Guidance for Socio-Economic Analysis in Local Area Energy Planning – Annexe 3

CATAPULT Energy Systems



UK Research and Innovation

LOCAL AREA ENERGY PLANNING



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1. Summary

1.1 Foreword

The role of appraisal and evaluation is to provide objective analysis to support decision making. This document is supplementary guidance to the main Guidance on Creating a Local Area Energy Plan and contains information and guidance on how to consider the wider social impacts of LAEP alongside techno-economic analysis. It should be read in conjunction with the main guidance and is intended for the same audiences as that document (refer to Main Guidance Section A.6. for details).

HM Treasury's Green Book (HMT, 2020) and associated documents contain guidance on how to appraise policies, programmes and projects. This document does not attempt to reproduce the Green Book and does not discuss all aspects of appraisal and evaluation that it contains. Instead, it signposts items within the Green Book and associated supplementary guidance[1] that have particular relevance to the social aspects of a local area energy plan. For social impacts where specific appraisal methods are not defined in the Green Book possible methods and data sources are suggested.

Some of these benefits are relevant for all local plans and should always be assessed. Others may only be appropriate if a local plan includes particular solutions or contains sufficient detail to allow assessment. On this basis social benefits are ranked in terms of a requirement for them to be included in the assessment.

The focus of this guidance is on social benefits that might be appropriate for numeric evaluation. This evaluation should be carried out in stage 5 of the LAEP development process on the scenarios developed in stage 4. It might also be appropriate for evaluation of specific projects developed in stage 6 of the LAEP process.

For discussion of other items that might be evaluated using qualitative approaches as part of a non-technical evaluation of options within the local area energy planning process please see main guidance document stage 5.

1.2 Wider benefits identified for evaluation as part of LAEP

The Green Book recommends that where proposals have a focus on a specific part of the UK, place based analysis should be performed and be central to appraisal of options (HMT, 2020). Place based analysis concerns appraisal applied to geographically defined areas within the UK and is clearly relevant to LAEP. In this context there are several wider social benefits of local area energy transition that could be considered as part of a place based analysis. The primary social aspects discussed are listed below.

1.2.1 Applicable to all local area energy plans

1. Carbon savings from switching away from fossil fuels
2. Energy savings from improved efficiency and technology switching
3. Air quality benefits from reduced fossil fuel combustion
4. Employment impacts from investment in low carbon solutions

1.2.2 Applicable to building decarbonisation

1. Comfort taking resulting from consumers using some of the savings from efficiency improvements to heat their homes to higher temperatures, or for longer periods of time so that they convert some of those savings to improved comfort.
2. Health benefits from improved housing
3. Influence on local energy costs
4. Impacts on energy bills and the effect on different income groups

1 In particular BEIS Supplementary guidance to the HM Treasury Green Book on Appraisal and Evaluation in Central Government on Valuation of energy use and greenhouse gas (BEIS, 2021-1)

1.2.3 Applicable to transport decarbonisation

Whether the benefits of transport decarbonisation should be evaluated within a LAEP will depend on whether transport decarbonisation is within the scope of the plan. In some areas this evaluation might be completed within a separate transport plan. In these cases, care should be taken to ensure that the benefits are not double counted.

1. Health benefits from physical activity resulting from increased walking and cycling
2. Reduced congestion due to modal shift from private car use
3. Bike Lane Ambience



Key points

Valuation of the wider social benefits of LAEP can help to build the case for local action.

Social benefits resulting from decarbonisation include

- Carbon savings achieved
- Local energy savings
- Local air quality improvements
- The impact of local energy projects on different income groups
- Employment opportunities created
- Improved comfort from using a proportion of energy saved to increase the level of warmth homes
- Health benefits from improved housing
- The influence of change on local energy costs
- Health benefits from physical activity associated with switching to active transport
- Reduced congestion from shifts in transport behaviours

A minimum of three scenarios should be appraised including business as usual, do minimum and a recommended preferred pathway.

Valuations should follow the methodology defined in the Treasury's Green Book or its accompanying guidance.

2. Introduction

2.1 Context

Local area energy planning and the decarbonisation of local energy systems is likely to require action, and investments by local councils, combined authorities and devolved and national governments. It provides a significant opportunity to link these actions and investments to wider social objectives which should be considered in any evaluation of options and decisions made as part of LAEP. Two obvious examples of social factors relating to energy system change are air quality, and fuel poverty (CSE & ESC, Local Area Energy Planning: The Method, 2020).

Air quality emissions can generally be modelled quite straightforwardly as a function of fuel consumption and plant type. However, the effect of emissions on local concentrations of air quality pollutants is far more complex, and beyond the scope of LAEP modelling. For example, modelling of emission concentrations at specific hot spots would not be included in LAEP modelling but the decrease in overall emissions across the study area would be included. In practice therefore, it will be necessary to consider any required emissions limits from local or national air quality policy alongside current emission concentrations when considering decarbonisation options.

Fuel poverty is a function of the thermal efficiency of buildings, the efficiency of heating systems, fuel costs, and household incomes. Of these, the first three are clearly in scope for LAEP technical analyses, and the fourth can be considered as an exogenous variable. LAEP analysis should therefore quantify and attempt to understand the possible impacts on fuel poverty of decarbonisation approaches under consideration. It could also explore the options for reducing fuel poverty, for example by prioritising the rollout of appropriate technical solutions to fuel poor areas.

The Treasury's Green Book (HMT, 2020) and associated documents provide guidance which should be followed as part of the decision making process on how to appraise policies, programmes and projects.

This document focusses on assessment of the wider social costs and benefits of local energy system decarbonisation, specifically in relation to options that are considered as part of the LAEP process. The value of these costs and benefits can be combined with the financial costs and benefits as the Net Present Social Value (NPSV). The NPSV of a low carbon measure is the present value of its capital and operating costs, energy savings and wider social costs and benefits (excluding climate risk) divided by the amount of carbon abated. The cost effectiveness of low carbon measures can be calculated as the NPSV minus the value of the carbon saved divided by the amount of carbon abated (ref PwC document)

2.2 Why analysis of social benefits is important

Although decarbonisation is the primary motivation behind LAEP, other important social factors are affected by the design and performance of the energy system. These may be in tension with the search for a low-cost solution to the decarbonisation problem. Appropriate analysis allows the wider social factors to be properly considered when making energy system choices and identifying the proposal that delivers best social value to society (HMT, 2018). This can be done as an economic appraisal, described in the Green Book as focusing on social value from the perspective of society and taking into account all social, economic, environmental costs and all effects on public welfare (HMT, 2018). The impacts should then be made explicit in the process of scenario refinement and selection is stage 5 of the LAEP development process. See the main Guidance on Creating a Local Area Energy Plan for details.

However, it should be noted that the literature tends to estimate the potential benefits rather than evaluating the actual benefits. Forecasting is more common than analysis after the fact, and there are almost no examples of literature that compare the two (Gouldson, 2018). As such the strengths and weaknesses of any analysis should be acknowledged.

2.3 Examples of scale of benefits that might be realised

The literature includes numerous examples of the types of social benefits that might be realised as part of energy projects and provide indications as to their scale. Examples include:

- Adopting a place specific approach to achieving net zero in Belfast could increase emissions reductions by 17% by 2035, reduce energy bills by £2.3bn and lead to £12bn in wider social benefits. (PwC, 2022)
- If sufficient investment across the UK was committed to retrofitting homes up to at least EPC C level by 2030, then some 150,000 jobs could be created across the UK. (CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100, 2021)
- Every £1m of investment in sustainable transport infrastructure can create 12.7 FTE jobs in the UK economy. (CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100, 2021)
- Congestion in towns and cities across the UK costs the economy £11bn every year. According to the British Chamber of Commerce, the direct and indirect costs of the effects of congestion and lost time amount to an average of £968 per driver per year (CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100, 2021)
- PHE put the total potential costs to the NHS and social care system due to the health impacts of PM2.5 and NO_2 in England between 2017 and 2025 at £1.69 billion combined. (CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100, 2021)
- For every £1 invested in energy efficiency measures, the NHS can save £0.42 (amounting to annual savings of £1.4bn in England alone) (CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100, 2021)



3. The Green Book and associated government guidance

Any appraisal of options within LAEP should follow the Green Book (HMT, 2020) methodology. This is issued by HM Treasury and contains guidance on how to appraise policies, programmes and projects. The Green Book is not a mechanical or deterministic decision-making device. It provides approved thinking models and methods to support the provision of advice to clarify the social –or public – welfare costs, benefits, and trade-offs of alternative implementation options for the delivery of policy objectives. It should be considered the primary source of information on assessment of the social costs and benefits of local area energy plans. In addition to the Green Book there are variety of associated guidance documents published by HM Treasury, the Department for Business, Energy and Industrial Strategy and other government departments which are particularly relevant to the assessment of options within the local area energy planning process. References for these sources are provided in section 7. This document does not attempt to reproduce the Green Book and does not discuss all aspects of appraisal and evaluation that it contains. Points with particular relevance to LAEP are discussed here but analysts should always refer to the primary sources to ensure that they are correctly interpreting and applying the guidance these contain.

3.1 Treatment of costs and benefits

The Treasury Green Book sets out rules that must be followed for the treatment of costs and benefits. These are that:

- The relevant costs and benefits to society of all the (short-listed) options should be valued and the net benefit and costs calculated. 'Relevant' in this instance means all those costs and benefits that can be affected by the decision at hand. This should be done as part of step 5b of the LAEP development process.
- Costs and benefits should cover the useful lifetime of the assets or the contractual period for the purchase of the service outputs and outcomes.
- The costs and benefits should be based on resource costs and reflect the best alternative uses (the 'opportunity cost') that the goods, assets and services could be put to.
- The wider social and environmental costs – for which there is no market price – should also be taken into account.
- The sources and assumptions underlying each cost and benefit included in the economic appraisals must be explained in full within an accompanying appendix.
- The costs and benefits must be base year. The base year is defined as 'year 0' and must be at real relative prices and the same for all options considered.

3.2 Approaches to valuation

The Green Book states that the approach to benefits measurement should be prudent, proportionate, and appropriate. Prudent, in terms of avoiding claiming for benefits that cannot be measured or assessed in any realistic way, because there is no real evidence base; proportionate, in terms of the resources required to cost justify the programme; and appropriate, in terms of the anticipated scope and spend of the programme.

Evaluation is a systematic assessment of an intervention's design, implementation and outcomes. It involves (HMT, 2020):

- Understanding how an intervention is being or has been implemented, what effects it had, for whom and why.
- Comparing what happens with what was expected under Business as Usual (the appropriate counterfactual).
- Identifying what can be improved, estimating overall impacts and cost-effectiveness.

3.2.1 Business as usual

Guidance requires consideration of a base case or counterfactual to consider what would happen if the policy or project was not carried out. This default course of action is known as the "do nothing" option and provides the base case, or counterfactual. It must be a quantified understanding to provide a well understood benchmark, against which proposals for change can be compared. This is true even when to continue with BAU would be unthinkable (HMT, 2020). Analysts need to appraise costs and benefits of each option relative to their counterfactual (BEIS, 2021-1). For further details see Step4a of the main Guidance on Creating a Local Area Energy Plan.

3.2.2 Other options for appraisal

In addition to the business as usual benchmark a minimum of two to three short-listed options should also be appraised (HMT, 2018) including a 'do minimum' option, a recommended preferred pathway and one or more other possible options based on realistic 'more ambitious' and 'less ambitious' choices. Options should be subjected to cost benefit analysis (CBA) or cost effectiveness analysis (CEA), where more appropriate, to identify the option that offers best social value to society (HMT, 2018). In the case of LAEP the 'do minimum' option is likely to be a scenario with a net zero target in line with national guidelines. For further details see Step4a of the main Guidance on Creating a Local Area Energy Plan.

Social Cost Benefit Analysis (CBA) assesses the impact of different options on social welfare. All relevant costs and benefits are valued in monetary terms unless it is not proportionate or possible to do so. Social CBA is the recommended approach for detailed comparison of the shortlist of options. Social Cost-Effectiveness Analysis (CEA) is a variant of Social CBA which compares the costs of alternative ways of producing the same or similar outputs.

Social CEA may sometimes be appropriate where:

- wider social costs or benefits will remain broadly unchanged or for the delivery of a public good, such as defence
- output may not be proportionately quantified

3.2.3 What to include in appraisals

Appraisal should consider any likely beneficial or adverse collateral effects and unintended consequences. This may include effects on particular groups in society and possible changes in behaviour as a result of an intervention (HMT, 2018). Where appraising a place based policy or a UK wide proposal with place based effects the relevant values include effects in the place of interest and similar nearby travel to work areas. The appraisal should be completed as part of step 5b of the LAEP development process given main Guidance on Creating a Local Area Energy Plan.

The following costs could be included in the appraisal of social value:

- Total direct public costs (to originating organisation):
  - Capital
  - Revenue
- Total indirect public costs (to other public sector organisations):
  - Capital
  - Revenue
- Wider costs to UK society:
  - Monetisable including cash costs
  - Quantifiable but unmonetisable costs
  - Qualitative unquantifiable costs
- Total risk costs (the costs of mitigating or managing risks):
  - Optimism bias (decreased as estimated risk costs are included)
  - Estimated or measured risk cost

Associated benefits in the appraisal of social value might be:

- Direct public sector benefits (to originating organisation):
  - Cash releasing benefits
  - Monetisable non cash releasing benefits
  - Quantifiable but not monetisable benefits
  - Qualitative unquantifiable benefits
- Indirect public sector benefits (to other public sector organisations):
  - Cash releasing benefits
  - Monetisable but non cash releasing benefits
  - Quantifiable but unmonetisable benefits
  - Qualitative unquantifiable benefits
- Wider benefits to UK society (e.g. Households, individuals, businesses):
  - Monetisable including cash benefits
  - Quantifiable but not monetisable benefits
  - Qualitative unquantifiable costs and benefits

3.2.4 How to perform appraisals

Various decision-making tools can be used to evaluate options as part of an appraisal process. The appropriate tool will depend on the policy, programme or project being appraised, although other options should be considered as additional or supplementary to standard cost-benefit techniques (DEFRA, 2020).

The Green Book specifies the following with regard to how options should be appraised:

- What matters are costs and benefits affected by decisions still to be made.
- Costs and benefits should be calculated over the lifetime of the proposal.
- Proposals involving infrastructure such as roads, railways and new buildings are appraised over a 60 year period.
- Refurbishment of existing buildings is considered over 30 years.
- For proposals involving administrative changes a ten year period is used as a standard measure.
- In all cases, the maintenance and renewal costs associated with the servicing of these assets should be included.
- An asset's residual value or liability at the end of the appraisal period should also be included.
- Sunk costs refer to expenditure or payments already incurred and should be excluded from the appraisal of social value.
- The costs of continuing to use resources that are already paid for (e.g. assets or buildings) are relevant and should be included as opportunity costs.

The Department for Environment Food and Rural Affairs suggest the following methods for use when numeric appraisal not proportionate or possible (DEFRA, 2020):

1. Real Options Analysis
2. Robust Decision Making
3. Portfolio Analysis
4. Iterative Risk Management

3.3 Considering infrastructure

When considering aspects of energy system change as part of LAEP it is important that the whole system is considered and that infrastructure changes are included in any analysis. HM Treasury (HMT, 2015) describes infrastructure as consisting of networks that provide goods and services fundamental for economic activity to take place in today's society. As a result, infrastructure has the potential to influence both the level of economic growth as well as the location of such growth. For example it may provide access to, or use of, land for new housing or development, enabling new economic activity to take place. The ability of infrastructure to support and enable new activity and outcomes that may not have previously been possible is referred to as a 'non-marginal effect'. These effects can potentially lead to transformational impacts, particularly at a local level by opening up new labour and product markets, facilitating connections between employees and business, between businesses and consumers and amongst businesses, and can result in innovation (ibid). However, the type and scale of impacts are hard to predict and assess, particularly as outcomes are predicated on other activity taking place, for example

a business investing in a new location. The impacts may be positive or negative and could vary in type or scale during the construction and/or operational lifetime of infrastructure, which should be considered in order to reach a balanced decision on infrastructure spending. Non-marginal effects may be relevant to other types of impacts, as well as economic impacts, such as environmental and social outcomes (ibid).

Infrastructure interventions should be appraised and valued in the same way as all other interventions. Many of these assets have grown organically over time and are often highly interdependent. Because of their size, and in certain cases complexity, some decisions may have effects on future flexibility of an organisation or industry affected and other infrastructure service providers. Productivity benefits should be considered as part of appraisal, including agglomeration effects or changes in the structure of the economy that may result from infrastructure investment (HMT, 2020).

3.4 Non-market prices

Evaluation should use prices from the relevant market (excluding taxes and subsidies) where possible (HMT, 2020). Where a direct market price is unavailable prices from a closely comparable market can be used. Generic prices from a Green Book approved transferable price applicable to the proposal can also be used as an alternative.

Where direct prices cannot be established then revealed preference techniques may be appropriate. These involve inferring the implicit price placed on a good by consumers by examining their behaviour in a similar or related market.

Alternatively, a stated preference of willingness to pay, or willingness to accept obtained through research studies using professionally designed questionnaires may be appropriate.

In some cases, use of direct wellbeing based responses (in existing data or from research by questionnaire) to estimate relative prices of non-market goods might be suitable.

3.5 Uncertainty testing

Uncertainty should always be a consideration when assessing options as part of LAEP. This may be due to random uncertainty which can be quantified using techniques such as use of probability functions. Alternatively, uncertainty may be due to a lack of knowledge or limited data. This is highly likely to be the case for LAEP where a large amount of input data is required. In these cases sensitivity analysis is a good way of testing the effects of various assumptions on model outputs. Thirdly, uncertainty might relate to unexpected or unforeseeable conditions, for example, future events that might render the analysis meaningless. This uncertainty cannot be quantified but horizon-scanning exercises can help to identify potential sources. Uncertainty will be partly assessed by the process of developing different future scenarios in Stage 4 of the main Guidance on Creating a Local Area Energy Plan. In addition, uncertainty testing could be carried out within Stage 5 of the process.

Analysts should always try to explicitly state where uncertainty is prevalent, even if they cannot quantify it (DEFRA, 2020).

Sensitivity analysis explores the sensitivity of the expected outcomes of an intervention to potential variations in key input variables (HMT, 2020). It can demonstrate, for example, the changes in key assumptions required to change the preferred option on a net present social value (NPSV) or Benefit to Cost Ratio (BCR) basis or to turn the NPSV of an option positive. At a minimum sensitivity analysis and the identification of switching values should be carried out on the preferred option from the shortlist appraisal. These results must form part of the presentation of results. If the costs and benefits of the preferred option are highly sensitive to certain values or input variables, sensitivity analysis will probably be required for other options in the shortlist.

3.5.1 Uncertainty testing discussion

Any economic analysis spanning out to 2050 is inherently uncertain by nature and then amplified by the uncertainty within the LAEP itself; there are many potential pathways a local area could follow, with no one "correct" choice. To try and reflect this in the methodology the economic analysis should be performed on the full range of scenarios applied to the LAEP area with results presented as an average with a range across the scenarios. In presenting the results in this way the analysis will capture the uncertainty in the future energy system (Ternent, 2016). The analysis will feed into the evaluation of wider factors in step 5b of the main Guidance on Creating a Local Area Energy Plan.

The value of testing uncertainty in this way as part of the LAEP process is also supported in Ofgem's method for Local Area Energy Planning (CSE & ESC, Local Area Energy Planning: The Method, 2020). This says that appropriate annual values from the government guidance should be used when costing decarbonisation options in LAEP to ensure consistency with standard practice. However, it goes on to suggest that these values are both inherently uncertain and likely to be influential and recommends that the effect on preferred options of changes in the social cost of carbon should be explored in sensitivity analysis. Furthermore, the document goes on to say that the effect of discounting on the preferred LAEP option should be explored as part of the sensitivity analysis allowing participants to explore the question for themselves, in a transparent manner.

3.6 Net present value discussion

One pound is worth more today than a pound in, say, one year's time as people generally prefer to receive goods and services now rather than later. Discounting is a financial process which aims to determine the "present value of future cash flows". It enables consistent comparison of costs and benefits occurring over different periods of time, or in other words: calculating what monies spent or earned in the future would be worth today. As part of the LAEP appraisal process all future costs and benefits should be discounted to give current values.

The Social Time Preference Rate used in the Green Book is set at 3.5% in real terms, with the exception of risk to health and life values which use a lower rate of 1.5%. The recommended Green Book discount rate applies to real values, with the effects of general inflation already removed.

The standard STPR of 3.5% applied in appraisal should decline over the long term due to uncertainty about future values of its components. To support practical application in appraisal, standard declining discount rates and discount factors by year can be found in Table 6 of the Green Book.



4. Benefits for evaluation

A wide range of benefits might be considered for evaluation as part of the assessment of options within step 5b of the LAEP development process. Some of these are amenable to monetary evaluation whilst others are more readily assessed using non-numeric approaches. It is important that consistent approaches are used in analysis of different scenarios to allow informed decision making.

It is important to note, however, that the Treasury's review of the Green Book (HMT, 2020-1) recognises that "While the BCR is a useful metric for capturing quantifiable costs and benefits, there is a tendency to place an inappropriate emphasis on it, in a way that frames value for money as an absolute concept". This is an important consideration when assessing options as part of LAEP where reducing the analysis to a simple comparison of benefits given a monetary valuation with associated costs is unlikely to produce the best outcomes for local communities.

4.1 Monetary evaluation

Table 1 contains items that are most likely to be considered for inclusion in numeric evaluation of social aspects of local area energy plans. It identifies which items have a methodology defined within the Green Book and associated guidance and includes an indication of their importance within the evaluation process. This ranking uses the following criteria:

1. MUST for items which are core to LAEP and which have a clear methodology defined in government guidance
2. MUST for impact on different income groups due to the importance of ensuring a fair and equitable energy transition
3. SHOULD for items which are likely to be relevant to all local area energy plans
4. COULD for items which are predominantly related to changes in transport behaviours recognising that not all local area energy plans will include modal shift within their scope and that these benefits might be evaluated within a separate transport planning process

Table 1: Items for numerical assessment within economic analysis of local area energy plans

Assessment Item	Applicability in LAEP	Methodology Defined in Green Book	Ranking
Carbon savings	All aspects	Yes	Must
Energy savings	All aspects	Yes	Must
Air quality	All aspects	Yes	Must
Impact on different income groups	Buildings	No	Must
Employment	All aspects	No	Should
Comfort taking	Buildings	Yes	Should
Health benefits from improved housing	Buildings	No	Should
Local energy costs	Buildings	No	Should
Health benefits from physical activity	Transport	No	Could
Reduced congestion	Transport	Yes	Could
Bike Lane Ambience	Transport	No	Could

4.2 Non-monetary evaluation

Some impacts of local energy transition can be monetised. For some others there is clear evidence that a benefit occurs but insufficient evidence to attempt to apply a monetary value. In line with Green Book Guidance, these unmonetisable benefits should be included in assessments where there is evidence of their impact (CAG, 2021). Only a relatively small proportion of the co-benefits identified and analysed in the research have been monetised, and common frameworks for assessing non-monetary benefits are largely absent (Gouldson, 2018). This consideration might influence the choice of evaluation method considering the Green Book requirement that the approach to benefits measurement should be prudent, proportionate, and appropriate.

The following list suggests items that could be considered for non-monetary evaluation as part of assessment of options within the local area planning process. For further discussion of these items and suggested methods for non-monetary evaluation see step 5b of the main guidance.

1. Public attitudes and preferences
2. Skills required
3. Supply chain capability
4. Factors critical to success
5. Regional influences

5. Evaluation methods

Choosing the appropriate assessment approach for different benefits can be challenging. Evidence on the pathways that connect low-carbon actions with different co-benefits is highly variable. Some co-benefits have been heavily researched, and others have been largely overlooked. For example, the health benefits of a range of low-carbon actions have been described as "game changing" due to their scale. Similarly, air pollution as a pathway to improved public health is widely described in literature, but other pathways, for instance on the distributional impacts of measures, have received significantly less attention (Gouldson, 2018). This means that, in many cases, the most appropriate evaluation methodology used in assessing co-benefits could be dependent on the local situation as well as the scale of the particular projects being assessed and the data available locally amongst other factors.

This section discusses possible methods that might be used to assess different co-benefits. Beyond the requirement to follow the Green Book and its accompanying guidance the methods and data sources identified here are not supposed to be definitive or restrictive. The availability of local data and specific local opportunities and ambitions may influence the choice of analysis approach. A variety of papers and documents are available e.g. (Gouldson, 2018) which provide a systematic review of the literature focused on energy efficiency in buildings, low-carbon transport and sustainable waste management. These can be used to inform this choice.

In cases where methods are defined in the Green Book or its accompanying guidance it is expected that these methods will be used as part of LAEP. Where methods are not defined alternative options are discussed. In all cases future values must be discounted to current values using the appropriate Social Time Preference Rate as discussed in Section 3.6.

5.1 Energy and carbon savings

By its very nature LAEP will influence local energy consumption and associated emissions of greenhouse gasses. Energy efficiency has a direct social value, in addition to the value of a reduction in GHGs, as the energy saved itself has a direct benefit to society (similarly, activities that create extra demand for energy have a direct energy cost).

The approach and values to be used to quantify GHGs and energy efficiency can be found in Green Book Annex 1. BEIS publish more extensive guidance, background, rationale and relevant data tables that should be used (BEIS, 2021-1).

Carbon value assumptions for the traded and non-traded sectors are available for 3 different scenarios (low, central, and high) to enable sensitivity analysis. The values can be found in data tables[2] published by BEIS. Further detail on how to map energy use to the traded and non-traded sectors is available in BEIS online guidance at the same web address.

There is no Green Book requirement to include embedded emissions in the UK inventory. However, the decision making and appraisal process should take into account the impact of UK policy on emissions from abroad if it is appropriate, proportionate and practical (BEIS, 2021-1). On this basis it is not expected that embedded emissions will be included in valuation of greenhouse gas emissions in the case of LAEP.

5.2 Air quality

Reduced consumption of fossil fuels as a result of decarbonisation of local energy systems is likely to improve local air quality by reducing emissions of pollutants such as particulate matter, nitrogen dioxide, sulphur dioxide and ozone.

Three approaches can be used for valuation of changes in air quality (HMT, 2020), (BEIS, 2021-1):

1. if impacts are likely to be less than £50 million and do not affect compliance with legal limits then a "damage cost" approach is appropriate. This involves multiplying emissions changes by pre-calculated unit costs. This is often used to value the consequences of changes in pollution e.g. on health, crops and buildings.
2. if impacts are greater than £50 million then the "impact pathway" approach should be considered. This involves bespoke modelling specific to the intervention.
3. an "abatement cost" approach should be used in the limited instances where a proposal could affect compliance with legal limits. This involves estimating the least costly way of mitigating the impact of the proposal to ensure continued compliance with legal obligations.

Damage costs are estimates of the societal cost of a change in emissions of different pollutants, including the influence on health. They are calculated per year and should be multiplied by the number of years to which they apply. This approach is a relatively simple way to value changes in air pollution and is likely to be the most appropriate technique for assessment of projects within LAEP.

Analysts should also take note of DEFRA guidance[3] on assessing the impact of changes in air quality and appraisal using a damage cost approach.

2 https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

3 https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance#damage-costs

5.3 Impacts on energy bills and effect on different income groups

The Green Book is clear that effects on protected groups identified by the Equality Act should be assessed. In the case of LAEP this has particular relevance to the fuel poor. The influence on fuel poverty should be a key driver when making choices in LAEP and changes in energy cost should therefore be quantified to enable analysis of fuel poverty impacts. The Green Book and associated guidance do not provide an explicit methodology for assessment of fuel poverty impacts. However, it is likely that it will require assessment of:

1. Changes to household energy demand as a result of any fabric retrofit works and heating system changes
2. Changes to household energy demand as a result of installation of renewable generation and / or energy storage.
3. Future retail energy prices – ideally including the influence of the cost of network upgrades which may be required as a result of local decarbonisation.

Changes in household energy bills can then be monetised. Since fuel poverty data is not available at household level it is then necessary to compare average change in energy bill across different areas with the fuel poverty data to establish possible impacts on fuel poverty.

In instances where household energy bills are predicted to increase, the value of this increase might be used to determine policies for interventions which may be required to ensure that fuel poverty does not increase as a result of the transition.

5.4 Employment

Investments in local energy systems can be expected to have employment benefits by providing local, skilled jobs. These will include direct jobs from construction and operational phases of the development as well as associated supply chain and multiplier effects (CAG, 2021).

The Green Book (HMT, 2020) does not specify a detailed methodology that should be used to assess employment impacts. However, it does state that place based effects should be adjusted for:

- substitution where firms substitute one type of labour for another to benefit from an intervention but do not increase employment or output.
- leakage which is the extent to which effects "leak out" of a target area into others. For an intervention designed to increase employment in a particular area, leakage could take the form of increased employment in neighbouring areas.
- displacement which is the extent to which an increase in economic activity or other desired outcome is offset by reductions in economic activity or other desired outcome in the area under consideration or in areas close by.

Where appropriate, employment multipliers[4] can be applied following the adjustment for leakage, displacement and substitution. The Green Book provides recommended values based on empirical research and provides estimates of the additional jobs that will be generated in the area via both supply and demand linkages. Care must be taken to apply the appropriate multiplier and to use ranges to indicate low and high estimates.

4 Employment multipliers provide estimates of the additional jobs that will be generated in the area via both supply and demand linkages.

There are two main types of multipliers from expenditure on the project itself (CAG, 2021):

- Supply chain multipliers through spending on goods and services to support the development and operation of the energy project.
- Induced or consumption multipliers generated through expenditure on goods and services by those employed in the construction and operation of the project.

The size of the multiplier is a function of the geographical area that is defined as the 'impact area'. It is higher at a national level than a local level as a greater proportion of expenditure is captured at a national level, as some expenditure that leaks out of the local area does not leak out of the country (CAG, 2021).

Deadweight should also be assessed (HMT, 2020). This refers to allowing for outcomes that would have taken place without the intervention under consideration. It applies to any proposed intervention and it will be revealed when the total outcome of an option for intervention is compared with business as usual, since comparison with the BAU reveals what would have occurred without intervention.

Different methods have been used to assess the possible employment benefits of energy projects.

5.4.1 Method 1: Based on GVA (PwC, 2022-1)

This method uses UK Input-Output tables to assess the change in GVA that might result in different sectors of the economy as a result of energy projects. It assumes that the local economy has the same structure as the UK economy. In addition to local leakage, assumptions need to be made on the level of international leakage due to investment flowing out of the UK and into other countries due to the international nature of hardware manufacture.

The following steps are performed:

1. Split low carbon measures by cost type
2. Assign measures to broad sectors, e.g. Retail, Manufacturing
3. Lookup detailed sectoral SIC codes by searching for each on SICcode.co.uk
4. Split expenditure by what percentage of it takes place in the UK
5. By multiplying the cost split per sector, with the UK split per measure, create a value for each measure which shows how many pence would stimulate each UK sector for £1 spent on that particular measure
6. Calculate direct GVA per measure using the GVA to output ratio for each sector
7. Calculate jobs per measure per £ by multiplying direct GVA by either Type I or Type II multiplier for each sector to give jobs per £1m spent in each sector
8. Calculate total direct + indirect jobs per measure by multiplying the previous step by the total real £ expenditure per measure per year
9. Correct for productivity. £1m (in real prices) spent in a sector now may create 10 jobs, but in 20 years' time, it is likely that that sector will have become more productive either because fewer people can do the same job better, or because of automation. To take these factors into account, the job creation numbers can be corrected using the ONS long-run productivity estimates. This data estimates that productivity will grow by ~1.4% p.a. (and therefore it will require 1.4% more investment in real terms to create the same number of jobs).

5.4.2 Method 2: Based on employment multipliers for investment

In this case the employment impacts are calculated using a broad approach of estimating based on the amount of money spent. A range of studies estimating the employment impact of expenditure on domestic energy renovations[5] are available to estimate the employment impacts of each £1m spent.

1. Calculate the capital and operational costs for different energy system sectors (e.g. power generation, transmission and distribution, construction) for each scenario and the business as usual case
2. Use appropriate multipliers to estimate the number of FTE created in each sector.
3. Adjust for leakage[6]
4. Calculate the change in predicted jobs for each scenario from the business as usual case to get the deadweight.

As part of a sensitivity analysis it is possible to vary both the employment multipliers and the leakage percentage.

Examples of this method can be found in (Ternent, 2016), (UK100, 2021).

5.4.3 Method 3: Based on jobs created for different energy technologies per capacity unit installed

Some practitioners have used a methodology based on jobs created for different energy technologies per MW installed. In this case the expected jobs are calculated using multipliers applied to the capacity of different energy technologies installed in different scenarios. Examples of this method with associated references is given in (CAG, 2021) and (Arup, 2021).

5.5 Comfort taking

Comfort taking is the proportion of energy saved which householders retain and utilise in order to increase the level of warmth in their homes. BEIS guidance (BEIS, 2021-1) provides a methodology on how to value the additional comfort that households receive from being able to use domestic appliances (e.g. heating, lighting) more when the energy efficiency of the appliances improves. This method should be followed in LAEP.

Comfort taking should only be applied to appropriate energy technologies and must be applied to the appropriate energy vector for that technology. For example, low-energy lighting only affects electricity use.

5.6 Health from improved housing

The LAEP will lead to a number of improvements to the housing stock within the LA, such as improved building insulation, more energy efficient[7] and lower carbon heating. This will lead to an increased level of comfort due to housing that is warmer and less damp and air quality in the house should also be better as fossil fuels will not be used directly in the home. These factors should help to improve the health of residents who have existing medical

5 The following two studies provide summary statistics of the findings of a range of studies: http://www.ukace.org/wp-content/uploads/2012/11/ACE-Research-2000-09-Energy-Efficiency-and-Jobs-UK-Issuesand-Case-Studies-Case-Studies.pdf http://www.neujobs.eu/sites/default/files/publication/2013/01/Energy%20renovation-D14-2%2019th%20December%202012_.pdf

6 BIS Occasional Paper No. 1: Research to improve the assessment of additionality: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191512/Research_to_improve_the_assessment_of_additionality.pdf

7 Any energy savings as a result of solar PV installations are not accounted for in this calculation as these will translate to health benefits via comfort taking, not due to increased energy efficiency.

conditions such as respiratory, cardio-vascular and circulatory problems, and also help to prevent new cases developing. This will lead to better health of the general population of the study area.

Given its widespread use, the Quality of Life Year (QALY) is considered to be the most appropriate generic measure of health benefit that reflects both mortality and health-related quality of life (HRQL) effects. It is predicated on the assumption that society values the health of its members in terms of the quality of life that is implied by their health status, and the number of years for which that health status is enjoyed (DoH, 2004). The QALY approach weights life years (saved or lost) by the quality of life (QoL) experienced in those years. Years of good health are more desirable than years of poor health (ibid). This is useful when appraising options that result in different effects on both longevity and QoL. The current values of a Statistical Life Year and a QALY, how they can be applied, and background information is contained in Annex 1 of the Green Book (HMT, 2020).

QALYs are calculated by multiplying the change in QoL by the duration (in years) – for example a reduction in QoL from 1.0 to 0.5 for 6 months equals the loss of 0.25 QALYs (HMT, 2020). The value of QALY effects should be discounted at the health rate of 1.5%, declining after 30 years. See Annex 6 of the Green Book for further information on the discount rate. Sensitivity analysis should be conducted around this rate (DoH, 2004).

Valuing a health impact in money terms will help comparison to other economic and social impacts. However, setting a value on a QALY involves setting a value on life-years gained or lost. This is controversial and many people prefer not to do so (DoH, 2004).

5.6.1 Method 1: Use the value to the NHS of eliminating excess cold (PwC, 2022-1)

In this method NHS costs associated with excess cold are apportioned to the local area and allocated to different measures.

1. Calculate the total value to the NHS of eliminating excess cold.
2. Allocate NHS costs to local areas on a population basis weighted for each area's experience of excess winter deaths pre-COVID. This assumes that factors influencing excess cold deaths are equally prevalent in different areas.
3. Allocate NHS costs to measures that relate to increased temperatures (insulation is included, heat pumps are excluded). The temperature increase of each measure is used to calculate a warming factor per measure assuming there is a direct, linear relationship between the extent to which a measure increases temperature and that measure's reduction in NHS costs.
4. Correct the warming factor assuming 100% of NHS cost savings can be realised without 100% deployment of possible measures.
5. Use corrected warming factor to assign a total £ value for each low carbon measure in the study area. The total NHS costs can now be split between low carbon measures.
6. Multiply these £ values by the number of each low carbon measure deployed in each area/scenario each year

5.6.2 Method 2: Convert energy savings to QALYs

1. For each property type and fuel type, an average MWh/QALY value is derived using QALY per measure estimates from DECC's framework for future action on poverty (DECC, 2013) and the respective energy savings of these measures.
2. The calculated value of a QALY is then applied to the energy savings for each property and fuel type over the period of interest and monetised using the value of a QALY given in the Green Book.

An example of this method is given in (Ternent, 2016).

5.7 Local energy costs

It may be useful to estimate the influence on local energy costs of the costs associated with building, reinforcing or modifying local energy networks in support of the local area energy plan. This is particularly relevant to any new heat networks that might be included in the LAEP as the Green Book supplementary guidance data tables do not have price estimates for heat delivered via district heat networks.
The following costs should be included in a calculation of local energy costs. These costs should be calculated as part of modelling options for the future (see Stage 4 of the main guidance).

- UK market price of energy
- Annualised network (transmission & distribution) investment costs, including both new-build networks and network reinforcements (this includes a cost of capital)
- Network operating & maintenance costs
- Annualised investment costs for local generation which is part of LAEP
- Local generation operating & maintenance costs (e.g. for solar PV)
- Annualised investment, operating and maintenance costs for energy centres providing heat to networks.

In the case of energy centres which are producing both electricity and heat (e.g. through use of gas combined heat and power) the costs of the energy centre and generation fuel need to be apportioned between the two products so as to be represented in the calculated costs. The apportioning can be based on the electricity to heat generated ratio. If an energy centre is producing waste heat in order to access generation electricity, then this is counted towards electricity generation not heat.

Predicted future energy consumption for each energy vector can then be used to calculate the unit costs of energy locally. For each time period, the total costs of delivering each of the fuels (including any local generation) are summed and divided by the total energy delivered to give levelised costs for gas, electricity and heat. See (Ternent, 2016) for further details on one method of doing this.

The following three areas may or may not be relevant to the LAEP process, where the organisation conducting the assessment will need to establish if these benefits can be directly attributed to the LAEP process. For example, these benefits may already have been accounted for in an area's transport plan e.g. through proposed modal shift in the local area.

5.8 Health benefits from physical activity

If the LAEP includes significant shifts to walking and cycling then there are likely to be health benefits that result from this increase in physical activity. The World Health Organisation (WHO, 2017) have developed a methodology for valuing the benefits of increased physical activity resulting from a modal switch to walking and cycling (Health Economic Assessment Tool – HEAT) which can be applied as follows. These benefits should only be evaluated within a LEAP if they have not been evaluated in a separate transport plan.

1. Take estimates of the extra vehicle kilometres being walked and cycled per year.

2. Estimate the extra hours of exercise per person per year - assuming all people split the exercise evenly.
3. Divide the extra exercise per person in each age group by the reference range given by HEAT, and then multiply by the total reduction in risk that is associated with the reference range (see HEAT tool).
4. If the volume of exercise exceeds the capped amount the apply the cap.
5. Multiply the reduction in risk for each age group by the total all-cause mortality for each age group in the area - this gives the total number of mortalities per year that would be avoided by increased physical activity.
6. Calculate the average number of life years remaining for each age group (older age groups are likely to live less long).
7. Multiply this by the number of expected mortalities and the value of a life year to give a total value of life lost per year.
8. Create a lag so that it takes 5 years to accrue total benefits, with 20% created in the first year, 40% in the second etc.

For further discussion of this see (PwC, 2022-1)

5.9 Congestion

The use of road vehicles incurs both private costs borne by the individual traveller (such as fuel costs and personal travel time) and external costs borne by others. These external costs include congestion, local & global air pollution, noise, infrastructure and accident costs. These benefits should only be evaluated within a LEAP if they have not been evaluated in a separate transport plan.

Some co-benefits of climate mitigation actions in the transport sector have been extensively researched, including improved outdoor air quality, increased physical activity, and reduced congestion and travel time. Others do not have such extensive evidence, including improved indoor air quality, reduced ambient noise, and motor vehicle crashes. Generally, there is a lack of costing estimates in the literature and few studies monetise the value of co-benefits (Gouldson, 2018). Where benefits have been assessed (Gouldson, 2018) suggests that switching the public from car to active travel modes (walking and cycling) would consistently result in an associated, positive influence on benefit to cost ratio.

The Department for Transport recommend an approach to valuing reductions in traffic congestion (DfT, 2021). The primary method for estimating decongestion benefits in the absence of a multi-modal model is based on marginal external costs (MECs). The MEC method is based on the change in these external costs arising from an additional (or removed) vehicle (or vehicle km) on the network. The costs are available in the DfT WebTAG data book[8] and include different factors:

1. Less congestion resulting in improved journey time and quality, lower vehicle operating costs
2. Fewer accidents leading to lower mortality and morbidity
3. Fewer road repairs required with associated lower cost to the Exchequer
4. Lower levels of noise pollution resulting in a lower health and productivity burden
5. Fewer GHG emissions
6. Lower air pollution
7. Lower road / fuel duty to the Exchequer

In the case of LAEP items 5 and 6 are valued elsewhere in the analysis (so not used here) and item 7 is a transfer from one group to another, so should not be included. If avoided vehicles kms per mode have been estimated per congestion band and road type as part of a transport decarbonisation plan the value of the associated benefits can then be calculated using the DfT WebTAG data for:

1. Traffic by region, congestion band, area type & road type.
2. Marginal External Costs and Indirect Tax

Further discussion of this approach can be found in (PwC, 2022-1)

8 See Suggested data sources

5.10 Bike Lane Ambience (PwC, 2022-1)

A cyclist can experience extra journey quality when cycling in a bike lane as opposed to an open road. If the LAEP increases the opportunities for this to occur, then assessment of this improved experience could be undertaken. These benefits should only be evaluated within a LEAP if they have not been evaluated in a separate transport plan.

1. Translate bike vehicle kilometres into minutes spent cycling each year by dividing by average cycling speed (14km/h)
2. Create a constant to understand how much of this time was spent in bike lanes by multiplying the assumed percentage of all kms spent in bike lanes by the assumed difference in speed in bike lanes versus the road[9]. Cyclists will travel faster in bike lanes because of fewer interruptions[10].
3. Multiply total bike minutes p.a. by this constant to give bike lane minutes p.a.
4. Calculate the average benefit generated per minute of cycle lane usage by averaging the 5 types of bike lane given in WebTAG[11]
5. Multiply bike lane minutes p.a. by this value to generate total benefits



9 There is very little data on what percentage of time cyclists spend in bike lanes versus the open road in UK cities, but 20% is thought to be a reasonable level for non-London cities. Cyclists will travel 15% faster in bike lanes because of fewer interruptions.

10 There is very little data on difference in speeds in bike lanes, but 15% is thought to be reasonable

11 DfT provide values for time spent in (1) Off-road segregated cycle track, (2) On-road segregated cycle lane (3) On-road non-segregated cycle lane (4) Wider lane (5) Shared bus lane. A decision must be made on the proportion of time spent in each type.

6. Suggested data sources

Greenhouse gas reporting: conversion factors 2019. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

Updated energy and emissions projections: 2019. https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2019

Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal data tables. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1024043/data-tables-1-19.xlsx

DEFRA guidance and air quality damage cost estimates. https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance#damage-costs

Transport analysis guidance data book. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1037341/tag-data-book.xlsm

United Kingdom Input-Output Analytical Tables, 2017 https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesdetailed with supporting documentation at https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/articles/inputoutputanalyticaltables/methodsandapplicationtouknationalaccounts

Employment multipliers and effects by industry and sector
https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/adhocs/007234provisionalestimatesoftypeiukemploymentmultipliersandeffectsbysu114industrygroupandsectormarketgovernmentnpishreferenceyear2013

EPC certificates (https://epc.opendatacommunities.org/) will provide information about likely expenditure on fuel bills. Local Authorities can access postcode level household income information through the Office for National Statistics.

7. References

Arup. (2021). *South Wales Net Zero 2050. Socio-economics Final report* . Ove Arup & Partners Ltd.

BEIS. (2021-1). *Valuation of Energy Use and Greenhouse Gas. Supplementary guidance to the HM Treasury Green Book on Appraisal and Evaluation in Central Government.* Department for Business, Energy and Industrial Strategy .

BEIS. (2021-2). *Valuation of energy use and greenhouse gas. Background documentation.* Department for business, energy and Industrial Strategy.

BRE. (2015). *The Cost of Poor Housing to the NHS.* BRE.

CAG. (2021). *Devon Community Energy: Socio Economic Impact Assessment.* Devon County Council.

CSE, & ESC. (2020). *Local Area Energy Planning: The Method.* Centre for Sustainable Energy and Energy Systems Catapult for Ofgem.

CSE, Equality and Climate Action, Queens University Belfast, & Place-Based Climate Action Network for UK100. (2021). *The Economic Benefits of Local Climate Action.* UK100.

DECC. (2013). *Fuel Poverty: a Framework for Future Action.* DECC.

DEFRA. (2020). *Accounting for the Effects of Climate Change. Supplementary Green Book Guidance.* Department for Environment, Food and Rural Affairs.

DfT. (2021). *TAG UNIT A5.4 Marginal External costs.* Department for Transport.

DoH. (2004). *Policy Appraisal and Health.* Department of Health.

Fingleton, J., & Jammet, M. (2021). *Capturing the benefits of building renovation.* Build Upon Project.

Gouldson, A. S. (2018). *The Economic and Social Benefits of Low-Carbon Cities: A Systematic Review of the Evidence.* London and Washington: Coalition for Urban Transitions.

HMT. (2015). *Valuing Infrastructure Spend: Supplementary guidance to the Green Book.* HM Treasury.

HMT. (2018). *Guide to Developing the Programme Business Case. Better Business Cases for better outcomes.* HM Treasury.

HMT. (2020). *The Green Book. Central government guidance on appraisal and evaluation.* HM Treasury.

HMT. (2020-1). *Green Book Review 2020: Findings and response.* HM Treasury.

NHS. (2004). *Guide to the Methods of Technology Appraisal.* National Institute for Clinical Excellence.

PwC. (2022). *Accelerating Net Zero Delivery.* InnovateUK.

PwC. (2022-1). *Accelerating Net Zero Delivery Technical Annex: Economics Methodology.* London: InnovateUK.

Ternent, L. (2016). *Methodology for Assessing Economic Impact of Local Energy Plan.* Energy Systems Catapult.

UK100. (2021). *The Economic Benefits of Local Climate Action.* UK100.

WHO. (2017). *Health economic assessment tool (HEAT) for walking and cycling.* World Health Organisation.

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