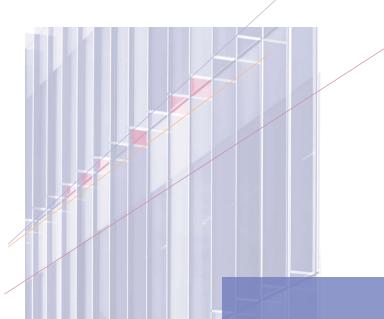
ARCC COORDINATION NETWORK UKCIP ANNUAL REPORT 2012



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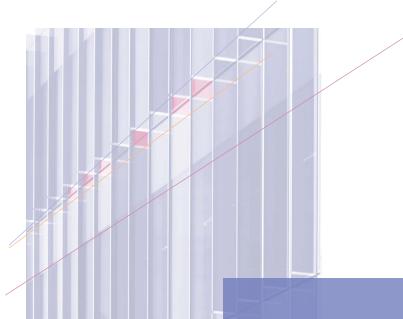
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ARCC Coordination Network UKCIP, Environmental Change Institute, University of Oxford, South Parks Road, Oxford, OX1 3QY

01865 285049

arcc@ukcip.org.uk www.arcc-cn.org.uk





EXECUTIVE SUMMARY

The Adaptation and Resilience to a Changing Climate Coordination Network (ARCC CN) seeks to enhance the impact and benefit of on-going research in the built environment and infrastructure sectors to support sustainable development and economic prosperity across the UK.

During 2012, the ARCC CN evolved successfully into a substantial rolling portfolio of 27 multi-disciplinary research projects with a wide range of stakeholders working together to maximise and accelerate the use of research outputs in policy and practice. Focussing initially on the impacts of climate change and potential response strategies, the network has now broadened its remit to include evidence and information on other technical and socio-economic aspects of adaptation. This will support resilient and sustained performance into the future.

Responsible for managing the network, the work of UKCIP in 2012 focussed on synthesising information and evidence from across research projects and facilitating dialogue between the academic community and stakeholders to access expertise on both sides to deliver relevant and timely outputs for use by policymakers and practitioners.

Key achievements in the built environment and infrastructure sectors in 2012 included:

- providing evidence for central and local government initiatives including integrated network input to the Climate Change Risk Assessment, the draft National Adaptation Programme, the Green Deal and Climate Ready.
- synthesising research and broadening engagement through a major two-day conference on *Adapting our built environment* and themed activities focussing on specific issues such as resilient energy systems, community resilience, overheating and health and social care.
- establishing a series of ARCC CN synthesis notes and briefing notes to summarise key findings from across research projects in formats suitable for target audiences.



- capturing and sharing learning from across the network on research processes including effective collaborative research and demonstrating approaches to knowledge exchange.
- building the community through the integration of additional research focussing on sustainable urban systems, targeted work to foster the development of early career researchers and participation in external awareness-raising and dissemination events.

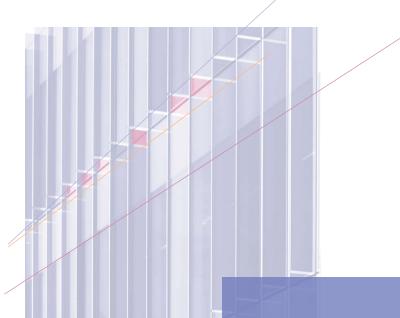
By taking a lead in coordination and knowledge exchange activities, UKCIP has established the added value of the network to realising the benefits from EPSRC-funded research commitments over and above that achievable by individual projects. Further information on both the network and research projects can be found at: <u>www.arcc-cn.org.uk</u>





PROJECT ACRONYMS

ALL in ONE	Feasibility analysis of supplying all services through one utility product
ARCADIA	Adaptation and resilience in cities: analysis and decision- making using integrated assessment
ARCC-Water	Water system resilience
ARCoES	Adaptation and resilience of coastal energy supply
ARIES	Adaptation and resilience in energy systems
BIOPICCC	Built infrastructure for older people in conditions of climate change
CLUES	Challenging lock-in through urban energy systems
COPSE	Coincident probabilistic climate change weather data for a sustainable built environment
CREW	Community resilience to extreme weather
DeDeRHECC	Design and delivery of robust hospital environments in a changing climate
DOWNPIPE:	The use of probabilistic climate scenarios in decision-making for adaptation of building and property drainage
FUTURENET	Future resilient transport networks
ITRC	UK infrastructure transitions research consortium
Land of the MUSCos	Multiple-utility service companies
LCF:	Low carbon futures
LUCID	The development of a local urban climate model and its application to the development of cities
PROCLIMATION:	The use of probabilistic climate scenarios in building environmental performance simulation
PROMETHEUS	The use of probabilistic climate data to future proof design decisions in the buildings sector
RESNET	Resilient electricity networks for Great Britain
RETROFIT2050	Re-engineering the city 2020-2050
SCORCHIO	Sustainable cities: options for responding to climate change impacts and outcomes
SECURE	Self-conserving urban environments
SHOCK (not) HORROR	Shock (not) horror
SNACC	Suburban neighbourhood adaptation for a changing climate
STEP-CHANGE	Sustainable transport evidence
TUCP	Transforming utilities' conversion points
UI	Undermining infrastructure



INTRODUCTION

The performance of the UK built environment and its infrastructure is critical to national health and well-being, the growth agenda and economic competitiveness and stability. Yet these increasingly complex and interdependent sectors face serious challenges over the next 10-50 years and beyond. Decisions need to be made now if these sectors are to minimise the risk of systematic failures and disruptions and be capable of responding positively to expected demographic, environmental and technological changes.

In order to meet these challenges, the Engineering and Physical Sciences Research Council (EPSRC) and, more broadly, the Living with Environmental Change (LWEC) partnership, are investing heavily in high-quality research to inform decisionmakers at the national, regional and local level. As part of this investment, the EPSRC supports the Adaptation and Resilience to a Changing Climate Coordination Network (ARCC CN), an accredited activity within the LWEC programme. The ARCC CN aims to maximise the impact and benefits of the research investment. It provides a focussed network enabling researchers, policymakers and practitioners to work together to promote the timely production of salient and credible evidence. It also facilitates efficient knowledge exchange processes to promote a more sustainable urban environment.

The overall aim of the network is to support researchers and stakeholders working in the built environment and infrastructure sectors by:

- developing and delivering integrated evidence on adaptation and resilience to inform current and emerging policy and business decisions and investments;
- building a vibrant and innovative stakeholder and researcher community to respond to evolving evidence needs and research requirements in a timely manner;
- supporting end-users in accessing and applying evidence and outputs from research within their own policies, decisions and practices.

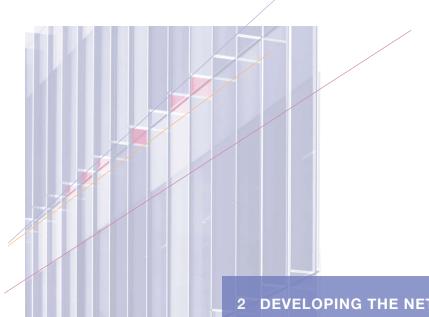
This is being achieved by providing an integrating network to enable:

- access to knowledge, data and practical tools drawing on research outputs from across the network community;
- opportunities for facilitated knowledge exchange to better inform and focus research, practice and evidence-gathering activities;
- the provision of mechanisms to contribute to the production of targeted outputs such that the resulting knowledge can be integrated into policy and practice.

The ARCC CN was established in 2009 and originally comprised a suite of research projects focussing on adaptation and resilience to a changing climate, their stakeholders and a central coordination unit to facilitate collaboration and knowledge exchange activities. UKCIP at the University of Oxford provides this latter coordination and management role. With new projects being added to the network to meet policy and practice requirements, and research timelines now stretching out to 2016, the work of UKCIP has evolved into a rolling programme of activities aimed at facilitating coordination between and beyond projects and promoting the effective dissemination and use of research outputs.

This annual report focusses on the benefits and impacts of the coordination and knowledge exchange work across the ARCC CN during 2012 and the role of UKCIP in managing and delivering these cross-project activities. More information on individual research projects can be found on the ARCC CN website¹ and a summary of the individual projects is given in Section 9.





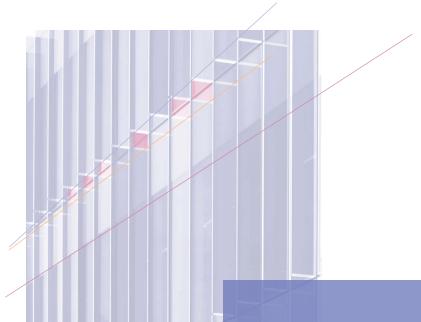
2 DEVELOPING THE NETWORK – THE TRANSITION PHASE

Early in 2012 discussions with EPSRC and other stakeholders highlighted the need to expand the remit of the network to integrate evidence and information on the broader aspects of adaptation and resilience, including climate change, to support the built environment and infrastructure sectors. This will ensure that decision-makers are informed by the best possible evidence from across research taking into account interrelated aspects of socio-economic, technological and environmental drivers of change.

Additional funding from EPSRC was invested in the network (£281k, 1 April 2012 – 31 July 2013) as part of its on-going contribution to the LWEC programme. The aim was to support a transition phase, moving from a discrete portfolio of projects and a small coordination unit towards a more extensive network of research and knowledge exchange activities. This represented a fundamental change in the strategic role of the network with a call to:

- broaden the remit to include other related research projects exploring adaptation and resilience of the built environment and infrastructure sectors;
- enhance engagement opportunities to strengthen the impacts of the associated research to policy and practice including through the provision of specific briefings and synthesis reports;
- ensure the legacy of research by providing access to output, tools and metadata from across the network.

Together with on-going coordination and dissemination work, this enhancement reflected the belief of EPSRC and LWEC in the network and its benefits to researchers and other stakeholders. By putting in place the processes, links and structures required to support a more extensive network, the ARCC CN is moving towards providing a major UK source of evidence to support policy and practice in the built environment and infrastructure sectors.



3 THE NETWORK COMMUNITY

3.1. RESEARCH PROJECTS

At the start of 2012, 18 multi-disciplinary research consortia spanning over 35 different UK research organisations were involved in the network. Research covered the impacts of climate change and adaptation options for buildings and infrastructure systems including water resources, transport systems, telecommunications, energy and waste.

As part of the transition phase, the portfolio of research was expanded during 2012 to include additional on-going EPSRC-funded research focussing on the future sustainability of national infrastructure:

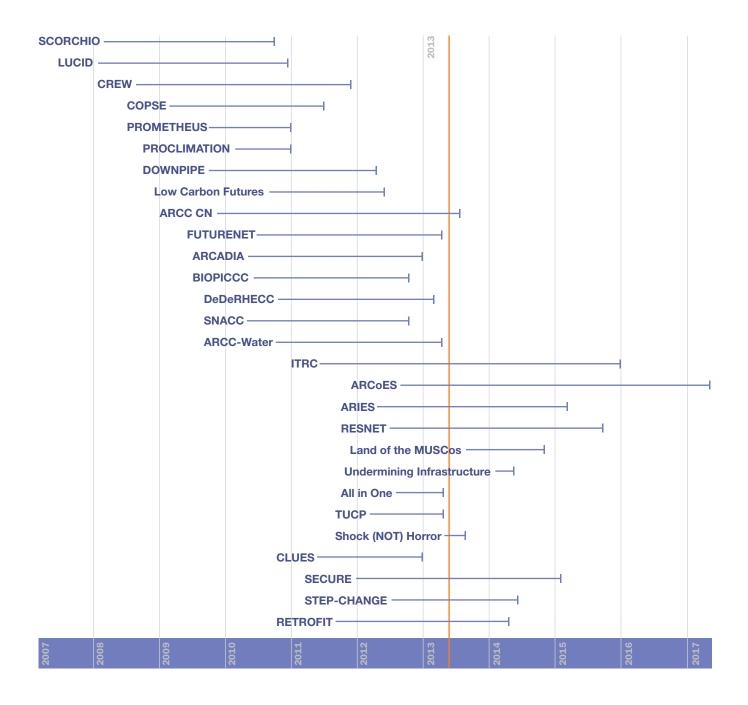
- Five projects developing during the 2011 ESPRC sandpit: Achieving adaptable assets: sustainable integrated infrastructure². Land of the MUSCos, UI, All in One, TUCP and Shock (not) Horror all focus on novel cross-utility approaches to meeting long-term service delivery requirements.
- Four projects funded during the third phase of the Sustainable Urban Environment (SUE) programme³. CLUES, RETROFIT, STEP-CHANGE and SECURE are all looking at ways of improving overall sustainability across the urban environment.

The challenge during 2012 was to integrate these additional projects into the ARCC CN. Following individual discussions with research teams, all projects were invited to participate in the ARCC CN conference in September 2012 (see section 5) which provided a first opportunity to develop a shared understanding of the links and synergies across projects. This also provided a starting point for on-going discussions on potential approaches to synthesising research outputs and coordinating stakeholder engagement.

⁹

² www.epsrc.ac.uk/funding/calls/2010/integratedinfrastructure/Pages/adaptableassets.aspx

³ www.urbansustainabilityexchange.org.uk/ISSUESSueProgramme.htm



3.2 STAKEHOLDERS

The ARCC CN is an open network involving researchers and a wide range of other stakeholders: business, industry, central and local policy-makers, professional institutions, voluntary organisations, related networks and knowledge exchange programmes. There are also links with international researchers and stakeholders with interests relevant to the UK.



Recognising that stakeholders have widely varying levels of expertise, requirements and capacity to engage, activities during 2012 promoted engagement at various levels, ranging from keeping in touch with developments through to complex co-production of specific outputs. Flexibility within the programme of network activities was also essential to take advantage of new opportunities in a rapidly changing policy environment (e.g. unexpected implications of the Green Deal) and to respond to requests for specific activities from projects and/or stakeholders (e.g. coordination of energy sector research).

Approximately 250 stakeholders are directly involved with the network either through individual projects or via involvement in overarching joint activities. The ARCC CN newsletter reaches an increasing list of over 500 individuals from a wide range of organisations including academia, central and local government, professional institutions, other delivery bodies with related work areas and international colleagues. There is also encouraging evidence of onward dissemination to colleagues within external organisations. An important priority during 2012 was establishing links for enhanced dissemination via related networks and delivery bodies (e.g. the Sustainable Development Research Network, the Modern Built Environment KTN and Adaptation Scotland), which has successfully broadened the understanding and reach of information and outputs.

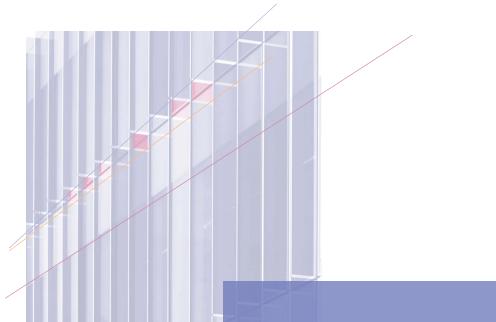
3.2. THE COORDINATION UNIT

The coordination role carried out by UKCIP aims to add value to individual project outputs and to maximise and accelerate the impact and benefits of research by:

- promoting stakeholder and researcher participation and collaboration across projects;
- broadening engagement, knowledge exchange opportunities and targeted dissemination;
- facilitating the further exploration of evidence needs and research gaps.

Building on the extensive literature in this area, it is recognised that for knowledge exchange to be successful, there is a need to engage both researchers and other stakeholders in the co-production, interpretation and integration of evidence. Experience gained by the network in previous years has shown that coordinated engagement and facilitated dialogue among stakeholders and researchers, initiated early and sustained throughout the overall research process, ensures expertise on both sides can be used to deliver relevant outputs for policy and practice.

All projects have their own pathways to impact; the work of the ARCC CN seeks to enhance this by expanding cross-project engagement and integration. During 2012, specific efforts focussed on meeting evidence requirements to help design more resilient and sustainable urban systems, on strengthening synthesis and knowledge exchange activities to maximise understanding and uptake of results, and on the focussed expansion of the network community to meet current and anticipated future needs.



4 MEETING EVIDENCE REQUIREMENTS

A key objective of the ARCC CN is the provision and integration of credible and salient knowledge and information to ensure stakeholders have access to the best available evidence in a timely manner. During 2012, as a key source of evidence on adaptation and resilience in the built environment and infrastructure sectors, the ARCC CN was instrumental in engaging researchers and stakeholders in the provision of integrated evidence to inform specific policies and practice.

4.1. SYNTHESISING ADVICE FOR THE GREEN DEAL

The Green Deal is a new government scheme designed to enable householders and businesses make energy-saving improvements, with a focus on retrofitting existing properties. However, results from three ARCC CN projects, CREW, LUCID and SNACC, suggest that in some circumstances measures initiated under the Green Deal could increase the risk of summertime overheating. The ARCC CN was instrumental in bringing evidence from across relevant projects to the attention of key government departments (DECC, DCLG and Defra) and in facilitating a meeting to discuss its implications (October 2012). As a result, and in consultation with the projects, the network also led the production of written guidance on overheating for inclusion in advice from DECC to be used by Green Deal assessors and installers. In parallel, the ARCC CN has produced a briefing note, Overheating in homes: advice and evidence from the latest research⁴ to provide guidance on overheating for policymakers and practitioners as well as a synthesis note on practical information on tackling overheating for use by homeowners and community groups, Adapting UK homes to reduce overheating⁵.

¹²

⁴ www.arcc-cn.org.uk/wp-content/pdfs/ACN-overheating-guidance.pdf

⁵ www.arcc-cn.org.uk/wp-content/pdfs/ACN-overheating-synthesis.pdf

4.2. COORDINATING INPUT TO THE UK CLIMATE CHANGE RISK ASSESSMENT (CCRA)

Published in 2012, this major Government report evaluates climate change risks and opportunities across all sectors and provides information to policymakers on vulnerability of the UK. The ARCC CN worked with all projects and with Defra to promote and facilitate access to evidence drawn from across the network. Outputs from individual projects informed the conclusions in the CCRA Evidence Report⁶ on the built environment and infrastructure and the health and well-being sectors.

4.3. UNDERPINNING THE UK NATIONAL ADAPTATION PROGRAMME (NAP)

Defra is responsible for developing the NAP to address the risks set out in the CCRA and focussing on helping UK businesses, local authorities and civil society to become more resilient to climate change impacts. Throughout 2012, the network engaged with Defra and individual projects to identify and coordinate the reporting of information from across the research to support current and planned actions to mitigate these risks⁷. As a result of this synthesis work, research outputs will provide direct input to the NAP (to be published in 2013) and will help business and industry access knowledge and tools from academia to understand and manage climate change risks.

4.4. SUPPORT TO THE CHARTERED INSTITUTION OF BUILDING SERVICES ENGINEERS (CIBSE)

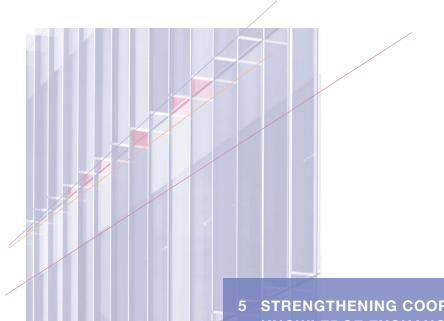
For several years, CIBSE has been a key stakeholder within the ARCC CN working with specific projects looking at the use of probabilistic climate change projections in the design of well-adapted buildings (PROCLIMATION, PROMETHEUS, LCF and COPSE). To inform their membership of 20,000 industry professionals, CIBSE has worked with the network to update published weather data and advice through the CIBSE Climate Task Force⁸ and to revise CIBSE best practice guidance on environmental design (to be published).



7 www.arcc-cn.org.uk/resources/mapping-to-ccra/

⁶ https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-governmentreport

⁸ https://www.cibseknowledgeportal.co.uk/weather-data



STRENGTHENING COORDINATION & KNOWLEDGE EXCHANGE

Building relationships with both researchers and stakeholders is crucial to ensuring the ARCC CN is seen as a trusted and reliable source of evidence and information. Working closely with policy-makers and practitioners to understand their on-going evidence requirements and with researchers to keep up-to-date with the latest outputs has ensured that the ARCC CN can respond positively to requests for information. This two-way flow of information also ensures that the network is seen as a focal point for knowledge exchange and engagement opportunities for adaptation in the built environment and infrastructure sectors.

5.1. ARCC CN CONFERENCE, 2012. LIVING WITH OUR BUILDINGS AND INFRASTRUCTURE: ADAPTING FOR THE FUTURE

This major two-day event (September 2012) provided a timely opportunity to showcase recent scientific advances from across the network and to highlight their implications for end-users. Over 140 researchers and stakeholders came together to engage with current research, explore policy and practice implications and consider future challenges and opportunities. Importantly, ARCC CN outputs were seen in the context of wider policy and practice requirements and the conference also encouraged extensive networking opportunities for researchers and stakeholders. A Research Update 2012 brochure⁹ was produced to summarise current research across all network projects and the conference also provided a first opportunity for the newly-affiliated research projects to engage more formally within the network.



⁹ www.arcc-cn.org.uk/wp-content/ACN-conference-2012/ACN-conference-brochure-2012-WEB. pdf



Presentations and discussions focussed on eight specific themes which helped highlight particular on-going issues and to address where and how the research was contributing to overall understanding: Overheating in buildings, energy and water infrastructure, building to community level adaptation, transport, health and well-being, urban environments, understanding attitudes and behaviour, and future infrastructure in the context of change.

Joint researcher-stakeholder presentations emphasised the implications and impact of research from an end-user perspective and dedicated time in both formal sessions (including poster sessions) and informal periods allowed for more in-depth discussions of key issues.

Feedback via a questionnaire highlighted the value of the conference in enabling sustained interaction between researchers and stakeholders to help establish new relationships, to strengthen existing relationships and to provide a platform for further engagement. It was also encouraging that a significant number of the stakeholders attending, particularly from local authorities, were new to the ARCC CN and that they reported a considerable expansion of their knowledge on adaptation issues with identified potential for use in their on-going work.

5.2. THEME FOCUSSED INITIATIVES

a. Resilient energy systems

Previous experience within the network has shown that stakeholders, with little time to engage with individual projects, can be frustrated by apparently different and sometimes conflicting messages emerging from various research projects. This then limits efficient uptake of results. But coordinated efforts throughout the research process led by the network and involving both researchers and stakeholders helps promote the provision of coherent and consistent messages on a range of specific cross-project issues.

Within the ARCC CN, four projects focus on adaptation and resilience in the energy sector (ARIES, RESNET, ARCoES and ITRC). A first meeting of researchers from these projects was convened by the network (February 2012) to develop a shared understanding of the individual project work programmes, to identify where links and synergies could be established and to initiate discussions on possible coordinated knowledge exchange activities. This was followed by a joint meeting with key stakeholders (May 2012) to provide an early opportunity for stakeholders to influence the research direction and to coordinate engagement with all four projects in order to maximise understanding and impact. Following these meetings, work programmes have been adjusted to take account of potential synergies, and further coordination meetings are planned for 2013.

b. Informing local strategies for health and social care

In support of the BIOPICCC and CREW projects, a workshop was organised on Tools to Support Local Level Resilience Planning in the Health and Social Care Sectors (May 2012). This brought together over 30 local authorities and representatives from the health, climate change and environment sectors to demonstrate how evidence and tools from these projects can be used in local level resilience planning. This built on similar events held in 2011, and provided a valuable update on delivery of outputs and insights into potential uses of the research.



c. Building community resilience

The Cabinet Office leads on thinking across government on community resilience and seeks to explore how better to work with the research community to realise impacts in this area. The ARCC CN arranged a briefing meeting (October 2012) for the Cabinet Office and Department of Health with several individual projects (DeDeRHECC, BIOPICCC, SNACC) to explore evidence needs and how to best deliver them. Discussions were underpinned by a briefing note initiated by the ARCC CN which synthesised the key findings from BIOPICCC and DeDeRHECC¹⁰. Links established here have now been followed up to discuss specific issues and a similar meeting with policymakers working on health has also been suggested.

d. Informing city councils

As part of the government's Climate Ready programme to help businesses and other organisations live with the changing climate, the ARCC CN was asked to facilitate a meeting bringing together 25 officials from Core City councils and relevant central government departments (November 2012). A number of academics working on sustainability in cities, both within the network and beyond, were also identified by the network and provided expert advice. ARCC CN presentations and those by invited researchers outlined the latest research and highlighted case studies where research has been applied successfully and translated into action at the local level. This then provided a basis for further discussions on cross cutting issues and potential responses needed at the city level.

5.3. CAPTURING AND SHARING LEARNING

The ARCC CN is now well established and both individual projects and the overarching coordination unit have gained expertise on knowledge exchange in the climate change adaptation arena. Efforts are now being directed at capturing and promoting this learning to advise on-going projects and networks.

a. Collaborative research processes

Many projects within the network have gained valuable experience in managing large, interdisciplinary research projects and in promoting active collaboration between researchers and stakeholders throughout the research process. To capture this learning and to share experiences of requirements for effective collaboration, a study was commissioned of six ARCC projects nearing completion (ARCADIA, ARCC-Water, BIOPICCC, DeDeRHECC, FUTURENET and SNACC).

Following interviews with project researchers and stakeholders, a final report from the consultants (Kate Lonsdale and Mark Goldthorpe) and an ARCC CN briefing note¹¹ were published in 2012, including a range of recommendations to help guide those delivering, coordinating and commissioning research projects. Although derived from projects in the built environment and infrastructure sectors, the recommendations are relevant to projects and activities other sectors with an interest in securing the maximum impact for their work. This includes: multidisciplinary and stakeholderengaged research projects; overarching programmes such as LWEC with a broad remit across a range of subject areas; and funding agencies with a responsibility to ensure maximum impact from research investments.

¹⁶

¹⁰ www.arcc-cn.org.uk/project-summaries/dederhecc/dederhecc-outputs/

¹¹ www.arcc-cn.org.uk/lessons-learned/collaborative-research/



b. Stakeholder perspectives

To demonstrate the use and potential impact of research, the ARCC CN works with individual projects coming to completion to capture key messages and a stakeholder perspective. During 2012, stakeholder reports were published for LCF, CREW and SNACC and identified both the implications of results for various end-user communities and the lessons learned on engagement throughout the research¹².

c. Contributions to LWEC initiatives

Throughout 2012, LWEC coordinated several initiatives designed to gather information, share experiences and provide input to wider discussions on environmental research in the UK. As an accredited activity within the LWEC programme, the ARCC CN has participated fully in such activities, both offering experiences and taking learning from the other 70 accredited projects to share across the network.

The ARCC CN contributed expertise and two case studies (on targeted workshops and the value of a facilitator) to support the new LWEC Knowledge Exchange Guidelines¹³. The network also provided detailed questionnaire responses and workshop participation for an LWEC project surveying current stakeholder engagement and recommendations for the future direction of knowledge exchange and public engagement within LWEC.

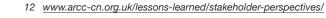
5.4. TARGETED COMMUNICATION AND DISSEMINATION

Effective and timely communication and dissemination of information across the network is necessary to better engage the broad research community and the full range of potential end-users. The overall aim is to improve the visibility, awareness and understanding of the research and to promote the uptake and use of research outputs.

a. ARCC CN website, social media and newsletters

An actively managed website provides a dedicated outward-facing focus for all ARCC CN activities¹⁴. The website was updated and restructured during 2012 taking account of suggestions from users for more synthesised information and now provides more comprehensive evidence on cross-cutting themes, details of individual projects, forthcoming events and summaries from past activities. With hits rising to over 2500 a month from an increasing number of organisations, the website provides a single source of up-to-date information on UK adaptation research in the built environment and infrastructure sectors.

Rapid changes in technology are transforming opportunities for efficient communication and knowledge transfer to complement face-to-face meetings. Since initiating the ARCC CN twitter feed in April 2012, this has provided a useful additional quick dissemination route (currently over 90 followers) and is also an important source of relevant information from other organisations that can then be disseminated across the network.



- 13 www.lwec.org.uk/ke-guidelines
- 14 www.arcc-cn.org.uk

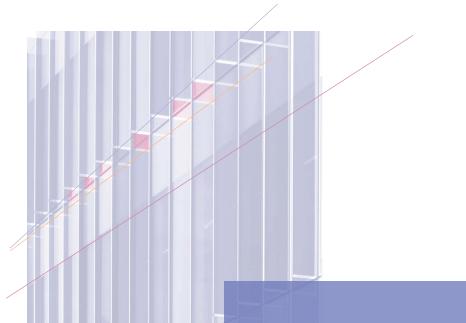


Two ARCC CN newsletters were issued (June 2012 and December 2012) to over 500 recipients including researchers, stakeholders, funding organisations and other national and international networks. These newsletters provide regular updates on research progress, new evidence and tools, forthcoming events and emerging policy initiatives.

b. Enhancing project pathways to impacts

Throughout 2012, the ARCC CN worked with individual projects and researchers to help enhance their own pathways to impacts and to respond to specific requests for additional engagement and knowledge exchange. Reports highlighting key results have been produced with COPSE and CREW and disseminated widely, ARCC-Water has requested help in stakeholder engagement and the network is supporting additional activities by LCF to develop their overheating tool for use by building professionals.





6 DEVELOPING THE NETWORK COMMUNITY

A priority for the 2012 transition phase was to expand the community and sustain engagement by building on early stakeholder and research mapping work. In addition to the work already summarised in Sections 4 and 5, a range of network activities actively sought, or took advantage of emerging opportunities, to engage more broadly and with new audiences. For example:

- Central government: the network organised presentations by FUTURENET and ITRC at a Department of Transport seminar for 20 government officials on the future of transport systems and the implications of research findings for use by policymakers (April 2012)
- Delivery programmes: the network was invited to participate in a range of Climate Ready workshops, meetings and briefings (including the Infrastructure Operators Adaptation Forum) to help scope their emerging programme on responding to the impacts of climate change in the built environment and infrastructure sectors. This on-going interaction is also helping to ensure that ARCC CN research is considered in the development of the programme.
- Regional engagement: building on participation at a Climate NI stakeholder meeting on building resilience in a changing climate (October 2012), further work by the network has identified ARCC CN projects with a particular relevance to Northern Ireland and links are being established.
- Researchers: participation by UKCIP at several national and international science conferences (LWEC Assembly, November 2012, Adaptation Futures conference, Arizona, May 2012) and meetings (e.g. with the EU CIRCLE-2 project, the Canadian OURANOS programme and the Australian NCCARF adaptation research network on settlements and infrastructure) were beneficial in both raising awareness of the network and its outputs and in placing UK research in the wider scientific and policy context.

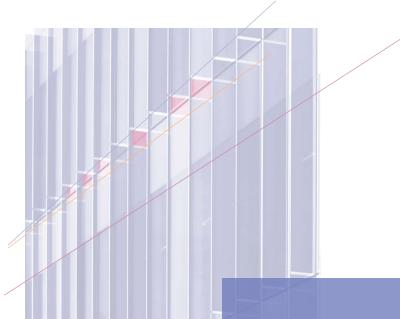
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6.1. EARLY CAREER RESEARCHERS

An increasingly important aspect of the work of the ARCC CN is in supporting the EPSRC strategic goal of developing the leaders of the future, skilled at multidisciplinary research and capable of engaging effectively with end users. At least 20 PhD students are being trained through the network and many other researchers are at early stages in their career. To foster their development and engagement within the network, the first ARCC CN/ITRC conference for early career researchers was held in November 2012: Infrastructure Delivery in an Uncertain Future. This one-day event enabled the 25 researchers attending (from both ARCC CN projects and a number of related projects) to showcase and share innovative thinking on future challenges and opportunities in the infrastructure area and to gain valuable experience on related aspects of research to enhance their own professional development.

Informal feedback highlighted the value of such focussed events and a second conference is tentatively scheduled for 2013, with additional time being made available for developing collaborations and informal networking.





7 FOR THE FUTURE

The current ARCC CN work programme extends to 31 July 2013. Until then, work will build on existing achievements to support the transition to a dynamic and focussed network that enables researchers and stakeholders to expand and accelerate the exchange of evidence in the built environment and infrastructure sectors.

A key priority for 2013 is the development of a legacy management strategy to enable the on-going access to evidence, outputs and data (qualitative and quantitative) for realistic periods after individual project lifetimes. Difficulties in accessing information from past projects have been identified within the network as a major barrier to exploiting research. Joint work with Climate UK has just been initiated and builds on their expertise to deliver a legacy framework to support the on-going access to, and therefore impact of, network outputs.

Other priorities for early 2013 include:

- · Themed activities and synthesis work:
 - » Understanding behavioural aspects of adaptation by developing a shared understanding of the contributions to knowledge and the lessons learned from the work of social scientists across ARCC CN projects.
 - » Working with the five Achieving Adaptable Assets projects (UI, TUCP, Land of the MUSCos, ALL in ONE, SHOCK (not) HORROR) to develop a position paper capturing key messages from across the research and highlighting new ways of thinking about future infrastructure.
 - » Continuing to synthesise outputs from projects on, for example, community resilience, health and well-being and suburban adaptation strategies.
- Strengthening the mapping and engagement of regional stakeholders and networks to identify their emerging user needs and how to develop and shape the ARCC CN to support them (working with Climate UK).





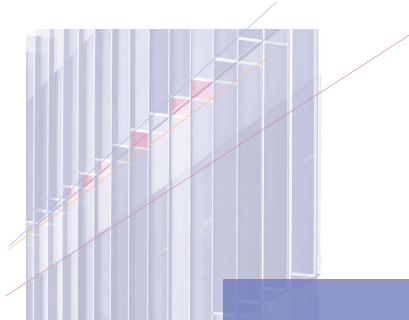
- Demonstrating and communicating the added value of the network and the impact of network activities. By developing further the evaluation framework (section 8.2), case studies and narratives will be captured illustrating how different aspects of the network's performance have influenced where, when and how outputs and evidence have been used.
- Working with early career researchers to build on the success of the first conference and to add value to their own career development.

All future activities will respond to findings from the on-going EPSRC evaluation of the ARCC and SUE programmes and will build on and contribute to relevant aspects of the recently restructured LWEC programme strategy.

7.1 BEYOND 2013

As current evidence gaps are identified and new policy and practice questions emerge, there is a need to continue research coordination, stakeholder engagement and knowledge exchange activities to promote sustainable development at the national, regional and local scale. The ESPRC is investing heavily in research in this area with new initiatives in, for example, structural engineering, relevant doctoral training centres and innovative business models in the infrastructure sector. Working with the EPSRC and the Network Advisory Group (see section 8), UKCIP is exploring innovative approaches to expanding the ARCC CN to maximise and accelerate the impact of this research beyond 2013.





8 PROJECT MANAGEMENT

8.1. ADVISORY GROUP

Recognising the need to ensure different perspectives on adaptation in the built environment and infrastructure sectors are taken into account in the design and delivery of the network, an Advisory Group was established in 2012 with responsibility to oversee the strategic development of the work programme. Membership includes representatives from central government (Defra, DCLG), local government (GLA), regional partners (Climate UK), related networks with a business and industry focus (MBE KTN), funding bodies (LWEC, EPSRC) and the research community. Meeting every six months (June 2012, October 2012), the Advisory Group has provided advice and a broad perspective to help ensure the successful delivery of the network during the transition phase and to evaluate progress on delivering impacts relative to agreed milestones.

8.2. EVALUATION

To monitor progress, to help discern whether the ARCC CN has been successful and to learn from past experiences, the original opportunistic collection of evidence of performance and impact has been replaced by a rigorous evaluation framework. Working with Ian Cooper of Eclipse Research Consultants, an acknowledged expert in programme evaluation methodologies, a comprehensive framework has now been established (from 1 April 2012) and is providing a robust structure against which the network's progress is being monitored against key performance indicators. This is enabling the network to demonstrate to EPSRC, LWEC partners and the wider research and stakeholder community evidence of success and an understanding of actions needed to achieve progress in the future.

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As part of the evidence-gathering process, a questionnaire was distributed to all participants at the ARCC CN conference. The aim was to both understand the value of the specific event, and also to look forward by capturing examples of where project/network outputs are being or could be used and identifying priorities for future activities. Responses were very supportive of the work of the network and the data and results have been incorporated into both the evaluation framework and the future work programme.

8.3 FINANCIAL STATEMENT

Roger Street, Director UKCIP, is the Principal Investigator with responsibility for the overall strategic development and delivery of the project. Other staff (all part-time) include:

- Stephanie Ferguson, communications
- · Vicky Hayman, knowledge exchange and coordination support
- · Kay Jenkinson, communications
- · Anastasia Mylona, built environment sector
- Phil Sivell, infrastructure sector

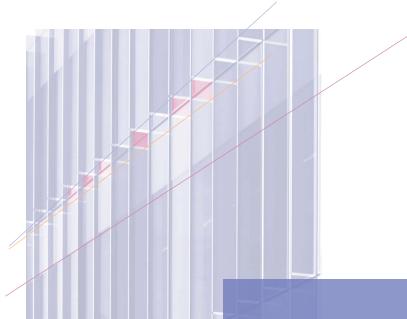
Financial statement, to 31 December 2012

- EPSRC contributes 80%, £815,404
- University of Oxford contributes 20%, £203,851

Overall, expenditure is tracking the profile anticipated in the work programme with sufficient funds available to support planned activities through to contract completion on 31 July 2013.

Financial statement, 31 December 2012					
Expenditure category	Budget	Actual expenditure	Funds available		
Staff costs	£288,443	£171,730	£116,713		
Travel and subsistence	£119,919	£49,795	£70,124		
Consumables, conference, publications	£192,383	£81,264	£111,119		
Overheads	£418,510	£209,834	£208,676		
Total (including uplift for the transition period)	£1,019,255	£512,623	£506,632		

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9 RESEARCH PROJECTS

Summary information on each research project is given below together with links to individual project websites where applicable. Further information can also be found on the ARCC CN website (www.arcc-cn.org.uk/).

The ARCC CN is now an established network of researchers and stakeholders with active participation from 27 multi-disciplinary research teams based in various departments within 35 academic institutions. Over 250 researchers are involved together with a similar number of directly-involved stakeholders representing a wide range of central and local government, business and industry organisations. Beyond this is a much broader audience of end-users interested in high-quality scientific evidence on climate change resilience and adaptation issues in the built environment and infrastructure sectors.

EPSRC has invested nearly £28m in this on-going programme of research with an additional £0.8m to support the coordination and knowledge exchange activities of the ARCC CN. By working across projects and engaging with stakeholders, the network is maximising the impact from the overall research investment. Synthesised evidence has informed major national policy reports, in particular the Climate Change Risk Assessment and the National Adaptation Programme, further engagement of key end-users in specific sectors, e.g. in the health and social care sector and the energy sector, has advanced significantly, and efforts continue to capture and share learning on research processes and approaches to knowledge exchange.

Capacity building is another key aspect of the network. An expanding pool of skilled researchers capable of engaging effectively with end-users is gaining expertise that can be applied in the future and across disciplines. Over 20 PhD students are being trained through the network with positive implications for the quality and validity of future research projects. Stakeholders are also gaining experience of working with the research community to help meet on-going requirements for evidence and of incorporating this into their own policies and practices.

ON-GOING PROJECTS

 ALL in ONE: Feasibility analysis of supplying all services through one utility product

Fatih Camci, Cranfield University October 2011 to June 2013

http://lamp-lbi-34.rcs.le.ac.uk/

This project is focused around the following questions:

- · Can a single utility product supply all the services that the end users need?
- What are the scientific and technological gaps on the road to the realisation of the single-utility product vision?
- What is the timed agenda to have a feasible single-utility product delivery by 2111?
- ARCADIA: Adaptation and resilience in cities: analysis and decisionmaking using integrated assessment

Jim Hall, Newcastle University (now at Oxford University) July 2009 to August 2012

To provide system-scale understanding of the inter-relationships between climate impacts, the urban economy, land use, transport and the built environment and to use this understanding to design cities that are more resilient and adaptable.

ARCC-Water: Water system resilience

Mark New, University of Oxford September 2009 to October 2012

www.arcc-water.org.uk

To develop an integrated 'whole system' approach to water resource planning in SE England under multiple uncertainties, in which portfolios of infrastructure and demand management options are considered to maintain secure supplies and enhance the environment.

ARCoES: Adaptation and resilience of coastal energy supply

andy plater, university of liverpool November 2011 to October 2016

www.liv.ac.uk/environmental-sciences/research/adaptation-and-resilience-of-coastalenergy-supply/about/

To evaluate the implications of climate change impacts for coastal energy production and distribution, with a focus on the NW region and to identify the practical steps necessary to achieve effective adaptation and to enhance resilience to climate change for (i) the nuclear sector and (ii) coastal energy supply in the NW region. ARIES: Adaptation and resilience in energy systems

Gareth Harrison, University of Edinburgh September 2011 to February 2015

To deliver a comprehensive risk framework to assess and manage UK energy system resilience to climate change.

BIOPICCC: Built infrastructure for older people in conditions of climate change

Sarah Curtis, Durham University November 2009 to October 2012

www.dur.ac.uk/geography/research/researchprojects/biopiccc/

To develop a methodology for selecting locally sensitive, efficient adaptation strategies during the period up to 2050 to ensure that the infrastructures and health and social care systems supporting older people will be sufficiently resilient to withstand harmful impacts of climate change.

DeDeRHECC: Design and delivery of robust hospital environments in a changing climate

Alan Short, University of Cambridge September 2009 to October 2012

www-edc.eng.cam.ac.uk/robusthospitals/

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.

FUTURENET: Future resilient transport networks

Chris Baker, University of Birmingham June 2009 to February 2013

www.arcc-futurenet.org

To determine the nature of the UK transport system in 2050 both in terms of its physical characteristics and its usage, and to assess resilience to climate change.

■ ITRC: UK infrastructure transitions research consortium

Jim Hall, University of Oxford January 2011 to December 2015

www.itrc.org.uk

To develop and demonstrate a new generation of system simulation models and tools to inform analysis, planning and design of national infrastructure (energy, water, waste and information and communication technologies systems).

■ Land of the MUSCos: Multiple-utility service companies

Julia Steinberger, University of Leeds December 2011 to November 2014

http://sure-infrastructure.leeds.ac.uk/doku.php?Fid=Dmuscos:home

To investigate the potential for a change in infrastructure operation away from supply of unmanaged demand and towards resource-efficient service delivery.

LCF: Decision support for building adaptation in a low-carbon climate change future

Phil Banfill, Heriot-Watt University December 2008 to May 2012

To produce a general, deterministic and computationally efficient methodology for adequately sizing Low Carbon Future heating, ventilating, and air-conditioning plant and equipment in buildings.

RESNET: Resilient electricity networks for great britain

Kevin Anderson, University of Manchester September 2011 to August 2015

www.tyndall.ac.uk/research/cities-and-coasts/resnet

To develop and demonstrate a comprehensive approach to analyse, at a national scale, climate-related changes in the reliability of the UK's electricity system, and to develop tools for quantifying the value of adaptations that would enhance its resilience.

■ RETROFIT2050: Re-engineering the city 2020–2050

Malcolm Eames, Cardiff University October 2010 to March 2014

www.retrofit2050.org.uk

To develop the knowledge and capability to overcome the separation between the "what" and "how" of urban scale retrofitting in order to promote a managed sociotechnical transition in built environment and urban infrastructure (two core UK cityregions: Cardiff/South East Wales and Manchester)

SECURE- Self-conserving urban environments

Margaret Bell, University of Newcastle February 2011 to January 2015

www.secure-project.org

To deliver a step change in thinking by enabling integration of resource-supplydemand-waste systems across city-to-regional scales to create scientifically informed, strategic, integrated policies and planning driven by efficient transport, use of land as a resource, using waste as an asset, micro-generation of energy and up-scaling systems management from a local/city to regional level. STEP-CHANGE – Sustainable transport evidence

Miles Tight, University of Birmingham January 2011 to April 2014

www.changing-mobilities.org.uk/index.html

To develop an understanding of the complex mix of factors underlying transport practices, especially transport behaviour change, and to develop new transport modelling paradigms that better represent and account for such behaviours.

SHOCK (not) HORROR

Stephanie Glendinning, Newcastle University October 2011 to August 2013

http://research.ncl.ac.uk/shock/

The study of infrastructure shocks through medical allegories will enable a fundamental shift in thinking of current infrastructure to understanding it as a system of systems of infrastructural interconnections that can help foster sustainable futures. The aim is to understand trauma as a lever to unlock higher and more impactful levels of intervention across integrated infrastructure systems.

TUCP: Transforming utility conversion points

Liz Varga, Cranfield University September 2011 to September 2013

www.cranfieldccedportal.com/tucp/pages/default.aspx

This project takes a complex systems perspective and uses agent based modelling methods to understanding interdependencies and inefficiencies in order to exploit opportunities to adapt infrastructure at points of conversion where two or more utilities might benefit from the change.

■ UI: Undermining infrastructure

Phil Purnell, University of Leeds November 2011 to April 2014

www.arcc-cn.org.uk/project-summaries/undermining-infrastructure/

To develop a new methodology, based on enhancing stocks and flows modeling with additional information on material criticality and technology and material properties, to evaluate the resilience of low carbon infrastructure transitions to material supply risks.

COMPLETED PROJECTS

 COPSE: Coincident Probabilistic climate change weather data for a Sustainable built Environment

Geoffrey Levermore, University of Manchester July 2008 to June 2011

www.copse.manchester.ac.uk/index.htm

To develop a methodology for deriving weather data for building designers etc. that is based on future data rather than observational records from the last 20 years or so. A final report is available at www.arcc-cn.org.uk/wp-content/pdfs/COPSE-final.pdf



CLUES – Challenging Lock-in through Urban Energy Systems

Yvonne Rydin, UCL October 2010 to December 2012

www.ucl.ac.uk/silva/clues

To critically assess the development of decentralised energy systems in urban areas in the light of national decarbonisation and urban sustainability goals. A final report is available at www.ucl.ac.uk/clues/CLUES_Tool

CREW: Community Resilience to Extreme Weather

Steve Hallett, Cranfield University February 2008 to November 2011

www.extreme-weather-impacts.net/twiki/bin/view

To gain a better understanding of the effects of extreme weather events and to develop a set of tools for improving the resilience of local communities. A final report is available at: www.arcc-cn.org.uk/wp-content/pdfs/CREW_Final_Report.pdf

DOWNPIPE: The use of probabilistic climate scenarios in decisionmaking for adaptation of building and property drainage

Lynne Jack, Heriot-Watt University October 2008 to September 2011

To realise potential benefits to property drainage design and adaption by using probabilistic data from UKCP09. The location and extent of any under-capacity will be identified and adaptation solutions proposed, thus impacting positively on the mitigation of flood risk.

LUCID: The Development of a Local Urban Climate Model and its Application to the Intelligent Development of Cities

Michael Davies, University College London June 2007 to December 2010

www.lucid-project.org.uk/

To develop, test and apply state-of-the-art methods for calculating local climate in the urban environment. The impact on the internal built environment, energy use and the consequences for health will then be explored and the implications for urban planning considered. A final summary report is available at: <u>www.arcc-cn.org.uk/wp-</u> <u>content/Summaries/LUCID-summary-final.pdf</u>

PROCLIMATION: The use of probabilistic climate scenarios in building environmental performance simulation

Vic Hanby, De Montfort University October 2008 to September 2010

To develop and implement methodologies for using probabilistic climate scenarios (UKCP09) in building simulation and other related analytical procedures. Final summary report available at: www.arcc-cn.org.uk/wp-content/Summaries/PROCLIMATION-summary-final.pdf



PROMETHEUS: The use of probabilistic climate data to future proof design decisions in the buildings sector

David Coley, University of Exeter July 2008 to December 2010

http://emps.exeter.ac.uk/research/energy-environment/cee/projects/prometheus/

To develop a new set of probabilistic reference years that can be understood and used by building designers. A final summary report is available at: <u>www.arcc-cn.org.uk/</u><u>wp-content/Summaries/PROMETHEUS-summary-final.pdf</u>

SCORCHIO: Sustainable Cities: Options for Responding to Climate Change Impacts and Outcomes

Geoffrey Levermore, University of Manchester March 2007 to September 2010

www.sed.manchester.ac.uk/research/cure/research/scorchio/background/

To develop tools for analysis of adaptation options in urban areas, with a particular emphasis on heat and human comfort in the built environment. A final summary report is available at: www.arcc-cn.org.uk/wp-content/Summaries/SCORCHIO-summary-final.pdf

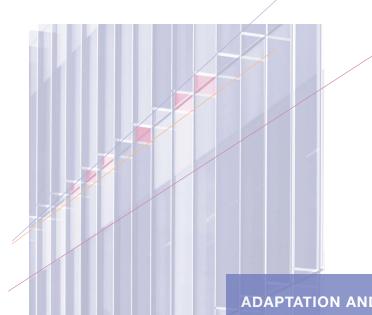
SNACC: Suburban Neighbourhood Adaptation for a Changing Climate

Katie Williams, University of the West of England September 2009 to August 2012

www.snacc-research.org/

To answer the question: how can existing suburban neighbourhoods be best adapted to reduce further impacts of climate change and withstand ongoing changes? A final report is available at: <u>http://snacc.files.wordpress.com/2012/10/snacc_report.pdf</u>





ADAPTATION AND RESILIENCE TO A CHANGING CLIMATE COORDINATION NETWORK



The Adaptation and Resilience to a Changing Climate Coordination Network brings together a range of research projects funded by the Engineering and Physical Sciences Research Council. These look at the impacts of climate change and possible adaptation options in the built environment and its infrastructure including water resources, transport systems, telecommunications, energy and waste. The Network contributes to the Living with Environmental Change programme which aims to ensure that decision-makers in government, business and society have the knowledge, foresight and tools to mitigate, adapt to and benefit from environmental change.



UKCIP provides the management and support role for the network which aims to enhance the cooperative development of the research projects, and to synthesise and disseminate evidence and outputs to maximise the benefits to all stakeholders.





Energy