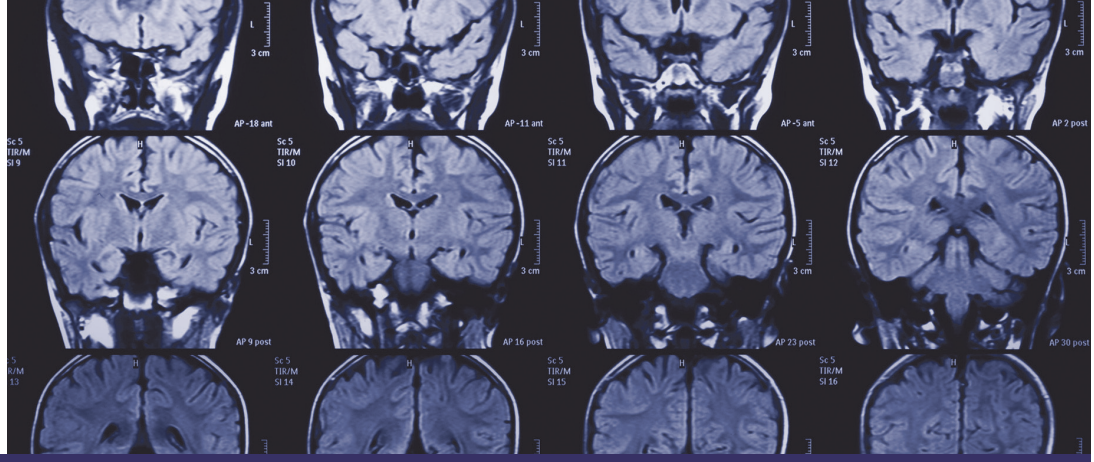

DeDeRHECC

Design and Delivery of Robust Hospital Environments in a Changing Climate

AIM	**The project aims to investigate the design and delivery of economical and practical strategies for the adaptation of the NHS Retained Estate to increase its resilience to climate change whilst meeting the challenging carbon reduction goals and performance requirements of the NHS.**
Principal Investigator	**Prof Alan Short, University of Cambridge**
Research partners	**University of Cambridge, Open University, University of Loughborough, University of Leeds, with input from Arup and Davis Langdon**
Stakeholder partners	**Bradford Teaching Hospitals NHS Foundation Trust, Cambridge University Hospitals NHS Foundation Trust, University Hospitals of Leicester NHS Trust, West Hertfordshire Hospitals NHS Trust, Department of Health**
Project duration	**October 2009 to October 2012**
Project website	**www.robusthospitals.org.uk**

Objectives

- The meaning of resilience will be refined and methods for its evaluation will be devised through consultation with DoH, NHS and Trust level policy-makers and other stakeholders, patients and staff,
- 2Building types occurring frequently within the 4 stakeholder NHS Trust estates will be identified, yielding ‘typical’ case study buildings. For each type the services strategies, internal condition and energy use will be determined through a combination of field measurement and site survey.
- Through a combination of modelling and critical appraisal, the resilience of the existing case study buildings will be established using current and future weather data for different geographical locations.
- Robust refurbishment strategies will be developed for the case-study buildings. The likely future internal environmental conditions, including the prospects for effective airborne pathogen control will be predicted, energy use and capital and lifecycle costs estimated, and stakeholder responses to these scenarios tested.
- The barriers to adaptive refurbishment will be diagnosed. A Re-Design Decision-making Process for managing and delivering the refurbishment pathway will be evolved through the adaptation of engineering design change prediction tools.

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- Finally, what the Project Team has come to call a 'catalogue' of viable refurbishment options will be developed. The principles of delivering sustainable, low-energy refurbishment to enhance resilience will be distilled for incorporation into current DH and NHS guidelines. Decision-making protocols will be developed. The Project outcomes will be disseminated widely through the health, construction and research communities in part through the medium of film.

Work packages

Objective 1

- **Task 1:** Define 'resilience' in the hospital context through consultation with policy-makers at the national and Trust levels.
- **Task 2:** Broker appropriate and acceptable levels of 'resilience' with the key stakeholders.

Objective 2

- **Task 3:** Review the current performance requirements of various healthcare spaces as defined in current national international standards and guidelines (e.g. the NHS Activity Database, HTM07-027).
- **Task 4:** Identify and catalogue recurrent building types within participating NHS Trusts with Trusts' input (referring back to the DH Estates and Facilities ERIC database), organise these by age, construction type and plan geometry and out of this list select 4-6 case-study buildings emerging as quasi-typical of the retained stock, as the basis for further study.
- **Task 5:** Select up to 10 clinical and non-clinical healthcare spaces to be investigated from the NHS Activity Database and which occur sufficiently in the selected case study buildings, in close consultation with the Trust End-User Stakeholders and the DH.

Objective 3

- **Task 6:** Use existing Trust and DH energy consumption data, field measurement and site surveys by the researchers to build a picture of the actual energy performance, servicing strategy, occupant characteristics, internal heat gains and internal environmental conditions (especially air quality and summertime temperatures) in typical health care spaces.
- **Task 7:** Assess resilience of the existing building stock by modelling selected participating Trust buildings against 2020, 2050 and 2080 climate bases. The airborne distribution of pathogens will be investigated in selected buildings and modelled. Compare modelled performance with current criteria. How are these buildings doing?
- **Task 8:** Identify promising environmental design strategies evolved for other building types and transform them, where appropriate, into the context of health care building types selected. Infection control implications will be screened as part of decision to import strategies and techniques.

Objective 4

- **Task 9:** Assemble 4-6 detailed design and construction case studies of participating Trusts' recent refurbishment projects to illuminate briefing, strategy, goals and targets observed, decision-making particularly in respect to climate change, risk analysis, value engineering, consideration of lifecycle implications in a changing climate.
- **Task 10:** Propose enhancements or more radical transformations of the refurbishment strategies adopted.
- **Task 11:** Model, incrementally, the environmental performance of the more promising refurbishment options to predict the likely energy use, the internal temperatures and the overheating risks (now and in the future using the UKCP09 data), and the airborne pathogen control implications.
- **Task 12:** Establish comparative capital costs for the refurbishment interventions, comparative lifecycle costs and a value-for-money commentary for each refurbishment option with respect to levels of resilience achieved.

- **Task 13:** Test the more promising strategies on the NHS Trusts and the DH, commencing with the project Sounding Panel and proceeding with Trust in-house and external consultants and contractors, staff and patient groups. Collect and process feedback.

Objective 5

- **Task 14:** To expose the evident barriers (contractual, patient safety, procurement.) to the implementation of low energy re-designs (take up is so low) with leading main contractor/ developers, Facilities Management (FM) contractors, designers, and senior Department of Health and NHS Trust CEO's, Directors of Estates and Planning.
- **Task 15:** Help participating NHS Trusts understand the nature and complexity of their refurbishment challenges. Identify and model interacting networks of concern: flows of medical staff, patients, visitors, their relative sensitivity to warming environments and extreme events and investigate the assignment of activities to spaces of compatible resilience before and after refurbishment. Draw on complexity science to assess the potential to extend current change propogation algorithms to model multi-layer networks. Present to Trusts, DH and Sounding Panel.

Objective 6

- **Task 16:** To develop processes from this change/risk analysis that facilitate and accelerate the successful integration of these new environmental design strategies in hospital refurbishment projects, aligning with current positive policies (EnCO2de).
- **Task 17:** To assemble and present a 'catalogue' of viable refurbishment strategies organised by building type and age, potential for carbon reduction, comparative future resilience to a warming environment, capital and likely lifecycle costs, construction methodology, implementation requirements.
- **Task 18:** Devise a refurbishment fact-based decision-making process protocol. The project team is very interested in adapting the existing AEDET evaluation toolkit for refurbishment in collaboration with its originator, the DH Chief Architect.
- **Task 19:** Design and develop dissemination material including the editing of the project DVD containing interviews with a cross-section of Trust, DH and construction industry stakeholders, definitions of resilience, implications of climate change on refurbishment planning, re-design advice referenced to the typical building types encountered, re-engineered design and delivery processes, exemplar schemes.
- **Task 20:** Dissemination in practice: vigorous participation in ARCC activities, dissemination through the four Trusts, the Project Sounding Panel with its many connections into the health, political, professional practice, construction and project management communities.

Research themes

The Deptartment of Health is particularly exercised by climate change. NHS patients' wellbeing may well be compromised by warming summers. In fact the DoH and the NHS are hit by a double whammy, the pressure to dramatically reduce energy consumption in the recently launched NHS Carbon Reduction Strategy colliding with the imperative to protect patients and staff from summer overheating.

The DoH Director of Estates and Facilities Management Rob Smith has commented that "*no-one knows how to achieve these targets in a health context …. is (it) possible without compromising patient safety and well-being?*"

Innovative environmental design strategies are urgently needed to increase resilience across the 27,701,676 m^2 of the NHS Retained Estate but perceived barriers to implementation seem entrenched: are stable temperatures achievable – can such environments achieve the somewhat confused criteria? Is the risk of airborne infection amplified? Won't equipment heat loads continue to increase? Isn't innovation anathema to prevailing risk engineered procurement methods? How real are these perceived risks?

Can risk assessment tools for change be transferred from engineering design to the re-engineering of the NHS Estate? Strategies to avoid unwanted changes have been developed and tools exist to predict and visualise the impact of engineering change spreading from one part of a system to another.

Products & dissemination

'Shopping lists' for type refurbishments will be road-tested across the 4 participating Trusts; AEDET type toolkit for assembling rebuild formulae for specific contexts to accompany newbuild toolkit national roadshows; MBE KTN web-based product; journal papers; articles in professional journals in Health, construction and design; DVD film of research findings made by Cam.Univ.Moving Image Studio recounting particular stakeholder experiences.

Jan Filochowski, Chief Executive of West Hertfordshire NHS Trust is our ARCC End-User Stakeholder Network Rep. The DoH and NHS have very effective information networks, the new NHS Sustainable Development Unit is the obvious conduit.