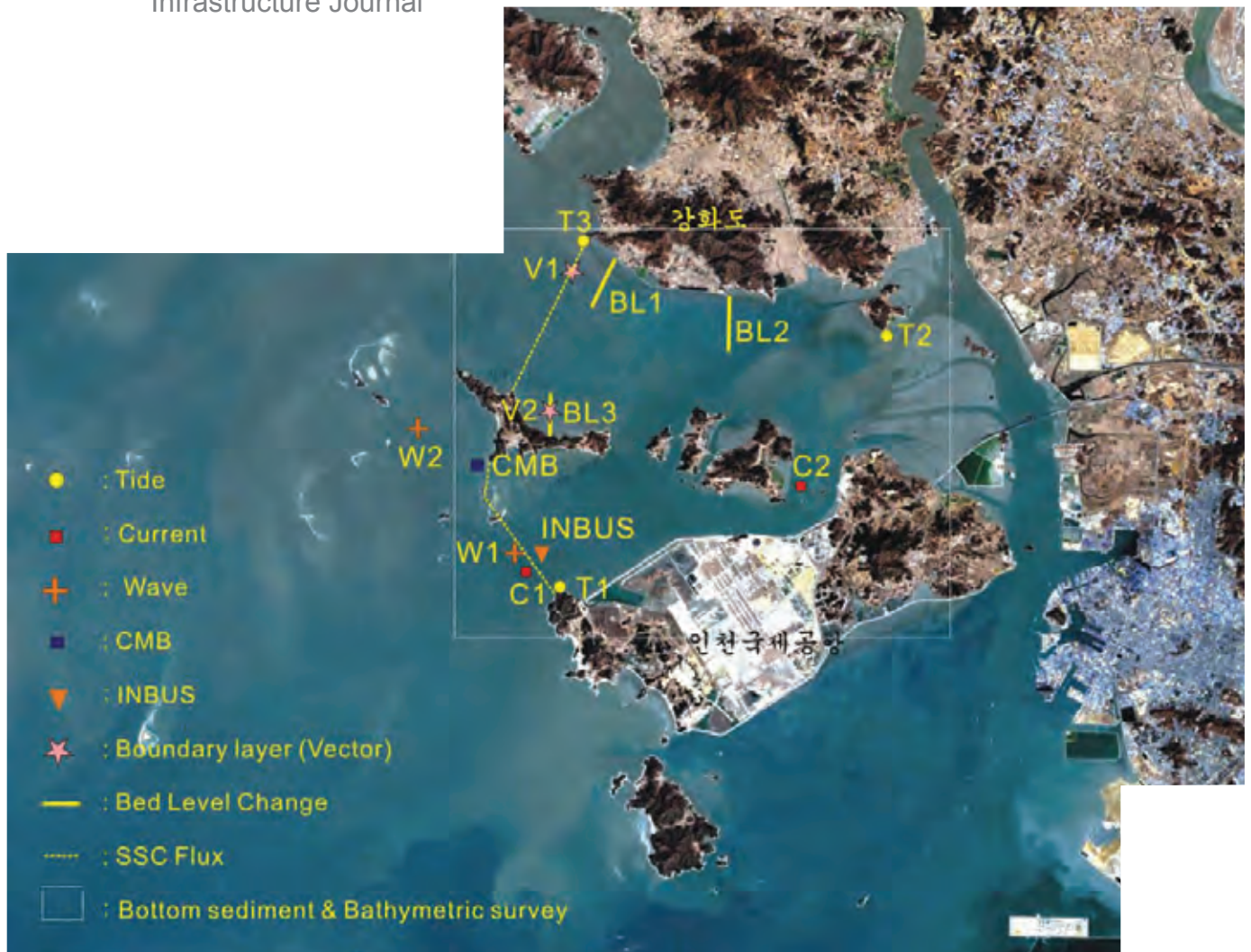
As wind and solar power is widely deployed at both small-scale and utility-scale levels, countries across the globe, focussed on cutting their carbon emissions are looking for other technologies that can bring big wins in terms of renewables generation. Not only is there massive potential in the sea as a generating resource, but wave and tidal power is also far more predictable than solar and wind power.

Unfortunately development of wave and tidal power technology has not kept pace with other forms of renewable energy and it is now between three and four times more expensive per megawatt to develop than wind power, owing to many of the technologies being embryonic. The most established form of tidal technology is the tidal range

method, whereby a barrage is built across an estuary. The tide is allowed to flow in through sluices before the sea is then impounded until the tide recedes.

Once sufficient head – the difference in height between the impounded water and the sea on the other side of the barrage – has been established, the impounded water is released through the turbine gates to generate electricity. The only large-scale barrage currently operational is the 240MW La Rance barrage in Brittany (France), which has been running successfully since the 1960s.

*Infrastructure 100's* featured Renewables project is a barrage being built in South Korea that will have more than five times the generating capacity of La Rance. The project is the



Incheon Tidal Power Project, South Korea

1.32GW Incheon Tidal Power Project, sponsored by state-run Korea Hydro and Nuclear Power (KHNP).

Located in Incheon city's Gyeonggi Bay, 80km west of Seoul, KHNP signed a memorandum of understanding with GS Engineering & Construction to develop the project in January 2010, following five years of investigations. This trailblazing project will comprise 44 water turbines each with a generating capacity of 30MW.

It will connect four islands - Ganghwa, Gyodong, Seoggeom and Seongmowith - with seawalls and install 32 electric generators. Electricity will be generated by using the difference in water levels during high and low tide, which can reach a maximum of 9.6 metres. On average, the difference is about 6 to 7.6 metres. The sheer scale of this landmark project is difficult to ignore and there are significant engineering challenges to overcome.

Incheon Tidal Power has attracted controversy over its environmental impact on the regional ecosystem. Local civic groups have been criticising the plan, asserting that the massive construction will destroy vast areas of wetland on the west coast.

Officials have reassured opponents that artificial wetlands and fields of reeds will be created using by-products of the construction. Key bird habitats in the region will also be protected by creating alternative breeding sites.

While selecting Incheon as the featured renewables scheme for this publication, some judges expressed concerns about the project's environmental impact. However, others noted the positives outweigh the negatives as Korea lacks an abundance of natural resources to harness for electricity generation.

The project was chosen as the featured renewables scheme for its game-changing potential: a tidal barrage of Incheon's size and scale has never been attempted before, but should it be successful, several might soon follow.

Tidal barrages work best when there is a substantial tidal range, i.e. the vertical difference between high and low tide. The greater the tidal range, the more pressure is exerted on turbines when water is released.

Incheon is providing the inspiration for the sites of world's two top tidal ranges are both currently being considered for tidal power development. Canada's Bay of Fundy has a tidal range of 17m, the world's largest, and three companies are currently in the process of testing tidal stream devices in the Bay.

The UK's Severn Estuary has the second greatest tidal range at 14m. A two-year government study into five potential options – including three barrages similar to Incheon - is due to report its conclusions later this year.

Of the three barrage options being considered for the Severn, one is smaller than Incheon at 625MW (projected to cost £2.3 billion), one is roughly the same at 1.05GW (£3.2 billion) and one is more than six times the size of Incheon at 8.64GW (£20.9 billion). These projects would all face the same environmental and engineering challenges, particularly the creation of artificial wetlands and bird habitats.

With the UK having deliberated over the construction of a barrage on the Severn Estuary for more than 30 years, the success (or otherwise) of Incheon may well determine whether the UK and other coastal nations finally embrace investment in tidal power on a grand scale.

# RENEWABLES OUTLOOK

## KPMG's view

By Adrian Scholtz

Deal-making and transactions continue to dominate the outlook for the renewable energy sector. Set against a backdrop of energy security concerns, fluctuating oil prices, and the availability of 'feedstock', the renewable energy sector continues to evolve, in part thanks to technological innovation, robust incentive programmes and – in many cases – stubborn optimism.

At the same time, public concern over the environment and the growing calls for a global 'carbon tax' has created great interest in low-carbon technologies and sources. In turn, this is driving fierce competition for the limited pool of investment and financing available to the sector. This is particularly true for off-shore technologies which require much higher initial investment, are more difficult to maintain and hold more long-term risk.

But as the equity markets start to recover, there has already been a significant upswing in the number of completed deals in the sector. In the first few months of 2010, the market has more than doubled the number of transactions in comparison to the corresponding period in 2009. Leading this charge are transactions for solar companies, followed closely by wind projects.

However, there still remains a significant gap between the valuation expectations of sellers and acquirers. While recent

transactions have been closing at around 9x historic EBITDA (which is a 30 per cent discount to 2006-2008 valuations), the majority of acquirers believe a 5x EBITDA valuation to be their ceiling. At the same time, securing finance from traditional banks has become harder and more expensive for the sector over the past year, in part due to a debt market that is not keeping up with the sector's rapid growth.

Despite the disappointing outcome of the Copenhagen Climate Change Conference in December 2009 (COP15), many countries have already approved and distributed significant incentives and stimuli in the form of direct grants, feed-in-tariffs (FiTs) and loan guarantees. According to Yvo De Boer, Executive Secretary of the United Nations Framework Convention on Climate Change, "Since the summit, 43 industrialized countries as well as 41 developing nations have submitted national targets and action plans to reduce carbon emissions on a national level. These countries represent 80 per cent of the global energy related CO2 emissions."

While these initiatives will act as the principal driver for renewable energy activity over the next 18 months, the US will continue to be a key market for renewables, supported by the American Recovery and Reinvestment Act (ARRA).

China and India are also expected to bolster their incentive programs, while some major European countries such as Germany and Spain are actively reducing stimuli. In many jurisdictions, government financed 'incubation' clusters are further nurturing the development of technology and start-up companies.

While wind is still recording significant deal activity, our research has shown that dealmakers - particularly large companies such as the utilities - are betting on biomass projects as the next big global trend. In comparison to more intermittent technologies such as wind and solar, biomass plants have the advantage of yielding higher returns than other renewable energy sources and operating more effectively as a base load power source, making the sub sector an attractive investment.

However, the biomass sub-sector still faces a number of difficult challenges on the road to adoption including the securing of finance for construction, the identification of long term sources of fuel, and the management of the visibility of fuel prices. Yet despite these challenges, a growing number of investors are driving biomass projects forward alongside their wind and solar portfolios, which will be arguably easier to deliver in the short to medium term.

# LEADERS IN THE FIELD

## ARCOSOL TERMESOL

Cape Wind

Dunhuang 10MW PV Project

Hidromaule Lircay

KenGen 280MW Geothermal Project

London Array Offshore Wind

Ontario Wind and Solar Clusters

Parc Eolien Taiba Ndiaye

Parque Eólico Talinay



Wind Turbines and Solar Panels, Stock Image

The renewable energy sector is one where excitement is derived from potential, i.e. the potential success of new technologies, the potential for growth in emerging markets and the potential for mega-projects in more established markets.

This sector's most established market, Europe, offers the most thrilling schemes; none more so than the proposed **London Array** offshore wind farm. With a 1GW generating capacity, the project would be the largest offshore wind farm in the world. It would include 341 wind turbines installed over 20km east of the Thames Estuary. In May 2009, the three sponsors of the project, DONG Energy, E.ON and Masdar, announced they would be investing €2.2 billion in the first phase.

Despite its impressive scale, doubts linger over whether the project will ever be realised in full. It has been beset by problems, such as one of its major stakeholders (Shell) exiting the project and a concrete date for setting turbines in the sea is yet to be put forward.

Europe's other shortlisted scheme for the *Infrastructure 100* is **ARCOSOL TERMESOL**, a project comprising two 50MW solar thermal plants in San Jose del Valle in Spain. The project was financed in 2009 and both plants employ concentrating solar power technology and salt storage. The judges like this technology and the potential it represents.

Kenya's **KenGen Olkaria 280MW Geothermal Project** is the only geothermal scheme in the final *100* and was shortlisted for both its scale and its ability to compete with fossil fuels in meeting the east African county's growing electricity requirements. Kenya Electricity Generating Company is planning two new geothermal units at its Olkaria I power plant with a combined capacity of around 140MW and a new plant, Olkaria IV, with another 140MW generating capacity.



Financial close on the project's debt financing is scheduled for June 2010 and the project is expected to be completed in 2013. The development will form the biggest geothermal plant in the Kenya and one of the largest geothermal projects in the world. Africa's other shortlisted project – **Parc Eolien Taiba Ndiaye** – is again a case of established renewable energy technology finding a foothold on the continent at a utility scale that can compete with the prevalent coal, oil and gas-fired power plants.

It will be a 125MW wind project located in the commune of Taiba Ndiaye in Senegal, about 75km northwest of the Dakar. The project will be the first wind project in Senegal as well as the first commercial wind project in West Africa. Currently under construction, the project will represent the single largest private investment in the energy sector in Senegal when completed and could lead to further projects.

The growth potential seen in Africa is mirrored in the Asia Pacific region, with China in particular promising to be on the verge of a solar and wind power boom. The **Dunhuang 10MW PV Project** in Dunhuang City is China's largest and first major PV project. Located in China's Gansu Province, it will have a franchised operation term of 25 years and produce 16.37 million KWh annually.



Hidromaule Lircay Project, Chile



Parc Eolien Taiba Ndiaye, Senegal



Offshore Wind Digital Graphic, Stock Image

The contract was awarded in September 2009 and the project is currently under construction. It is anticipated that the development and construction of the project will further help promote other utility-scale grid PV projects. After Asia Pacific, the third and final emerging region is Latin America. Unlike Africa, Middle East and Asia, the southern American continent is an emerging market region that already makes substantial use of a well-established renewable energy technology – hydroelectricity.

Hydropower is a one of the region's main power sources, and this popular technology has provided one of Latin America's two shortlisted projects. The **Hidromaule Lircay** run-of-river scheme consists of a 20MW run-of-river hydropower project located along the Lircay River in Chile's VII Maule Region. The plant's design was relatively simple and proven, comprising a 3km canal extension with no tunnelling to an established irrigation canal network, two Francis turbines and a 27km transmission line.

The project was large enough to make an international project financing cost-effective, but small enough to prove that it is possible to independently develop world-class small hydropower plants. Outside of hydro, the Latin American region has been slow to embrace renewables for electricity generation (although it does have a booming biofuels industry), so any developments in wind or solar are to be welcomed given the region is likely to be a huge growth market, particularly for solar power.



ARCOSOL TERMESOL, Spain

The region's other shortlisted project was not a solar scheme, but a wind project, and again is located in Chile. The 500MW **Parque Eólico Talinay** wind farm is a 10,000-hectare facility that will be built in three phases in the Ovalle community in the Coquimbo region of Chile. Equipped with 243 Vestas wind turbines ranging from 2MW to 3MW of capacity each, the first phase of construction started in 2009 and once complete the project will be the largest wind farm in Latin America.

The rapid up-scaling of renewables is already happening in North America, particularly in the US, thanks to government incentives. In a region that is playing catch-up with Europe at a rapid pace, there are a number of significant milestones on the horizon, not least the first of our shortlisted projects for the region.

**Cape Wind**, located on Horseshoe Shoal in Nantucket Sound, will be the US' first offshore wind farm. It would include 130 turbines with a combined generating capacity of up to 420MW. After 10 years of developer Cape Wind Associates battling against local opposition including the influential Kennedy family, US Secretary of the Interior Ken Salazar finally gave federal approval to the project in April 2010. This was followed in May 2010 by a power purchase contract being signed between Cape Wind Associates and National Grid.

Should it finally be built, the project must be recognised as something truly outstanding. This amazing North American offshore wind project will pave the way for other projects in the future. In North America, like Africa, the huge level of resource and potential to build renewable energy projects on an unprecedented scale is what makes the market so exciting. Nowhere is this capacity for large scale renewables more evident than in the second shortlisted project for the region, the **Ontario Wind and Solar Clusters**.

The project is designed to triple Ontario's output from wind and solar, with clusters built over 20 years in several locations throughout the province. By 2016, wind turbines will have been built to generate 2,000MW and solar power facilities to generate 500MW. It will be the largest project of its kind in the world once completed.







Hong Kong-Zhuhai-Macau Bridge Pearl River Delta Intersection, Hong Kong

socioeconomic impact of this project is huge. It will open up a whole new economic region and reduce travelling times between Hong Kong and Zhuhai from 4.5 hours to 40 minutes. The true impact of the deal is the linkage to the south west part of China into the major hubs.

It is a landmark example of the development of western Chinese infrastructure and its impact will be felt across generations. One member of the judging panel said: "It's an incredible project and a paradigm shift for the human condition in this part of the world."

The commencement of ground investigation works for the Hong Kong Boundary Crossing Facilities (HKBCF) - which was officially launched on 10 December 2009 - marks an important milestone and will provide essential geotechnical data for the detailed design of the project.

In March (2010), the government of the Hong Kong received over 160 entries from more than 20 countries for the HZMB international design ideas

competition. All eligible entries and winners will be showcased in the roving exhibitions later this year. The Hong Kong-Zhuhai-Macau Bridge Advance Work Coordination Group was established in 2003 and China's central government and the regional governments of Guangdong, Hong Kong and Macau agreed finance in 2008.

In March 2009, Arup was appointed to carry out preliminary design work for the 30km Chinese section, in joint venture with Highway & Planning Design Institute Beijing, COWI, First Harbour and Shanghai Tunnel. Arup's work covers the three cable stay bridges and viaducts linking them together. COWI and Shanghai Tunnel Design Institute are concentrating on the tunnel.

Prefabrication is likely to dominate the project, given that it will be built in open sea across a region where construction programmes are likely to be squeezed by extreme weather ranging from typhoons and tornadoes

to tropical cyclones and lightning storms.

Four-fifths of the length of the 30km main section is made up of a combination of cable-stayed bridges and viaducts with the remainder being an immersed tube tunnel. The crossing runs across the mouth of the Pearl River Delta which is a major river route.

An immersed tube tunnel will take the crossing under a fourth navigation channel close to Lantau Island. With its proximity to Hong Kong's Chek Lap Kok airport precluded bridge construction, a 5.5km immersed tube tunnel was the best option.

The Hong Kong-Zhuhai-Macau crossing is a giant in the world of bridges and tunnels and stands as the first major marine bridge and tunnel project in China. It is not surprising - based on these accolades and the multiple impacts the project will have on this Asian region - that the deal was the obvious choice for the *Infrastructure 100* featured road schemes.



# ROADS OUTLOOK

## KPMG's view

By Richard Threlfall

Forget copper and gold. If you want to invest in a rock-solid commodity, try tarmac. Global demand for roads construction is - forgive me - motoring. Construction continues unabated across North America and Europe. But it is the programmes in China, India, Brazil and the Middle East that will eventually dwarf the networks now in place across most of the developed world. Pause on China. In 2006 they laid 69,000km of road and in 2007 a further 53,900km.

Take some basic comparisons. The US has 21 kilometres per person of road. Now compare this to China (2.7km), Russia (6.7km), India (2.9km) or say Syria (4.5km). While on their own, roads do not drive development, they are certainly an essential catalyst when combined with access to real estate and social infrastructure.

This interdependency between the provision of road infrastructure and the quest for wider social regeneration also creates opportunities for some interesting commercial models.

India, for example, ties real estate concessions along the route to the completion and upkeep of road infrastructure, thereby completing large amounts of infrastructure with little to no government funding.

This is in contrast to the traditional tax-paid procurement methods that underpinned the vast majority of the North American and UK networks, and which continues to be the norm in many jurisdictions today.

But one of the key problems with traditional procurement is that it fails to secure the maintenance of the asset. According to the American Society of Civil Engineers around US\$106 billion is needed to improve the condition of the US national network.

Hence, while the European toll road mania that characterised the last two decades has begun to falter under the weight of economic recession and national road pricing frameworks, toll roads still continue to be an enticing option for financially-strapped governments.

Those following this route may well benefit by studying the lessons learned by countries such as Portugal: where the burden of road payments has forced the conversion of shadow tolls to real tolls; or Ireland, where the first PPP roads were funded through real tolls, but the latest batch are availability based; and Hungary, where real tolls were withdrawn (albeit that at the same time the national vignette system was extended).

The lesson for governments is that one size does not fit all. Policy decisions should be made based on the deliverability of user pays, which – in turn – depends on the wealth of the economy and the relative availability and cost of the alternatives.

Looking ahead, potentially one of the most significant changes for the road sector in the future will come from national road pricing. Pricing schemes

for HGVs are already in place or in development across much of Europe. Following the establishment of the trans-border Eurovignette scheme back in 1995, schemes currently exist in Switzerland, Austria, Germany and the Czech Republic. Then there are noteworthy city-based schemes in Stockholm, Singapore and London.

However, it is the extension of these programmes to all roads and vehicles is likely to bring about the most significant changes to the outlook for road infrastructure. Besides sweeping up the entire current toll roads, these schemes will provide governments with unprecedented insight and control over the cost of travel, choice of mode and patterns of economic development.

Ultimately, these programmes should lead to a renewed focus on higher-volume routes which will likely receive more investment, lanes and associated infrastructure than the peripheral roads which 'earn' less. When viewed in the context of the shift towards electric powered vehicles and the inevitable move from fuel-based tax regimes to distance-based ones, it becomes obvious that a dramatic evolution is already underway within the roads sector.

From Seattle to the Sinai and from Swindon to Singapore, the stage is gradually being set for a system of road investment that is primarily driven by consumers rather than governments.

# LEADERS IN THE FIELD

Autopistas de La Montaña

IH 635 (LBJ) Managed Lanes P3

M25 Widening PPP

Mafraq-Ghweifat Highway PPP

Nanjing Yangtze Tunnel Crossing

Qatar-Bahrain Causeway

R1 Expressway

São Paulo Ring-Road -  
RodoAnel Oeste

Windsor-Essex Parkway/  
Detroit River Int. Crossing



IH 635 (LBJ), USA

Roads are often seen as the initial building blocks for the development of infrastructure, trade and commerce, and an economic stimulant. A key driver in the selection process in this category has been the social impact of roads – in reducing travel times, congestion and emissions. Subsidiary judging factors included benefits to local residents and businesses, and boost such projects provide to employment.

The projects shortlisted represent a wide-ranging, ambitious and eclectic mix of deals that demonstrate real progress in global infrastructure development. They are leading examples of technical and financial innovation as well as leaders in terms of scale and complexity. These projects are vitally important to the regions they serve and have opened up whole new areas of economic growth.

While short-listing, cross-border connectivity was as much of a deciding issue as the centrality of trade links between different regions and countries. Many projects put forward for this category were identified as Trans-European Transport Networks (TEN-T) schemes – part of a co-ordinated approach to developing a wider European transportation system.

Although not allocated as a TEN-T project, the [R1 Expressway](#) in Slovakia forms part of the international E-road network - route E 58 - and is one of the largest transport deals in the CEE region to date.

The 51.6km availability fee-based concession exemplifies real progress in global infrastructure development as the first DBFOM project in Slovakia and one of the first large road PPPs to close in the region outside of Hungary. Another strong example of connectivity in Europe is the UK's [M25 Widening PPP](#). This landmark transaction will have a dramatic impact on reducing congestion around London and more widely across the UK motorway network.

One of the panel judges commented that through reducing congestion, the M25 scheme will produce lower emission levels – proving to be an example of managing the environment better, rather than simply responding to increased demand.

The project pulled together a range of significant investors and came through the financing stage during the height of the financial crisis. After decades of neglect, the impact of the London orbital deal will be a leading example of how to manage road infrastructure in complicated urban areas. The need to deal with congestion problems and improving aging infrastructure has also been strongly felt in the US; particularly in the large metropolitan areas such as Los Angeles, California, and Dallas, Texas.

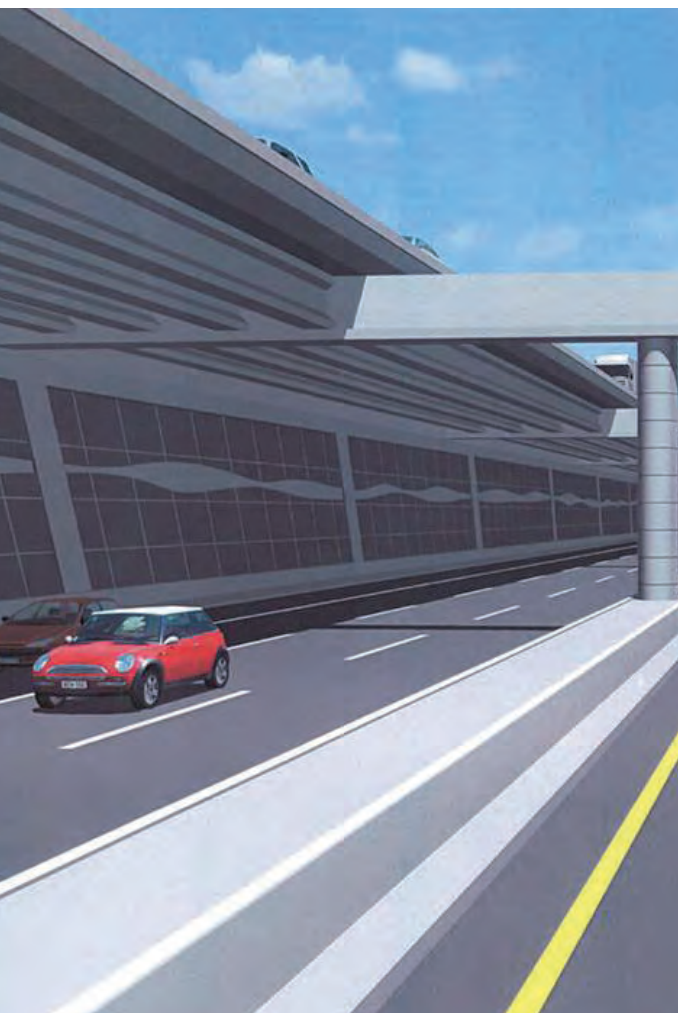
The Lone Star State's **LBJ Freeway Managed Lanes P3** project is one such deal moving towards financial close and due to its scale and innovation will have much larger implications nationally. Managed lanes P3s are gaining traction in the US and will likely be replicated by other states and municipalities with congestion problems.



Detroit River International Crossing - Windsor-Essex Parkway, Canada/USA



Desert Highway, UAE



IH 635 - Animated Illustration, USA

The project will relieve congestion north of Dallas on 13 miles of IH 635 from just west of I-35E to just east of US 75, and south on I-35E from I-635 to Loop 12. Upon completion, it will have one of the most comprehensive managed HOV lane systems in the US, deploying Automatic Vehicle Identification (AVI) technology.

Other than the roll out of managed lanes P3s across the country, another notable area is cross-border infrastructure development. The **Detroit River International Crossing (DRIC)** is a strong example of this, and at US\$2.3 billion, is of great importance to both the US and Canada. The Detroit River gateway handles around 20 per cent of the total US trade with Canada and over 29 per cent of heavy vehicle and haulage traffic.

It is an unprecedented and unique cross-border P3 effort to provide safe, efficient and secure movement of people and goods across the US-Canadian border. One of the most significant impacts of the project is the economic benefit in Michigan and Ontario – with up to 10,000 construction jobs created; an additional 25,000 jobs may be retained after construction.

The economic and social benefits of the development of road infrastructure are also apparent throughout Latin America, in particular a section of the **São Paulo ring-road – the Rodoanel Oeste**. In one of the largest cities in the Americas, the Rodoanel deal will have a significant impact on reducing traffic volume and developing infrastructure in the expanding city.

The deal is the largest long-term transportation transaction in Latin America and a leading example for the development of PPPs in the region. One of the judges commented that it was good to see local companies winning the contract – along with international firms involved – thereby providing a strong model for the rest of Latin America.



Qatar-Bahrain Causeway, Qatar/Bahrain

The project is also a first for JBIC as they are involved without any Japanese connections to the project. Colombia's [Autopistas de La Montaña](#) project is a further example of the scale and complexity of deals getting done in Latin America.

The strategically important deal is logistically challenging - crossing 125 municipalities and stretching 1,251km – but will bring huge social benefits and help increase trade and commerce in Colombia and the surrounding region.

The ambitious highway will help Colombia increase its regional connectivity and significantly reduce transportation costs. Regional and international connectivity is a fundamental issue that brings together all the road projects in the *Infrastructure 100* – and this is certainly the case when it comes to deals in the Middle East.

The [Mafraq-Ghweifat Highway PPP](#) in Abu Dhabi creates an important cross border road link between the UAE and the neighbouring countries of the Kingdom of Saudi Arabia as well as the State of Qatar.

This project is of strategic importance to the Emirate of Abu Dhabi since it will serve as the land link between the UAE. The 327km pathfinder availability deal ticks all the boxes as regionally transformative and integrative, as well as innovating in terms of financing structure and technology. The project also includes a unique shareholders agreement that was drafted to manage the hybrid of government equity and associated structuring issues under Abu Dhabi law.

The [Qatar-Bahrain Causeway](#) is another ME deal that made the shortlist for the Africa, Middle East and India panel due to its scale and interconnectivity. Once complete, the 40km causeway will be the world's longest marine causeway connecting the west coast of Qatar to the east coast of Bahrain.

The causeway is an exciting project with great technical challenges and now includes the development of a rail link in the project scope. Another landmark project that presents significant technical challenges is China's [Nanjing Yangtze Tunnel Crossing](#) - both from a design and construction viewpoint.

At just 3.71km long under China's longest river, the engineering challenges were huge and getting the project running is a tremendous achievement. One of the judges pointed out that shorter, shallow tunnels are often more difficult than long tunnels. As the first underwater crossing of the Yangtze River in Nanjing, Jiangsu Province, the project has overcome some unique challenges.

# FEATURED GLOBAL PROJECT

## Greater Manchester Waste D.A. PFI

### SOCIAL INFRASTRUCTURE - OTHER

By Angus Leslie Melville  
Editor  
Infrastructure Journal

One of the greatest challenges of the 20th Century was to reduce the amount of waste that was being sent to landfill sites, while at the same time driving ahead an agenda to increase recycling. As the throw-away society established itself in the second half of the 1900s, the UK had fallen behind the rest of the Continent and soon settled into its moniker of the Dirty Man of Europe.

It was in this environment that the north western English city of Manchester decided to tackle the issue of waste and avoid impending penalties from the European Union Landfill Directive. It entered the 21st Century determined to pull together the financing for one of the most ambitious projects to sort and recycle the city's waste as well as building a number of waste-to-energy power plants.

The Manchester Waste PFI project stands out as the featured project to be spearheaded in the UK and sees the Greater Manchester Waste Disposal Authority (GMWDA) pool the efforts of the largest of six waste disposal authorities established by the Local Government Act 1985.

The waste management project will provide a revolutionary integrated solution for the 1.3 million tonnes of municipal waste which the Authority handles each year, and is the first of its kind in the UK on this scale. Its impact will be felt by nine boroughs which accounts for 973,000 households and a resident population of more than 2.27 million.

It is the social impact of such an impressive and innovative deal that made the Infrastructure100 judges single out Manchester Waste as the global winner for this section, beating as it did hugely impressive deals like the construction of the world's tallest building, the retrofit of the Empire State Building, Olympic Village for the 2012 London Olympic Games and challenging telecoms deals.

The new facilities, which involve more than 40 sites and the application of several different technologies, will see the creation of world-class facilities to divert more than 75 per cent of Greater Manchester's municipal waste from landfill. And that is a lot of waste as the municipality represents a staggering 5 per cent of the UK's total.



Greater Manchester Waste Sites, UK



Greater Manchester Waste Sites, UK

Its early goals were to ensure that, in the run-up to delivery, there would be a rise of no more than 1 per cent in municipal waste by 2010. Thereafter, Manchester's target is to register 0 per cent increases in municipal waste by 2020, and no growth through to 2030. As well as sorting recyclable materials, the waste programme will achieve 33 per cent of recycling and composting of household waste by 2010, increasing to a minimum of 50 per cent by 2020.

There is also a considerable energy component in this deal, created through a number of competing energy from waste technologies, adding to the UK's already burgeoning alternative energy sector. Waste already accounts for 30 per cent of the total renewable energy production in the country; 1.5 per cent of the UK's electricity. This energy source has a big future in the UK with some believing that waste will one day account for 6 per cent of the UK's total power generation.

These facilities include a thermal power station in Runcorn, Cheshire, for solid recovered fuel created from residual waste that cannot be recycled. This will be used to provide electricity and heat for the nearby Ineos Chlor chemicals plant.

There will also be five mechanical biological treatment plants with four

associated anaerobic digestion facilities that will sort materials into dry recyclables and solid recovered fuel for use in creating renewable energy as well as using the methane from the AD process to create electricity.

This contract is worth £3.8 billion to Viridor Laing and will increase costs (at current prices) to Greater Manchester householders by £1 per week. However, this compares favourably with the cost of a "do nothing, build nothing" option which would cost an extra £2 a week in Landfill Tax and penalties – while failing social responsibility to recycle and move away from the 'throw-away' society of old.

This transaction stands as a landmark for the PFI sector and was essential to getting the UK on track to reducing the amount of waste it sends to landfill and shedding the image of old.

It also saw the banking community lend £245 million in a tight financing environment, in the very heart of the global financial crisis – thought it did have to be supported by the recently-created Treasury Infrastructure Finance Unit. Financial close on Manchester Waste lent confidence to the beleaguered financing and sponsor community and helped break the UK logjam in PPP deals.



Greater Manchester Waste Sites, UK

# SOCIAL INFRASTRUCTURE - OTHER OUTLOOK

## KPMG's view

By Graham Brooke

"Governments around the world have been increasingly turning towards public-private partnerships (PPPs) to take on the responsibility of designing, building, financing and operating public infrastructure," declared Jim Flaherty, Canada's Finance Minister at a recent unveiling of a new Maritime Radio Communications Initiative emergency response service funded by both government and private sources. "PPPs represent an innovative approach to infrastructure investment," he noted.

Although the global financial crisis clearly impacted the volume of "other" social infrastructure projects in 2008 and 2009, the outlook for 2010 and beyond is for an increase in activity as governments worldwide look to infrastructure projects as a way to stimulate their economies and counter the impact of the crisis. The PPP market now covers every continent (except Antarctica). A growing number of countries are using PPP principles to deliver greater value for public money, with many newly industrialising countries expanding beyond common sectors such as transport into social infrastructure, including some challenging sectors such as prisons.

Sectors of growing activity include:

- **Prisons** – With new projects underway or planned in several countries, the inclusion of custodial services within the project scope remains a controversial point of difference between certain jurisdictions, despite the success of a similar model in the UK.
- **Public buildings** – Projects to build and operate public facilities such as police and fire stations, courts, office accommodation, convention centres, scientific laboratories and museums

bear little usage risk, with payments based largely on the availability and performance of support services, making them attractive to the private sector.

- **Telecommunications** – Following the success of Singapore's national broadband project, Australia has proposed a similar initiative to deliver internet access to the entire population at an estimated cost of US\$39bn. Fibre optic, satellite and wireless services are increasingly being co-funded or subsidised by governments eager to close their 'global digital divide'. Other new projects include emergency communications networks, such as Canada's Maritime emergency response service.
- **Defence** – Projects in this sector include office and residential accommodation, non-lethal equipment and training facilities (such as flight simulators). National interests and politics often complicate equipment projects, favouring local suppliers or requiring investment offset programmes.
- **Residential accommodation and urban development** – These projects include student and nurse accommodation as well as the development of government land to subsidise social or affordable housing. Sometimes, private sector participants have to take on a portion of the revenue risk.
- **Waste treatment** – In an effort to offset growing environmental concerns about landfill, governments are increasingly looking to process and recycle waste, including using newer and cleaner Energy-from-Waste (EfW) technologies. Given the cost of these projects, local government bodies are

commonly banding together to benefit from economies of scale.

- **Sports facilities** – Governments are using PPPs to develop or upgrade facilities, particularly in countries linked to major international competitions such as the 2012 London Olympic Games and the 2014 FIFA World Cup in Brazil.

Notable pathfinder projects include:

- the Pernambuco prison project in Brazil, seen as a model for other Latin American countries
- the Greater Manchester Waste PPP project, which combined state-of-the-art anaerobic digestion plants and thermal treatment, diverting more than 75% of Greater Manchester's waste away from landfill
- Singapore's Next Generation National Broadband Network, delivering ultra-high speed broadband access across the country under a PPP arrangement
- The New York University campus in Abu Dhabi.

Even with the increased activity in this sector, there are still substantial variations in the sizes of social infrastructure PPP projects. Whereas large defence projects can easily exceed US\$1 billion in value, many accommodation projects have capital values as low as US\$10 million.

The good news for this sector is that, although the global financial crisis has certainly tightened funding for these types of projects, social infrastructure PPPs generally have low risk profiles, which makes them likely to be the first to attract finance from the debt capital markets as the credit crisis gradually starts to loosen.



# LEADERS IN THE FIELD

Burj Khalifa

Cidade Administrativa do Estado de Minas Gerais

Empire State Building Retrofit

Guangzhou Television and Sightseeing Tower

London Olympic Park

Long Beach Courthouse P3

Neotel

Next Generation National Broadband Network

Pernambuco Prison PPP



Guangzhou TV and Sightseeing Tower, China

The eclectic nature of the “Social Infrastructure - Other” section saw a fascinating selection of projects submitted that ranged from the tallest building in the world to a prison, telecoms networks and the Olympic Park for the 2012 London Games.

The visual impact of imposing structures always dominates discussion when debating infrastructure and in this case it tended to centre on submissions like Dubai’s [Burj Khalifa](#) and the retrofit of New York’s [Empire State Building](#).

As the tallest structure in the world standing 828 metres tall, Burj Khalifa was completed in October 2009 and officially opened in January 2010. It was designed to be the centrepiece of a mixed-use development that will include 30,000 homes, nine hotels, parkland, residential towers, the Dubai Mall and the man-made Burj Khalifa Lake.

Once construction was completed, it returned the title of the Earth’s tallest free-standing structure to the Middle East where the Great Pyramid of Giza held it until being surpassed in 1311 by Lincoln Cathedral in England.

Seven hundred years later, the title is back where it started as His Majesty Sheikh Mohammed bin Rashid Al Maktoum put the Emirate on the map with a sensational structure, forming a key part of his strategy to diversify Dubai from an oil-based economy while also tapping into tourism and the service industries.

Every society has at some stage tried to impress through outstanding structures and the United States did just that back in 1931 when the 300m Empire State Building took the title of the world’s tallest building. However, since the glory days for skyscrapers it has fallen into a sorry state of repair and the retrofit of the iconic landmark is a welcome move on more than one front.

The retrofit of the skyscraper’s energy system will result in annual power savings of 38 per cent by 2013 which amounts to yearly savings of US\$4.4 million. The makeover will also transform the iconic building’s somewhat jaded reputation and attract more blue-chip occupants, returning it to its previous exclusive stature.

If the criteria for this category had been visual impact, it would have been won by either Burj Khalifa or the Empire State Building – which even today is a hugely impressive building. But they would have faced stiff competition from the elegant [Guangzhou TV and Sightseeing Tower](#) with its hyperboloid structure generated by two ellipses, one at foundation level and the other at an imaginary horizontal plane just above 450 metres.

The waist of the tower contains a 180-metre long open-air skywalk where visitors can physically climb the tower. There are outdoor gardens set within the structure, and at the top, just above 450 metres, a large open-air observation deck.



London 2012 Olympic Village, UK



Burj Khalifa, Dubai

The eclectic nature of this section brought a gamut of fascinating deals into play, but social impact was one of the key criteria, and this will be fully achieved by the [London Olympic Park](#) – one of the largest urban parks created in Europe for more than 150 years.

Once the 2012 Olympic Games are over, a new university will be founded there to make use of the legacy sporting facilities and high-tech communications infrastructure. The Olympic Village will be converted into 3,600 apartments in the Stratford City development to ensure a lasting impact, transforming a deprived region on the outskirts of London.

On the other side of the Atlantic, three projects were singled out – two of which are public-private partnerships – one in the US and the other two in Brazil.

The US P3 project is the hugely ambitious [Long Beach Courthouse](#) which, if it makes it to financial close, will serve as a pathfinder for the rest of the state, and indeed the entire Federation.

The courthouse project would be the first non-transport design, build, finance, operate and maintain (DBFOM) project to make it through the system in the US. Governor Arnold Schwarzenegger has high hopes for this project and the procurement model and if it takes a foothold in California, it could have huge ramifications for the public sector across the other 49 states.



Cidade Administrativa do Estado de Minas Gerais, Brazil

Looking south of the border, two Brazilian deals were singled out – the [Pernambuco Prison PPP](#) and [Cidade Administrativa do Estado de Minas Gerais](#).

The prison programme has already had an enormous impact on the Brazilian penal system and is pivotal for establishing the procurement model in the country. It is also being closely observed by the rest of Latin America and the model is being adopted by a number of its neighbours which could result in a revolution in the regional penal system.

Meanwhile, the Cidade Administrativa Centre is impressive for having pulled together all the region's administrative functions into new facilities at the Palácio do Governo in buildings that have set new benchmarks for architectural style and use of concrete. The judging panel was particularly impressed by the positive environmental impact.

While all the submissions have centred on imposing structures and buildings that will impact the lives of many in the regions where they are built, the final two shortlisted projects were less visible – but their impact was no less impressive. They are both communications projects: the [Next Generation National Broadband Network](#) in Singapore and South Africa's [Neotel](#).

Singapore's project represents the city state's bid to keep itself ahead of its competitors by providing nationwide ultra-high speed broadband access of 1GB per second, and more. Rollout is scheduled to reach 60 per cent of homes, schools, government buildings, businesses and hospitals by the end of 2010, with 95 per cent of homes and offices serviced by mid-2013. The project will secure Singapore as the regional info-communications hub and help secure its role as an economic powerhouse well into the new century.

South Africa's Neotel, on the other hand, is not of the same high technological specification but its impact will be every bit as important. It will facilitate the country-wide rollout of fibre-optic broadband and provide communications to areas that have never enjoyed connectivity. As one of the judges pointed out, the provision of communications infrastructure was every bit as important today as the invention of the steam engine was to people living in the industrial age.

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# FEATURED GLOBAL PROJECT

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## Panama Canal

TRANSPORT - OTHER

By Angus Leslie Melville  
Editor  
Infrastructure Journal

Mega transport projects have always had the capacity to inspire awe through their fundamental scale and impact on society. From the early days of the steam railway, to forging a rail line from one side of the United States to the other, and sinking a tunnel to link the UK to Europe, such projects are impressive for their sheer magnitude and ambition.

The Panama Canal is one such project that instantly evokes images of engineers and labourers toiling to dig the 48mile (77km) ship canal to link the Atlantic and Pacific oceans, replacing the long and treacherous route by Drake Passage and round Cape Horn at the southernmost tip of South America.

Plans to link the two oceans by canal and lake date back to as early as the 16th Century, but it was not until the early 20th Century that these ambitions were achieved.

The US succeeded in opening the canal in 1914 and it remained under American control until the 1977 Torrijos-Carter Treaties ceded control to Panama. The waterway was then operated under joint US-Panama control from 1979 to 1999, eventually being taken over by the Panama Canal Authority (an agency of the Panamanian government) on 31 December 1999.

Even to this day, the Panama Canal remains one of the biggest and most challenging engineering feats ever undertaken and its impact on shipping between the two oceans was instant, slashing back travel times, vastly improving the economics of shipping and making for safer voyages.

But as ships have increased in size, usage of the canal has fallen off making it essential for Panama to invest massively to make it a viable international infrastructure asset.



Panama Canal, Panama

Expansion of the waterway started in September 2007 and will see the canal's capacity doubled to allow more traffic and larger ships.

At the moment around 92 per cent of the world's shipping cannot use the waterway. But once this hugely ambitious, seven-year, US\$5.25 billion expansion is complete, the canal will be open to all but the very largest vessels – the ultra-Panamax.

Work will be finished in 2014, almost 100 years since the steamship SS Ancon passed through the Miraos Locks near Panama City to become the first vessel to complete the ocean-to-ocean passage. With widening and deepening, the waterway will be open to post-Panamax vessels.

To pay for it, the authority will increase tolls by 3.5 per cent annually over a 20-year period, which started

this May (2010). Greater capacity coupled with increased tolls will catapult the canal's annual revenue from US\$500 million to US\$3 billion.

Back in 1908 the canal was made possible by the damming of the Chagres River and the creation of the 43,000 hectare Gatun Lake. Today, the reservoir is a critical component of the canal but also provides 95 per cent of the country's drinking water. At its current operation, every day more than 200 million litres of fresh water is lost from the lake as vessels use the lock system.

To reduce this water loss, a series of water-saving basins – around 70m wide by 5.5m deep – are being constructed for each individual lock, allowing the water to be re-used rather than flushed out to sea. Although the sheer size of the new lock chambers will require 65 per cent more



Panama Canal, Panama



water than the existing locks, they will use 7 per cent less water per opening that is currently wasted.

Work is not limited to the locks. To allow larger vessels to cross Gatun Lake, the level will be raised by 0.5m to 27.1m, giving it additional draft as well as increasing its water reserve capacity by a daily average of 625 million litres.

Each sea entrance navigation channel will be expanded to 225m wide and deepened to 15.5m deep below the level of the lowest tides. Currently, some sections of these approach channels are only 192m wide.

The impact of this expansion is every bit as important today as when it was opened to business in 1914 as it had become unusable for the

vast majority of the seagoing vessels. By widening and deepening the canal and raising the level of the Gatun Lake, the Panama Canal once again becomes a pivotal trading link.

The judges were impressed by the sheer scale of the works to be carried out and the ingenuity displayed in reducing water loss by 7 per cent even though it would take far greater amounts of water to raise and lower larger vessels.

When the canal opens to post-Panamax vessels in 2014 – just in time for the centenary of the SS Ancon's traversing the isthmus – there will be every bit as much call for celebration as there was back in 1914.

# TRANSPORT - OTHER OUTLOOK

## KPMG's view

By Steve Beatty

The state of the global economy has wrecked havoc on the air and marine transport sectors over the past two years. But even as economies recover and the demand for international trade and travel improves, significant changes are afoot that will continue to impact the outlook for both the Air and Marine Transport sectors.

### Air Transport

While the global financial crisis resulted in a sudden drop in both air freight and passenger markets in 2009, the sector has already started to experience a strong rebound with freight and passenger volumes now only marginally below the peak of early 2008.

However, the recovery of the air transport sector has not been even across the globe. For example, traffic from the Middle East to Asia was little affected by the economic crisis, and intra-Asian passenger traffic has already rebounded strongly, making Asia-Pacific the strongest international market for air traffic.

As the air transport sector returns to some semblance of normal, a number of trends and issues will have implications for this sector and those who provide the related infrastructure:

- consolidation and the growth of alliances will result in capacity reduction and less feverish bidding for landing slots and gates at airports in slower growth areas,
- rising fuel costs - combined with a pending need to purchase carbon

offsets - will affect aircraft type and routing economics, while aircraft right-sizing and the realignment of routes through hubs will affect airport development and economics, and

- the growth of the emerging economies will raise per capita income and drive market growth, leading to the need for further development of airport infrastructure in these countries.

### Marine transport

Similarly, the global financial crisis has had a significant negative impact on the marine transport sector and shipping rates in general.

Global container volumes declined by about 11 per cent in 2009, ending a pattern of unbridled growth in container trade. However, the drop in container volumes may be a blessing in disguise for the ports sector, leading to more rational planning of new developments on a proactive rather than a reactive basis.

And while global trade in bulk commodities declined in 2009 by about 3 per cent, growth is expected to increase significantly again in 2010 as resource-consuming economies such as India and China regain traction and resource-producing economies return to their historical levels of liquid, agricultural and mineral exports. While the past decade has really been about the rapid growth of container trade and associated infrastructure, the coming decade could be about the

emergence of bulk trade as a key driver of port development.

Beyond the economic crisis, a number of key trends and issues will affect the marine transport sector including:

- the completion of the Panama Canal Expansion which could significantly impact trade routes between North America and Asia as well as plans for the development of future ports,
- the move to larger capacity ships, resulting in the need for super hub ports, deeper draft harbours, the development of short-sea shipping networks and improved inland logistics systems, and
- the growth of the emerging economies which will also affect marine transport as trade intensity increases and eventually catches up with that of the developed economies, requiring significant port infrastructure development.

### Implications for infrastructure developers

For air and marine infrastructure developers, the recovery of the global economy coupled with the changing dynamics of trade and travel will create significant demand for facilities and services. However, while the obvious marine and air terminals will certainly be required, these trends will also result in some great opportunities for organisations that provide related security, traffic control and broader supply chain integration systems.

# LEADERS IN THE FIELD

Berlin-Brandenburg International Airport

Haneda Airport Expansion

IGI Airport Expansion

London Gateway Port

Metro Cable San Agustín

Middle Harbor  
Redevelopment Project

New Port of Aqaba

NextGen Air Traffic Control System

Nhon Hoi International Port



Metro Cable San Agustín, Venezuela

In each region in this section, the judging panels selected two deals apiece in the port and air traffic sector, apart from Latin America which centred on two fascinating projects, the overall featured project – the Panama Canal expansion – and a deal that intrigued them every bit as much as it impressed them: **Metro Cable San Agustín**, Caracas.

While the expansion of the Panamanian waterway won overall for its impact in opening up one of the world's most important trade routes to a whole new generation of shipping, Metro Cable San Agustín was singled out purely for its impact on society.

Providing a 1.8km-long gondola system linking San Agustín and some of the poorest barrios of the Venezuelan capital to the metro network, the system was completed in March 2010 and is the only horse-shoe cable car system in the world. Beyond providing a much needed mass transit solution in a hugely congested city, the cable stations will double as community hubs.

While these two deals bucked the trend with the judging panel, all the other shortlisted submissions were sea ports, airports and an air traffic control system that should have been in place 15 years ago. Each of the airports was nominated for a different reason, and the drivers were different for each.

The role of an international sporting event as the catalyst for big-ticket investments in airports was undeniably the driver for the **New Delhi Indira Gandhi International Airport Expansion** which has to be ready in time for the 2010 Commonwealth Games in India.

This airport was taken over by the GMR-led Delhi International Airport Limited (DIAL) team. It is being upgraded and modernised while still functioning, then operated under a 30-year concession. Not only will this mega project deliver a world-class facility, it is being turned around in record time.

It was anything but sporting impetus that brought **Berlin-Brandenburg International Airport** to market. It was a decade-long process that will see the centring of three airports at the BBIA site, a massive investment into the local economy that will result in a highly individual piece of infrastructure.



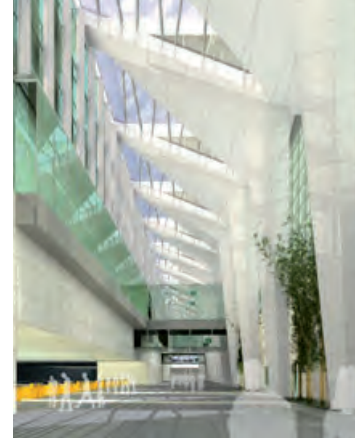
The terminal – situated between the two runways – will have a 50 million annual passenger capacity, a six-track heavy rail station underneath the airport and will finally give Berlin the transport hub it has long needed.

It is more often the fundamental business case that drives investments into this sector and Japan's **Haneda Airport Expansion** is just such an example. Located 14km south of Tokyo Station, it is one of two primary airports serving the Greater Tokyo Area.

Haneda handles almost all domestic flights to and from Tokyo, but it is increasingly catering to international flights alongside its rival, Narita International Airport. By passenger throughput, it is the second busiest airport in Asia and the fifth busiest in the world and is expected to be able to handle 90 million passengers after its expansion is completed in 2010.



Port of Long Beach Middle Harbor Redevelopment Project, USA



IGI Airport Expansion Project, India



London Gateway Port, UK





Berlin-Brandenburg International Airport, Germany

And then there is the **NextGen Air Traffic Control System** which had the North American judging panel of one mind – that it should have been delivered 15 years ago when the technology would have lived up to its “next generation” moniker. However, they included it on the strength that the upgrade is essential, better late than never and that the impact of its installation would result in a safer US flying environment.

And then there are sea ports and the essential role such infrastructure plays in a country’s – sometimes a region’s – economy. In few examples was this clearer than with the relocation of Jordan’s **Aqaba Port**. This project is spearheading the Gulf state’s ambitions to corner the role of regional transshipment hub.

Work consists of dredging and reclamation to create four general cargo berths, a roll-on/roll-off and grain terminal, a marine services harbour, a breakwater and the extension of an existing seawater intake and outfall. Completion is scheduled for the end of 2012.

One of the deciding factors for the Middle East judging team to include Aqaba in its submission was the role this port could play in helping to rebuild Iraq and well as the impact it would have on the Jordanian economy.

When new ports are built, the economic drivers are crucial and in few cases are they as clear as with **London Gateway Port** which will combine the UK’s newest deep-water sea container port with Europe’s largest logistics park.

The terminal area will cover 175ha and the port will be one of the most automated and efficient in the world. Construction started in March 2010 and when finished it will be fully integrated into the heavy rail and road network.

The new London port will live up to its name, serving as a gateway to the UK in much the same way that California’s **Port of Long Beach, Middle Harbor**, does for US-Asia trade in North America. The 10-year project to consolidate two outdated ports into one efficient 245 acre rectangular terminal, once completed, will accommodate up to 364 vessels per annum, 10,112 daily truck trips, 2,098 trains and provide employment to 2,961 people.

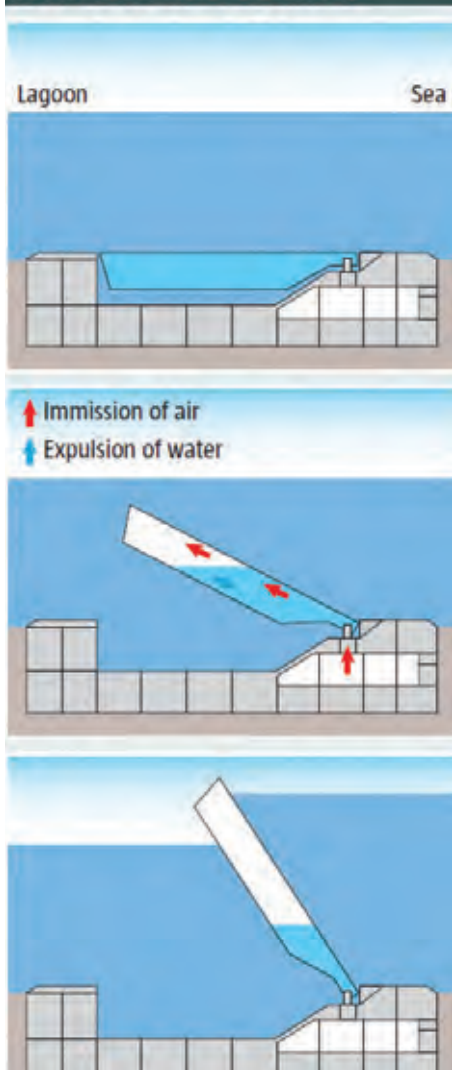
Groundbreaking takes place later this year and the finished terminal will be one of the most environmentally-friendly in the world. But perhaps the impact of a new sea harbour will be most noticed in an emerging economy like Vietnam where work started towards the end of 2007 on the **Nhon Hoi International Port**, the first stage of which will boast two main 480-metre berths.

Construction work will open the port – which falls within the Nhon Hoi Economic Zone – to 30,000-ton (dry weight) vessels and is intended to have an annual cargo throughput of 3 million tons this year once the first phase is completed. This target will step up to 12 million tons once fully operational in 2020.

Binh Dinh desperately needs a sea port that is capable of serving the economic zone and neighbouring provinces. As such this investment in the marine infrastructure is deemed to be the most vital one for the region.



## VENICE FLOOD DEFENCE



Venice MOSE Flood Barrier mechanism

city. The project's impact will be felt well beyond the local and regional inhabitants. Though the city's physical size is small with a population less than 300,000 people, the heritage and beauty of Venice captivates and seduces millions all over the world.

The MOSE structure works using rows of mobile submerged gates fixed to massive concrete bases dug into the seabed at the three inlets to the Venetian Lagoon. The bases are being constructed much the same as the city itself; instead of wood, engineers are driving 125-foot-long steel and concrete pilings into the lagoon bed.

The project's gates consist of 300 ton hinged-panels, 92 feet wide and 65 feet high. They remain on the seabed until needed. When a tide above 110 centimetres is forecast, the 78 hollow gates are filled with compressed air and reach the raised position in about 30 minutes. They take about 15 minutes

to retract. Emerging from the water, they can defend high-tides up to a maximum of 3 metres by isolating the lagoon from the sea. When in operation, locks will allow large vessels to pass in and out of the lagoon without a problem.

The European judging panel called the MOSE and St. Petersburg flood protection schemes "stunning marvels of engineering in every sense". Around the world, sea levels are predicated to increase up to two-feet by the end of this century. If true, many other cities will need similar protection. Holding back the sea could be one of the great infrastructure challenges of the 21st Century.

MOSE, the Italian word for Moses, intentionally recalls the biblical parting of the Red Sea. If it works, and Venetians hold back the Adriatic, this project will become an iconic example of how humans continue to thrive with innovative ideas and overcome even the most arduous of obstacles.



Venice Lagoon Porto di Lido / Venice MOSE Flood Barrier, Italy

# WATER OUTLOOK

## KPMG's view

By Bastien Simeon

Water is quickly becoming one of the most politically sensitive infrastructure sectors as governments vie to harness available resources (less than 0.5 per cent of the water on earth is fresh and available to mankind) and minimize wastage.

The UN Millennium Development Goals initiative has become the focus of development assistance in the water sector. The target is to halve, by 2015, the proportion of population without access to safe drinking water and basic sanitation. In 2000, one billion people lacked access to safe drinking water, and 2.4 billion to adequate sanitation.

To achieve this target, circa an additional 1.5 billion people require access to some form of improved water supply by 2015, which is an additional 100 million people each year until 2015. Some progress has been made but large efforts are still required, in particular for sanitation.

Globally, investment in water infrastructure projects is expected to grow from a current level of around US\$90 billion to more than US\$131 billion in 2016 (Source: *Global Water Intelligence*). Similarly, investment in wastewater infrastructure should grow from US\$82 billion to \$115 billion. This increase in demand for water infrastructure is largely being driven by three global trends: a growing urban population; the scarcity of potable water sources; and the long-term need for

sustainable environmental protection. In response, utilities are increasingly investing in infrastructure, and businesses in treatment equipment that allows for more efficient water use.

Much of this additional investment is being driven by a shift in ideology towards applying market rules and pricing to the municipal water sector. While utilities have traditionally generated less than half the money they invest from their own operations (a direct effect of selling water at prices below cost), there is still massive resistance to closing this financial shortfall by treating the provision of water services as a business.

Governments and municipalities who subsidise water services are therefore finding themselves under significant financial pressure and will increasingly expect water utilities to finance themselves; there could be a trend towards corporatisation of water utilities. This will largely be accomplished through tariffs and debt issues that are repayable by the utility rather than the municipality, which in turn implies an increase in end-user costs in order to meet these new financial obligations.

While this will certainly be painful for politicians, it will effectively liberate the sector by bringing greater financial independence to water utilities. There are already a number of significant success stories: major utilities in both Puerto Rico and the Philippines have already seized the opportunity

to become self-financing and have improved water services as a result.

The financial crisis will also draw more private investment to the sector. Despite the universal recognition of water as a basic human necessity, private finance will play a growing role in the funding of water infrastructure projects, offsetting highly stretched public balance sheets. At the same time, the private sector will often be better suited to deliver on performance metrics through tighter accountability and more defined service standards.

Private sector involvement will be particularly strong in areas of Southern Europe, as countries struggle to comply with the new European Union wastewater regulations. Developing nations will also see a rise in private sector funding, especially areas of the Middle East, Latin America and China.

Private sector participation in the water sector will also benefit from greater demand for advanced technologies, especially for desalination and wastewater reuse, as it is usually better at handling technology risks.

Heavy industries such as oil & gas or mining will also see an increase in water infrastructure and technology investments in an effort to make more efficient use of their current water resources and comply with stringent environmental regulations and expectations.

# LEADERS IN THE FIELD

Atotonilco Wastewater Treatment Plant

Disi Water Conveyance Project

Falcón Matamoros Aqueduct Project

Four Rivers Restoration Project

Greater New Orleans HSDRRS

New Cairo Wastewater PPP

New York City Water Tunnel No. 3

St. Petersburg Flood Barrier

Victorian Desalination Plant



Victorian Desalination Project, Australia

Water is an essential element of life, and one we often take for granted. It's arguably the most important sector included in this publication. Good schools, good roads and clean energy are things we all want, but not necessarily things we need to survive. Water is no such luxury.

Water problems are often regional problems. When President Anwar Sadat signed the peace treaty with Israel in 1979, he said that Egypt would never again go to war except to protect its water resources. What concerned Sadat then still concerns Egypt today. Political tensions have grown in recent years as Ethiopia tries to tap more of the Blue Nile flowing within its borders (which supplies 85 per cent of the Nile waters flowing through Egypt); the more water Ethiopia uses the less Egypt has to survive.

However, conflict is not Egypt's preferred solution. The **New Cairo Wastewater PPP** is an example of how the country is becoming more efficient at managing its water resources. The 250,000 cubic metres per day wastewater treatment plant in New Cairo City was initiated by a major program to expand and improve infrastructure through public-private partnerships.

"It is a small project, but never-the-less it is showing the type of investment that is absolutely essential to public health, to economic development generally, and also to urban living," said Tom Barrett, from the European Investment Bank.

Water management and treatment are critical issues for all countries. The water projects considered for this publication are all solutions to two primary problems; either too much water (as is the case with the Venice MOSE Flood Barrier) or not enough. In order to address both, other complications must be managed, such as transportation and sanitation.

Projects identified in the judging process included aqueducts and pipelines, wastewater and sewage treatment, desalination, flood and storm protection, and dams and reservoirs. Though no single technology stood out, the size, scope and importance of several flood protection schemes elevated those projects above others in the opinion of our judges.



With a price tag of US\$14.45 billion, the **Greater New Orleans HSDRRS** (Hurricane and Storm Damage Risk Reduction System) is the largest civil project in United States history and is scheduled for completion in 2011. Spurred by the tragedy experienced in August 2005 when Hurricane Katrina nearly destroyed the Crescent City, lessons have been learnt and applied by the US Army Corps of Engineers. HSDRRS includes the installation of interim closure structures with a pumping capacity over 16,000 cubic feet per second combined, and the reparation of over 220 miles of levees and floodwall.

Across the Atlantic, the **St. Petersburg Flood Barrier** will be completed this year and protect the Russian city against flooding from the Gulf of Finland. St. Petersburg stands just four metres above sea level and, since its foundation in 1703, has been battered by storms and flooding at least once a year on average. The 25.4km long barrier, the largest of its kind in Europe, includes rock and earth embankment dams, two navigation channels and six water discharge sluices to accommodate outflow from the river Neva. It also incorporates road bridges, a road tunnel at the main navigation channel, and a road constructed on the embankment dams.



New York City Water Tunnel No. 3, USA

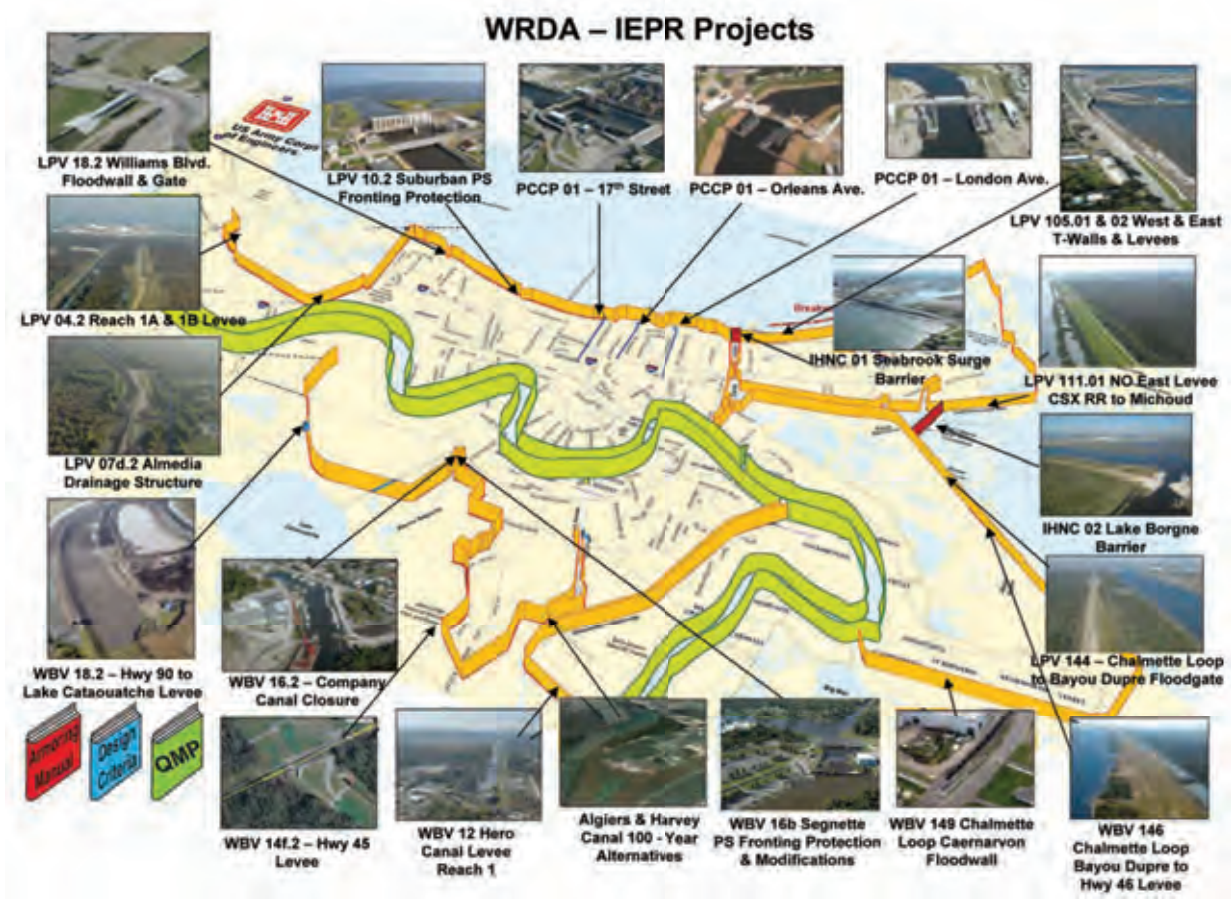


St. Petersburg Flood Barrier, Russia

Aqueducts and pipelines were also highly valued for the tremendous need they would serve. One judge, when referring to the 325km **Disi Water Conveyance Project**, said Jordan is water starved: "Without this project, Amman is going to die. It cannot exist," said Edmund O'Sullivan, chairman of *MEED Events*. "The project is relatively small but it is absolutely essential." Gama Energy's pipeline will pump water from the Disi aquifer in Mudawarra to the capital. Jordan's water resources per capita are among the lowest in the world. Water is delivered only once a week to Amman's residents and the Disi project will account for around 6 per cent of Jordan's total consumption by 2015.

Located only a few miles south of the US border, the 262km **Falcón Matamoros Aqueduct** has a total capacity of 182.6 MGD, with two pumping plants and two storage tanks. The project will ensure drinking water supply for nine localities situated in the lowest part of the Rio Grande basin. It aims to eliminate losses caused by water conveyance through an open channel and was one of several projects in Mexico supported by the National Infrastructure Fund, further highlighting the country's massive need for new water management facilities.

North of the border, and 600 feet below street level, **New York City Water Tunnel No. 3** is the largest capital construction project in New York State's history. Work began in 1970 to replace the old system intended to provide the city with a critical third connection to its upstate water supply. When completed, the tunnel will be 60-miles in length carrying 1.3 billion gallons of water daily to nine million area residents. Section II (of four) is expected to begin water delivery in 2010.



Greater New Orleans HSDRRS (Hurricane and Storm Damage Risk Reduction System), USA

“This is a very important project to the United States and will have an enormous impact,” said Peter Luchetti from Table Rock Capital. “It’s a very difficult project and has taken 30 years to get it done.”

Water supply is also a major issue for Australia. The [Victorian Desalination Plant](#) will be one of the world’s largest reverse osmosis plants and was the only desalination project selected in the 100. Once completed, it will provide up to 30 per cent of Melbourne’s water supply to 3.9 million inhabitants. This was the largest availability PPP worldwide in the past five years. The sheer size of the transaction (close to Aus\$4 billion of debt and Aus\$800 million of equity) makes it a noteworthy and collaborative approach with the State of Victoria was required to achieve certainty of financing.

In terms of scale, there are few projects in this publication bigger than South Korea’s [Four Rivers Restoration Project](#) which includes restoring, maintaining and upgrading four major waterways – the Han, Nakdong, Geum, and Youngsan. Work requires building 16 new dams, rebuilding 87 old dams, reinforcing 209 miles of riverbanks, and dredging 570 million cubic meters of sediment from 428 river miles. Some concern was expressed about this project’s environmental impact and the added stress on wildlife, but nearly all of the judges agreed that it is critical for the prevention of water shortages, improved water quality, and better flood control on the Korean Peninsula.

Finally, treatment and recycling of wastewater and sewage is not glamorous, but innovative, essential and, perhaps most importantly, sustainable. [Atotonilco Wastewater Treatment Plant](#) in Mexico is one of the largest wastewater treatment plants in the world and will treat more than 50 per cent of the wastewater produced in the Valley of Mexico on a 25-year concession with a local consortium. It will also irrigate over 80,000 hectares with treated wastewater in the Valley of Tula, increasing agricultural potential.

Many small projects in this category did not make it into the final list of 100, but still impressed the judges. The Fort McMurray Water Reclamation Facility was noted aiming to be the first water treatment plant in the Canada to achieve LEED Silver certification and the ETE Barueri Sewage Treatment Plant in Brazil was commended for electricity generation from biogas released by the sewage treatment process – something several judges suggested was not as common as it perhaps should be.

# judging profiles

Following on from the roundtable discussion with our global panel (page 4), IJ and KPMG are proud to introduce our esteemed regional judges. In addition to their profiles, we've selected some of their responses for an expanded Q&A:

**Q:** Which project stood out for you and why?

**A: David Yaw:** I think Burj Khalifa in Dubai will become an easily recognised icon, and the Dubai metro will transform the way we think of public transport for Gulf Cooperation Council (GCC) cities. But in the end, I voted for King Abdullah University of Science & Technology (KAUST). Many of these projects are the "future", while at least the initial phases of KAUST are complete. Nothing could be better for one of these countries to invest in other than the education of their burgeoning young population, to equip them to take their place in the higher added value "knowledge" economies of the future.

**David Roseman:** The project which stood out for me was the Victorian Desalination PPP project as it was an Aus\$4.8 billion project financed at the height of the global financial crisis. Therefore, it demonstrated that public private partnerships could be done. Additionally, it is a landmark project for the city of Melbourne which has been experiencing one of the longest droughts in its history.

**Keiran Travers:** Several projects stood out for me. They are the AgriBio, Centre for AgriBioscience, La Trobe project (for completing financial close five months ahead of schedule), the Haneda Airport Expansion (being the first project PFI using concession templates in Japan) and the Cebu Power Project (for alleviating a power shortage in the Philippines).

**David Livesley:** Two projects stood out for me - Nord Stream Pipeline and Venice MOSE flood barrier. Nord Stream, I felt had the best all-round performance against the five judging criteria, and in particular had the vision and determination to overcome the huge challenges of getting a project off the ground which crosses so many national boundaries and consequently has so many vested interests and stakeholders to manage. Venice MOSE on the other hand impressed me particularly by its innovative use of very simple principles to develop a solution to a centuries-old problem, and again by overcoming the sheer complexity of aligning all the parties interested in such a special world heritage site.

**Stephen E. Schlickman:** The US FAA's Next Generation Air Traffic Control System stood out to me. The current air traffic control system is outdated and insufficient for today's demands. This project would increase the capacity and productivity of the air system. Moreover, improving efficiency would produce positive national economic benefits, especially for the airline industry. This technology has the potential to provide substantial national environmental benefits such as reduction in fuel consumption and carbon emissions.

**Q:** Governments around the world have talked about investing in infrastructure to create jobs during the economic downturn; is that investment happening? If so, what impact has it had in your region; if not, when do you think we will see that investment?

**A: William M. Dachs:** Yes, in fact it has been happening for the last four fiscal years in AMEA. It has been driven partly by the tremendous economic growth in Africa and partly by South Africa's drive to catch up on roads, transport and power backlogs. This level of investment looks set to continue into the future despite the challenges posed by the financial crisis.

**Wilfred Lau:** This has not happened in the Asia Pacific region yet in a meaningful way, even though investment in infrastructure is increasing in most countries in the region. We will see further increment in investment in the social infrastructure sector from the private sector, especially in health care and education sectors.

**Ana Karina Esteves De Souza:** Investment in infrastructure is key for the growth of Latin America with the Brazilian economy leading the way. For this reason alone, we have seen movement from the Brazilian government towards facilitating or incentivising both public and private investment in infrastructure. Such initiatives include the launch of priority-investment infrastructure projects under the "PAC" – a federal program for investment in infrastructure, certain tax incentives and lines of credit available to the private sector through development banks, such as the BNDES and BNB.

**Keiran Travers:** The delivery of infrastructure is now in a difficult phase with the effects of the global financial crisis still very prevalent. Many governments around the world are holding large sovereign debt so the delay of projects may improve their cash flow but will reduce the growth in employment. Also the private sector has reduced its appetite for risk and as a result several revenue based PPPs are having difficulty in raising finance.

**David Yaw:** The picture in the six countries of the Gulf Cooperation Council (GCC) is relatively mixed. Dubai continues to suffer from the effects of the speculative residential property sector bubble – and many commentators think it will be years before Dubai rebounds. The same commentators express concerns about the extent to which Dubai's problems may have a knock on effect on Abu Dhabi, where several major projects have been announced but where contract awards are being deferred increasingly frequently. Beyond the UAE, there are signs that oil and gas rich countries such as Saudi Arabia, Kuwait and Qatar, and beyond them Libya are investing more in the infrastructure which helps their transition to industrialised economies.

**Q:** What is the greatest infrastructure challenge in your region that you think will need to be addressed in the next ten years?

**A: Keiran Travers:** Finding project finance and potentially looking at other PPP management models will need to be investigated. Furthermore, in Australia we have had several well publicised PPP failures in toll road projects where the private sector has over-estimated traffic volumes. These



projects have suffered from optimism bias and many investors have been burnt badly. As a result governments will find it harder to attract private finance if the previous projects suffer financially. Projects need to also look into wider issues such as environmental management and social matters and may be the private sector could receive environmental credits for developing projects in a certain way.

**David Livesley:** I think the biggest infrastructure challenge we will face over the next 10 years is the transition to a low-carbon economy. In the UK this is particularly an issue for power generation: new generating capacity is unavoidable as existing plants reach the end of their economic life, and critical choices have to be made about the mix of types of generating capacity that will be built as a replacement.

**Ana Karina Esteves De Souza:** The implementation of new projects under sustainable development guidelines is always a challenge, especially when we refer to infrastructure projects of a greater size. Delays in the procurement of environmental licensing and conflicts of jurisdiction involving the Federal and State government are also a challenge in this regard. Also, reforms in the tax, social security and labour regulation have been sought for some time and, if successfully implemented, could attract additional investment in this area.

**Stephen E. Schlickman:** North America's greatest infrastructure challenge is bringing its mass transit system into a "state of good repair". Currently, there is at least a ten year US\$15 billion backlog of projects for assets that have outlived their useful lifespan and are in need of extensive repair. If our system was in a state of good repair, it would be one of the best performing transit systems in the world.

**David Yaw:** The biggest challenge is probably establishing robust models for the effective maintenance of the massive amounts of infrastructure already built. Most states in the GCC region are able to plan and implement massive new infrastructure projects. However, most have not yet got the mechanisms in place for systematically prioritising their spending on maintaining the huge asset base they have already created and will continue to create.

**Q:** What's your vision for the future and how do you think infrastructure will shape society by 2050?

**A:** **William M. Dachs:** Being more cautious, given that 2050 is a fair distance away, I would say that the drive to develop the extractive industries in Africa will lead to an infrastructure boom. If managed well, these industries would create jobs and sustain them thereby translating into economic growth that benefits societies as a whole.

**Keiran Travers:** The finance world needs to get past the damaging effect of the global financial crisis – both in terms of reducing sovereign debt and the availability of private finance. The speed (or lack thereof) will determine the rate of infrastructure and its effect on society. Once this is achieved then we can start looking at a vision. Having said that, my vision would be that innovative funding options are provided by the private sector to allow infrastructure for public transport, freight movement and social infrastructure that does not place a strain on the public sector. I would predict that the concession periods need to be more like 50 years rather than the standard 25 – 30 years and that the government provides incentives for environmental / climate change initiatives.

## Europe Judging Panel

### LORD JOHN BIRT TERRA FIRMA



Lord Birt has been an adviser to Terra Firma since 2005, and has been involved in several of its portfolio companies - as Chairman of, successively - WRG, Infinis and Maltby Capital, the holding company of EMI. He is also a non-executive director of both PayPal Europe and Eutelsat. In addition, Lord Birt has also been an adviser to McKinsey, and currently advises Capgemini. He was the Director General of the BBC from 1992-2000, and Strategy Adviser to the then UK Chancellor Gordon Brown from 2000-2005.

### PAUL FINCH CABE



Paul Finch is the chairman of UK government's Commission for Architecture and the Built Environment (CABE). He is a Programme Director of the World Architecture Festival, and editorial director of the *Architectural Review* and *Architects' Journal*. Previously, Finch has worked as a journalist at the *Estates Times* (1976-1983), *Building Design* (1983-94), *Architects' Journal* (1994-1999) and the *Architectural Review* (2005-2009). He has also served as joint editor, *Planning in London* since 1994.

### DAVID LIVESLEY CROSSRAIL



David Livesley joined Crossrail as Chief of Staff in August 2008. He is a member of Crossrail's Executive Committee and, as well as managing governance within this extremely large and complex infrastructure project, he manages working relationships with Crossrail's two sponsors. Livesley was previously Director, Acquisitions and Divestments, at AEA Technology plc, where his involvement with the rail industry began by building a rail business through negotiating the acquisitions of a number of rail consultancies.

### JULIA PRESCOTT MERIDIAM INFRASTRUCTURE



Julia Prescott has an extensive background in project funding, having acted as an investor, adviser both to Governments and to the private sector and provider of debt and junior funding in respect of a large number of PPP projects around the globe. Prescott's past roles have included Head of Project Finance at Hill Samuel in London, Co-Head of Project Advisory at Charterhouse Bank to Senior Director and Head of Eurozone Infrastructure Finance at Bank of Scotland. In 2005, she moved to work on the development and realisation of Meridiam, where she is a Partner and a Member of the Board of Meridiam Infrastructure Managers.

### TIM STONE KPMG



Tim Stone is Partner at KPMG's Corporate Finance practice. He is Chairman and founder of KPMG's Global Infrastructure and Projects Group and is the Expert Chair, Office for Nuclear Development and Senior Advisor to the Secretary of State for Energy & Climate Change and also to the Chief Sec machado mayer sendacz e opice retary to the Treasury. As part of this work, he has undertaken a review of the Nuclear Installations Inspectorate and has led the work to develop the guidance for the Waste & Decommissioning of new nuclear power stations. He also advises the ministers on the 2050 program and on other large energy projects. He is also an expert non-Executive member of the board of the European Investment Bank and was a founder member of the CBI's Public Services Strategy Board and was Chairman of IFSL's PPP Export Group.

## North America Judging Panel

### JOSEPH P. PAVONA

MICHIGAN PUBLIC-PRIVATE PARTNERSHIPS



Joseph P. Pavona is the Director of Michigan's Office for Public-Private Partnerships. A 25-year veteran with Michigan state government, he has extensive knowledge and experience in all aspects of US government operations including procurement, finance, budgeting, accounting, intra-governmental support services and real estate. In his current role, Pavona oversees the daily operation of Michigan's Office for Public-Private Partnerships and ensures that PPPs are strategically considered as Michigan explores its business options. He began his career with Michigan state government in the Department of Management & Budget where he held several managerial positions, with the last five years as the state's property management director, during a 15-year stay.

### STEPHEN E. SCHLICKMAN

REGIONAL TRANSPORTATION AUTHORITY, ILLINOIS



Stephen E. Schlickman became the Executive Director of the Regional Transportation Authority (RTA) of Northeastern Illinois on October 1, 2005, charged with oversight, financial assistance and planning coordination for the region's transit operating agencies - the Chicago Transit Authority (CTA), Metra and Pace. Schlickman has more than 30 years of transportation experience and has been involved in every federal and Illinois highway and transit program reauthorisation since 1982. Prior to being named RTA Executive Director, Schlickman operated his own consulting practice providing financial, project policy, and legislative advice to clients involved in all modes of surface transportation, as well as for water and urban park infrastructure activities. In 2005, Schlickman advised Macquarie Bank in their successful US\$1.8 billion bid with Cintra for the concession for Chicago Skyway bridge toll facility.

### SEAN T. CONNAUGHTON

SECRETARY OF TRANSPORTATION,  
COMMONWEALTH OF VIRGINIA



Sean T. Connaughton is the Secretary of Transportation for the Commonwealth of Virginia serving in the cabinet of Governor Bob McDonnell. Prior to joining the McDonnell administration, Connaughton served as Corporate Vice President, Government Affairs for the American Bureau of Shipping, one of the world's leading ship and marine classification societies. He was named U.S. Maritime Administrator by President George W. Bush in 2006. As Maritime Administrator, he was head of the Maritime Administration, U.S. Department of Transportation, and responsible for the daily management of that agency and its promotional programs for the marine transportation industry. This included advising and assisting the Secretary of Transportation on commercial maritime matters, operation of over 50 ships in the Ready Reserve Force, supervision of the U.S. Merchant Marine Academy, oversight of the six State Maritime Academies, and administration of various shipyard and cargo programs. Connaughton was appointed by the President and confirmed by the Senate.

### DOREEN M. FRASCA

FRASCA & ASSOCIATES



Doreen M. Frasca is the President and Principal of Frasca & Associates which she formed in 1997, to provide advisory and strategic consulting services for airports and airport tenants, including airlines and concessionaires. She spent the previous 20 years of her career on Wall Street, initially at Dillon, Read & Co. Inc., on the municipal bond trading desk as a dollar bond trader, and then at Merrill Lynch & Co., where she spent 15 years in the Public Finance Division, ultimately heading the Airports and Transportation Group. Frasca specialises in the structuring and financing of airport, airport access and other transportation related projects. Throughout her career, Frasca has assisted her clients in evaluating the financial feasibility of project financings, structuring financing plans, and accessing the taxable and tax-exempt markets. She has financed in excess of \$12 billion in projects for US airports as well as innovative financial products such as swaps and GLCs. She was appointed by Mayor Bloomberg in 2004 to the Board of the NYC Off-Track Betting Corporation. In May 2008, she was appointed by the Governor to the Board of the Metropolitan Transportation Authority.

**Wilfred Lau:** In the decades to come, behavioural change will have an impact on the requirement and planning of infrastructure. After all, development of IT and communication infrastructure will have an impact on the behavioural change in the first place. Hence, future Infrastructure systems will enable the optimisation of resource(s).

**Paul Finch:** Infrastructure will become increasingly significant as we grapple with climate change and its consequences. This will affect everything from power generation to environment controls at a macro and micro level. Utility companies will become increasingly important and probably more political. Railways will assume more importance. Water management will be critical, from flood control to consumption.

**Stephen E. Schlickman:** In the future, I would like to see better integration of infrastructure spending with other urban investment initiatives to create more livable and sustainable metropolitan areas. Urban planning should be conducted in a coordinated effort that allows for an effective integration between land use and transportation.

**Q:** What, in your opinion, have we achieved from this process?

**A:** **Paul Finch:** Via this process we assessed and celebrated successful infrastructure projects. It was a way of reminding us, in a very broad sense, about the importance of engineering in all its many guises to civilised life. It is well worth doing the opposite of taking things for granted.

**Joe Pavona:** I believe this process has highlighted both the social and economic impact innovative infrastructure will have on society. The perpetuation of traditional infrastructure delivery can limit the scope for creative thinking when it comes to the design, development, and financing of infrastructure projects. By thinking 'outside of the box,' we can provide infrastructure projects that may have otherwise been unable to be delivered.

**David Livesley:** This process has raised the profile of many excellent projects from which important lessons may be learnt, but which might not normally not have attracted as much wider attention. We could capitalise further on this by having a special class for smaller projects with particular emphasis on innovative and transferable approaches. We also considered a number of projects which could have a high impact, but which have a relatively low probability of succeeding. Raising the profile of these too is important, for the encouragement they give to the development of other visionary projects which may have the potential to be truly game-changing.

**Wilfred Lau:** This process would hopefully increase the communities' understanding and appreciation of infrastructure development. The fundamental objective for infrastructure development is to improve the quality of life of the people and this process promotes better communication and understanding between the communities and various stakeholders.

**David Roseman:** This process has given me an excellent insight into the range of projects and priorities throughout the region. It is very interesting to see how different countries are tackling the issues raised by population growth and it gives me a good insight into the future.

## Latin America Judging Panel

### MANUEL JIMENEZ AGUILAR ABENGOA



Manuel Jimenez Aguilar is the Structured Finance Director for Latin America in Abengoa. He holds a bachelor's degree in Economics and an MBA from Universidad de Sevilla, with 10 years of experience in Abengoa and seven years in the Power sector in Latin America.

### HERNANDO GRAÑA GRAÑA Y MONTERO



Hernando Graña has been a Member of the Board of Directors at Graña y Montero SA since August of 1994. He joined the business development division of Graña y Montero in 1977, rising to General Manager in 1992 before taking his current position in the boardroom. Graña has also been the first vice-president of CAPECO (Peruvian Construction Chamber) since 2007 and holds positions of the board of several Peruvian companies. He is an Industrial Engineer with a Post Graduate Degree in Mining Engineering from the University of Minnesota, USA.

### MIGUEL ANGEL MARTINEZ PARRA IDEAL



Miguel Angel Martinez Parra represented IDEAL, a private investment firm created in Mexico in June 2005 through a spin-off from Grupo Financiero Inbursa with a capital of close to US\$900 million, on the *Infrastructure100* judging panel. IDEAL is listed on the Mexican Stock Exchange since September 2005, with the purpose of becoming an institutional company and provide information to investors. Over the past five years, the company has gathered a team of successful engineers, who have furthered the company's objectives in different infrastructure sectors such as - Roads, Water Treatment, Energy, Health and Education among others.

### ANA KARINA ESTEVES DE SOUZA MACHADO MEYER SENDACZ E OPICE



Ana Karina Esteves De Souza was admitted to legal practice in 1999 in São Paulo, Brazil. She is a member of the Brazilian Bar Association, New York State Bar, Brazil Lawyers Association, Brazilian Institute for Energy Law and International Bar Association. She was earlier associated with Dewey Ballantine LLP, New York (2005-2006). De Souza currently offers legal advice on Infrastructure, Project Finance, Transportation, Energy, Oil and Gas sectors. She has authored/co-authored several research papers, industry reports and articles and is active on the Infrastructure speaking circuit.

## Asia Pacific Judging Panel

### KEIRAN TRAVERS ELP MUDDY BOOTS



Keiran Travers has been recently appointed General Manager of ELP Muddy Boots who are a Brisbane based consultancy that provides project management, environmental and training services to the mining, resources and infrastructure areas. He was previously a Senior Project Advisor with the management consulting team at Aurecon. Travers holds a MBA from the University of Queensland and also has qualifications in environmental management. He has worked in a variety of industries including infrastructure projects (toll roads, education), waste management and government projects.

### WILFRED LAU ARUP



Wilfred Lau is a Director of Arup and an Executive of Arup's Global Consulting Practice. He was the Chairman of the Association of Consulting Engineers of Hong Kong (2005 – 2006) and member of Infrastructure Development Advisory Committee of Hong Kong Trade Development Council (2006 – 2010). He leads Arup's Consulting Practice in East Asia Region and is the Chief Executive of Arup Vietnam.

### BOE PAHARI AMP CAPITAL



Boe Pahari has over twenty years experience in the banking industry. He started his banking career at Citigroup in Sydney and subsequently worked for more than 13 years with ABN AMRO based in Singapore, Amsterdam, New York and London. During this period, Pahari worked in regional and global positions, including Regional CFO for Asia Pacific, Global Head of Strategy and M&A, Global Head of Proprietary Structuring Group, Head of Emerging Growth Markets, Head of Infrastructure Capital, Americas, Global Head of Integrated Finance/Infrastructure Capital, Global Head of Special Situations and Distressed Capital and Global Head Structured Capital. Subsequently, at RBS, Pahari was appointed Global co-Head Principal Strategies.

### DAVID ROSEMAN MACQUARIE CAPITAL



David Roseman is the global head of Infrastructure & Utilities Advisory team at Macquarie Capital Group Ltd. He joined Macquarie's then Project and Structured Finance Group in 1992. Prior to his current role, Roseman was the Australasian head of the Infrastructure and Utilities Advisory business. He also initiated the development of Macquarie's infrastructure business in the US where he later served as head of the New York office of the group. Over a long and successful career with Macquarie, Roseman has worked on financing infrastructure projects in Asia, Australia, North America and Europe. Thus far, he has completed transactions with a value in excess of \$80 billion.

## Africa, the Middle East and India Judging Panel

### **WILLIAM M. DACHS** PPP UNIT, NATIONAL TREASURY



William M. Dachs is currently the Head of the PPP Unit at National Treasury in South Africa and is one of the Unit's founding members. He was appointed to his current position in March 2005. Between 2007 and 2009 he worked for the World Bank as a senior finance specialist focusing on infrastructure finance in Central and East Asia. During this time he was involved in the Bank's new municipal Financial Intermediary Loan programme and PPP programme advisory work. He is a civil engineer and also has a degree in law. Prior to joining Treasury in 2000, he worked as a consulting civil engineer in transport and water related projects in the Eastern Cape and Western Cape.

### **DAVID YAW** HALCROW



David Yaw joined Halcrow in 2002, and in April 2007 was appointed Halcrow's Regional Managing Director for the Middle East based in Dubai. Established in the Gulf for over 55 years, Halcrow currently employs some 1500 staff in 13 countries across the region, generating annual revenue of £125 million in 2009, representing around 25 per cent of the company's worldwide income. In his current role, Yaw undertakes relationship management with senior representatives of clients and business partners. He leads the Regional Management Team, which includes Directors responsible for the firm's operations in urban and transport planning; coastal and maritime; property; transportation including aviation, highways and bridges; water and power; and business support services including HR, finance and accounting, and IT.

### **RALPH J. HENDERSON** KEO-INTERNATIONAL CONSULTANTS



Ralph J. Henderson is the Managing Director of the Infrastructure Division of KEO-International Consultants. He is responsible for all KEO-Infrastructure operations in the Persian Gulf and Internationally. He has over 30 years experience in design and engineering management, working in both client and consultant roles, with a wide range of experience in project development from feasibility studies through detailed design to construction. Henderson is a Chartered Civil Engineer and started his professional career in the UK before moving on to projects in Europe. He has spent the last 8 years in Gulf Region, working in Qatar and now in Abu Dhabi.

### **SHAUN KILLA** ATKINS



Shaun Killa worked for Munnick Visser and Stefan Antoni Architects before moving to Dubai and joining Atkins in 1998 as part of the team on the Burj Al Arab. From 2000 he became Head of Architecture and later Design Director for Atkins Dubai. He has won several commissions such as the 21st Century Tower (2000-2003), Chelsea Tower (2001-2004), Dubai Flower Centre (2001-2005), The Millennium Tower (2003-2006), Al Mas Tower (2005-2008) to name a few, which assisted in expanding the office from 60 to over 500 staff. His design specialisation in large projects and high-rise towers and his passion for sustainable design has led him to design the world's first large scale integration of wind turbines on a building for the Bahrain World Trade Centre (2003-2007).

# photos

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**I**nfrastucture development is one of the great challenges of the 21st century and KPMG member firms are proud to be a global market leader in helping address and manage this challenge.

KPMG's Global Infrastructure practice advise government organisations, contractors, operators and investors regarding their infrastructure projects and programmes.

Our member firm teams offer a broad range of services throughout the life of infrastructure assets and programmes – from strategy, to execution, to end-of-life or hand-back. Services may include specialist advisory, tax, audit, accounting and compliance related assistance.

KPMG's Global Infrastructure practice has a well established and proven track record of obtaining results for our clients. Our member firm professionals have advised on numerous groundbreaking infrastructure projects, assets and businesses around the world and are delighted that many of our clients' projects have won market awards.

Infrastructure projects are complex and KPMG member firms have, and will continue to, invest heavily in high calibre infrastructure resources to assist our clients with infrastructure development. Our practice includes 3,000 member firms' professionals in KPMG's offices in 146 countries around the world. Our teams are drawn from market leading professionals from government, industry, engineering, banking and finance sectors.

KPMG is an objective advisor, free from any conflicting incentives related to particular financing products or a potential role in underwriting or arranging project financing, meaning our clients always receive value-added, unbiased advice.



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# About Infrastructure Journal



**I**nrastructure Journal is the most influential insight and data service provider for global infrastructure and project finance.

IJ commenced publishing in 1997 as a print publication. Keeping abreast of latest trends in the publishing world, IJ made a successful transition from being a print media publication to a subscription-based website model in June 2003. Complementing its website, IJ continues to publish special print publications on a regular basis.

In 2007, IJ was acquired by Emap Ltd., a British media company specialising in the production of business-tobusiness magazines and organisation of business events and conferences. Recording a steady growth, both in terms of editorial coverage and operations, IJ presently employs correspondents, feature writers and in-house analysts, covering developments in Infrastructure Funds, Oil & Gas, Power, Renewables, Water, Transport, Infra Policy & Regulation, Health and Education sectors and the latest PPP/PFI trends.

The team is led by Kay Scott who has been the publisher and managing director of IJ since 2007, along with Angus Leslie Melville (Editor) and John Kjorstad (Head of Research & Analysis), who joined the publication in 2004 and 2006 respectively.

Through its close links with the industry, from global investment to leading advising firms, government agencies to financial institutions, IJ delivers valuable content on the projects making it to market, updates on how they are progressing right through to financial close and, in cases where it becomes sticky - tracking syndication of debt. This is achieved via its breaking news service, regular market analysis, in-depth features, a projects database of over 5000 projects and a

comprehensive archive.

The IJ project database is essential for project-tracking and private sector investment in infrastructure, monitoring current market conditions and analysing past market activity as it contains technical and financial information of both closed and live transactions at various stages of development. Additionally, IJ also provides custom research with bespoke research solutions.

The publication has also been instrumental in recognising landmark transactions and achievements in the sector by awarding top performers. Since its inception nine years ago, the IJ Annual Awards ceremony, the latest of which took place in March 2010, has become a signature industry event with key figures from the infrastructure markets in regular attendance.

Over the years, IJ's readership has grown to include government ministers, officials, developers, investors, financiers, lawyers and consultants seeking unbiased, innovative and thought-provoking information on topics of key importance in the Infrastructure world.



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