UK Infrastructure Transitions Research Consortium

Long term dynamics of interdependent infrastructure systems

An EPSRC Programme Grant

Jim Hall
Oxford University

Tyndall Centre for Climate Change Research

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Propositions

- Transformations of infrastructure systems are required in order to:
  - mitigate carbon emissions
  - adapt to a changing climate and build resilience to extreme events and man-made threats
  - prepare for demographic changes e.g. ageing
  - provide the reliability and service required for a 21st Century advanced economy
- Inter-dependence between
  - infrastructure networks (energy, transport, water, waste, telecoms)
  - the economy and society
  - land use and the built environment

  is a complexity, a constraint and an opportunity
- The legacy of decisions and timescales of change are long. Potential for lock-in abounds
- Uncertainties are endemic, but decisions need to be made

Research challenges

1. *How can infrastructure capacity and demand be balanced in an uncertain future?*
2. *What are the risks of infrastructure failure and how can we adapt national infrastructure to make it more resilient?*
3. *How do infrastructure systems evolve and interact with society and the economy?*
4. *What should the UK's strategy be for integrated provision of national infrastructure in the long term?*

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The Investigators

Prof Jim Hall (University of Oxford)) is Director of the ITRC

Prof Nick Jenkins (Cardiff University) is an expert in energy supply and transmission

Dr Nick Eyre (University of Oxford) is an expert in energy demand

Prof John Preston (University of Southampton) is an expert in transport systems

Prof Chris Kilsby (Newcastle University) is an expert in water resource systems

Prof Tom Curtis (Newcastle University) is an expert in waste water systems

Prof William Powrie (University of Southampton) is an expert in solid waste and geotechnics

Prof Cliff Jones (Newcastle University) is an expert in the reliability of computer-based systems

Dr Seth Bullock (University of Southampton) is an expert in complex systems

Dr Stuart Barr (Newcastle University) is an expert geospatial data analysis

Prof Robert Nicholls (University of Southampton) is an expert in the impacts of climate change

Prof Peter Tyler (University of Cambridge) is an expert in regional economics

Prof Mark Birkin (University of Leeds) is an expert in analysis of demographic change

Dr Jim Watson (University of Sussex) is an expert on socio-technical transitions and the governance of energy systems

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… plus a wider research team

- 42 person-years of researchers
- 4 PhD students
- Cambridge Econometrics, CEH Wallingford, Cranfield University
- stakeholder champion: Roger Street
- programme manager: Ben Kidd
- affiliated students and projects

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… plus a remarkable group of project partners

EA Technology
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ssociation of North East Councils
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abinet Office
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epartment for Environment, Food and Rural Affairs
epartment for Transport
epartment of Communities and Local Government
epartment of Energy and Climate Change
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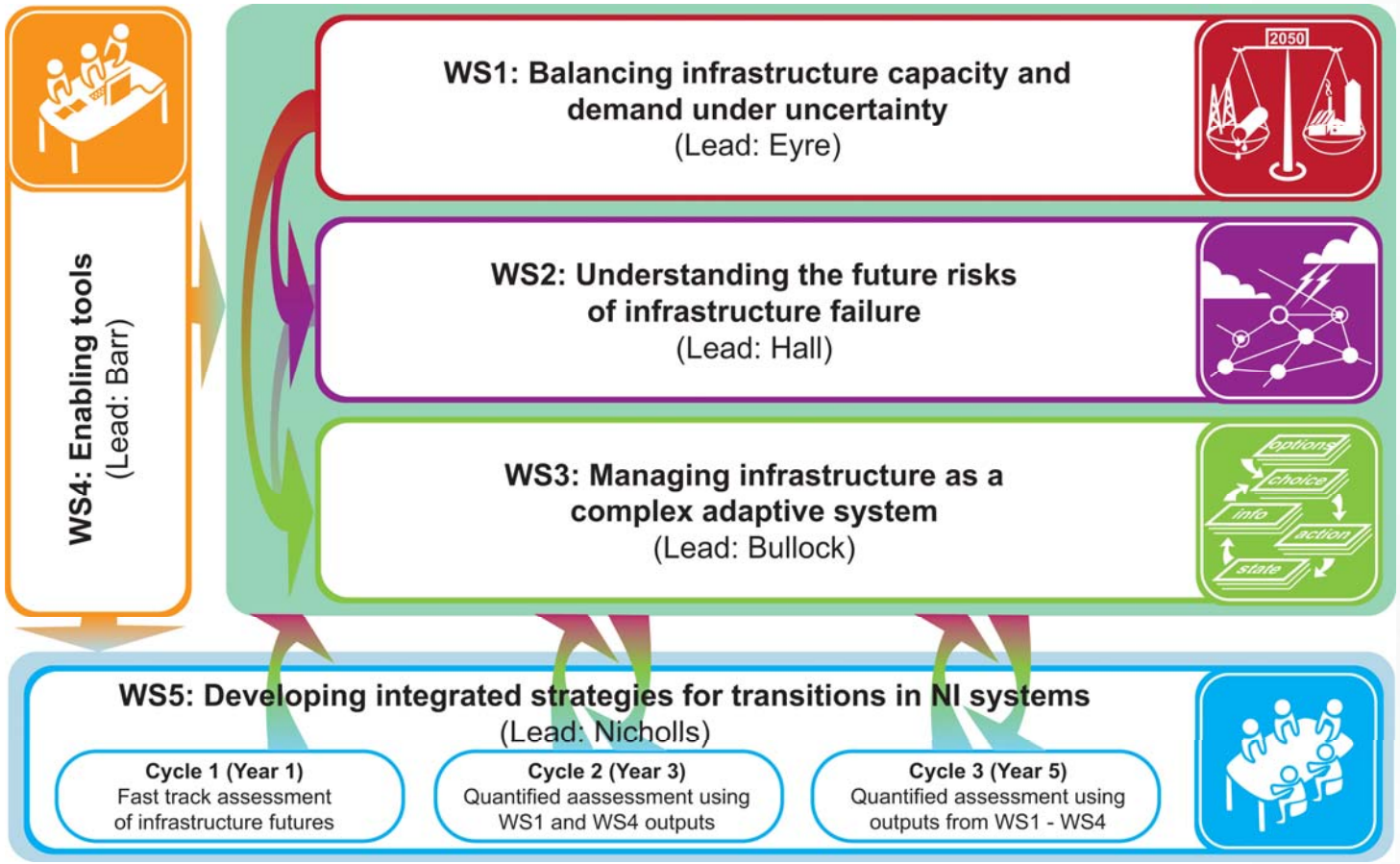
Institution of Engineering and Technology
Institution of Mechanical Engineers
JBA Consulting
Local Government Association
Met Office
Mott MacDonald
MWH
National Grid
Network Rail
Northumbrian Water
Ordnance Survey
Parsons Brinckerhoff
Royal Haskoning
Scottish and Southern Energy
Swanbarton
Town and Country Planning Association
Transport Scotland
UK Water Industry Research
United Utilities
Veolia Environmental Services
Willis
Yorkshire Water

Structure



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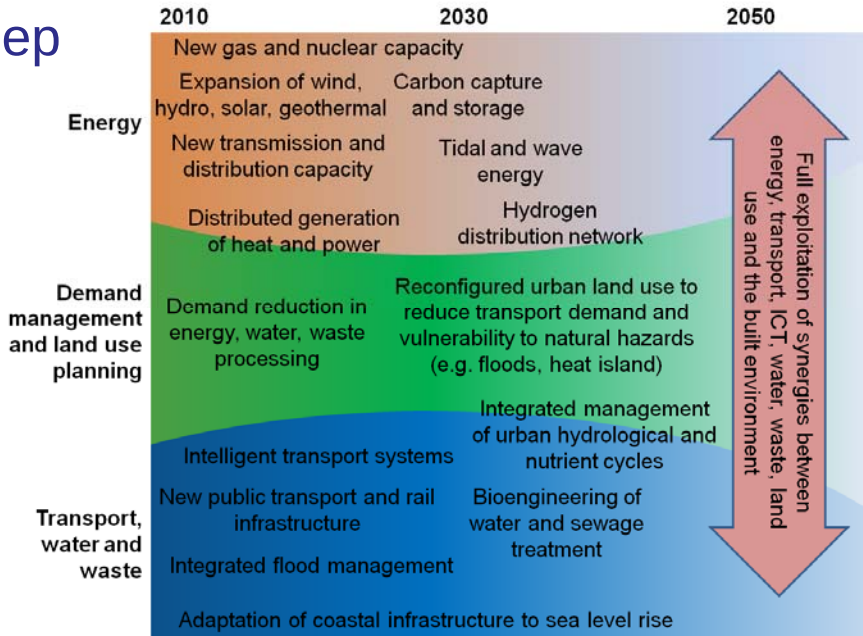
Improving decision making

- Balancing infrastructure capacity and demand under uncertainty
- Understanding the future risks of infrastructure failure
- Infrastructure as a complex adaptive system

In order to identify **transition strategies** that:

- Exploit-dependence rather than being vulnerable to it
- Robust to uncertainty (min-max, least regrets, info-gap)
- Adaptable (flexible design) and keep options open (real options)
- Resilient (resistance to shocks, capacity to recover and learn from failure)
- Can demonstrably lead to more sustainable outcomes



Outcomes

A new generation of methods for modelling capacity, demand and interdependence in National Infrastructure systems.

National network models to analyse the vulnerability of interdependent infrastructure systems to failure.

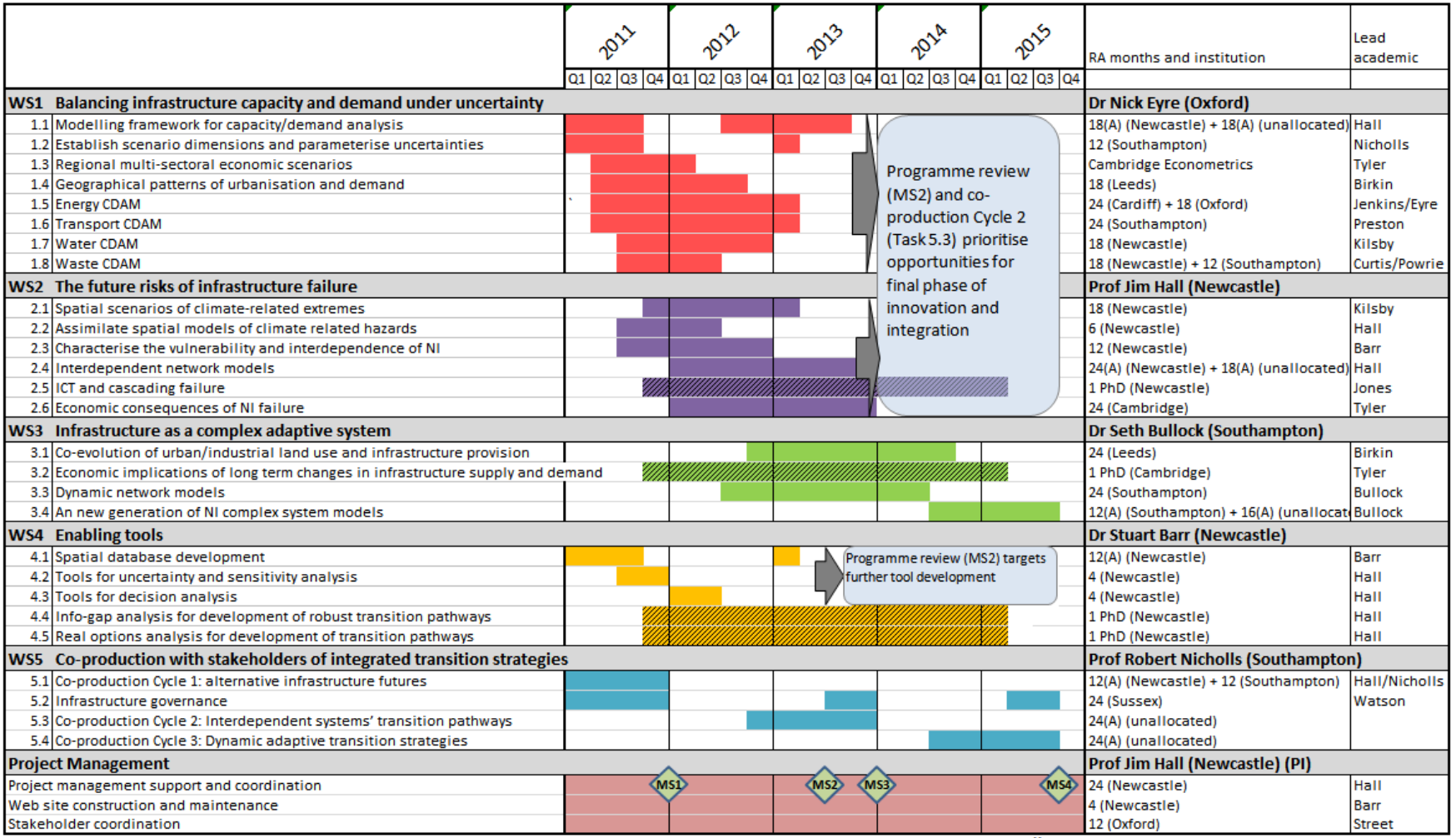
Pioneering simulation models of how infrastructure, demography and the economy evolve in the long term.

3 national assessments of how national infrastructure can be transitioned to a more sustainable configuration:

- Year 1: ‘Fast track’ analysis of possible futures for infrastructure in the UK
- Year 3: Assessment of future prospects infrastructure demand and capacity and appraisal of technology and policy options
- Year 5: Assessment report of the risks of infrastructure failure and the implications for strategies for infrastructure provision

Datasets of national infrastructure, demography, economy, demand and climate hazards

Programme



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Next steps and forthcoming events

ITRC Assembly:

- 15 June: Stakeholder workshop to review approach and initial results for the Year 1 Fast Track analysis (Task 5.1)
- 16 June: ITRC researchers assembly
- 17 June: Expert Advisory Board meeting

7 June: Infrastructure Resilience and Adaptation showcase event

24 June: ARCC workshop with Scottish government and stakeholders

30 June: Infrastructure Resilience conference at Leeds University

tba: Network Rail infrastructure adaptation workshop

September 2011: launch workshop for ITRC Work Stream 2

January 2012: Launch of the ITRC Fast Track analysis (national conference)

March 2012: Invited session on Infrastructure Sustainability at the Planet Under Pressure global conference London (joint with World Bank and OECD)

UK Infrastructure Transitions Research Consortium

For further information visit :

http://itrc.org.uk/home/

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