Department for Energy Security & Net Zero

Unlocking Resource Efficiency

Phase 2 Technical Report

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1.0 Methodology

1.1 Overview

The first stage of this research was to conduct a comprehensive literature review to gather the latest evidence on the research objectives. The findings from this literature review including preliminary measures and indicators were then discussed with sector experts from industry and academia through sector-specific interviews. Findings from the literature and interviews were then tested in workshops with key sector stakeholders, with the aim of filling any evidence gaps.

The methodology for all Phase 2 sectors (plastic, paper, chemicals, electricals, glass, and food & drink) was split into five tasks as outlined in Table 2. This differs to the methodology used in Phase 1 of the project (covering the cement & concrete, construction, steel, vehicles and textiles sectors) which did not include Task 3 (see 'Phase 1 Technical Summary').

Table 1: Description of the tasks

Task	Name	Description
Task 1	Measures and indicators	Development of a preliminary list of resource efficiency measures and indicators that fed into the following tasks.
Task 2	Literature review	Delivery of a rapid evidence assessment looking at academic, government and industry sources to identify information on the research objectives. A summary of findings was discussed with interview participants as part of the interview process.
Task 3	Interviews	Delivery of sector-specific interviews across all sectors. This included stakeholder selection, interview material development, interview delivery and interview summary development.
Task 4	Workshop planning & delivery	Preparation for facilitated workshops for each sector. This included stakeholder engagement and development of preparatory and workshop materials, including post-workshop surveys. One facilitated half-day workshop held for each sector.
Task 5	Reporting	Summarising the results from Tasks 1 – 4 into this Main Report and the sector specific reports.

1.2 Task 1 – Measures and Indicators

A preliminary list of measures and indicators was drawn up based on the expertise of the research team for each sector. This helped prepare for the rest of the tasks (e.g., identify search terms for Task 2, literature review) without pre-empting the results.

The final list of measures and indicators was drawn up based on the literature review and the stakeholder engagement.

1.3 Task 2 – Literature Review

1.3.1 Identifying literature sources

To ensure that the literature review was as comprehensive as possible, four different strategies were used to identify relevant literature:

- The research team and the Department for Energy Security and Net Zero/Department for Environment, Food & Rural Affairs provided relevant sources;

- Expert stakeholders provided relevant sources;

- A call for evidence was published externally; and

- An online search was used to identify additional relevant sources.

For the online search a list of search strings relating to resource efficiency and the circular economy was collated for each sector. These search strings were informed by the research teams' sector experts and included a range of both generic, sector and resource efficiency measure specific phrases. These phrases were combined with Boolean operators ("AND", "OR", and "NOT") to narrow or broaden the set of results.[1]

For example, some search strings used in the chemicals sector were "Chemical* OR "Chemical industry" AND "design for recycling" OR recyclability OR remanufact* OR recover* OR regenerat* OR reconditi* OR reuse"; an example search string used in the plastics sector was "(plastic OR polymer) AND (light weight* OR light-weight* OR lightweight*)". A full list of all search strings used can be found in the annexes of the sector specific reports.

Subsequently, the collated search strings were used in online search engines including Google, Google Scholar, and Scopus to identify individual research papers as well as grey literature. Scientific, governmental and industry reports and articles found in authoritative databases (mainly Science Direct, Research Gate and Springer) were prioritised.

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[1] An example of this involves the use of the expression "glass AND circular economy", in which case the search engine targets results that combine the word 'glass' with the phrase 'circular economy'. Another example would be the choice of the term "glass recycl*" whereby the asterisk allows for the search to be broadened by accounting for the different variations of words starting with "recycl-" (i.e., the search engine would show results involving the words recycling, recycle, recycled, etc.).

1.3.2 Assessing the literature sources

Once the literature sources had been identified, an indicative applicability score (IAS) was calculated for each source to reflect the applicability of the source to the scope of this research.

This score was based on five key criteria: geography, date of publication, sector applicability, methodologies used and level of peer review. Each of these criteria were scored at one of three levels as outlined in Table 3.

Table 2: Five criteria of IAS and scoring criteria

Criteria	High	Medium	Low
Sector relevance	The source is specific to the sector, and to the measure. It discusses resource efficiency and circularity.	The source is specific to the sector.	The source discusses several sectors.
Geographic relevance	The source is based on UK data / UK experience.	The source is not based on UK data / UK experience but it is applicable (e.g., because a similar technology is used in the UK).	The source is not based on UK data / UK experience and it is not applicable.
Time relevance	Less than 10 years old.	Between 10 and 20 years old.	More than 20 years old.
Peer review	The source has been peer reviewed (e.g., published in an academic journal).	The source does not mention it, but it is assumed to have been peer reviewed.	There is no evidence of peer-review.
Methodology	The research methodology is well defined and it is deemed appropriate.	The research methodology well defined but it is not deemed appropriate / Minor description of research methodology.	No research methodology included.

After the five criteria of the IAS had been evaluated, the overall IAS score was calculated, ranging from 1 to 5, according to the number of components scoring 'high' and 'low'.

Table 3: Methodology for the calculation of the IAS

Number of 'high' criteria	Number of 'low' criteria	IAS
Indifferent	3 or more	1
<= 1	2	2
>= 2	2	3
<= 2	1	3
>= 3	1	4
<= 1	None	3
2	None	4
>= 3	None	5

A full list of all the literature reviewed, and their IAS can be found in the accompanying sector reports.

1.3.3 Summarising the literature sources

Once the literature review was completed, the preliminary list of measures and indicators prepared under Task 1 was amended with the literature findings. A database covering the literature review for each sector was populated to facilitate subsequent interview delivery and reporting (below).

1.4 Task 3 – Interviews

1.4.1 Stakeholder selection

The first stage of Task 3 was to identify expert stakeholders to invite to the sector-specific interviews and sector workshops. The stakeholder selection process was informed by the following criteria:

- Ensuring representation of industry actors from across the value chain;
- Ensuring representation from the research and academic fields;
- A minimum of 10 interviews (10-20 participants total) per sector, to ensure a balanced view through interviews, and subsequently enough space for contributions from all stakeholders in workshop discussions; and
- Availability to participate in the interviews and subsequent workshop.

A total of 278 participants were invited to contribute to the research across the 6 sectors (note that no interviews were conducted in the textiles sector shown in section 8.0 of the main report as this sector was part of Phase 1).

1.4.2 Stakeholder engagement

Stakeholders were contacted via email with the request to participate in the research for the selected sectors. An invitation letter was attached which explained the motivation, objectives, and purpose of the research, and which was signed by representatives of the Department for Energy Security and Net Zero and Department for Environment, Food & Rural Affairs.

1.4.3 Interview delivery

Interview materials were developed in line with the research objectives and measures and indicators found through Task 1, 2 and 3. All sector teams underwent interview training ahead of the interview period to ensure consistency in interview approach between sectors. Interviews were recorded (where consent to do so was provided), transcribed and interview notes collated. Any clarification questions for interviewees were resolved via email following the interviews.

1.4.4 Interview synthesis

Information gathered through the interview process was collected through sector-specific interview summaries. These were then combined with the information gathered through literature reviews for the development of the sector reports. Literature findings were presented against each measure and indicator, in line with the four research objectives. Where there was diverging information within the literature sources, preference was given to the sources with highest IAS, as these were deemed most reliable and most relevant to the research scope.

1.5 Task 4 – Workshop planning and delivery

1.5.1 Workshop invitations

Stakeholders who participated in the interviews (Task 3) were then invited to the sector-specific workshops. Briefing materials summarising the purpose of the research, lists of measures and indicators and indicative levels of efficiency for each sector were sent to participants ahead of workshops, alongside instructions on workshop practicalities.

1.5.2 Workshop delivery

One facilitated workshop was held for each sector, with a duration between three and four hours. The workshops were held online via MS Teams.

The purpose of these workshops was to test the findings from the literature review and interviews with stakeholders, to allow stakeholders to share their expert views on the research findings, in particular on the levels of efficiency, and to fill any gaps found in the literature and through interviews.

The workshops focused on:

- Building consensus around the comprehensive list of resource efficiency measures;

- Building consensus estimates for the current "level of efficiency" and maximum "level of efficiency" in 2035, for each of the identified resource efficiency measures;

- Building consensus around the current and anticipated drivers and barriers affecting improvements in the identified resource efficiency measures, and their relative importance; and

- Building consensus estimates for the likely "levels of efficiency" in 2035 given current private sector incentives and the existing policy mix (a "business-as-usual" scenario), for each of the identified resource efficiency measures.

In the workshops, the workshop lead (who was a sector expert) gave a short overview of each measure and the information that had been found in the literature review and stakeholder interviews. Participants were asked to share their initial thoughts on the findings via an online whiteboard. This was then followed by an open discussion, facilitated by the sector lead, to draw out key insights, areas of consensus and areas of disagreement.

After the discussion, participants were asked to vote on the estimates for the levels of efficiency and the most significant drivers and barriers for the measure. The voting was used to gather a snapshot of stakeholder views and the level of consensus. The results of the votes were used alongside the information from the online whiteboard, and comments made via the chat and in the discussion to inform the research conclusions.

There were a total of 49 workshop participants in Phase 2, ranging from 5 to 17 participants per sector.

1.6 Task 5 – Reporting

Information gathered in the interviews and workshops was used, alongside information from the literature, to inform the conclusions in the final reports.

1.6.1 Levels of efficiency

The estimates for the current, maximum and BAU levels of efficiency for each measure are presented in the accompanying sector specific reports, alongside a summary of the evidence that underpins these estimates.

For each level of efficiency, an evidence RAG rating has also been provided which reflects the strength of the evidence supporting the conclusions.

- **Red:** Limited evidence available from literature review or stakeholders

- **Red-amber:** Some evidence available from literature review but it is not relevant/out of date, limited evidence from stakeholders, stakeholders are not experts on this measure

- **Amber:** High quality evidence from either literature or stakeholders

- **Amber-green:** High quality evidence from literature or stakeholders, evidence from stakeholders is supported by some information in the literature (or vice versa)
- **Green:** High quality evidence from literature supported by stakeholder expertise.

Note, because the estimates for the BAU level of efficiency were only based on stakeholder input the maximum evidence RAG rating they received was amber.

1.6.2 Drivers & Barriers

The identified drivers and barriers for each measure are described in the sector-specific reports, alongside examples or caveats provided by either the literature sources or stakeholders. The PESTLE and COM-B categories have been assigned to each driver and barrier (see Section 1.3.2 of the main report).

During the workshops, stakeholders were asked to vote on the most significant drivers and barriers for each measure, and these are presented in bold in the summary tables. The top drivers and barriers are also presented in later sections of this report, alongside an analysis of the main themes (see Section 9.1 and 9.2 of the main report).

1.6.3 Final Report

The findings of Phase 2 have been summarised into 9 reports:

- The main report which provides an overview of the research purpose and research objectives and high-level information about the key research conclusions both by sector, and across all sectors;
- The technical report (this document) which provides detail on the research methodology;
- Seven sector-specific reports which provide detailed information on the research conclusions for all four research objectives and for each resource efficiency measure. This includes estimates of the current, maximum and BAU level of efficiency for each measure.

1.7 Limitations

This report was commissioned by the Government to improve the evidence base on the impact of resource efficiency measures. The methodology is designed to provide robust answers to the research objectives, based on the best available evidence at the time the work was undertaken.

While every effort was made to be comprehensive in the literature review, it is inevitable that some relevant literature may not have been captured. A full list of all the literature reviewed is provided in the annexes of each sector report.

The feedback captured during the interviews and workshops represent the views of a sample of stakeholders from industry, think tanks, trade associations and academia. Effort was made

to ensure that interviews and workshops included a cross-section of stakeholders from each stage of the sectors' supply chain, representing a range of backgrounds and perspectives. It is, however, noted that capacity and scheduling limitations meant that some stakeholders, whose view would have been valuable to the research, were not able to participate. This was mitigated with a long interview period and a call for evidence sent to a wide range of stakeholders, including some who did not attend the interviews and workshops.

It is also worth noting that higher levels of literature evidence and stakeholder engagement were available for some sectors rather than others. Where relevant, this has been indicated on a measure level through the allocated RAG ratings.

A key research objective of this project is to estimate the level of efficiency of resource efficiency measures in 2035. Any future projections are inherently uncertain as they depend on a range of different factors such as technological innovation, consumer behaviour change and the macro-economic environment. The estimates from this research are the best estimates that could be produced, based on the current literature and stakeholder expertise. Evidence RAG ratings have been provided to indicate the level of supporting evidence for each of these estimates.

The report does not seek to make recommendations on the appropriate direction of Government policy or independent industry action. The Department for Energy Security and Net Zero and Department for Environment, Food & Rural Affairs will seek to conduct further engagement with stakeholders to inform the next steps for resource efficiency policy within Government, ensuring that any omissions or developments in the evidence reviewed in this report are taken into account.

Glossary and abbreviations

BAU	Business-as-usual
IAS	Indicative applicability score
RE	Resource efficiency

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