

## ASC advice on the proposed methodology for the Climate Change Risk Assessment

### I Introduction

This technical note, produced by the Adaptation Sub Committee (ASC)<sup>1</sup> of the Committee on Climate Change (CCC), sets out the Committee's advice on the evolving methodology for the Climate Change Risk Assessment (CCRA). The objective of the CCRA is to understand the risks to the UK from current and predicted climate change. Under the Climate Change Act the CCC is required to advise the Secretary of State on the preparation of the risk assessment and the Secretary of State must take this advice into account before the risk assessment is laid before Parliament<sup>2</sup>.

Whilst the Act only requires the Government to produce a risk assessment, Defra has also commissioned an Adaptation Economic Assessment (AEA) to be produced alongside the risk assessment. The Committee will also advise upon the AEA as the CCRA will depend on AEA outputs and vice versa.

Although the Act specifies that the Committee must give its advice on the completed risk assessment by 26th July 2011, the Committee intends to provide its advice at key stages in the development of the risk assessment to ensure that its advice is timely and can be acted upon. This report therefore includes a number of recommendations which it believes the Secretary of State should take into account in the development of the risk assessment. These recommendations are summarised in the covering letter to the Secretary of State.

This technical note is structured as follows:

- Section two sets out the process followed by the Committee to develop its advice.
- Section three sets out the Committee's understanding and assessment of the approach, as described in the documents presented at the ASC meeting on 10<sup>th</sup> November, 2009.

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<sup>1</sup> Referred to hereafter as 'the Committee'.

<sup>2</sup> Climate Change Act, Articles 56 and 57.

- Section four sets out the Committee's conclusions and recommendations.

## II Process for developing ASC's advice

In developing its advice the ASC considered the objectives for the risk assessment (and the associated AEA) which are to provide evidence and analysis to enable UK administrations to<sup>3</sup>:

- a. understand the level of risks (threats and opportunities) posed by climate change (likelihood and scale of impact) to the things society values;
- b. Compare the risks of a changing climate with other pressures on the Government;
- c. Prioritise adaptation policy geographically and by sector; and
- d. Assess the costs and benefits of adaptation actions and support the case for resources for these.

To assess whether these objectives were likely to be met, the Committee, and its secretariat, looked at several project documents at its meeting on 23<sup>rd</sup> October, 2009:

- The contractors' bid to carry out the risk assessment, dated July 2009.
- The project inception report, dated September 2009.

The Secretariat relayed comments on these documents to Defra and the contractors shortly after the ASC meeting on 23<sup>rd</sup> October<sup>4</sup>.

The Committee also received the following documents on 3<sup>rd</sup> November, 2009:

- An interim report on the risk assessment method;
- An interim report on AEA method;
- A note on measuring adaptive capacity;
- Draft stakeholder engagement plan; and
- Draft communications plan.

<sup>3</sup> <http://www.defra.gov.uk/environment/climate/adaptation/assess-risk.htm>, accessed 3<sup>rd</sup> November.

<sup>4</sup> <http://www.theccc.org.uk/images/asc/minutes%20final%20231009.pdf>

The Committee also met with the contractors on 10<sup>th</sup> November, accompanied by Defra officials, to hear about, and discuss, aspects of the approach. This report reflects the Committee's understanding of the approach set out at this meeting. Clearly, any developments in the methodological approach subsequent to this meeting will not be reflected in this report.

### III Description of the approach

This section sets out the Committee's understanding of:

- The requirements set out by Defra in the Terms of Reference (TOR) for the CCRA;
- The contractors' approach to meeting these requirements; and
- The main comments of the Committee.

#### **The Terms of Reference**

Guidance on risk and impact assessments sets out how, to be useful, they need to address a specific need and those conducting them need to be clear about their audience; the issues to be assessed; their area of coverage and time frame and their data requirements<sup>5</sup>. The TOR for the CCRA is clear on some of these aspects and was, intentionally, left unclear on others.

- The Climate Change Act requires the CCRA to inform the Government's National Adaptation Programme which will establish the Government's objectives in relation to climate change adaptation and the policies for meeting these<sup>6</sup>. The scoping study for the CCRA showed that stakeholders varied in their expectations about what the CCRA would deliver. Some saw the CCRA as a tool to support local or regional action, others saw it as a means to prioritise action and funding at the UK level<sup>7</sup>. The CCRA TOR sets out the intention to deliver: 'an assessment of risks (including opportunities)

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<sup>5</sup> Climate Impact and Adaptation assessment, Parry, M and T Carter, Earthscan Publications Ltd., 1998, page 34. Add citation to UKCIP guidance.

<sup>6</sup> Climate Change Act, section 58 (1).

<sup>7</sup> Scoping Study for a National Climate Change Risk Assessment and Cost Benefit Analysis, Paul Watkiss, Alistair Hunt and Lisa Horrocks, February 2009.

to those things which have social, environmental and economic value in the UK, although it left the definition of who valued what to later in the project.<sup>8</sup>.

- To achieve the stated objectives, the CCRA was required to provide an appreciation of risks at UK, national and regional levels<sup>9</sup> out to 2100 and identify possible adaptation options. The key deliverables for the CCRA and associated economic analysis, as set out in the TOR, are listed in annex A.
- The parts of the TOR relevant to the AEA state that it should: provide an indication of the scale of the challenge and potential benefits from acting; and given the wide ranging nature of possible interventions, identify priority areas for action on a consistent basis. In discussion with Defra the contractors have agreed that the latter – to identify priority areas – should have greater priority over the former given that ‘...difficulties of quantification and valuation will clearly be an important constraint.’<sup>10</sup>
- The CCRA and AEA are presented as two separate tasks in the TOR however they are very closely linked. The AEA is currently timetabled to follow the identification of risks, since the risks are a key input for processes of quantification and valuation of the impacts of climate change. Equally, the AEA will depend upon the CCRA for key definitions and an analytical structure.
- The TOR was less prescriptive regarding methods and data requirements, leaving the contractor to recommend these at the end of phase one of the project, due to complete in January 2010. Defra provided some direction which required the contractor to:
  - Build upon best existing approaches and integrate existing assessments completed or underway,
  - Use the latest UKCP09 climate projections,
  - Use the Government’s guidance on options appraisal and discounting and present impacts which allowed consistent comparisons between

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<sup>8</sup> Terms of Reference for the CCRA, page 3.

<sup>9</sup> Where the regions equate to the 9 areas represented by Regional Development Agencies.

<sup>10</sup> HR Wallingford Interim Report on the AEA method, November 2009, pp. 2.

- sectors, regions and different priorities for government spending,
  - Integrate the key concepts of adaptive capacity and vulnerability into their approach to risks,
  - Set up of sector/issue based technical groups, and
  - Set aside a proportion of the budget for primary research.
- Defra also left some key aspects of the approach in the TOR unclear, drawing upon the recommendations of the scoping study for the CCRA. This recommended that ‘...it is not necessary to choose one methodological approach to the exclusion of others, and a strong recommendation is that a composite (complementary) approach should be adopted, whereby approaches are explored in parallel, and the strong elements of each of the different methods are combined.’ Referring to the scoping study the TOR suggested that a composite approach, covering a variety of approaches (including amongst others synthesis, impact assessment and risk assessment) ‘would seem useful’. The TOR also did not specify the balance of effort to be employed between **top down approaches**, which were defined as the impacts of climate change, and **bottom up approaches**, which were defined in the TOR as what do we care about, the decision making processes and timescales for government, regions and sectors<sup>11</sup>.

### The contractors’ approach

To meet the requirements set out in the TOR the contractors developed an approach and a project plan.

- The contractors are proposing a composite approach and this is consistent with the CCRA scoping study and the TOR. It will include aspects of impact, risk, vulnerability and adaptive capacity assessment to reflect the differences in the availability of data across sectors<sup>12</sup>. The ASC understand that the contractors propose to:
  - carry out national, country and regional level assessments, using a combination of approaches;
  - compare impacts across different sectors, using social, economic and

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<sup>11</sup> CCRA Terms of Reference, p14.

<sup>12</sup> HR Wallingford Interim CCRA method report, pp. 8, November 2009

- environmental metrics. This includes an assessment of the robustness of evidence used, and prioritises policy relevant issues;
  - map vulnerability: overlaying climate hazards with defined social, or environmental indicators (such as age and income) to assess vulnerability geographically;
  - assess adaptive capacity using the PACT<sup>13</sup> framework, a measure for managing organisational change;
  - use decision pipe-lines to prioritise adaptation options for some sectors or risks.
- The project plan sets out key deliverables for the CCRA and AEA (Table one), including the high level national assessments in July 2010 and the country and regional reports in January 2011<sup>14</sup>. The main point to note is that methodological development should be completed by 15<sup>th</sup> January 2010.<sup>15</sup> There are five key phases:
    - Phase 1 develops the methodological approaches;
    - Phase 2 generates high level risk and economic analysis assessments;
    - Phase 3 develops country and regional applications and research;
    - Phase 4 integrates and reports on the CCRA; and,
    - Phase 5 generates economic analysis.

Perhaps reflecting the perceived differences, noted in the scoping study, between stakeholders over what the CCRA should deliver, the contractors have developed a methodology that could, in theory, meet the need for tools to aid adaptation at a local level (e.g. decision pipelines) and allow prioritisation at the UK level. However, time, the requirement for a clear method and other resource constraints during the project are likely to require tradeoffs between these two objectives.

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<sup>13</sup> PACT categorises organisational adaptive capacity into six 'response levels' and highlights nine 'pathways for change'.

<sup>14</sup> AEA outputs will be produced over a longer timescale since it is not bound by the same statutory deadline as the CCRA.

<sup>15</sup> HR Wallingford Inception Report, September 2009.

**Table one: Key deliverables in the CCRA, table assembled from key deliverables listed in inception report appendices 1 and 2.**

	Phase	CCRA	AEA	Stakeholders	Communication	General
2009	S	Framework report	High level approach	High level plan	Plan	Inception & management Research gaps report
	O	Adaptive capacity plan		Database launch		
	N			Workshop		
	D	High level method	High level method	Detailed Plan		
2010	J			Workshop		
	F					
	M		Technical development and user reports			
	A					
	M					
	J	High level report	High level report			
	J					
	A	Country & regional method report	Country & regional method report			
	S					Primary research reports
	O					
2011	N					Primary research summary & integration strategy
	D	Country & regional report	Country & regional report			
	J			Stakeholder event		
	F					
	M	Draft CCRA				
2012	A					
	M					
	J					
	J					
	A		Draft AEA			
2012	S					
	O	Final CCRA				
	N		Final AEA			
D	CCRA2 recommendations				Priorities for National Adaptation Plan	

Source: Assembled from HR Wallingford, Inception Report

### Main comments of the Committee

The main comments of the Committee fall into the following categories:

- Progress towards a CCRA methodology;
- Methods to prioritise impacts or risks in phase one for further analysis;
- Use of the latest climate and socio-economic scenarios;
- The PACT methodology for measuring adaptive capacity;
- The use of decision pipeline techniques;
- The adaptation economic assessment; and
- Stakeholder engagement.

Taking each in turn:

### Progress towards an agreed CCRA methodology

Judging by the documents provided and the presentation by the contractors the Committee could not see evidence of significant methodological development since the inception report produced in September, 2009. Key aspects of the methodology remain undefined:

- The draft methods report clearly identifies that the key challenge is to ‘...give careful thought to the definitions of risk, resilience, adaptive capacity and vulnerability, as well as how these concepts link and at times conflict with each other.’<sup>16</sup> The methods report does not set out a process for addressing this challenge and initial ideas, provided in the earlier inception report produced in September, are not developed further;
- The contractors identify the need for consistent definitions to enable parts of the analysis to be linked together and ensure consistency across different elements of the project. To this end the contractors provided a glossary. However there are examples in the CCRA methods and other reports where terms are used **inconsistently**: definitions of adaptive capacity differ between reports - the CCRA methods report implies that the CCRA will use an IPCC definition whilst the report on adaptive capacity does not<sup>17</sup>; **incorrectly** (e.g. distinctions between risk and uncertainty<sup>18</sup>); or are **partial** - the focus on social vulnerability excludes the vulnerability of natural systems and does not capture interdependencies between natural and social systems which could mitigate or exacerbate vulnerabilities<sup>19</sup>;
- The contractors have established sector champions, sector groups and

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<sup>16</sup> HR Wallingford Interim CCRA method report, pp. 4, November 2009

<sup>17</sup> HR Wallingford Interim CCRA method report, pp. 6, November 2009. HR Wallingford Interim report on measuring Adaptive Capacity, pp. 2, November 2009.

<sup>18</sup> HR Wallingford Interim CCRA method report, pp. 4, November 2009

<sup>19</sup> HR Wallingford Interim CCRA method report, pp. 6, November 2009

regional networks which are responsible for gathering evidence and providing feedback. The Committee understands from the presentation on 10<sup>th</sup> November that the process of data collection has begun. However, the Committee is concerned that the absence of an agreed methodological approach will mean data is not provided on a consistent basis within and between sectors. The contractors have started to develop a list of definitions, which is necessary to ensure that all involved are working from the same set and so that the data collection exercises underway are operating on a consistent basis.

- In terms of the sector groups, the Committee believe that the taxonomy of sectors set out in the literature is coarse and incomplete, since it does not explicitly cover key issues which will prove important for adaptation policies e.g. security, SME's, citizens in general, the vulnerable in particular, local government, and the professions. The Committee noted that the sector framework presented was essentially a means to gather data and that the final data could be presented in various ways, but it is important to know how this data will be used and presented at the outset.

#### Methods to prioritise risks in phase one for further analysis

The contractors propose an approach for prioritising impacts in the inception report which is developed further in the CCRA methods report. Key criteria relate to the significance of the impact, its policy relevance, levels of uncertainty and strength of evidence. The contractors anticipate that these can be used to: prioritise work after January 2010 for the high level UK assessment; identify research gaps and provide a starting point for the more detailed regional work. However, there is a significant risk that the initial screening could lead to important risks not being given the weight they deserve in the work after January:

- To assess significance the contractors propose to use common metrics, such as numbers of casualties, people affected or the impact on the UK economy (Table two). Impacts or risks receive a score based upon their significance. However there are difficulties with the approach. In particular differences in methods, the scope for quantification and the effects of uncertainty means that risks or impacts will be difficult to compare.

**Table two: draft qualitative and semi-quantitative description for scoring the significance of climate impacts and consequences (CCRA draft methods report)**

	Score	Economic		Social		Environmental
		Costs * (economic effects on UK economy)	Costs (damage following extreme events and asset deterioration )	Fatalities * and/or serious harm	Social effects – illness of injury*; social disruption*; inequality political unrest	Biodiversity loss and/or reduction in ecosystem services
Significance of impacts or benefits →	-2	<b>Major impact</b> >5 % of GDP	<b>Major damages</b> ; tens of billions annual damage	<b>Unacceptable risks to people</b> – 1000s+ at risk....	<b>&gt; x millions affected</b> ; unequal effects on vulnerable groups; major increase in "health burden"; political issue	<b>Irreversible loss</b> of valued habitats
	-1	<b>Significant impact</b> 2-5 % of GDP	<b>Significant damages</b> 1-10 billion of annual average damage	<b>Unacceptable risks to people</b> – 100s at risk....	<b>&gt; 1 million affected</b> ; significant increase in "health burden".....	<b>Significant Loss</b> of biodiversity
	0	<b>No significant effect</b> on UK economy	<b>Minor damages</b>	<b>Risks to people in 'tolerable' range</b>	<b>Small numbers affected</b> ; can easily cope with climate effects	<b>No change</b> in extinction rates, habitat loss.....
	+1	<b>Significant benefit</b> + 2-5% of GDP	<b>Significant reduction</b> in damage	<b>Significant reduction</b> in risks to people	<b>&gt; 1 million benefit</b> ; vulnerability reduced .....	<b>Significant gain</b> - reduction in extinction rate; environmental enhancement...
	+2	<b>Major benefit</b> > +5% of GDP	<b>Major reduction</b> in damage	<b>Major reduction</b> in risks to people	Major social benefits > x millions benefit .....	<b>Major gain</b> .....

*\*Taken from the Cabinet Office's National Risk Assessment. Further work is needed to 'calibrate' this table but as a simple guide OST Future Flooding study reported Expected Annual Damage (EAD) figures of up to £4 billion for residential and commercial property in the South East of England (National Enterprise, 2080s scenario) . The 'Great Depression' 1930-1934 caused a reduction in GDP of 7 to 8 percent and so on.*

- It is not clear that all impacts or risks can be classified according to common metrics<sup>20</sup>, in which case the scoring of risks has to become an exercise in assigning preferences to certain risks; i.e. society tolerates one risk more than another. Comparing different risks or impacts is not straight-forward and calibrating metrics within table

<sup>20</sup> With regard to consideration of adaptation, about half of the risks have a qualitative assessment but only a very small number have a quantitative assessment. This leads to some important

one to ensure equivalence between different types of impacts even less so. Comparability between the first two columns of the table requires clarity about whether losses are to capital or income, the returns to capital, whether losses are recurrent or not and to complicate things even more whether they are discounted or not. And a risk that led to 1000 fatalities, which equates to a 5% loss of national income, would imply a cost per life on over £50,000,000, far in excess of values currently used in government appraisals<sup>21</sup>.

- Consistent and accurate appraisal of risks depends upon a thorough understanding of the interplay between climate effects (e.g. increased rainfall), other biophysical processes and socio economic processes. The Committee noted that Defra's requirement for 'A systems analysis of drivers of change and causality in the climate/UK socio-economic system, that discovers, describes, and prioritises for attention important potential cross sectoral, secondary and indirect impacts'<sup>22</sup> would provide the logical framework for risk prioritisation and for the CCRA more generally. Yet no methodology for this has been presented by the contractors and the timescale for the delivery of the systems analysis remains unclear. The Committee felt that, in the absence of an agreed methodology to ensure the consistent appraisal of risks, the risk comparison could not be done in a meaningful way.
- More generally the Committee believes that any prioritisation exercise should not solely focus on impacts that can be monetised or quantified, as this would lead to a partial assessment of: the costs of climate change and the potential benefits of adaptation, and false prioritisation.
- Even where impacts or risks can be classified according to common metrics, the draft CCRA method report acknowledges<sup>23</sup> that there '...are a large

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questions about what is actually achievable within the CCRA. Inception Report p8

<sup>21</sup> <http://www.dft.gov.uk/webtag/documents/expert/unit3.4.php#07>

<sup>22</sup> CCRA Terms of Reference, p4.

<sup>23</sup> HR Wallingford Interim CCRA method report, pp. 14, November 2009

number of difficult issues associated with this regarding baselines, autonomous adaptation, social equity issues and values.’ Impacts or risks will vary according to what is assumed about each of these factors, as well as by climate scenario and different assumptions could lead to a different ordering of impacts.

- Wide uncertainties surround the timing, likelihood and scale of impacts, not least because the UK faces a range of possible climate futures, which will depend on the success of global mitigation efforts, natural climate variability and model uncertainty<sup>24</sup>. Other elements also introduce uncertainty such as what is assumed about socio-economic trends. These make judgements about the ordering of impacts or risks more complex.
  - It is likely therefore that a simple comparison of point estimates will be misleading for many types of impact that follow a distribution, where society values protection against high impact, low probability events or where relationships between risks or impacts and climate drivers are subject to wide margins of error or where the relationship between climate driver and impact is convex or discontinuous<sup>25</sup>. So far the approach to assessing uncertainty has not yet been agreed: where ‘...there is a choice to adopt a common IPCC approach to describing uncertainty or to develop a new approach that might reflect some of the findings from UKCP09 and subsequent work.’<sup>26</sup>
  - Procedures for handling uncertainty in relation to extreme events, or clusters of events, include 'stress testing' based on expert knowledge. This approach is common in the financial and insurance industries and in civil engineering but appears to have been ignored.
- Another criterion to be used in the prioritisation will be pedigree analysis,

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<sup>24</sup> For example see the wide range of potential climate outcomes shown by the latest UK climate projections.

<sup>25</sup> Agricultural yields in the northern hemisphere are an example of convex impacts. They are expected to rise over a narrow range of temperature increases and then fall if the upper limit of the range is exceeded.

<sup>26</sup> HR Wallingford Interim CCRA method report, pp. 16, November 2009.

using tables to score research evidence. The success of this depends upon getting the right set of experts to derive scores. However,

- The CCRA method report states that ‘...this is best achieved through expert elicitation and as part of the stakeholder engagement process.’
- Arguably it could be more straightforward for the sector experts to assess the quality of the research since they are better qualified to do so and will be more familiar with it. Peer review could then be carried out independently;
- Indeed the Committee recommend that external academic peer-review is essential to ensuring a robust CCRA, and should be carried out as the CCRA progresses.

The pre-screening approach differs from that employed in impact assessments carried out by other countries. Typically, these focus on analysing risks to things that society values, such as the most important economic sectors, most valuable species or agricultural commodities. This approach requires some body to articulate what the valuable activities in society are, assess the potential risks to these and then decide upon adaptation priorities based on an assessment of relative costs and benefits. Given the CCRA objectives, as set out in the TOR<sup>27</sup>, the Government should establish what these valuable activities are early on, after consulting with stakeholders.

Furthermore, the methodology for risk analysis, in the context of uncertain future climate and socio-economic scenarios, is not well developed. The diagrams presented to the Committee on 10<sup>th</sup> November confused the relationship between climate variables and risk. Even at this early stage of methodological development, the Committee expected to see a more rigorous statement of the approach to estimating climate risks, which lies at the heart of the CCRA, including preliminary worked examples.

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<sup>27</sup> The CCRA aims to assess ‘...the risks to those things that have social, environmental and economic value in the UK,...in order to help Government create an enabling environment for the UK to adapt and identify priorities for action.’

### Use of the latest climate and socio-economic scenarios

The contractor's approach to developing socio-economic scenarios and using the latest climate scenarios is pragmatic. Although the Committee believe the contractors should set out how impacts and risks will vary under mitigation scenarios.

- Given the lack of time to develop new socio-economic scenarios, the contractors propose to use scenarios which are already available, draw upon stakeholder views and identify some key socio economic drivers. These will need to be communicated to sector groups to ensure that, to a first approximation, estimates of impacts take into account consistent socio-economic trends. This was the approach adopted in the Foresight flooding study which provided a common set of socio economic assumptions for the different groups of analysts.
- Although some impact studies will draw upon the latest UKCP09 projections, most will not. Hence the challenge is to find a way of mapping previous impact studies to the new climate projections. The contractors are essentially promising to deliver a pragmatic approach, which maps the climate effects underpinning impact studies to the distribution of climate effects produced under UKCP09. This is sensible and should allow analysts to apply expert judgement to the impact results based on earlier climate projections.
- Although there is little or no literature currently available on impacts under a future scenario of strong mitigation, the Committee believe that the risk assessment should consider the implications of low-carbon scenarios. Two issues are relevant: first, lower levels of climate change may reduce or delay some impacts; second, a strong domestic effort to reduce GHG emissions will lead to significant socio-economic changes to the UK, leading to altered exposure and vulnerability. For instance policy to reduce emissions of nitrous oxide may provide a limit to agricultural productivity increases.
- The contractors propose to check the robustness of the UKCP09 outputs by comparing them with the CMIP3 ensemble (a database from several climate models used extensively in the IPCC's 4<sup>th</sup> Assessment) and the climateprediction.net ensemble. Given the time constraints of the CCRA, the Committee believe that this is a lower priority, noting that UKCP09 already

goes some way to incorporating evidence from structurally different climate models, and that the process of improving climate projections is an ongoing endeavour. The Committee proposes that, where UKCP09 outputs are used, relevant experts should be carefully consulted in order to provide appropriate bounds to this evidence. Other norms of reasoning should be used for shorter-term decisions (e.g. measurements of current climate variability) and for variables not robustly predicted by any model (e.g. sensitivity analysis for extreme events).

#### The PACT methodology for measuring adaptive capacity

The contractors also propose to use a methodology called Performance Acceleration Climate Tool (PACT) to measure 100 organisations' capacity to make adaptation related decisions. As we understand it PACT involves circulating questionnaires which ask respondents to assess their level of response against nine organisational 'pathways for change'. Improvement requires the organisation to increase their response level against each pathway simultaneously. The PACT model starts from the presumption that not every organisation needs to act at the highest levels of capacity, but those that take substantial decisions affecting communities and services – e.g. local and national governments, major companies – do need to display a high level of capacity. However it does not identify the technical, social, economic or environmental limits which constrain adaptation responses, and is much less relevant to the adaptive capacity of natural environments.

- The contractors believe that there is a robust relationship between the questions asked, the PACT classification and the phenomena being measured (i.e. the capacity to make decisions), which would allow the CCRA to make a judgement about the readiness of organisations to address climate change risks. The approach has been used to assist individual organisations manage climate change risks.
- Stakeholder engagement is likely to be vital in ensuring that responding organisations agree with the judgements made and some stakeholder engagement will take place. How judgements are made about the required level of capacity to address particular risks seems to be vital, although the process for assessing this is currently unclear.
- It is also unclear how judgements about required levels of organisational

capacity will be integrated with other considerations such as cost, whether required technologies exist or whether environmental limits are exceeded. Equally by focusing the unit of analysis on the organisation, it is much less relevant to, say, how species might adapt.

- The physical characteristics and lifetime of infrastructure systems (such as energy supply and distribution, water and sewage, flood defences and transport systems) and buildings, will also determine the cost and feasibility of adaptation. By focussing upon organisational issues the PACT methodology overlooks the need for practical engineering assessment of these physical systems in order to evaluate adaptation options.

#### The use of decision pipeline techniques

The contractors set out their approach for using decision pipeline techniques to identify and select adaptation options for a subset of risks. This involves developing a portfolio of adaptation measures for a given set of risks, assessing at a high level the costs and benefits of these and determining the climate thresholds which govern when such measures need to be introduced<sup>28</sup>. However, it is not clear from the methods report whether and how data on thresholds will be collected given that thresholds receive no consideration in the CCRA methods report or the inception report.

The decision pipeline approach has been applied before (e.g. the Thames Estuary 2100 project) although the resources involved substantially exceeded those available to the CCRA. The CCRA methods report states that where developing a decision pipeline is not possible a simpler approach can be adopted which would involve a high level assessment of costs and benefits of adaptation portfolios, to identify the most effective decision pipelines and hence options. No details of this “simpler approach” are provided. Given that the simpler approach will presumably be the one that is most widely used in the CCRA and AEA, it should be described.

#### The Adaptation Economic Assessment

The AEA methods report is less well developed than the CCRA methods report, reflecting delays in assembling the team. The methodology is not yet fit for purpose.

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<sup>28</sup> Interim report on CCRA method, p8.

There is no evidence of integration between the CCRA and AEA, although the contractors propose to address this, nor is there much awareness demonstrated of the existing literature on the subject.

- The contractors state that the main element of their work will be methodological development. In particular they state that they will identify what a well adapted society should look like and how the UK could move from its current state to the well adapted society and over what timescale.
- To achieve this approach the AEA method proposes three analytical categories: themes, methods and data. To be frank, from this point on the AEA methods report reads like a series of unrelated lists which makes it difficult for an outside observer to know what is being proposed. The section on tools is potentially more informative since it comes closest to being a list of possible outputs, which might contribute to the CCRA. For example:
  - Cataloguing damages
  - Identifying adaptation options
  - Developing typologies and
  - Building modelling frameworks.
- However, since these tools are not referred to in the CCRA method report it remains unclear what will be delivered or required to deliver the stated objectives – to identify priority areas for action on a consistent basis and quantify impacts. In particular, the Committee are concerned about the lack of detail, even at this early stage, of the basic process for assembling functions quantifying direct and indirect economic damages and adaptation costs. This proved to be a major constraint on previous economic assessments.

Even though the AEA and the CCRA are intended to be analytically entwined, it is clear from both the CCRA and AEA method reports that there has been little interaction between the different teams producing the reports. It is still unclear which elements of the AEA analysis need to be provided to the CCRA before the statutory deadline, and which can be left until later. Defra and the contractors recognise that the lack of integration is an issue, and they wish to resolve it, but the Committee note that there is not much time before the two method reports need to be finalised. The risk of slippage is significant and as a matter of urgency the

contractors should set out how this integration will take place.

### Stakeholder engagement

The contractors identify two overarching objectives of stakeholder engagement for the CCRA and the AEA in their draft report. They are to gather information and data for the analysis and to promote ownership of and buy-in to the findings. The second objective seemed to be underplayed in the material provided. It is essential for developing awareness amongst stakeholders of possible impacts of climate change and the potential need to adapt to these.

The approach centres on the development of a Stakeholder Database, which will contain the names of organisations and individuals who are pertinent to the CCRA and AEA. Preliminary stakeholder analysis by the contractors has identified over 500 stakeholders. This is expected to grow through future engagement. In addition, an online registration form is being set up for people to register their interests in the project and this will also be recorded in the database.

Adaptation to climate change is intrinsically local in nature. The Committee has expressed concern at the lack of local authority level representation in the stakeholder engagement strategy. Indeed, the Scoping Study states that “it is essential that a national and regional strategy acts to encourage adaptation which retains flexibility and robustness for enabling measures at the ‘local’ scale.”

The contractor states in their stakeholder report that stakeholder engagement will provide a lasting legacy for the project, which will facilitate future CCRA cycles. However, the Committee would welcome more clarity on how stakeholder engagement would be taken forward by Defra beyond the end of the CCRA, to inform subsequent adaptation actions and future CCRA. More generally, the Committee is concerned about the legacy of knowledge and data beyond this CCRA contract. If the first CCRA is to effectively support adaptation decision making and lead constructively into the next CCRA cycle, processes must be put in place for knowledge transfer to key stakeholders (including Defra, UKCIP and the CCC) well in advance of the completion of the contract. This knowledge transfer should include a strategy for transferring datasets and tools so that they may be used by various parts of government.

#### IV The Committee's conclusions and recommendations

This technical note constitutes the Committee's first set of advice on the CCRA. The Committee has taken into account the following in developing its conclusions and recommendations:

- Firstly, the contractors are just over half way through developing the methodology. The Committee therefore did not expect to see a fully formed method, rather they wanted to see evidence that one would be delivered by January as required by Defra, and that the method was likely to deliver the intended objectives of the CCRA;
- Secondly, our advice relates to the methodology presented to the Committee on 10<sup>th</sup> November and the supporting documents provided. Clearly, any developments since the 10<sup>th</sup> November will not be reflected in this advice;
- Thirdly, officials and the contractors face a difficult methodological task and they have not had a lot of time to carry it out. Indeed a principle concern of the Committee is the lack of time available for the CCRA, including the time available for ASC scrutiny;
- Finally the Committee very strongly believes that its success depends upon the contractor delivering an assessment with sufficient depth, breadth and scientific credibility to guide policy decisions.

The Committee's main points are:

- The Committee want to see a fuller statement of the methodology which the contractors intend to employ. The method presented has not developed far beyond the state of play in September. In particular, the Committee feels that the consultants have not yet presented a coherent framework to address the CCRA's stated objective to 'assess the risks (including opportunities) to those **things which have social, economic and environmental value** in the UK from current and future climate change'.
- The contractors have developed novel ideas, but were trying to reinvent the process of doing risk and impact assessments for which there is already a wealth of experience and guidance. Given the tight timescales for delivering

the method and the CCRA, the contractors should build on this guidance and simplify their approach. In the Committee's view the key steps are:

- To conduct a robust literature review of all the main sectors covered in previous UK assessments. The literature review should inform, and be informed by, what the Government and the national authorities value (e.g. protection against major threats). The literature review should, where possible, distinguish between risks common to all the UK and those that are specific to parts of the UK. And take into account the impact that climate changes overseas will have on the UK;
- In parallel, to develop more complex aspects such as: monetising risks, evaluating adaptation options, incorporating socio economic scenarios, incorporating risk and assessing the implications of mitigation efforts (in terms of climate and socio economic scenarios, e.g. limitations on land-use response);
- To test the novel elements of the approach on a manageable and well documented UK sector which is central to the adaptation challenge;
- To then roll out the method, revised if needed, for other sectors or activities, starting with those judged to be the most important.

The Committee set out a possible structure for the literature reviews in Annex B.

- Before the end of this year the contractors will prioritise impacts or risks for analysis. The Committee has concerns about the proposed method:
  - There is no clear mapping from projected climate changes, bio-physical effects and socio economic influences through to impacts, which is necessary to ensure consistent appraisal of risks. The systems analysis, required under the CCRA, would provide this but it has received little attention so far. The process of gathering data from sector groups has already begun. The Committee question whether data can be gathered on a systematic basis without an agreed methodology to ensure consistency;
  - To deliver meaningful policy recommendations, a finer sector classification will be required in the CCRA report to reflect policy

- interests (e.g. impacts on vulnerable groups, implications for SMEs). This requirement needs to be built into the CCRA at the start;
- Prioritisation of CCRA analysis based on the existing literature is unlikely to fully capture key risks since the existing impacts literature is largely driven by academic interest and may not reflect the risks to things society values. It will also be driven by what can be readily estimated: things that are less certain (e.g. extreme events) are unlikely to be fully considered.
  - We welcome the contractor's intention to increase integration between the CCRA and the AEA, which has hitherto been lacking. The Committee recognises that the AEA started later than the CCRA due to delays assembling the team and that as a result the methodology is less developed. The Committee note that time is short and that a method needs to be developed quickly. In the Committee's view the key steps are:
    - Conduct a literature review of economic impact studies, including studies that go beyond the UK (e.g. EU, US). This will identify currently available methods and data although the evidence base will be uneven across sectors. The contractors should understand different adaptation assumptions and valuation methods used in studies;
    - Introduce additional complications such as: inter-linkages between sectors which increase or reduce impacts; effects on the UK from overseas; standardising sector results using consistent assumptions about climate and socio-economic trends; looking at adaptation strategies in more detail considering uncertainty, prioritisation and role of the state;
    - Apply these complications to a pilot case and, depending on the success of this, roll out more widely.
  - One aspect of stakeholder engagement, which seemed to be underplayed, was the role of the CCRA in developing greater awareness of the potential need to adapt to climate change and signing key actors up to a commitment to action. Stakeholder engagement should help governments and national authorities identify things of value and identify the points at which impacts become an issue. Plans to continue stakeholder engagement beyond the first CCRA should be developed. It would be a missed opportunity if, at the end of the CCRA process, stakeholder engagement was to end and actions, such as

building the evidence base for future CCRA's or efforts to encourage better adaptation, were not followed through. The Committee also believe that local authorities and other groups such as SMEs should be represented in the stakeholder engagement strategy as they are key actors in adaptation.

- The Committee believe that the contractor needs to establish an **academic** peer review process to validate the science used in the CCRA, drawing on experts from a wide range of fields.

## Annex A: Key deliverables set out in TOR

1. **CCRA – Analytical Frameworks and Approaches;** Using UKCP09 projections and other analytical tools, and building on the best of existing evidence and approaches;
  - a. An assessment of the range of types of climate impacts that will create risks (both threats and opportunities) for the UK to 2100, and subsequently a framework that can be applied at national and regional level to identify their specific risks.
  - b. An assessment of range of issues/areas/sectors affected by climate impacts, their adaptive capacity and vulnerability and an approach to assessing which sectors become priorities for application to the required national and regional breakdowns
  - c. A systems analysis of drivers of change and causality in the climate/UK socio-economic system, that discovers, describes, and prioritises for attention important potential cross sectoral, secondary and indirect impacts.
  - d. A short synthesis of other work (some of which is ongoing) that prioritises international climate change issues for attention in the CCRA
  - e. Using a framework derived from a, b, c and d, that can be consistently applied at UK, national, and regional levels, an assessment of risk (including opportunities<sup>29</sup>), including economic, social, and environmental impacts and their likelihood. This will need to include an assessment of vulnerability and adaptive capacity as key determinants of level of impacts.
  - f. Methods for dealing with uncertainty, both in assessing climate impacts, and in assessing risks (which may be dependent on uncertainty in non-climate factors)
  
2. **Economic Analysis - Analytical Frameworks and Approaches;** building on the analysis of the CCRA, and using existing analysis where appropriate:
  - a. A monetary estimate of the total impacts of climate change on the UK, broken down by sector and the 9 regions where possible
  - b. An identification of the broad types of options for reducing the potential damages from the risks identified in 1, both for sectoral and cross-sectoral risks, and their expected costs and benefits

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<sup>29</sup> Throughout, 'risks' should be taken to include both threats and opportunities.

- c. Development of a methodology for prioritising Government action on adaptation given uncertainty and incomplete information
  - d. An overall estimate of the scale and resources required for adaptation, and the likely benefits from this in reducing the impacts identified in part a.
- 3. **Primary Research and Evidence gaps;** In parallel with 1 and 2, from a synthesis of existing sources, an assessment of primary research that needs to be fast tracked to deliver 1 and 2, and recommendations on research priorities needed to inform future CCRA cycles, including relative timing. Deliver this research, working with UKCIP (see further discussion).
- 4. **Applications;** Using the approaches and frameworks developed in 1 and 2, assessment of risks from current and future climate impacts to -
  - i. The UK as a whole (including territorial waters)
  - ii. England (including each of the 9 English regions)
  - iii. Wales
  - iv. Northern Ireland
  - v. Scotland
- 5. **Learning for the future;** recommendations on research priorities and approaches needed to inform subsequent CCRA cycles to build on this first CCRA.

## Annex B – Structure for the literature reviews

To deliver meaningful output at the end of the CCRA, the Committee proposes that the contractors create an overarching framework that draws together their suggested tools around clear goals and analytical stages. This rigour should also enable the creation of clear guidance for stakeholder engagement which collects required information from sector groups, stakeholders and experts in a timely fashion, and in a manner that facilitates cross sector comparison. Such frameworks have previously been described by UKCIP and the IPCC on risk and impact assessment respectively.

A key aspect of the Committee’s recommended approach is the commissioning of sector level literature reviews, to bring together analysis of climate changes, bio-physical processes, socio-economic changes, impacts and risks. The literature reviews should be designed to collect data on a consistent basis both within and across sectors. They should also, where possible, distinguish between impacts and risks common to all parts of the UK and those that are specific to different geographies within the UK. And take into account the impact that climate changes overseas will have on the UK, for example changes in global agricultural output will affect global prices and hence the incomes of UK farmers.

This annex sets out one possible structure for the collation of data.

### Key data to be collected

To the greatest extent possible the literature reviews should collect the following data, drawing on the academic literature as well as the views of stakeholders. This process should inform, and be informed by, what UK society values (e.g. shelter, food, clean environment):

- **How does current climate affect the sector?** This should establish a baseline for analysing the impacts of future climate change. It should consider what factors make the sector particularly exposed to climate, and whether the activity concerned is particularly sensitive to changes in climate. It should identify which climate variables – e.g. rain, wind – influence the sector and how these translate into impacts. It should distinguish between the sector’s sensitivity to gradual changes and extreme events. Ideally the reviews should establish whether activities within the sector are dependent on the climatic variables staying within a certain range. What thresholds exist and are they

physical, e.g. sea level rises to overtop a sea defence, economic, e.g. farmers stop planting certain crops, or legislative e.g. a certain species should be maintained in a certain area.

- **How will the key climatic variables change given the expected change in climate?** The contractors will need to provide supplementary guidance to the teams producing the literature reviews to ensure consistency in approach, including guidance on how to integrate mitigation scenarios into existing analysis and timescales to consider.
- **What socio-economic changes influence the sector's exposure to climate?** How might these trends evolve, including under mitigation scenarios? Will climate changes overseas impact on the UK? If so, how?
- **How will a combination of socio economic and climate changes lead to impacts or risks?** What is the potential scale of these? Are potential thresholds crossed, and if so when?
- **To what extent can future impacts or risks be moderated by appropriate adaptations?** Will adaptation occur autonomously or does it need to be planned? What types of measure could be adopted, by whom? What are the potential limits to adaptation? How can it occur in a sustainable fashion? When might adaptations potentially lead to unanticipated and adverse consequences and how might adaptations help deliver other policy objectives?
- **Whether sectors, or activities within them, are sufficiently resilient to continue providing their essential functions<sup>30</sup>?** Resilience is likely to be a function of physical constraints on repair or replacement, socio-economic limitations and system redundancy.

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<sup>30</sup> For example the loss of a road from flooding may force road users to use alternative routes. The transport network as a whole is usually resilient to the loss of one road, although there is disruption caused by greater traffic congestion.