

Cost-benefit analysis for environmental policy

An introduction to environmental policy:
Part three

May 2025



the-ies.org

The Institution
of Environmental
Sciences

Contents

4	Introduction
5	Overview and limitations
7	Identifying policy objectives
8	Assessing costs and benefits
13	Comparing costs and benefits
15	Case study: retrofitting buildings
17	What next?

Acknowledgements

Authors: Joseph Lewis

Design: Bea Gilbert & Lucy Rowland

This briefing paper was first published in November 2023 as part of the IES ‘red paper’ series, introducing environmental professionals to policy engagement.

About the Institution of Environmental Sciences

The Institution of Environmental Sciences (the IES) is at the forefront of uniting the environmental sciences around a shared goal: to work with speed, vision and expertise to solve the world’s most pressing environmental challenges, together.

As the global professional membership body for environmental scientists, we support a diverse network of professionals all over the world – and at every stage of their education and careers – to connect, develop, progress and inspire.

Registered charity no. 277611

Image credits:

Cover Image – © Imogen | Adobe Stock

p. 11 – © Szymon Bartosz | Adobe Stock

Introduction

Effective engagement with environmental policy relies on building strong relationships with decision makers. Those relationships are at their best when both parties feel that they are gaining something beneficial.

In that context, environmental scientists often bring evidence to discussions, building relationships by presenting decision makers with clear and useful evidence.

Where different decision makers have different values or priorities, having a diversity of tools and techniques allows for tailored approaches to engagement. Influential engagement often focuses on the decision maker as an individual, addressing their concerns directly and speaking to them ‘in their own language’.

Cost-benefit analysis is one of the tools which can support influential engagement. The [IPBES Values Assessment](#) revealed the extent to which policy makers’ values are often linked to economics, resources, and financial value, so cost-benefit analysis can be particularly useful for speaking ‘in the language’ of policy makers who are often resource constrained and under pressure to make financially-optimal decisions.

This is a briefing paper for IES members, providing a short introduction to cost-benefit analysis as a tool for engaging in environmental policy decisions.

It outlines how to use cost-benefit analysis to better understand policies and their potential impact, as well as how to use cost-benefit analysis as a tool for policy influencing. It focuses on cost-benefit analysis as a policy tool, rather than other applications of cost-benefit analysis models.

This briefing is suitable for those seeking an introduction to cost-benefit analysis. It is not formal guidance. The [Government’s Green Book](#) (2022) offers more substantive guidance for those already engaged in high-level analytical activities.

While providing an overview of cost-benefit analysis as a specific approach, this paper should be viewed as just one aspect of the wider range of policy-related skills needed for greater engagement in policy.

See also the other briefings in our introduction to environmental policy series: [Policy analysis and awareness](#) and [evidence-informed policy making](#).

Overview and limitations

This briefing provides an introduction to the process of cost-benefit analysis for environmental policy. There are several key steps in that process:

1. Reflect on the limitations of cost-benefit analysis and whether it is the correct tool to use
2. Identify the objectives of using cost-benefit analysis, as well as the objectives of the policy being considered
3. Identify the full range of costs and benefits associated with the policy, as well as any uncertainties, unintended consequences, or co-costs and co-benefits
4. Assess the extent of those costs and benefits
5. Consider alternative policy approaches and the extent to which the policy being considered presents an 'opportunity cost'
6. Translate the costs and benefits into a single 'language' so that they are comparable
7. Compare the costs and benefits, taking account of any additional context such

as the distribution of costs and benefits to different groups

8. Assess the outcomes of the analysis: what are its implications and how will they be used?

Cost-benefit analysis can be an iterative process. When following the process, further reflections may emerge that require earlier steps to be revisited or different approaches to be taken.

For a more detailed approach, consult the [Government's Green Book](#).

Limitations of cost-benefit analysis as a policy tool

Cost-benefit analysis is not a perfect tool, particularly for the complex, interconnected, and intangible considerations often associated with the environment.

The distinction between a standard cost-benefit analysis and one conducted for the purpose of engaging with environmental policy presents three limitations which should be considered when approaching cost-benefit analysis for policy:

1. The value of nature cannot always be quantified and costs and benefits may be subjective.
2. Uncertainties arising from data gaps can require predictions or further information-gathering.
3. The strength of the analysis will depend on its rigour, which may vary depending on its purpose in policy engagement.

There are inherent imperfections in any approach to quantifying the value of nature which should be recognised and accounted for throughout the process. Significant attempts have been made in the policy sphere to manage these challenges, such as through the [IPBES Values Assessment](#), the [Sustainable Development Goals](#), and the [2006 Stern Review](#).

Given gaps in data and the long-term character of many environmental decisions, these uncertainties can be exacerbated by the need to predict or make estimations of costs or potential benefits. It may not always be possible to control this ambiguity, but recognising the uncertainties and the ramifications they have for any analysis is crucial to the legitimacy of any decisions or advocacy based on that information.

Additionally, cost-benefit analyses exist on a spectrum from informal comparisons ‘on the back of a napkin’ to rigorous modelled assessments supported by robust data and stakeholder evidence.

The level of rigour is likely to depend on the purpose of the analysis, as it may not be necessary to use sophisticated approaches for an internal evaluation of a policy by a small business or an individual seeking to understand the consequences of policy.

Those seeking to influence government decisions will naturally require a much higher degree of rigour and evidence underpinning calculations, with policy makers themselves often using still more complex approaches. For such an approach, the guidance in the [Government’s Green Book](#) should be used.

Selecting the correct approach to cost-benefit analysis should follow from the objective of the analysis, as well as the purposes for which it will be used.

It may not always be possible to assure absolute certainty over every calculation, but where evidence is limited or has a degree of uncertainty associated, any limitations must be made transparent to anyone engaging with that analysis.

Identifying policy objectives

The first step of a cost-benefit analysis is to identify the objectives of the policy being assessed.

Understanding the goals of the policy is generally helpful for policy analysis, but it has a particular role in cost-benefit analysis where the rationale of a policy is an important part of understanding the costs associated with inaction, the challenges the policy is attempting to solve, and any implicit costs or benefits which should be considered as part of the cost-benefit analysis.

If the objectives of a policy are not immediately clear, it may be possible to find further information by examining the

rationale presented at the time the policy was announced or examined in detail.

Consider consulting [Hansard for Parliamentary debates](#), announcements by Ministers or Government departments, or secondary sources such as media coverage and stakeholder commentary.

At the same time, it can be useful to evaluate your own objectives when conducting the cost-benefit analysis, which will be important to framing the decisions you make throughout the process, such as the level of rigour you wish to apply and the stakeholders that should be consulted to determine the costs and benefits being analysed.

Assessing costs and benefits

A baseline assessment of the costs and benefits will be necessary before it is possible to conduct any comparison or cross-analysis.

Much of the substantive work behind a cost-benefit analysis involves identifying these potential costs and benefits and determining how they should be assessed to support a fair and accurate comparison.

Start by considering the policy and its likely effects. Beginning from the most immediate and intended effects of the policy, consider the consequences and whether they are likely to be positive, negative, or a mixture of both.

Identifying the negative outcomes will naturally indicate areas where there may be associated costs, whereas positive outcomes are likely to align with potential benefits.

There may also be direct or indirect costs associated with the process of the policy and its implementation, or costs which arise as a result which are neither positive nor negative outcomes.

When considering implementation costs, there are likely to be a variety, including

monetary costs, staff time, and non-financial costs such as delays to other activities caused by the process of implementation.

Choosing one policy may preclude another, particularly in the short-term, or could make other options impractical or impossible in the long-term.

Some costs linked to the policy may be unintended, so a broad scope of consideration is important, including different perspectives and values. Identifying and assessing those potential unintended consequences can be challenging, but policy analysis techniques can simplify the process. See our briefing on 'policy analysis and awareness' for more information.

Similarly, co-benefits are crucial considerations for cost-benefit analysis, particularly in environmental policy where many natural systems are linked and decisions can produce positive (or negative) outcomes in unexpected ways.

Co-benefits are any additional benefits beyond the explicit purpose of the policy, often including economic benefits from jobs or infrastructure, health benefits from

reduced emissions, or linked environmental benefits. Much as with other unintended consequences, co-benefits can be identified through a typical policy analysis approach.

While assessing costs and benefits, a critical consideration is where they fall: are they concentrated in a particular place, time, or with a particular group of people?

Though a cost-benefit analysis assesses a policy from a single perspective (typically the Government or country's perspective for an overall policy evaluation, or the perspective of an individual or organisation for a policy risk assessment), it may be important to consider how the costs or benefits are distributed.

If all the benefits are given to one group and all the harms experienced by another, it may not be palatable or desirable to pursue the policy, even if the benefits outweigh the costs overall.

Similarly, if all the benefits of a policy are in the far future and all the costs are short-term, the policy may be infeasible, and if the benefits are all short-term, the long-term consequences may make the policy unfair on future generations.

These non-numerical considerations are ultimately questions of judgment but should be considered from the outset to inform the eventual comparison and ensure that any associated unintended consequences are addressed.

Case study: Co-costs and the green recovery from COVID-19

Some of the costs associated with policies may be 'co-costs': costs which already had to be accrued as a result of other decisions. If there is no choice about whether or not to accrue a cost, there is no opportunity cost associated with the policy so it may effectively be cheaper than it would otherwise appear.

For example, following the COVID-19 pandemic, there was a widespread acceptance of the need for public investment policies to support business and prompt an economic recovery. As these policies all required government investment in jobs or infrastructure, any other policies where such investment would be a cost could be achievable at a lower cost than usual, as the cost was already needed for a secondary policy.

To that end, a green recovery from COVID-19 where a national government invested in green jobs, environmental retrofitting, or sustainable infrastructure would have had significant co-costs with any other economic recovery.

Using co-costs in cost-benefit analysis can be difficult. They are costs, and should be included as such, but being transparent about the comparatively lower opportunity cost can improve clarity. A balance can be reached by including the cost in the overall analysis but reflecting on the implications of other policies. Even if a cost is inevitable regardless of policy choices, being clear makes the analysis more transparent and avoids subsequent confusion.

Handling risk and uncertainty

Cost-benefit analysis is often future-facing, so uncertainty can be a significant challenge when assessing the extent of costs and benefits. Similarly, the general concept of risk is often seen as a challenge for policy practitioners seeking to make fair and robust assessments.

Naturally, there are no perfect solutions, though these challenges can be simplified by breaking down uncertainties into smaller questions:

- What is the uncertain hazard associated with the policy?
- How likely would that hazard be if the policy was enacted?
- What is the expected cost (or benefit) associated with the hazard?
- Is there any particular vulnerability to that risk that should be considered?

Risk can be viewed as a matrix of likelihood, severity, and vulnerability. By combining these factors, it is possible to produce an expected cost associated with a risk, based on the level of uncertainty.

Further guidance on taking a systems approach to risk evaluation for policy decisions is provided in the 2023 IES report: '[Entering the forest of risk](#)'. Our collection of case studies for engaging with environmental policy, '[Speaking up for science: Case studies for environmental policy](#)' also includes a case study on uncertainty.

Similarly, if there is a possibility that a policy may not be successfully implemented

(or a chance it fails to solve the problem), many of the costs and benefits associated with the policy may be subject to a degree of uncertainty. Some costs and benefits are likely to occur whether or not the policy is implemented, so differentiating between them can be valuable.

The same logic can account for those uncertainties, viewing the risk of failed implementation as 'a tax on failure'. If the policy is only 80% likely to be successfully implemented, the benefits of successful implementation are only 80% likely to happen.

Acknowledging this in the assessment can produce more realistic results, also highlighting the importance of successful implementation and the need for robust delivery plans at the outset of policy design.

For example, when producing a new scheme for how farmers will be compensated for environmentally-positive actions on their land, such as Environmental Land Management Schemes in England, the ability to secure the environmental benefits associated with the policy would rely on farmers adopting the schemes in practice.

Even with robust delivery plans and strong engagement activities, there is likely to always be a degree of uncertainty at the policy design stage on the degree of uptake.

In this example, some costs and benefits could still be certain, such as the removal of environmentally-damaging subsidies or the cost of engagement.

Equally, some costs and benefits could have a degree of uncertainty, such as the benefits of pro-environmental activities and the costs of individual subsidies.

Considering alternatives

When using cost-benefit analysis for environmental policy, decisions will often not be made in isolation. Many policy decisions involve choices between multiple policies, where the question is not whether action will be taken, but what action will be taken.

In such circumstances, it may be necessary to consider the 'opportunity cost' associated with a policy: does enacting this policy come at the expense of carrying out an alternative?

This will not always be the case. Sometimes, multiple policy approaches can be used simultaneously, so there may not be a necessary trade-off between alternatives.

For the purpose of cost-benefit analysis, the objective should be to identify how much potential benefit (or cost) is lost as a result of taking one choice at the expense of potential alternatives. If the policy does not preclude alternatives, there is no associated opportunity cost.

For example, a policy setting out regulations for water companies relating to pollution would not be at the expense of other policies supporting action on water pollution, such as environmental targets or policies targeting chemical products.

Conversely, it is likely that the policy would be at the expense of alternative regulatory arrangements on water companies, if those alternatives were contradictory with the proposed policy.



Top tip: Advanced approaches to cost-benefit analysis

When conducting cost-benefit analysis, there are more advanced approaches which can expand the number of considerations and their accuracy, potentially offering a more robust analysis overall.

These additional tools are likely to significantly increase the complexity of the analysis, so are most appropriate for those seeking to present specific policy recommendations, such as those working in think tanks or Government departments. These include:

- More complex approaches to uncertainty and scenario planning such as sensitivity analysis
- Ways of addressing the value of events in the future such as discount rates
- Analysis of social, economic, or environmental reactions to policies such as through modelling, and
- Heuristics for bringing together different value systems

Advanced techniques such as these can add significant value to a cost-benefit analysis, but they may not be necessary for an internal policy analysis or risk assessment. Where they are used, the approach and application may be subject to specific organisational requirements and standards. In that context, further advice on their application can be found in the [Government's Green Book](#).

For many environmental scientists engaging with cost-benefit analysis for the first time, their application will not be necessary.

Comparing costs and benefits

Once all costs, benefits, and additional factors have been identified and individually assessed, they can be accumulated and compared to one another to produce the final analysis.

Naturally, it will be necessary to find a common language through which to compare the benefits. Often, policy-focused cost-benefit analyses conduct this comparison using money as the language of exchange, though alternative options are possible and this may depend on the purpose and nature of the cost-benefit analysis.

Similarly, a consistent timeframe should be used to ensure a fair comparison. If one cost is considered over a 20-year period, the analysis should not exclude costs or benefits that occur within the same timeframe.

Challenges often arise when attempting to quantify environmental costs and benefits, particularly when they are linked to the complex social or natural systems.

Although these challenges are inherent to conducting cost-benefit analyses for environmental policy, some approaches can simplify difficult assessments.

One is the Pigouvian approach to tax, under which the costs of a harm are priced at the cost to society, so that the polluter pays for the cost of undoing that harm.

For example, pricing the emission of Greenhouse Gases at the cost of their removal from the atmosphere has been used as the basis for carbon taxes.

However, these examples also show that this approach can lead to absurdities or policy failures.

A Pigouvian approach can make harm seem more appealing or imply that causing harm and remediating it is the same as not causing that harm in the first place. While the approach is imperfect, it can be valuable where standard approaches do not apply, as long as these limitations are understood and accounted for in the analysis.

Risks and uncertainties can also be difficult to quantify and compare, particularly where available data is limited.

The section on '[handling risk and uncertainty](#)' addresses these challenges in more detail. In some cases, there may be no ideal solution to accounting for these

uncertainties, so the most important consideration is that any approach to acknowledging them has a clear and transparent justification, and that the same approach is taken consistently throughout the analysis.

Once all these considerations have been addressed and aggregated, all the necessary evidence should be available to conduct the comparison.

Directly comparing the costs and benefits will provide an overall assessment of whether the policy is more beneficial or costly as a whole, though there may also be other considerations to address, such as the distribution of costs and benefits, as addressed in the section on '[Assessing costs and benefits](#)'.

With the analysis completed, it can be used to prepare for an upcoming policy and its effects, manage long-term risks around policy change, or to engage directly in policy influence, depending on the objective of the analysis.

Summary

Cost-benefit analysis is a tool which can support effective engagement in environmental policy. As an approach, it relies on quantification and may not be appropriate where significant intangible or uncertain factors are being considered.

Conversely, it is most effective as a tool for communicating 'in the language' of policy makers who may be resource-constrained.

An effective application of cost-benefit analysis should be purpose-driven, based on the objectives of the analysis and the audience for whom it is intended.

Tools are available to increase the complexity and robustness of the analysis, which may be appropriate in some contexts, but all cost-benefit analysis relies on a strong understanding of the potential outcomes of a policy and whether they are likely to be positive or negative.

Developing skills in cost-benefit analysis can improve a general understanding of environmental policy decisions and will often be effective in specific circumstances. In other scenarios, the limitations of cost-benefit analysis may make it prudent to adopt an alternative approach to engagement.

Case study: Retrofitting buildings

As a worked example of the process for conducting a cost-benefit analysis, consider the perspective of a local authority assessing whether or not to carry out a scheme to support the retrofitting of buildings for improved energy efficiency, such as through direct funding or sustainable growth grants.

Reflecting on the **limitations of cost-benefit analysis**, it would still be a useful tool for assessing the appropriateness of the policy, given the largely economic nature and the broadly quantifiable outputs. It would also have a specific role in supporting business case decisions for the local authority.

Identifying the broader objectives of such a scheme, the primary objective may be to meet a local authority's commitments under a climate emergency declaration, with secondary considerations around the local economy.

The objective of the cost-benefit analysis would be to determine whether or not the local authority should go ahead with the scheme, potentially considering the balance of different proposals.

Through a thorough **consideration of costs and benefits**, the local authority might conclude that:

- There are likely to be significant positive effects on greenhouse gas emissions.
- There may also be significant positive effects for air quality emissions such as NO_x from cooking fuel as a result of improved heat efficiency, with secondary effects for local air quality hotspots.
- There are likely to be minor positive benefits for public health when more people are able to afford to heat their homes.
- There are likely to be benefits to the local economy, both for those paid to undertake the retrofitting process and for consumers who spend less on energy bills.
- There would be significant upfront costs associated with a scheme, particularly where the local authority is directly funding the process or providing grants.
- There may also be costs associated with reduced indoor air quality where insufficient information is available to residents on how to maximise the ventilation of airtight buildings.
- There would be further costs associated with implementation, including the costs of public engagement, staff time in administration, and opportunity cost associated with other business grant options.
- The distribution of benefits is particularly directed towards

low-income residents who are especially vulnerable to rising energy costs and who may lack alternatives without local authority support.

After identifying these costs and benefits, the local authority would then reflect on **uncertainty and risks**.

Given that the outcomes of the scheme would depend on whether or not it is implemented in practice, a clear delivery plan would be needed to ensure that the skills and suppliers were available locally to take advantage of the scheme. Without such assurances in place, the local authority might consider some of the benefits to be less certain.

Equally, the authority may receive some assurance from existing guidance on the rollout of similar schemes, increasing the certainty of achieving the identified benefits.

Depending on the local authority, there could be co-costs to consider around the state of existing infrastructure, the need for economic investment in business by the local authority, or similar factors. Co-benefits for air quality and public health are identified above.

For many of the costs and benefits, there is significant research into the monetary implications of the costs and benefits.

Some, such as energy bills, public health, and air quality, predominantly accrue to individual members of the

community, though as a public body, the local authority would likely consider the consequences for its community to be relevant considerations.

As an alternative to comparing costs and benefits financially, the local authority could consider comparing the social costs and benefits as part of its overall offering to residents.

At this stage, the local authority might seek to consider alternative policy options, such as increased public awareness, informal partnerships with energy providers, or other energy efficiency schemes.

This could result in a direct comparison of the costs and benefits associated with different interventions, providing a deeper understanding of the opportunity cost and any synergies or trade-offs between them.

Finally, the local authority could **compare the costs** of the proposed scheme with and benefits, relative to any alternative options. This final analysis would inform the local authority's approach and would directly contribute towards the business case of the proposed scheme if the analysis suggested it should go ahead.

The cost-benefit analysis would both support the internal understanding of the policy and its delivery requirements, while also providing a basis for external engagement, such as budget decisions by elected representatives.

What next?

Cost-benefit analysis is only one tool for understanding and engaging with environmental policy.

Effective policy influencers will often need to be prepared to utilise many different approaches to reach different audiences, where costbenefit analysis will not always be an appropriate tool.

For those professionals seeking to improve their skills in influencing policy or diversify their approaches to engagement, the IES offers training and other resources. Find out more by [visiting our events page](#).

The IES also works to represent environmental science in policy across disciplines and sectors. If you want to become part of the conversation, ensure that your voice is represented by getting in touch with Joseph Lewis, IES Policy Lead (joseph@the-ies.org).

Further information

Other relevant IES briefings and resources:

- [Primer: An introduction to policy analysis and awareness](#)
- [Primer: An introduction to evidence-](#)

[informed policy making](#)

- [Briefing: Influencing the UK Parliament](#)
- [Primer: Cross-departmental environmental policy](#)
- [Speaking up for science: Case studies for environmental policy](#)
- [Sign up for policy training](#) directly through the IES website

If there is a particular policy topic where you want more information, please [get in touch with the IES policy team](#). We may already have appropriate content, or we may be able to produce future resources to support your needs.

