



Department
for Environment
Food & Rural Affairs

www.gov.uk/defra

Impact Assessment on the 2013 Strategy for exercising the Adaptation Reporting Power

July 2013

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PB13973

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Introduction

- 1.1 The climate is changing and the impacts from it are likely to affect almost everyone in some way during our lifetimes. There have always been natural fluctuations in climate but observational records show that current rates of change are far greater than those experienced in recent history. Such events may occur increasingly often in the future. These extreme weather events are likely to disrupt the economy and without adequate preparation, could cost lives and money. Building the country's resilience to climate change is applicable to all society.
- 1.2 The government's vision for a Climate Ready country: *"A society which makes timely, far-sighted and well-informed decisions to address the risks and opportunities posed by a changing climate."*
- 1.3 The Climate Change Act (2008) gives the Secretary of State the power to direct reporting authorities (organisations with functions of a public nature and statutory undertakers) to produce reports detailing:
 - the current and future predicted impacts of climate change on their organisation,
 - proposals for adapting to climate change,
 - an assessment of progress towards implementing the policies and proposals set out in previous reports.
- 1.4 This is known as the Adaptation Reporting Power (ARP).
- 1.5 In 2009, the Secretary of State laid before Parliament a report on the strategy for exercising this power for the first time, as required by Section 65 of the Climate Change Act. The strategy focused on major infrastructure providers from the energy, transport and water sectors. The first round was completed in March 2012, and the reports produced can be found here:
<http://www.defra.gov.uk/environment/climate/sectors/reporting-authorities/reporting-authorities-reports/>.
- 1.6 Every five years, the government is required to lay before Parliament a report setting out the government's approach to exercising the power. This document considers the various options for the second round of the ARP and attempts to set out the associated costs and benefits of different approaches. It should be read alongside the report to Parliament, entitled 'Adapting to Climate Change: Ensuring Progress in Key Sectors, 2013 Strategy for exercising the Adaptation Reporting Power' and list of priority reporting authorities.

- 1.8 This impact assessment builds on the previous impact assessment for the first round of the ARP, as well as the relevant section of the overall impact assessment of the UK's Climate Change Act (2008).^{1,2} Whereas the first impact assessment was unable to quantify any benefits from reporting, this impact assessment is able to provide illustrative benefits as well as highlighting where further research or understanding is needed. Defra undertook a consultation on the proposed approach to exercising the ARP between December 2012 and February 2013. This impact assessment has been updated in light of responses to the consultation.
- 1.9 The government has produced this impact assessment as best practice for evidence-based policy-making even though it is not formally required as the government is exercising a voluntary approach to the ARP.

¹ <https://www.gov.uk/government/publications/adapting-to-climate-change-helping-key-sectors-to-adapt-to-climate-change>

² http://webarchive.nationalarchives.gov.uk/20121217150421/http://www.decc.gov.uk/publications/basket.aspx?FilePath=85_20090310164124_e_%40%40_climatechangeactia.pdf&filetype=4

Rationale for government intervention

- 2.1 Prominent scientific research, such as the Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC, 2007) and the Stern Review on the Economics of Climate Change (Stern et al; 2006), have stressed the need to reduce global greenhouse gas emissions as a main policy objective.
- 2.2 Stern et al (2006) identify greenhouse gases, in particular carbon dioxide (CO₂) emissions, as a major economic externality. They estimate a 2-5°C rise in global mean temperatures between 2030 and 2060. The IPCC (2007) consider a number of different climate change emissions scenarios with an overall range lying between rises of 1.1-6.4°C by the end of the 21st century. Even with substantial effort to mitigate CO₂ emissions some of the effects of climate change are unavoidable. Stern et al (2006) acknowledge that adaptation is fundamental to reducing vulnerability to climate change.
- 2.3 The impact of projected climate change brings opportunities and threats across many sectors in the country. If adaptation is in the private interests of an organisation then it is anticipated that it shall occur without the need for government intervention.
- 2.4 There are barriers to adaptation, however, that risk undermining the functioning of an efficiently working market. These barriers may lead to organisations taking insufficient action to adapt to climate change. Alternatively, they could lead to maladaptive actions being taken. Government intervention is necessary to identify and overcome these barriers and ensure effective adaptation to climate change is achieved.

Market failures

- 2.5 Market failures occur when private incentives for adaptation are misaligned with the socially optimal level. First is the imperfect information risk that exists when organisations take adaptation actions given the uncertain impacts of climate change. This may be exacerbated by a failure of organisations to use the best available information on climate change risks. This will lead to misaligned incentives if these impacts are not fully understood and accounted for. The Adaptation Reporting Power (ARP) can address this risk through encouragement to consider consequences of climate change. The ARP can require public institutions to incorporate adaptation into their risk management to correct misaligned incentives to adapt
- 2.6 The government also must secondly that moral hazard incentives are eliminated. Organisations may lack the incentive to follow market signals under the belief

government will pay in the event of climate change damages. For example, public transport service providers may not consider the disruption caused by an increase in the probability of flooding due to climate change. Reticence to adapt may be caused by the belief that government will intervene anyway to ensure continuity of services for public benefit. The ARP will reinforce that opportunities to adapt to climate change need to be incorporated into organisations' strategic frameworks.

- 2.7 Thirdly, many organisations potentially subject to the ARP are heavily regulated, or in some way exempt from traditional market mechanisms. Government has a responsibility to ensure that where it intervenes in the market for the provision of public services, it does so in such a way as to minimise the potential for crowding out private adaptation actions.

Behavioural barriers

- 2.8 Climate change does not pose an immediate risk to many organisations and there is a risk of inertia as short-term objectives are prioritised.³ Risks may be compounded through maladaptation if decisions taken today ignore risks of projected climate change and changing probabilities of extreme weather events.⁴ The consequences of inertia are greater for organisations facing a low capacity to adapt their structure.⁵ The ARP can identify and encourage organisations to focus their attentions on improving the capacity and capability for the risks and taking appropriate action which will help ensure resilience.

Equity

- 2.9 Organisations also need to consider both intergenerational and intragenerational equity issues to ensure the costs of adapting to climate change are minimised. This is to ensure that the costs of taking action (and the consequences of not taking action) do not fall disproportionately on low income and vulnerable groups today or being passed on to future generations.

³ Although it is not possible to link directly individual weather events and climate change, they could affect behaviour and perceptions of risk.

⁴ Maladaptation is when an organisation undertakes inadequate action to adapt to climate change. This, for example, could be due to a misguided belief of the risks of climate change (e.g. flood proofing a building when the actual consequence is overheating) or under/overestimating the true impact of future climate change in an adaptation strategy.

⁵ This may include organisations with very long-term decision outcomes or whose current assets face significant exposure to projected climate change.

Policy objectives

3.1 The policy aims to:

i) ensure climate change risk management is systematically undertaken by Reporting Authorities. This will help to mitigate misaligned incentives caused by imperfect information.

ii) help ensure public services and infrastructure are resilient to climate change and are maximising any opportunities from climate change. Encouraging reporting will help reduce the issue of inertia caused by short-term focus as well as moral hazard incentives.

iii) monitor the level of preparedness of sectors to climate change. The second round of the Adaptation Reporting Power will help government to map better how the country is adapting and enable government to ensure sectors are adapting appropriately.

Policy options

4.1 The following three questions summarise the issues for the second round of the Adaptation Reporting Power (ARP):

- To whom should the ARP apply?
- What should be done about the organisations that have already reported?
- Should the ARP be used on a voluntary or mandatory basis?

To whom should the power apply?

4.2 The ARP could potentially be applied to thousands of organisations.⁶ In order to identify potential new Reporting Authorities, four criteria have been defined.

4.3 The four criteria are:

1. Is the organisation eligible as a Reporting Authority?⁷
2. Is the organisation vulnerable to the projected impacts of climate change as set out in through the UK Climate Change Risk Assessment (2012)?⁸
3. No duplication. Would reporting duplicate an already existing process? The organisation must not be already subject to reporting requirements, or already covered by an existing voluntary agreement.
4. Proportionality. Is it proportionate to designate the organisation as a Reporting Authority?⁹

4.4 The government's approach is to apply all 4 of these criteria.

How should the first round of the Adaptation Reporting Power be taken into account?

4.5 Organisations that reported under the first round of the ARP have already made an assessment of their risks from climate change. Repeating this assessment would be

⁶Adapting to Climate Change: Ensuring Progress in Key Sectors, 2009 strategy for exercising the Adaptation Reporting Power and list of priority reporting authorities, Defra.

⁷ Eligibility as a Reporting Authority under the terms of the UK Climate Change Act (2008)

⁸Available online: <https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report>

⁹ Producing a report on how climate change will affect an organisation requires a commitment of resource, primarily in the form of staff time. For such an investment to be worthwhile the organisation must be of a sufficient size to see adequate benefits.

unlikely to add any additional value, since understanding of climate change risks is unlikely to have changed significantly in that time. It would impose unnecessary additional costs.

- 4.6 Under the ARP, however, the Secretary of State can require organisations to provide a progress update on the actions and work programmes they committed to in previous reports. This ensures transparency of the results of the reporting process and provides assurance that actions are being carried out.
- 4.7 The government's approach is to ask organisations that reported in the first round to provide a 'light touch' progress update on the actions set out in their adaptation reports. This will provide sustained impetus for organisations to adapt to future climate and continue their resilience-building work, whilst avoiding unnecessary costs that would result from repeating the entire reporting process. This is a decision that has been taken in consultation with Reporting Authorities from the first round.

Should the power be used on a voluntary or mandatory basis?

- 4.8 Directing organisations to report makes it mandatory for them to respond to the ARP. This ensures that organisations undertake the exercise to report, however it runs the risk of introducing an unnecessary regulatory burden if the process is not helpful to them. If the process is found (or perceived) to be unhelpful, organisations could adopt a 'tick-box mentality' of reporting, which would undermine the effectiveness of reporting.
- 4.9 Inviting organisations to report reduces this risk of an unnecessary regulatory burden. Organisations may decline to report, however, when it would be in their own interest or when it would be in the interest of society more widely. This could be due to lack of information or understanding of climate change, or it could be because of another barrier to adaptation. There may be a risk of moral hazard for instance if the organisation does not have to pay the costs of its lack of climate resilience.
- 4.10 In the first round of reporting the Secretary of State directed organisations to report as required by the UK Climate Change Act (2008). A small number of organisations volunteered to produce reports. Primarily these were National Parks who wished to be exemplars in climate change adaptation. A number of organisations from the private sector such as telecommunications companies and major food retailers were invited to report but declined the invitation.

- 4.11 For the second round of the ARP, Defra has engaged with potential Reporting Authorities to determine how the reporting process can be beneficial to them. All authorities identified in this document have been approached, and the majority have indicated that they wish to report.
- 4.12 Government is proposing a voluntary approach to ensure that the reporting process is flexible and responsive to the needs of Reporting Authorities.

Applying the criteria

- 4.13 The Venn diagram in the Report to Parliament sets out the assessment of which organisations meet 3 of the 4 criteria outlined in paragraph 4.3 above. The criterion of proportionality has been removed for simplicity's sake. For a full description of the application of criteria please see sections 4 and 5 of the Report to Parliament.

Options to be considered

- 5.1 In light of the selection criteria described in the previous section, four options have been considered. Options 1 and 2 compare a voluntary and mandatory approach whilst applying all four selection criteria. Options 3 and 4 partially relax the duplication criteria and extend the Adaptation Reporting Power to local councils to illustrate the potential costs of that approach. The government has decided to implement option 1 given the current available evidence and the difficulty of isolating any additional benefit in following a mandatory approach.
- 5.2 The figures provided below are based on discussion with new Reporting Authorities and those which reported in the first round prior and during the consultation process. This reflects our best knowledge on uptake of reporting under all voluntary and mandatory options.
- 5.3 The majority of costs described below will be borne by reporting authorities rather than government. Cost to government will mainly be through providing support and ex-post analysis. The purpose of this impact assessment is to investigate the costs and benefits of adaptation reporting. Identifying private costs and benefits is fundamental to understand this and the extent of barriers to adaptation. We therefore retain all costs and not just those that government expects to face.

Option 1: Follow a voluntary approach and apply all four selection criteria

- 5.4 Invite organisations that meet all four selection criteria to report in the second round of the ARP. For organisations that reported in the first round, a voluntary progress update will be asked for. Those new to the process will conduct the full reporting exercise. Under this option we estimate there will be between 6 and 9 new Reporting Authorities and 68 providing progress updates.

Option 2: Follow a mandatory approach and apply all four selection criteria

- 5.5 Direct organisations that meet all four selection criteria to report in the second round of the ARP. All organisations that reported in the first round would be required to provide a progress update. New Reporting Authorities to the process must conduct the full reporting exercise. Under this option we estimate there will be 9 new Reporting Authorities and 90 providing progress updates.

Option 3 Follow a voluntary approach extending the invitation to local councils

5.6 This will follow the same voluntary approach as option 1 but now the invitation would be extended to local councils. This reflects a partial relaxation on the duplication criteria because a number of local councils have signed up to the Climate Local initiative.¹⁰ Under option 3, organisations and local councils that meet the criteria would be invited to report in the second round of the ARP. For organisations that reported in the first round, a progress update will be asked for. Those new to the process (including all local councils) would conduct the full reporting exercise. Under this option we estimate there will be between 56 to 59 new Reporting Authorities, of which 50 are local councils and 68 providing voluntary progress updates.

Option 4: Follow a mandatory approach and include all local councils

5.7 This would follow the same mandatory approach as option 2 but now all local councils would be included. Once again, this reflects a partial relaxation on the duplication.¹¹ Proportionality is also partially relaxed because the size and therefore financial capacity of local councils vary significantly. Under option 4, organisations that meet the four selection criteria and all local councils would be directed to report in the second round of the ARP. For organisations that reported in the first round, a progress update would be required. Those new to the process must conduct the full reporting exercise. Under this option we estimate there would be 362 new Reporting Authorities, of which 353 would be local councils as well as 90 organisations from the first round providing progress updates.

¹⁰ Climate Local is a voluntary commitment to drive action on climate change in local councils. Part of this initiative is to improve local councils' resilience to climate change and extreme weather events.

¹¹ For both options 3 and 4 we considered inviting/mandating individuals hospitals and schools as well as local councils. However, we considered this to be in breach of the proportionality criterion and would lead to excessive cost or reporting.

Theoretical framework: costs and benefits of reporting

- 6.1 This section provides a theoretical illustration of the costs and benefits government expects to see from the Adaptation Reporting Power (ARP). The costs of reporting will occur in the near future. The benefits of reporting are numerous, interdependent and unique to each Reporting Authority. It is difficult to predict when the benefits will materialise and their size given current uncertainty of climate change impacts. A deterministic approach, assuming a specific scenario and identifying corresponding benefits, ignores the low probability and high risk impacts of climate change.
- 6.2 It is beyond the scope of this impact assessment to provide a detailed analysis of these benefits. Our aim is to provide an overview of the potential benefits of reporting. We demonstrate, where possible using numerical illustration, how these may be significant. We also seek to identify evidence gaps where future research may help to improve future impact assessments for the ARP. In addition, we will put in place an evaluation framework to assess the impact that the second round reporting has had in increasing take-up of climate actions.
- 6.3 The costs will be borne almost completely by the Reporting Authorities which will need to dedicate staff time to undertake the reporting. We anticipate a small additional cost to government in terms of providing support to Reporting Authorities. We estimate this will be a cost to government of between £2,500 and £5,000 for new RAs and between £250 and £500 for those providing a progress update.¹²
- 6.4 We expect that increasing the number of Reporting Authorities will raise total costs of the ARP proportionately. For example, if the number of Reporting Authorities doubled the total cost would be expected to double. Significant levels of intra-sectoral collaboration could lead to economies of scale for those Reporting Authorities. This is discussed in more detail in Section 8.
- 6.5 The consideration of benefits requires assumptions about the extent to which reporting leads to adaptation actions from Reporting Authorities. An organisation will introduce an adaptation action provided it is cost effective.¹³ Subsequent discussion of benefits in this impact assessment is therefore net of the cost of implementation (i.e. net benefits). We further assume that having more Reporting

¹² These figures are based on consultation with the Environment Agency who will be providing this support to Reporting Authorities.

¹³ We refer here to an action being privately cost effective. This ignores barriers which may alter the cost effectiveness of particular private actions. The reporting process which this document is assessing should help overcome barriers identified in Section 2.

Authorities will increase total benefits but at a diminishing rate. This will occur as we begin to relax the four selection criteria of the Reporting Authorities for the following reasons:

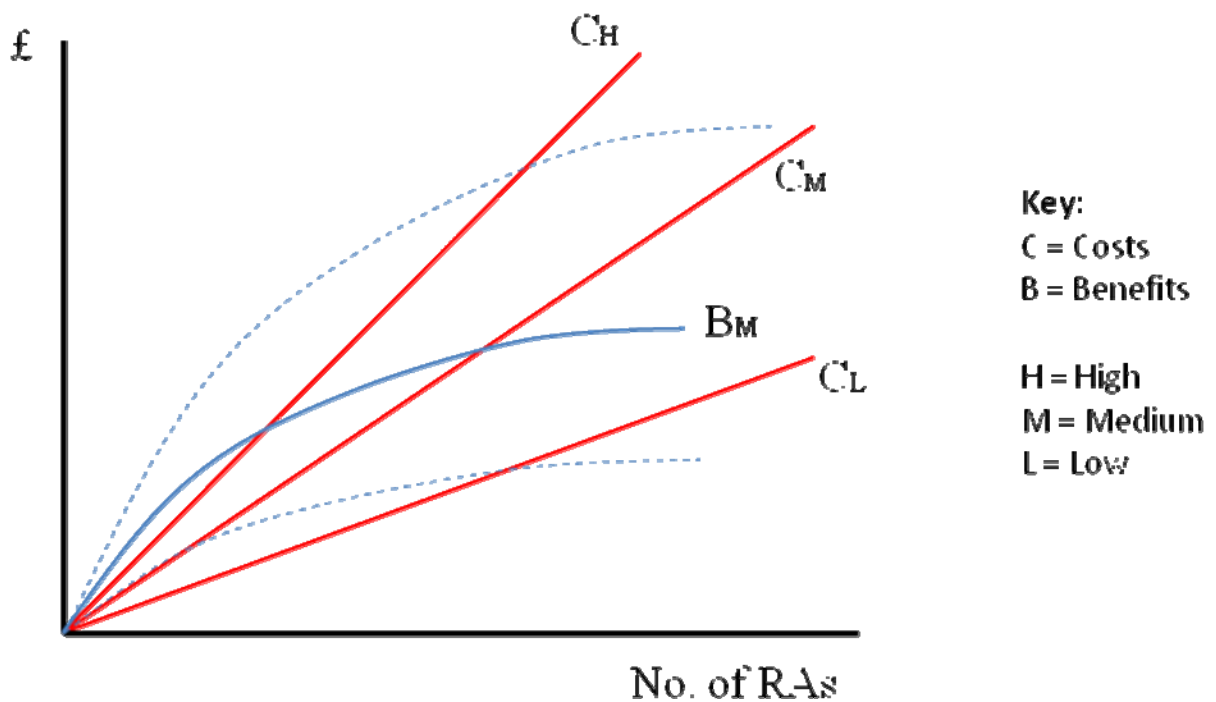
- Some organisations are already working on adaptation to climate change (e.g. the Climate Local initiative for local councils) and directing them to report is unlikely to lead to significant additional benefit.¹⁴
- Requiring organisations with public functions to report which are not vulnerable to climate change is likely to have limited benefits, both privately and socially.
- Some organisations with public functions may realise the benefits of adaptation without the need of the ARP.
- As the number of Reporting Authorities increases, adaptation measures are likely to overlap and there are likely to be spill-over effects and knowledge sharing which will limit the need to report.

6.6 Figure 2 below plots the anticipated costs and benefits of reporting as the number of Reporting Authorities (denoted RAs in Figure 2) increase. This is purely theoretical and not based on any empirical calculations. C_H reflects the upper bound of the cost range, C_L the lower bound and C_M the mid-point. The curve 'B' represents the true benefits of reporting which, for illustration, we assume to be approximately logarithmic in shape.¹⁵ The dotted blue lines above and below demonstrates a range of uncertainty around the true benefits of reporting.

¹⁴ Hence, we are assuming that the benefits of private initiatives are equivalent to those anticipated in the ARP.

¹⁵ Thus benefits diminish but never become negative. It is, of course, possible that for very high numbers of RAs that the benefits curve dips down e.g. through maladaptation or cost ineffective decisions. Furthermore, the shape of the curve may differ for RAs reporting voluntarily and those directed to do so.

Figure 2. Costs and benefits of reporting as number of RAs increase



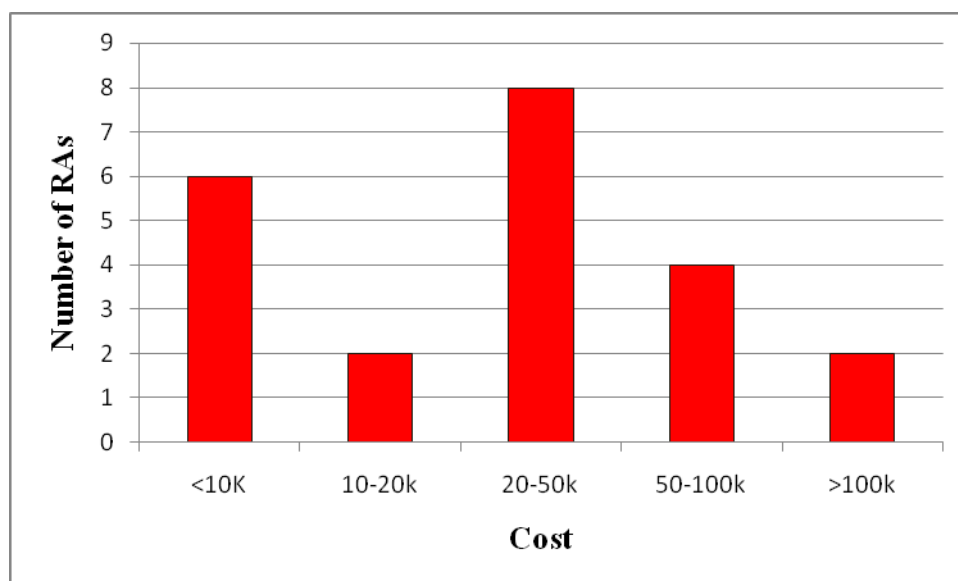
Source: Defra analysis

- 6.7 Theory cannot specify the optimal number of Reporting Authorities that should be reporting under the ARP. However, we can ensure cost effectiveness, if not optimality, by ensuring the number of Reporting Authorities is at a point where the benefits curve is above the cost curve. Here, the number of Reporting Authorities ensures benefits of reporting outweigh the costs.
- 6.8 Directing organisations could also force organisation to report when they do not believe that reporting is in their best interests. Using a voluntary approach means that if organisations choose to report they must consider that the benefits of reporting outweigh the costs. The benefits are not only financial but also relate to organisational reputation, and maintenance of position within a sector. In addition a voluntary approach will provide assurance that the process is flexible and proportional to the organisation's needs.

Monetising costs of the Adaptation Reporting Power

- 7.1 The impact assessment of the first round of the Adaptation Reporting Power (ARP) laid out a basic framework for cost estimation. It assumed the costs of conducting a risk assessment and devising a programme of measures to address climate change risks to be between £25,000 and £60,000 per Reporting Authority over four years. This does not include the cost of implementing the measures.
- 7.2 After completion of the first round a questionnaire was distributed to all Reporting Authorities to feed back on the reporting process. It included a question on the benefits and costs of reporting. 22 of the 103 Reporting Authorities completed the questionnaire including the costs and benefits question (a 21% response rate). Costs were monetised in a variety of ways. Some reporting authorities provided approximate monetary amounts whilst others gave values in full time equivalents (FTE).
- 7.3 Figure 3 displays distribution of costs in first round reporting for Reporting Authorities that responded to the questionnaire with summary statistics below.¹⁶

Figure 3. Cost of Reporting in First Round



¹⁶ A number of assumptions were used to construct this. Firstly, annual salary was assumed to be £45,000 for reporting authorities providing costs in terms of full-time equivalents. Secondly, there were assumed to be 222 working days in a calendar year once accounting for weekends and annual leave. Thirdly, we assume these costs occur in 2013 and discount appropriately.

Sum:	£957,003
Mean:	£43,500
Median:	£29,561
Standard Deviation:	£54,442

- 7.4 Ten of the 22 reporting authorities' costs (45%) are estimated to fall within the range of £20,000-£50,000. The mean cost is £43,500. The standard deviation is large at £54,442 implying there is significant variation of costs of individual authorities around the mean value. Indeed, the lowest cost was estimated to be £2,400 and the largest £230,000.¹⁷ Therefore the median value, which is not affected by outlying observations, may provide a more realistic estimate.
- 7.5 Figure 4 provides a sensitivity analysis of assumed salary of the full time equivalent writing the adaptation report. It shows the variation in mean and median costs of an adaptation report. Rather than choosing £45,000 we consider a range of £30,000 to £70,000 which we convert into a daily rate. The mean cost of reporting has a range of £33,156 to £60,741. The median cost of reporting has a narrower and lower range of £24,407 to £40,888. We take the lower bound of the median cost and the upper bound of the mean cost (£24,407 to £60,741) as a conservative range of estimates for the cost to each Reporting Authority.

¹⁷ This large variation in costs is difficult to explain. The Reporting Authority (which volunteered to do its report) with costs of £230,000 stated that their cost was 5 full-time annual staff plus £5,000 in expenses. The Reporting Authority with the lowest cost gave a specific financial cost. It is possible that these costs were overestimated and underestimated respectively but we lack the information to rule these as outliers and so tentatively retain them in our calculations.

Figure 4: Mean and Median Cost for Different Wage Assumptions



Progress updating

- 7.6 As well as inviting a small number of new organisations to report under the ARP, it is also important to obtain a progress update from all first round Reporting Authorities to publicise the actions they have taken to adapt to climate change since reporting. In total 103 organisations made up the first round of the ARP. However, due to mergers and agreements to undertake future reports jointly, we estimate the number of update reporters will fall to 90.
- 7.7 The progress update should take the form of a short report and we anticipate the cost to be a proportion of the full reporting cost. We assume the cost will be one tenth of the estimated cost of the full reporting (£4,848 to £12,148).¹⁸ This is the equivalent of between 12 and 30 working days.¹⁹

¹⁸ These figures are one fifth of the full cost of reporting given in paragraph 7.5. These have been calculated based on feedback from the consultation period.

¹⁹ We assume 222 working days in a calendar year. And an annual salary of £45,000

Efforts made to reduce costs to Reporting Authorities

- 8.1 Within the selected approach a number of efforts have been made to reduce the costs to Reporting Authorities.
- 8.2 For example the government has agreed with electricity generation companies that they will provide a progress update at a sectoral level rather than individual reports, which will reduce the costs of the process to each company.

Potential for avoided cost through Reporting Authorities collaborating

- 8.3 In the first round of reporting, electricity generators who were directed to report formed an Association of Electricity Producers (AEP) working group to work together to produce their adaptation reports. Seven of the nine electricity generators directed to report in the first round of the ARP responded to a questionnaire evaluating the reporting process. Under the same assumptions of Figure 2, the summary statistics of the electricity generators are provided in Table 1 below:

Table 1. Summary statistics of electricity generators

Number of generators	7
Actual Range of Reported Costs	£14,968-£38,116
Sum	£186,216
Mean	£26,603
Median	£29,126
Standard Deviation	£8,471
Range of costs without collaboration	£24,407-£60,741

- 8.4 Table 1 gives the cost per Reporting Authority when they collaborated, which was less than the average cost incurred by other Reporting Authorities, demonstrating the potential for collaboration to reduce costs. The smaller standard deviation indicates there is little variation around the mean value. Taking the mean cost this falls close to the lower bound estimate subtracting from the range of overall costs could lead to a potential saving of up to £34,138 per electricity generator.²⁰
- 8.5 Collaboration is likely to have wider implications than just being a cost saving exercise, although it is only possible to discuss these speculatively. It promotes knowledge transfer and may help to overcome market failure as individual organisations no longer act in their own private interest. Furthermore, pooling of financial resources may help to overcome inertia as a collaborative body provides a clearly defined focus on adaptation.
- 8.6 The government also consulted on how guidance could be made useful and helpful to Reporting Authorities. Feedback from the first round of reporting suggests that some organisations found the Statutory Guidance overly prescriptive and inappropriate for their organisation. By taking a voluntary approach and revising guidance, the government plans to reduce the burden of reporting on new organisations.
- 8.7 The Secretary of State will invite light touch progress updates to reduce burden on first round Reporting Authorities rather than requiring a completely new risk assessment. Furthermore the government will continue to work with organisations to ensure that adaptation reporting fits neatly with existing processes. We are aware for instance from discussions with water companies that a considerable amount of adaptation information will be contained within their Business plans for the Price Review 2014. Organisations may choose to 'sign-post' to this information in their submission to government which will further reduce costs.

²⁰ This aggregates up to £307,242 to reflect the nine generators in the first round.

Monetising benefits of the Adaptation Reporting Power

9.1 It is anticipated that the Adaptation Reporting Power (ARP) will bring a wide variety of private benefits to Reporting Authorities and wider benefits to society.

Private benefits

9.2 In terms of private benefits the ARP will help identify relevant climate change risks for the Reporting Authorities and help to incorporate these into current risk management processes. This may lead to adaptive measures that would not otherwise have been implemented. The ARP will encourage Reporting Authorities to consider appropriate early adaptive action. This is particularly important in sectors where long-term planning is required.²¹

9.3 The private benefits of reporting will correct market failure by bridging information gaps and thus allowing Reporting Authorities to maximise opportunities from climate change and minimise threats.

Societal benefits

9.4 The ARP has the ability to provide wider societal benefits. This may occur in a number of ways. If organisations with public functions implement measures to improve resilience it avoids (or reduces) costs of future disruptions. For example, increased resilience of electricity substations to flooding would reduce the potential for power cuts impacting on service provision. Identifying these risks through the ARP can potentially avoid the problem of moral hazard as long-term risks are incorporated into the strategic framework.

Other benefits

9.5 The ARP will provide the government with information on current understanding and the benefit to authorities of incorporating adaptation to climate change into their risk management strategies. An evaluation plan will help to assess the actual take-up of climate actions identified in the ARP.

9.6 The first round of the ARP also helped to identify collaborative opportunities in both the reporting itself and identifying risks. For example, the Association of Energy

²¹ Examples could include new/improved infrastructure and the construction of buildings

Producers Working Group discussed above chose to follow a common approach to reporting in electricity generation.

Determining the benefits of the Adaptation Reporting Power

- 9.7 Identifying benefits from the reporting process faces inherent difficulties. Determining how far reporting changes behaviour, and to what extent reporting provided an additional impetus to prioritise climate change adaptation is subjective. Simply asking RAs may not provide a fair evaluation of the question as they may not wish to admit they were previously unprepared for a future climate.
- 9.8 Quantifying the benefits of adaptation is extremely challenging, and the organisations likely to have the capacity to provide quantifiable measures of adaptation benefit are also likely to be organisations which already had well-developed thinking on climate change adaptation.
- 9.9 Defra sent a questionnaire to first round Reporting Authorities. They indicated that they found the process useful, and in some cases it began fresh consideration of climate change. For example, Scottish Power Energy Networks noted that they had not considered climate change risk before being directed to report- and stated:

'the development of this Adaptation Report is the start of a process of a more formal consideration of climate change risk within SP Energy Networks'

- 9.10 Overall the results of the questionnaire suggested that the process was useful to the majority of Reporting Authorities although they struggled to identify monetised benefits of reporting.

Case study of a success story²²

"Has the production of this report led to a change in your management of climate risks?"

The production of this report has resulted in the Port of London Authority (PLA) considering climate change risk, and the necessary adaptation measures in something other than the abstract. When Managers met for the first workshop session, there was a general understanding of climate change, but little as to the actual forecasts and their possible implications for the PLA's duties, activities and functions. Following an assessment of the forecasts and the 'brainstorming' exercise, the potential risks identified

²² Taken from the Cranfield Report on 'Evaluating the risk assessment of adaptation reports under the Adaptation Reporting Power'. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82751/annex-b-cranfield-uni-report-arp.pdf

were surprising - it was originally considered that the main risks, and hence need for adaptation measures, would be primarily if not exclusively focused in the lower reaches of the tidal Thames. Instead, the evaluation process demonstrated that by far the most serious risks were apparent within the upper reaches. This has resulted in a complete change in emphasis within the organisation as to where the greatest need for future adaptation activities will ultimately be focussed.

Similarly, the production of the report has resulted in a structure to the PLA's management of climate change risks. It has provided a framework for, in particular, the long-term data collection and monitoring necessary to provide an appropriate basis for future decision making. The processes required for review and reporting will also be initiated as a result of the preparation of this report.

The evaluation process has enabled Managers to obtain a meaningful understanding of the short and longer-term measures necessary for the PLA to manage climate change risks within the context of the organisation's activities. Most importantly, the production of this report has enabled the PLA to consider climate change as it will affect the organisation; to understand what it will mean for the tidal River Thames; and most importantly to ensure that action is taken on the basis of a sound evidence base which is provided by extant and new data collection and monitoring."

9.11 Even though the benefits are highly uncertain, and may not be evenly realised; they are potentially vast in proportion to the small, fixed costs to organisations (which they are choosing to accept in any case under the preferred voluntary option).

Wider social benefits of adaptation

9.12 The first round of the Adaption Reporting Power provided only limited, purely qualitative, analysis of the benefits of reporting. Nevertheless a number of potential benefits were identified which remain relevant to the second round. These include raising awareness and mapping the risks of climate change, encouragement of early adaptation actions and sustainability benefits.

9.13 For the second round of the ARP there are still a number of evidence gaps which limit our understanding of the benefits of adaptation reporting. However, using the Climate Change Risk Assessment (Defra, 2012) we have investigated and attempted to quantify one of the risks resulting from the impacts of climate change. The social benefits of the ARP are dependent on which sector it is applied to. This illustrative example focuses purely on the health sector as all of the options included the need for health sector involvement in reporting.

9.14 The Climate Change Risk Assessment health sector report estimates the climate change impact on mortality and morbidity in 2020, 2050 and 2080. This illustrative example considers projected climate change impacts on heat related deaths per year only. It is estimated that heat related deaths will increase over time. Findings

from the CCRA are presented in the second row of Table 2. The third row presents the monetary cost of increased heat related deaths using the Department for Transport's Accidents Sub-Objective which estimates the value of preventing a fatal casualty to be £1,585,510.²³ The fourth row estimates these in 2013 pounds and the final row converts this to the value of preventing one death.

Table 2. Heat related deaths and estimated monetary cost

	Current Estimate (2010)	2020	2050	2080
Increase in heat related deaths	1,100	1,230-2,800	1,680-7,000	2,100-15,100
Cost to society (£ billions undiscounted)	1.74	1.95-4.44	2.66-11.10	3.33-23.94
Present value cost to society (in 2013 £ billions)	1.85	1.53-3.49	0.74-3.11	0.33-2.39
Present value of preventing one death (in 2013 £millions)	1.68	1.24	0.44	0.16

9.15 These costs are large and reflect only one impact of climate change on health. The Climate Change Risk Assessment health sector report notes that estimates given are in the absence of any physiological or planned adaptation.²⁴ Clearly adaptation actions, such as the uptake of cooling measures in hospitals may have a significant effect of reducing heat-related deaths, and thus substantial benefits relative to the size of costs.²⁵

²³ Estimated in 2009 pounds. This consists of the value of lost output (£545,040), human costs (£1,039,530) and medical and ambulance costs (£940). Available online at:

<http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.4.1.pdf>

²⁴ The health sector report of the CCRA is available online at:

<http://randd.defra.gov.uk/Document.aspx?Document=CCRAfortheHealthSector.pdf>

²⁵ Uptake of active cooling measures, like air conditioning, could increase energy demand and could lead to feedback effects with increased greenhouse gas emissions and consequent temperature rises (Deschênes and Greenstone, 2007)

9.16 The ARP process will contribute to helping organisations within the health sector identify where they are vulnerable to overheating risks, and identify the measures they are going to take in response. How far any reduction in deaths from overheating can be attributed to the ARP is unclear and cannot be determined on present evidence. However given the low costs of reporting, only a very small proportion of the benefits would need to be attributed to the ARP for it to become cost effective. Preventing just a single heat related death in 2050 is equal to approximately £440,000 in present value terms.²⁶

²⁶ In 2013 pounds, estimated assuming a discount rate of 3.5%. See HM Treasury (2003).

Options assessment: costs and benefits

- 10.1 Costs are estimated for options 1, 2, 3 and 4 and compared to expected benefits. The full results presented in Table 3 below.
- 10.2 In total we assume there are 9 organisations who meet the four selection criteria defined previously and are eligible to report in this second round of the ARP. Furthermore the government will invite first round RAs to provide a progress date for how adaptation measures are being implemented.

Option 1: Follow a voluntary approach and apply all four selection criteria

- 10.3 All organisations that meet the four selection criteria and did not report in the first round will be invited to join a voluntary process of adaptation reporting. This will be a non-regulatory approach. All potential Reporting Authorities have already been contacted to gauge interest in voluntary reporting. **This is the selected option.**

Estimation of costs

- 10.4 We estimate that 6 to 9 potential Reporting Authorities will agree to report voluntarily. Furthermore, it is believed that most first round Reporting Authorities will provide a voluntary progress report. We assume 68 out of the 90 first round Reporting Authorities (approximately 75%) will provide a progress update.
- 10.5 Cost of reporting for between 6 and 9 new Reporting Authorities will be between £161,442²⁷ and £591,669²⁸. The progress update for 68 first round Reporting Authorities will be £348,935²⁹ to £860,078³⁰. Total costs are therefore estimated to be between £510,377 and £1,451,747.

Discussion

- 10.6 The ARP may lead to numerous additional social benefits. However, providing a full quantitative assessment of the benefits of reporting is beyond the scope of current available evidence and this impact assessment.
- 10.7 Adaptation reporting for infrastructure organisations from the energy, water and transport sectors has increased their resilience to climate change impacts such as

²⁷ Present value, assuming each new RAs incur a cost of £24,407

²⁸ Present value, assuming each new RAs incur a cost of £60,741

²⁹ Present value, assuming each progress update incurs a cost of £4,881

³⁰ Present value, assuming each progress update incurs a cost of £12,148

increased flooding, drought or heat waves. This should reduce transport delays, avoid power outages or help water companies manage water supply/demand deficits all of which will have wider benefits beyond the Reporting Authorities themselves.

- 10.8 Government has also identified a number of new organisations to invite to report on climate change. Reporting by the Chief Fire Officers' Association, for example, will help the fire service to identify and respond to risks from climate change such as increased frequency of severe weather events and wildfires. Reporting from the Marine Management Organisation will help it to deliver sustainable development for the country's seas by integrating climate change into its decision-making processes.
- 10.9 All of the organisations identified are responsible for making long-term decisions which should consider projections of future climate. Failure to climate-proof these decisions may result in costly changes of direction in future or increased vulnerability to climate events. Given the very low costs of reporting, and the potentially huge benefits of increased adaptation consideration, it is our conclusion that the benefits are likely to vastly exceed the costs.
- 10.10 Section 11 provides an overview of the additional information needed to provide a more quantitative assessment of benefits likely to stem from adaptation reporting. Its purpose is to provide a conceptual framework for an 'ideal' cost-benefit analysis which could drive future analysis and fill current evidence gaps.

Option 2: Follow a mandatory approach and apply all four selection criteria

- 10.11 All organisations that meet the four selection criteria and did not report in the first round would be directed to produce an adaptation report. This would be a regulatory approach.

Estimation of costs

- 10.12 The 9 new Reporting Authorities identified would be directed to report. The 90 existing first round Reporting Authorities would also be directed to provide a progress update.
- 10.13 Cost of reporting for the 9 new Reporting Authorities will be between £242,163 and £591,669. The progress update for 90 first round Reporting Authorities will be between £461,826 and £1,138,338. Total costs are therefore estimated to be between £703,989 and £1,730,007.

Discussion

- 10.14 It is difficult to isolate the additional benefits under option 2 compared to those identified in option 1. This is because those organisations subject to direction have already declined an invitation to volunteer. It might be that these organisations believe they are already resilient to climate change and therefore the ARP will provide little additional private benefit to them. Regardless, a directed organisation could report and then fail to implement any worthwhile adaptation measures they identify. In such an event no wider social benefits of the ARP will be realised compared to option 1. It is important to note that as the evidence base improves over time we hope to understand better the additional benefit that directing brings and whether it is likely to be a cost effective alternative to the voluntary approach.
- 10.15 One of the government's central aims is to free business and civil society from unnecessarily burdensome and detailed regulation. A voluntary approach to reporting ensures that the process is flexible and responsive to the needs of Reporting Authorities and reduces the likelihood of a 'tick-box' approach to reporting. The aim is that the most appropriate actors will identify and own the actions, in response to the threats and opportunities and that the level of work will be proportionate to the organisation.
- 10.16 At this stage we anticipate that the majority of organisations are willing to volunteer and therefore there is limited reason to take a directive approach to reporting even if the additional costs are modest. We therefore conclude that following the voluntary approach in option 1 is preferable to the mandatory process of option 2.

Option 3: Follow a voluntary approach and invite local councils to report

- 10.17 Option 3 follows an identical voluntary, non-regulatory approach to reporting as Option 1. However, it also extends the invitation to local councils.

Estimation of costs

- 10.18 We assume that the same 6 to 9 Reporting Authorities and 68 progress updates will volunteer as in option 1. Furthermore, we assume 50 local councils would choose to volunteer. This reflects the current number of local councils which have signed up to the Climate Local initiative.³¹ These assumptions mean a total of between 56 and 59 Reporting Authorities and 68 progress updates. We assume the cost of

³¹ http://www.local.gov.uk/web/guest/the-lga-and-climate-change/-/journal_content/56/10171/3574359/ARTICLE-TEMPLATE.

reporting remain in the range of £24,407 to £60,741 per local council as an original report needs to be written.

10.19 The cost of reporting for the 56-59 new Reporting Authorities is estimated to be between £1,506,792 and £3,878,719. The progress update for 68 volunteering first round Reporting Authorities will be £348,935 to £860,078. Total costs are therefore estimated to be between £1,855,727 and £4,738,797.

Discussion

10.20 Extending the invitation to report to local councils increases the scope of the project significantly, with the project coming almost four times more expensive than option 1.

10.21 Furthermore it is unclear whether inviting local councils to report would provide any further benefit compared to option 1. We anticipate that the majority of local councils which would volunteer for the ARP are already signed up to the Climate Local initiative.³² Therefore, the ARP might not provide any additional social benefits on top of what is achieved through Climate Local.

Option 4: Follow a mandatory approach and include all local councils

10.22 Option 4 follows an identical mandatory, regulatory approach to reporting as option 2. However, in option 4 all 353 English local councils would be directed to report.

Estimation of costs

10.23 The same 9 Reporting Authorities and 90 progress updates will be directed to report as in option 2. Furthermore, all 353 local councils would be directed. This gives a total of 362 Reporting Authorities and 90 progress updates.

10.24 Cost of reporting for the 365 Reporting Authorities would be between £9,740,334 and £23,798,242. The progress update for 90 volunteering first round Reporting Authorities would be £461,826 to £1,138,338. Total costs are therefore estimated to be between £10,202,160 and £24,936,580.

Discussion

³² Climate Local is a voluntary commitment to drive action on climate change in local councils. Part of this scheme is to improve local councils' resilience to climate change and extreme weather events.

- 10.25 The additional cost of mandating all local councils to report would be very large and would be likely to run into the tens of millions. This is more than 22 times the cost of option 1. All local councils, however, are likely to face costs from failing to adapt to climate change and the ARP could help them identify ways to reduce these costs. This is particularly the case for those who have not signed up to the Climate Local initiative.
- 10.26 It is not the intention of the government however to direct local councils to produce adaptation reports. Instead government encourages local councils to engage through their own sector-led Climate Local initiative. Given the much greater costs of Option 4, the risk of duplication with the Climate Local initiative and the government's desire to reduce burden on local authorities, option 4 has been rejected.

Quantitative results

- 10.27 Table 3 below summarises the costs for each option and compares them with each other. Under options 2, 3 and 4 an additional row provides the magnitude of costs relative to the upper and lower bound estimates for least cost option 1. For example, a value of between 1.19 and 1.38 in option 2 indicates that it is 19% to 38% more expensive than option 1.

Table 3. Summary of options

Option 1

COSTS	Number of RAs	Guidance Cost	Lower Bound	Upper Bound
New RAs	6 to 9	£15,000 to £45,000	£161,442	£591,669
Local councils	0	£0	£0	£0
Progress Updates	68	£17,000 to £34,000	£348,935	£860,078
Total	74 to 77	£32,000 to £79,000	£510,377	£1,451,747

Option 2

COSTS	Number of RAs	Guidance	Lower Bound	Upper Bound
New RAs	9	£22,500 to £45,000	£242,163	£591,669
Local councils	0	£0	£0	£0
Progress Updates	90	£22,500 to £45,000	£461,826	£1,138,338
Total	99	£45,000 to £90,000	£703,989	£1,730,007
Magnitude of costs relative to Option 1:			1.38	1.19

Option 3

COSTS	Number of RAs	Guidance	Lower Bound	Upper Bound
New RAs	6 to 9	£15,000 to £45,000	£161,442	£591,669
Local councils	50	£125,000 to £250,000	£1,345,350	£3,287,050
Progress Updates	68	£17,000 to £34,000	£348,935	£860,078
Total	124 to 127	£157,000 to £329,000	£1,855,727	£4,738,797
Magnitude of costs relative to Option 1:			3.64	3.26

Option 4

COSTS	Number of RAs	Guidance	Lower Bound	Upper Bound
New RAs	9	£22,500 to £45,000	£242,163	£591,669
Local councils	353	£882,500 to £1,765,000	£9,498,171	£23,206,573
Progress Updates	90	£22,500 to £45,000	£461,826	£1,138,338
Total	452	£927,500 to £1,855,000	£10,202,160	£24,936,580
Magnitude of costs relative to Option 1:			19.99	17.18

Improving current gaps in the evidence

11.1 The limitations in the current impact assessment reflect the extensive gaps in evidence which exist in quantifying the potential benefits of reporting on adaptation. The benefits the Adaptation Reporting Power will bring are predominantly through avoiding cost of being unprepared for a changing climate or avoiding making decisions today which lead to maladaptation. Table 4 below highlights some of the evidence gaps which future impact assessments should seek to overcome.

Table 4. Evidence gaps of the Adaptation Reporting Power

Benefits/Avoided Costs	Current Evidence Gaps
Avoided transport delays from flooding or overheating	There is limited understanding of the potential increase in transport delays as a result of climate change in order to set a baseline against which adaptation action can be measured. However, we can quantify the cost of time delay once this is known.
Avoided macroeconomic shocks (e.g. financial) caused by extreme weather events	Limited understanding of the potential for climate change to cause macroeconomic shocks through extreme weather events. The magnitudes of these impacts, including their indirect effects, remain uncertain.
Avoided power outages	More evidence is needed about how climate change impacts like flooding may affect the resilience of power supply. We need a better understanding of the benefits of measures to avoid power outages.
Avoided mental health impacts of flooding	There is currently little understanding of the likely costs of the mental health impacts of flooding. This question has been specifically identified by the Economics of Climate Resilience project.
Avoided water deficit	Better understanding is needed about what the benefits of reducing the deficit between water supply and water demand are likely to be, and how

	far the Adaptation Reporting Rower is able to contribute to this reduction.
Improved long-term investment decisions as they are made on the basis of future as well as current climate.	We need to better understand the benefits of long-term investment decisions being climate-proofed, and determine how adaptation reporting increases an organisation's capacity to understand and manage climate risk.
Effectiveness of reporting to affect behaviour	More evidence is needed on the relationship between climate risk reporting and adaptation action.

Monitoring and evaluation

- 12.1 Following completion of the second round the government will undertake a review of the impacts and benefits of the Adaptation Reporting Power. This could involve analysing the adaptive capacity of organisations after the second round and monitoring changes. Recently published work by Defra has conducted similar analysis for a number of important sectors.³³ In particular, the research will need to understand the effectiveness of the voluntary approach to reporting. This is dependent on developing a better understanding of the benefits of reporting itself. It is also important to acknowledge the expected private and social benefits of implementation which may occur as a result of the ARP. These are the indirect benefits of reporting.
- 12.2 Quantifying the benefits of adaptation reporting remains a significant evidence gap. The government will make use of other related research, for instance from the Economics of Climate Resilience project.³⁴

³³ To be published as part of the PREPARES project – link to be added at a later date

³⁴ The Economics of Climate Resilience can be found online at:

<http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18016>