



Department
of Energy &
Climate Change

CRC Energy Efficiency Scheme Evaluation

Final synthesis report

July 2015

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Executive summary

CAG Consultants, in partnership with Carbon Trust, Databuild and the Imperial College Business School, were commissioned by DECC to undertake research on the CRC energy efficiency scheme, focussing on phase 1 of the scheme which ran from April 2010 to the end of March 2014.

The research also examined a number of wider themes including: how energy use is managed by organisations, what steps they may have taken or considered to improve energy efficiency in recent years and which factors influenced their decision making processes.

This final synthesis report brings together findings from three workstreams: a quantitative survey, qualitative research and econometric research, as well as supporting desk research. The detailed findings of the three workstreams are documented in separate appendices.

Background to the CRC

The CRC was designed to drive energy efficiency and reduce carbon emissions in large non-intensive energy users, both public and private sector, across the UK. Collectively these are estimated to be responsible for around 10% of the UK's greenhouse gas emissions. Qualification for the CRC was based on electricity usage, with over 13,000 organisations required to report their electricity consumption in 2008. Organisations became subject to the scheme if, during 2008, they had consumed over 6,000 megawatt-hours (MWh) of qualifying electricity. The CRC operates in phases. Phase 1 of the scheme ran from April 2010 to the end of March 2014.

The scheme features a range of drivers to encourage organisations to develop energy management strategies that promote a better understanding of energy usage and to take up cost-effective energy efficiency opportunities. Organisations that meet the original qualification criteria are required to participate, and thereafter buy allowances for every tonne of carbon they emit. Organisations must also report eligible carbon emissions to the relevant regulatory body on an annual basis. Allowances are purchased and then amounts equal to declared carbon emissions are surrendered. Senior management within each organisation have responsibility for compliance with the scheme: for example, authorising the purchase and surrender of allowances.

Various changes have been made to the CRC since its inception. The original design involved the recycling of revenue from allowances to participating organisations on the basis of their performance, as defined by an annual 'Performance League Table' (PLT). In October 2010 the government simplified the scheme and removed the recycling element. The CRC was further simplified in April 2013, following consultation with participants.

Aims of the research

It is important for government to know the impact that its policies have in practice (in contrast to their expected impacts) and to understand which elements of a policy have or have not worked. Evaluation of the CRC has taken place in this context: independent consultants were asked to

undertake robust analysis of how the CRC had been delivered in practice and provide an understanding of the actual energy efficiency, economic, financial and wider environmental impacts of the scheme. The findings of the evaluation will also inform and feed into the planned CRC review in 2016.

The evaluation aimed to assess the impact of phase 1 of the CRC, while also evaluating the delivery process for phase 1. It was therefore both a formative and a summative evaluation; with four main objectives:

A: Assess the extent that the CRC has delivered reductions in emissions by the take-up of energy efficiency measures.

B: Identify the barriers and drivers to energy efficiency and assess the extent to which the CRC has overcome barriers and emphasised drivers.

C: Assess whether the CRC has delivered abatement in a cost-effective manner.

D: Identify how the CRC has been delivered and whether it has been administered effectively.

This was a theory-based evaluation: a 'theory of change' was developed to test the mechanisms for objectives A-C while a 'customer journey' was developed to improve understanding of objective D.

Use of comparison groups

To assess the impact of the CRC on energy use and carbon emissions, it was important to explore what would have happened in the absence of the CRC. The methodology had to allow for energy efficiency and energy use being strongly influenced by non-CRC factors over the CRC period, such as the recession and energy price rises. Our approach was therefore to use a comparison group to control for these effects.

The evaluation used 'information declarers' as the comparison group. These were organisations which were obliged to report their electricity consumption in 2008 but which fell below the 6,000 MWh threshold in that year and were therefore not included in the CRC. For the purposes of qualitative and quantitative research samples were drawn from information declarers with electricity consumption in 2008 in the range 3,000-6,000 MWh (2,000-6,000 MWh for the public sector). The comparison group had comparable energy intensities to CRC participants: 'electricity intensity per unit of employment' is used as a proxy for energy intensity throughout this study. For the econometric research, the full set of information declarer meters for England and Wales was used as the comparison group.

The research also examined the behaviour of organisations which were fully exempt from paying for phase 1 CRC allowances because their carbon emissions were adequately covered by other government carbon schemes, namely Climate Change Agreements (CCAs) and the EU Emissions Trading System (EU ETS). Many of these organisations were more energy intensive than CRC participants.

No comparison group is perfect. Two limitations of 'information declarers' as a comparison group were: firstly, they tended to be smaller than CRC participants, although not necessarily less energy-intensive; and secondly, they may have been influenced by CRC communications, by the preparatory stages for the CRC and by the motivation of staying below the threshold for CRC in phases 1 and 2. The latter point means that our estimates of CRC impact on the CRC

participant group will tend to be conservative, since the comparison group itself may have been influenced by the policy.

Research methodology

The research methodology comprised three parallel workstreams plus supporting desk research. After an initial scoping study, the main research was undertaken between July and December 2014. There were three main elements of research:

- **a quantitative survey** of around 900 telephone interviews with energy managers, or their equivalent, across a range of medium to large organisations (including approximately 500 covered by the CRC, 100 covered by full CCA and EU ETS exemptions, and 300 information declarers). The aim of this workstream was to generate data on behavioural issues related to energy efficiency, and to generate statistics about perceptions of CRC delivery;
- **in-depth qualitative interviews** with 74 organisations, including both energy managers and senior managers in medium to large organisations (again, covering the CRC, CCA and EU ETS schemes, and information declarers). The aim of the qualitative workstream was to explore the reasons behind any changes in energy efficiency behaviours, including the role played by the CRC and other schemes; and
- **econometric analysis** of electricity and gas meter data, and related carbon emissions, for the period 2006 to 2012, looking for differences in energy consumption patterns between the CRC and comparison groups. The econometric analysis used a 'differences in differences' (DiD) approach.

For the quantitative survey a stratified random sample of CRC and non-CRC organisations was drawn from Environment Agency databases. The number of interviews conducted represented 24% of all CRC participants; 20% of information declarers with electricity consumption in the range 3,000-6,000 MWh (2,000-6,000 MWh for the public sector); and 15% of organisations covered by full CCA and EU ETS exemptions. Therefore, there was reasonable coverage of CRC participants and organisations in the policy's comparison groups.

The econometric analysis compared energy consumption between CRC participants and the comparison group in 'pre-treatment' and 'post-treatment' periods, defined as 2006-2009 and 2010-2012 respectively. These periods were defined in calendar years, which did not match exactly with the financial years used by the CRC. Furthermore, the econometric analysis does not examine differences in behaviour between the CRC and non-CRC organisations prior to January 2010, as the samples were matched to show similar pre-treatment behaviour. This may understate the impact of the CRC preparation period.

The qualitative and quantitative research was framed to participants as broad research on non-domestic energy efficiency, including the influence of government energy efficiency schemes. This allowed the interviews to establish the overall context and drivers for energy efficiency within an organisation, before asking about the influence of the CRC. This approach generated broad findings on non-domestic energy efficiency and government schemes, as well as findings relevant to the CRC evaluation.

Findings and analysis

Broad findings on non-domestic energy efficiency

The research found that nearly all the organisations investigated (inside and outside the CRC scheme) were taking some action on energy efficiency. More than two-thirds of energy managers reported that their organisation's level of action on energy efficiency had increased compared to 2010, the first year of the CRC. Rising energy prices were cited as the single most important driver for this change. Government carbon schemes, including the CRC, were also cited as drivers by more than half of all respondents.

Early action on energy efficiency (before 2010) was reported by public sector organisations, larger private sector organisations and those in energy-intensive sectors. Lack of funding was identified as a barrier to further action on energy efficiency by nearly half of all respondents, but around 20% of all respondents felt that there were no barriers to further action. Many respondents felt that there was a need for more coherence and consistency between government policies, both in terms of carbon schemes and in terms of Greenhouse Gas (GHG) reporting.

Detailed findings on the CRC scheme

A: Assess the extent that the CRC has delivered reductions in emissions by the take-up of energy efficiency measures.

There was consistent evidence from the quantitative and qualitative research to suggest that the CRC has had a beneficial impact on energy efficiency organisational behaviour and has had some positive influence on the take-up of energy efficiency measures. This impact appears to have been stronger in the private sector than in the public sector. For example:

- a third of CRC participants reported that action had been undertaken earlier or on a greater scale because of the CRC;
- CRC organisations were more likely than information declarers to report adoption of energy management practices such as conducting energy audits and installing energy reporting systems and software; and
- in the private sector, more CRC participants than information declarers reported that their board or senior management now met more frequently to discuss energy efficiency matters and that it was now easier to get board approval for energy efficiency investments, compared with four years ago.

The econometric analysis compared energy consumption between CRC participants and the comparison groups for the period 2006 to 2012. This analysis suggests that the CRC has reduced electricity consumption by an annual average of 3-5% between 2010 and 2012, compared to information declarers. For CRC organisations with the highest gas use there was a significant reduction in gas consumption (estimated at 30%) compared to information declarers.

While there is a need for caution with this result due to uncertainties in the data, this finding suggests that - for this group - the CRC may have had a sizeable impact on gas consumption¹.

There is also evidence that the CRC has reduced carbon emissions, compared to information declarers, by an annual average of 6-8%, between 2010 and 2012. In addition, there is weaker evidence that it has led to an improvement in energy efficiency (i.e. a reduction in energy intensity relative to information declarers), as measured by the proxy of electricity intensity per unit of employment).

For comparison, the original government Impact Assessment predicted that the CRC would lead to a 2% annual reduction in carbon emissions by 2015, under the original policy design². However this estimate applied to all fuels, not just electricity and gas.

There is mixed evidence on the scale of organisation most influenced by the CRC. The qualitative and quantitative research found that smaller organisations tended to report more CRC influence, as larger organisations were more likely to have already taken early action on energy efficiency. However, although the econometric research did not differentiate between sizes of organisation, it found that the CRC had the greatest impact at both extremes of consumption – on electricity meters in the lowest and highest bands. This analysis calculated that energy and emissions reductions from meters in the top 20% consumption band represented nearly three-quarters of the impact attributable to the scheme.

B: Identify the barriers and drivers to energy efficiency and assess the extent to which the CRC has overcome barriers and emphasised drivers.

The quantitative and qualitative evidence suggested that CRC has raised the profile of energy efficiency at board level in some organisations, through the legal requirement for compliance, through senior responsibility for compliance (particularly high-level sign-off of allowances) and through increasing the overall cost of energy. In addition to this financial driver, some organisations reported that the CRC's awareness-raising drivers had contributed to improvements in energy data and reporting, and improved visibility of energy use in their organisation.

Most CRC participants felt that the influence of CRC on reputation was less marked than its influence on finance or awareness: few CRC participants reported that the Performance League Table (PLT) (or its successor the Annual Report Publication (ARP)) had significant influence beyond year 1. However, the reputational influence of compliance appeared to be a strong driver.

But these were not universal effects – some organisations reported that the CRC had little impact on their energy awareness or energy-related behaviour because they were already taking action. Qualitative research found that organisations with the following characteristics tended to report early awareness and action on energy efficiency, before the CRC. These characteristics are explained further in chapters 4 and 6:

- high energy costs relative to total costs;

¹ The data on gas consumption used for this analysis is subject to a more limited match between the different component databases, leading to only a subset of CRC participants or information declarers being included. See Section 2.2.3 of the econometric research report for more detail.

² The Final Impact Assessment estimated that the CRC would save 1.3 MT CO₂ per year up to 2015, rising to 3.2 MT CO₂ per year by 2020, from a base of 53.2 MT CO₂. Reference: Final Impact Assessment on the Order to implement the CRC Energy Efficiency Scheme, DECC, January 2010.

- sensitivity to reputational drivers (e.g. public sector bodies, publicly-quoted organisations, organisations which tendered for public sector contracts and organisations with a high public profile);
- sensitivity to environmental factors (e.g. waste and water industries); and
- organisations which were larger scale (in terms of capacity to address energy management).

This was consistent with quantitative research findings that smaller organisations, with low energy intensity and lower electricity consumption, tended to report more CRC influence.

In contrast, the econometric research found that the CRC seemed to have most impact on electricity meters at the extremes of consumption, with higher consumption meters dominating the overall econometric results because of the greater scale of savings in electricity use.

The qualitative and econometric research appeared to suggest that the early stages of the CRC may have had most impact (i.e. pre-scheme preparation and the first year or so of the scheme). This appears to have been linked to the incentive effect of proposed revenue recycling, linked to the PLT, together with the impact of ensuring compliance at the start of the scheme.

C: Assess whether the CRC has delivered abatement in a cost-effective manner

The evidence gathered for this evaluation, in combination with other sources, suggests that the actions taken by participants in the CRC have been cost-effective. Payback criteria are a clear part of the investment decision for energy efficiency projects, and while requirements range from those looking for a very short (1 year) payback to those comfortable with longer paybacks (5 years or more), organisations reported looking for and making investments that do pay back. Lighting was the most popular technology for private and public participants, followed by building fabric, building controls, metering and boilers. All of these could be expected to pay back within five years in normal circumstances.

The costs to the public sector of delivering and providing oversight of the CRC were beyond the scope of this research.

The majority of participants recognised that energy efficiency action led to wider benefits beyond reduced energy and CRC costs. The most commonly noted benefit was reputational, manifesting in improved Corporate Social Responsibility (CSR) image, brand and better public relations (PR). Respondents also recognised benefit from reduced greenhouse gas (GHG) emissions and better sustainability performance, and improved employee engagement. On a more practical level some measures led to better light or heating performance and reduced maintenance.

Some unanticipated impacts were reported by participants during the research. These mainly took one of two forms: some organisations reported diversion of energy management resources away from implementation of energy efficiency projects towards compliance with the scheme; others noted impacts on competitiveness and profitability, where costs did not apply to competitors and /or could not be passed on to customers. One in three private sector participants said the impact on profitability was 'significant' or 'very significant'. Whilst sample sizes in the quantitative survey were not sufficient to give a full sector breakdown, there was some indication that the impact on profitability was perceived particularly strongly in the water and waste sectors and in accommodation and food sectors.

D: Identify how the CRC has been delivered and whether it has been administered effectively.

The evidence on the efficiency and consistency of scheme delivery was mixed. Around half of CRC participants in the quantitative survey felt the scheme was not delivered efficiently and consistently. It was unclear how far this was due to its design, changes made to the scheme, the way in which it had been delivered, or more general resistance to the scheme. Around two-thirds of participants, however, felt that the core processes were straightforward or clear.

Participant surveys conducted by the Environment Agency from 2011 to 2013 showed that customer satisfaction across most aspects of the scheme was low initially but improved over the following years of phase 1. The quality and clarity of communications was seen to improve over phase 1. Participants were initially frustrated by the written guidance and the help desk, but were much happier by the end of the phase, and the positive ratings in the customer surveys increased dramatically.

Evidence from a previous survey undertaken before the simplification of the scheme showed that the most burdensome aspects of the scheme were tasks related to annual reporting, and the effort required to understand the scheme on its introduction³. Qualitative research found that simplification had reduced the burden associated with these activities, for most but not all participants, and had reduced overlaps with other schemes. Qualitative and quantitative research found that the aspects still perceived to be burdensome by some participants, post simplification, were: the activities related to purchasing and surrendering allowances; some aspects of the use of the CRC Registry; and challenges associated with some participants' complicated organisational structures.

However, in the qualitative interviews, many participants felt that the successive changes to the scheme had made compliance more complicated, had created an administrative burden of adjustment to changes, and had undermined the overall credibility of the scheme.

Conclusions on CRC impact

While increasing energy costs have been the single biggest driver for increased action on energy efficiency in recent years, there is evidence that the CRC has had an impact on energy efficiency behaviour and carbon emissions, at least as sizeable, if not greater than the original impact assessment. This is supported by all three research streams: econometric, quantitative and qualitative.

Not all CRC participants were significantly influenced by the scheme: some were already taking early action on energy efficiency before the CRC. In those organisations which have been influenced by the CRC, the evaluation evidence suggests that the main mechanisms for influence were:

- the cost of allowances (both in raising awareness and in slightly improving the business case for energy efficiency investments);
- improved data and reporting on energy use;
- high-level sign-off of CRC allowances, which raised awareness at board level within some organisations;

³ KPMG, Assessing the Administrative Costs of the CRC Energy Efficiency Scheme, for DECC, 2011.

- the reputational aspects of complying with the CRC, and associated fear of enforcement and publicity about non-compliance; and
- reputational aspects of CRC publications, particularly the PLT, but only in the preparatory period and the first year of the CRC.

There was some suggestion across all workstreams that CRC impacts may have declined since the early stages of the scheme. This could be the subject of further research, when 2013 consumption data is available.

Conclusions on effectiveness of CRC delivery

Views on the efficiency of CRC delivery appeared to be influenced by the complexity of the scheme. Many participants felt that the scheme had imposed a significant administrative burden, especially at the beginning, and had found the scheme complicated to understand. Satisfaction with scheme delivery was low initially but improved over the following years of phase 1, particularly after simplification.

Many respondents in the qualitative and quantitative research felt that, without revenue recycling, the CRC had effectively become a 'tax' and could be more efficiently administered as such. But others felt that the process of reporting energy consumption and approving purchase of CRC allowances helped to make energy efficiency more visible within their organisations.

Within the broader findings on non-domestic energy efficiency, there were calls for a clearer strategic overview of government energy efficiency policy, for more consistency between government carbon schemes (including GHG reporting), more stability in policy and more forewarning of future change – to enable organisations to plan appropriate strategies to minimise compliance costs.

1. Introduction

CAG Consultants, in partnership with Carbon Trust, Databuild and the Imperial College Business School, were commissioned by DECC to undertake research on the CRC energy efficiency scheme, focussing on phase 1 of the scheme which ran from April 2010 to the end of March 2014.

The research also examined a number of wider themes including: how energy use is managed by organisations, what steps they may have taken or considered to improve energy efficiency in recent years and which factors influenced their decision making processes.

The scoping stage of this study was completed in June 2014, comprising a literature review, initial qualitative research and development of a theory of change for the evaluation. Stage 2 of the research, running from July to December 2014, comprised three separate workstreams: econometric research led by the Imperial College Business School, a quantitative survey led by Databuild and further qualitative research led by CAG Consultants. Synthesis of the findings from these workstreams was undertaken in stage 3.

This is the final synthesis report of the CRC evaluation, which draws on findings from stages 1 and 2 and also on further desk research undertaken by Carbon Trust during stage 3. These findings are supported by three workstream reports documenting the findings from each of the stage 2 workstreams. These are available in separate volumes as appendices to this report.

The CRC

The CRC is designed to drive energy efficiency and reduce carbon emissions in large non-intensive energy users, both public and private sector, across the UK. There are a wide range of participants including supermarkets, water companies, banks, local authorities and all central government departments. Collectively CRC participants are estimated to be responsible for around 10% of the UK's greenhouse gas emissions⁴.

The scheme is designed to target emissions not already covered by Climate Change Agreements (CCAs) and the EU Emissions Trading System (EU ETS). It features a range of drivers to encourage organisations to develop energy management strategies that promote a better understanding of energy usage and to take up cost-effective energy efficiency opportunities.

Organisations that meet the qualification criteria are required to participate, and must buy allowances for every tonne of carbon they emit. Organisations must also report eligible carbon emissions to the relevant regulatory body⁵ on an annual basis. Allowances are purchased and

⁴ <https://www.gov.uk/government/policies/reducing-demand-for-energy-from-industry-businesses-and-the-public-sector--2/supporting-pages/crc-energy-efficiency-scheme>

⁵ The regulatory body for CRC is the Environment Agency for organisations based in England, Natural Resources Wales for those based in Wales, the Department of Environment for Northern Ireland and the Scottish Environmental Protection Agency (SEPA) in Scotland.

then amounts equal to declared carbon emissions must be surrendered. Senior management within each organisation have responsibility for compliance with the scheme: for example, authorising the purchase and surrender of allowances.

Phase 1 of the CRC ran from April 2010 to end March 2014. Qualification for the scheme was based on electricity usage. Organisations qualified for phase 1 of the CRC if, during 2008, they had at least one settled half-hourly meter and consumed over 6,000 megawatt-hours (MWh) of qualifying electricity through all their half-hourly meters. Qualifying organisations had to comply with the scheme or face financial and other penalties.

Various changes have been made to the CRC since its inception. The original design involved the recycling of revenue from allowances to participating organisations on the basis of their performance, as defined by an annual 'Performance League Table' (PLT). In October 2010 the government simplified the scheme and removed the recycling element. In the 2012 Autumn Statement, the Chancellor stated that 'the government will review the effectiveness of the CRC in 2016 [...] the tax element of the CRC introduced at Spending Review 2010 will be a high priority for removal when the public finances allow.'

The CRC was further simplified in April 2013, following consultation with participants. The simplification reduced the number of fuels covered from 29 to two, focusing the scheme solely on electricity use and gas for heating purposes. The simplification also removed the need for organisations to submit a 'footprint' report detailing all their energy use, but required them to report on all their consumption for eligible electricity and gas.

Further simplifications were introduced in April 2014, as part of phase 2 of the CRC. These are beyond the scope of this evaluation but it is relevant to the evaluation that organisations qualified for phase 2 of the scheme if they used more than 6,000 MWh of electricity from settled half-hourly meters between 1 April 2012 and 31 March 2013.

Comparison groups

To assess the impact of the CRC on energy use and carbon emissions, it is important to explore what would have happened in the absence of the CRC. This evaluation has therefore used a counterfactual group, known as 'information declarers', in all three workstreams. These are organisations with half-hourly electricity meters which were obliged to report their electricity consumption in 2008 but which fell below the 6,000 MWh threshold in that year and were therefore not included in phase 1 of the CRC.

As the information declarers were generally smaller organisations than the CRC participants, a second comparison group was used in the quantitative and qualitative research only. These were organisations which were fully exempt⁶ from paying for phase 1 CRC allowances because their carbon emissions were adequately covered by other government carbon schemes, namely Climate Change Agreements (CCAs) and the EU Emissions Trading System (EU ETS). Many of these organisations were more energy intensive than CRC participants.

Further details on these comparison groups, and their use in different workstreams, are given in chapter 3 on methodology.

⁶ During phase 1, complex rules prevented organisations from having to buy CRC allowances for emissions already covered by the EU ETS or CCA schemes, but all organisations with electricity consumption exceeding 6,000 MWh in 2008 had to register for the CRC and report on emissions, even if they were not liable for any CRC allowances. Simpler rules apply to phase 2 of the CRC: organisations only need to register if their emissions (excluding those covered by EU ETS and CCA schemes) exceed 6,000 MWh, and they only need to report on these emissions.

Aims of this evaluation

It is important for government to know the impact that its policies have in practice (in contrast to their expected impacts) and to understand which elements of a policy have or have not worked. Such evidence can help DECC to alter elements of the policy to maximise impact and can inform future policy development in the area. Evaluation of the CRC has taken place in this context: independent consultants were asked to undertake robust analysis of how the CRC had been delivered in practice and whether its objectives had been met. Evaluation of the CRC has provided DECC with an understanding of the actual energy efficiency, economic, financial and wider environmental impacts of the scheme to inform future policy decisions. The findings of the evaluation will also inform and feed into the planned CRC review in 2016.

The evaluation of the CRC was commissioned to establish the impact of the CRC and specifically to address the following objectives:

A: Assess the extent that the CRC has delivered reductions in emissions by the take-up of energy efficiency measures.

B: Identify the barriers and drivers to energy efficiency and assess the extent to which the CRC has overcome barriers and emphasised drivers.

C: Assess whether the CRC has delivered abatement in a cost-effective manner.

D: Identify how the CRC has been delivered and whether it has been administered effectively.

This report presents broad findings on non-domestic energy efficiency, drawing on the quantitative and qualitative workstreams, and then presents a synthesis of findings from all sources in relation to these four evaluation objectives.

The evaluation has been underpinned by a theoretical framework, including a 'theory of change' which sets out potential mechanisms through which the CRC could have influenced organisations' behaviour. This report assesses the validity of these assumptions against evidence collected during the research and provides an assessment of the usefulness of the theory of change.

Progress on the evaluation was overseen by a project steering group which included representation from DECC, other government departments, Environment Agency and academics concerned with non-domestic energy efficiency. The outputs from the study have been peer reviewed.

The remainder of this report is split into the following chapters:

- chapter 2 presents the theoretical framework for the evaluation
- chapter 3 presents the methodology for the research
- chapter 4 analyses general findings on non-domestic energy efficiency
- chapter 5 analyses findings on objective A
- chapter 6 analyses findings on objective B
- chapter 7 analyses findings on objective C
- chapter 8 analyses findings on objective D

- chapter 9 presents overall conclusions.

2. Theoretical framework

Theory-based approach to evaluation

Our approach to this evaluation has been theory-based. The evaluation research was designed to test assumptions set out in a theoretical framework⁷. During the scoping stage we developed a 'theory of change' which attempted to set out explicitly the causal links by which phase 1 of the CRC was expected to drive changes in energy efficiency. Our research on evaluation objectives A, B and C tested the validity of assumptions set out in the theory of change, and the relative importance of the CRC compared to other potential drivers for change, as well as assessing the cost-effectiveness of abatement driven by the CRC.

Similarly, we developed a customer journey for the CRC which explored the different aspects of the scheme from a participant's perspective, and identified the steps involved in compliance and the types of compliance costs incurred. This informed our research on evaluation objective D.

Both of these documents were developed by the research team in collaboration with DECC and the Environment Agency (EA) and were refined through a series of interactive workshops with these organisations. Earlier versions of these documents have also been shared with the steering group for the evaluation.

Theory of change

The theory of change aimed to make explicit the assumptions underlying the design of phase 1 of the CRC, so that they could be tested during the evaluation. As this was a complex scheme, which had undergone successive changes from its original design through implementation, the theory of change was inevitably a snapshot. The diagram below represents the theory of change during implementation of phase 1, including the PLT and its successor the ARP, but excluding the influence of revenue recycling. This diagram was refined throughout the evaluation and is presented here in its final form.

Figure 2.1 below presents the theory of change. The policy intervention at the bottom is assumed to drive the intermediate outcomes (in pale blue boxes), using various different drivers, leading to the desired outcome at the top (in dark blue box). The three main drivers underlying the design of the CRC design are shown at the bottom: the cost driver, awareness driver and reputational driver. Enforcement is shown as linked to the reputational driver. Assumptions to be tested by the evaluation are shown in pink boxes, while influences external to the CRC are shown in green boxes.

The theory of change was used to inform the design of stage 2 research. The proposed stage 2 research instruments were designed to test the causal chain between the CRC and its desired outcomes, the validity of assumptions and the influence of other drivers (outside the CRC) on these outcomes. Chapter 9 presents a final review of the theory of change against the evidence gathered during this evaluation, and provides an assessment of its usefulness.

⁷ See 'Theory-based approaches to evaluation: concepts and practices', Treasury Board of Canada, 2012. Available at www.tbs-sct.gc.ca.

Key:

Dark blue boxes – CRC intervention and its desired outcome

Pale blue boxes – intermediate 7outcomes

Bold arrows – assumed causal links between intermediate outcomes (to be tested)

Pink boxes – assumptions underlying these causal links (to be tested)

Green boxes – other factors that may be influencing these outcomes (to be tested)

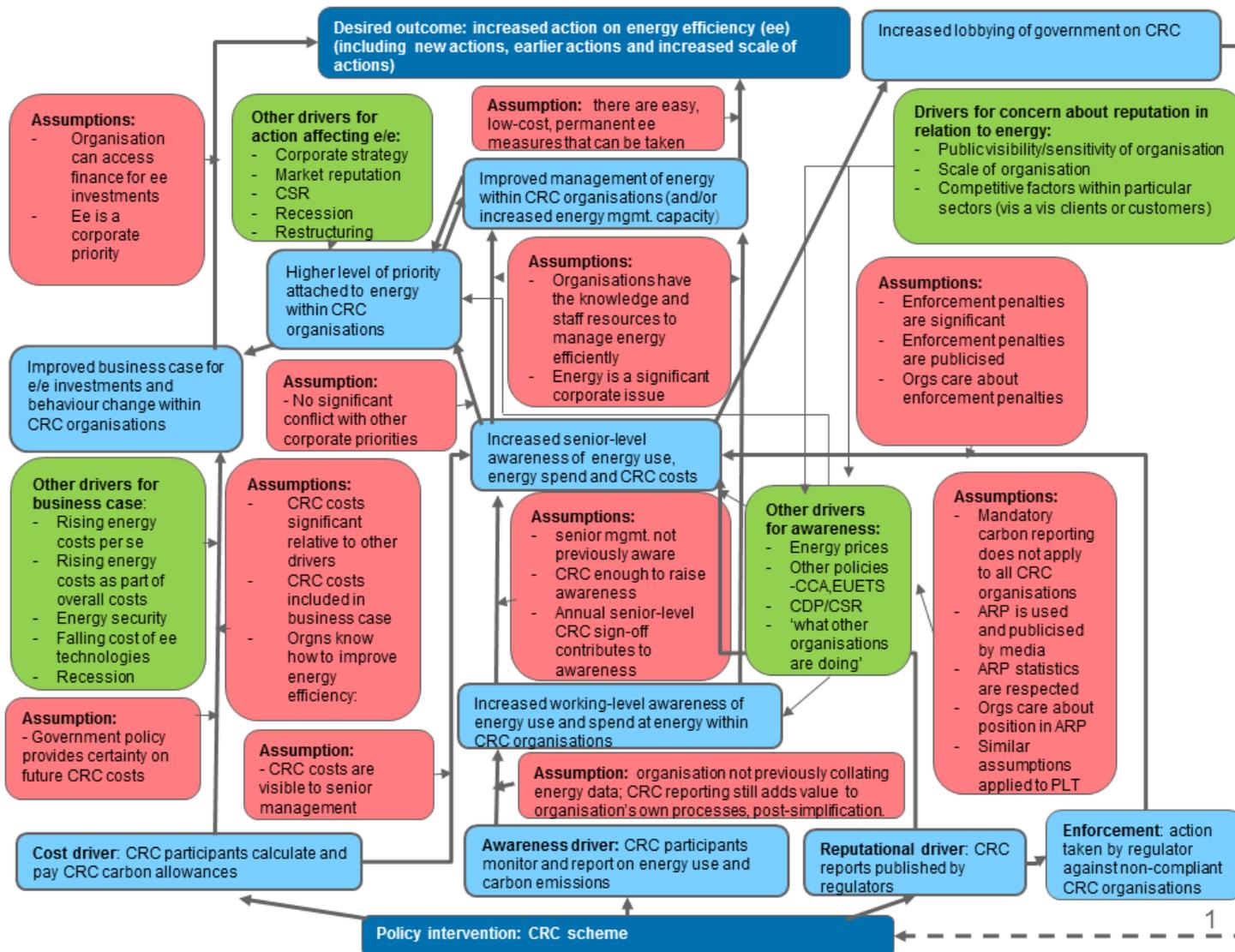


Figure 2.1: Final theory of change for the CRC

Customer journey

We also developed a detailed mapping of the customer journey as the framework for addressing evaluation objective D: 'Identify how the CRC has been delivered and whether it has been administered effectively'. Mapping of the customer journey enabled us to understand how the scheme was intended to be delivered and what requirements and processes were put in place. We used this understanding of the CRC customer journey to inform our research with CRC participants and other stakeholders, researching whether these processes have functioned smoothly, effectively and in such a way as to minimise costs and burden on participants.

CRC customer journey

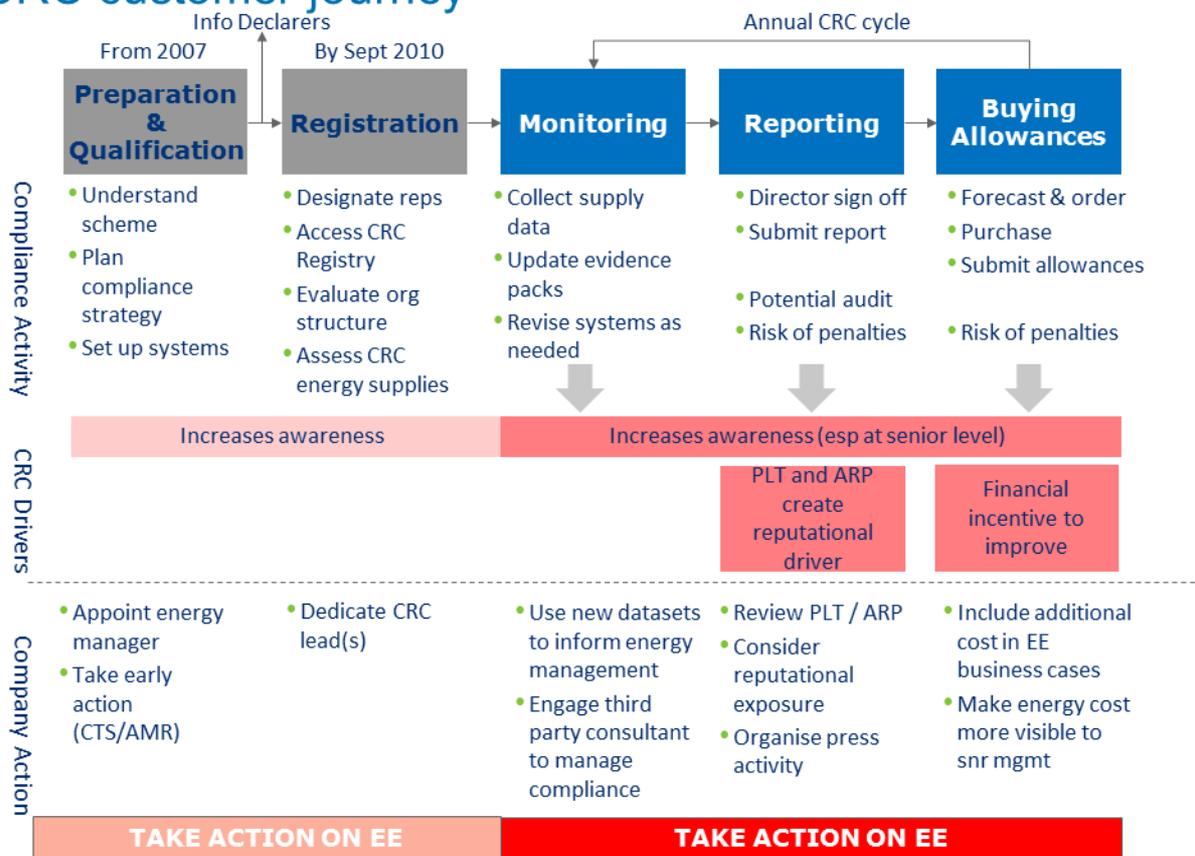


Figure 2.2: CRC customer journey

Notes on abbreviations:

- EE – energy efficiency
- Early Action Metric (EAM) – measures used to assess 'early action' on energy efficiency in the Performance League Table
- Carbon Trust Standard (CTS) – an energy performance standard, used as an EAM
- Automatic Meter Readings (AMR) – automated meters, used as an EAM
- Information declarers – organisations with at least one half-hourly meter, but below the CRC threshold of 6,000 MWh electricity consumption in the qualifying year (2008 for phase 1)
- PLT – Performance League Table (presented a league table of CRC participants, with ranking based on EAM and a growth metric; published in 2011 and 2012)
- ARP – Annual Report Publication (replaced the PLT in 2013; publishes CRC emissions and related information for CRC participants, but not in league table format)

Evaluation questions

We used the theory of change and the customer journey mapping to review the original evaluation questions set out by DECC and develop a refined set of evaluation questions for stages 2 and 3 of the evaluation. These provided a framework for stage 2 research and were used to synthesise findings from different sources of evidence during stage 3.

Evaluation objectives and questions
Evaluation aim A: Assess the extent that the CRC has delivered reductions in emissions by the take-up of energy efficiency measures
A1 - Are there increases in the take-up of energy efficiency measures that can be attributed to the scheme? (DECC has provided a menu of potential measures)
A2 – Are there improvements in energy management practices and capacity that can be attributed to the scheme? (menu includes: staff capacity and training; data reporting; accurate forecasting of energy consumption; business planning; business cases; financing; staff awareness)
A3 – Are there increases in board-level awareness of energy efficiency that can be attributed to the scheme? (menu includes: allocation of resourcing; targets; strategic priority)
A4 – Are CRC participants behaving in different ways to non-CRC participants in any other respects (as a result of the policy, and not for other reasons)?
A5 - What is the timescale for the changes in A1-A3: permanent/temporary; short/long-term?
A6 - What are the incremental emissions reductions achieved as a direct/indirect result of the scheme?
Evaluation aim B: Identify the barriers and drivers to energy efficiency and assess the extent to which the CRC has overcome barriers and emphasised drivers
B1 What broader factors have been driving changes in A1-A3, over the period of the CRC, in both CRC and non-CRC organisations (including the recession, restructuring, market influences, energy prices, other policies such as CCL, EU ETS, CCA and mandatory reporting)?
B2 How far are changes in A1-A3 attributable to the financial cost of CRC payments, as opposed to these other factors?
B3 How far are the changes in A1-A3 attributable to the awareness-raising drivers in the CRC (e.g. board-level sign-off; corporate reporting), as opposed to other factors?
B4 How far are the changes in A1-A3 attributable to the reputational drivers in the CRC (e.g. publication of the Performance League Table, its successor the ARP and enforcement), as opposed to other factors?
B5 Which phases of the scheme had most impact on the actions (A1-A3): pre-scheme preparation, phase 1 or phase 2?
B6 What factors have influenced the effectiveness of different drivers (CRC/other), across different types of participant (e.g. price signal, presentation of data, energy intensity of participant; scale of participant)?

B7 Are there additional barriers to actions A1-A3 that need to be overcome, and how far do these apply to different types of participant? (e.g. finance, ownership structure, lack of viable energy efficient technologies, other...)
B8 Have policy uncertainty and changes in government policy, within or beyond the CRC, been a barrier to action on energy efficiency (A1-A3)?
Evaluation aim C: Assess whether the CRC has delivered abatement in a cost-effective manner
C1 Have the energy efficiency actions taken by participants been cost-effective (with particular reference to the menu of actions in A1)?
C2 What wider benefits have actions A1-A3 generated for participants? (in relation to energy bills, reduced CRC costs, carbon emissions, improved services for customers etc.)
C3 Have there been any unanticipated effects of the CRC, other than the intended impacts covered by objectives A and B?
Evaluation aim D: Has the CRC been administered effectively?
D1 Is the scheme delivered efficiently and consistently (e.g. by promoting simple procedures)?
D2 Has communication with participants been clear, convenient and timely (e.g. guidance, help desk, other communications with stakeholders)?
D3 What were the most burdensome aspects of the scheme in phase 1 (including registration, reporting, audit enforcement and other elements of the CRC), and how have these changed with phase 1 simplification and phase 2?
D4 Has simplification of the scheme sufficiently minimised overlap with other schemes (primarily EU ETS and CCA) and reduced the administrative burden on participants?
D5 What has been the impact of successive changes to the scheme, and what lessons can be drawn for the management of future changes?

Figure 2.3: Evaluation objectives and questions

The next section of this report sets out the methodology that we have used to develop answers to these questions.

3. Methodology for evaluation

Building on earlier research by Eunomia

DECC originally commissioned Eunomia to undertake a feasibility study for the evaluation in 2013. Eunomia's report⁸ provided a detailed assessment of data sources relevant to the CRC evaluation and examined various options for econometric analysis. In many respects, this evaluation has built on the painstaking research of the Eunomia team. Consistent with their recommendation, analysis of the impact of the CRC on energy use was based on electricity and gas meter point data held by DECC, as this provided longer, fuller and more consistent time series than the CRC annual report data held by the EA.

But our methodology has diverged from Eunomia's recommendations in our approach to establishing a counterfactual. To assess the impact of the CRC on energy use and carbon emissions, we felt that it was important to explore what would have happened in the absence of the CRC. We used a 'with/without' approach to develop a counterfactual instead of the 'deviation from pre-existing trend' approach recommended by Eunomia. While our research encompassed Eunomia's proposed approach, in that we examined pre- and post-CRC trends in CRC participant behaviour, the 'with/without' approach helped to disentangle the impact of the CRC from other major changes affecting organisations during the delivery period, such as the economic downturn and changes in energy prices.

We established a counterfactual by matching a sample of CRC organisations with a comparison group of organisations which were not subject to the CRC. We are aware that no comparison group is perfect. We have used 'information declarers' as our main comparison group: these are organisations with half-hourly electricity meters which were obliged to report their electricity consumption in 2008 but which fell below the 6,000 MWh threshold in that year and were therefore not included in the CRC.

For the qualitative and quantitative research, comparison groups were drawn from the 1,400 or so information declarers with 2008 electricity consumption in the range 3,000-6,000 MWh, on the grounds that they would be relatively close in behaviour to CRC organisations⁹. For the econometric research, the full set of information declarer meters for England and Wales was used as the control group, since it was not straightforward to identify which meters fell into particular consumption bands at organisational-level.

Comparisons were also drawn with organisations which had to register for phase 1 of the CRC but did not have to buy any CRC allowances because their emissions were sufficiently covered by the EU ETS or CCA.¹⁰ Organisations with full (i.e. 'General' or 'Group') CCA exemptions

⁸ Laurence, E., Sherrington, Dr C., Hogg, Dr. D, CRC Energy Efficiency Scheme Evaluation Feasibility Study, by Eunomia on behalf of DECC, 2013.

⁹ Information declarers with 2008 electricity consumption in the range 2,000-6,000 MWh were used for the public sector sample in the quantitative research, as the 3,000-6,000 MWh band did not provide a large enough sample.

¹⁰ During phase 1, complicated rules prevented organisations from having to buy CRC allowances for emissions already covered by the EU ETS or CCA schemes, but all organisations with electricity consumption exceeding 6,000 MWh in 2008 had to register for the CRC and report on emissions, even if they were not liable for any CRC

from CRC were included in this second comparison group. But organisations with partial exemptions, arising from 'member only' CCA agreements, were included in the CRC group unless specified otherwise.

Overview of methodology for the three workstreams

The research methodology comprised three parallel workstreams:

- **a quantitative survey** of 900+ interviews with energy managers, or their equivalent, across a range of medium to large organisations (including approximately 500 covered by the CRC, 100 covered by full CCA and EU ETS exemptions, and 300 information declarers outside these schemes). The aim of this workstream was to generate data on behavioural issues related to energy efficiency, and to generate statistics about perceptions of CRC delivery;
- **in-depth qualitative interviews** with 74 organisations, including both energy managers and senior managers in medium to large organisations (again, covering those within and outside the CRC, CCA and EU ETS schemes). The aim of the qualitative workstream was to explore the reasons behind any changes in energy efficiency behaviours, including the role played by the CRC and other schemes; and
- **econometric analysis** of electricity and gas meter data, and related carbon emissions, for the period 2006 to 2012, looking for differences in energy consumption patterns between the CRC and comparison groups.

The stage 2 qualitative and quantitative research was framed as broad research on non-domestic energy efficiency, including the influence of government carbon schemes. This allowed the interviews to establish the overall context and drivers for energy efficiency within an organisation, before asking about the influence of the CRC. It also meant that a consistent approach could be taken for interviews with CRC and non-CRC organisations, using the same overall topic guide. This approach generated broad findings on non-domestic energy efficiency research and government schemes (presented in chapter 4), as well as findings relevant to the CRC evaluation (presented in chapters 5-8).

An overview of the methodology used for each workstream is presented below. Further details are available in the workstream appendices which are presented in separate volumes.

Methodology for quantitative research

The quantitative research involved Databuild staff undertaking 904 quantitative telephone interviews with energy managers (or their equivalent) within a range of private and public organisations, including CRC and non-CRC organisations. Interviews lasted 26 minutes on average. The questionnaire was developed in collaboration with DECC and the evaluation consortium, and was piloted during August 2014. No interviews from the pilot study are included in any of the results presented in this workstream, as the survey questionnaire was

allowances. Simpler rules apply to phase 2 of the CRC: organisations only need to register if their emissions (excluding those covered by EU ETS and CCA schemes) exceed 6,000 MWh, and they only need to report on these emissions.

revised after the pilot. The main phase of fieldwork was undertaken between September and November 2014.

A stratified random sample designed to include CRC and non-CRC organisations was drawn from databases supplied by the Environment Agency. The databases listed all half-hourly electricity meters in the UK in 2008, including those belonging to organisations which were required to register for phase 1 of the CRC (because they exceeded the threshold of 6,000 MWh of electricity in that year) and those belonging to organisations which were below this threshold (known as 'information declarers'¹¹). Some of the organisations which were required to register for phase 1 of the CRC were given exemptions from CRC payments, provided that a certain proportion of their carbon emissions were covered by a Climate Change Agreement (CCA) or the EU Emissions Trading System (EU ETS). These tended to be organisations which used energy more intensively.

The sample was stratified to ensure that:

- conclusions could be drawn separately for public and non-public sector organisations, as these were of particular interest to DECC; and
- differences could be identified between CRC participants with relatively high electricity usage and those with lower usage.

The latter was achieved by splitting the sample of private sector participants into four quartiles based on 2008 electricity consumption, while the public sector sample was split into two halves (above and below median). A separate sample was drawn from CRC participants for whom electricity consumption data for 2008 was missing from the EA database, so that they were not excluded from the sample.

To construct the sample for the core comparison group it was decided to approach a random selection of information declarers whose electricity consumption in 2008 was at least 3,000 MWh for private sector and 2,000 MWh for public sector. This was to ensure that information declarers with relatively low energy consumption were not included in the comparison group, as they might be expected to behave differently from CRC participants on these grounds alone.¹²

A separate sample was drawn for organisations which registered for CRC but had exemptions from allowances owing to CCA (Group/General) or EU ETS participation. A feature of this additional comparison group was that they tended to be more intensive energy users than many CRC participants. Organisations with 'member only' CCA exemptions were included in the CRC group, since some parts of these organisations would pay CRC allowances.

The sample was divided into ten strata as illustrated in Figure 3.1 below, which also includes the population of organisations within each stratum and number of quantitative interviews conducted. As a key use of this research was CRC evaluation focussing on the impact of

¹¹ Organisations which, in 2008, had one or more Half Hourly electricity Meters settled on the half hourly market, but consumed less than 6,000 MWh per year (the threshold for CRC participation). These organisations were required to register and perform an information disclosure, but were not required to participate in the CRC. Information declarers were included in the survey to provide a comparison group for CRC participants.

¹² The reason the threshold was lowered to 2,000 MWh for the public sector was to provide us with a sample size that was sufficiently robust. Using 3,000 MWh would have limited the available sample to such an extent that we would not have enough to carry out a sufficient number of interviews to provide for robust analysis.

phase 1 of the scheme, the sample was adjusted to exclude organisations which did not participate in phase 1 but were participants in phase 2 of the CRC.

Further analysis on the suitability of the comparison groups is presented towards the end of this chapter.

CCA / EU ETS exempt?	Sector	CRC status	'Total Supply - matched with Half-Hourly Meter database (MWh) in 2008' ¹³	Population	Number of interviews conducted	% of pop. interviewed
No or CCA member only exemptions	Private/ Public	Participant	Not available	61	20	33%
	Private	Participant	At or above third quartile (i.e. top 25%)	402	102	25%
			At or above median, but below upper quartile	381	100	26%
			At or above first quartile, but below median	374	93	25%
			Below first quartile (i.e. bottom 25%)	274	88	32%
		Information declarers	More than 3,000 MWh	1227	214	17%
	Public	Participant	At or above median consumption for public sector participants	312	57	18%
			Below median consumption for public sector participants	288	52	18%
		Information declarers	More than 2,000 MWh ¹⁴	247	79	32%
	Sub-total for CRC participants (with no CCA exemption or 'member only' CCA exemption)				2,093	512
Sub-total for information declarers				1,474	293	20%
Organisations which registered for CRC but have exemptions from allowances owing to CCA (Group/General) or EU ETS participation				657	99	15%
Total across all groups				4,224	904	21%

Figure 3.1: Population and number of interviews achieved in each stratum covered in the quantitative survey (after removal of organisations that became participants in phase 2¹⁵)

For the quantitative research, organisations included in the sample were selected at random from within each of the categories described in the final column of Figure 3.1. The proportion of the population interviewed ranged from 15% for CRC registrants with CCA or EU ETS exemptions to 32% for CRC participants in the lowest quartile of electricity use. A small proportion of these samples was also reserved for qualitative research, as outlined below.

¹³ Phase 2 meter data was matched with the Environment Agency's Half-Hourly Meter database (HHM DB) and used in instances where supply was not available from the information supplied for phase 1. NB Differences between the population figures for sub-groups split by electricity consumption (private & public sector participants) are due to the removal of phase 2 only participants from the population and the inclusion of organisations covered in stage 1 of the quantitative and qualitative research.

¹⁴ Only 145 public sector information declarers were recorded as having more than 3,000 MWh, so we extended this category to include those with 2,000-3,000 MWh of consumption.

¹⁵ It was identified that some organisations that were non-participants in phase 1 (information declarers and those with exemptions due to CCA or EU ETS participation) became participants in phase 2. A small number of these organisations were interviewed during the fieldwork (22) and removed from the survey sample and populations prior to analysis.

Methodology for qualitative research

The qualitative research involved 74 in-depth telephone interviews with CRC and non-CRC organisations and stakeholders, at both energy manager and senior manager level: 45 of these interviews were with CRC organisations, while 14 were with information declarers and 10 with CCA/EU ETS exempt organisations. The remaining five interviews were with DECC, the EA and industry stakeholders. Some additional qualitative findings were generated by an external stakeholder workshop which tested the emerging synthesis during stage 3. These have been incorporated into this report.

As summarised in Figure 3.2 below, 44 of the CRC and non-CRC interviews were with energy managers or their equivalent, who had operational responsibility for energy management in their organisation. In a few cases, these were consultants retained by the organisation to provide support on CRC and other energy matters. The aim of these interviews was to explore the organisation’s behaviour on energy efficiency, the drivers for this behaviour (including CRC and other government schemes) and – for CRC participants – to explore the organisation’s experience of the CRC. The interviews lasted between 30 and 60 minutes. Interviews with CRC organisations tended to be at the upper end of this range because of the need to cover the participant’s experience of the scheme.

The remaining 20 interviews were with senior managers, at or near board level in these organisations. These interviews were shorter and more focused, lasting 15-30 minutes, as experience during the scoping stage showed that it was not realistic to obtain longer interviews with this respondent group. The aim of these interviews was to explore the level of priority attached to energy efficiency at board level and the strategic drivers for this priority, and to assess the influence of government schemes including the CRC.

Stakeholder	Energy manager interviews	Senior manager interviews	Total number of interviews
CRC participants	30	15	45
Information declarers for phase 1 of CRC	9	5	14
Organisations with CCA/EU ETS exemptions for phase 1 of CRC	5	5	10
Other stakeholders			5
Total	44	25	74

Figure 3.2: Summary of qualitative interviews across stages 1 and 2

The qualitative research sample comprised three separate strands:

- the initial scoping sample (18 interviews with CRC and non-CRC organisations during stage 1 of the research) comprised CRC participants who had made contact with DECC, together with a random sample of information declarers;
- the bulk of the stage 2 sample was a random cross-section of the samples selected for quantitative research; and

- a few organisations in the stage 2 research were purposively chosen because their profile or their initial participation in the quantitative survey suggested that further investigation would be useful.

The topic guides for the scoping interviews were broadly similar to those used later in the main qualitative research, although the interviews with CRC participants were at this stage framed as part of the evaluation of the CRC rather than as broad research on non-domestic energy efficiency. Further detail on the methodology for the qualitative interviews is presented in the qualitative workstream report.

Methodology for econometric research

The purpose of the econometric research was to estimate the average causal impact of the CRC on energy consumption and intensity. The methodology compared energy consumption before and after the introduction of the CRC, between participating organisations and organisations in suitable control groups.

Control organisations were drawn from the ‘information declarers’: organisations that had a least one settled half-hourly meter in 2008, and were required to submit their electricity consumption for 2008 to the Environment Agency, but were below the threshold of 6,000 MWh annual consumption set for CRC registration.

The econometric analysis used a ‘differences in differences’ (DiD) approach. Using Regression Discontinuity Design (RDD) in relation to the CRC qualification threshold was also considered. However this would have required meter data to be reliably aggregated to organisational level, ensuring that the level of organisation was equivalent to that used for CRC registration. This was problematic in practice, because of difficulties in merging different data sets. In addition, we felt that there were not a sufficiently large number of organisations around the 6,000 MWh threshold to support RDD.

Therefore ‘difference-in-difference’ regression analysis was used to isolate the causal effect of the CRC. We compared the average difference in an outcome such as electricity consumption relative to a base year in CRC-participating units (e.g. meter points, buildings) with similar non-participating units.

We implemented our matching approach by setting up discrete bands for all matching variables (unless they were already discrete such as industrial sector). For example, when matching on energy consumption in a base year, we divided the sample into energy consumption bands. We then undertook regressions using the following specification:

$$E_{it} - E_{i2008} = \beta_{tCRC} \times CRC_i + \beta_t + \sum_M \beta_{Mt} \times M_i + \epsilon_{it}$$

In this formula:

- E_{it} is an outcome in aggregation unit i (i.e. meter point, organisation etc.) at time t ; e.g. (log) electricity consumption.
- CRC_i is an indicator variable equal to 1 if an organisation is covered by Phase 1 of the CRC, and 0 if it is not.
- β_t is a set of time fixed-effects

- β_{tCRC} is a set of time fixed-effects specific to CRC participants; i.e. the parameters β_{tCRC} tell us the average difference-in-differences between CRC and non-CRC organisations for a given year. If the control group and matching criteria are adequately defined, this provides an estimate of the causal impact of the CRC policy.
- M indexes various sets of discrete matching variables and M_i is an indicator equal to 1 if a unit i falls into a particular category; e.g. M could represent a certain pre-policy implementation band of energy consumption or a certain sector.

In the equation above and all results below we used 2008 as the base year. We experimented with other base years, however, 2008 had a number of advantages:

- the CRC was proposed around 2008. Hence 2008 is the closest year to the start of the policy that is plausibly not affected by potential pre-policy effects;
- using a year as close as possible to the start of the policy minimises the loss of organisations where data further back in time is not available because of incomplete data gathering or because of organisation entry; and
- qualification for the CRC policy was based on 2008 electricity consumption and so 2008 is also a desirable year for matching of control and treatment groups. Using the same years for matching and comparison purposes reduces the risk of further sample loss because of missing variables.

As well as presenting the annualised effects graphically, we also reported the average pre- and post-treatment difference between CRC and non-CRC organisations. To report pre- and post-treatment differences, we fitted the following restricted version of the equation:

$$E_{it} - E_{i2008} = \beta_{Pre,CRC} I\{t < 2010\} \times CRC_i + \beta_{Post,CRC} I\{t \geq 2010\} \times CRC_i + \beta_t + \sum_M \beta_{Mt} \times M_i + \epsilon_{it}$$

This equation contains the same variables as the first equation except for $I\{t < 2010\}$, a 'pre-treatment' dummy that takes the value 1 if the observation measures consumption in a year before 2010 and the value 0 otherwise. Conversely, $I\{t \geq 2010\}$, the 'post-treatment' dummy, is equal to 0 if , $t < 2010$ and 1 otherwise.

Additional angles of analysis were achieved by undertaking analysis at five different levels of aggregation of the data. The data matching processes generated a trade-off between the accuracy of matching and the number of variables covered by the matched data sets, and the diminishing sample sizes (and potential bias) arising from the matching process.

- i. At the most disaggregate level, the meter level provided precise electricity consumption data.
- ii. Aggregating at the building level provided information on gas consumption and on building type by matching to the non-domestic National Energy Efficiency Data-Framework (NEED) dataset.

- iii. At the postcode level of aggregation, nearly the full sample of organisations contained in the Office for National Statistics' Business Statistics Database (BSD) could be included, adding information on the sector of activity and employment at that postcode.
- iv. A more precise matching at the establishment level provided employment at each postcode an organisation operates at, but reduced the sample size.
- v. Finally, aggregation at the organisation level makes the computation of energy intensity in terms of both employment and turnover possible, but reduced sample sizes still further.

In addition to these five aggregation levels, a distinction was made between two potential definitions of CRC participants required by a limitation on the information available regarding participation of specific meters. In all cases, meters belonging to organisations with full exemptions from CRC were excluded from the CRC sample, as were meters located at CCA sites. But in Analysis Sample 1, meters that were part of a CCA organisation with partial (i.e. 'member only') CRC exemptions were included in the CRC sample, provided that they were not at a location listed as a CCA site. In Analysis Sample 2 all meters belonging to an organisation with a CCA exemption were excluded from the CRC sample, which was a more conservative approach.

Finally, in each case, the sample was divided into five groups based on their consumption in 2008, to understand which CRC participants were being most affected by the policy. The impact was measured separately for each quintile.

While most of the econometric analysis focused on electricity consumption and gas consumption, these were also combined to produce an estimate of carbon emissions from these two fuels. This is consistent with the fuels covered by CRC after simplification of the scheme in April 2013, although a full range of 29 fuels were initially covered by the scheme. Carbon emissions were calculated using the conversion factors that CRC participants were required to use during phase 1: 0.541 kg per kilowatt hour of electricity consumption and 0.1836 kg per kilowatt hour of gas consumption.

Suitability of comparison groups

To assess the suitability of comparison groups used for the quantitative research, Imperial College examined the average electricity intensity of each stratum covered in the survey. Electricity intensity per employee was used as a proxy for energy intensity because of the difficulty in reliably identifying gas consumption and turnover data for a sufficient proportion of organisations in the sample.

Figure 3.3 presents the electricity intensity both for the stratum from which each quantitative survey sample was drawn and for the organisations actually interviewed within each stratum as part of the quantitative research. Using number of employees and establishment level electricity consumption in 2008 to provide an estimate of electricity intensity, we found that there was little difference in the electricity intensities of CRC participants and information declarers. While there were some differences in the means for particular groups, owing to the higher top-end in the CRC group, there was little difference in the median values. Further analysis of the distribution of electricity consumption for the CRC and information groups is presented in the econometric appendix.

The electricity intensity analysis also confirms that organisations which registered for CRC, but have CCA or EU ETS exemptions from CRC allowances, have a significantly higher electricity

intensity than other groups covered in the survey. This should be kept in mind when interpreting the results presented in this report.

Electricity intensity in 2008 (GWh per employee)					
	Mean	Median	p95	Establishments	
All data	0.09	0.01	0.25	20,302	
CRC establishments	0.11	0.01	0.30	14,469	
Quantitative strata	Private Sector CRC above 75th percentile	0.08	0.01	0.21	6,998
	Private Sector CRC 50-75th percentile	0.06	0.01	0.17	1,181
	Private Sector 25th to 50th percentile	0.04	0.01	0.12	789
	Private Sector 0 to 25th percentile	0.05	0.01	0.18	409
	Private sector information declarers above 3GWh in 2008	0.07	0.01	0.19	1,079
	Public sector above 50 percentile	0.15	0.01	0.57	742
	Public sector below 50 percentile	0.11	0.00	0.47	167
	Public sector information declarers above 2GWh in 2008	0.18	0.01	1.33	55
	CRC exemptions due to CCA/EU ETS participation	0.25	0.05	0.58	2,364
Interviewed Quantitative Strata	Private Sector CRC above 75th percentile	0.16	0.01	0.57	1,434
	Private Sector CRC 50-75th percentile	0.03	0.01	0.13	340
	Private Sector 25th to 50th percentile	0.06	0.01	0.25	259
	Private Sector 0 to 25th percentile	0.05	0.01	0.20	113
	Private sector information declarers above 3GWh in 2008	0.07	0.02	0.18	227
	Public sector above 50 percentile	0.06	0.01	0.25	136
	Public sector below 50 percentile	0.10	0.01	0.51	33
	Public sector information declarers above 2GWh in 2008	0.17	0.01	1.33	29
	CRC exemptions due to CCA/EU ETS participation	1.25	0.06	2.14	164

Figure 3.3: Electricity intensity of CRC participants, information declarers and organisations with exemptions

We also undertook an analysis of the sector breakdown of the main sample groups, based on phase 1 registration data provided by the EA. The charts below illustrate that the CRC and information declarer samples had broadly similar sectoral breakdowns, although manufacturing firms represented a slightly higher proportion of information declarers than CRC organisations. But the samples for CCA or EU ETS exemptions were strongly dominated by manufacturing companies and holding companies.

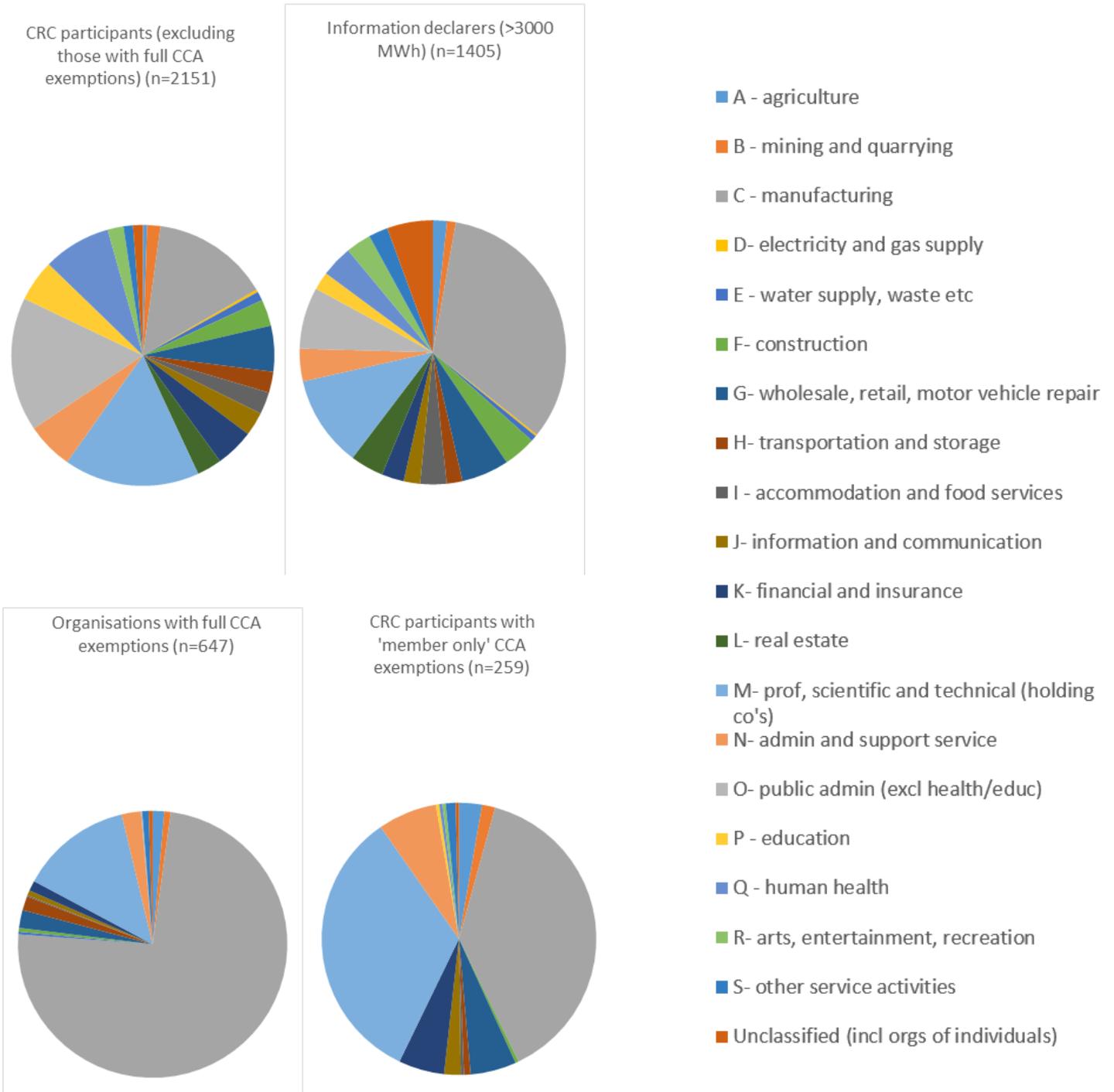


Figure 3.4: Sector breakdown of main sample groups (source: EA data)

These pie charts are presented in terms of numbers of organisations, but the dominance of manufacturing companies would probably be greater if the charts were presented in terms of energy consumption (analysis not conducted).

Limitations of the methodology

Limitations of the comparison group

The main limitation of using information declarers as a comparison group is that they will generally be smaller than CRC organisations, since their electricity consumption in 2008 was lower. This could lead to some systemic differences in behaviour compared to the larger organisations within the CRC. Our original intention had been to match CRC and non-CRC organisations on the basis of energy intensity, which would have overcome some of the problems arising from different scales. In practice this was not possible because of the difficulty of achieving reliable matching in turnover/expenditure and energy consumption data at CRC registrant level. However, the characterisation of the comparison groups provided earlier in chapter 3 provides some reassurance on the comparability of the CRC and information declarer groups.

The organisations whose emissions were fully covered by the EU ETS and CCA schemes were not used as a comparison group as such in the econometric analysis. Firstly, they tended to include more energy-intensive industries than the CRC group, because these were the target groups of the EU ETS and CCA policies. Secondly, these organisations have been influenced by the EU ETS/CCA policies, and the effect of this would need to be disentangled from CRC effects. However, results are presented for these groups where they shed light on general energy efficiency behaviour or specific CRC behaviours.

Both non-CRC groups - information declarers and EU ETS/CCA exempt organisations - may have been influenced to some degree by the initial announcements about the upcoming CRC, by the need to declare their consumption to the EA and, in the case of EU ETS/CCA organisations, the need to register within the CRC system. Some of the information declarers have specific sites covered by the EU ETS and CCA, so they may – to some degree – be influenced by these policies. And some information declarers may have been influenced by the desire to keep below the electricity consumption threshold for CRC phase 2. The quantitative and qualitative research probed for the influence of different policies on the CRC and non-CRC groups.

The definition of the comparison group varied slightly between the workstreams. For the qualitative and quantitative research, comparison groups were drawn from the 1,400 or so information declarers with 2008 electricity consumption in the range 3,000-6,000 MWh (or 2,000-6,000 MWh for public sector information declarers), on the grounds that they would be relatively close in behaviour to CRC organisations. For the econometric research, the full set of information declarer meters for England and Wales was used as the control group, since it was not straightforward to identify which meters fell into particular consumption bands at organisational-level.

While the number of information declarer electricity meters was only about a third of the number of CRC participant meters, the econometric research found ‘common support¹⁶’ on CRC and information declarer consumption levels except at very high consumption levels. However the

¹⁶In econometric terms, ‘common support’ means that the CRC and information declarer samples were similar enough in terms of their overall characteristics (e.g. the distribution of meters with different levels of electricity consumption) to make comparisons valid.

research itself found that the impacts were significant in all consumption bands, not only for top consumers.

Time periods

A few caveats should be noted in relation to the pre- and post-treatment periods in the econometric analysis. Firstly, the pre-treatment period covers the calendar years 2006-2009 inclusive, while the post-treatment period covers the calendar years 2010-2012. The meter data is available for calendar year periods, which provides an approximate match to the financial years used by the CRC policy. Secondly, the econometric analysis does not examine differences in behaviour between the CRC and non-CRC organisations prior to January 2010, as the samples are matched to show similar pre-treatment behaviour. This may understate the impact of the CRC preparation period.

Sampling

There was little control over the sector spread for comparison group interviews in the qualitative research because of the way these interviews were recruited. The manufacturing sector dominated both the information declarer and CCA/EU ETS groups in the qualitative research, which is probably fair for CCA/EU ETS but may over-represent manufacturers within the information declarer group.

The boundaries between groups were less clear than might be expected in both the qualitative and quantitative research. For example, some CRC organisations interviewed had partial exemptions from CRC owing to CCA or EU ETS participation. A few information declarers had qualified for phase 2 of the CRC, so had some experience of the phase 2 customer journey. Similarly, a few CCA/EU ETS organisations had also become liable for CRC payments in phase 2. Conversely, a few CRC organisations which qualified for phase 1 were no longer part of the scheme in phase 2, or were now fully exempt on the grounds of the new rules for CCA/EU ETS exemption. Information declarers and organisations with full CCA/EU ETS exemptions for phase 1 which then qualified for phase 2 were excluded from the quantitative analysis but their comments were still reported in the qualitative research.

Breakdown of sample

The sample size used for the quantitative survey did not allow results to be presented separately for individual sectors; neither did the sample size allow results to be presented separately for devolved administrations.

While the econometric research used meter data for England and Wales only, the quantitative and qualitative research randomly selected interviewees across the whole of the UK. A number of interviews were undertaken with organisations regulated within the devolved administrations, as shown in Figure 3.5 below.

Region or Devolved Administration	Whole population of organisations registered for CRC Phase 1 (including all information declarers and exempt organisations)	Quant respondents, weighted by respondent group (n=904)	Qual respondents (n= 69, across stages 1 and 2)
England	90.3%	88.2%	92.8%
Scotland	6.5%	8.3%	1.4% (i.e. 1 organisation)
Northern Ireland	2.8%	2.4%	2.9% (i.e. 2 organisations)
Wales	0.4%	1.1%	2.9% (i.e. 2 organisations)

Figure 3.5: Breakdown of respondents by regulator

As coverage of the devolved administrations was not a sampling criterion, the breakdown for the quantitative and qualitative samples was a random outcome of the sampling strategy. As might be expected, the breakdown was closer to the population distribution for quantitative research (where the sample was sizeable) than for qualitative research (where the sample was small). But the figures show that both the quantitative and qualitative research included some representation from each of the regulators. The main point to note is that there was slightly greater coverage of SEPA-regulated bodies than might be expected in the quantitative research but - by chance - slightly lower coverage of this group in the qualitative research.

Influence of other policies

Our methodology explicitly controlled for differences between the CRC and comparison groups relating to the influence of the CCA and EU ETS schemes. Organisations with full CCA exemptions and any EU ETS exemptions from the CRC scheme were analysed separately in the quantitative and qualitative research, and were excluded from the econometric analysis. The econometric analysis tested the effect of including within the CRC sample those meters which belonged to organisations with 'member only' CCA exemptions (which meant that some parts of their business did not pay CRC allowances), provided these meters were not located at CCA sites. Organisations with 'member only' CCA exemptions were included in the CRC sample for quantitative and qualitative research, because they had experienced all elements of the CRC scheme and paid CRC allowances on some of their emissions. This group represented a modest proportion of the private sector CRC sample: 61 of the 383 organisations, slightly skewed towards the higher electricity consumption bands. We tested the sensitivity of key results to the exclusion of this group from the private sector CRC sample and found that there was little change in the findings from the quantitative survey.

The Energy Savings Opportunity Scheme (ESOS) had not started at the time of the research but the scheme became law in July 2014 and many organisations were preparing for it. ESOS applies to larger private sector organisations with more than 250 employees, with turnover above €50 million or a balance sheet above €43 million, and might be expected to apply to more CRC firms than information declarers. The influence of ESOS was explicitly explored in qualitative and quantitative research, but would not have influenced econometric results as this used data for the period 2006 to 2012.

We have assumed that other policies aiming to influence energy-related behaviour over the study period had equal influence on both the CRC and comparison groups. This seems a reasonable assumption: the Climate Change Levy (CCL) is normally payable on non-renewable

energy by all but the smallest business users¹⁷; and renewable energy incentives¹⁸ such as the Feed-in-Tariff and Renewable Heat Incentive are open to non-domestic organisations at all scales. The findings from qualitative and quantitative research were consistent with this assumption, in that many organisations in both CRC and information declarer groups reported take-up of renewable energy.

¹⁷ CCL is a tax normally payable on electricity and gas use by non-domestic customers, other than charities, on which VAT is paid at the standard rate. Under current rules, non-domestic sites using less than 33 kWh per day of electricity or 145 kWh per day for gas, pay reduced rate VAT and fall below the 'de minimis' threshold for CCL. (Source: VAT notice 701/19: Fuel and power, HMRC, 2012)

¹⁸ CRC rules ensure that there is no double-subsidy of electricity from renewable sources. Exemption from CRC payments is only available for renewable energy which has not been subsidised by other DECC incentives.

4. Broad findings on non-domestic energy efficiency

Summary

The research found that nearly all non-domestic organisations investigated (inside and outside the CRC scheme) were taking some action on energy efficiency. More than two-thirds of energy managers reported that their organisation's level of action on energy efficiency had increased compared to 2010, the first year of the CRC. Rising energy prices were cited as the single most important driver for this change. Government energy efficiency schemes, including the CRC, were also cited as drivers by more than half of all respondents.

Early action on energy efficiency (before 2010) was reported by public sector organisations, larger private sector organisations and those in energy-intensive sectors. Lack of funding was identified as a barrier to further action on energy efficiency by nearly half of all respondents, but 20% of all respondents felt that there were no barriers to further action. Many respondents felt that there was a need for more coherence and consistency between government policies, both in terms of energy efficiency policy and in terms of Greenhouse Gas (GHG) reporting.

Broad findings on non-domestic energy efficiency

Types of action taken

The econometric research found that electricity and gas use by all sample groups had generally declined over the last four years. The methodology and data for this research did not allow analysis of how much of this was due to changes in economic activity and how much to changes in energy efficiency.

The quantitative and qualitative research found that most non-domestic organisations were taking action on energy efficiency. In the quantitative survey, 71% of energy managers (sample size 904) reported increased action on energy efficiency compared to four years ago. The top five actions on energy efficiency taken by organisations in the last four years were:

- investing in energy efficient technologies (particularly lighting) (93%);
- improvements in energy monitoring (85%);
- commissioning external bodies to undertake an energy audit and/or assess energy efficiency (79%);
- staff trained/educated in energy efficiency behaviour (79%); and
- the installation of automatic meter reading systems (77%).

The quantitative survey found that energy managers rated the level of priority assigned to energy efficiency at board level as 6.5 out of 10. Three-quarters of respondents stated that the

priority attached to energy efficiency in their organisations was higher than four years ago. This finding was echoed by qualitative interviews with both energy managers and senior managers which also found that the priority attached to energy efficiency had increased in recent years, driven mainly by increasing energy costs.

We started around 2008, I think we experienced a spike towards the latter end of 2008 [...] I noticed from then we had a bigger up-step in our price of energy from that point on. That's when it raised its profile as being a major cost element going forward from that point on. (CCA/EU ETS senior manager 2, manufacturing)

Drivers for energy efficiency action

A desire to address increasing energy costs was identified as the single most important factor influencing action on energy efficiency. There was strong evidence for this from qualitative research findings on the importance of energy costs in driving energy efficiency investments, and from the quantitative survey findings presented in Figure 4.1.

There's a very, very strong driver from wholesale energy prices making any reductions in energy usage far more attractive than they were previously in terms of paybacks etc. (CRC energy manager 8, water company)

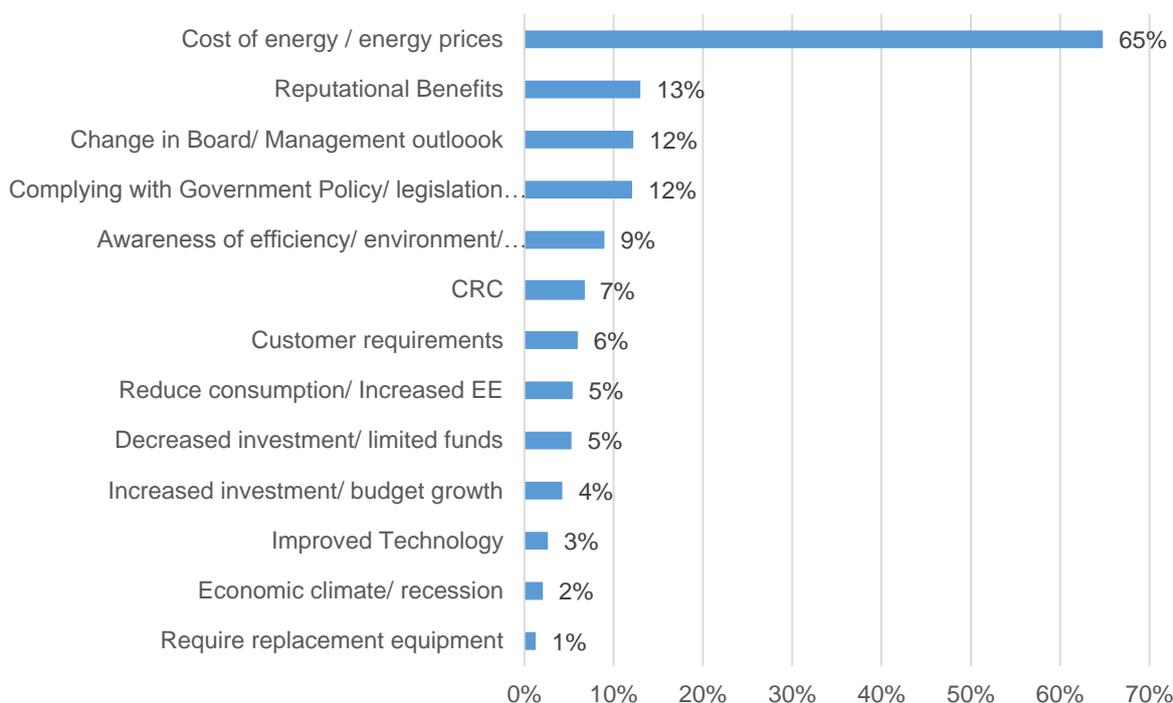


Figure 4.1: What is the most important factor that has affected more investment in energy efficiency? (Unprompted, all respondents, n=904)

While the cost of energy was identified as the single most important driver for energy efficiency in recent years, other important factors cited by qualitative and quantitative respondents included reputational benefits (or protection) for the organisation, increase in board priority and compliance with government policies (e.g. CRC, Climate Change Levy (CCL), Climate Change Agreements (CCAs)). The findings presented in Figure 4.2 below are broadly consistent with other research in this field.¹⁹ Mandatory greenhouse gas reporting was cited as a driver by some interviewees during qualitative research but does not appear in Figure 4.2 as it was not included as a prompt in the quantitative survey. The degree of influence of government policies on particular groups is discussed further at the end of this chapter and in chapter 6.

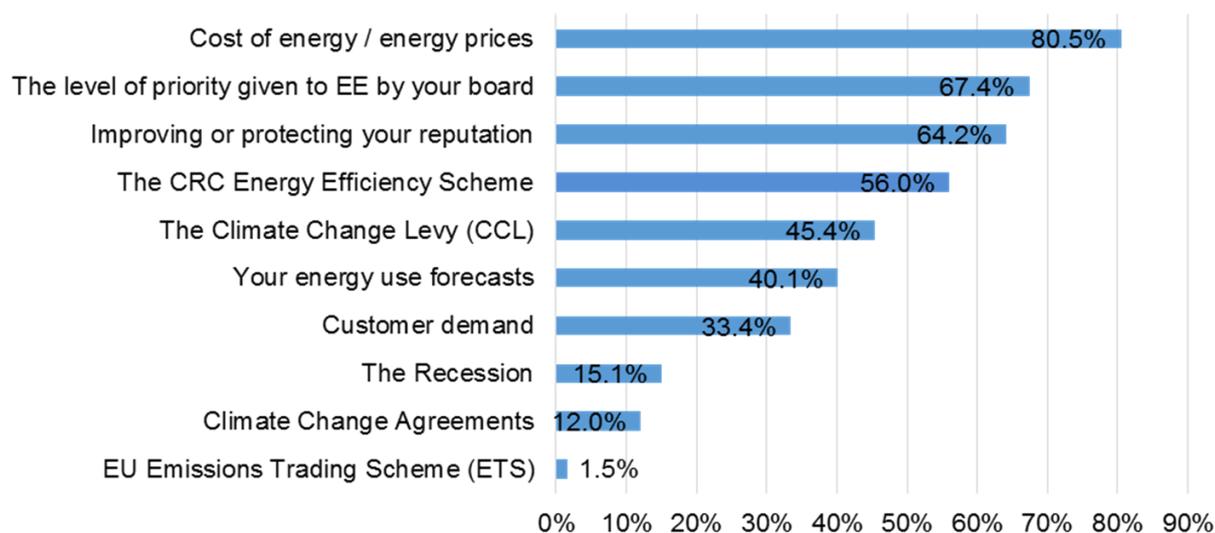


Figure 4.2: What factors have affected more investment in energy efficiency? (Prompted, all respondents n=904, multiple response % within factor saying it has an effect)

How did behaviour differ between organisations?

Both the quantitative and qualitative research found that public sector organisations, larger private sector organisations and those in energy-intensive sectors were more likely to report having taken early action on energy efficiency, before 2010.

Qualitative research found that factors affecting reports of early action on energy efficiency included:

- **significance of energy costs relative to total costs:** organisations for which energy represented a significant proportion of their costs were more likely to have taken early action;

¹⁹ Institute of Environmental Management and Assessment: Special report - GHG management and reporting, 2010; http://www.iema.net/system/files/iema20ghg20report204.10.10_0.pdf.

- **sensitivity to reputational drivers:** this category covered a range of bodies with different types of reputational sensitivities including:
 - public sector bodies (driven by political leaders and government targets);
 - publicly-quoted organisations (driven by investors and by mandatory greenhouse gas reporting);
 - organisations which tendered for public sector contracts (driven by tendering requirements); and
 - organisations with a high public profile (e.g. supermarkets);
- **sensitivity to environmental factors:** this category comprised organisations with specific environmental concerns (e.g. water and waste companies); and
- **scale:** larger organisations (with more capacity to address energy management); were more likely to have taken early action.

However, the qualitative research found that privately-owned firms, primarily engaged in ‘business 2 business’ activity, were less likely to have taken early action, unless their energy costs were significant. There was some indication from both qualitative and quantitative research that smaller organisations were less likely to have taken early action on energy efficiency, as they tended to face staff/skill constraints.

Barriers to further action

The quantitative survey found that lack of funding was the most commonly cited barrier to further action on energy efficiency (cited by 48% of respondents). But 21% of respondents felt there was no barrier to further action.

Barriers	% of respondents
Lack of funding/finance	48%
Too much uncertainty about long term benefits and costs	10%
Limitations of the premises	8%
Personnel resources not available to take forward	8%
There are no cost effective technologies available to us at the moment	5%
We don't stand to benefit from taking action [split-incentives]	4%
Lack of support from board/senior management	4%
Lack of information on what's possible	3%
Energy efficiency is not an organisational priority	3%
Lack of support from workforce	2%
Lack of trusted information	1%
No barriers	21%

Figure 4.3: Barriers to further action on energy efficiency (multiple response; n=904)

In the qualitative research, many interviewees identified the capital cost of energy efficiency investments as a barrier, and reported that energy efficiency investments were often competing with other capital investments which had quicker payback rates. This was consistent with the quantitative survey finding on the importance of funding as a barrier.

Many interviewees in the qualitative research also reported that other corporate objectives constrained their action on energy efficiency: this was not about organisations' growth objectives per se (which would affect energy use more than energy efficiency) but about changes to service standards that tended to limit the potential for energy efficiency (e.g. stricter standards for water quality).

Other barriers identified by some participants in the qualitative research were consistent with the additional barriers in Figure 4.3:

- some participants reported that the most cost-effective energy efficiency measures had already been implemented;
- some felt their management did not prioritise energy efficiency;
- short-timescales for leases on buildings, and uncertainties over medium/long term estate strategies, also constrained investment;
- lack of knowledge on specialist energy efficiency technologies; and
- split incentives for energy efficiency, owing to landlord-tenant relationships, franchise models and service-company arrangements.

Industry stakeholders also reported that there was a shortage of energy management skills in the workforce, as demand for these skills has increased.

These barriers were similar to those identified in other research on non-domestic energy efficiency²⁰. For example, the CSE/ECI report 'Factors influencing energy behaviours and decision making in the non-domestic sector' highlighted the barriers posed by split incentives and capital costs, particularly in relation to the relative attraction of energy efficiency compared to other investments.

General comments on government policy on non-domestic energy efficiency

In the qualitative research, some respondents felt they would like to see more clarity on the overall direction of policy and more stability. Some reported that they perceived DECC as creating a succession of 'ad hoc' schemes. This was echoed by industry stakeholders involved in reviewing preliminary findings.

²⁰ Two examples of previous research on barriers to non-domestic energy efficiency:

Carbon Trust and SPA Future Thinking, Exploring the design of policies to increase efficiency of electricity use within the industrial and commercial sectors, Research report for DECC, 2012. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66566/7028-design-policies-efficiency-elec-edr.pdf; Centre for Sustainable Energy and Environmental Change Institute (University of Oxford), What are the factors influencing energy behaviour and decision-making in the non-domestic sector? A rapid evidence assessment for DECC, 2012. http://www.cse.org.uk/downloads/reports-and-publications/behaviour-change/factors_influencing_energy_behaviours_in_non-dom_sector.pdf

Many respondents would like to see fewer different schemes and more consistency between government schemes (e.g. consistency of reporting requirements between DECC and Defra). But there was recognition that it is difficult to have a 'one-size-fits-all' policy owing to significant sectoral differences. Some stakeholders suggested that a more closely targeted approach might reduce overlap between schemes, while others would like to see one overarching scheme with variations for particular sectors.

The industry stakeholders highlighted that many energy efficiency schemes only applied to organisations above a certain size threshold. This had the effect of putting a significant cumulative burden of regulation on large organisations, while medium-sized organisations were much less targeted by energy efficiency policy.

Many respondents reported that some incentives or 'carrots' were needed, as well as regulatory requirements or 'sticks'. But many respondents also felt that frequent changes in policy can – in themselves – impose an administrative burden on organisations. So there was no overall consensus on the desirability of change.

Views on particular energy efficiency schemes

The qualitative research generated findings on the perceived impact of particular energy efficiency schemes. Views on the CRC are reported in chapters 5-8. Emerging themes were that:

- **Climate Change Levy (CCL)** payments were automatically added to electricity bills, and therefore straightforward in terms of compliance. The tax did not have high visibility at board level but a large number of organisations were liable;
- **Climate Change Agreements (CCAs)** were viewed positively, as they offered exemption from both CRC and CCL payments to organisations in specific energy-intensive sectors. Respondents reported that targets had become more influential in the second round of CCAs;
- **the EU Emissions Trading System (EU ETS)** also applied only to organisations in specific energy-intensive sectors but was reported to have little impact currently because of the low carbon price and abundance of allowances; and
- although the **Energy Savings Opportunity Scheme (ESOS)** was not yet in place during the fieldwork period, many private sector organisations were preparing their compliance strategies and volunteered views on the scheme. These views were mixed – some viewed energy audits as potentially useful while others resented the cost of bringing in independent experts, to redo something they had already done or were doing anyway.

These findings appear to be broadly consistent with the quantitative survey, as shown in Figure 4.2 above: 45% of all respondents cited the CCL as a factor influencing investment in energy efficiency, compared to 56% for CRC. Only 12% of all respondents cited CCAs as a factor and 1.5% cited EU ETS as a factor, but this partly reflects the low proportion of the sample covered by these schemes.

Amongst organisations with full CCA/EU ETS exemptions from the CCL and CRC, the survey found that 70% of organisations cited CCL as an influence on energy efficiency action, and 66% cited CCAs as an influence. Only 13% of this group cited the EU ETS scheme as an influence,

but this may again reflect the fact that more of the sample had exemptions on the grounds of CCA than EU ETS.

There was some suggestion from the qualitative research that the cumulative impact of these schemes may be encouraging 'laggards' to take action on energy efficiency. This is consistent with the quantitative survey finding that 19% of respondents, from all sample groups, cited compliance with some form of government energy efficiency policy as the most important factor affecting investment in energy efficiency. However, industry stakeholders commented that many energy efficiency policies (including the CRC and ESOS) were targeted at organisations or sites above a certain size threshold. They felt that smaller organisations were not adequately targeted and that new threshold-based policies had less impact on larger organisations because of the cumulative effect of other schemes.

5. Assessment of evaluation objective A

Objective A: Assess the extent to which the CRC has delivered reductions in emissions by the take-up of energy efficiency measures

Summary

There was consistent evidence from the quantitative and qualitative research to suggest that the CRC has had a beneficial impact on energy efficiency organisational behaviour and has had some positive influence on the take-up of energy efficiency measures. This impact appears to have been stronger in the private sector than in the public sector.

The econometric analysis suggests that the CRC has reduced electricity consumption by an annual average of 3-5% between 2010 and 2012, compared to information declarers. For CRC organisations with the highest gas use there was a significant reduction in gas consumption (estimated as an annual average of 30%) compared to information declarers. While there is a need for caution with this result due to uncertainties in the data - this finding suggests that, for this group, the CRC may have had a sizeable impact on gas consumption²¹.

There is also evidence that the CRC has reduced carbon emissions compared to information declarers, by an annual average of 6-8%, between 2010 and 2012. In addition, there is weak evidence that it has improved energy intensity relative to information declarers (measured in terms of electricity consumption per unit of employment).

For comparison, the original government Impact Assessment predicted that the CRC would lead to a 2% annual reduction in carbon emissions by 2015, under the original policy design²². Note though that this estimate applied to all fuels, not just electricity and gas.

There is mixed evidence on the scale of organisation most influenced by the CRC. The qualitative and quantitative research found that smaller organisations tended to report more CRC influence, as larger organisations were more likely to have already taken early action on energy efficiency. However, although the econometric research did not differentiate between sizes of organisation, it found that the CRC had the greatest impact at both extremes of consumption – on electricity meters in the lowest and highest bands. This analysis calculated that energy and emissions reductions from meters in the top 20% consumption band represented nearly three-quarters of the impact attributable to the scheme.

Detailed findings on objective A

Under objective A, we examine evidence on the trends in actions on energy efficiency and then the trends in emissions themselves, and the factors driving these trends. The next section on objective B reviews the evidence as to how far the CRC is driving these trends. This section analyses findings in relation to the evaluation questions A1-A6.

²¹ The data on gas consumption used for this analysis is subject to a more limited match between the different component databases, leading to only a subset of CRC participants or information declarers being included. See Section 2.2.3 of the econometric research report for more detail.

²² The Final Impact Assessment estimated that the CRC would save 1.3 MT CO₂ per year up to 2015, rising to 3.2 MT CO₂ per year by 2020, from a base of 53.2 MT CO₂. Reference: Final Impact Assessment on the Order to implement the CRC Energy Efficiency Scheme, DECC, January 2010.

Econometric findings are presented under evaluation question A6, which considers the ultimate impact of the CRC on energy consumption and energy efficiency. The intermediate outcomes leading to these impacts are explored through evaluation questions A1-A5, using evidence from the quantitative and qualitative workstreams. The econometric research does not provide direct evidence in relation to evaluation questions A1-A5.

A1: Are there increases in the take-up of energy efficiency measures that can be attributed to the Scheme?

The quantitative survey found that action on energy efficiency was reported to be greater than four years ago for more private sector CRC participants than for private sector information declarers (see Figure 5.1). This implies that the CRC encouraged an increase in energy efficiency action for private sector participants, relative to information declarers. The difference between public sector CRC participants and information declarers was not statistically significant.

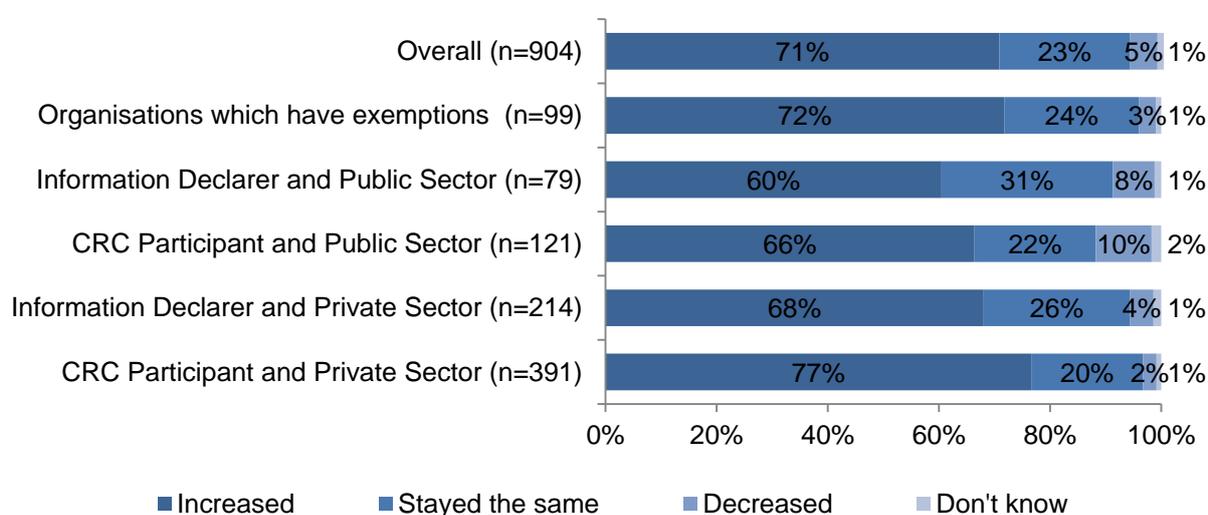


Figure 5.1: Reported change in amount of action taken on energy efficiency compared to four years ago

While nearly all organisations reported some investment in energy efficiency technologies, the quantitative survey found that around a third of CRC participants reported that action had been undertaken earlier or on a greater scale because of the CRC.

In terms of technologies, both the qualitative and quantitative research found that the installation of energy efficient lighting measures, including Light Emitting Diodes (LEDs), were the most common type of measure for both CRC participants and information declarers. Figure 5.2 below shows that reported levels of investment in a wide range of standard energy efficient and renewable energy technologies were higher in public sector organisations than private sector, irrespective of CRC status. While renewable energy technologies are not directly incentivised by the CRC²³, many respondents saw energy efficiency and renewable energy actions as being linked and reported actions on both types of technology.

The quantitative survey found that reported take-up of some technologies (e.g. boiler controls, energy efficient lighting, and voltage optimisers) was slightly higher in the CRC than information declarer groups. But the results were not clear-cut: information declarers reported slightly

²³ Except that, post simplification, CRC recognises that there are no distribution losses from onsite renewable energy.

higher take-up of some energy efficiency and renewable energy technologies (e.g. boilers and solar photovoltaics) than CRC participants, and public sector CRC participants reported more building fabric work than information declarers, while private sector CRC participants reported more metering than information declarers in their sector. The qualitative research similarly found that both CRC and non-CRC organisations reported take-up of a similar range of energy efficiency measures. This research also found that some respondents with energy-intensive sites (e.g. those covered by EU ETS or CCAs) reported that CRC had encouraged them to look at energy efficiency on their smaller or less energy-intensive sites.

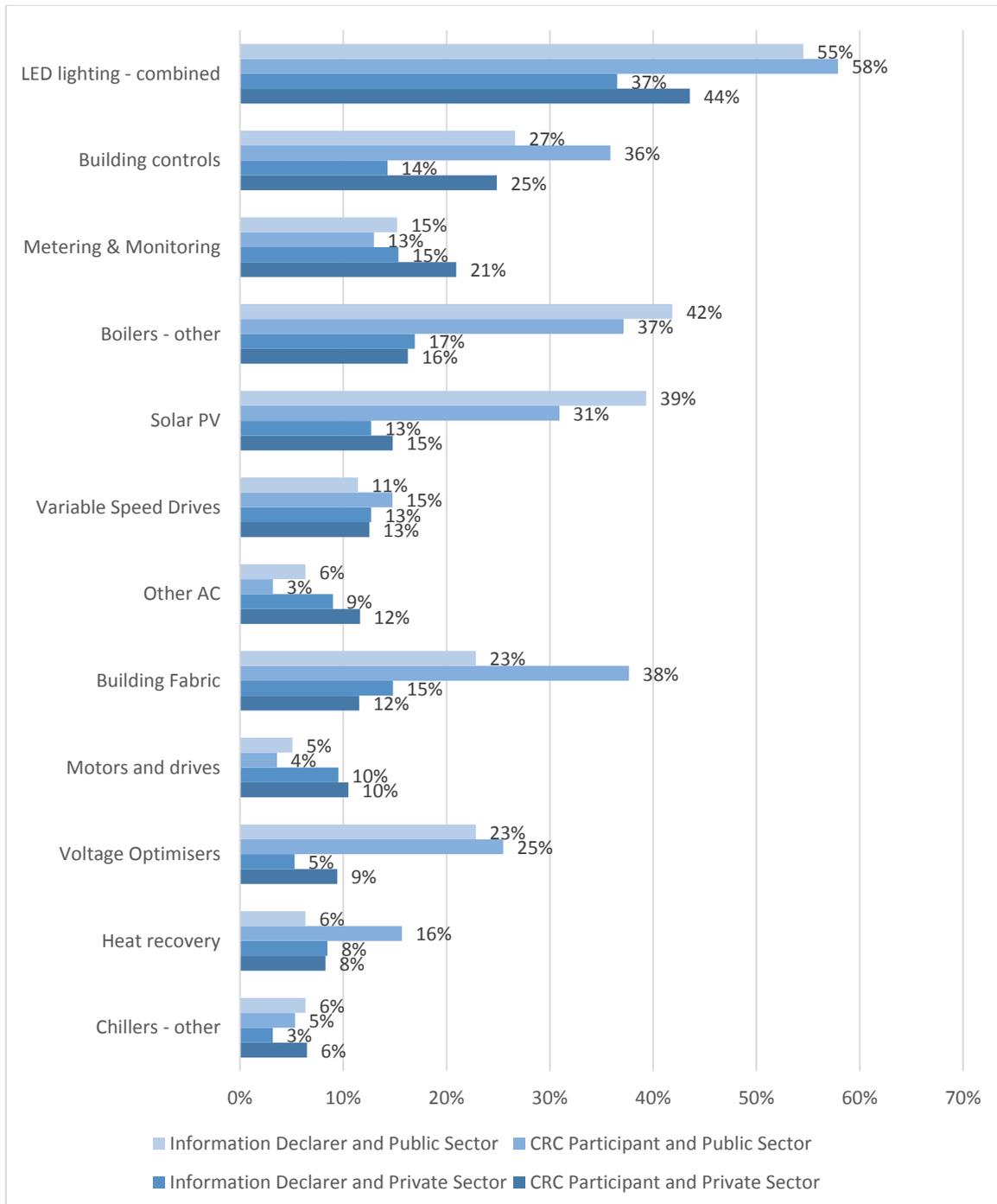


Figure 5.2: List of the 12 most common energy efficient and renewable energy technology investments²⁴

²⁴ Responses shown by % of cases within group. Any mentions of LED technology combined.

Figure 5.2 above only presents findings for standard categories of energy efficient investment. In the qualitative research, some respondents indicated that the greatest scale of energy efficiency savings came from investment in specialist equipment. For example, one local authority in phase 1 of the CRC saved 2,000 MWh per year by replacing chillers, although this action was taken not to save energy but to replace equipment which had reached the end of its useful life. The drivers for energy efficiency investments are discussed further in chapter 6.

Both the quantitative and qualitative research found that the installation of Automatic Meter Readings (AMRs) was influenced by the 'Early Action Metrics' for the CRC, which affected an organisation's position in the Performance League Table. Qualitative findings suggest that AMRs have contributed to better energy management through improved energy use data.

A2: Are there improvements in energy management practices and capacity that can be attributed to the Scheme?

This question relates to the adoption of management practices that promote energy efficiency. The quantitative survey found that CRC organisations reported significantly greater adoption of certain energy management practices than information declarers. Some of these differences applied to both the private and public sectors:

- undertaking carbon management and reporting;
- undertaking an energy audit in the past year;
- routinely forecasting energy use;
- installing energy reporting systems and software;
- employing dedicated staff (e.g. energy managers); and
- applying for/achieving a certified energy efficiency or energy reduction standard.

There was both quantitative and qualitative evidence that take-up of the Carbon Trust Standard by CRC participants had been stimulated by the CRC Early Action Metrics (EAMs). But qualitative research indicated that many organisations dropped the Carbon Trust Standard when the EAMs were dropped.

Some further differences were only statistically significant for private sector CRC organisations. For example, more private sector CRC organisations than information declarers reported that they set energy targets, that they had set up a dedicated cross-organisation working group on energy efficiency and that they used staff performance metrics linked to energy.

Qualitative research also found that the CRC was perceived to have encouraged the adoption of energy management in some organisations. But some organisations reported that they had already been focused on energy management, before the introduction of the CRC:

But energy control and energy management has been part of the norm for [Company] for quite a time now, so from a corporate level I can't say there have been many changes for a long time. (CRC energy manager 19, food)

For many CRC participants, CRC reporting had provided an impetus for improving energy data and rationalising electricity and gas meters:

I've been trying to run this European office reduction initiative but because I don't have any CRC sticks behind me I don't get the information I necessarily want in the format that I've asked for it. (CRC energy manager 1, holding company)

The qualitative research found that there were house-keeping benefits for many CRC organisations, in terms of clarifying which meters they were using and paying for. In some cases, this improved house-keeping resulted in some initial savings.

And for both CRC and information declarers, the qualitative research found that employing an energy manager could be a critical step in an organisation's energy efficiency journey. It was therefore significant that the CRC had influenced some organisations into taking this step.

I think the step-change was when they decided to employ an Energy Manager and then [there has been] the drive ever since then. (CRC energy manager 22 – retail)

A3: Are there increases in board-level awareness of energy efficiency that can be attributed to the Scheme?

This section examines whether changes in board-level awareness of energy efficiency within participating organisations could be attributed to the CRC.

Three-quarters of all the organisations interviewed in the quantitative survey reported that the overall level of priority in the organisation as a whole was higher now than four years ago. In the private sector, more CRC participants than information declarers reported an increase in priority, suggesting that the CRC influenced priority levels in some organisations. Qualitative research suggests that this difference was not observed in the public sector. Some public sector respondents reported a shift away from sustainability priorities and towards financial efficiency priorities over this period.

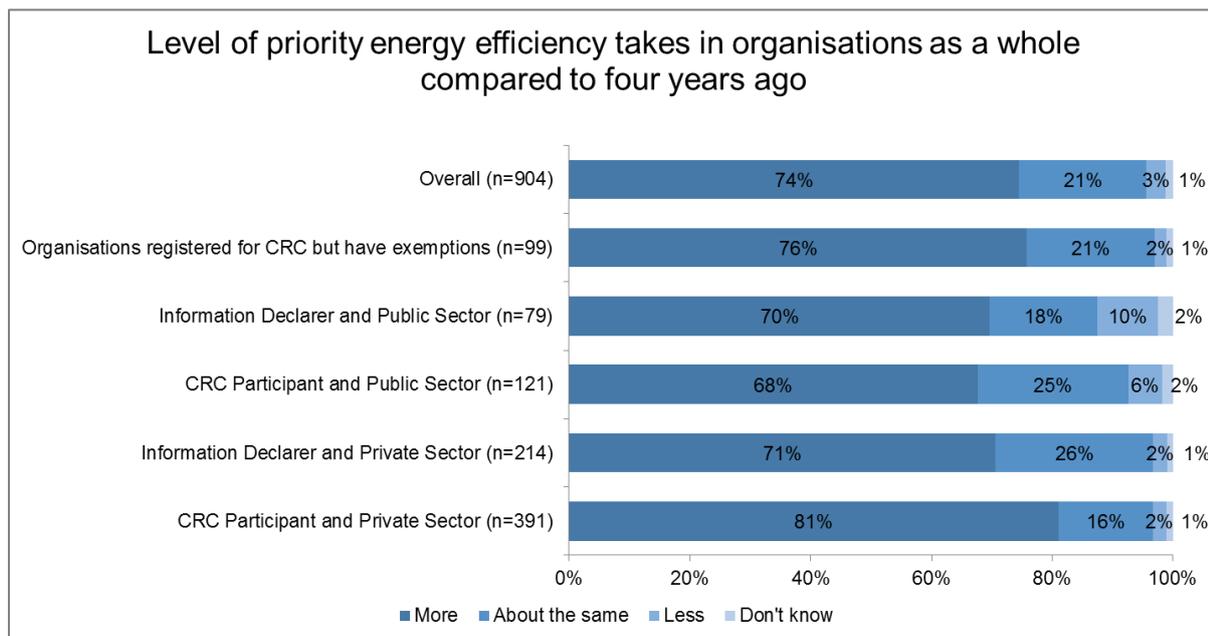


Figure 5.3: Change in level of priority that energy efficiency takes in the organisation, compared to four years ago

As discussed further in chapter 6, both quantitative and qualitative research found that the main driver for this increase in priority was increasing energy costs. But the quantitative survey found that the CRC was also a factor. For example, where respondents said that more priority was being given to energy efficiency compared to four years ago, 30% of private sector participants and 23% of public sector participants made some mention of the CRC.

The quantitative survey also found that significantly more private sector CRC participants than information declarers reported that their board or senior management met more frequently to discuss energy efficiency matters than they did four years ago. And more private sector CRC participants than information declarers reported that it was now easier to get board approval for energy efficiency investments, compared to four years ago.

This was consistent with qualitative research which found that, for some but not all organisations, the CRC was felt to have increased board-level awareness of energy efficiency. The mechanisms for this increase in awareness, and the types of organisations most and least likely to be influenced by the CRC, are discussed further in chapter 6.

A4: Are CRC participants behaving in different ways to non-CRC participants in any other respects (as a result of the policy, and not for other reasons)?

This section summarises the differences in behaviour between CRC and non-CRC participants that appear to be attributable to the CRC, on the basis of evidence on objectives A1-A3 above.

Clearly, CRC participants have had to comply with the CRC, in terms of meeting regulatory requirements, submitting reports, maintaining an evidence base and buying/surrendering allowances. Both qualitative and quantitative research found that this has imposed a cost and time burden on CRC participants. This is discussed further in chapter 8.

Both quantitative and qualitative research found that, for most organisations, energy costs have been the main driver for increased priority being attached to energy at board level. But both these elements of research found that, for some CRC organisations, CRC compliance has contributed to a significant increase in the priority attached to energy use at board or senior management level – particularly in the private sector.

The quantitative survey found that more CRC participants than information declarers reported the adoption of better energy management practices, such as employing dedicated energy staff and adopting energy reduction standards (at least on a temporary basis). This was consistent with findings from the qualitative research. The quantitative survey found that the CRC impact appeared to be greater in the private sector, where more CRC participants than information declarers reported establishing cross-organisation working groups on energy efficiency and using staff performance metrics based on energy efficiency, amongst other measures. Both the quantitative and qualitative research found that the CRC had stimulated the collection of more complete and accurate energy use data. However, some organisations reported that they had already adopted a wide range of energy management practices prior to CRC.

The quantitative survey found that the CRC had - on balance - encouraged a higher level of action on energy efficiency in CRC participants, compared to information declarers. While nearly all organisations reported some investment in energy efficiency technologies, the quantitative survey found that around a third of CRC participants reported that action had been undertaken earlier or on a greater scale because of the CRC. The range of technologies deployed varied more between private and public sector organisations than it did between CRC and non-CRC organisations, with the public sector reporting greater take-up than the private sector across a broad range of energy efficient and renewable energy technologies.

A5: What is the timescale for the changes in A1-A3; permanent/temporary; short/long-term?

There is little evidence from either the quantitative or qualitative research of CRC participants undertaking energy efficiency actions that were consciously short-term or temporary. In a few qualitative interviews, phase 1 CRC participants reported making particular efforts to avoid qualifying for phase 2: these efforts may well be temporary unless the participants expect there to be an eventual phase 3.

A6: What are the incremental emissions reductions achieved as a direct/indirect result of the Scheme?

This section focuses primarily on the impact of the CRC on energy use, but also considers the implications for carbon emissions and for energy intensity. Findings from econometric research are central to the attribution of emissions reductions, but we will first consider evidence from other sources before examining the econometric evidence.

EA annual reports for the CRC, initially the Performance League Tables and latterly the Annual Report Publication (ARP), show a significant reduction in carbon emissions from year to year for most of the organisations involved in the scheme. For example, total carbon emissions reported in the ARP declined by 5.4% from 2012/13 to 2013/14.²⁵ Although there have been

²⁵ CRC Energy efficiency scheme: annual report publications 2012/13 and 2013/14; Performance League Tables 2010/11 and 2011/12. <https://www.gov.uk/crc-energy-efficiency-scheme-annual-report-publication>.

changes in CRC definitions, particularly between the end and beginning of phase 1, these do not affect the overall declining trend in emissions.²⁶

However, it is not clear from the ARP and PLT how far this reduction can be attributed to the CRC. Qualitative and quantitative research identified a number of factors other than the CRC that were reported to have influenced energy use – and hence carbon emissions - during the CRC period. These included:

- rising energy costs;
- the economic downturn, which reduced absolute emissions; while
- the recent recovery in some sectors has tended to increase absolute emissions (although operating efficiency tends to increase when plants are operating closer to capacity);
- acquisitions/disposals have increased/decreased emissions for some organisations;
- disposals/closures have tended to raise the average efficiency of residual assets;
- some efficiency gains have arisen from new/refurbished premises and equipment; while
- in some sectors, regulation has had a negative impact on energy efficiency (e.g. more demanding water quality or waste disposal standards, which involve more use of energy in treatment processes);
- some efficiency gains have arisen from energy efficiency actions and better energy/building management; and
- gas heating demand has been lower during mild winters (e.g. 2013/14).

The qualitative research also highlighted a point relevant to the eventual evaluation of CRC phase 2: CRC participants reported that their phase 2 submissions were affected by annual changes in the emissions factors used by Defra. This means that their phase 2 carbon emissions could increase even if underlying electricity and gas use did not increase.

So, while the CRC data provides evidence of emissions reductions, and the qualitative and quantitative research highlight the range of factors that may have contributed to emissions reductions, we need to examine the econometric research to consider how far these reductions are attributable to the CRC.

The role of econometric research in relation to A6

The econometric research did not attempt to quantify the relative impact of energy prices or other factors compared to CRC influence. Instead, it removed these other factors by looking at differences in behaviour between CRC participants and information declarers, both of which would have been subject to these factors. The aim of using comparison groups in the econometric research was to isolate the influence of the CRC from all of these other factors.

²⁶ Hatchwell, P., Can the CRC find its mojo? ENDS Report 480, pp. 27-31, February 2015.
<http://www.endsreport.com/46942/can-the-crc-find-its-mojo>.

The econometric research focused primarily on electricity consumption, but some of the research also examined gas consumption and carbon emissions from these two fuels. The econometric analysis used confidential meter data held by DECC, rather than data submitted for CRC purposes, because of the need for a long and consistent time series to examine behaviour before and after the start of CRC phase 1, for both CRC organisations and comparison groups. The meter data also offered detailed consumption by meter point, rather than the total consumption figures submitted in CRC reports, and was more accurate because it had not been entered by hand, as was the case with CRC submission data.

In the econometric analysis, meter data was aggregated to a number of different levels, to facilitate matching with other data sets. Further details of the research methodology are provided in chapter 3.

The main findings of the econometric analysis are summarised below. The overall impact of the CRC is likely to be conservative, because there is evidence from both qualitative and quantitative research that some members of the comparison group (information declarers) were also influenced to some degree by the CRC. Subject to these caveats, which are discussed further in chapter 3, the overall impact of CRC should lie between the estimates derived from analysis sample 1 and the estimates derived from analysis sample 2. Further explanations of the two analysis samples, CCA exemptions and comparison groups, are given in chapter 3.

Analysis of A6 using electricity meter data

Analysis of electricity meter data, without any matching to other data sets, provides the largest dataset for econometric analysis, without any bias from the process of matching meter data with other datasets.

Analysis of electricity meter data, at meter level, shows a significant impact of CRC in reducing electricity consumption since 2008, compared to information declarers, for both samples (annual averages compared to business as usual ranging between 3% and 5%). The charts below show that the decline in electricity use for CRC meters (shown in red) is stronger than for information declarer meters during the CRC period (2010 to 2012). This finding is statistically significant for both analysis sample groups, at the 1% level, but is stronger for analysis sample 1.

There is some suggestion that the scale of the CRC effect may be declining in 2012, but analysis of data from 2013 would be required to confirm whether this is a consistent trend. The pre-CRC trends have been matched by matching the sample by electricity consumption bands and by trends in electricity use for 2009 (which is why the red and blue lines coincide in 2009). Further details of the econometric results are presented in a separate econometric appendix.

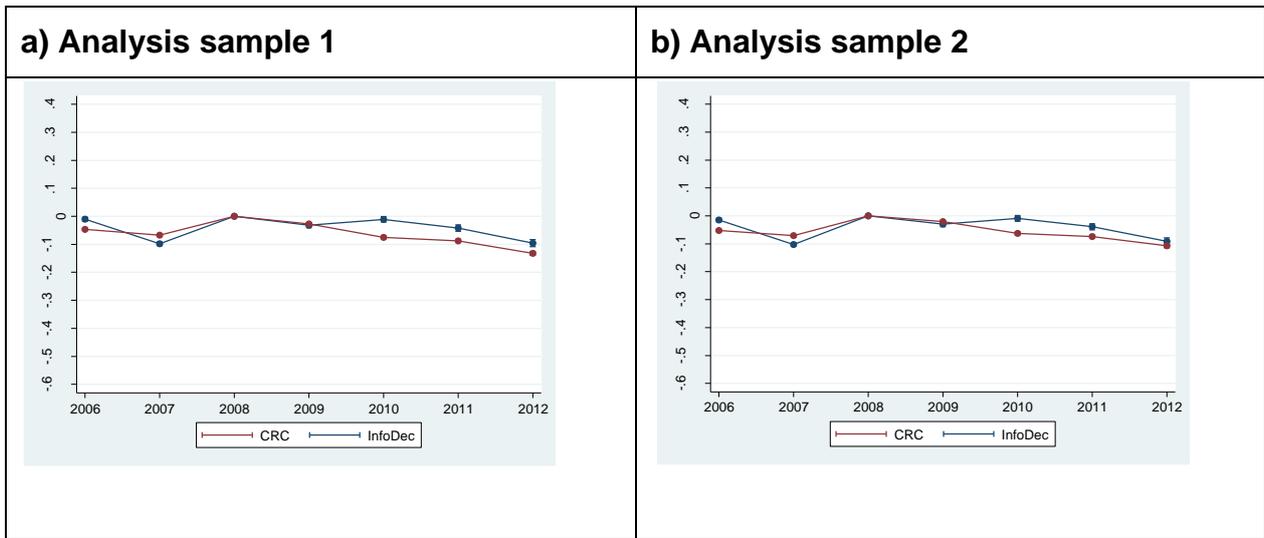


Figure 5.4: Analysis of growth in electricity consumption since 2008 at meter level for CRC and non-CRC meters

The meter-level analysis shows significant impacts for the CRC across all electricity meter consumption bands, but the impact is strongest for those meters with the lowest consumption (0-20% band) and for those with the highest consumption (80-100% band). The meters in the highest consumption band represent a significant proportion of the electricity consumption by all the meters shown here (74% of electricity consumption in 2008), and dominate the overall results.

Analysis of A6 using aggregated data

Similar ‘difference-in-difference’ regressions were undertaken at each of the five data levels set out in chapter 3. The main findings of the econometric analysis of electricity consumption are summarised in Figure 5.5, where one, two or three stars respectively denote statistical significance at the 10%, 5% and 1% level. The most significant results are marked with three stars. The quintiles column lists the consumption bands that display significant impacts at least at the 5% level. Cells marked ‘not available’ (n/a) indicate specifications that we have not considered in this report. Further details of these regression results are presented in a separate econometric appendix. We have used the meter-level estimates as the basis for our overall estimate of CRC impact on electricity consumption, as they are not affected by matching errors.

Aggregation level	Sample	Electricity	Quintiles
Meter level	Sample 1	5.1% ***	All 5
	Sample 2	3.7% ***	n/a
Building level	Sample 1	6.0% ***	Top 2
	Sample 2	3.1%	None
Postcode level	Sample 1	6.2% ***	n/a
	Sample 2	4.4% ***	n/a
Establishment level	Sample 1	5.5% ***	n/a
	Sample 2	4.5% ***	n/a
Organisation level	Sample 1	8.1% ***	n/a
	Sample 2	6.6% *	n/a

Notes: (*) indicates that the result is significant at the 10% level, (**) at the 5% level and (***) at the 1% level.

Figure 5.5: Summary of regression results for CRC impact on growth in electricity consumption

Analysis of gas meter data at building level does not show statistically significant impacts overall. But analysis by consumption band shows that there is a significant 30% reduction in gas consumption in the top percentile band (80-100%) for both sample groups, compared to information declarers. This is consistent with larger users of gas being more ready to replace boilers or change their processes to reduce consumption. However, data issues, including the coverage of gas meters in the NEED data (due to matching constraints), imply that this result needs to be interpreted with caution.

Analysis of carbon emissions at building level, from combined electricity and gas consumption data, shows a significant impact across both sample groups (annual averages compared to information declarers ranging between 6% and 8%). This is significant for the top four consumption bands in Sample 1, but is only significant in the middle three consumption bands for Sample 2.

Further analysis of electricity data has been undertaken at postcode, establishment and organisation level, to research possible effects of the CRC on employment, turnover and energy efficiency. As we cannot directly measure energy efficiency, we looked instead at its inverse: energy intensity. We could not model full energy intensity because of the difficulty in matching gas data reliably across the sample within the timescale of the study, so we used electricity intensity measured in two ways (electricity consumption relative to either employment or turnover) as a proxy for energy intensity. The findings of this analysis are summarised in Figure 5.6.

Aggregation level	Sample	Decrease in employment	Decrease in electricity intensity (electricity over employment)
Postcode level	Sample 1	n/a	4.8% ***
	Sample 2	n/a	3.1% ***
Establishment level	Sample 1	3.0%***	2.5% **
	Sample 2	3.2%***	1.3%
Organisation level	Sample 1	0.6%	7.6% *
	Sample 2	-1.3%	8.0% *

Notes: (*) indicates that the result is significant at the 10% level, (**) at the 5% level and (***) at the 1% level

Figure 5.6: Summary of regression results for CRC impact on growth in employment and electricity intensity

At organisation level, there is a significant impact on electricity intensity in relation to employment, but the impact on turnover is not statistically significant and is not presented here. Further details are presented in the econometric appendix. The results show a CRC impact on employment at one level of aggregation, but we do not view this as a robust result because it is not replicated at other levels of aggregation.

Overall conclusion on evaluation question A6

In conclusion, there is broad and robust evidence from the econometric research that the CRC has had an impact on electricity consumption – and also carbon emissions from electricity and gas consumption – of at least 3-5%, relative to information declarers. There is evidence of a strong CRC impact on those organisations with the highest gas consumption, although this does not apply across all levels of gas consumption and there are caveats around the matching of gas consumption data. There is weaker evidence that the CRC has had some impact in

reducing electricity intensity per unit of employment, which we are using as a proxy for energy intensity. A reduction in energy intensity implies an improvement in energy efficiency, relative to information declarers.

These econometric results provide insight into the scale of CRC impact on emissions, as opposed to other influencing factors identified by the quantitative and qualitative research. These results also help to explain how far the emissions reductions observable in ARP and PLT data are attributable to the CRC.

For comparison, the original government impact assessment predicted that the CRC would lead to a 2% annual reduction in carbon emissions by 2015 (under the original policy design, including revenue recycling). However, this reduction applied to all fuels, not just electricity and gas.²⁷

Further econometric findings on the differential impact of the CRC at different scales, in different sectors or at different times are presented in chapter 6.

²⁷ The Final Impact Assessment estimated that the CRC would save 1.3 MT CO₂ per year up to 2015, rising to 3.2 MT CO₂ per year by 2020, from a base of 53.2 MT CO₂. Reference: Final Impact Assessment on the Order to implement the CRC Energy Efficiency Scheme, DECC, January 2010.
http://webarchive.nationalarchives.gov.uk/20110508074721/http://decc.gov.uk/assets/decc/1_20100120102757_e@@_crrconsia.pdf.

6. Assessment of evaluation objective B

Objective B: Identify the barriers and drivers to energy efficiency and assess the extent to which the CRC has overcome barriers and emphasised drivers

Summary

The quantitative and qualitative evidence suggested that CRC has raised the profile of energy efficiency at board level in some types of organisations, through the legal requirement for compliance, through senior responsibility for compliance (particularly high-level sign-off of allowances) and through increasing the overall cost of energy. In addition to this financial driver, some organisations reported that the CRC's awareness-raising drivers had contributed to improvements in energy data and reporting, and improved visibility of energy use in their organisation.

Most CRC participants felt that the influence of CRC on reputation was less marked than its influence on finance or awareness: few CRC participants reported that the Performance League Table (PLT) (or its successor the Annual Report Publication (ARP)) had significant influence beyond year 1. However, the reputational influence of compliance appeared to be a strong driver.

But these were not universal effects – some organisations reported that the CRC had little impact on their energy awareness or energy-related behaviour because they were already taking action. Qualitative research found that organisations with the following characteristics tended to report early awareness and action on energy efficiency, before the CRC:

- high energy costs relative to total costs;
- sensitivity to reputational drivers (e.g. public sector bodies, publicly-quoted organisations, organisations which tendered for public sector contracts and organisations with a high public profile);
- sensitivity to environmental factors (e.g. waste and water industries); and
- organisations which were larger scale (in terms of capacity to address energy management).

This was consistent with quantitative research findings that smaller organisations, with low energy intensity and so lower electricity consumption, tended to report more CRC influence.

In contrast, the econometric research found that the CRC seemed to have most impact on electricity meters with relatively low consumption or relatively high consumption. The latter dominated the econometric results because of the greater scale of savings in electricity use. Results in relation to gas consumption were less conclusive, but the econometric research only found a significant CRC impact for gas meters with high consumption. It is not clear how the econometric finding of greater CRC influence on meters with higher consumption relates to the

quantitative and qualitative finding that larger organisations reported less influence: this could either be explained by an element of lobbying in the quantitative and qualitative responses, or by higher consumption (by meter) not necessarily being linked to organisation size.

The qualitative research and econometric research appeared to suggest that the early stages of the CRC may have had most impact (i.e. pre-scheme preparation and the first year or so of the scheme). This appears to have been linked to the incentive effect of proposed revenue recycling, linked to the PLT, together with the impact of ensuring compliance at the start of the scheme.

Detailed findings on objective B

In this section, we examine the drivers for energy efficiency action, the significance of CRC influence and those aspects of the CRC that have been most effective in overcoming previously identified barriers. We then look at any remaining barriers not addressed by the CRC.

B1: What broader factors have been driving changes in A1-A3, over the period of the CRC, in both CRC and non-CRC organisations drivers for energy efficiency?

Evidence on the broader factors driving changes in energy efficiency is presented separately in chapter 4. The remainder of this section examines the role of the CRC within this broader context.

The cost of energy was cited as the overwhelmingly dominant driver for action on energy efficiency in recent years, in both the quantitative and qualitative research. When asked to identify the most important driver, only 7% of survey respondents cited CRC as the most important (see Figure 4.1).

But when prompted as to whether particular factors had influenced energy efficiency investment to some degree, 56% of all survey respondents cited CRC as one of the factors influencing investment (see Figure 4.2). This varied from 74-81% for CRC participants (private and public sector) to 27-32% for information declarers and organisations with full exemptions from the CRC.²⁸

In the qualitative research, some organisations reported that they had already taken action on energy efficiency prior to the CRC and that the CRC had little impact. These tended to be public sector organisations or those meeting the criteria for 'early action' identified in chapter 4.

I wouldn't have said that [the CRC] made any significant difference in terms of the way we dealt with energy, because we were already monitoring it anyway. (CRC energy manager 4, health)

But others did see the CRC as a significant driver for action:

²⁸ Comments made by information declarers during the quantitative survey suggest that some had been influenced by having to declare their energy consumption before phase 1, while others were influenced by desire to avoid being in phase 2. Those information declarers and those with full CRC exemptions from phase 1 who then became eligible for CRC phase 2 were excluded from the quantitative survey analysis.

I think it is fair to say the carbon reduction commitment [sic] is one of the drivers that ensures that carbon and energy remains higher up the agenda in our organisation, because obviously we have a statutory duty to comply with that scheme. (CRC energy manager 11, local authority)

A few CRC participants and information declarers reported significant action on energy efficiency with the aim of reducing or keeping consumption below the qualifying threshold for phase 2. This evidence came both from the qualitative research and from verbatim comments in the quantitative survey.

The driver from CRC was that it set a benchmark, get below 6 [GWh] and you're not paying carbon tax and you've have the benefit of the energy reduction as well. So that was a real target for us. (CRC senior manager 6, local authority)

It initially made us more aware of energy use. We made sure we dropped below the threshold. (Information declarer, quantitative survey)

The differential impact of CRC on different groups was consistent with survey findings. While just under 60% of CRC participants said that the CRC had not made much difference to the scale or timing of action on energy efficiency, around a third reported that action was taken earlier or on a greater scale because of the scheme. The impact of the CRC on different groups is discussed further below under heading B6.

Sections B2 to B4 below examine how the CRC influenced energy efficiency behaviour by exploring the influence of the different drivers within the design of the CRC:

- the financial cost of CRC payments;
- awareness raising impact of the CRC; and
- reputational aspects of the CRC.

Evidence on the cumulative effect of these three drivers is presented at the end of section B4.

B2: How far are changes in A1-A3 attributable to the financial cost of CRC payments, as opposed to these other factors?

There was limited evidence on the actual cost added to energy prices by the CRC. Evidence from some of the qualitative interviews suggested that CRC payments of £12/tonne during phase 1 typically added 6-8% to their organisation's energy costs. In addition, industry stakeholders suggested that in some sectors this figure was typically 11%. This is similar to the figures presented in Annex D of DECC's report on energy prices and bills for 2014²⁹. The recent increase in the cost of allowances to £15.60/tonne or £16.40/tonne during phase 2,

²⁹Detailed information on the cost of CRC to energy bills can be found in the 2014 bills and prices report: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384404/Prices_Bills_report_2014.pdf.

combined with possible reductions in business energy prices, will tend to increase this further. For any particular organisation, the exact figure depends on the price at which they buy their energy and the mix of electricity and gas. Gas is lower than grid electricity in both price per kWh and in carbon content, and is not subject to all the pass-through costs applicable to electricity (such as the Levy Control Framework), so CRC costs may represent a higher proportion of final gas costs to customers.

There is evidence from the qualitative research that the additional cost of the CRC improved business cases for energy efficient investments to some degree, acting in the same direction as energy price increases. But the visibility of having to pay for CRC allowances once a year appears to have been a stronger financial driver for some organisations.

The CRC all of a sudden basically added about 6% to energy bills for businesses, but I think more importantly than that at the end of the year was a big cheque that somebody had to sign. (CRC energy manager 31, finance (energy consultant))

The quantitative survey found that around two-thirds of CRC participants included CRC costs in their business cases for energy efficiency investments (see Figure 6.1). Qualitative research also suggested that some organisations did not include CRC costs in business cases. This was either because CRC costs were regarded as too marginal and uncertain to be included, or because the business structure made it difficult to allocate CRC costs down to operational level.

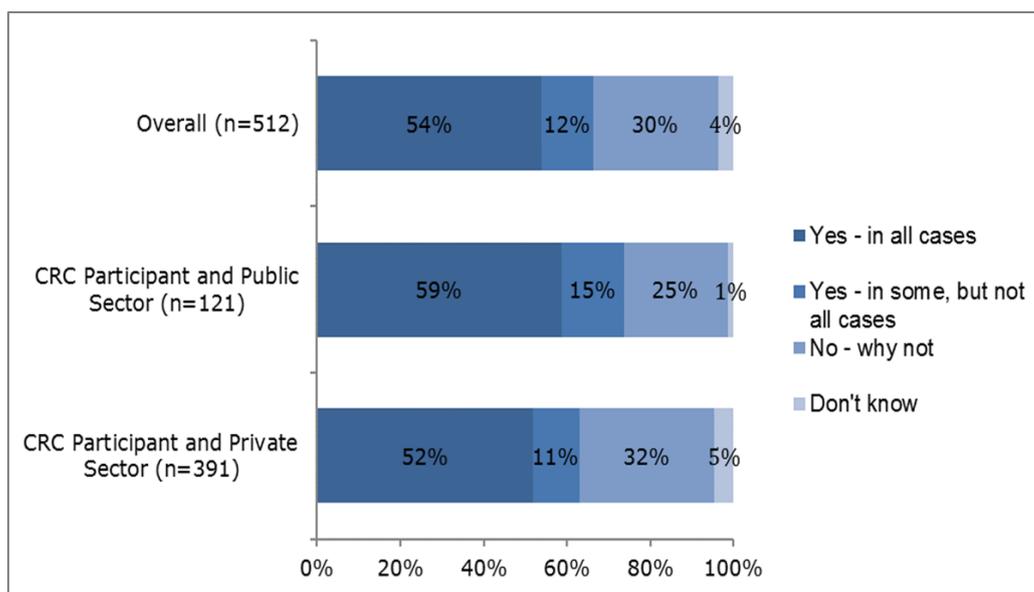


Figure 6.1: Do you include the cost of CRC within the business case for Energy Efficiency Investments? (CRC participants, n=512)

The qualitative research found that savings in CRC allowances were seen as positive for business cases but were generally reported to be marginal compared to other factors.

Basically the CRC saving on [the gas saved by a particular gadget] is negligible on how much it's going to cost. So there is already a good payback on the term of investment,

and the CRC reduction is seen as a small bonus. (CRC energy manager 1, holding company)

In the qualitative research, many CRC respondents commented that revenue recycling would have provided a real incentive for businesses to improve their performance in order to reduce CRC payments or get some money back.

In the concept of revenue recycling was something to get your teeth into and was a way for us to arguably drive some competition in the hotels. (CRC energy manager 2, hotels)

The econometric research presented in chapter 4 suggests that, ignoring the other aspects of the CRC, the impact of the CRC costs on electricity consumption from 2010 to 2012 imply a price elasticity of electricity demand of between 0.3 and 0.52. This is plausible and in line with comparable figures reported in the literature for energy price elasticities³⁰. We attribute this price elasticity to CRC rather than the combined impact of CRC and CCL, since most CRC participants and information declarers would pay CCL (except on consumption covered by CCAs, which is already excluded from the econometric analysis).

To sum up, the qualitative, quantitative and econometric evidence suggests that the financial cost of the CRC was a driver for action on energy efficiency, albeit a less significant driver than energy costs themselves. This financial cost improved business cases for energy efficiency investments, to a modest degree. An important element of this driver appears to have been the impact of high-level sign-off of annual CRC allowances, which is reported to have raised senior management awareness of the benefits of increased energy efficiency.

B3: How far are the changes in A1-A3 attributable to the awareness-raising drivers in the CRC (e.g. board-level sign-off; corporate reporting), as opposed to other factors?

In the quantitative survey, energy managers reported that the level of organisational awareness of energy efficiency had increased in recent years, across all subgroups of participant and information declarers. In this survey, there were very few mentions of the CRC being the only reason for an increase in energy awareness within organisations. But, where survey respondents said that awareness of energy efficiency compared to four years ago has increased, 21% of private sector and 24% of public sector participants made some mention of the CRC.

Many CRC participants in the qualitative research reported that the CRC had helped to raise awareness of energy use and energy efficiency in their organisation. One mechanism for this was through high-level sign-off of CRC allowances, as outlined under heading B2.

But the CRC helped me in a way of engaging the board to say here's cost of about [nearly £100,000], here's a big pot of money which is coming out. (CRC energy manager 16, property)

³⁰ Steinbuks, J. (2011), 'A Survey of Recent Developments in Economic Modelling of Energy Demand' in Jamasb, T. and Pollitt, M., Eds. (2011), *Electricity and Heat Demand in a Low-Carbon World: Customers, Citizens and Loads*, Cambridge University Press

A few CRC participants mentioned that awareness was raised by making board members personally responsible for compliance.

I think the threat of putting the key person in jail for a period of time did the job. If you want to influence a company into taking notice, the fact that you're going to put the most senior person behind bars for not conforming, yes definitely it focused people's attention. (CRC stakeholder 4)

Many respondents in the qualitative research reported that the CRC had encouraged improvements in measuring energy use, and some pointed out that this was the first step towards managing energy.

CRC has taught them one thing, [if] you can't measure it [then] you can't manage it. (CRC energy manager 1, holding company)

The combination of better data and high-level sign-off required for CRC gave energy more visibility within some organisations which were not already prioritising energy.

So for me it was perfect walking into a job where we were doing very little, or we had useless data and processes, it was an ideal perfect scheme to kick off through the company to get that attention. (CRC senior manager 16, energy)

But, as explained above under B1, less impact was reported by those CRC participants who had already engaged with energy efficiency prior to the CRC, which tended to meet the 'early action' criteria set out in chapter 4.

The idea of CRC was to make the board aware by giving them one big bill, well that didn't work for us at all they were already aware. (CRC energy manager 19, food)

The quantitative survey found that 5% of private sector information declarers, and 1% of public sector information declarers also mentioned the CRC as a reason why awareness of energy efficiency had increased within their organisation. Verbatim comments from these respondents indicate that the possibility of qualifying for the CRC in future raised awareness of legislation, sustainability and energy efficiency, and highlighted the cost that CRC could impose on their organisations.

To sum up, the CRC awareness-raising drivers appear to have been relatively influential by making energy more visible within CRC organisations, and to a small degree within information declarers. While the evidence from the quantitative survey was limited, possibly because of the wide range of factors affecting organisational energy awareness, there was strong evidence from the qualitative research.

B4: How far are the changes in A1-A3 attributable to the reputational drivers in the CRC (e.g. publication of the Performance League Table, its successor the ARP and enforcement), as opposed to other factors?

In this section we first consider the reputational influence of published CRC reports, before considering the reputational influence of CRC enforcement.

Influence of the Performance League Table and Annual Report Publication

There was some evidence from qualitative research that the Performance League Table (PLT) acted as a reputational driver during the preparatory phase (when revenue recycling was expected) and the first year of the CRC (when media interest was expected). As highlighted in chapter 5, some CRC participants reported taking action on the 'Early Action Metrics' to improve their position in the table.

[Our Company] was 151st – in the top 10%. Before that nobody was looking at it. (CRC energy manager 7, service company)

But a few CRC participants commented that there was little national media interest in the first PLT, which affected their view of subsequent reports.

We did not get a single enquiry from any media organisation that challenged us as to where we were in the league table. That spoke volumes to me. (CRC energy manager 8, water company)

There was little evidence from qualitative research that the published CRC reports (i.e. the PLT or Annual Report Publication (ARP)) acted as motivators after the first year. Several respondents commented that the PLT was not useful because it compared organisations in very diverse sectors.

A recent article in the environmental press, analysing trends in the 2013 ARP, highlighted the challenge of analysing long-term trends in carbon emissions owing to differences in definition between the PLT and ARP.³¹ This limitation of the data may be overcome in future, as a longer time series of consistent ARP data emerges. But the article also highlighted the incompleteness of turnover data in the ARP, which made analysis of energy efficiency problematic in the absence of econometric research such as that presented in this report. These points, and the lack of national media coverage, were echoed by respondents in the qualitative research.

The ARP is absolutely not a driver. Initially in year 1 it [the PLT] had an impact but it was just on the EA website – and you even had to look for it there. It's not really in the public domain. Organisations have worked out that you can just say 'undisclosed' to the management questions – you don't have to answer all the questions. (CRC energy manager 14, energy consultant)

³¹ Hatchwell, P., Can the CRC find its mojo? ENDS Report 480, pp. 27-31, February 2015. <http://www.endsreport.com/46942/can-the-crc-find-its-mojo>.

These points were consistent with quantitative research findings that two-thirds of CRC participants did not currently attach importance to the published CRC reports (see Figure 6.2).

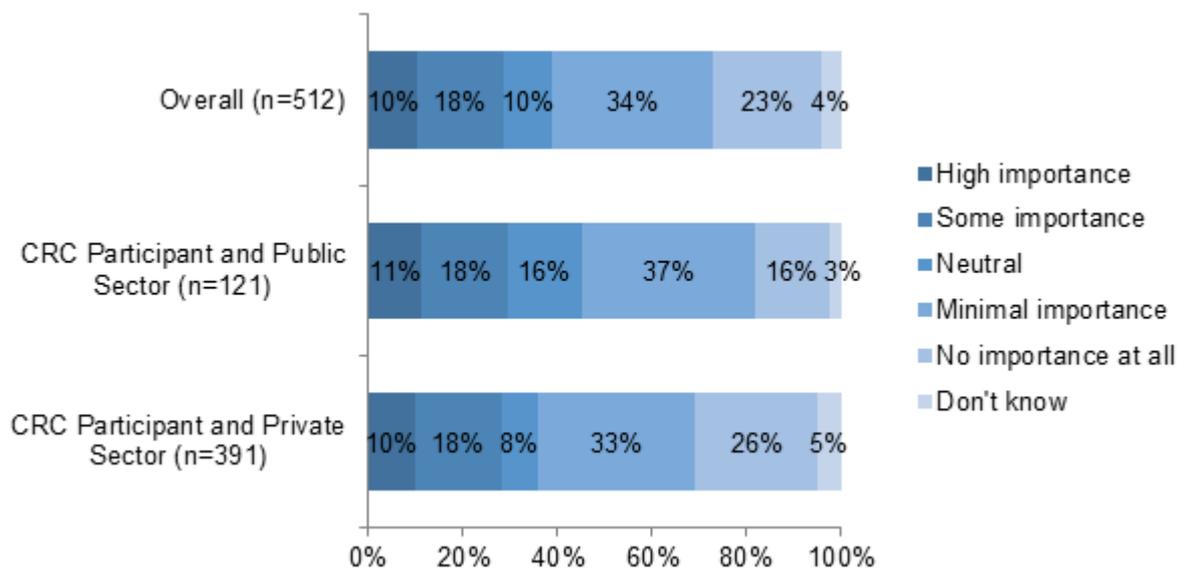


Figure 6.2: What level of importance do you attach to publicly available reports from the CRC? (CRC participants, n=512)

Reputational influence of compliance and enforcement

There is evidence from the quantitative and qualitative research, that compliance has been a strong reputational driver for many CRC participants. Many organisations reported that ensuring compliance with legislation was important to them. This is consistent with the high levels of compliance observed by the Environment Agency (generally in the range 97-99%).

Those organisations which were most concerned about their reputation were particularly concerned not to generate negative media headlines through non-compliance with the scheme.

It's reputational drivers, it's more a question of a certain paper(s) having the headline that [Company] doesn't comply with legislation rather than having to pay a certain amount for it. At the end of the day we want to do what's right and obviously we want to comply with all legislation. (CRC energy manager 19, food)

Several participants mentioned that the enforcement fines and penalties, as well as the threat of criminal charges and fear of the EA publicising non-compliance, were significant enough to raise attention.

Yes, as was the intention of the scheme it's highlighted the role of energy let's say from a compliance perspective. It probably had a limited effect in terms of the additional cost but the drivers around compliance were very strong, obviously with the associated fines and penalties involved. It raised the profile of energy certainly on that basis. (CRC energy manager 21, local authority (energy consultant))

But a few participants mentioned that they were unaware of enforcement actions being taken against participants.

Yes, the threat of being fined is important. But I haven't seen any information on organisations which have failed to comply with CRC. (CRC energy manager 14, energy consultant)

To sum up, the reputational influence of CRC publications was influential up to and including the first year of phase 1 but declined thereafter. But the reputational influence of compliance and enforcement appear to have been significant, as supported by the high compliance rate.

B2-B4: Cumulative influence of the three CRC drivers

As explained in chapter 3 on methodology, the quantitative findings have been analysed using a behavioural variable (BEH) which reflects sensitivity to one or more CRC drivers. CRC participants were allocated to BEH group 1 if they were more influenced by the CRC, having reported sensitivities to one or more of the drivers. This group comprised CRC participants who reported that:

- CRC costs had a significant impact on profitability (i.e. they were sensitive to the financial driver); and/or
- CRC was a factor for increased awareness of energy efficiency (i.e. they were sensitive to the awareness driver); and/or
- they attached high importance to publicly available CRC documents (i.e. they were sensitive to the reputational driver).

CRC participants who reported none of these influences were allocated to BEH group 2.

There was evidence from the quantitative research, that the 491 private sector CRC participants in BEH group 1 who reported sensitivity to CRC drivers also reported increased action on or priority for energy efficiency, relative to the 152 private sector CRC participants in BEH group 2:

- proportionately more private sector participants in BEH group 1 (87%) reported that energy efficiency takes priority compared to those in BEH group 2 (71%);
- a larger percentage of private sector participants in BEH group 1 (84%) have seen an increase in the amount of action taken on energy efficiency within their organisations, compared with those in BEH group 2 (66%); and
- a larger percentage of energy managers in private sector CRC participants in BEH group 1 (53%) find it easier to secure board/ senior management approval for investment in energy efficient technologies, compared with those in BEH group 2 (44%).

These findings suggest that the private sector CRC participants most influenced by the three CRC drivers have increased both the level of priority assigned to energy efficiency and the level

of practical activity. There were smaller differences between public sector participants in BEH groups 1 and 2.

B5: Which phases of the scheme had most impact on the actions (A1-A3): Pre-scheme preparation, phase 1 or phase 2?

The qualitative research suggests that the early stages of the CRC appear to have had most impact (i.e. pre-scheme preparation and the first year or so of the scheme). This appears to have been linked to the incentive effect of proposed revenue recycling and PLT, together with the impact of ensuring compliance at the start of the scheme.

The headline results of the econometric analysis treated the calendar years 2006-2009 as 'pre-CRC'. This did not allow the detection of any pre-CRC effects. However, the econometric analysis also reported year by year effects graphically. These did not suggest any impact before 2010, at least as far as differences between CRC participants and information declarers were concerned. Of course this does not rule out effects on both of these groups as a whole.

Several CRC participants reported that board-level interest in the CRC had declined since the start of the scheme. The qualitative research suggested that this was largely because CRC payments were now a standard part of participants' budgets, and that CRC compliance had become systematised: many board members had got used to the scheme and simply treated it as a carbon tax.

This appears to be consistent with one interpretation of econometric findings, as presented in chapter 5: the impact of CRC on energy consumption appears to be lower in 2012 than the two preceding years. But there are other possible interpretations of the reduced impact in 2012: this may simply be a statistical blip; or it might reflect CRC avoidance activity by some members of the information declarer comparison group, dampening the difference between the CRC and comparison group. This is plausible since the qualifying year for CRC phase 2 ran from April 2012 to end March 2013. To distinguish between these interpretations, the analysis would need to be extended to 2013 – when data becomes available.

While most respondents did not feel that the recent increase in the cost of CRC allowances from £12/tonne in phase 1 to £15.60-£16.40/tonne in phase 2 was financially significant, a few commented that this had raised board awareness.

It is too early to say whether the CRC will have lagged effects that are not yet observable but may appear over time. Industry stakeholders suggested that it may take time for analysis and use of AMR data to feed through into energy efficiency initiatives. Similarly, they suggested that some businesses may reconfigure their structures or services over time.

B6: What factors have influenced the effectiveness of different drivers (CRC/other), across different types of participant (e.g. price signal, presentation of data, energy-intensity of participant; scale of participant)?

The first part of this section analyses the four characteristics which were identified as being linked with 'early action' on energy efficiency in chapter 4. The final part of the section examines how CRC influence varied across different sectors.

Energy intensity

The qualitative research found that energy costs tended to outweigh CRC as a driver for organisations undertaking relatively energy intensive activities.³² This was consistent with quantitative findings that organisations with CCA and EU ETS exemptions, which have the highest energy intensity of all the sample groups, reported the highest level of priority attached to energy efficiency at board level (7.1 on average, compared to 6.5 for the sample as a whole).

The qualitative research found that organisations for which energy costs were a lower percentage of total costs, as reported in qualitative interviews, tended to report that they had not prioritised energy pre-CRC unless they fell into another 'early action' category. Some of these interviewees reported that they were more influenced by the CRC, but others still attached a low priority to energy efficiency, despite CRC influence.

As explained in chapter 3, full analysis of quantitative findings by energy intensity was not possible owing to the difficulty of matching turnover data with energy use data for specific CRC participants and information declarers. While matching of energy and turnover at organisational level was done for econometric purposes, the matching was only possible for a subset of CRC meters, the organisational level were not always equivalent to CRC registration levels, and the econometric data could not be used in a way that identified individual organisations.

However it was possible to combine the high-level characterisation of sample strata by electricity intensity, presented in chapter 3, with quantitative findings for these different sample groups. The quantitative survey found that CRC was reported to have more impact on the private sector CRC participants with below median electricity consumption (which also had lower electricity intensity). This survey also found that the CRC had less impact on private sector participants with above median electricity consumption (which had slightly higher electricity intensity). This is consistent with the hypothesis that the more energy-intensive organisations tended to have already taken action on energy efficiency.

Sensitivity to reputational risk

The qualitative research found that organisations which were sensitive about reputational risk were more likely to have undertaken early work on energy or carbon before CRC, but were also more influenced by the CRCs reputational drivers (e.g. PLT). This is consistent with the quantitative research finding that those influenced by the reputational and other drivers (in BEH group 1) were more likely to say that their organisation prioritised energy efficiency.

Sensitivity to environmental factors

The qualitative research found that organisations which recognised the impacts of environmental change on their business (such as water or waste companies) also tended to report that they had already taken action on energy or carbon pre-CRC.

Scale

The qualitative research found that larger organisations (e.g. those with more staff and higher energy consumption) were more likely to have taken action pre-CRC. This is broadly consistent

³² CRC costs clearly formed one part of overall energy costs, but in the qualitative research and stakeholder workshops these were estimated at only 6-11% of underlying energy costs.

with quantitative research findings that smaller organisations, with lower energy intensity and electricity consumption, tended to report more CRC influence, as reported under 'energy intensity' above.

These findings cannot easily be compared to econometric findings, which considered scale in terms of high or low electricity consumption per meter rather than per organisation. The econometric research found that the CRC seemed to have most impact on electricity meters with relatively low consumption or relatively high consumption, although the latter dominated the overall results.

There was some conflicting evidence about the behaviour of large gas consumers. The econometric research found that the impact of the CRC in reducing gas consumption was only significant for meters with high gas consumption. In contrast, the qualitative research found that a few major energy users were switching from electricity or oil to gas for industrial processes, to reduce their overall energy costs, which would tend to increase their gas consumption. The econometric finding of major reductions in gas consumption for the biggest gas consumers is based on a larger sample size than the qualitative research and is therefore a more robust finding. But the possibility of fuel switching by some organisations, and at some scales, may help to explain the wide spread of results in the econometric analysis of gas consumption.

It is not clear how the econometric finding of greater CRC influence on electricity and gas meters with higher consumption relates to the quantitative and qualitative finding that larger organisations reported less influence: this could either be explained by an element of lobbying in the quantitative and qualitative responses, or by higher consumption (by meter) not necessarily being linked to organisational size.

Variation by sector

The econometric research generated a range of different estimates of CRC impacts on specific sectors, depending on the level of analysis:

- the building-level analysis found that the largest impact was coming from factory-type premises, with a slight impact on office-type premises; while
- the postcode and establishment-level analysis found that the most consistent and significant impacts were on the food, metals, trade and hospitality services, as well as 'other personal services'.

The sample sizes within the quantitative and qualitative research did not allow breakdown of findings by sector group. It was therefore difficult to cross-check the quantitative and econometric findings on sector variations, particularly since the sectors emerging as significant cover both energy intensive and non-intensive activities. Further details of the sector results are given in the econometric appendix.

B7: Are there additional barriers to actions A1-A3 that need to be overcome, and how far do these apply to different types of participant?

Findings on the remaining barriers to further action on energy efficiency are presented in chapter 4. This section considers how far these barriers apply to different types of CRC participants.

Lack of funding was a barrier cited most frequently by the public sector. The quantitative survey found that 70% of public sector CRC participants cited access to funding for capital investments

as a significant barrier compared with 37% of the private sector participants. But qualitative research found that even some very large private sector organisations reported problems accessing internal capital. As reported in chapter 4, the qualitative research found that energy efficiency investments were often competing with other capital investments which had quicker payback rates.

In the quantitative survey, more private sector (25%) than public sector CRC participants (5%) reported that there were no significant barriers to further action on energy efficiency. 20% of organisations with CCA/EU ETS exemptions also reported that there were no barriers to further action.

Conversely, 16% of public sector CRC participants noted that they did not have the personnel to take forward energy efficiency work, compared to only 5-6% of other CRC/information declarer groups and 9% of those with CCA/EU ETS exemptions. This may reflect current staffing constraints in the public sector.

In the qualitative research, some CRC participants reported conflicts between energy efficiency and other business priorities, including rising quality standards and regulatory requirements. These tended to be sector specific (e.g. higher water quality standards tended to require more energy-intensive water treatment processes, while the introduction of incineration for clinical waste increased energy use for waste disposal).

Some sector-specific or business-specific barriers were reported in the qualitative research. For example, property organisations tended to report that investment was constrained by split motivations between landlords and tenants, or between lessors and lessees. Some organisations operating facilities on behalf of others (e.g. operating leisure centres on behalf of the local council) reported that service agreements tended not to incentivise energy efficiency investment by either the client or operator. Similarly, businesses operating franchises, often in the hospitality or retail sector, tended to report that CRC costs were not fully charged to franchisees which reduced their incentive to take action on energy efficiency.

B8: Have policy uncertainty and changes in government policy, within or beyond the CRC, been a barrier to action on energy efficiency (A1-A3)?

There is little direct evidence from quantitative or qualitative research that uncertainty is acting as a direct barrier to energy efficiency. But, as reported in chapter 4, some respondents to the qualitative research were keen to see more clarity and certainty on future government policy. Many of these respondents would like to see a simpler and clearer policy landscape for energy and carbon, with more consistency between schemes.

7. Assessment of evaluation objective C

Objective C: Assess whether the CRC has delivered abatement in a cost-effective manner

Summary

The evidence gathered for this evaluation, in combination with other sources, suggests that the actions taken by participants in the CRC have been cost-effective. Payback criteria are a clear part of the investment decision for energy efficiency projects, and while requirements range from those looking for a very short (1 year) payback to those comfortable with longer paybacks (5 years or more), participants are looking for and making investments that do pay back. Lighting was the most popular technology for private and public participants, followed by building fabric, building controls, metering and boilers. All of these could be expected to pay back within 5 years in normal circumstances.

The costs to the public sector of delivering and providing oversight of the CRC were beyond the scope of this research.

The majority of participants recognised that action led to wider benefits beyond reduced energy and CRC costs. The most commonly noted benefit was reputational, manifesting in improved CSR image, brand and better PR. Respondents also recognised benefit from reduced GHG emissions and better sustainability performance, and improved employee engagement. On a more practical level some measures led to better light or heating performance and reduced maintenance.

Some unanticipated impacts were reported by participants during the research. These mainly took one of two forms: diversion of energy management resources away from implementation of energy efficiency projects towards compliance with the scheme; and impacts on competitiveness and profitability, where costs did not apply to competitors and /or could not be passed on to customers. One in three private sector participants said the impact on profitability was 'significant'. Whilst sample sizes in the quantitative survey were not sufficient to give a full sector breakdown, there was some indication that the impact on profitability was perceived particularly strongly in the water and waste sectors and in accommodation and food sectors.

Detailed findings on objective C

C1: Have the energy efficiency actions taken by participants been cost-effective (with particular reference to the menu of actions in A1)?

The evaluation gathered limited evidence on this question. The quantitative survey explored the types of action taken, but did not ask about their cost-effectiveness, while the qualitative research also covered the types of action taken and explored participants' approaches to payback periods and cost-effectiveness. Other sources reviewed have not directly assessed the cost-effectiveness of actions taken as a result of the CRC. Actual project data from current energy efficiency finance schemes was used to indicate payback periods for the types of action taken by participants.

In general the evidence gathered suggests that the energy efficiency actions taken by participants have been cost-effective.

The actions most frequently taken by both private and public sector participants, as identified in the quantitative survey, and shown in Figure 7.1 and Figure 7.2, would mostly be expected to pay back within 5 years based on the paybacks achieved by similar projects funded by the Carbon Trust / Siemens Financial Services scheme and by Salix. While the Carbon Trust / Siemens scheme funds energy efficiency investments in the private sector, the Salix scheme funds similar investments in the public sector.

Lighting was the most commonly mentioned action, with 40-50% of respondents in the quantitative survey across private and public sectors listing lighting projects (both LED and other types of efficient lighting). This is consistent with Carbon Trust and Salix finance scheme data, where lighting projects account for 38% and 52% of recent projects respectively, with average paybacks between 3.8 and 4.9 years depending on type and sector.

The next most frequently mentioned actions (for participants overall) related to building controls, metering, building fabric, and boilers; these actions could be expected to pay back after 1 to 4 years. Some of these technologies are easier to install than others: payback is not the only driver.

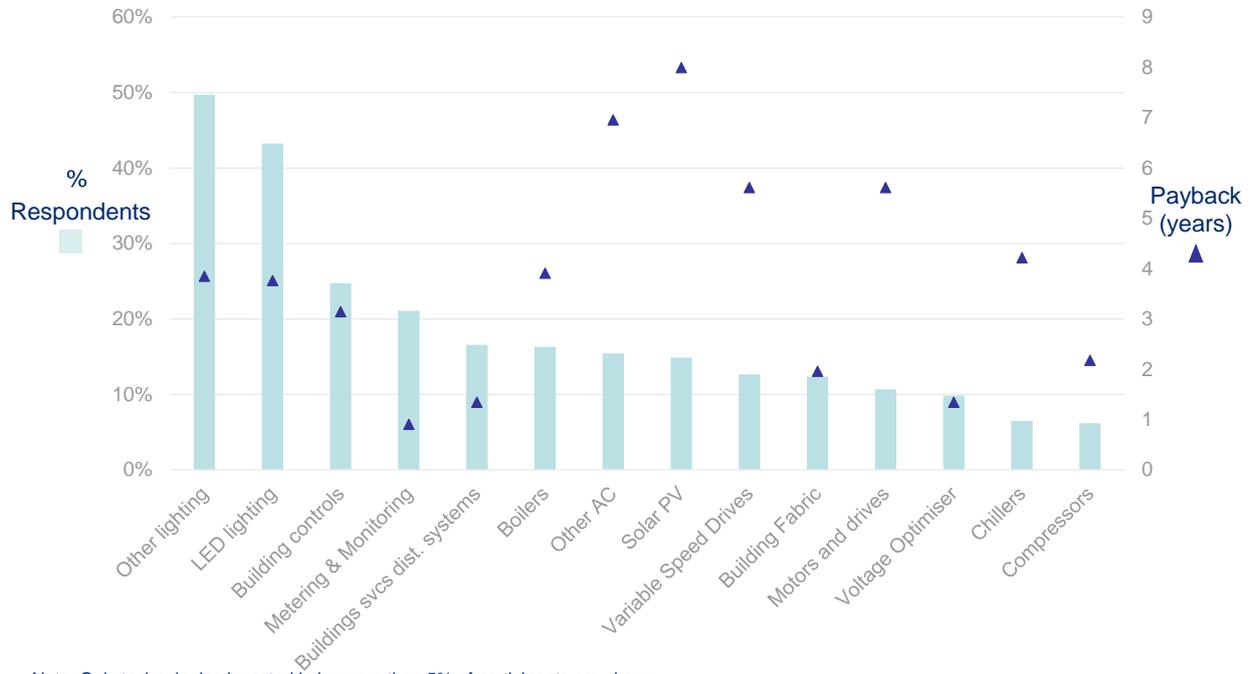
Renewable energy measures such as solar photovoltaics (PV) and biomass boilers would have slightly longer payback periods (around 8 and 6 years respectively) but were mentioned by 15% of private sector participants and 30% of public sector participants in the survey; more frequently than a range of energy efficiency measures that would normally pay back more quickly. Other factors may offset their longer payback periods and increase their popularity (e.g. the visibility of PV; and a preference among organisations to 'make' money via Feed-in-Tariffs (FiTs) or Renewable Heat Incentive (RHI) payments than to save money via traditional efficiency measures).

As shown in Figure 5.2, information declarers interviewed in the quantitative research had invested in similar technologies to CRC participants in both the private and public sectors, with LED and lighting projects the most frequently mentioned. The CCA/EU ETS respondents had invested in a slightly different range of technologies, with variable speed drives (VSDs), motors, and compressors all being mentioned more frequently, reflecting the more energy-intensive nature of those organisations' operations.

The evidence from the qualitative interviews with participants also suggests that the actions they are taking are cost-effective. Payback periods are a key part of the decision making process for energy efficiency investments, and while requirements varied across respondents, participants are clearly looking for cost-effective investments that do pay back.

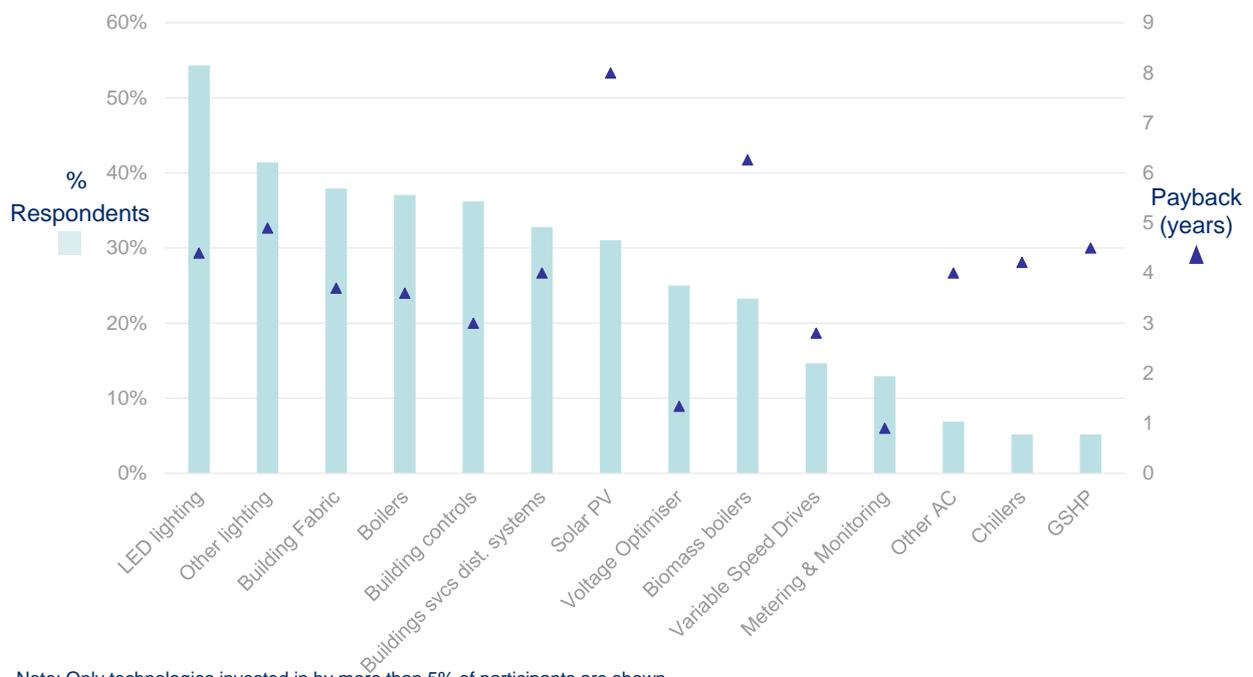
Actions were being taken with payback periods ranging from the near-immediate (i.e. where there was little or no investment needed, as with changes in behaviour) through to both short (1-3 years) and longer payback periods (3 years and above). Some participants were very focussed on short payback actions, and said projects with a payback period in excess of 1 year would be hard to get approved, while others were open to longer payback periods, either for large investments relating to more energy intensive processes, or for renewable energy projects such as installing solar PV.

Participants (and also information declarers) felt that regardless of previous actions taken, further cost-effective technologies were available to them, with only 7% and 3% of private sector and public sector participants respectively stating that the lack of availability of further cost-effective technologies would be a barrier to action.



Note: Only technologies invested in by more than 5% of participants are shown
 Source: Frequency from CRC Quant Survey data; Payback periods from Carbon Trust loans data 2012-14

Figure 7.1: EE technologies invested in by CRC participants (Private Sector) and payback periods



Note: Only technologies invested in by more than 5% of participants are shown
 Source: Frequency from CRC Quant Survey data; Payback periods from Salix and Carbon Trust loans data 2012-14

Figure 7.2: EE technologies invested in by CRC participants (Public Sector) and payback periods

C2: What wider benefits have actions A1-A3 generated for participants (in relation to energy bills, reduced CRC costs, carbon emissions, improved services for customers etc.)?

Both the qualitative and quantitative research showed that organisations recognised that action on energy efficiency could generate other benefits in addition to cost reduction. 81% of all respondents in the quantitative survey said that taking action had generated benefits other than reduced energy costs; the main types of benefit mentioned are shown in Figure 7.3 below. The different benefits generated by the different kinds of action represented by A1-A3 were explored in the qualitative research and these are discussed separately in the following sections.

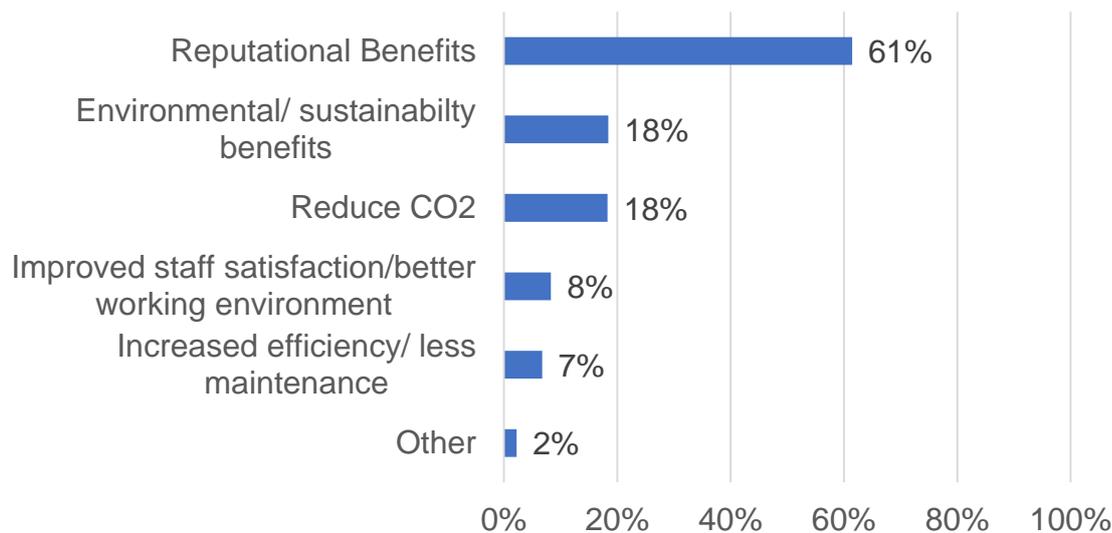


Figure 7.3: Wider benefits to taking action to improve energy efficiency other than reduced energy costs

Benefits of installing energy efficiency measures (A1)

Participants reported in the qualitative interviews that installing energy efficient lighting could provide better quality light, could extend lifespans and reduce maintenance costs. These benefits were also mentioned in the quantitative survey which also identified improved thermal comfort and an improved working environment as benefits of installing energy savings measures. A small number of interview respondents referred to the reputational benefits of implementing measures, with one making the point that more visible environmental measures (such as PV panels) were felt to generate more reputational benefits than hidden ones (such as a building management system).

Benefits of taking action at corporate level (A2)

A greater range of benefits from taking action at corporate level were identified by respondents, in both the qualitative and the quantitative research. These benefits included better management of information and resources, reputational and image benefits, and improved employee satisfaction and engagement.

The management benefits identified by participants mainly flowed from the data collection and reporting requirements of the CRC. Gathering information on their organisation's meters enabled some participants to identify meters they were incorrectly paying for, and collating

energy consumption information across multiple business units helped some organisations to negotiate better contracts and prices for their energy. In addition, the uptake of energy management systems and certifications such as ISO14001, ISO 50001 and the Carbon Trust Standard had been stimulated by the CRC (certification to the Carbon Trust Standard or its equivalents was one of the two early action metrics) and may have facilitated the introduction of improved energy management practices in organisations.

Reputational benefits were mentioned by participants in both the qualitative and the quantitative research, especially by organisations serving the public sector or the general public. A large number of the respondents (61% as shown in Figure 7.3) in the quantitative survey who recognised wider benefits included reputational benefits in their response, and referenced several ways that these reputational benefits could be accrued including better PR, improved customer and market perception, a stronger CSR story, and better performance when benchmarked against competitors or similar organisations (especially in the public sector). Improved employee engagement and satisfaction was also listed as a benefit by 8% of the respondents in the quantitative survey.

Benefits of raising board-level awareness (A3)

The evaluation did not find evidence of non-energy benefits from raised board-level awareness in either the qualitative or quantitative research.

In summary the key wider benefits recognised by participants include better performance and reduced maintenance costs for energy using systems (lighting and heat); better management and utilisation of energy consumption data; and reputational and employee engagement benefits

C3: Have there been any unanticipated effects of the CRC, other than the intended impacts covered by objectives A and B?

There was evidence from both the quantitative and qualitative research of unintended impacts from the CRC. The two main impacts noted were a diversion of energy management resources towards compliance activity and away from actual energy efficiency improvement work; and impacts on competitiveness and profitability as a result of CRC costs.

Diversion of energy management resources

Several participant respondents in the qualitative interviews said that the CRC had consumed financial and manpower resources that would otherwise have been focussed on undertaking the actual implementation of energy efficiency actions. In particular this applied at the beginning of the scheme when there was a substantial volume of new requirements to be understood, and new processes to be put in place. Both internal and external resources (in the form of consultancies) were used to comply with the CRC.

This seems consistent with evidence gathered in the quantitative survey. This showed that 8% of respondents (overall) said they had invested less in energy efficiency as a result of the CRC, as shown in Figure 7.4 below (though it is important to note that four times as many (32% overall) said that they had invested more as a result of the scheme). The figure for the public sector was higher than for private (11% vs. 7%) perhaps reflecting their more constrained resources. And 9% of private sector participants and 13% of public sector participants said that the scale of action they had taken on energy efficiency was less than it would have been in the absence of the CRC.

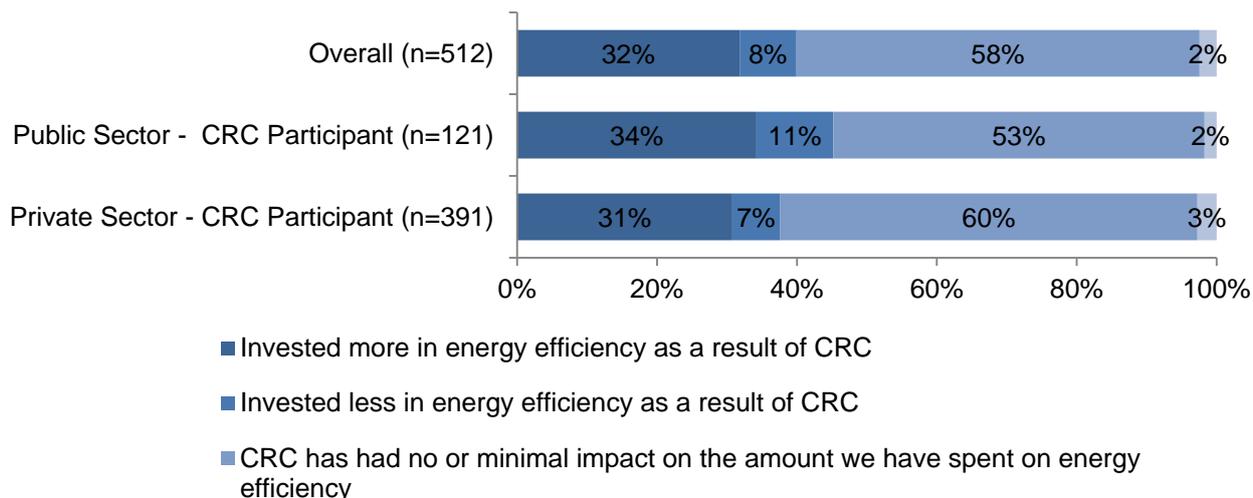


Figure 7.4: Excluding the administrative costs of complying with CRC, would the amount of money invested in energy efficiency measures have been higher, lower or about the same as it would have been in the absence of CRC?

Financial impact of CRC on profitability

The second area of unintended impact related to the financial impact of the CRC on organisations, in terms of the cost of CRC allowances. In the qualitative interviews, some participants noted concerns over the impact of the CRC costs on their competitiveness, when compared to competitors outside the CRC or in other countries. While some companies felt able to pass CRC costs on to their customers, many said they did not explicitly pass costs on. In some cases this simply meant that the pricing of their goods or services was based on a large number of factors, and there was no clear linkage to CRC costs. Organisations which did explicitly pass CRC costs on to their customers tended to be property or service companies which were charging clients for use of certain premises.

The quantitative survey added further evidence that participants felt the financial impact of CRC costs. It showed that 33% of private sector CRC participants said that CRC costs had a ‘significant’ (28%) or ‘very significant’ (5%) impact on their profitability, with 30% of public sector participants rating the impact (on their cost base) as ‘significant’ (27%) or ‘very significant’ (3%). While sample sizes in the quantitative survey were not sufficient to give a full sector breakdown, there is some indication that the impact on profitability was perceived particularly strongly in the water and waste sectors and in accommodation and food sectors.

The econometric analysis did not directly look for CRC impacts on profitability, but did look for potential CRC impacts on turnover and employment. No conclusive evidence was found of CRC impact on turnover or employment.

One other area in which unanticipated impacts may have occurred relates to organisations altering their corporate structures or ownership of assets in order to avoid inclusion in the CRC. This evidence came from only a few comments in the qualitative interviews and the scale of these effects overall is unclear.

8. Assessment of evaluation objective D

Objective D: Identify how the CRC has been delivered and whether it has been administered effectively

Summary

The evidence on the efficiency and consistency of scheme delivery was mixed. Around half of CRC participants in the quantitative survey felt the scheme was not delivered efficiently and consistently. It was unclear how far this was due to its design, changes made to the scheme, the way in which it had been delivered, or more general resistance to the scheme. Around two-thirds of participants, however, felt that the core processes were straightforward or clear.

Participant surveys conducted by the Environment Agency from 2011 to 2013 showed that customer satisfaction across most aspects of the scheme was low initially but improved over the following years of phase 1. The quality and clarity of communications improved over phase 1. Participants were initially frustrated by the written guidance and the help desk, but were much happier by the end of the phase, and the positive ratings in the customer surveys increased dramatically.

Evidence from a previous survey undertaken before the simplification of the scheme showed that the most burdensome aspects of the scheme were tasks related to annual reporting, and the effort required to understand the scheme on its introduction³³. In general, qualitative research found that the simplification had reduced the burden associated with these activities, and had reduced overlaps with other schemes, though there were losers as well as winners from the scheme changes. Qualitative and quantitative research found that the aspects still perceived to be burdensome by some participants, post simplification, were: the activities related to purchasing and surrendering allowances; some aspects of the use of the CRC Registry; and challenges associated with complicated organisational structures.

However, in the qualitative interviews, many participants felt that the successive changes to the scheme had created an administrative burden of adjustment to changes and had undermined the overall credibility of the scheme.

Detailed findings on objective D

D1: Is the Scheme delivered efficiently and consistently (e.g. by promoting simple procedures)?

The quantitative survey asked this question directly of CRC participants; the results are shown in Figure 8.1 below. 53% of private sector participants and 46% of public sector participants surveyed agreed that the scheme is delivered efficiently and consistently. This means that around half of the participants did not feel that the scheme was delivered efficiently and consistently.

³³ KPMG, Assessing the Administrative Costs of the CRC Energy Efficiency Scheme, for DECC, 2011.

Comments from some of those who agreed that it was delivered efficiently and consistently reveal that they valued the support provided by the Environment Agency through the helpdesk and other communications, and found the scheme easy to understand and not onerous to comply with. In contrast those who disagreed referenced the many ways the scheme had been changed, its complexity, the level of bureaucracy involved, and the fact that they saw it as tax rather than a scheme from which they could benefit. The comments show that some respondents separated issues related to the scheme’s design and evolution from issues relating to its delivery, and some did not, and this may have influenced whether they assessed its delivery favourably or negatively.

The quantitative survey showed greater satisfaction with the core processes of the CRC, also shown in Figure 8.1 below. Around two-thirds of surveyed participants agreed that the processes of reporting, and of buying and selling allowances, were straightforward or clear. This seems inconsistent with the overall assessment of scheme delivery which may have been influenced by other unsatisfactory aspects of the scheme or its delivery.

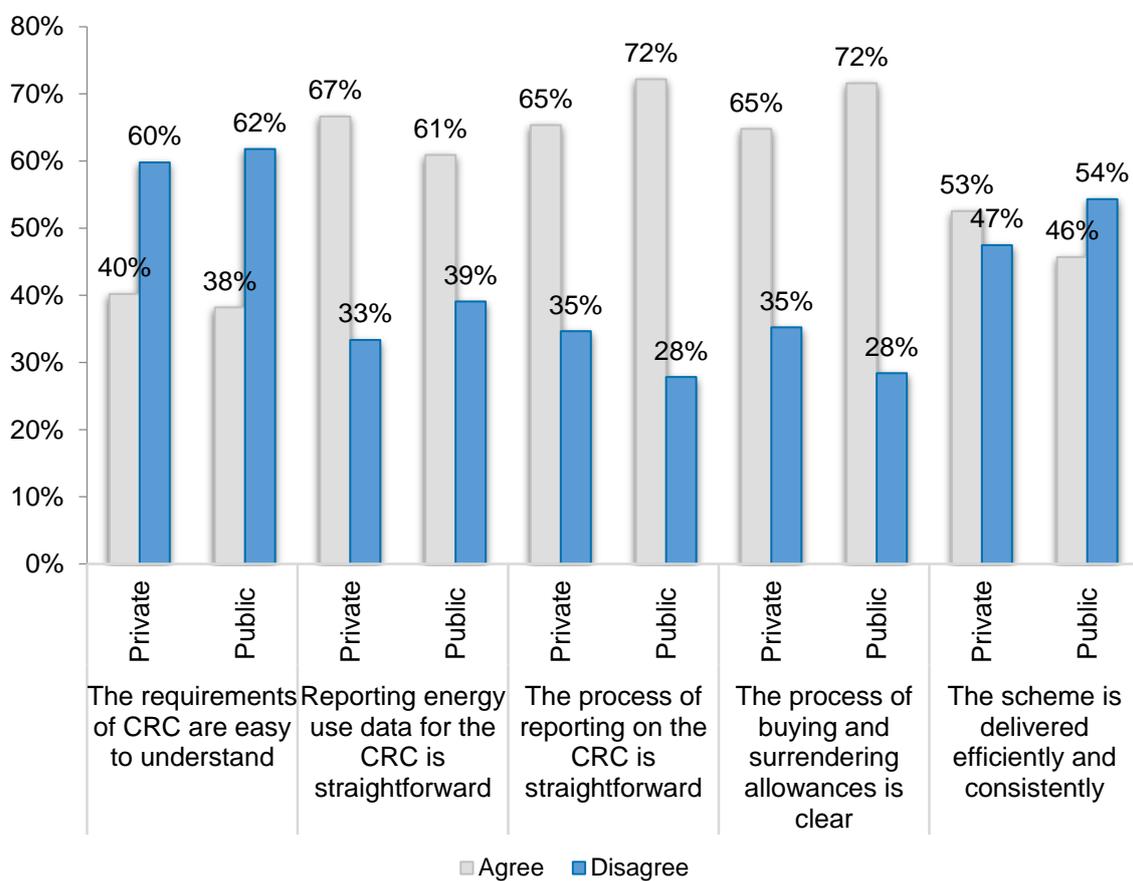


Figure 8.1: CRC participants’ rating of the scheme

The qualitative evidence from interviews with participants shows that many participants felt that the CRC had imposed a significant administrative burden on them, particularly in its early years. For many of them this was related to its complexity, which they saw as especially unjustified following the removal of revenue recycling (which they felt made the CRC essentially a tax, and an overcomplicated one). Respondents to the qualitative research did not comment directly on the efficiency or consistency of the scheme’s delivery.

The quantitative survey also provided evidence that participants found the scheme complex, with around 60% of respondents disagreeing that the requirements of the CRC are easy to understand, as shown in Figure 8.1. It is not clear whether they found them to be difficult to understand because they were not communicated effectively or consistently, or because they are inherently complicated. The National Audit Office's report on the CRC in 2012³⁴ states that 42% of participants had errors in their registration submissions, which again could be due to poor processes and communications, or due to the inherent complexity of the scheme and its requirements (the most common errors related to omission of business units in large corporate groups).

Previous reviews of the CRC also found evidence of the perceived complexity of the scheme. An example is the oral evidence presented to the House of Commons Energy and Climate Change Committee in 2012³⁵ in which the external stakeholders attending opined that the scheme was complicated, and needlessly burdensome on the participating companies.

For most participants interviewed in the qualitative research, the administrative burden had been reduced by simplification of the scheme, but some participants with complex structures or particular business models (e.g. franchises, leases) still found administration burdensome. A significant proportion of participants used external consultants to reduce this burden and to reduce the risk of non-compliance.

Participant surveys conducted by the Environment Agency from 2011 to 2013³⁶ provided an additional source of evidence about scheme delivery. These documents, held by DECC, show that customer satisfaction was initially low, but then improved over the following years: in the two 2011 surveys around 50% of respondents gave positive scores across the main activities; by November 2013 this had risen to 80-90% across most areas. One area that received favourable assessment from the outset was the Environment Agency's staff: their professionalism and attitude received positive ratings from 90% or more of responses from 2011 onwards. By November 2013, around 70% of respondents rated as easy 5 key processes of the CRC, covering the registry, payment online, and purchasing and surrendering allowances.

In summary the evidence from both the quantitative and qualitative research shows that participants found the scheme to be complicated and burdensome, though it is unclear how far this was due to its design, changes made to the scheme, the way in which it had been delivered, or more general resistance to the scheme. Simplification has reduced both complexity and the compliance burden, though not equally for all participants. Participants' positivity about the delivery of the scheme was low initially, but improved substantially over the following years.

³⁴The CRC Energy Efficiency Scheme, National Audit Office, March 2012. http://www.nao.org.uk/wp-content/uploads/2012/08/ECCC_briefing_CRC_scheme.pdf.

³⁵ CRC Energy Efficiency Scheme - Oral evidence to the House of Commons, Energy and Climate Change Select Committee, May 2012. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenergy/138i/138i.pdf>.

³⁶ Customer Survey Results, Environment Agency - February 2011, November 2011, November 2012, November 2013. (unpublished)

D2: Has communication with participants been clear, convenient and timely (e.g. guidance, help desk, other communications with stakeholders)?

Respondents in the qualitative interviews were asked for their views on scheme communications, and the Environment Agency customer surveys provide further evidence on this question. The quantitative survey did not directly explore CRC communications.

Many participants commenting in the qualitative research felt that CRC guidance was problematic in the early stages of the scheme but had since improved. The guidance was criticised for being long and complex, and for being changed frequently. A few participants commented that the guidance was sometimes inaccurate, particularly when changes were introduced, and that there was sometimes a lack of clarity on points of detail.

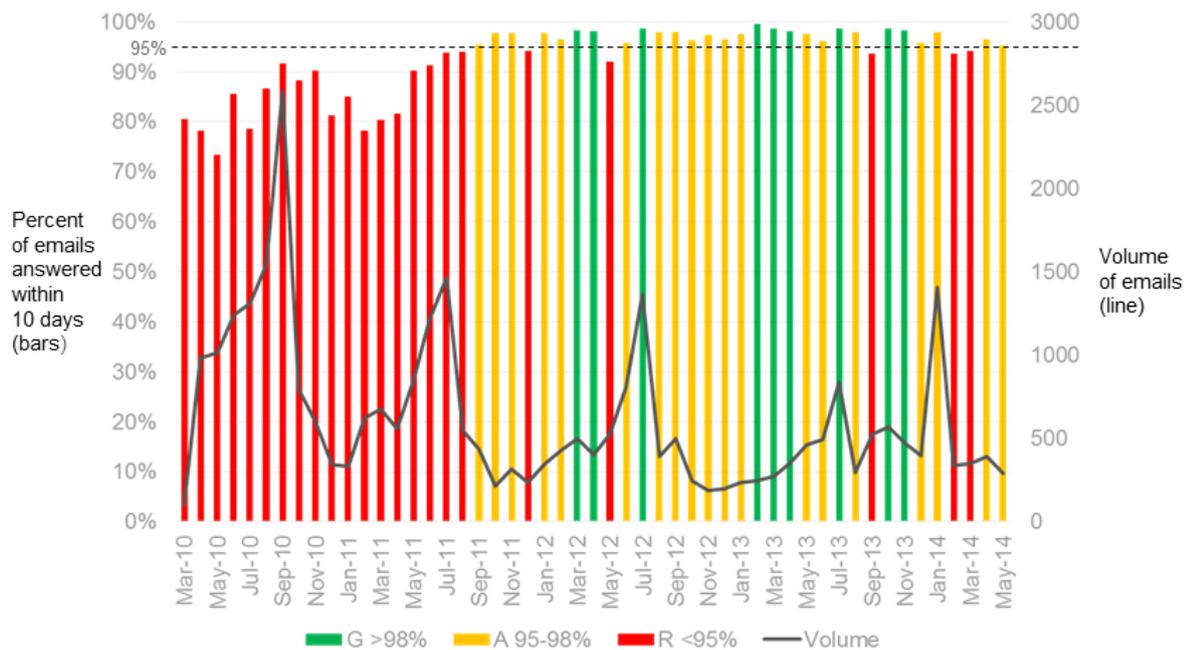
The picture of a mixed performance initially, followed by improvement over the following few years, is also evidenced by the Environment Agency customer surveys. The percentage of respondents giving positive views about the written guidance increased from around 50% in 2011-12 to 78% by November 2013, though there was still some concern that the documents were very lengthy.

Similarly, many participants found the Help Desk frustrating at the start of the scheme, but most had found that it had since improved. Particular issues referenced in the qualitative research included not being able to speak to the same person when dealing with a logged issue over multiple calls, inconsistency in the answers given by different staff members, and varying levels of staff knowledge, requiring calls to be referred. The Environment Agency customer surveys again provide evidence that customer satisfaction improved over time, showing an increase in positive views from around 50% of respondents across 2011-12 to 83% in November 2013.

A commonly used method of accessing support from the Environment Agency was to send a query by email. The qualitative research found some evidence of dissatisfaction caused by delayed responses and this seems consistent with the initial performance of the Agency as shown in its records of response times to customer email queries during the first year of the scheme. However, as with other areas of scheme communications, there was notable improvement over the following years.

Query volumes received and the percentage responded to within 10 days are shown in Figure 8.2 below. During the first 12 months of the scheme, on average only 83% of email queries received were answered within 10 days, which would have been scored red on the EA's Green-Amber-Red rating system (less than 95%), with no months in which the performance would have merited an amber (95-98%) or green (>98%) rating. In subsequent years average response times improved markedly, with the rolling 12 month average rising to 93% by February 2012, and then settling at 97% for the 12 month periods to February 2013 and February 2014. Despite this improved performance, some customers remained unhappy with the EA's performance. The customer surveys from November 2012 and 2013 show 28% and 27% negative ratings respectively for the time taken to resolve queries, and were among the least favourably scored areas of the scheme at that time. They may have felt that even a guaranteed response within 10 days was not entirely satisfactory.

The Environment Agency used other methods to provide assistance to participants, including outbound emails, on-screen guidance, video guidance, and workshops. There was some evidence from the qualitative interviews that the volume of outbound emails had initially been too high, but had reduced to a more manageable level. There was also evidence that the workshops were a useful way of sharing information on upcoming changes to the scheme. The video guidance was initially the most poorly rated communications activity in the 2011 and 2012 customer surveys (18% positive) but improved markedly to around 80% by November 2013, in line with other areas.



Note: Email volumes and response times are for EA National Climate Change Centre and CRC helpdesk combined
 Source: Environment Agency

Figure 8.2: Volume of emails received by helpdesk and response times³⁷

In summary across the various communication channels the evidence shows significant improvement in customer satisfaction from a slow start. The favourable ratings (around 80% positive) achieved in the 2013 customer survey across the range of channels suggests that most customers were happy with both the clarity of the information they were given, and the way it was delivered or accessed. Some level of dissatisfaction with the clarity of communications may have been impossible to avoid given the inherent complexity of the scheme; we know from the quantitative survey that around 60% of participants disagreed that the requirements of the CRC are easy to understand (see Figure 8.1 above), and as discussed earlier, this may reflect the complexity of the scheme rather than any problems with the communications themselves.

D3: What were the most burdensome aspects of the Scheme in Phase 1 (including registration, reporting, audit enforcement and other elements of the CRC), and how have these changed with Phase 1 simplification and Phase 2?

CRC participants taking part in the qualitative research for this evaluation were asked to identify the most burdensome aspects of phase 1 of the CRC. This evidence is complemented by the Environment Agency’s customer surveys, and by the research undertaken by KPMG for DECC in 2011³⁸ to support the simplification exercise. The issues that were most frequently raised in

³⁷ Note on Figure 8.2: peaks in email volumes correspond to key milestones in the CRC (e.g. submitting annual reports and ordering allowances by end July each year, as well as registering for phase 2 in January 2014).

³⁸ KPMG, Assessing the Administrative Costs of the CRC Energy Efficiency Scheme, for DECC, 2011.

the qualitative research are summarised below, in approximate chronological order. The effects of phase 1 simplification and phase 2 are discussed under heading D4.

The initial stages of phase 1 used a high level of computer security, involving digital certificates, because it was anticipated that the PLT would be used for revenue recycling. Digital certificates were very problematic at the start of the scheme. These were replaced with single-use PIN numbers which appear to have been more straightforward for participants to use, and participants who were familiar with the requirements of the EU ETS felt the CRC to be more straightforward in comparison. Evidence of dissatisfaction with the digital certificates also came from the customer surveys, with a negative rating from 69% of respondents about their ease of installation in November 2012 (17% positive). Actual use of the certificates seems to have been found slightly easier, with 48% negative ratings (38% positive).

Several participants in the qualitative research commented that the process of purchasing and surrendering allowances was unnecessarily complex and protracted, particularly given that the CRC was simpler than initially envisaged. They described a relatively long-winded process for paying CRC allowances, and would have preferred a more straightforward system with the Environment Agency invoicing them. This is consistent with verbatim comments made in the quantitative survey. After digital certificates, buying and surrendering allowances were among the most negatively rated areas of the scheme in the Agency's customer surveys, with 30% and 23% negative responses in November 2012 and 25% and 20% in November 2013 respectively, though it should be noted that along with other areas of the scheme, these gained much better scores in November 2013.

By November 2013, with most areas scoring well in the customer surveys, the two least satisfactory areas were identified as ease of payment online and use of the CRC Registry online system overall, with 31% and 32% negative responses respectively.

While their quality and suitability was clearly outside the control of the CRC administrators, energy supplier statements were identified as a cause of frustration by respondents in the qualitative research. The statements provided were often late, or inadequate, and this impacted on participants' ability to meet scheme deadlines. The resulting need to chase up and double-check statements added to the burden of complying with the CRC.

Some participants reported in the qualitative interviews that they found it frustrating and time-consuming that CRC reporting requirements were not consistent with other government schemes (e.g. ESOS, CCA, EU ETS). They noted that the reporting requirements of these schemes were similar but that there were differences in the emissions factors, the emissions covered (e.g. carbon vs all greenhouse gases), the activities covered and the time periods (e.g. financial year reporting for the CRC compared to calendar year reporting for EU ETS).

Participants with complex corporate structures or with business models involving franchising, service companies, or Private Finance Initiatives, found compliance to be especially burdensome, because of the complexities of collating data and determining who should bear the CRC costs. This had even led to legal disputes in some cases.

Similar issues were encountered by property companies in the CRC, and most of the property companies interviewed were critical of the CRC, feeling that it was not appropriate for their type of business, not least because of the complexities of recharging CRC costs to tenants.

The KPMG survey, conducted in December 2011, was commissioned by DECC to provide an updated and more detailed estimate of compliance costs for participants in phase 1 of the CRC.³⁹ An electronic survey was sent to participants, with 704 responses (27% of the total)

³⁹ KPMG, Assessing the Administrative Costs of the CRC Energy Efficiency Scheme, for DECC, 2011.

representing all strata of the population. Respondents were asked how much time, and from what grade of staff, they had had to devote to different aspects of CRC compliance. It is important to note that there were some significant limitations to the methodology of the survey, as noted by DECC in the 2012 CRC Simplification Impact Assessment.⁴⁰ These include the degree of estimation in the respondents' assessments of time spent on different aspects of the CRC (few captured this in timesheets) and the significant variability in the average costs due to the heterogeneity of participants.

The high level results of the KPMG survey are presented in Figure 8.3 below. The activities identified as most burdensome are slightly different to those identified in the qualitative research undertaken for this evaluation and discussed above. This may be due to the timing of the two activities: this survey took place before simplification, and the qualitative interviews took place three and half years later. During that period the scheme was simplified, staff may have changed, and memories of the initial effort required to understand, register for and begin to comply with the CRC may have faded.

As is clear from the chart, respondents said that annual reporting activity took the most time and incurred the most cost in total across phase 1. This is not surprising given it is an annual requirement that must be undertaken in each of the four years of the phase, whereas other tasks such as registration needed only to be done once per phase. Within reporting, the most time consuming / costly activities were gathering data for core sources, compiling the report, reviewing and testing data, signing off the report, and maintaining the list of sources. The next most costly area – especially because it involved more senior staff – comprised the one-off activities necessary following the introduction of the CRC, namely understanding the rules, and educating the organisation. This is consistent with the evidence from this evaluation's quantitative survey that participants did not find the scheme easy to understand, as shown in Figure 8.1 above. Preparing the footprint report (no longer required in phase 2) also incurred quite significant cost, principally in gathering the required data and compiling and submitting the evidence pack. Registration was the least costly of the four main activities assessed.

⁴⁰ There were two impact assessments (February 2013 and June 2012) presented in a combined document: 'Simplification options for the CRC Energy Efficiency scheme to help business : CRC(Amendment) Order 2013' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/153713/CRC_Simplification_Final_Stage_Impact_Assessment_December_2012_FINAL_IA_GB_.pdf.

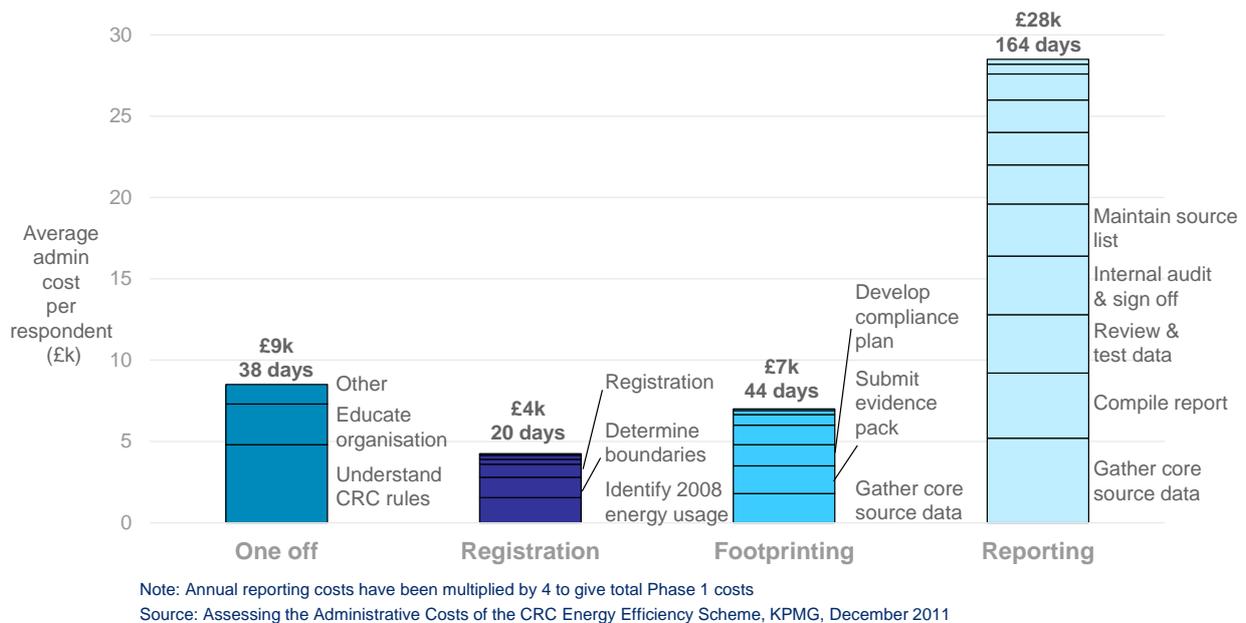


Figure 8.3: Breakdown of administrative costs of phase 1 (average across all participants)⁴¹

In summary, the research conducted by KPMG in 2011, before scheme simplification, identified reporting activities as the most burdensome, followed by some one-off costs related to understanding the CRC rules. In contrast, in the qualitative research undertaken in 2014 for this evaluation, participants identified some slightly different aspects of the scheme that they had found burdensome or frustrating, including the use of digital certificates, purchasing and surrendering allowances (the KPMG research did not ask about this activity), some aspects of the use of the CRC Registry, and challenges associated with complicated organisational structures.

The differences between the KPMG and qualitative research findings may suggest that simplification has successfully reduced the burden associated with annual reporting, not least by reducing the number of fuels covered from 29 to two. Further research into CRC administrative costs, post-simplification, would be required to confirm this hypothesis. The impact of simplification is considered further in the next section.

D4: Has simplification of the Scheme sufficiently minimised overlap with other schemes (primarily EU ETS and CCA) and reduced the administrative burden on participants?

There have been two major rounds of changes to the CRC. A number of simplifications were introduced to the final year of phase 1, in April 2013, after considerable consultation with CRC participants. These simplifications included the change from the PLT to the ARP, the removal of the cap-and-trade mechanism, the removal of schools in England from the CRC and reduction from 29 to two fuels (gas and electricity). This reduced the scope of emissions covered by the scheme. A further change was that participants were no longer required to submit a footprint report, which had been required to establish an organisation’s full emissions. Linked to this, there was no longer a ‘de minimis’ rule requiring payment of CRC on 90% of emissions, but instead CRC had to be paid on 100% of electricity consumption, including non-half-hourly meters.

⁴¹ Total phase 1 costs were calculated by multiplying the annual reporting costs by 4. This reconciles with the total costs for phase 1 shown in the executive summary of the KPMG report.

Some further changes were introduced to phase 2 of the scheme, principally relating to the overlap of CRC, EU ETS and CCA liabilities. In phase 2, organisations only had to register and report for CRC if their residual electricity consumption, omitting consumption covered by EU ETS and CCAs, was greater than 6,000 MWh. But all non-CCA and non-EU ETS sites were potentially liable for CRC payments, if this threshold was reached. Other changes included the option of purchasing allowances in advance and an increase in the cost of allowances, with a slight discount for advance purchases.

Respondents in the qualitative research were asked about the impact of the changes to the scheme, and the effect they had had in reducing overlap with other schemes and the administrative burden imposed on them. The evaluation of both this question and D5 are based principally on the evidence from the qualitative interviews as other sources do not provide clear evidence on the impact of changes to the scheme.

The qualitative research found that the phase 1 simplification changes had reduced the administrative burden for most, but not all, respondents. The reduction from 29 to two fuels generally benefitted organisations, reducing both the cost of administration and the cost of their CRC allowances. A few commented also that dropping the footprint report had reduced their administrative costs, since most of the data required could now be obtained from energy supplier invoices. The KPMG survey showed that activities necessary to compile and submit the footprinting report had been relatively costly for businesses, taking them on average 44 days in Phase 1 (see Figure 8.3).

Some organisations reported that dropping the 'de minimis' rule, and reporting on 100% rather than 90% of all electricity consumption, brought in many of their small sites, increased their CRC costs and meant that their compliance systems had to be changed.

Some respondents felt that the simplifications contributed to a sense that the CRC was continually changing and there had not been a 'steady state' during phase 1. This is discussed further under heading D5. But, in general, participants welcomed the simplifications introduced for the last year of phase 1.

Phase 2 of the CRC commenced during the research period, so this research only covered the start-up of this phase. The application of the phase 2 qualification threshold in 2013 created winners and losers, particularly amongst organisations with CCA or EU ETS exemptions, who could find themselves with higher or lower CRC burdens depending on the details of their situation.

Assessment of the administration of phase 2 is beyond the scope of this evaluation. But early indications are that administration of phase 2 has been relatively smooth so far, particularly for those organisations already familiar with phase 1. The increased cost of allowances was significant for some, while others found forecasting the number of allowances they needed problematic, particularly if they had a decentralised structure for energy purchasing. Attitudes to forward purchasing were mixed: some organisations had gone ahead to make purchases while others felt that the price differential between 'forward purchasing' and 'buy to comply' was insufficient to motivate forward purchase. Some organisations expressed irritation that emissions factors for the year ahead were not available at the time that they needed to define next year's requirement for allowances.

D5 What has been the impact of successive changes to the Scheme, and what lessons can be drawn for the management of future changes?

Many of the CRC participants interviewed in the qualitative research commented that compliance had been complicated by successive changes to the scheme, from the early changes to remove revenue recycling and trading, to the more recent changes to replace the PLT with the ARP, and to reduce the number of fuels from 29 to two. Each set of changes

meant that senior staff in CRC organisations had to spend time familiarising themselves with the new guidance and revising their systems to ensure compliance with the changed rules. This increased the administrative burden they faced.

A few participants felt that successive changes had undermined the overall credibility of the scheme, and made it harder to engage their boards in the scheme. Some saw similarities with other schemes that had featured high-profile changes, such as the Feed-in-Tariff regime. A small number thought the scheme would be scrapped and as a result had done the minimum required to comply.

Overall there was a general view that there had been too many successive changes to the scheme, including changes between the design and implementation phase.

Looking to the future, the main lesson that can be drawn for the management of future changes is that a period of 'steady state' might be valuable for the CRC, allowing organisations to get used to the current system. But it is a moot point whether a scheme which has become familiar to participants, and has become systematised within their organisation – as the CRC has arguably now become - generates as much board-level attention as a new or changed scheme: perhaps some form of prompt is required to retain focus. A few respondents commented that advance notice of change is helpful, as this allows organisations to plan their response to future changes and can help them to minimise the effect on their competitiveness.

9. Conclusions

Conclusions on CRC impact

While increasing energy costs have been the single biggest driver for increased action on energy efficiency in recent years, there is evidence that the CRC has had an impact on energy efficiency behaviour and carbon emissions, at least as sizeable, if not greater than the original impact assessment. We have confidence in this conclusion as it is supported by all three research streams: econometric, quantitative and qualitative.

Not all CRC participants were significantly influenced by the scheme: some were already taking early action on energy efficiency before the CRC. The quantitative and qualitative research found that the CRC was reported to have less impact (because of early action) on organisations which were:

- relatively energy intensive;
- sensitive to reputation;
- sensitive to environmental factors; or
- larger scale (in terms of capacity to address energy management).

However, the econometric research found that the CRC had more influence on consumption by electricity and gas meters in the highest consumption bands, although we cannot be sure that these meters are used by large organisations.

In those organisations which have been influenced by the CRC, the evaluation evidence suggests that the main mechanisms for influence have been:

- the cost of allowances (both in raising awareness and in slightly improving the business case for energy efficiency investments);
- improved data and reporting on energy use;
- high-level sign-off of CRC allowances, which raised awareness at board level within some organisations;
- the reputational aspects of complying with the CRC, and associated fear of enforcement; and
- reputational aspects of CRC publications, particularly the PLT, but only in the preparatory period and the first year of the CRC.

There is some suggestion that CRC impacts may have declined since the early stages of the scheme. There are various possible interpretations of the 2012 data which could be tested using 2013 energy consumption data, when this becomes available.

Conclusions on CRC effectiveness

Our conclusions on CRC effectiveness are based on both qualitative and quantitative workstreams, which show a broadly consistent picture. Views on the efficiency of CRC delivery appeared to be influenced by the complexity of the scheme. Many participants felt that the scheme had imposed a significant administrative burden, especially at the beginning, and had found the scheme complicated to understand. Satisfaction with scheme delivery was low initially but improved over the following years of phase 1.

Many respondents in the qualitative and quantitative research felt that, without revenue recycling, the CRC had effectively become a 'tax' and could be more efficiently administered as such. But others felt that the process of reporting energy consumption and approving purchase of CRC allowances helped to make energy efficiency more visible within their organisations.

Within the broader findings on non-domestic energy efficiency, there were calls for a clearer strategic overview of government energy efficiency policy, for more consistency between government carbon schemes (including GHG reporting), more stability in policy and more forewarning of future change – to enable organisations to plan appropriate strategies to minimise compliance costs.

Reflection on the theory-based approach

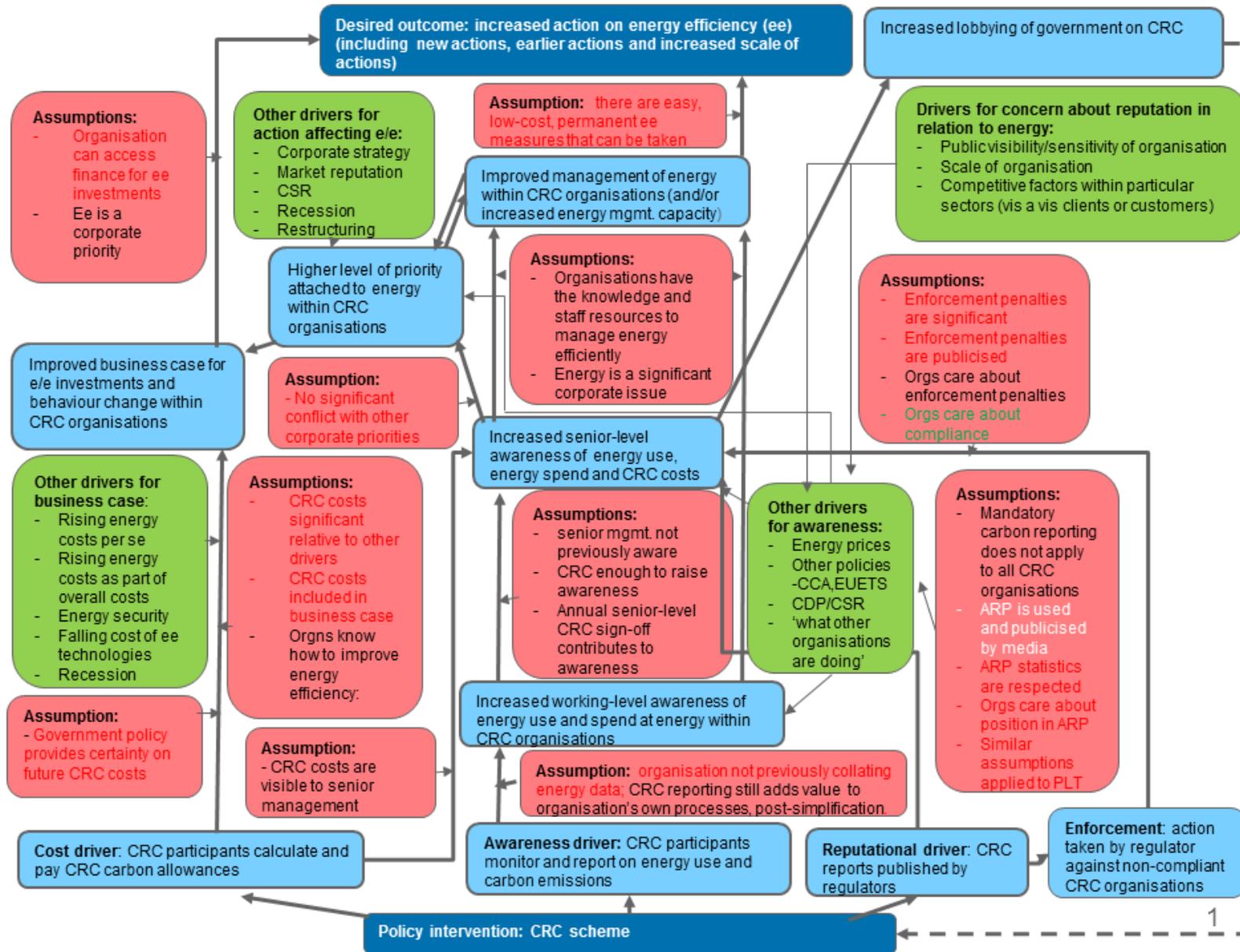
We have related the findings summarised above to the assumptions set out in the theory of change, as presented in chapter 2. Figure 9.1 highlights those assumptions which are fully or partially supported by evaluation evidence, as well as those which do not appear to be supported by evidence from this evaluation.

Only one assumption appears to be poorly supported by the evaluation evidence: that the ARP is used and publicised by the national media. In contrast, the PLT – which as a league table was inherently more newsworthy – did generate some national news coverage⁴². The remaining assumptions on causal mechanisms are either fully or partially supported by evidence from the evaluation.

On reflection, we feel that the theory of change has provided a convenient tool for summarising hypotheses, assumptions and possible causal links in a one-page diagram, albeit a complex one. It has provided a focus for gathering and refining insights as the evaluation proceeded, and for engaging DECC and EA stakeholders in participative workshops during the evaluation. While there are limits to the complexity of issues that can be summarised in one diagram, we feel that the theory of change has been easier to communicate and use in workshops than a word-processed document setting out the same assumptions and causal links.

We also found the customer journey tool useful in the early stages of the evaluation, in clarifying understanding of the different processes required of CRC participants and informing the design of research instruments. But the customer journey diagram has not evolved during the evaluation in the same way as the theory of change.

⁴² <http://www.theguardian.com/environment/2013/feb/27/manchester-united-carbon-reduction-league>.



Key:

Pink boxes – assumptions on mechanisms underlying causal links

Black text – these mechanisms are well supported by evaluation evidence

Red text – these mechanisms have partial support, with mixed evidence from different organisations

White text – these mechanisms are poorly supported by evaluation evidence

Green text – new mechanisms identified from evaluation evidence

Figure 9.1: Testing of theory of change for the CRC

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