

## Use of Systems Models in Infrastructure

The UK journey towards infrastructure systems & the experience of small-island developing states

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## Infrastructure development

What challenges do we face?



How can we best address those challenges?



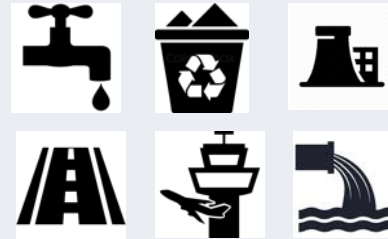
- What to do?
- Where to do it?
- When to do it?
- How much of it to do?

## Infrastructure development

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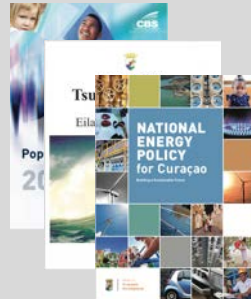
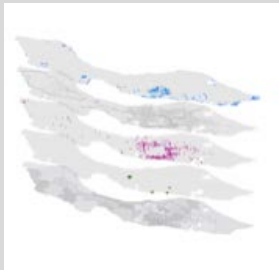
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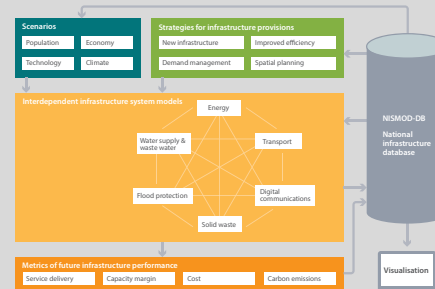
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## Evidence Base

National Infrastructure Databases



National Infrastructure Systems Modelling



- Interdependencies
- Forecast demands
- Infrastructure decisions
- Performance metrics



## Infrastructure Transitions Research Consortium (ITRC)

*To develop and demonstrate a new generation of data, simulation models and tools to inform the analysis, planning and design of national infrastructure*

- 10 years (2011-2021)
- \$15 million US dollars
- 7 Universities
- Oxford lead
- Multiple stakeholders
  - Industry
  - Government

# ITRC timeline: International Impact

Start of the ITRC Programme

Curaçao Resilient Infrastructure Conference

UK



International







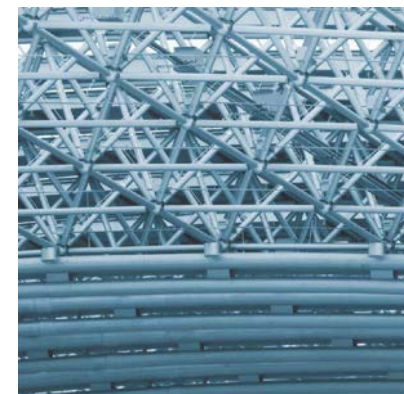
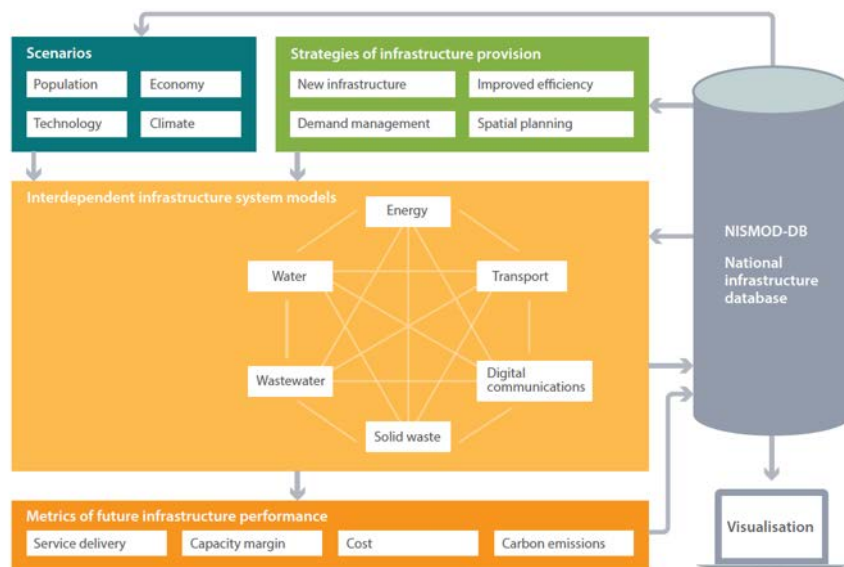
# The UK context



- **Infrastructure vital for:**
  - Economic growth
  - Social wellbeing
  - Environmental protection
- **Formation of Infrastructure UK**
  - First National Infrastructure Plan (NIP)
  - List of projects – rather than a plan
- **Modelling and simulation are powerful tools to:**
  - Find efficiencies and savings
  - Optimise policies and investments
  - Robust to demographic and climate changes
  - Address environmental issues

## UK ITRC First Assessment

- Building our national infrastructure database
- Building infrastructure systems models
- Preliminary testing of future infrastructure strategies and scenarios

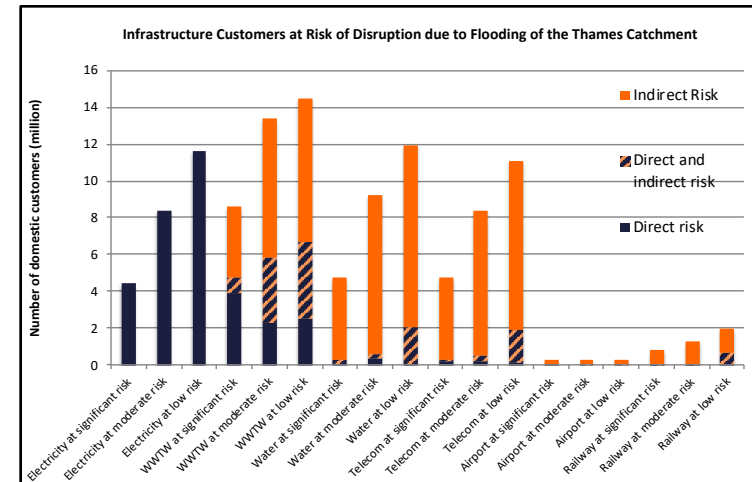
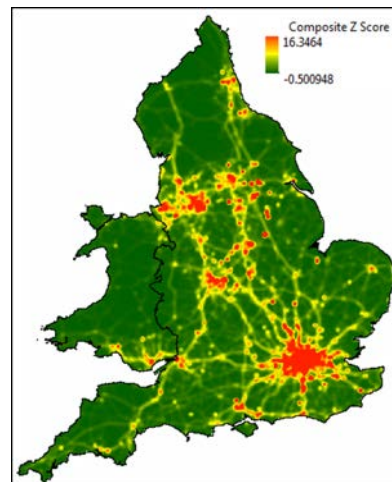


ITRC

A Fast Track Analysis of strategies  
for infrastructure provision in  
Great Britain

Executive Summary

*“The government recognises that meeting the UK’s infrastructure ambitions requires a long-term sustainable plan, which means taking a cross-cutting and strategic approach”*



Infrastructure UK

**SAGE**

Scientific Advisory  
Group for Emergencies





# Establishing a vision for UK infrastructure

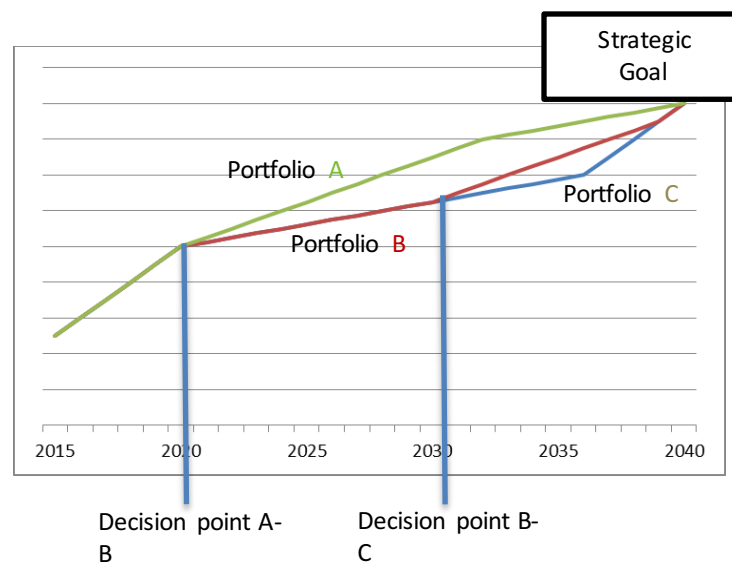
## The Armitt Review

An independent review of long term infrastructure planning commissioned for Labour's Policy Review



## Recommendations:

- Cross-ministerial planning unit
- National infrastructure assessment
  - Pro-active – Defined by a strong vision

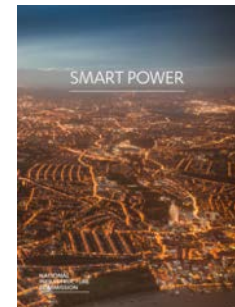
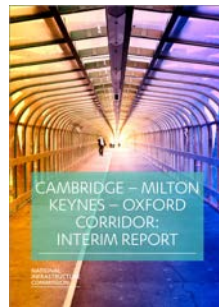
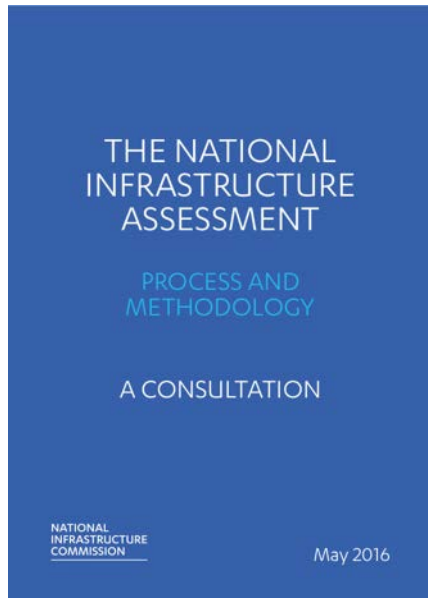


*“The National Infrastructure Commission is an independent body that enables long term strategic decision making to build effective and efficient infrastructure for the UK.”*



National Infrastructure  
Commission

- **A National Infrastructure Assessment (NIA)**
  - Long-term needs and how they can be met
- **Specific studies**
  - Addressing key challenges
- **Annual monitoring report**
  - Progress towards NIC recommendations

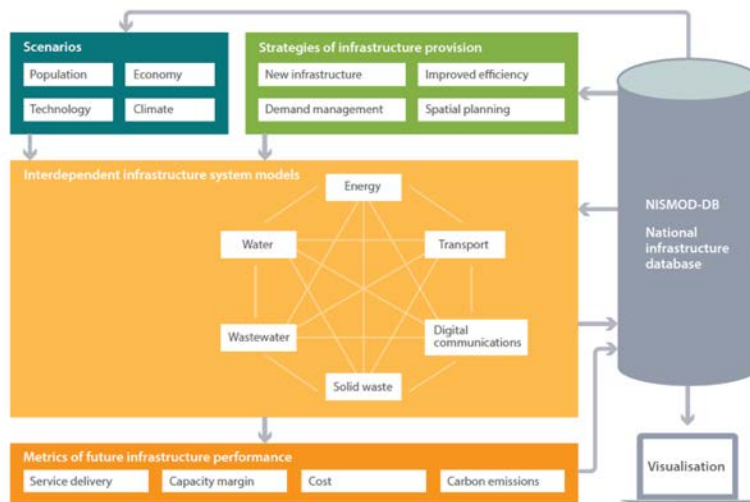




# Next Generation Modelling of Infrastructure

## National Infrastructure System Model – NISMOD v2.0

- Modular approach
- System-of-systems model of linked infrastructure simulation models
  - Explicitly describes interdependencies
  - Simulates performance of coupled infrastructure systems
- Explore consequences of decisions under long-term planning strategies using high-performance computing



## Summary: The UK journey

- **The UK is driving best practice**
  - Infrastructure planning
  - Infrastructure systems modelling
- **Co-evolution of governance and modelling**
  - Long-term
  - Vision-based
  - Cross-sectoral
- **Lessons learnt along the way...**
  - Many lessons for other countries and contexts
    - Start simple – build complexity
    - Start with ‘key sectoral challenges’



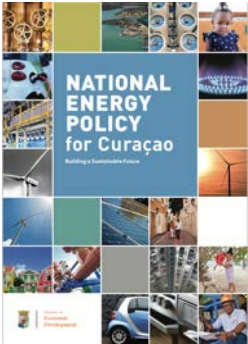


Photo Credit: Curaçao Ministry of Traffic, Transport and Urban Planning

- UNOPS' adoption of ITRC's infrastructure system modelling and assessment approach
- Curaçao Resilient Infrastructure Conference
- Achieving Sustainable Development Goals
- Linked issues across infrastructure sectors
  - Economic dependence on tourism
  - Little waste water treatment
  - Reliance on desalination for fresh water
  - Legacy of fossil fuel reliance (diesel generators)
  - Excellent renewable energy resources
  - Very poor solid waste infrastructure