Infrastructure for a Better Future: A Forum for Vision, Leadership and Action

EVENT PROGRAM

www.isngi.org
Welcome address

On behalf of the ISNGI Organising Committee and Academic Steering Committee, I am delighted to welcome delegates from all over the world to the University of Wollongong for the International Symposium for Next Generation Infrastructure Australia 2013.

This event marks the commencement of a co-ordinated global infrastructure research program focussed on long term infrastructure and land use planning. It will see the best and sharpest minds from industry, government and academia work together to create not only best practice benchmarks but new knowledge to better inform strategies for long term prosperity.

Throughout the symposium we will explore the Grand Challenge:

“What is required to design, develop and carry through the effective provision of Infrastructure to sustain the development of modern society?”

and

“Given that infrastructure is not an ‘engineering artefact’ but an ‘agent of change’, is it possible to imagine infrastructure systems that can meet the needs of twice today’s population with half today’s resources while providing twice the liveability? (Factor 8)”

We look forward to all attendees becoming deeply engaged in exploring these challenges over the next three and a half days through an impressive program of plenary sessions, forums, panels, parallel papers, study tours and evening events.

We would like to take this opportunity to thank all presenters and delegates for sharing their time and expertise. We hope you not only find the conference full of stimulating presentations and conversations, but also use it as an opportunity to grow your networks.

Garry Bowditch
CEO SMART Infrastructure Facility
University of Wollongong

ISNGI Master of Ceremonies

Mr Nick Hartgerink

Symposium MC Nick Hartgerink is a Wollongong-based media consultant and writer. A former journalist and newspaper editor, he is the author of five books, including a history of the University of Wollongong. He has also written for many of Australia’s leading newspapers and magazines and provides media and publication services to national and regional organisations. Nick has been a media consultant to the University since 2002.

Access the event app via isngi2013.mobi.
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## Program

### WELCOME EVENT

Hosted by ISNGI MC **Mr Nick Hartgerink** and **Professor Pascal Perez**, Research Director, SMART Infrastructure Facility, University of Wollongong, the ISNGI welcome event provides an opportunity for attendees to network with fellow delegates, meet some of the presenters and familiarise themselves with the University campus.

Delegates will be welcomed to the SMART Infrastructure Facility for light refreshments from 18:00pm.

### IMPROVING ON THE 80/20 RULE FOR INFRASTRUCTURE RESEARCH

**TUESDAY 1 OCTOBER 2013**

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<td><strong>BREAKFAST AND REGISTRATIONS</strong></td>
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<td>08:45</td>
<td><strong>Mr Garry Bowditch</strong></td>
<td>Chief Executive Officer, SMART Infrastructure Facility, University of Wollongong</td>
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<td></td>
<td>Welcome and opening</td>
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<td>09:05</td>
<td><strong>Prof Graham Harris</strong></td>
<td>Honorary Professor, Infrastructure and Environmental Systems, SMART Infrastructure Facility, University of Wollongong</td>
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<tr>
<td></td>
<td>Infrastructure systems as hybrid artefacts: process, prediction and perversity</td>
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<td>09:40</td>
<td><strong>Prof Margot Weijnen</strong></td>
<td>Founding and Scientific Director, Delft University of Technology, Netherlands</td>
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<td></td>
<td>How shifting concepts and fuzzy borders encourage new solutions for infrastructure provision in the 21st century</td>
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<td>10:15</td>
<td><strong>MORNING TEA</strong></td>
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<td>10:35</td>
<td><strong>LEADERSHIP FORUM</strong></td>
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<td>10:35</td>
<td><strong>HOW CAN AUSTRALIA HAVE A WORLD CLASS FREIGHT LOGISTICS NETWORK?</strong></td>
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<td><strong>Chair:</strong> Mr Michael Kilgariff</td>
<td>Chief Executive Officer, Australian Logistics Council</td>
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<td></td>
<td><strong>Mr Vadim Sokolov</strong></td>
<td>Modelling framework for regional integrated simulation of transportation network and activity-based demand (Polaris)</td>
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<td><strong>Mr Prof Peter Campbell</strong></td>
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<td><strong>Dr Matthew Berryman</strong></td>
<td>Modelling and data frameworks for understanding infrastructure systems through a systems-of-systems lens</td>
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<td><strong>Prof Ram Pendyala</strong></td>
<td>A network-sensitive transport modelling framework for evaluating impacts of network disruptions on traveller choices: An activity-based travel modelling approach</td>
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<td><strong>Prof Mark Hickman</strong></td>
<td>Advances in transport network analysis and modelling</td>
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<td><strong>Mr Phillip Delaney</strong></td>
<td>Realising the data hubs concept for urban research in Australia</td>
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<td><strong>Mr Shahadat Hossain</strong></td>
<td>Coping with new challenges in water resources management in Bangladesh</td>
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<td><strong>Dr Rohan Wickramasuriya</strong></td>
<td>A fusion between business intelligence and geographic information systems</td>
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<td><strong>Mr Sasha Sadegholvaad</strong></td>
<td>A star schema for utility network analysis and visualisation in a geo-business intelligence environment</td>
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<td><strong>Dr Jun Shen</strong></td>
<td>Bio-inspired cost-effective access to big data</td>
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Join the conversation on Twitter with #isngi2013
11:50  TRANSITION BREAK

12:00  Dr Theresa Brown  
Distinguished Member of Technical Staff, Sandia National Laboratories, United States of America  

Engineering infrastructures for resilience and growth

12:35  Dr Don Hillebrand  
Director, Energy Systems Division, Argonne National Laboratory and President, SAE International, United States of America  

Interaction of new transport technology with the development of future transportation infrastructure

13:10  LUNCH

14:10  LEADERSHIP FORUM  
CAN BIG CITIES AND REGIONS BENEFIT FROM BIG DATA?

| Chair: Dr Tim Williams  
Chief Executive Officer, Committee for Sydney  
| PARALLEL PAPER PRESENTATIONS |
| **ASSESSMENT FOCUS** | **UTILITY FOCUS** | **ASSESSMENT FOCUS** | **PROCESS FOCUS** |
| Economics of Infrastructure | Transport Networks | Infrastructure Resilience | Liveability & Urban Dynamics |
| Chair: Dr Mark Harrison  
Dr Shuaian Wang, Efficiency and equity analysis of toll pricing on Sydney Harbour Bridge with heterogeneous travellers  
| Chair: Prof Peter Campbell  
Prof Corinne Mulley, Practical road pricing: Distance based charg es and discounted registration fees providing benefits for motorists and for government revenue  
| Chair: Prof Jim Hall  
Dr Raghav Pant, Analyzing interdependent national infrastructure provisions under extreme climate risk  
| Chair: Prof Laurie Buys  
Dr Amineh Ghorbani, Structuring socio-technical complexity in infrastructure systems: The Biogas system  

Panel:  
Ms Catherine Caruana-McManus, Smarter Cities Executive, IBM Australia  
Mr Chris Kearney, Vice President Asia Pacific, TomTom  
Mr Martin Stewart-Weeks, Director, CISCO  
Mr Les Wielinga, Former Director General, Transport for NSW  
Mr Ashkan Masouman, Incorporating time-series into an inter-industry analysis to model the regional economic structure: a case study of the Illawarra  
Mrs Kate Young, Strategic appraisal of interdependent infrastructure provision: A case study from the Thames Hub  
Mr Hadi Ghaderi, Reliability improvement in Australian rail freight network by transit time management  
Mr John Gardiner, The planning and funding of road infrastructure via PPPs  
Mr L. Andrew Bollinger, Evolving resilient electricity networks in the Netherlands  
Mr Matthew Holmes, How do we ensure the assessment of infrastructure resilience is proportionate to the risk?  
Prof Bob Stimson, A large scale urban model to simulate future patterns of population and dwelling and economic activity for a metropolitan region: An application to Brisbane-South East Queensland

15:25  AFTERNOON TEA

15:45  Prof Ram Pendyala  
Professor, Transportation Systems, School of Sustainable Engineering and the Built Environment, Ira A. Fulton Schools of Engineering, Arizona State University, United States of America  

Next generation infrastructure implications of autonomous vehicles and transport automation

16:00  Prof Laurie Buys  
Professor, Social Change, School of Design, Creative Industries Faculties, Queensland University of Technology  

Exploring the complex relationship between community liveability and infrastructure

16:55  Prof Jim Hall  
Director, Infrastructure Transitions Research Consortium, University of Oxford, United Kingdom  

Systems-of-systems analysis of infrastructure for the 21st century

17:30  CLOSE

EVENING EVENT

18:00  TEDxU WOLLONGONG (Live stream)  
SMART Infrastructure Facility, Building 6, Foyer, University of Wollongong

20:00  CLOSE
08:00  BREAKFAST AND REGISTRATIONS

08:30  Prof Pascal Perez  
       Research Director, SMART Infrastructure Facility, University of Wollongong  
       Planning for next generation infrastructure: supporting more productive and liveable regions

09:05  Prof Nick Tyler CBE  
       Chadwick Professor, Civil Engineering, University College London, United Kingdom  
       Future cities: Meeting the Brundtland challenge

09:40  Prof Chris Barrett  
       Scientific Director, Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, United States of America  
       The subtlety of big computation for social & policy informatics: The data will never be big enough

10:15  MORNING TEA

10:35  LEADERSHIP FORUM  
       PREPARING FOR NEXT GENERATION UTILITIES: WHAT, WHY AND HOW THEY WILL EMERGE

Chair:  Mr Les Hosking  
       Honorary Professor, SMART Infrastructure Facility, University of Wollongong

Panel:  Mr Alexander Koch, Partner & Managing Director, The Boston Consulting Group  
       Mr Timothy Nelson, Head of Economic Policy, AGL  
       Mr David Swift, Acting CEO, AEMO  
       Mr Kevin Young, Managing Director, Sydney Water

Chair:  Prof Pascal Perez  
       Mr Payam Mokhtarian, A general framework for infrastructure system reliability modelling and analysis

Chair:  Prof Peter Campbell  
       Mr Mehbub Anwar, Agency in transport service: Implications of traveller mode choice objective and latent attributes using random parameter logit model

Chair:  Dr Mark Harrison  
       Mr Shanta Hallock, A decision framework for investment in supply chain driven intermodal systems

Chair:  Prof Roger Bradbury  
       Mr Mehrdad Amirghasemi, The roles of evolutionary computation, fitness landscape, constructive methods and local searches in the development of adaptive systems for infrastructure planning

Panel:  Dr Nam Huynh, A semi-deterministic approach for modelling of urban travel demand  
       Mrs Deshani Kariyawasan, A study of the dynamic behaviour of daily load curve for short term predictions

Panel:  Dr David Cosgrove, Estimating the emission reduction potential of Australian transport  
       Ms Nicole Badstuber, London overground: A success story transforming neglected urban railway infrastructure to meet capacity and connectivity demands

Panel:  Ms Maria Rashidi, A new approach to bridge infrastructure management  
       Mr Yuan Deng, Cost benefit analysis: key features and future directions

Panel:  Mr Aumnad Phdungsilp, A framework for integrated energy systems, infrastructure and services optimization with visualization and simulation platform for low-carbon precincts

11:50  TRANSITION BREAK

12:00  Dr Kang Soo Kim  
       Executive Director, Korean Development Institute (KDI), Republic of Korea  
       Infrastructure planning and financing in Korea an insight to economic development

12:35  Prof Brian Collins CB  
       Professor of Engineering Policy, and Director, UCL Centre of Engineering Policy, Faculty of Engineering Sciences, University College London, United Kingdom  
       Infrastructure governance – a multidisciplinary challenge

13:10  LUNCH
## LEADERSHIP FORUM

### IS INFRASTRUCTURE THE NEXT NATIONAL SECURITY FRONTIER?

| Chair: | Ms Pamela Sydelko, Deputy Associate Laboratory Director – Energy Engineering and Systems Analysis Argonne National Laboratory |
| Panel: | Prof Chris Barrett, Scientific Director, Virginia Bioinformatics Institute, Virginia Tech |
| | Mr David Brannegan, Director, Infrastructure Assurance Center at Argonne National Laboratory |
| | Dr Theresa Brown, Distinguished Member of Technical Staff, Sandia National Laboratories, United States of America |
| | Prof Brian Collins CB, Professor of Engineering Policy, and Director, UCL Centre of Engineering Policy, Faculty of Engineering Sciences, University College London, United Kingdom |
| | Mr Christopher Joye, Australian Financial Review |

### PARALLEL PAPER PRESENTATIONS

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<td>Dr Agnieszka Labus</td>
<td>Transport infrastructure renewal in the context of an ageing society in European cities in the 21st century</td>
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<td>Dr Rodney Clarke</td>
<td>Travel journey appraisal: Communicative evaluation of service experience</td>
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<td>Dr Mark Harrison</td>
<td>The care of victims: Implications of the productivity commission’s proposed no fault insurance scheme</td>
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<td>Prof Peter Campbell</td>
<td>Cost-driven residential energy management for adaption of smart grid and local power generation</td>
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<td>Dr Weiliang Zhao</td>
<td>Energy efficiency dashboard for small businesses in the Illawarra</td>
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<td>Prof Roger Bradbury</td>
<td>Metamorphosis: Grid 2.0, emerging at the edge of the world</td>
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<td>Mr Murad Safadi</td>
<td>Energy efficiency for small businesses in the Illawarra</td>
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<td>Mrs Joanne Leach</td>
<td>What makes a city liveable? Implications for next-generation infrastructure services</td>
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<td>Dr Mohammad-Reza Namazi-Rad</td>
<td>A probabilistic predictive model for residential mobility in Australia</td>
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<td>Prof Margaret Weijnen</td>
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<td>Prof Pamela Sydelko</td>
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## EVENING EVENT

**Dress Code:** Business Attire

**GPT SYMPOSIUM DINNER**

Novotel Wollongong Northbeach Hotel, 2-14 Cliff Road, North Wollongong

Hosted by MC Mr Nick Hartgerink

Distinguished After Dinner Speaker

Dr Ken Henry AC, Chairman, SMART Infrastructure Facility Advisory Council, University of Wollongong

A case for change: Why Australia must think and act differently to secure its infrastructure future

Vote of Thanks

Mr Anthony McNulty, Head of Development – Retail & Major Projects, The GPT Group
Breakfast and Registrations

8:30
Prof Henry Ergas
Professor, Infrastructure Economics, SMART Infrastructure Facility, University of Wollongong

Challenges for research in infrastructure economics

09:05
Prof Warwick McKibbin
Chair, Public Policy, Adjunct Professor, Australian Centre for Economic Research on Health Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, Australian National University

Macroeconomic outcomes from infrastructure spending in Australia

09:40
Ms Clara Cutajar
Partner, PwC

Inside the deal: Port Botany

Morning Tea

10:35
Leadership Forum

How to Accelerate Superannuation Fund Investment in Infrastructure?

Chair: Mr Joseph Carrozzi
Partner, PwC

Panel:
Mr John Gardiner, Honorary Professorial Fellow, SMART Infrastructure Facility, University of Wollongong
Mr Chris McLean, Partner, PwC
Mr Peter McVean, Honorary Professorial Fellow, SMART Infrastructure Facility, University of Wollongong
Mr Gordon Noble, Director, Investment and Economy, ASFA

Parallel Paper Presentations

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Chair: Prof Jim Hall
A/Prof Kang Tai, Identifying extreme risks in critical infrastructure interdependencies

Chair: Prof Brian Collins CB
Prof Tim Brady, Governing complex infrastructure developments: learning from successful megaprojects

Chair: Prof Tim Brady
Dr Tomás Holderness, An evaluation of spatial network modelling to aid sanitation planning in informal settlements using crowd-sourced data

Chair: Prof Pascal Perez
Miss Sarah Dunn, Modelling infrastructure systems for resilience and sustainability

Chair: Dr Matthew Berryman
Mr Viengnam Douangphachanh, Using smartphones to estimate road pavement condition

11:50
Transition Break

12:00
Mr Andrew Hagger
Group Executive, NAB Wealth, National Australia Bank

How should the $1.7trillion “treasure chest” of superannuation capital be enticed to invest more actively into Australian infrastructure projects?

12:35
Mr Matthew Canavan
Senator – Elect for Queensland, Australia

To be advised

Lunch

Join the conversation on Twitter with #isngi2013
### LEADERSHIP FORUM

**THE COST OF INFRASTRUCTURE: ARE GOVERNMENTS PAYING TOO MUCH?**

**Chair:** Mr Chris Lock  
Deputy Director General, Transport for NSW

**Panel:**  
Mr Patrick Holland, Partner, McCullough Robertson Lawyers  
Mr Joe Owen, Senior Research Fellow, SMART Infrastructure Facility, University of Wollongong  
Dr Richard Sharp, Principal, ARUP Australasia

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<td>Liveability &amp; Urban Dynamics</td>
<td>Water Management</td>
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**Chair:**  
A/Prof Rodney Clarke

Dr Stuart Barr,  
A national scale infrastructure database and modelling environment for the UK, (paper presented by David Alderson)  
Dr Liz Varga,  
Action in 8 domains for an 8 factor improvement: Infrastructure with agency  
Dr Liwan Liyanage Hansen,  
Data mining: Simulation and operational statistics for real time dynamic decision making for next generation infrastructure

**Chair:**  
Prof Roger Bradbury

Dr Luke Onyekakeyeh,  
Biofuel energy production as catalyst for sustainable agriculture in Nigeria  
Dr Marci Webster-Mannison,  
Green infrastructure: Connecting people with landscapes through urban retrofitting  
Mr Rick Walters,  
Pilot application of the infrastructure sustainability rating tool to local council road management

**Chair:**  
A/Prof Rasmus Frisk

Miss Shiva Pedram,  
Assessing the impact of virtual reality-based training on health and safety issues in the mining industry  
Mr Brett Williams,  
Evaluation of accessibility measures in practitioner policy and their effectiveness in non-metropolitan areas  
Dr Trevor Chorvat,  
Gazelle: A feasible pathway for Australia’s next infrastructure paradigm

**Chair:**  
Prof Graham Harris

Miss W. M. Nadeeka Dilini, Effective water management in the Mahaweli reservoir system; Analyzing the inflow of the upmost reservoir  
Mr Milind Kumar,  
The Adelaide desalination project: A case study in the development and delivery of complex infrastructure against a backdrop of climate change, building security, resilience, sustainability and innovation into metropolitan Adelaide’s water supply system. (paper presented by Chitra Raje)

### PARALLEL PAPER PRESENTATIONS

15:25  **AFTERNOON TEA**

15:45  **Prof Edward J Blakely**  
Honorary Professor, Urban Policy & disaster recovery expert, United States Studies Centre, University of Sydney  
Resilient adaptive and regenerative infrastructures for tomorrow

16:20  **INTERNATIONAL SYMPOSIA FOR NEXT GENERATION INFRASTRUCTURE – WAY FORWARD**

**Mr Garry Bowditch**  
Chief Executive Officer, SMART Infrastructure Facility, University of Wollongong  
Where to next workshop

17:30  **CLOSE**
ANY DELEGATES WISHING TO PARTICIPATE IN THE STUDY TOUR SHOULD SIGN UP AT THE REGISTRATION DESK BY 3PM, TUESDAY 1ST OCTOBER

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<td>Novotel Northbeach Wollongong</td>
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<td>09.30</td>
<td>NSW Ports, Port Kembla</td>
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<td>12.00</td>
<td>Innovation Campus and Sustainable Buildings Research Centre</td>
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<td>13.00</td>
<td>RETURN TO NOVOTEL</td>
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Value-Focused Thinking in Civil Infrastructure Development

ABSTRACT: Civil infrastructure and its impact on societies can tell us different stories about the values of the people who invest in, create and maintain these facilities and systems, and are in due course impacted by them. Ultimately, the story of infrastructure and its interaction with societies can also be viewed as a story of values, how we choose to value different types of capital – human, societal, economic, natural environment, built environment and other technology, etc. – and the impact of our choices on our relative abilities to continue to live out our evolving values. It can also be viewed as a story of civic responsibility – related to the extent to which we choose to be responsible and pay for the full costs of our actions and choices, or the extent to which we make decisions based on information that involves significant externalities. The way we choose to value different types of capital in infrastructure development and management can have vastly different outcomes over time – evident in our stewardship of different types of capital. We can learn some lessons from history. This talk will offer a capital asset management analysis of selected societies and make inferences on the lessons we can learn about creating comprehensive and sustainable wealth through infrastructure decision making.

BIOGRAPHY: Professor Adjo Amekudzi's research, teaching and professional activities focus on civil infrastructure decision making to promote sustainable development. She studies complex real-world systems to understand how we can make better decisions to improve societal quality of life. Amekudzi earned her Bachelor's in Civil Engineering (Structures) from Stanford University in 1994, a Masters in Civil Engineering (Transportation) from Florida International University in 1996; a Masters in Civil Infrastructure Systems from Carnegie Mellon University in 1997, and her Ph.D. in Civil and Environmental Engineering (Infrastructure Systems) from Carnegie Mellon University in 1999. Dr. Amekudzi directs the Infrastructure Research Group (www.irg.ce.gatech.edu) at Georgia Tech, a research group whose vision is to develop thought leaders in civil infrastructure systems and sustainability – engineering and policy. Amekudzi has developed undergraduate and graduate courses in Systems Engineering, Transportation Asset Management and Infrastructure for Sustainable Development, published extensively on these subjects, and serves on various related professional boards and expert panels including the U.S. National Research Council's Board on Infrastructure and the Constructed Environment (BICE) and the International Panel for Climate Change (IPCC). She is coauthor of the college textbook Systems Engineering with Economics, Probability and Statistics, J. Ross Publishing, 2012; and founding chair of the American Society of Civil Engineers (ASCE) Committee on Sustainability and Environment, of the Transportation and Development Institute. Amekudzi serves on the editorial board of the International Journal of Sustainable Transportation, and as Associate Editor for the ASCE Journal of Infrastructure Systems, and the ASCE Journal of Transportation. She is a member of the NSF-funded Research Coordination Network (RCN) on Megacities and Sustainability, and the RCN on Social Sustainability. In her leisure time, Amekudzi enjoys playing the piano, reading and painting.

The Subtlety of Big Computation for Social and Policy Informatics: The data will never be big enough

ABSTRACT: The depth and breadth of system configuration branching due to massive interactions in large socially-coupled systems is a central, but arguably underappreciated, property. Most issues that arise from it relate to the fact that measurements pertain in detail to very small numbers of branches in actual socially-coupled systems. This is the case no matter how resolved and numerous the measurements are. There are many implications but I will discuss four. The need to:

– move ideas about what decision informatics does beyond prediction,
– move ideas about what decision informatics is beyond simulation and modeling,
– focus technical attention on very large, evolving synthetic information resources and,
– provide abductive, counterfactual, many user decision support in a pervasive computational environment. Motivate with realistic decision problems in real systems.

BIOGRAPHY: Chris is a Ph.D. in bioinformation systems from the California Institute of Technology in 1985. Prior to joining VBI, he worked for 17 years at the Los Alamos National Laboratory (LANL). While at LANL, he was leader of the Basic and Applied Simulation Science Group and built up a research group active in theoretical and applied research in intelligent systems, distributed systems, and advanced computer simulation. Chris has scientific experience in simulation, scientific computation, algorithm theory and development, system science and control, engineering science, biosystems analysis, decision science, cognitive human factors, testing and training. His achievements include the development of large-scale, high performance simulation systems, and the development of a distributed computing approach for detailed simulation-based study of mobile, packet-switched digital communications systems. Dr. Barrett has received Distinguished Service Awards from Los Alamos National Laboratory, the Alliance for Transportation Research, the Royal Institute of Technology in Stockholm, and Artificial Life and Robotics, Oita University, Japan.
against nature. It was built to be solid and immovable. It also had to be upgraded and repaired in the same places to perform the same functions. Future function were merely linear projections of the past. But the past is no longer prologue. Too much of what we term infrastructure today is not useful for solving today’s problems let alone tomorrows. Would we ever create cities on the ocean’s edge, if we knew of sea-level rise? Would we ever create massive non-adaptable fixed power stations if we knew fuels would dwindle and centralized systems would be dangerous and unsustainable? We know the answers. But we continue to march backward to the future. In this talk I want to look back to ancient times where cities failed because they were not adaptable and project a future where we will have to create re-generative infrastructure that adapts to its environment and settlement systems that are light on the environment rather than fixed and heavy. This approach calls for a total re-thinking of urban settlement systems and a new generative infrastructure to support them.

**BIOGRAPHY:** Edward Blakely is Honorary Professor of Urban Policy at the US Studies Centre, having previously served for two years as Executive Director of the Office of Recovery and Development Administration, the “recovery czar” for New Orleans following the devastation of hurricane Katrina. One of the world’s leading scholars and practitioners of urban policy, Blakely has been Dean of the School of Urban Planning and Development at the University of Southern California and Dean of the Robert J. Milano Graduate School of Management and Urban Policy, New School University in New York City. He has also held professorial appointments at the University of California Berkeley, the University of Southern California and the University of Sydney. Professor Blakely is author of four books and more than one hundred scholarly articles as well as scores of essays and opinion pieces. His publications include *Fortress America, Separate Societies: Poverty and Inequality in U.S. Cities, Planning Local Economic Development: Theory and Practice,* and *Rural Communities in Advanced Industrial Society.*

Blakely’s extensive record of public service includes advising the Organization for Economic Cooperation and Development, state and federal governments in Australia and the United States, as well as governments in Korea, Japan, Sweden, Indonesia, New Zealand and Vietnam. A Fulbright Scholar, Professor Blakely earned his BA at the University of California Riverside, an MA in Latin American history at UC Berkeley, and a PhD in Education and Management at UCLA. His new book is called *My Storm – Managing the Recovery of New Orleans in the Wake of Katrina.*

**Mr Garry Bowditch**

SMART Infrastructure Facility, University of Wollongong

Garry is the inaugural Chief Executive Officer of the SMART Infrastructure Facility at the University of Wollongong.

With almost 20 years of commercial and Government experience spanning Australia, Asia and the OECD, Garry has a wealth of experience, insight and ‘blue chip’ networks to help SMART achieve its goals with government and business within Australia and internationally.

Garry has a unique mix of government and private sector experience in building greater partnership among the key stakeholders involved in infrastructure planning and investment, public service delivery and foreign investment.

He was the Founding Executive Director of Infrastructure Partnerships Australia (IPA). Established in September 2005, IPA grew rapidly under his leadership to be Australia’s peak body for infrastructure development. Garry built a corporate and government membership exceeding 160 organisations of leading financiers, builders, service providers and government to advocate greater private sector involvement in infrastructure. He is widely recognised as a leader in the infrastructure sector and is highly influential in shaping public debate and community opinion.

He has also held senior executive positions in commercial organizations including Tenex as Senior Vice President, Marketing & Business Development. Garry achieved significant success in establishing and growing its traffic business in Australia, New Zealand, United Kingdom, Ireland and East Asia.

Garry also founded Vmax Consulting in 1999 with the specific purpose of helping to bridge the gap between commercial and Government imperatives that exist in the context of shaping future policy directions, regulatory changes, public-private partnerships, privatisation and outsourcing.

Prior to entering the private sector he held the post as Head of International Economics and Finance at the Department of Foreign Affairs and Trade. He has served as Australia’s Export Credit Trade and Finance representative at the OECD in Paris. Garry was a senior Commonwealth Treasury Official for several years involved in economic forecasting and policy development concerning macroeconomic and Commonwealth-State financial relations.

Currently he is an Expert Panel Member of the ITRC (Infrastructure Transitions Research Consortia) at Oxford University; Board Member of AURIN (Australian Urban Research Infrastructure Network) at Melbourne University and Member of the University of Wollongong Research Council. He also is an adviser to the new government body, Infrastructure NSW and is an appointed member of the Australia Pacific Economic Cooperation Committee (PECC) to advise on regional trade and investment initiatives in APEC.

He holds a Master of Business Administration from Macquarie Graduate School of Management and an Honours degree in Economics from the University of Wollongong. He also studied at the Paul H. Nitze School of Advanced International Studies, Johns Hopkins University, Washington DC.

**Dr Theresa Brown**

Sandia National Laboratories

Engineering Infrastructures for Resilience and Growth

**ABSTRACT:** Civil infrastructure and its impact on societies can tell us different stories. Infrastructures are complex, adaptive, systems of systems. We have engineered their elements, but their topology emerges and changes over time as population grows and moves and as we learn how they fail and can be protected from failure. As we expand our modelling capability to better anticipate and improve our understanding of these systems we tend to focus on optimization of their performance to increase efficiency and reduce costs. Over the past decade, we’ve expanded the use of models to evaluate risks to infrastructures. Modeling is expanding to support the goal of resilient design for future infrastructures under the stresses of a changing global climate, population growth,
Professor of Social Change in the School of Design, Creative Industries Faculties at Queensland University of Technology (QUT). She is an experienced social researcher and research manager with a successful track record of inter-disciplinary collaborative research. Her main research interests fall under the broad headings of social sustainability and social gerontology, focusing specifically on issues associated with community engagement, consumer energy use, sustainable buildings, measuring sustainability and active ageing. Through social sustainability research, she aims to enhance the understanding of, and accountability for, the real effects felt by people in the community resulting from changes in their physical, economic, social and cultural life.

**Infrastructure governance – a multidisciplinary challenge**

**ABSTRACT:** The man made world of infrastructure is now so complex that, in order to maintain and affordably develop it in a synergistic way with the natural world, new approaches to research, policy, investment and execution are essential. The body of scholarship in single sector infrastructure systems engineering is now relatively mature, but by contrast that for multidisciplinary, multisectoral systems design and governance is less well developed. But unless we find a way of putting together the bodies of knowledge from these different aspects of infrastructure governance in ways that positively affects large scale outcomes in the domains of, for example, adaptation and mitigation to climate change, energy and water security, city and national infrastructure and public health we will fail to maintain our developed world and have difficulty growing capability and capacity for development everywhere else. This talk will address these questions, show examples of where activity is showing promise in delivering on this agenda, and where future research and consolidation is needed.

**BIography:** Professor Brian Collins took up the role of Professor of Engineering Policy at University College London on 1st August 2011 and is Head of a new Department at UCL, Science, Engineering, Technology and Public Policy. Prior to his appointment at UCL, he was the Chief Scientific Adviser (CSA) for the UK Department for Transport (DfT) from October 2006; CSA for the Department for Business, Enterprise and Regulatory Reform (BERR) from May 2008; and CSA for the Department for Business, Innovation and Skills (BIS) from March 2009. In his time within BERR UK energy policy was within his remit. He was Professor of Information Systems at Cranfield University from August 2003 until July 2011. He was a member of the Council of Science and Technology working party that published in 2009 the report ‘A National Infrastructure for the 21st Century’ under the leadership of Sir Mark Walport, now GCSA.

Until March 2012, Professor Collins was Chair of the Engineering and Interdependency Expert Group for Infrastructure UK, then led by Lord James Sassoon, Commercial Secretary in Her Majesty’s Treasury.
In 2009 Professor Collins was elected a Fellow of the Royal Academy of Engineering. In the 2011 New Year Honours List, he was bestowed by Her Majesty the Queen the Honour of Companion of the Bath (CB).

He is a Fellow of the Institute of Civil Engineers, of the Institute of Engineering and Technology, of the British Computer Society and of the Institute of Physics.

Ms Clara Cutajar
PwC

Inside the Deal: Port Botany and Port Kembla

ABSTRACT: The long term lease of Port Botany and Port Kembla is the perfect case study in which private sector investors and infrastructure have been the “perfect match”. The NSW Ports Consortium comprising of Industry Funds Management (IFM), Australian Super, Q Super (managed by Global Infrastructure Partners) and Abu Dhabi Investment Authority acquired the ports in May 2013. The gross sale price of $5.07 billion for both ports with an implied multiple of approximately 25 times for Port Botany compared to pre-GFC prices has risen dramatically. While immediate drivers, such as rising materials and labour costs, are readily identified, it is important to understand the underlying causes. These are numerous, complex and interconnected and relate not only to the cost of inputs but to the regulatory, standards, contracting and governance arrangements that critically influence input costs.

The paper will present the framework for undertaking this analysis as well as early results from the study so far.

BIOGRAPHY: Clara has provided advice on a broad range of infrastructure assets which demonstrated significant confidence by investors in these assets. There were a number of challenges and opportunities encountered in this transaction which lay the ground work for further capital recycling.

Hear from Clara Cutajar the lead PwC partner on the sell side team as she tells us a story of how “we made investors fall in love with the ports”.

BIOGRAPHY: Clara is a partner in PwC’s Transaction Services business in Sydney. Clara has provided advice on a broad range of transactions including due diligence, Initial Public Offerings and other public document transactions in Australia, United States and Asia.

Over the past 15 years she has specialised in Infrastructure and Transport transactions and has been involved in the majority of the government privatisations of infrastructure assets in that time. Clara leads the Asia Pacific Infrastructure transactions team and co-leads PwC’s Australian Infrastructure & Utilities Deals team. Most recently Clara lead the PwC team working for NSW Treasury on the long term lease of Port Botany and Port Kembla and is currently engaged by NSW Treasury in the scoping study being conducted in relation Newcastle Ports Corporation.

Professor Henry Ergas
SMART Infrastructure Facility, University of Wollongong

Drivers of Infrastructure Costs

ABSTRACT: Infrastructure is the sinew of nations and vital to support economic development and increase living standards in the long-run. But it is clear that, over the past decade in Australia, infrastructure costs have risen dramatically. While immediate drivers, such as rising materials and labour costs, are readily identified, it is important to understand the underlying causes. These are numerous, complex and interconnected and relate not only to the cost of inputs but to the regulatory, standards, contracting and governance arrangements that critically influence input costs.

The paper will present the framework for undertaking this analysis as well as early results from the study so far.

BIOGRAPHY: Professor Ergas held a range of leading positions at the OECD before returning to Australia in the mid-1990s. He chaired the Australian Intellectual Property and Competition Review Committee for the Australian Government in 1999-2000 and was a member of the Prime Minister’s Export Infrastructure Task Force in 2005 and the Defence Industry Policy Review in 2006. He has published extensively on infrastructure regulation and cost-benefit analysis.

As well as his work at the OECD, Professor Ergas’ career includes appointments with the National University of Singapore, the Kennedy School of Government at Harvard University, the Centre for Research in Network Economics and Communications at the University of Auckland, Monash University and at the Ecole Nationale de la Statistique et de l’Administration Economique in Paris.

Henry is the inaugural Professor of Infrastructure Economics at SMART where his focus is on the economic, regulatory and public policy research program. He takes a special interest in the development and application of cost-benefit analysis and in the analysis of pricing and investment decisions in regulated infrastructure industries. Professor Ergas is also a regular columnist in The Australian and Senior Economic Adviser at Deloitte Access Economics.

Mr Andrew Hagger
Group Executive, NAB Wealth, National Australia Bank

How should the $1.7trillion “treasure chest” of superannuation capital be enticed to invest more actively into Australian infrastructure projects?

ABSTRACT: At MLC we believe the best model for infrastructure investing is a fiduciary long-term model, not a transaction-driven business model. When infrastructure investing is done well there are a number of positive outcomes that investors should expect from the asset class including low risk, stable long-term cash flows with inflation protection; attractive risk adjusted and absolute returns; and matching of long-term liabilities.

Unfortunately, many in the industry have struggled to deliver these outcomes causing some investors to doubt the merits of the asset class.

Drawing on the heritage of Lend Lease company (sold to MLC in 2000) and its forward thinking on infrastructure investing in the 1990s we believe that when there is clear alignment of interest between investors and their clients, transparency on fees and an investment culture where decisions are made based on extensive due diligence, there is the potential for strong returns over time.

BIOGRAPHY: Andrew was appointed Group Executive, NAB Wealth in April 2013. In this role he is responsible for all NAB’s wealth businesses including MLC (for which he is Chief Executive Officer), Plum, JANA, JBWere and NAB Financial Planning.

Andrew joined National Australia Bank in 2008 to lead the Private & Institutional Wealth business. In May 2009 Andrew was appointed Executive General Manager of MLC & NAB Wealth’s Insurance business and in October 2010 was appointed Group Executive, Corporate Affairs & Marketing, before taking up the expanded position of Group Executive, People, Marketing & Communications in October 2011.

Prior to joining NAB, Andrew spent 21 years with PricewaterhouseCoopers in a number of capacities, including Melbourne Managing Partner and as a member of PwC’s Firmwide Leadership Team.

Andrew has a Masters of Applied Finance degree (Macquarie University), a Bachelor of Economics degree (University of Adelaide) and is a Fellow of the Institute of Chartered Accountants in Australia.

He is currently Chair of the Olivia Newton-John Cancer & Wellness Centre Appeal Committee.
**ABSTRACT:** Infrastructure is not just an engineering artifact; it is also an agent of socio-economic and environmental change. Society and its infrastructure adapt and evolve together so there are complex, dynamic, and reflexive interactions between the two. These interactions have become more evident in recent decades as technological and political changes have fostered individual choices, market-based instruments, and distributed networks. Given that it is often difficult to achieve the desired outcomes from the construction of major infrastructure systems, what is it about these complex and reflexive interactions that create problems? What new approaches do we need to deal with them?

We are actually dealing with a hybrid “system of systems”: a mix of “hard” engineered systems and “soft” social systems including both people, economies, and the natural environment. Prediction of the properties and outcomes of “hard” systems is usually successful using accepted scientific and engineering approaches. However, using these approaches to predict the outcomes of embedding the “hard” system in the “soft” socio-economic and ecological system can cause major problems. New thinking is required to understand and manage the dynamics of these complex networks. There can be major asymmetries in knowledge and in costs and benefits, and these may also be difficult to estimate. To make progress, we require new mental models, new analysis tools, and new kinds of evidence.

Recognition of the different characteristics of “hard” and “soft” systems suggests new ways of combining appropriate methodologies, of anticipating perverse outcomes, and of designing more effective and resilient infrastructure systems. “Hard” systems may show unexpectedly complex dynamics and “soft” systems that are non-stationary and exhibit adaptive internal dynamics can quickly change system responses in unpredictable ways. This combination defeats reductionist, rationalist approaches such as computer modeling and risk assessments that depend on Gaussian statistics. Perverse outcomes often arise unexpectedly despite the best of intentions. New tools and techniques are emerging in a range of disciplines that will allow us to better understand these issues.

Constructing and managing hybrid infrastructure systems as “agents of change” is a problem at the cutting edge of science, engineering, and social science. Given the speed and magnitude of changes in 21st century technologies and societies, we must develop tools and techniques for better understanding the issues and for “co-producing” effective and robust solutions to these emerging infrastructure challenges. In addition to rapid innovation and synthesis across many disciplines, entirely new conceptual models are required.

**BIOGRAPHY:** Graham has worked in and around the interface between research, management, and policy for more than 40 years. He specializes in trying to understand and manage the complex interactions between the environment and society; with a particular focus on water and natural resource management.

After completing a degree in Botany and Ph.D in Plant Ecology at Imperial College, London in the late 1960s, Graham taught at McMaster University in Canada for 15 years where he worked on the ecology and management of the Laurentian Great Lakes. He moved to Australia in 1984 and worked for CSIRO for over 20 years where he held many senior research and executive appointments including Chief of CSIRO Land and Water and foundation Director of the CSIRO Flagship Programs.

After a spell as a private consultant based in Hobart, Tasmania, he was (until July 2011) foundation Director of the expanded Lancaster Environment Centre at Lancaster University, UK – one of the largest environmental research centers in Europe, which brings together a community of university researchers (environmental and social scientists), government scientists (the NERC Centre for Ecology and Hydrology) and a growing number of commercial enterprises.

Graham is now back in Hobart as Director of ESE Systems Pty Ltd once again. He continues to do research, edit journals, and engage in knowledge exchange activities. He has an Adjunct Professorship in the Centre for Environment at the University of Tasmania and in June 2012 was made an Honorary Professorial Fellow in the SMART Infrastructure Facility, University of Wollongong. He was awarded the CSIRO Chairman’s Gold Medal in 1996 and was elected a Fellow of the Australian Academy of Technological Sciences and Engineering in 1997. In 2002 he was elected a life member of the International Water Academy, Oslo. He was awarded the Australian Centenary Medal in April 2003 for services to environmental science and technology.

Graham has published more than 150 papers, and 3 books. His latest book “Seeking sustainability in an age of complexity” was published by Cambridge University Press in June 2007.

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**Professor Jim Hall**

FREng

University of Oxford

**Systems-of-systems analysis of infrastructure for the 21st Century**

**ABSTRACT:** Transforming infrastructure requires new tools for thinking about infrastructure performance and interdependencies in the long term. I will explain how the UK Infrastructure Transitions Research Consortium has developed systems-of-systems methodology for analysing the performance of long term strategies for infrastructure provision in the context of multiple uncertain futures.

**BIOGRAPHY:** Professor Jim Hall FREng is Director of the Environmental Change Institute in the University of Oxford and Professor of Climate and Environmental Risks. His research focuses upon management of climate-related risks in infrastructure systems, in particular relating to flooding, coastal erosion and water scarcity. He has a particular interest in problems of uncertainty representation and decision analysis. He has been responsible for development of integrated methodologies for assessment of risks and opportunities in urban and catchment systems. He is the engineer on the UK’s independent Committee on Climate Change Adaptation, which was brough into being in the 2008 Climate Change Act. He is Associate Editor of the Journal of Flood Risk Management, member of the Public Voice Committee of the Institution of Civil Engineers. Jim Hall leads the UK Infrastructure Transitions Research Consortium, which is funded by the Engineering and Physical Sciences Research Council to develop a new generation of models for the assessment and planning of infrastructure for the 21st Century at a national scale.

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**Professor Graham Harris**

SMART Infrastructure Facility, University of Wollongong

**21st century infrastructure systems are hybrid artifacts: part engineering and part agents of socio-economic change.** Recognition of this requires urgent innovation in the ways we approach the design and operation of these hybrid systems.

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**ABSTRACT:** Current transportation and vehicle research has spawned a wide range of new technologies that are designed to improve the efficiency or reduce the environmental impact of transportation. But these new technologies inevitably encounter barriers to introduction that delay and in some cases prevent widespread adoption. Electric vehicles, biofuels, natural gas, and fuel cells all have specific and significant advantages over conventional technologies, but in each case the new technology is stymied by the cost, complexity, or impact of the supporting infrastructure required for the new technology. This talk will explore the barriers to introduction of several of the leading transportation technologies and will propose pathways for quicker adoption.

**BIOGRAPHY:** Dr. Don Hillebrand is the Director of Argonne’s Energy Systems Division. In this role Don is responsible for leading a team of engineers and scientists who are actively seeking to develop sustainable innovative technologies to improve the efficiency of resource and energy utilization; to minimize our dependence on imported energy; and to enhance our national security.

Prior to joining Argonne in 2004, Hillebrand worked for Daimler Research in Stuttgart, Germany. While there, he was responsible for Daimler’s research and technology liaison with the European Commission in Brussels, and interacting with European research organizations and business groups and leading integrated government industry research programs.

Hillebrand worked for three years in the White House Office of Science and Technology Policy, Technology Division where he served as Senior Policy Advisor. In 2011 Don was named by Automotive News as one of the 100 most influential people bringing about the electrification of the automobile. He is listed on Forbes 10 list of automotive thought leaders, is a member of the Board of Directors of the Society of Automotive Engineers, and in November of 2011 was elected the 2013 President of SAE international. He was named Michigan’s Outstanding Young Engineer of 1993 and served as an AAAS Washington fellow.

Don has two patents and is the author of over a hundred publications and invited seminar presentations. He earned a bachelor’s degree in Mechanical Engineering, a master’s degree in Mechanical Engineering, and a PhD in Mechanical Systems Engineering from Oakland University.

**ABSTRACT:** Infrastructure development has played an important role in achieving a high rate of economic growth and improving the quality of life for Koreans. Empirical studies show this to be true, and that such developments have produced a high rate of economic return.

This presentation chronologically reviews the infrastructure development in Korea and focuses on how the transport infrastructure development plan was linked to the country’s economic development plan. In particular, this presentation will provide insights on measures to tackle the lack of available resources for the infrastructure development. For example, earmarked transport taxes, creation of special accounts and PPPs, which enhance Korean government’s fiscal flexibility will be introduced. This presentation will also provide some experiences and lessons focusing on the infrastructure planning and financing for the infrastructure development.

**BIOGRAPHY:** Dr. Kang-Soo Kim is currently the Executive Director of Public and Private Infrastructure Investment Management Center (PIMAC) in Korea Development Institute (KDI) which provides the government with assistance to implementing Public-Private Partnership (PPP) projects through formulating RFPs, tender evaluation, and negotiations with preferred bidders and building strong relationship with private sector partners. PIMAC also conducts numerous researches on public and private infrastructure investment policies and provides public and private sectors with policy advice.

Prior to becoming the Executive Director of PIMAC, Dr.Kim was the Director of PPP Division at KDI from 2009 to 2012. He was the Director of Center for Transport Infrastructure Investment from 2005 to 2006 and he was the Director of Center for Korea Transport Database in 2004 at Korea Transport Institute.

Dr. Kim has a Ph.D. in Transport Studies from University of Leeds in 1998. He received Master of Science in Urban Planning from Seoul National University in 1995. Dr. Kim’s areas of expertise include transport planning, transport modeling, data analysis, infrastructure investment appraisal and PPP.
Use of agent-based models to understand the interactions and interdependencies between infrastructure systems and people

ABSTRACT: The rules of business and social interaction are at least as important as the rules of physics for the operation and use of the infrastructure. Adding human behavior to infrastructure and physics-based models through agent-based modeling helps us understand the interactions and interdependencies between infrastructure systems and the people that use them.

BIOGRAPHY: Charles Macal, Ph.D., P.E., is Senior Systems Engineer and Director of the Complex Adaptive Systems Group at Argonne National Laboratory. Dr. Macal directs an interdisciplinary team of modelers, operations researchers, systems analysts, social scientists, engineers, and computer programmers. He has extensive experience applying agent-based modeling and simulation, discrete event simulation, system dynamics and operations research methods to solve government and business decision problems in a variety of fields, including energy, infrastructure, healthcare, and national security. He has been a principal investigator for the development of the widely used Repast Simphony agent-based modeling toolkit. Dr. Macal serves on the editorial boards of several simulation and modeling journals and has co-authored a book, Managing Business Complexity: Discovering Strategic Solutions with Agent-Based Modeling and Simulation (Oxford Press). He is Adjunct Professor at The University of Chicago, where he teaches on complex adaptive systems applications to threat management and emergency preparedness. Dr. Macal received a Ph.D. in Industrial Engineering & Management Sciences from Northwestern University and holds an M.S. in Industrial Engineering and a B.S. in Engineering Sciences from Purdue University. He is a registered professional engineer in the State of Illinois.

Macroeconomic Outcomes from Infrastructure Spending in Australia

ABSTRACT: This presentation will use recent World Bank research on the macroeconomic returns to infrastructure to explore the macroeconomic impact of infrastructure spending on the Australian economy. This will combine the World Bank empirical results to the G-Cubed model of the world economy to explore the macroeconomic adjustment to a substantial increase in infrastructure spending in Australia.

BIOGRAPHY: Professor Warwick McKibbin has a Distinguished Chair in Public Policy in the ANU Centre for Applied Macroeconomic Analysis (CAMA) in the Crawford School of Public Policy at the Australian National University (ANU). He is also an ANU Public Policy Fellow; a Fellow of the Australian Academy of Social Sciences; a Distinguished Fellow of the Asia and Pacific Policy Society; a non-resident Senior Fellow at the Brookings Institution in Washington D.C (where he is co-Director of the Climate and Energy Economics Project) and President of McKibbin Software Group Inc. Professor McKibbin was foundation Director of the ANU Centre for Applied Macroeconomic Analysis and foundation Director of the ANU Research School of Economics.

Prof McKibbin received his B.Com (Honours 1) and University Medal from University of NSW (1980) and his AM (1984) and a PhD (1986) from Harvard University. He was awarded the Centenary medal in 2003 “For Service to Australian Society through Economic Policy and Tertiary Education”.

Professor McKibbin is internationally renowned for his contributions to global economic modeling. Professor McKibbin has published more than 200 academic papers as well as being a regular commentator in the popular press. He has authored/ edited 5 books including “Climate Change Policy after Kyoto: A Blueprint for a Realistic Approach” with Professor Peter Wilcoxen of Syracuse University. He has been a consultant for many international agencies and a range of governments on issues of macroeconomic policy, international trade and finance, greenhouse policy issues, global demographic change and the economic cost of pandemics.

Next Generation Infrastructure Implications of Autonomous Vehicles and Transport Automation

ABSTRACT: Rapidly evolving vehicular technologies, including the advent of driverless and connected vehicles, are likely to have far-reaching implications on the design, development, provision, and financing of infrastructure in the future. There is widespread interest in and debate on the possible impacts that autonomous vehicles will have on people’s activity-travel patterns, location choices, vehicle ownership, and use of time. At the same time, ubiquitous mobile technologies and rapidly evolving communication systems have provided the ability to access information any time anywhere, and to obtain instantaneous feedback on the financial, temporal, energy, carbon, and health impacts of the full range of travel choices that may be exercised by users of the transport infrastructure. The gradual penetration of driverless and connected vehicles into households and business fleets over a period of time will necessitate the adaptation of existing infrastructure to deal with a mixed fleet of autonomous and manually controlled vehicles on the transition to a fully automated transportation system. This presentation focuses on the scenarios that may play out on the path to transport automation and the implications of the different scenarios on the design and provision of infrastructure. The presentation will draw a distinction among various emerging vehicular technologies, consider market penetration scenarios, identify the range of behavioral choices and outcomes that may result from the ownership of such vehicles, and assess the sustainability implications of emerging vehicles. While driverless vehicles may ease the stress of driving, enhance safety, reliability, and capacity utilization, and allow travelers to use travel time productively, many of these benefits do not necessarily come without costs. The convenience afforded by such technologies may lead to dramatic shifts in work and home location choices that result in larger vehicle miles of travel – which will in turn have implications from energy, environmental, and infrastructure provision perspectives. This presentation includes a discussion of the multitude of perspectives that must be considered in planning for a driverless transportation system of the future.
This presentation is the result of a collaboration between Professor Pendyala and Professors Brad Allenby and Mikhail Chester.

**BIOGRAPHY:** Ram M. Pendyala is a Professor of Transportation Systems in the School of Sustainable Engineering and the Built Environment at Arizona State University. His expertise lies in the study of human activity-travel behavior, sustainable mobility strategies, public transportation systems, and the land use, travel, energy, and air quality impacts of a wide range of transportation policies and technologies. Dr. Pendyala has conducted more than $6 million in sponsored research and published more than 100 peer-reviewed journal articles and book chapters. He serves on the editorial boards of a number of journals including Transportation, Transport Reviews, Journal of Choice Modeling, and Transportation Letters. He is the chair of the Travel Analysis Methods Section of the Transportation Research Board and the immediate past chair of its Committee on Travel Behavior and Values. He is also the immediate past chair of the International Association for Travel Behaviour Research (IATBR). Dr. Pendyala has his PhD and MS degrees in Civil Engineering with a specialization in transportation systems from the University of California at Davis. He obtained his undergraduate degree in Civil Engineering from the Indian Institute of Technology – Madras in Chennai, India.

**Professor Nick Tyler CBE**

**University College London**

**Future cities: meeting the Brundtland challenge**

**ABSTRACT:** Brundtland famously said that sustainability is about meeting the needs of the present without compromising the needs of future generations. This seems reasonable enough, but what will be the ‘future generations’ needs? The search for that outcome means a complete rethink of how we think about the infrastructure that supports a city – including the social, as well as the ‘hard’, infrastructure that enables a city to survive. Unsurprisingly many countries and cities are thinking about this problem but the increase in future wellbeing will need new thinking, new approaches and new substance.

**BIOGRAPHY:** Professor Nick Tyler CBE is the Chadwick Professor of Civil Engineering, Head of the Department of Civil, Environmental and Geomatic Engineering at UCL and Pro-Provost, East and South Asia. Nick Tyler works with clinical, engineering, social science, arts and humanities researchers in order to explore exactly how a person interacts with their immediate environment. Nick’s research portfolio amounts to some £20 million in funding from Research Councils, industry and government and he has established research projects in Latin America, Japan, China and the EU as well as in the UK. Nick is the UK PI on an extensive Chinese research and application project “Low Carbon City Development” in which approximately £2 billion is being invested by Chinese cities in the development of practical low carbon initiatives in cities including Guangzhou, Shanghai and Nanyang. He is developing national policy with the Peruvian and Colombian governments in relation to low carbon transport as part of a project funded by the UK Foreign & Commonwealth Office. He is a member of the EPSRC Experts Group on Infrastructure. Apart from being the Director of the CRUCIBLE Centre and the Pedestrian Accessibility and Movement Environment Laboratory (PAMELA), he is a Co-investigator on the Oimin EPSRC Programme Grant “Transforming the Engineering of Cities”, is a Principal Investigator developing an invisible exoskeleton on a £11m EPSRC project, a Co-I on an EPSRC project to develop a new generation of hybrid buses, a Co-I on a £3.4m EPSRC/ESRC project to investigate the future financing of infrastructure and a Co-I on a £2.4m ESRC-NHR project to investigate how people with dementia see and interact with their immediate environment. He transformed the department’s teaching portfolio to make the education of civil engineers pertinent for the needs of the 21st century.

Nick is a Fellow of the Institution of Civil Engineers, a Fellow of the Royal Society of Arts and a Fellow of the Transport Research Foundation. He was appointed a CBE in the 2011 New Year’s Honours for services to technology.

**Professor Margot Weijnen**

**Next Generation Infrastructures / Delft University of Technology**

**How shifting concepts and fuzzy borders encourage new solutions for infrastructure provision in the 21st century.**

**ABSTRACT:** As the Next Generation Infrastructure research community is expanding across the globe, it is time to reflect on the meaning of infrastructure to people in different cultures and on users’ expectations of infrastructure services in different societies at different stages of economic development. Can infrastructure development in today’s fast growing economies be compared with the development of infrastructure in the Western world, where many of today’s infrastructure systems evolved over decades and centuries? How have historic visions of society and societal needs in Western societies shaped infrastructure development? Can today’s infrastructure development in Western and other societies be related to similar visions and strategies, or do we see new interpretations of the concept of infrastructure and new infrastructure development models being brought into being?

The relevance of these questions is aggravated by the rapid urbanisation worldwide and the increasing stress on...
natural resources. Just expanding our legacy infrastructure systems is unlikely to be the best strategy to support the surging urban population in the megalopolises of the future and the dwindling rural population. Today’s planning and design choices will determine whether tomorrow’s infrastructure systems will enable or inhibit a sustainable development of societies across the globe, and to what extent we can ensure livelihoods for all, while safeguarding the livability of cities and the quality of the natural environment. We will explore how national governments and infrastructure providers navigate the multi-scale and cross-sectoral governance reality of infrastructure systems in response to the challenges of the 21st century, and how bottom-up initiatives add their own dynamics to the picture. We will reflect on the potential of translating best practices across cultural borders.

BIOGRAPHY: Prof. Margot Weijnen is the founding and scientific director of the Next Generation Infrastructures Foundation, established in 2001, which unites a large number of (inter)national knowledge institutions as well as public and private organizations involved in the design and management of energy, transport, water, telecommunication and information infrastructures. The Next Generation Infrastructures knowledge consortium focuses specifically on issues at the interface of public policy and technological change in the public utilities and network industries. The Foundation’s research and knowledge dissemination program is financially supported by the Dutch government as well as by the public and private consortium partners.

She received her MSc and PhD degrees in the field of chemical process systems engineering from TU Delft, then joined Shell, where she worked in R&D (Amsterdam), in chemicals manufacturing operations (Pernis) and process design engineering (The Hague). From 1990 to 1995 she headed the interfaculty Delft University Clean Technology Institute. In 1995, she was appointed full professor of process and energy systems engineering in the faculty of Technology, Policy and Management of TU Delft, where she still resides.

Among other external activities and affiliations, Margot Weijnen currently is a member of the:
- Dutch Scientific Council for Government Policy
- Supervisory Board, AkzoNobel Nederland BV
- Executive Board, Netherlands Technology Foundation STW (vice chair)
- Innovation Advisory Board, TenneT (Dutch TSO)
- Executive Board, Netherlands Study Centre for Technology Trends STT
- Advisory Council, National Valorization Program
- Expert Advisory Group, UK Infrastructure Transitions Research Consortium
- Executive Board, Energy Delta Gas Research programme

She is:
- a founding fellow of the International Society for Integrated Engineering Asset Management
- European editor for the International Journal of Critical Infrastructures
- chair of the IEEE SMC Technical Committee on Infrastructure Systems & Services
- Previous activities and affiliations include membership of the:
  - Netherlands General Energy Council (AER) (2000-2008)
  - Supervisory Board, Netherlands Aerospace Laboratory (NLR) (2000-2012)
  - Board of Governors, IEEE System, Man & Cybernetics Society

ABSTRACT: Transport system is one of the fundamental infrastructures, and a significant source of energy consumption and environmental load. Electric vehicles are expected to reduce the latter negative effects, and improve the functionality of the transport system. However, the limited driving mileage of the electric vehicles requires different electric charging system than gasoline refueling system, and the lower driving performance might potentially cause negative effects on traffic flows. An electric charging behavior model is developed and the efficiency in battery capacity usage is investigated in this study. We also developed a simulation system to investigate electricity demand distribution across time of day and space within urban area considering charging behavior of electric vehicles. In addition, the effects of introducing electric micro-cars into traffic are investigated by microscopic traffic simulations considering lower maximum speed of the micro-cars. These modeling and simulation tools enable rigorous evaluations of future transport system.

BIOGRAPHY: Toshiyuki Yamamoto is a Professor in EcoTopia Science Institute at Nagoya University, Japan. He obtained doctoral degree from Kyoto University, Japan in 2000. He developed several statistical models to represent household behaviors related with car ownership and use, especially vehicle transaction behavior. He also explored the behavioral mechanisms and evaluated the effect of transport policies such as periodical vehicle inspection program on the vehicle replacement behavior. Besides the car ownership and use, he investigated individuals’ activity engagement and travel behaviour. One of the topics was discretionary time allocation into in-home and out-of-home activities to derive the travel demand for discretionary activities. He was also involved in a project to develop microscopic activity simulator integrated with traffic simulator, and investigated the effects of several transport measures on future activity and travel demands throughout the metropolitan area.

Since he joined Nagoya University in 2001, he has been involved in several projects on intelligent transport systems (ITS), especially the probe car system. He became a professor at EcoTopia Science Institute, Nagoya University in 2010, and also concurrently joined Green Mobility Collaborative Research Center in 2011. His research topics now expand to include electricity demand forecast at home and demand forecasts of next-generation mobility including electric car, plug-in hybrid car and micro-car.

He serves as an Asia Editor for the journal Transportation (Springer) and serves on the editorial advisory board of Transportation Research Part C: Emerging Technologies (Elsevier).
## Leadership Forums

### How can Australia have a world class freight logistics network?

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<th>Name</th>
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<tr>
<td>Mr Michael Kilgariff</td>
<td>CEO, Australian Logistics Council (Chair)</td>
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<tr>
<td>Mr Dom Figliomeni</td>
<td>CEO, NSW Ports – Port Kembla Operations</td>
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<tr>
<td>Mr Andrew McCusker</td>
<td>Director, Rail Logistics Group, SMART Infrastructure Facility, University of Wollongong</td>
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<td>Mr Murray Vitlich</td>
<td>Director, Strategy and Business Development, Asciano</td>
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### Can cities benefit from big data?

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<td>Dr Tim Williams</td>
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<td>Ms Catherine Caruana-McManus</td>
<td>Smarter Cities Executive, IBM Australia</td>
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<td>Mr Chris Kearney</td>
<td>Vice President Asia Pacific, TomTom</td>
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<td>Mr Martin Stewart-Weeks</td>
<td>Director, CISCO</td>
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<td>Mr Les Wielinga</td>
<td>Former Director General, NSW Transport</td>
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### Preparing for next generation utilities: what, why and how will they emerge?

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<tr>
<td>Mr Les Hosking</td>
<td>Honorary Professor, SMART Infrastructure Facility, University of Wollongong (Chair)</td>
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<td>Mr Alexander Koch</td>
<td>Partner and Managing Director, The Boston Consulting Group</td>
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<td>Mr Timothy Nelson</td>
<td>Head of Economic Policy, AGL</td>
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<td>Mr David Swift</td>
<td>Acting CEO, AEMO</td>
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<td>Mr Kevin Young</td>
<td>Managing Director, Sydney Water</td>
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### Is infrastructure the next national security frontier?

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<tr>
<td>Ms Pamela Sydelko</td>
<td>Deputy Associate Laboratory Director, Energy Engineering and Systems Analysis Argonne National Laboratory (Chair)</td>
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<td>Professor Chris Barrett</td>
<td>Scientific Director, Virginia Bioinformatics Institute, Virginia Tech</td>
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<tr>
<td>Mr David Brannegan</td>
<td>Director, Infrastructure Assurance Center at Argonne National Laboratory</td>
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<tr>
<td>Dr Theresa Brown</td>
<td>Distinguished Member of Technical Staff, Sandia National Laboratories, United States of America</td>
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<tr>
<td>Professor Brian Collins CB</td>
<td>Professor of Engineering Policy, and Director, UCL Centre of Engineering Policy, Faculty of Engineering Sciences, University College London, United Kingdom</td>
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<td>Mr Christopher Joye</td>
<td>Australian Financial Review</td>
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### How to accelerate superannuation fund investment in infrastructure?

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<td>Mr Joseph Carrozzi</td>
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<td>Mr John Gardiner</td>
<td>Honorary Professorial Fellow, SMART Infrastructure Facility, University of Wollongong</td>
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<td>Mr Chris McLean</td>
<td>Partner, PwC</td>
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<td>Mr Peter McVean</td>
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<td>Mr Gordon Noble</td>
<td>Director, Investment and Economy, ASFA</td>
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<td>Mr Patrick Sieb</td>
<td>Executive Director, Macquarie Capital – Infrastructure Group</td>
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### The cost of infrastructure: are governments paying too much?

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<td>Mr Chris Lock</td>
<td>Deputy Director General, Transport for NSW (Chair)</td>
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<tr>
<td>Mr Patrick Holland</td>
<td>Partner, McCulloch Robertson Lawyers</td>
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<tr>
<td>Mr Joe Owen</td>
<td>Senior Research Fellow, SMART Infrastructure Facility, University of Wollongong</td>
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<tr>
<td>Dr Richard Sharp</td>
<td>Principal, ARUP Australia</td>
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Mr Mehrad Amirghasemi
SMART Infrastructure Facility, University of Wollongong
The Roles of Evolutionary Computation, Fitness Landscape, Constructive Methods and Local Searches in the Development of Adaptive Systems for Infrastructure Planning
ABSTRACT: Modelling and simulation for improved infrastructure is involved with the development of adaptive systems that can learn and respond to the environment intelligently. Developing simple agents with limited intelligence that collectively represent complex behaviour can assist infrastructure planning and can model many real-world situations. By employing sophisticated techniques which highly support infrastructure planning and design, evolutionary computation can play a key role in the development of such systems. The key to presenting solution strategies for these systems is fitness landscape which makes some problems hard and some problems easy to tackle. Moreover, constructive methods and local searches can assist evolutionary searches to improve their performance. In this paper, all these four concepts are reviewed and their application in infrastructure planning and design is discussed. With respect to applications, the main emphasis includes city planning, and traffic equilibrium.

Mr AHM Mehbub Anwar
University of Wollongong
ABSTRACT: This paper explains how principal-agent theory (PAT) can be used as an analytical tool to understand the traveller-Transport for NSW relationship and minimise the agency uncertainty in the relationship by examining traveller preferences for mode choices. The paper emphasises latent variables and objective attributes together during the choice process within the agency relationship, as a method by which the utility of the principal (traveller) can be maximised and evaluated using a discrete choice experiment, i.e. random parameter logit (RPL) model. The probability of car use is significantly higher than public transport, which indicates that an agency uncertainty exists in the relationship and incorporating traveller preferences in the transport projects may minimise this uncertainty.

Ms Nicole Badstubber
University College London
Transforming neglected urban railway infrastructure to meet capacity and connectivity demands
ABSTRACT: London Overground (LO) illustrates the successful transformation of neglected and fragmented urban railway infrastructure into an orbital service boasting record passenger satisfaction and popularity. London’s metropolitan transport authority Transport for London (TfL) achieved this through a combination of measures. In addition to station upgrades and new trains, the provision of integrated transport services, such as integrated ticketing and customer information, marketing and branding, contributed to LO’s success. In 2007, TfL took over the concession to operate and manage the neglected railway routes. Since then, LO has become the best performing train operator in Great Britain. LO patronage tripled since TfL took over the management of the concession surpassing demand forecasts and leading to capacity enhancement investment.

Dr Stuart Barr (paper presented by David Alderson)
Newcastle University
A national scale infrastructure database and modelling environment for the UK
ABSTRACT: Reliable and detailed spatial-temporal data, information and knowledge on infrastructure assets is essential to inform the long term delivery of infrastructure systems. To leverage maxim utility integrated data management, analysis, modelling and visualization environments are required for this purpose. In both the UK Infrastructure Transitions Research Consortium (ITRC) a spatial database and modelling system has been developed, that contains national scale data and information on infrastructure assets and networks, and information on the geotemporal patterns of infrastructure demand, supply and capacity. Via examples, including multi-sectorial capacity/demand modelling and independent infrastructure network analysis, we demonstrate how the database and interfacing middleware is used to query, read and write data, as well as, analyse and visualize data within infrastructure modelling.

Dr Matthew Berryman
SMART Infrastructure Facility, University of Wollongong
Modelling and data frameworks for understanding infrastructure systems through a systems-of-systems lens.
ABSTRACT: Modelling and analysis of large systems of infrastructure systems carries with it a number of challenges, in particular around the volume of data and the requisite complexity (and thus computing resources required) of models. In this paper we discuss both some novel architectures for scalability of modelling as well as for fusion and relevant visualisation of large data sets. We have a particular focus on geospatial infrastructure data visualisation.

Mr L. Andrew Bollinger
Delft University of Technology
Evolving resilient electricity networks in the Netherlands
ABSTRACT: A resilient electricity infrastructure is one which preserves continuity of service despite perturbations in its environment, if it fails, it does so gracefully, not catastrophically. Electricity infrastructures globally are undergoing a low-carbon transition with a yet-to-be defined endpoint. What will be the impact of these transitions on network resilience? How can we steer them to foster resilience? This paper introduces results from a model exploring the evolution of the Dutch electricity transmission network under various transition scenarios. The model captures the development of this network as a result of the decisions of a set of boundedly rational agents, representing power producers and a grid operator. These agents make repeated decisions to (dis)invest in various types of infrastructure components, driving the evo-
Resilience to resource disruption from flooding

**ABSTRACT:** This paper presents a quantitative, spatial, resource model to enable the design of infrastructure systems able to secure the resource flows required by modern societies. The complex flow and sharing of resources between industrial sectors is described by an input-output (I-O) model, capturing interdependencies between a system's elements. Whilst, the spatial interaction between infrastructure systems that mediates the flow of these resources is highlighted using a network model. A preliminary case study of the Shetland Islands (UK), explores alternative management strategies, and their effectiveness when disrupted (e.g., as a result of flooding). The analysis highlights the potential for a single flood event to disrupt the movement of resources in other industrial sectors away from the initial disturbance. Disruption of some important sectors can rapidly lead to collapse of the entire system due to system interdependencies. Thus, this work contributes to Theme 2.

**Mr Shaun Brown**
Newcastle University

Understanding the National Infrastructure Landscape

**ABSTRACT:** Infrastructure UK has been established within UK Government to co-ordinate the provision of National Economic Infrastructure, defined as energy, water, waste, transport and ICT. Co-ordination is not, however, easy. The lead for Government policy over the five infrastructure areas is shared across different Departments and arms-length bodies, sometimes with strong delineation and sometimes with wide co-operation. Policy is constantly developing and changes the overall landscape. To allow progress a snapshot of overall UK infrastructure policy across the five infrastructure areas has been developed, which provides a framework from which interdependencies between and among infrastructure polices and plans can be examined. This is enabling the identification of areas where a lack of discernible policy could lead to wider failures in interdependent sectors of UK national infrastructure or where synergetic opportunities should be captured. The author directed this work.

**Prof Tim Broyd**
University College London

Gazelle – A feasible pathway for Australia’s next infrastructure paradigm

**ABSTRACT:** There are many paradigms that could shape this century’s infrastructure in Australia, and indeed the world. This paper outlines one feasible pathway to fill a glaring gap in public transport within our cities, and do this while addressing a number of pressing social, environmental and economic needs including providing transport users an alternative to the car and truck, reduce congestion in cities, promote renewable energy sources, return ‘people space’ to cities and suburbs, and make it a healthier and happier space to name a few. The pathway outlined in this paper involves using a fully-automated small-vehicle system called Gazelle. The system uses linear motors for propulsion and an air cushion for frictionless levitation of the vehicle. Contact-less electromagnetic switching allows the vehicles to be routed across the track network. It is self-sufficient in renewable energy. Use of vertical space facilitates safe automation and allows continued use of most ground vehicles.

**Dr Trevor Chorvat**
Independent Researcher

Travel Journey Appraisal: Communicative Evaluation of Service Experience

**ABSTRACT:** For its users, infrastructure is not an artefact; it is in fact an experience. Understanding a customer’s response to a specific transport service involves appraisal resources; communication resources by we express evaluation, attitude and emotion. Customer appraisal responses can be registered to transport systems. This literally enables maps to be created that reveal customer evaluations, attitudes and emotions associated with locations along a transport route. Comparative studies of service experience are possible by conducting appraisal analyses of interviews from different customers segments. This paper identifies the key methodological issues and their resolution to develop a communication-orientated spatial normalization procedure that enables appraisal to be visualized for a journey. Using a study of authentic local shuttle services, this paper describes how the ‘go-along’ interviews method can be conducted in order to undertake the appraisal analyses and how travel journey appraisal can be used to map customer service experience along transport routes.

**Dr Rodney Clarke**
SMART Infrastructure Facility, University of Wollongong

Metamorphosis: Grid 2.0 emerging at the edge of the world

**ABSTRACT:** Were we to rebuild the power grid today, we wouldn’t build the one we have. We would build a resilient, non-hierarchical network, smart and adaptive at every node, with diffuse and multi-scaled power producers and consumers. If this is Grid 2.0, can we find an evolutionary path to it? This profound complex systems problem no feasible adjacent possibilities for Grid 1.0 is typically solved by evolution through metamorphosis. Caterpillars become butterflies by breaking down the caterpillar system into its base components and reorganising (most of) them into a new butterfly system. But this can only be done in the quiet edges of the enveloping super-system Stewart Brand’s outlaw regions. We’re taking the first steps to metamorphose Rarotonga’s grid in the remote Cook Islands of the South Pacific. Here the conditions are just right. We invite collaboration to help realise our vision and its transpose lessons for the super-system’s centre.

**Prof Roger Bradbury**
National Security College

Governing complex infrastructure developments: learning from successful megaprojects

**ABSTRACT:** Past literature suggests increasing complexity in projects may be a significant factor in project failure (e.g. Morris & Hough, 1987; Miller & Lessard, 2001; Flyvbjerg et al, 2003; Williams, 1999, 2005). Megaprojects – defined by Flyvbjerg, 2001; Flyvbjerg et al, 2003; Williams, 1999, 2005) – are amongst the most complex with many uncertainties, and both involved the development and management of projects suffering severe cost and time overruns. – are amongst the most complex with many uncertainties, and both involved the development and management of projects suffering severe cost and time overruns.

**Prof Tim Brady**
Brighton University
Dr David Cosgrove  
Bureau of Infrastructure, Transport and Regional Economics (BITRE)

Estimating the emission reduction potential of Australian transport

ABSTRACT: The Australian Low Carbon Transport Forum (initiated by ARRB, BITRE and CSIRO) was organised to gather knowledge on options for transport emission abatement, with participation of government, industry, academic and other research organisations; aiming to identify options capable of significantly improving transport sector efficiency, estimate possible greenhouse emission reductions for each option, and examine any challenges to achieving their full potential. This interdisciplinary study analysed a wide range of prospects, covering vehicle and fuel technologies, infrastructure improvements and land-use planning, travel demand management, mode shifts and other behaviour change. A novel aggregation process was developed, to estimate the maximal benefits, by 2050, from a full package of measures acting together – demonstrating that large reductions in expected emissions should be technically feasible, even with increasing population, without sacrificing access to transport services.

Mr Phillip Delaney  
(The Co-Authored by Chris Pettit)  
The University of Melbourne

Realising the Data Hubs Concept for Urban Research in Australia

Abstract: Discovering and accessing relevant data is a problem often faced by urban researchers, policy and decision-makers across Australia. Several public, private and academic entities are establishing Data Hubs; online catalogues for data discovery, access and interrogation. Data Hubs are typically web services accessible via a portal, often with narrow geographic or application focus, with varied levels of analytical and visualisation capability. The Australian Urban Research Infrastructure Network (AURIN) is focused on providing better access to comprehensive datasets through a dedicated e-infrastructure platform. The AURIN portal will facilitate programmatic access to data held in many emerging Data Hubs across Australia. AURIN is implementing a federated data model, providing a single access point and common interface for interrogating datasets. This paper outlines the Data Hub concept, describing the process and benefits of Data Hub integration within the AURIN e-infrastructure context.

Mr Yuan Deng (Co-Authored by Marcus Deng)  
SGS Economics & Planning

Cost Benefit Analysis – key features and future directions

ABSTRACT: Cost Benefit Analysis (CBA) has played a critical role in public policy for more than 50 years. CBA goes beyond financial analysis which considers direct monetary costs and revenues. It enables policymakers to assess whether a policy initiative or project will provide a net community benefit, taking into account that the (limited) resources deployed in implementing the initiative or project have alternative productive uses. Correctly applied, CBA is a rigorous technique for evaluating projects competing for limited public sector resources. However, it does have its limitations and failings. To overcome the systemic failings, advanced CBA needs to be capable of tracking the long term and ‘second round’ benefits of major transport projects and better quantifying ‘intangibles’ that are fundamental to architectural and cultural building projects. There is need for improved consistency across practitioners, through peer review and the publication of peer-endorsed methodologies for CBA.

Mr Richard Di Bona  
Independent Consultant

The Potential of MISTER Personal Rapid Transit to Sustain the Mobility and Development of Modern Communities

ABSTRACT: The Potential of MISTER Personal Rapid Transit to Sustain the Mobility and Development of Modern Communities

1. Introduction: the role of transport in Schumpeterian innovation waves

2. Key challenges faced for public transport investments:
   - CapEx, OpEx and the subsidy requirements of most public transit systems
   - Providing a level of service sufficient to persuade motorists from their cars and making transit itself an attractive choice
   - Mass personalisation in consumer markets
   - The issue of pedestrian, vehicular and junction conflicts
   - Engineering problems with retrofitting good solutions into existing urban environments

3. Outlining Personal Rapid Transit (PRT), comparing some of the systems in the market place, to show how Second Generation PRT could likely address the above issues and ISNGI’s stated Grand Challenge, likely including:
   - Summary results from transport modelling-based analysis
   - Explanation of some features specific to MISTER PRT

Miss WM Nadeeka Dilini  
University of Colombo

Effective Water Management in the Mahaweli Reservoir System; Analysing the Inflow of the Upmost Reservoir

ABSTRACT: Mahaweli cascaded reservoir system is built contiguous to the Mahaweli river, enhancing the water storage and transferring ability to reinforce the needs of water. The foremost requirement of the system is to provide water for irrigation and to produce hydroelectricity to the country that has given rise to conflicting demands of both sectors. Forecasting future total water availability and the dynamic allocation of water balancing between both sectors is crucial to predict the hydroelectricity generation capacity. Modelling the changes of in-flow of the upmost reservoir is substantial, before considering the entire system. This study analyses the statistical nature of the in-flow and the distributional patterns of input variables such as rainfall, temperature and the parameters are estimated using R package. Finally the proposed methodology or framework for improved prediction power based on Operational Statistics and Data Mining will be presented.

Keywords: in-flow, water management, hydroelectricity, stochasticity, non-linearity, seasonality Operational Statistics, Data Mining

Mr Viengnam Douangphachanh  
Tokyo Metropolitan University

Using smartphones to estimate road pavement condition

Efficient road infrastructure maintenance and management depends on many factors, of which the availability of updated pavement condition data is among the most important. Today’s smartphones, which usually come with many sensors, are potentially useful tools for pavement condition estimation. This research explores the use of data from smartphones’ accelerometers to analyze for features and relationship of acceleration vibration to estimate road roughness condition. Although, the estimation might not be as accurate as modern profilers’, it is still may be very useful for cost saving and as an indicator for continuous monitoring. In the experiment, smartphones
are placed inside vehicles and drive along selected road sections to gather data for analysis. The analysis consists of data filtering, matching with location and reference data, sectioning and frequency domain analysis. Results show that acceleration vibration magnitude has a linear relationship with road roughness condition.

Miss Sarah Dunn (Co-Authored by Sean Wilkinson)
Newcastle University

Modelling infrastructure systems for resilience and sustainability

**ABSTRACT:** Modern infrastructure systems are vital to the functioning of modern society. They promote social well-being, support economic development and are crucial in mitigating the effects of natural hazards. While there is some understanding of their mitigation role, there has been little quantifiable work on how they support our societies or how they stimulate economic development.

Some recent analysis of infrastructure systems have shown that many of these seemingly different systems display similar architectures to each other leading to the hypothesis that the evolution of these systems is a result of underlying drivers that are common to all.

This paper presents a network model that captures the growth of infrastructure networks in terms of architecture, hazard tolerance and geographical characteristics. The results presented in the paper suggest that the model may be the basis for an enhanced understanding of the role that infrastructure plays in sustaining our communities.

Prof Peter Eklund (Co-Authored by Vu Tran)
University of Wollongong

Connected Mobility Digital Ecosystem: Case study

**ABSTRACT:** This presentation details the architectural and design issues associated with real-time control of bus operations to improve headway, minimize passenger wait time, maintain passenger comfort and reduce the impact of control strategies using a number of multimodal inputs including: passengers interacting with apps, vehicle GPS data and the real count of passengers on and off the transport network. A real-life bus route operating in Wollongong together with its passenger load data are used in the simulation analysis to verify and evaluate the proposed approach. Some of the analytics collected from our experimental platform are also discussed.

Mr Nampuraja Enose
Infosys

A mobile based Integrated Outage Management System

**ABSTRACT:** This system has a client application and a master application. The client application (mobile based) allows users to log an outage complaint with sufficient. The application also permits to include more details using the sophisticated mobile applications like the image, video etc. of the out-age. Each complaint is uniquely tagged and directed to the master application. The master intelligently assigns it to the respective group which has an identified owner, based on the details like type of utility, location, time etc. All child complaints are identified with the parent complaint making it easier to handle. The intelligent relationship matrix identifies the parent-child relationship and relationships which has interdependence between utilities. This intelligence therefore makes it as an integrated outage management system for the entire infrastructure services. Other benefits are reduced outage durations, faster restoration, extended service life and improved customer satisfaction.

Mr John Gardiner
SMART Infrastructure Facility

The Planning and Funding of Road Infrastructure via PPPs

**ABSTRACT:** The shortfall in the funding for construction, operation and maintenance of road infrastructure in Australia is substantial and future investment appears to be beyond the capabilities of government funding alone. In the past, the private sector has proven very willing to invest in PPPs with government to provide road infrastructure and, overall, its performance in relation to construction, operation and maintenance has been far superior to that of government and has relieved government of substantial risk. However, it is unlikely that the private sector will accept the same levels of risk on new PPPs as in the past.

Mr Hadi Ghaderi
National Center for Ports and Shipping

Reliability Improvement in Australian Interstate Rail Freight Network by Transit Time Management

**ABSTRACT:** With rapid development in just-in-time production over the last two decades, area-specific reliable and responsive, as well as customer-oriented, rail freight services are of increasing interest and soaring demand. Having a proper understanding on underlying factors in the evaluation of the quality of rail freight services is a key challenge in the short-term and long-term regional and metropolitan freight mobility planning, particularly with a competitive rail freight market as in Australia. Among the fundamental attributes of rail freight services, transit time and reliability/punctuality are of utmost importance and they are inevitably correlated. This paper aims to discuss the possibilities for service improvement in the Australian non-bulk interstate network through managing the underlying factors and address the conditions under which these factors can be combined to enhance the utilization and efficiency of rail freight services on the national rail infrastructure.

Dr Amineh Ghorbani
Delft University of Technology

Structuring socio-technical complexity in infrastructure systems: The Biogas system

**ABSTRACT:** Infrastructure systems consist of many heterogeneous decision making entities and technological artefacts. They are governed through public policy that unravels in a multi-scale institutional context, ranging from norms and values to technical standards. For example, to integrate biogas infrastructure in a region, various forms of governance, laws and regulations need to be implemented. To effectively design these requirements, insights into socio-technical systems can be gained through agent-based modelling and simulation.

To implement such social concepts in agent-based models of infrastructure systems, we designed a modelling framework called MAIA, based on the Institutional Analysis and Development framework of Elinor Ostrom. This paper will explain how MAIA can be used to model a biogas energy infrastructure in the Netherlands.

Mr Shanta Hallock
DRH Logistics

A Decision Framework for Investment in Supply Chain Driven Intermodal Systems

**ABSTRACT:** A research study identifying the role of ports, a forward timeframe of 30 years in servicing national supply chains is being undertaken. A paradigm shift to ‘water based’ freight solutions by barges and other forms of Short Sea Shipping (SSS) proposed in Hallock (2009 and 2010) as well as investigating stakeholder commitment to reducing their carbon footprint will be researched as part of this. Funding and better investment criteria will also be explored.
The paper draws on European policy and governance frame works incorporating SSS as a component of the logistics response to sustainability. The green supply chain is now an important determinant of competitive advantage and is commercially acceptable.

Dr Mark Harrison
SMART Infrastructure Facility, University of Wollongong

The care of victims: implications of the Productivity Commission’s proposed no fault insurance scheme

ABSTRACT: Traffic accidents impose large costs, with 1,291 road deaths in Australia in 2011. The total costs of road accidents were estimated to be $17 billion in 2003, equivalent to 2.3 per cent of that year’s GDP, averaging around 8.4 cents per vehicle kilometre.

The Productivity Commission has recommended replacing tort law with a compulsory, government run first party insurance scheme, where all victims receive compensation from the state, regardless of fault. The proposal is being implemented across Australia, NSW has adopted it this year.

Contrary to the PC’s assertions, the evidence is that no fault insurance would increase traffic fatalities by 10-30 per cent, and accidents by even more. This has implications for the safety design of road infrastructure.

An inter-disciplinary approach is taken, in this paper, combining, law, economics and transportation engineering to examine the interaction of legal rules, insurance arrangements, economic incentives and physical infrastructure.

Prof Mark Hickman
University of Queensland

Advances in Transport Network Analysis and Modelling

ABSTRACT: Computational advances and rich data sources have allowed major progress in urban travel modelling over the last 25 years. We can now validate existing and forecast future vehicle- and person-movements in very large networks. We evaluate these new dynamic traffic and public transport modelling tools and their capabilities. We also report on recent successes and challenges in applying these models to practice.

Dr Tomas Holderness (Co-Authored by David Alderson)
SMART Infrastructure Facility, University of Wollongong

An evaluation of spatial network modelling to aid sanitation planning in informal settlements using crowd-sourced data

ABSTRACT: Limited water and sanitation infrastructure in rapidly-urbanising informal settlements can present significant health and environmental risks to populations in developing nations. Where formal pipe networks are not available, road-based sewage treatment-transportation options have been cited as a viable alternative. However, little research has been undertaken to evaluate the long term operational costs of such systems. In this paper we present an evaluation of network modelling, as a novel method to evaluate the costs of road-based sewage treatment-transport options. Such analysis is made possible using crowd-sourced, open geospatial data which allow us to examine costs based on different spatio-topological network configurations. It is envisaged that such a tool could be used by engineers as part of the sanitation planning process, to evaluate sanitation network implementation options. The paper includes a case-study based on the Kibera settlement in Kenya.

Mr Matthew Holmes
Newcastle University

How do we ensure the assessment of infrastructure resilience is proportionate to the risk?

ABSTRACT: As infrastructure becomes increasing integral to daily lives, society becomes more vulnerable to potential failures. We mitigate against this by investing some of the increased prosperity afforded by infrastructure to treat the most salient risks and increase the resilience of the system. Therefore we enter a cycle where our ability to identify and prioritise vulnerabilities is crucial to the further development of infrastructure.

It is easy to compose a list of risks occupying the whole spectrum from probable through to fanciful, but, how do infrastructure owners define defensible boundaries between the credible risks they should assess and those that can be set aside? This paper tests the hypothesis that incorporating information on the uncertainty of risk assessments provides risk managers with a more robust process to justify their choice of credible risks.

Mr Shahadat Hossain
Institute of Water Modelling

Coping with New Challenges in Water Resources Management in Bangladesh

One of the most stressed resources in Bangladesh is water. Major challenges facing sustainable water resources management in the country today include: increasing vulnerability to extreme events, unrestricted extractions, growing urban demand, climate change, land-use changes and environmental requirements. In this context, the study gives an overview of existing water management practices in the country; and elucidates the role of hydrological services including focused R&D in resolving water resources issues. A recent effort in enhancing institutional capacity for decision making is elaborated in the context of implementation of various Hydrology Projects. R&D efforts in water sector are shown to embrace two major roles in furthering sustainable water resources management: i) helping to decrease the vulnerability by furthering development and increasing adaptive capacity, and ii) giving an option to respond to numerous contingencies that an unknown future holds.

Dr Nam Hyunh
SMART Infrastructure Facility, University of Wollongong

An Activity Based Approach to the Modelling of Travel Demand on the Road Network in a Sydney Metropolitan Area

ABSTRACT: This work reports a methodology to construct activity schedules for a synthetic population in a Sydney urban area and demonstrates its application in an activity-based model to simulate travel demands on the road network in the area. The methodology comprises three steps. The first step generates a synthetic population for this area based on census data. Travel diaries are then assigned to individuals in the population using the Household Travel Survey (HTS) data that is available for the Sydney Greater Metropolitan Area. The sampling of travel diaries from HTS data is done at household level so that the inter-dependencies (in terms of the sequence, travel times and purpose) of daily trips of individuals in a synthetic population household are reserved. The third step assigns specific locations to trips in each individual’s diary. The ‘Journey To Work’ dataset is incorporated in this step to inform the allocation of destination to a work trip based on its origin and transport mode. The execution of travel diaries of the whole population in Transims provides a bird’s eye view.
view of the dynamic of traffic on the road network as well as the actual travel time of each trip. A simple algorithm is adopted to allow individuals in the population adjust an element in their travel diary (e.g. departure times) to minimise delays in their diaries due to the delays in travelling between activity locations. The new travel diaries are re-submitted into Transims for execution. The impacts of those adjustments in activity schedules to the traffic density on the road network in the study area are reported and discussed.

Mrs Deshani Kariyawasan
Department of Statistics, University of Colombo

A Study of the Dynamic Behaviour of Daily Load Curve for Short Term Predictions

ABSTRACT: Electricity demand is one of the most controversial topics in Sri Lanka as the price of electricity increases rapidly, due to the scarcity of electricity generation sources to meet the demand. Filling up the peak demand, starting around 6.30p.m and ending around 9.30p.m, of the load curve is identified as the most crucial aspect that needs to be addressed. During this period, high cost power plants are used, which cannot be met using other low cost options such as hydro power. Therefore, the Ceylon Electricity Board has to bear a huge loss in order to accommodate to this high demand at peak times. Therefore, it is an essential task for a country to consider developing strategically approached mechanisms to provide a reliable electricity supply at an affordable price. This study focuses on studying the statistical nature of the daily load curve for different consumer categories to capture the dynamics of electricity usage. Further an extensive literature such as model cities in terms of demographic changes, relying on the Mount Lofty natural catchments & River Murray as its sources. With climate change manifesting itself through severe drought & rainfall reaching historic lows, the State Government recognised the need to diversify & secure Adelaide’s water supplies. It responded by committing to build a desalination plant, nominating SA Water as the lead agency to deliver the project. Focusing on complex infrastructure delivery systems, the paper addresses: how effective & appropriate governance & control mechanisms were established during development to overcome long lead time approvals, project acceleration & complexity; how the need for a desalination plant & project delivery was balanced with often competing needs of the community & the environment; how the desalination plant integrates process optimisation, R&D & sustainability, & achieves benchmark performance in energy efficiency.

Mrs Agnieszka Labus
Silesian University of Technology

Transport infrastructure renewal in the context of the ageing society

ABSTRACT: The key question is: how can transport infrastructure provide senior citizens with access to a variety of areas, including housing areas and basic services, in order to prevent their exclusion from society? According to the OECD (2003), solutions can be found in integration services and reduced spatial distances, which contribute to a more compact urban structure in the development of future cities, and thus supported economic growth and urban renewal. There are many links the transport infrastructure in the sustainable development, among which, two aspects seem to be the most important. On the one hand, urban streets, should not only allow the smooth movement of vehicles, but to public spaces, social, with a small architecture, frontages, bike paths, etc., providing accessible and safe access to various locations in the city. On the other hand, the grid of streets in dense urban multifunctional structure can be used to support and motivate the senior citizens to take part in social networking in local venues and local services. The appropriate density of development and the street grid reduces the need to use transport and makes more efficient use of infrastructure. Three selected European cities serve as model cities in terms of demographic changes.

Mr Milind Kumar (Paper presented by Chitra Raju)
SA Water

The Adelaide Desalination Project: A case study in the development and delivery of complex infrastructure against a backdrop of climate change. Building security, resilience, sustainability and innovation into metropolitan Adelaide’s water supply system.

Inherently highly system interdependent, Adelaide’s water supply was also climate dependent, relying on the Mount Lofty natural catchments & River Murray as its sources. With climate change manifesting itself through severe drought & rainfall reaching historic lows, the State Government recognised the need to diversify & secure Adelaide’s water supplies. It responded by committing to build a desalination plant, nominating SA Water as the lead agency to deliver the project. Focusing on complex infrastructure delivery systems, the paper addresses: how effective & appropriate governance & control mechanisms were established during development to overcome long lead time approvals, project acceleration & complexity; how the need for a desalination plant & project delivery was balanced with often competing needs of the community & the environment; how the desalination plant integrates process optimisation, R&D & sustainability, & achieves benchmark performance in energy efficiency.

Mrs Joanne Leach
University of Birmingham

What makes a city liveable? Implications for next-generation infrastructure services

ABSTRACT: Infrastructure forms the framework within which modern societies operate both at the physical and social level. It includes (amongst others) digital, green and social infrastructures, emergency services and food networks as well as water, energy, waste and transport. In 2012 Liveable Cities, a 5-year research programme, combining the Universities of Birmingham, Lancaster, Southampton and UCL, was established to identify and test radical engineering interventions that will lead to liveable cities of the future (low carbon, resource secure cities in which societal wellbeing is prioritised). This paper presents a discussion of what comprises a truly liveable city and how it might be achieved. It presents the City Analysis Framework, a technique for the analysis of city operations that establishes a hierarchy of needs relevant to successfully achieving a liveable city. The results reflect the changing perceptions and importance of infrastructure and how proposed changes can radically alter people’s lifestyle and wellbeing.

Dr Liwanage Hansen
University of Western Sydney

Data Mining; Simulation and Operational Statistics for Real Time Dynamic Decision Making for Next Generation Infrastructure

Abstract: Meeting the need of increasing population, decreasing natural resources (energy, water, clean air, land, minerals, climate, natural vegetation flora forma, ocean, marine life, ecosystems) while maintaining increasing living standards, requires a system with optimum productivity and resource allocation capabilities. In order to model such complex system one needs to establish a real time data and information gathering platform in position (latitude, longitude, altitude) and time domain. This provides the big data source for data mining analysis and to produce real time analytical tools for better informed decision making. Simulation builds, validates and utilise the model to evaluate the impact of proposed operating strategies on performance indicators for better decision making. In operational statistics, one integrates the estimation and the optimization tasks to estimate the optimal policy directly. Traditional approach which separates the estimation and the optimization tasks can lead to suboptimal solution. These methods will be demonstrated using inventory control application.
Mr Ashkan Masouman
SMART Infrastructure Facility, University of Wollongong

Incorporating Time-Series into an Interindustry Analysis to Model the Regional Economic Structure: a Case Study of the Illawarra

ABSTRACT: Since the pioneering work of Glickman (1977) on embedding an input-output (IO) module into an econometric framework, there has been a plethora of studies on combining the two models in the literature. The popularity of the combined framework is due to its superior performance in economic forecasting and higher accuracy in impact analysis. There are a number of approaches through which an IO model is combined with an econometric model. This paper examines three approaches to combine IO analysis with econometric modelling, namely embedded, coupled, and linked. All three approaches are applied to the Illawarra region in a series of ex-post forecasting experiments. Each approach is applied to a hypothetical scenario of sectoral reallocation of government expenditure, to investigate certain key sectors that provide more jobs per dollar of expenditure relative to other sectors. The comparative forecasting performance and impact analysis accuracy of each approach is examined.

Dr Jun Ma
SMART Infrastructure Facility, University of Wollongong

Data-Driven Forecasts of Regional Demand for Infrastructure Services

Abstract: A region’s socio-economic development and livability are affected to a great extent by the region’s infrastructure services. Data-driven forecasting demands for infrastructure utilities (electricity, water, waste, etc) of a region becomes a challenging issue in the situation of highly integrative infrastructure networks and restricted data sharing, which involves handling temporary and spatial infrastructure utility data simultaneously and modelling the correlations between different infrastructure utilities and their interactions with relevant socio-economic and environmental indicators. Data mining and complex fuzzy set techniques are used to implement this kind of analytically capability in SMART Infrastructure Dashboard. The developed method and technique can be used for better governance, planning and delivering of effective and efficient infrastructure service and facility. It can also provide support evidence for a region’s long-term sustainable planning and development.

Mr Payam Mokhtarian
University of Wollongong

A General Framework for Infrastructure System Reliability Modelling and Analysis

ABSTRACT: An infrastructure system is inherently complex, with defined and subtle interfaces with other infrastructure systems and human users. High availability is desired, implying stringent requirement on reliability and safety. Reliability analysis typically starts at component or subsystem level and aggregates through the functional hierarchy. Owing to the system complexity, considering occurrences of all possible failures is not always practical and failure data is often limited. Further, there are unobserved events in the subsystems distributing randomly or with temporal trend. To enable reliability analysis amid the complex environment and uncertain data, this paper proposes a general framework on modelling and aggregating reliability for complex systems with distinctive statistical approaches. The underlying principles and the statistical techniques to match the data available will be discussed. This study addresses the assurance of life-long productivity of the infrastructure system.

Dr Mohammad-Reza Namazi-Rad
SMART Infrastructure Facility, University of Wollongong

A Probabilistic Predictive Model for Residential Mobility in Australia

ABSTRACT: Household relocation modelling is an integral part of the planning process as household locations determine demand for community facilities and services. Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) originally initiated the Household, Income and Labour Dynamics in Australia (HILDA) with the aim of gathering reliable longitudinal data about family and household dynamics. Socio-demographic information (such as general health situation and well-being, lifestyle changes, residential mobility, income and welfare dynamics, and labour market dynamics) is collected from the sample individuals and households. The data shows that around 13 per cent of couple families in the HILDA sample move each year. The main goal in our study is to use available information in HILDA survey data about the changes in the employment status and household types in order to calculate a reliable estimate for the probability of residential mobility.

Prof Corinne Mulley
University of Sydney

Practical road pricing: distance based charges and discounted registration fees providing benefits for motorists and for government revenue.

ABSTRACT: Metropolitan areas around the world are experiencing increasing levels of road congestion. The call for congestion charging is getting louder as is the recognition that governments need more funds to support existing road networks and to invest in new transport infrastructure. A key challenge in road pricing reform is selling the idea to the community of road users as well as a whole raft of interest groups that influence the views of society and politicians. Simply announcing a need for a congestion charge (often misleadingly called a tax) does little to progress the reform agenda. What is required is a carefully structured demonstration of what might be done to progressively introduce adjustments in road user charges that reduce the perceived costs to motorists, create better incentives for when to drive while ensuring no loss of revenue to government. This paper provides this demonstration in the context of Sydney, Australia.

Dr Luke Onyekakeyah
The Guardian, Lagos

Biofuel Energy Production as Catalyst for Sustainable Agriculture in Nigeria

ABSTRACT: Two factors underlie the quest for biofuel energy production in Nigeria. The oil boom of the mid 70s turned the country’s economy from being predominantly agrarian economy to crude oil based diseconomy. The result is the shift to oil as a major source of foreign revenue. Second is the energy crisis that hit the economy due to the mismanagement of the crude oil revenue earnings and lack of appropriate energy policy framework.

The objective of this paper is to review the policy framework and actions already put forward for biofuel production and assess the implications of such developments on agricultural production. This is with a view to ascertaining to what extent the introduction of biofuel into the energy mix would help to revamp the agricultural economy.

In making this assessment, we sought and obtained relevant information from published materials relating to the issue of concern.

Keywords: Energy, Biofuel, Sustainability, Nigeria.
Dr Raghav Pant
University of Oxford

Analyzing interdependent national infrastructure provisions under extreme climate risk

ABSTRACT: To create sustainable, adaptive and resilient societies we need to develop proper understanding of infrastructure risk. This research improves such understanding by examining widespread failures of interdependent infrastructure networks from extreme climate events. By subjecting infrastructure networks to extreme climate loading, we construct ensembles of direct failure sets that lead to cascading indirect failures across topological infrastructure networks.

Such analysis produces two results:
1. Estimations of the topological fragility of infrastructure networks
2. Infrastructure vulnerability quantification in terms of spatial effects on service provision and customers using networked infrastructures.

Producing multiple failure sets give wide range of possible outcomes, which help build infrastructure failure profiles. Insights from risk analysis strengthen understanding of failures and are used to inform resilience-building activities for effective infrastructure provisions.

Miss Shiva Pedram
University of Wollongong

Assessing the Impact of Virtual Reality-Based Training on Health and Safety Issues in the Mining Industry

ABSTRACT: By Shiva Pedram, Pascal Perez, Bruce Dowsett

Best practice in the mining industry includes extensive initial and professional training for staff involved in field operations. While changes in mining technology and operations accelerate to improve productivity, health and safety standards have to be continuously evaluated and improved, putting more pressure on training delivery. Borrowing from Defence and Airspace industries, training in the mining industry is increasingly relying on immersive virtual reality to simulate complex operations and procedures in potentially dangerous environments. Coal Services Pty Ltd is at the forefront of modern training facilities in Australia.

This paper presents a qualitative and quantitative research framework designed to analyse the impact of past and current training sessions on staff’s ability to better perform their tasks, overall safety standards and mine productivity. Interviews with trainees, trainers and managers are used alongside session recordings to qualitatively evaluate levels of knowledge transfer and aptitudes to perform in a real environment. Then, a cost-benefit analysis is used to evaluate the added-value of virtual reality-based training by examining technological and operational costs weighed against overall productivity of the mine being negatively affected by any safety issue.

Key words: Simulation, Modelling, Virtual Environment, Mining Industry, Safety

Prof Ram Pendyala
Arizona State University

A Network-Sensitive Transport Modeling Framework for Evaluating Impacts of Network Disruptions on Traveler Choices: An Activity-Based Travel Modeling Approach

ABSTRACT: There is considerable interest in the application of active traffic demand management (ATDM) and traveler information systems strategies to mitigate the adverse impacts of congestion and network disruptions. Such strategies and user information systems not only impact network performance through the modification of traveler route choices, but also through changes in the overall range of activity-travel choices such as activity generation, destination choice, mode choice, and time of day choice. The simulation of the impacts of alternative strategies on network performance therefore calls for the development and application of integrated modeling frameworks capable of reflecting the entire range of activity-travel pattern adjustments that may occur in response to changes in network conditions and user information provision. This presentation describes an integrated modeling framework wherein an activity-based travel demand model and a dynamic traffic assignment model are tightly coupled together with continuous information exchange between the models along the continuous time axis. The activity-based model system incorporates stochastic frontier models to reflect time-space prism constraints and multiple discrete continuous extreme value (MCDEV) models to simulate activity-travel participation and time allocation patterns. The framework is enhanced to accommodate the possible impacts of alternative user information provision strategies on traveler choices and applied to a subregion in the Greater Phoenix metropolitan area to demonstrate the sensitivity of the model to network disruptions under alternative information provision scenarios. Model results are consistent with expectations and show that impacts of network disruption are substantially mitigated in the presence of traveler information systems. Further, the model results show that workers – who have more rigid work schedules and locations – are more substantially impacted by network disruptions than non-workers who do not have such constraints. Integrated activity-based microsimulation modeling tools such as that described in this presentation offer promise for evaluating emerging operational and policy strategies aimed at influencing traveler choices.

Mr Aumna Phdungsilp
Royal Institute of Technology

A Framework for Integrated Energy Systems, Infrastructure and Services Optimization with Visualization and Simulation Platform for Low-carbon Precincts

ABSTRACT: The energy informatics can be enhanced to support decision-making, communications and benchmarking of the energy performance both in design and operational phases. To enable engineers, developers and policy-makers to better understand the implications of energy systems and services, computer-generated visualization is a powerful tool to inform a range of technological options and to analyze the effects of energy system strategies. Visualization increases the transparency of results and the understanding of interactions between users and energy systems. The paper presents a novel conceptual framework of integrated energy systems, infrastructure and services optimization with a visualization and simulation platform. It focuses on the development of tool for low-carbon energy systems and high quality energy services at precinct scale. The paper describes the vision and architectural design for integrated framework. It is expected to serve a next generation approach to managing energy services, carbon emissions and efficient resource use in the built environment. This will help to deliver new environmentally sustainable infrastructure and achieve carbon neutrality in urban development.

Ms Maria Rashidi
SMART Infrastructure Facility, University of Wollongong

A New Approach to Bridge Infrastructure Management

ABSTRACT: The maintenance of bridges as a key element in transportation infrastructure has become a major concern due to increasing traffic volumes, deterioration of existing bridges and well-publicised bridge failures. The main goal of this study is to develop a requirements-driven decision-making STRATEGIC framework for the assessment and prioritization of bridge/infrastructure maintenance and replacement. The framework presented here is an adaptation of the Strategic Bridge Management System (SBMS) framework developed by the Federal Highway Administration (FHWA) in the United States, with modifications and additions that make it specifically applicable to the Australian context.
support methodology for remediation of concrete bridges with the aim of maintaining bridge assets within acceptable limits of safety, serviceability and sustainability. The proposed model includes two phases: Phase one is focused on condition assessment and priority ranking of bridge projects which makes use of an integrated priority index addressing a variety of factors. Phase two includes a multi criteria decision making technique which is able to select the best remediation strategy at both project and network level. The modified Simple Multi Attribute Rating Technique (SMART) is used as a decision analysis tool that employs the eigenvector approach of the Analytical Hierarchy Process (AHP) for criteria weighting.

Mr Lindsay Robertson
University of Wollongong
Vulnerability, resilience and “exposure” – some thoughts on definitions and metrics

ABSTRACT: In the field of infrastructure security, there is significant definitional diversity of terms such as “vulnerable”, “resilient”, and even “risk”. Without clear definitions any derived metric will be similarly imprecise, and without metrics we can neither assess “vulnerability”, nor evaluate options for improvement. While research has made advances in metrics applied to homogeneous systems, adequate modelling of inhomogeneous (more than one service transmitted) and interconnected infrastructures (that supply goods and services to end-users), is generally regarded as being computationally intractable. This paper specifically considers the possibility of characterising end-user “exposure” that would allow evaluation of options for improvement in end-user security.

Dr Ges Rosenberg
University of Bristol
A Systems-based Approach to Creating Value from Infrastructure Interdependencies

ABSTRACT: Current planning and appraisal processes treat infrastructure as discrete, sector-specific assets, and as a consequence fail to identify and exploit potentially valuable interdependencies. Similarly, these silo-based approaches are unable to identify potentially hazardous and costly interdependencies in a systematic manner. A major challenge then for providers of modern infrastructure, is to realise the innovative opportunities in interdependencies, and so increase value-for-money, sustainability and resilience. To achieve this it is necessary to recognise that real-world infrastructure “systems” are highly interconnected, both with each other and with the socio-economic and natural systems in which they are located. This paper presents the outcome from a research partnership between the University of Bristol and University College London, sponsored by HM Treasury in the UK. It proposes an ‘open-systems’, cross-sectoral approach to create and manage infrastructure interdependencies, and comprises a framework of principles (“stewardship”, “shared-governance” and “interdisciplinarity”), and associated organisational maturity measures, and systems-based tools.

Mr Sasha Sadegholvaad
SMART Infrastructure Facility, University of Wollongong
A Star Schema for Utility Network Analysis and Visualization in a Geo-Business Intelligence Environment

ABSTRACT: Utility network analysis is an established area of research in Geographic Information Science (GIS), but it is yet to feature in a Business Intelligence (BI) environment. Inclusion of this capability in BI can be achieved by modelling a utility network as a star schema. However, modelling spatial data as star schema is still in its infancy for two main reasons, (a) only very recently have researchers started appreciating the importance of GIS capabilities in BI, (b) specific challenges associated with introducing geometry data with complex topological relationships into star schema. We present a star schema to model geometric utility networks such as water and sewer systems. Our schema brings in an important new feature ‘shared-governance’ and associated organisational maturity measures, and systems-based tools.

Dr Jun Shen
University of Wollongong
Bio-inspired cost-effective access to big data

ABSTRACT: With the rapid proliferation of services and cloud computing, Big Data has become a significant phenomenon across many scientific disciplines and sectors of society, wherever huge amounts of data are generated and processed daily. End users will always seek higher-quality data access at lower prices. This demand poses challenges to service composers, service providers and data providers, who should maintain their service and data provision as cost-effectively as possible. This paper will apply bio-inspired approaches to achieving equilibrium among the otherwise competitive stakeholders. In addition to novel models of cost for Big Data provision, bio-inspired algorithms will be developed and validated for dynamic optimisation. Furthermore, the optimised algorithms will also be applied in the data-mining research on the Alpha Magnetic Spectrometer (AMS) experiment, which is aiming to find dark matter in the universe. This experiment typically receives 200G and generates 700G data daily.

Mr Murad Safadi
SMART Infrastructure Facility, University of Wollongong
Energy Efficiency Dashboard for Small Businesses in the Illawarra

ABSTRACT: Recognising the need to improve small and medium enterprises’ energy consumption, the NSW - Office of Environment and Heritage (NSW-OEH) has successfully implemented a business-focused energy efficiency program. The program involved individual audits conducted by certified assessors, estimating actual energy use by appliances and providing recommendations for retrofitting of more energy efficient equipment. The SMART Infrastructure Facility and the NSW-OEH have partnered to create an online and interactive data portal that bring together information collected throughout the energy efficiency program in order to better inform other business managers about the opportunities to improve their profitability and sustainability. This paper demonstrates how the Energy Efficiency Dashboard, a fusion between Business Intelligence and Geographic Information Systems, can provide a robust, highly interactive, online analytical dashboard to evaluate the effectiveness of the energy savings program.

Mr Vadim Sokolov
Argonne National Laboratory
Modeling framework for regional integrated simulation of transportation network and activity-based demand (POLARIS)

ABSTRACT: Travel demand, traffic flow, network operations and land-use models are typically modeled in a decoupled way, i.e. each of the components is modeled separately assuming the others are fixed. Moreover, the models are often developed by different groups for different contexts, requirement, etc. In this paper we present a prototype of a software framework which allows the user to develop an integrated simulation of a transportation system in a standardized, extensible manner, as well...
as an implementation of an agent-based planning and network operations micro simulation model using this approach. The project uses an agent-based modeling approach to developing an integrated transportation system model. This allows the model to overcome some of the limitations of traditional aggregated transportation models, particularly with respect to sensitivity to behavioral aspects of the travelers. POLARIS project, then, is intended to develop such a modeling framework and demonstrate the benefits of this approach through the implementation of an integrated travel-demand and network operations agent-based micro simulation model. The model is intended to be used in evaluating network operations improvements and ITS implementations from a planning perspective. This paper provides background on the POLARIS modeling framework and details the development of several modules using the framework which form the basis of the planning and operations simulation model.

Prof Bob Stimson
University of Melbourne

A Large Scale Urban Model to Simulate Future patterns of Population and Dwelling and Economic Activity for a metropolitan Region: An Application to Brisbane-South East Queensland.

ABSTRACT: A LARGE Scale Urban Model (LSUM) has been developed and made operational for simulating potential future spatial patterns of population and dwelling growth and of the location of economic activity across a metropolitan region. The LSUM may be used as a spatial decision support system (SDSS) to inform planning decisions and inform the provision of urban services under different development scenarios over a 20 year forward time period. The paper describes the LSUM and illustrates its application in the Brisbane-South East Queensland region in Australia.

A/Prof Kang Tai
Nanyang Technological University

Identifying Extreme Risks in Critical Infrastructure Interdependencies

ABSTRACT: Critical infrastructures like our power generation facilities and water supply form highly interconnected networks that are mutually dependent and any failure can cascade through the network, resulting in devastating impact on health, safety and the economy. These catastrophic events/disruptions can be triggered by environmental accidents, geological/weather phenomena, disease pandemics, etc. The disruptions can be caused/exacerbated by their being unexpected, but they may actually be expected if relevant data have been accounted for. To help account for and thereby anticipate such disruptions, one way is to identify potential unforeseen interdependencies among infrastructure components that can lead to extreme disruptions upon some failure in the network. This paper shows how a simulation model for cascading failures and a risk analysis/optimization approach can be applied to search for unforeseen interdependencies and failure points that give rise to the highest risk in a network.

Dr Liz Varga
Cranfield University

Action in 8 domains for an 8 factor improvement: infrastructure with agency

ABSTRACT: If we define ‘critical infrastructure’ as ‘infrastructure with agency’ then we embrace both its physical assets and its use for the purpose of well-being, business and society. From this perspective infrastructure is seen as co-evolving between utilities and between users. This leads us to propose strategic action in 8 domains which together may achieve an 8 factor improvement:
1. Use infrastructure for multiple or permutable purposes
2. Identify and resolve under-utilization and poor efficiencies
3. Focus on service need rather than unconstrained demand
4. Design and create inter-utility solutions service provisions
5. Assess the value of infrastructure by the costs it avoids
6. Create an interdisciplinary agency to lead national infrastructure planning and strategy
7. Make the user and consumer a part of the system and not an exogenous factor
8. Continuously evaluate the competence of national infrastructure

Mr Rick Walters
Infrastructure Stainability Council of Australia

Pilot Application of the Infrastructure Sustainability Rating Tool to Local Council Road Management

ABSTRACT: Sustainable development requires infrastructure to be durable, minimise reliance on non-renewable resources, provide maximum benefits to society and the environment and contribute to prosperity in the long term. ISCA developed its infrastructure sustainability (IS) rating tool to assess the sustainability of both new projects and the operation of existing assets. The tool drives improved sustainability performance of infrastructure across all infrastructure sectors and all stages of the infrastructure lifecycle. The tool was piloted extensively on new projects and is now being taken up enthusiastically by industry to rate sustainability performance. During piloting, the rating tool had only undergone limited trials on infrastructure operations so ISCA and IPWEA undertook a pilot trial on the road management activities of two local councils. This paper describes the outcomes of the trial, actions that can be taken to make road management more sustainable and the next steps to progress use of the tool.

Dr Marci Webster-Mannison
University of Queensland

Green Infrastructure: Connecting people with landscapes through urban retrofitting.

ABSTRACT: This paper demonstrates a new way to integrate green infrastructure in the urban design of our cities whilst they continue to increase in density. A pilot study demonstrates how the population may be doubled through sensitive infill of the inner-city Brisbane neighbourhoods situated in the historical catchment of Western Creek. Hydrological modeling used MUSIC to...
size the associated green infrastructure elements and to quantify the benefits in terms of stormwater improvements.

The Western Creek Pilot Study reveals the important role that multifunctional green infrastructure has to play in the development of local solutions to urban intensification in response and energy, land, food and water supply pressures as part of a climate change adaptation strategy.

Dr Rohan Wickramasuriya
SMART Infrastructure Facility, University of Wollongong

SMART Infrastructure Dashboard: A Fusion between Business Intelligence and Geographic Information Systems

ABSTRACT: Business Intelligence (BI) has popularly been adopted as a process that enables easy access, analysis and visualization of information through specialized set of tools for informed decision making. Two most noticeable characteristics of traditional BI is that (a) is largely used in single-organization environments and (b) uses predominantly aspatial data. We believe that BI has applications beyond single-organization environments, but it very much requires integration of geospatial capabilities given the increasing availability of large volumes of spatial data and a growing interest to see things spatial. The SMART Infrastructure Dashboard (SID), our innovative solution that fuses BI and Geographic Information Systems (GIS), fills this significant gap. In this study, we demonstrate how SID can be used to perform spatio-temporal analysis and visualization of diverse sets of data to uncover complex interrelationships among utility usage, demographics and weather patterns at local and regional scale.

Mr Brett Williams
Shoalhaven City Council

Review of accessibility metrics and their effectiveness in non-metropolitan areas

ABSTRACT: Various accessibility metrics exist to explore the performance of transport by quantifying the opportunities available at a particular, discrete location and the available means to travel both to and from those opportunities. In Australia there is currently no consistent performance measure used by regulatory authorities to evaluate accessibility in order to inform land-use planning decisions. Considering the widespread availability and usage of strategic transport modelling software, a unified accessibility metric would benefit practitioners when planning for future infrastructure needs. Furthermore, the development of accessibility metrics tends to focus on metropolitan areas without exploring their effectiveness in regional and rural areas, where public transport, walking and cycling opportunities are limited due to lower population densities and wider disaggregation of localities. This paper provides a review of the existing literature on accessibility performance measures, and identifies areas of potential research on transport accessibility in non-metropolitan areas, with the aim to improve the planning and delivery of future infrastructure needs in an optimised and sustainable manner.

A/Prof Shu-Qing Yang
University of Wollongong

Coastal Reservoir – The trend of water supply in new era

ABSTRACT: Water scarcity is one of the major crises for other world problems liveability. Freshwater consumed by human will get to a tipping point, to solve this, many research activities have been conducted and can be grouped as: desalination plants; water detention; wastewater reuse; dams and reservoirs. But these methods can’t provide enough fresh water, only coastal reservoir strategy can achieve this, as it is technically feasible, environmentally sustainable and cost effective by demonstration and comparison.

Mrs Kate Young
University of Oxford

Strategic appraisal of interdependent infrastructure provision: A case study from the Thames Hub

ABSTRACT: Evaluation of potential infrastructure projects varies from straightforward financial assessment, to explicit methods requiring multi-criteria valuation and uncertainty analysis. All, however, are siloed to their own sector and in many cases the stand-alone project under consideration, ignoring the growing interdependence between the sectors. Reviewing outputs of current assessment methods against the London ‘Thames Hub’ proposal, we develop these into a multi-sector, multi-attribute decision analysis over a 100 year time-frame. Uncertainty is assessed through sensitivity analysis, provisioning time-dependency analysis and an adapted real options analysis, to produce bounded valuation of decision pathways. Further consideration of spatial feedbacks is then reviewed through a land-use transport model. The results are brought together to demonstrate a strategy level, integrated infrastructure assessment methodology, focused on delivering long-term resilience despite uncertainty.

Dr Weiliang Zhao

Cost-Driven Residential Energy Management for Adaption of Smart Grid and Local Power Generation

ABSTRACT: The existence of local power generation and varying price of power supply from a smart grid bring opportunities and challenges for energy management at residential homes. This paper proposes a cost-driven residential energy management approach for the adaption of smart grid and local power generation. The target system makes cost-driven scheduling, remote control, and automation of household appliances by considering the real-time and/or predictable status of smart grid, local power generation, and power consumption demands. The proposed approach minimizes the overall daily electricity cost of household appliances by taking into account both weather and electricity tariff forecasts, predictable home activities, and the flexibility of electricity use.
WITH SPECIAL THANKS TO OUR HOST AND CO-HOST PARTNERS

WITH SPECIAL THANKS TO OUR ASSOCIATE PARTNERS

FINANCIAL REVIEW

Institute of Transport and Logistics Studies,
The University of Sydney Business School
University of Southampton, UK
University of South Australia
Centre for Infrastructure Research, University of Auckland
Virginia Bioinformatics Institute at Virginia Tech
Faculty of Engineering, Pontificia Universidad Católica de Chile
Universidad Francisco de Vitoria
School of Architecture and Design, RMIT University
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Energy Pipelines CRC Ltd
United States Studies Centre, University of Sydney
The Australian APEC Study Centre at RMIT University

SMART WOULD LIKE TO THANK ALL DELEGATES FOR PARTICIPATING IN THE 2013 INTERNATIONAL SYMPOSIUM FOR NEXT GENERATION INFRASTRUCTURE

WE LOOK FORWARD TO SEEING YOU IN VIENNA 2014
About SMART Infrastructure Facility

Australia, like many of its international peers is grappling with very difficult questions about the future provision of infrastructure. The way we have settled our communities and developed industries in the past 100 years with an abundance of land, low population densities, scant attention to the environment and very modest community involvement all belongs to the past.

The SMART Infrastructure Facility is one of the largest research institutions in the world, funded by the Federal Government of Australia, NSW Government and University of Wollongong. It is dedicated to mapping out new data, concepts and frameworks to help govern-ments, business and the community be more front-footed in the planning, funding and management infrastructure networks for our cities and regions.

Our goal is to ensure infrastructure can be designed, procured, funded and managed for the betterment of our nation by enhancing Australia’s future global competitiveness, well-being of its citizens and resilience of its systems to natural and man-made events. It is these matters that are the subject of an intensive global collaboration where SMART works alongside government, industry and academic institutions to help ensure better long term performance of brownfield and new infrastructure assets and systems.

With its world-class laboratories, SMART can generate powerful and scalable models of national, regional and city-wide infrastructure networks, such as road, rail, water, energy and communication. This enables scenario planning of population changes on infrastructure networks and impact on performance over time.

SMART can deploy small and large-scale research teams and can access the expertise of University of Wollongong high degree students and academics.

SMART is set up to champion high quality and purposeful collaborations with industry and government in Australia and around the world to address key infrastructure challenges and assist with problem solving using evidence based computational tools.