

**Review of company surveys on consumers'
willingness to pay to reduce the impacts of existing
transmission infrastructure on visual amenity in
designated landscapes**

Final report to Ofgem

Prepared by



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Glossary

Terminology abbreviations

AONB	Area of Outstanding Natural Beauty
GEMA	Gas and Electricity Markets Authority
NGETL	National Grid Electricity Transmission Limited
NP	National Park
RIIO	Revenue = Incentives + Innovation + Outputs
TO	Transmission Operators
SHETL	Scottish Hydro Electric Transmission Limited
SPTL	Scottish Power Transmission Limited
WTP	Willingness to pay

Executive summary

Background and objectives

In December 2010, Ofgem consulted on a strategy decision which among other things set out the issues that companies should consider when managing the visual impact of transmission infrastructure. For existing infrastructure a similar approach to that used in the most recent electricity distribution price control was proposed. This implies that GEMA will propose an appropriate allowance for each transmission owner (TO) to mitigate the visual impact of existing infrastructure in national parks and areas of outstanding natural beauty.

Ofgem required that:

- the allowance for each company should be informed by a consumer willingness to pay (WTP) analysis undertaken by the transmission company;
- the analysis should form part of the business plan submitted by each company and should study a range of mitigation options e.g. tree planting near substations and undergrounding of lines; and
- each TO should submit their RIIO-T1 business plans by 31 July 2011.

This study will input into Ofgem's assessment of the quality of the business plans submitted by the TOs and Ofgem's development of proposed allowances for each electricity TO. The two main objectives of this study are therefore:

- To provide a critical review of the companies' willingness to pay surveys (or if no full survey is provided their response to the requirement in the business plan) including an assessment of the quality of the evidence provided in the RIIO-T1 business plans and supporting material.
- To provide advice on applying the survey results to set an allowance for each company.

Study approach

The first step of the review involved determining a current best practice model for WTP studies assessing visual amenity. This was based on existing best practice guidance developed by public bodies and up-to-date academic literature.

A desktop review of the evidence supplied in the TO business plans was then undertaken in order to provide a critical review of each of the willingness to pay studies. In undertaking the review the studies/arguments provided were compared to the best practice model for WTP studies.

TO responses and survey results

Scottish Power Transmission Limited and Scottish Hydro Electric Transmission Limited did not complete consumer willingness to pay studies for options to mitigate visual amenity impacts from existing infrastructure:

- SPTL state that they support an allowance for such options but then say that it should be used on a case by case basis in respect of new infrastructure, with supporting WTP evidence provided on a case by case basis.
- SHETL say that they do not intend to invest in such measures in respect of existing infrastructure because they are too expensive and they do not believe that the case can be made for customers to pay for them. No supporting evidence is provided in support of these assertions.

NGETL has undertaken a consumer survey with a WTP component aimed at understanding WTP for undergrounding of existing and new lines. No analysis has been carried out for other possible mitigating options. Although little analysis of the results of the survey has been undertaken the supporting material suggests that consumers on average have the following WTP for undergrounding (based on the open-ended contingent valuation questions):

- £7.22 per year for all existing infrastructure in National Parks;
- £7.76 per year for all existing infrastructure in Areas of Outstanding Natural Beauty; and
- £3.76 per year for all existing infrastructure in other rural areas.

The results of the survey also suggest a high dispersion in WTP.

Our report makes a detailed assessment of the WTP survey commissioned by NGETL and notes a number of positive and negative aspects. Overall, we believe that the most significant problem with the NGETL work relates to the methodology used, in particular the focus on undergrounding as the only mitigation option, the apparent lack of a theoretically consistent welfare measure and the flawed implementation of the payment card approach. The lack of analysis of the results is the next most significant drawback, followed by poor implementation and framing. The latter affect the interpretation of the results of the open-ended questions, which we believe are relatively more reliable estimates of WTP than those provided by the payment card approach used in this case. However, with the above caveats we believe that the average WTP derived from the open-ended questions could be used as a rough estimate of consumers' WTP for undergrounding in England and Wales. As they stand, we do not believe that they are likely to be robust enough to use in a value transfer exercise for application in Scotland.

Potential next steps for Ofgem

SPTL and SHETL

One potential response from Ofgem could be to not provide any allowance to these TOs in respect of visual amenity mitigation options for existing infrastructure, either through the RIIO-T1 process or through any associated uncertainty mechanism. However there is a possibility that this outcome would not be consistent with the wishes of consumers and it would not be consistent with Ofgem's overall approach to the current price review which has a strong focus on engagement with stakeholders. The only alternatives that we can suggest are that:

- 1) Ofgem requires these TOs to undertake the required programme of work in respect of WTP;
- 2) Ofgem undertake the WTP work themselves; or
- 3) Ofgem draws on the work undertaken by NGETL in order to estimate WTP for these TOs.

We have listed the options above in the order that we think would be preferable. Although option 3 is likely to be the least costly option, we prefer options 1 and 2 to option 3 because it is quite possible that WTP varies significantly between regions and so WTP estimates from the National Grid area may not be good estimators for WTP in the SPTL and SHETL areas. Whichever option Ofgem prefer, a first step would be to clarify the TO's positions with them.

NGETL

With respect to NGETL, we see four possible approaches for setting an allowance for mitigating visual effects of transmission lines:

- 1) Ofgem requires NGETL to undertake a new consumer WTP survey in line with best practice and the recommendations outlined in chapter 3;
- 2) Ofgem undertakes a new WTP consumer survey themselves;
- 3) Ofgem requires NGETL to improve the analysis and presentation of the current WTP survey based on the recommendations provided in chapter 3; or
- 4) Ofgem uses existing NGETL estimates based on the open-ended contingent valuation approach to set an allowance for undergrounding of existing transmission lines.

In our view, a new consumer survey following the steps outlined in our best practice section would yield the best results and be the only way to address our key concerns about the selected methodology and its implementation. However, we acknowledge that there are significant costs associated with this approach (and hence options 1 and 2 above). Nevertheless, these costs are minor compared to the potential costs involved if the estimates used are wrong and compared to the size of the potential allowance.

A second best approach would be to require NGETL to undertake additional analysis of the open-ended contingent valuation questions, in order to overcome some of the concerns we have raised with respect to the WTP analysis. We consider option 4 the least preferable option because of the inherent problems with the WTP estimates. However, we outline in our report how this approach could be used.

1 Introduction

1.1 Policy background

In July 2010, Ofgem initiated the fifth transmission (electricity and gas) price control review which is the first price control since the Gas and Electricity Markets Authority (GEMA) launched RIIO (revenue = incentives + innovation + outputs). Under RIIO, Ofgem has extended the engagement with stakeholders and transmission companies have been encouraged to demonstrate the use and application of stakeholder engagement in their business plans. One of the major issues arising from stakeholder engagement is how electricity transmission network companies manage the impact of new and existing transmission infrastructure on visual amenity values across Great Britain.

In December 2010, Ofgem consulted on a strategy decision which among other things set out the issues that companies should consider when managing the visual impact of transmission infrastructure. For existing infrastructure a similar approach to that used in the most recent electricity distribution price control was proposed. This implies that GEMA will propose an appropriate allowance for each transmission owner (TO) to mitigate the visual impact of existing infrastructure in National Parks (NPs) and Areas of Outstanding Natural Beauty (AONBs).

The allowance for each company should be informed by a consumer willingness to pay (WTP) analysis undertaken by the transmission company. The analysis should form part of the business plan submitted by each company and should study a range of mitigation options e.g. tree planting near substations and undergrounding of lines. Each TO was asked to submit their RIIO-T1 business plans by 31 July 2011. However, only one TO submitted a full WTP survey. Another provided arguments in its business plan seeking to justify why no WTP study for existing infrastructure had been undertaken, whilst the third TO recognised the merit of WTP studies in respect of new infrastructure, at some point in the future, but did not submit one with its business plan.

1.2 Objectives of the study

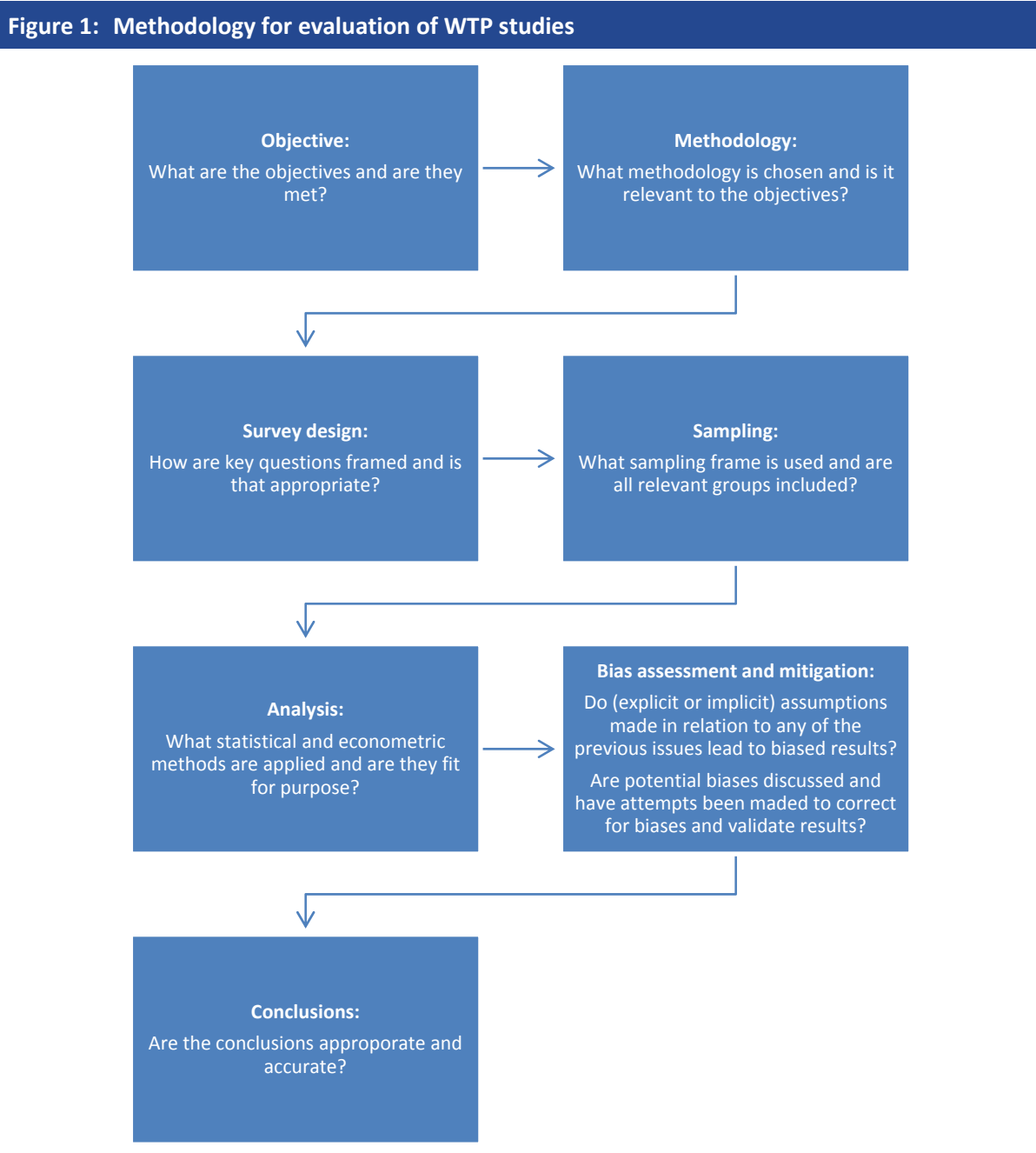
This project will input into Ofgem's assessment of the quality of the business plans submitted by the TOs and Ofgem's development of proposed allowances for each electricity TO. The two main objectives of this study are therefore:

- To provide a critical review the companies' willingness to pay surveys (or if no full survey is provided their response to the requirement in the business plan) including an assessment of the quality of the evidence provided in the RIIO-T1 business plans and supporting material.
- To provide advice on applying the survey results to set an allowance for each company.

1.3 Study approach

The first step of the review involved determining a current best practice model for WTP studies assessing visual amenity based on existing best practice guidance developed by public bodies and up-to-date academic literature.

A desktop review of the evidence supplied in the business plans was then undertaken in order to provide a critical review of each of the willingness to pay studies. In undertaking the review the studies/arguments provided were compared to the best practice model for WTP studies. The review considers the following aspects when applicable.



Source: London Economics

Finally, based on the review different methods of applying the results of the WTP studies in Ofgem’s future work are discussed as well as the relative merits of each of the options suggested. A number of criteria are used to assess alternative approaches e.g. feasibility, fairness, economic efficiency and impacts on incentives.



1.4 Scope of the study

The study focuses only on survey based WTP methods as TOs were specifically asked to undertake surveys of consumers' willingness to pay for improved visual amenity.

WTP is the maximum amount of money an individual is willing to give up in order to receive something e.g. access to a better looking landscape. WTP is a relatively broad valuation concept and WTP estimates include both the use and non-use value. The use value is the value to individuals who make use of the good either directly or indirectly. For example, the benefits derived from a visit to a national park by visitors or the value of increased visual amenity associated with mitigating options for people who live close to electricity transmission infrastructure. The non-use value is the value associated with knowing that the good exists (existence value) and can be enjoyed by other people (altruistic value) and future generations (bequest value).

Compared to DEFRA (2006) and Fujiwara and Campbell (2011) this study therefore does not consider any of the following and does not discuss best practices for these valuation approaches. We refer to DEFRA (2006) and Fujiwara and Campbell (2011) for an overview of these methodologies.

- *Deliberate and participatory methods* are not considered because these methods do not lead to an economic valuation and therefore also no WTP estimates. However, deliberate and participatory methods are discussed in so far that they can be used to support stated preference studies. For example, focus group research may be used to inform the design of stated preference surveys.
- *Revealed preference methods* are recommended by the HM Treasury Green Book (2011) in cases where reliable data can be achieved but it is also noted that these methods cannot estimate the total value of a non-market good and typically these methods only allow estimation of the use value. We also note that revealed preference methods typically use secondary data or a combination of both primary and secondary data.
 - *Market price proxies* are not discussed because while the use of market price proxies (such as opportunity costs, the cost of alternative provision, mitigation costs, the costs of aversive behaviour or shadow project costs) do provide an economic valuation the methods do not allow for a full assessment of consumers' WTP because consumers may, in fact, be willing to pay more than the market price.
 - *Production function approach* is not included in this study because the approach focuses on estimating input value of resources into the production of a marketed good or service. In practice, the production function approach is limited to environmental inputs such as water, soil, raw materials, air quality and ecosystem services. The approach is excluded from this study because it does not attempt to estimate consumers' WTP but instead estimates input values.
 - *Hedonic property pricing* is not considered because it does not lead to an estimate of consumers' WTP. Instead the method focuses on assessing the value by estimating the impact on property prices. This also means that it is in principle not a survey based method.

- *Travel cost methods* also do not provide an estimate of the willingness to pay. Instead it estimates direct costs (travel expenditures, entrance fees and the value of time) incurred by individuals travelling to and gaining access to an alternative (e.g. a recreation site). The direct costs measured using travel cost methods may be lower than the WTP for similar reasons that market price proxies may underestimate WTP.
- *Random utility model approaches* test the effect of changing the quality or quantity of the choice between different alternatives. It can be considered an extension of the travel cost method but instead of focusing on the visit frequency to a specific site, it focuses on whether individuals will visit a site and if so which site. However, like the travel cost method, this approach does not capture the full WTP.
- *Life satisfaction/subjective well-being approaches* may use either secondary data or primary data collection. However, instead of measuring WTP it measures the value of non-market goods in terms of the impact on life satisfaction or other subjective well-being measures. The approach builds on the assumption that the value can be measured by utility which in turn is assumed to be measurable by subjective measures. When, as in this case, the objective is to measure WTP, it is thus necessary to assume that differences in wellbeing between different scenarios equals the WTP. This may, however, not be the case and the life satisfaction approach is therefore a less direct way of measuring WTP.
- *Benefit transfer or value transfer* involves the use of value estimates that have been derived using primary data collection in other contexts as a proxy for benefit impacts in the context under analysis. Whilst this has obvious advantages in terms of timescale and cost, there are real questions about its accuracy. In many circumstances, preferences measured in the original context will not be the same as preferences in the new context. This approach can only be used where there is one (and preferably more) suitable valuation study that is a relevant match to the new policy context. Further guidance on value transfer is also provided in Defra (2009).

This study therefore focuses only on stated preference methods and, in particular, discusses the relative merits of contingent valuation and choice modelling for estimation of consumers' WTP using consumer surveys. In this context, it is also worth noting that, based on a review of the literature, DEFRA (2006) concluded that the most commonly used economic valuation methods are stated preference methods.

We note that stated preference methods may also be used to estimate the willingness to accept compensation for worse visual amenity. Willingness to accept is the minimum amount of money an individual would need to be compensated to forgo something. In this study we focus only on WTP applications because TOs were asked specifically to submit WTP studies.

The views expressed in this report are the views of London Economics and do not necessarily reflect the views of Ofgem. The critique of the TO WTP studies is based on the London Economics view of best practice in this area and our understanding of the needs of Ofgem. We would not expect most WTP studies to meet best practice standards in every single respect and so, in that sense, we are setting a high standard against which to compare the TO WTP studies. We also note that the aims of the researchers who undertook the WTP studies may not have been the same as our interpretation of Ofgem's needs.

2 Current best practices for WTP studies

This section outlines our view of the current best practices for WTP studies. Our work draws on both academic literature and best practice guidance and recommendations published by other public bodies such as DEFRA, the Competition Commission and HM Treasury.

It should be noted that best practises for WTP studies are constantly evolving and while the methodology outlined in this section represents our view of the current best practices in the area, this may not hold true for future WTP studies. However, the methodology presented contains a number of considerations and recommendations which are also likely to be applicable for future WTP studies.

2.1 Objectives

The objectives of any study should be clearly stated. In the context of WTP studies, it is important to clearly state:

- What non-market good should be valued e.g. a landscape or different characteristics of a landscape.
- How the target population is defined i.e. whose valuation of the non-market good should the study measure.

Determining the target population

Compared with research based on secondary data, research involving primary data collection has the advantage of allowing value estimates to be based on specifically defined populations. However, it is important to note that different groups of individuals may have very different valuations of the good so defining the target population is of key importance.

The appropriate target population depends on the specific good in question, who is or will be paying for it and the type of value that is being measured (Fujiwara and Campbell, 2011). In the case of a WTP estimation both the use and non-use value of the good to individuals in the target population are being captured by the WTP estimates. However, whilst the use value may largely be confined to a certain group of individuals e.g. people living in a certain area, this does not hold for non-use value. In contrast, the implication of non-use value is that it extends the size of the potential target population that has to be considered because people outside the local area may have non-use value of the good.

In some cases, there may also be large externalities associated with the good or there may be legal reasons why the target population should be relatively large and inclusive. For example, there are potentially large externalities of pollution and international agreements relating to global warming and pollution means that individuals in other regions and countries also are affected by the provision of a non-market good with environmental effects. Similarly, other countries can claim property rights over world heritage sites and therefore it may also be appropriate to include individuals in other countries in valuations of world heritage sites (Fujiwara and Campbell, 2011).

However, at the same time there may be arguments for limiting the size of the target population. For example, if the proposed or existing good is to be paid for by UK residents or residents in a

certain area, then policy makers may only be interested in estimating the values people in that specific area attach to the non-market good.

2.2 Methodology

There are two general survey based approaches to estimate WTP: contingent valuation and choice modelling. Both use hypothetical market scenarios and seek to elicit WTP for these different scenarios. This also implies that both methods can incorporate changes that have not yet occurred.

Contingent valuation has been applied for longer than choice modelling and has therefore been used in more studies (DEFRA, 2006). However, choice modelling is becoming increasingly popular because it overcomes some of the potential problems associated with contingent valuation and it allows for valuation of individual characteristics. Accent (2010) goes further and recommends the use of choice modelling and, in particular, choice experiments over contingent valuation techniques. However, the choice depends on the research question and in some cases contingent valuation may still be appropriate.

Table 1: Contingent valuation vs. choice modelling		
	Contingent valuation	Choice modelling
What is it?	Respondents are asked directly what they are willing to pay for a specified change	Respondents are asked to make a number of choices between different (hypothetical) scenarios with different prices
What does it cost?	Less costly than choice modelling	More costly survey
What is the timescale?	Shorter timescale required	Longer timescale required
What is valued?	A non-market good as a whole	Allows for valuation of the good as a whole and of specific characteristics/attributes of the good
What skills are required?	Simple methodology (survey design and subsequent data analysis) and task easier for respondents (risks of random response error lower)	Higher complexity in survey design and analysis. More complex task for respondents which may result in random response error
What are the most important problems?	There are a large number of identified biases that need to be taken into consideration when designing, implementing and evaluating contingent valuations	The choice and level of attributes to employ in a survey, method of survey implementation (i.e., face-to-face, phone, computer), choice of econometric methods to analyse survey data
How established is the methodology?	Has been applied for longer	A more recent approach but increasingly applied and more examples of choice modelling in recent literature than examples of contingent valuation

Source: London Economics based on several sources.

2.3 Survey design

The main difference between a contingent valuation questionnaire and a choice modelling questionnaire is the way in which the valuation question(s) in the questionnaire are presented to respondents. We first discuss common features of survey design for stated preference surveys and we then discuss different ways of presenting valuation questions in the next two subsections for contingent valuation and choice modelling, respectively. Next, we discuss other issues related to the design of the valuation survey including inclusion of no-choice options and piloting and pretesting of questionnaires.

2.3.1 Components in a stated preference survey

A WTP survey should include (Fujiwara and Campbell, 2011) the following components; regardless of whether a contingent valuation approach or a choice modelling approach is chosen:

- An introduction describing the purpose of the questionnaire, the estimated length in minutes and the sponsor of the questionnaire.
- An initial set of questions about the respondent's attitudes towards the good and specific use of the good.
- The valuation scenario:
 - A detailed description of the good, how it will be provided, the method of payment (i.e. through changes in taxes, rates, fee, charges or prices) and the frequency of payment.
 - A description of any currently available substitutes or complements for the good.
 - Questions to infer a respondent's WTP with reminders of budget constraints. It is important to remind respondents of their budget constraint in order to help ensure that respondents perceive the choice as a real economic choice with trade-offs.
- Follow-up questions relating to:
 - **The reasons behind their valuation responses.** The responses to these questions are typically used to model the determinants of the valuations (see the discussion on regression analysis for bid functions below) and to identify invalid or protest valuations (e.g. respondents who state a zero WTP as a matter of principle due to an objection to paying for the good).
 - **The respondents' socioeconomic and demographic characteristics.** Questions on the respondents' characteristics (e.g., age, income, education) are useful for assessing the representativeness of the sample and for testing response validity (i.e. does WTP increase with income? Do responses confirm other a priori expectations of the relationship between WTP and other variables?).

It is important to include as much detail as possible in the description of the valuation scenario because valuations may be influenced by details such as who is in charge of delivering the good or improvement, who will collect the money and how frequently. Otherwise, the results may be subject to information bias caused by lacking information (information bias may also arise even if all relevant information is provided if the information is not presented in an unbiased way). However, at the same time it is important that the survey is not too long and complicated because this may lead to respondent fatigue and increases the risk of non-response bias.

Careful consideration should be given to the payment vehicle used i.e. how the respondent is (hypothetically) expected to pay for the good. The most appropriate payment vehicle depends on the research question but common examples of different payment vehicles include national tax, regional tax, fee/charge, price increases, donations or gifts (Pearce et al, 2002). It is worth noting that respondents may be hostile to the agency responsible for collecting the tax or fee and this should be tested in pre-tests. In the context of donations and gifts, the voluntary element of the payment vehicle invites to free-riding and as a result Pearce et al (2002), generally, do not recommend it for contingent valuation surveys.

2.3.2 Contingent valuation methods

There are four widely used ways to present the valuation question(s) in contingent valuation questionnaires:

- **Open ended:** The open-ended format asks respondents directly for their maximum WTP for the good under consideration. The question formulation is along the lines of: “what is the maximum amount you would be prepared to pay (every period) through (payment vehicle) to receive the good just described?”. The open ended format often results in a large number of zero responses and potential protest votes (see discussion on biases and mitigating options).
- **Bidding game:** The bidding game format is an iterative process where respondents indicate agreement or disagreement with a particular level of payment. The level of payment (the bid) keeps increasing if the respondent agrees. Once a bid is rejected by the respondent the bidding game stops and in the closed-ended version of the bidding game the maximum WTP is inferred from the maximum bid accepted. In the open-ended version, the game finishes with an open-ended WTP question after a bid is rejected. Research has suggested that WTP results of bidding games depend on the starting point for the bidding game.
- **Payment card:** The payment card method presents respondents with a range of different monetary amounts. Respondents are either asked to indicate amounts they are willing to pay (or not pay), their maximum WTP or a range of values they are willing to pay. WTP estimates based on the payment card method are, not surprisingly, strongly influenced by the scale of values used.
- **Dichotomous choice:** The dichotomous choice (or referendum method) gives respondents the chance to respond “yes” or “no” to a single amount. Therefore, respondents are offered a binary choice between not having the good or having the good but giving up the offered price. The amount presented to respondents varies and is randomly drawn. This single dichotomous format tends to produce relatively high WTP estimates. The double-bounded dichotomous choice method is a variant where an additional higher (lower) offer is made if the respondent responds “yes” (“no”) to the first offer. Like the bidding game format and the payment card format, WTP estimates are likely to be influenced by the bids presented to respondents; in this case represented by the range from which bids are drawn.

Payment cards and dichotomous choice are the most popular formats and it has been found that the dichotomous choice format tends to give the most theoretically consistent results (consequentiality). Payment cards and dichotomous choice formats are also the formats recommended by Accent (2010) to the Competition Commission for contingent valuations. It is

worth noting that both methods yield interval data at the individual level rather than a single amount of maximum WTP.

2.3.3 Choice modelling methods

Choice modelling questionnaires generally follow much the same structure as contingent valuation questionnaires. The main difference is related to the design and presentation of the valuation scenario(s).

Compared to contingent valuation a key part of the survey design for choice modelling is the choice of and presentation of attributes (characteristics) of the non-market good. Most non-market goods can be described by their attributes and the levels that these attributes take. For example a power outage can be described in terms of the length, duration and frequency of the outage. Similarly, a landscape can be described in terms of the biodiversity, visual amenity, etc.

There are four general choice modelling methods:

- **Choice experiments:** Respondents are presented with a series of choices between alternative scenarios and they are asked to choose the scenario they prefer given the price and non-price attributes specified for each scenario.
- **Contingent ranking:** Respondents are asked to rank alternative options from most to least preferred.
- **Contingent rating:** Respondents are presented a series of single alternative descriptions of the good. The respondent then has to rate the strength of their preference for each description on a semantic or numeric scale e.g. a scale from 1 to 10.
- **Paired comparisons:** Respondents choose their favourite alternative out of a set of two and then indicate the strength of their preference on a numeric or semantic scale.

All of these methods present respondents with alternative descriptions of a good which vary in terms of the level of the attributes. The scenarios presented should include the status quo scenario if one is available and well defined. In addition, to the status-quo respondents may be presented with one or several other scenarios. Respondents are then asked to either rank, rate or choose the scenarios. In comparison a contingent valuation questionnaire, typically, involves fewer scenarios (the status quo and one alternative) because the valuation of different attributes is not studied in these surveys.

Although there are several different choice modelling methods, most applications of choice modelling use choice experiments and both terms are often used to refer to choice experiments.

Designing alternative scenarios

A key component of the design of choice modelling questionnaires is to design alternative scenarios. The key questionnaire design stages that are specific to choice modelling studies are (Fujiwara and Campbell, 2011):

- selecting the attributes of the good;
- assigning levels to the attributes;
- creating the alternative descriptions of the good; and

- constructing the specific choices that are presented to respondents.

The first choice for researchers is the choice of attributes. These may be chosen through literature reviews, focus groups, or interviews with policy makers. Relevant attributes to consider are attributes of the good that people in the target population value and attributes that may be affected by a policy. Attempts should be made to ensure that attributes are important to respondents in order to avoid attribute non-attendance i.e. that respondents do not react to changes in attributes because they attach no value to the attributes. This may cause response uncertainty (see further discussion of response uncertainty in the bias section below). It is also important to note that price must be one of the attributes included. Otherwise, WTP estimates cannot be elicited.

The next step for researchers is to determine appropriate attribute levels. The attribute levels should span a reasonable range and consideration should be given to what levels respondents are likely to have preferences over. Focus groups with potential respondents from the target population can be used to inform the decision on what attribute levels to use.

Given the attributes and the selected attribute levels the complete set of alternative scenarios can be constructed as the total number of possible combinations. It is important to note that the larger the number of attributes and the larger the number of attribute levels, the larger the number of possible scenarios. Researchers should therefore consider carefully how many attributes and attribute levels that can be realistically included.

Finally, a number of specific choices between two or more alternative scenarios are constructed (this is called the 'choice set'). If the number of alternative scenarios is very large, the choice set will also be very large. However, respondents can only be asked to make a choice, ranking or rating between different scenarios a limited number of times. Typically, the number of repetitions in choice modelling is limited to 8-10.

Therefore, in some cases it will be necessary to reduce the choice set to a more manageable size. When doing this, it is best practise to use statistical methods. The most established method is to use an 'orthogonal fractional factorial design'. This essentially ensures that attributes are statistically independent (i.e. uncorrelated) and that the full choice set is covered by the subset of choices included in the survey.

There have also been methods developed to reduce the necessary size of a choice set employing Bayesian methods. In this setup the researcher must have priors over the parameters in respondents' utility functions. Based on these priors a pre-test of the survey instrument is run and this allows for an update of the priors which in turn can be used to estimate a statistically efficient design.

The final design should be balanced i.e. each alternative scenario should appear an equal number of times. If the design is not balanced, it could result in biased results simply because a particular level of an attribute is shown more often.

2.3.4 No choice options

In both contingent valuation and in choice modelling inclusion of a 'no choice' option has been advocated and should be considered best practice. Intuitively, inclusion of a 'no choice' option

ensures that respondents stated preferences/WTP are not conditional on having been forced to make a choice by the survey instrument.

If a no-choice option is not included, it may lead to random response error where respondents randomly pick an option or state a WTP. This in turn may bias the estimates of WTP that can be obtained based on the survey. In contingent valuation questions, this may also be a source of protest valuations (and the extent to which this is the case could be asserted through follow-up questions if no 'no choice' option is included in valuation question(s)).

In some cases, researchers also choose to include a 'don't know' option in addition to the 'no-choice' option.

2.3.5 Pretesting

The survey instrument should always be pretested and this is particularly important for stated preference questionnaires because of the hypothetical nature of the valuation scenarios.

Pretesting may include both focus groups and pilot tests of the questionnaires. It is generally recommended to use focus groups with individuals in the target population to determine prior knowledge about the topic and for choice modelling to determine which attributes are important to respondents and what the appropriate levels of the attributes may be. In choice modelling a difficult part of the survey design is setting appropriate levels for the price attribute. This is also a challenge in contingent valuations questionnaires that rely on payment cards, dichotomous choice and bidding games. It is best practise to use focus groups to inform these attribute levels.

Pilot testing of the final questionnaire with a small sample of the target population is essential and should always be done. This will ensure that the chosen description of the hypothetical scenarios is well understood by respondents and that respondents actively participate by trading-off costs and benefits when making their choice or stating their WTP. At the piloting stage, it is important to give respondents the opportunity to provide feedback and to analyse the results so that adjustments to the questionnaires can be implemented before fieldwork begins (analysis of pilot data is discussed as part of the analysis section below).

2.4 Sampling

As choice modelling and contingent valuation are survey-based approaches to valuation, both require construction of original questionnaires which are then distributed to members of a target population.

Given the target population set out as part of the study objectives, data must be collected from a representative sample of this population. There are a number of alternative approaches to sampling. The most straightforward approach is **simple random sampling**. With this method, each member of the target population has the same probability of selection. This minimises bias and simplifies analysis of the results, but there is a possibility of sampling error – i.e. a non-representative sample.

Other methods such as **stratified random sampling** and **cluster sampling** seek to address this in an efficient way by separating the sample into separate categories (clusters or strata) and selecting randomly from within these categories. **Quota sampling** also separates the sample into separate

categories, but the selection from within these categories is not random, it is based on a quota (e.g. an interviewer chooses which respondents to approach to meet his quota of interviewees). Whilst quota sampling is quicker and cheaper to administer than the probabilistic techniques, and is less reliant on a sampling frame, it can lead to the introduction of bias with inappropriate quotas.

Surveys can be administered via mail, by telephone, face-to-face, or online (or through a combination of these methods). Each survey mode has its pros and cons in terms of costs, response rates, and the complexity of the information that can be presented to respondents.

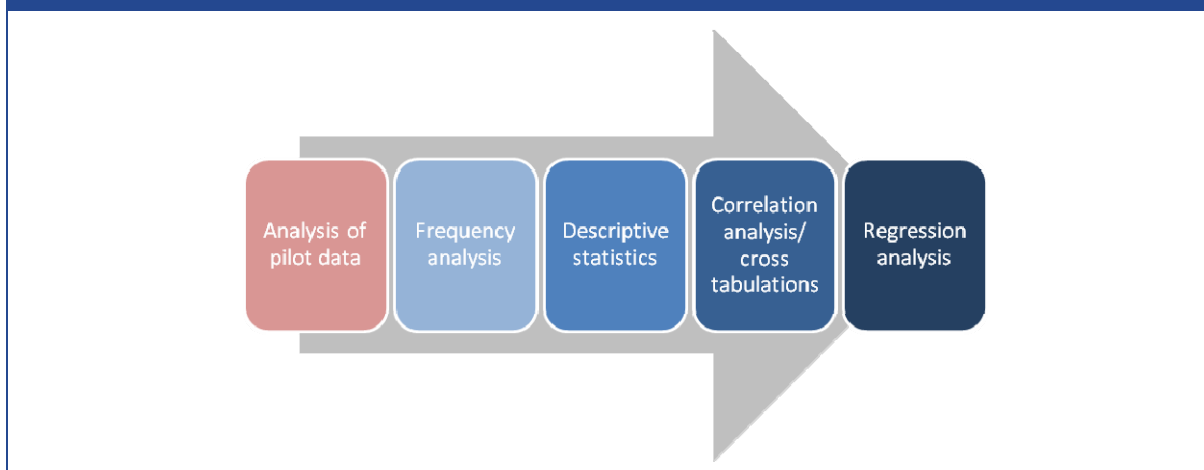
In terms of sample size there is no definitive answer as to what the correct sample size is. Generally, larger samples are always better and lead to more accurate results. However, there is obviously a trade-off in terms of the costs and time required to run the survey.

It should be noted that for choice modelling it is possible to generate more data by asking each respondent to make more choices, ratings and ranking. However, there is a trade-off in terms of fatigue and learning.

2.5 Analysis

Analysis of quantitative survey data (regardless of whether it is a stated preference survey) should, in general, include the steps outlined in Figure 2. We briefly discuss the steps in general terms and we then discuss key analysis for contingent valuation and choice modelling, respectively.

Figure 2: Standard methodology for analysis of survey data



Source: London Economics

Analysis of pilot data

The first step of the data analysis begins before the fieldwork is started and is based on the pilot data. This is a very important step in any analysis because it helps ensure that the survey is fit for purpose and allows researchers to undertake the type of analysis envisaged.

Analysis of pilot data is based on a relatively limited number of observations and typically only includes simple analyses such as frequency analysis and descriptive statistics. This, nevertheless, allows for an assessment of whether certain questions are problematic and whether key questions

in the survey are subject to high or low response rates. Low response rates will be likely to have negative impacts on the certainty of the conclusions that can be made based on the survey results.

Frequency analysis

The first analysis of the full data is generally a frequency analysis, which shows the distribution of responses to all questions (using the full response ranges and exact wording). This also provides a response rate to each individual question. These data tables should be made available as supporting material (e.g. on request) and when appropriate and informative frequency tables and graphical representations of frequency counts could be included in the main text presenting the survey results.

The aim of this part of the data analysis is to ensure a high level of transparency in the analysis and that the responses are well documented. In addition, it allows an analysis of whether the sample is representative and brings out initial conclusions.

Descriptive statistics

The second step of the data analysis consists of generating descriptive statistics on relevant variables e.g. the mean or median WTP. In this context it is best practice is to give confidence intervals for means, and to use t-tests to test for significance of key statistics.

Correlation analysis/cross tabulations

The fourth element of the data analysis involves a correlation analysis/ cross tabulation of relevant variables. This allows for an assessment of associations between different variables in the survey. Where associations are found (or not found) the information may be represented graphically.

In the context of stated preference surveys, cross tabulation should for example be used to analyse the relationship between WTP responses and prior knowledge, usage and attitudes.

Regression analysis

The data analysis typically culminates in a series of regression analyses. The objective of this element of the analysis is, typically, to explain determinants of different aspects of observed or stated behaviour. For instance, can differences in WTP be explained by differences in personal characteristics?

It is worth emphasising that regression analysis cannot replace any of the previous steps in the analysis and in some cases regression analysis may not be necessary in order to draw conclusions. However, regression analysis can test the robustness of the conclusions in a multivariate setting i.e. do the conclusions in the analyses above hold even when other factors are taken into account?

In general, regression analysis should aim to exploit as much information in the data as possible and careful consideration needs to be given to the choice of estimation model in order to ensure that as much information as possible is utilised. Therefore, the choice of regression model depends on the exact design of the valuation part of the questionnaire.

2.5.1 Contingent valuation

The key outcome of the analysis of the responses to a contingent valuation questionnaire is an estimate of the average (or median) WTP across the sample of people surveyed. This can be obtained from a simple analysis of **descriptive statistics** for the valuation questionnaire. If the sample is representative of the target population, then this estimate can be aggregated to obtain an estimate of the total value of the outcome or good. However, when doing so, careful consideration should be given to potential biases and in particular to protest valuations (see below).

Researchers should also consider whether it is most appropriate to report the average or median WTP given the research objectives. The mean and the median have quite different policy implications (Pearce, 2002):

- The mean is appropriate if the WTP analysis feeds into a cost-benefit analysis. If the average WTP estimate of benefits is larger than the costs per individual the proposed project should go ahead.
- The median is relevant in the context of public choice because it provides the amount that the majority of respondents would be willing to pay. This may not be the case for the average.

A **regression analysis** of the respondents' bid function should also be undertaken in order to fully understand the relationship between WTP values and socio-economic, demographic and other variables. Usually, the bid function is estimated using either probit, logit or tobit regression models.

If there are a large number of zero-responses or missing responses for the contingent valuation questions, it may be appropriate to use a binary regression model (logit or probit estimation) to estimate the likelihood that a respondent provided a (non-zero) response. This enables an analysis of whether respondents who provide a (non-zero) response are different to respondents who do not and if so in what way.

Bid functions may also be estimated using a tobit model. The tobit model uses more of the information contained in the dataset because the estimation technique distinguishes not only between zero and non-zero responses but also takes into account the variation in non-zero responses. The tobit model can be used to explain variation in the WTP responses provided (while taking into account that WTP responses cannot be less than zero).

There are also a whole set of parametric and non-parametric econometric models that can be used to model contingent valuation survey data, with the choice depending on the specific form that the WTP question takes.

2.5.2 Choice modelling

In choice modelling regression analysis is required in order to arrive at WTP estimates. WTP estimates cannot be derived as a simple average. The choice of estimation methods depends on the way the information is presented to respondents. Since choice experiments are the most used type of choice modelling, we only discuss estimation methods for choice experiments in this section.

Even within choice experiments the specific choice of regression models will depend very much on the exact presentation of the data. A large academic literature discusses different types of estimation techniques. However, the most established and basic model is the Multinomial (Conditional) Logit model. Essentially, the model estimates the likelihood that an alternative is selected and from the parameter estimates a WTP for each attribute can be derived.

However, the method assumes independence from irrelevant alternatives. This means that the relative probabilities of choosing two different options is assumed to be unaffected by the introduction or removal of other alternative choices. This may in practice be a strong assumption. To overcome this problem and also to better model preference heterogeneity many researchers have started to use more advanced econometric methods such as the Mixed Logit model, the Nested Logit model, the Random Parameter Error Components Logit model and Latent Class models.

2.6 Bias assessment and mitigating options

The selected methodology, survey design and analysis may give rise to a number of biases; either due to unintentional measurement errors arising from the survey design or due to deliberate misreporting of WTP and preferences by respondents. Table 2 summarises some of the most important biases that may arise in WTP surveys and this section discusses these biases and possible mitigating options.

Table 2: Overview of biases and effects

Implication of bias	Bias name
Unintentional measurement errors	Non-response bias Position and importance bias Information bias Anchoring bias Response uncertainty
Deliberate misreporting of WTP/preferences by respondents	Interviewer and sponsor bias Hypothetical bias Protest valuation

Source: London Economics

Non-response bias

Non-response bias can occur when individuals who respond to a survey systematically differ from non-respondents. Individuals with particularly strong feelings toward the good in question may be more willing to commit time to the questionnaire and this may lead to either an upward or a downward bias.

There is also the potential for fatigue and frustration to set in, especially in iterative bidding formats and in choice modelling with a large number of choice cards. This may imply that respondents end up making less effort to provide accurate replies and, at the extreme, that some respondents fail to complete the questionnaire (Accent, 2010).

Non-response bias may also arise if the questionnaire involves highly sensitive topics that a certain group of respondents do not wish to reveal information about. Respondents may then fail to

complete the questionnaire causing non-response bias. A common way to deal with this is to place sensitive questions towards the end of the questionnaire. Experience suggests that respondents are more likely to provide sensitive information towards the end of the survey.

Position and importance bias

These biases are both related to the survey design and are biases that relate to the use of the survey instrument itself. The position bias arises where the position or sequence of valuation questions for different levels of a good (or different goods) suggests to respondents how those levels should be valued. This could be mitigated by randomising the sequencing of valuation questions in the questionnaire such that different respondents see valuation questions in different order.

Importance bias occurs when the act of being interviewed or some feature of the survey instrument suggests to the respondent that one or more levels of the amenity have value. In such cases the respondent may not give the true WTP. However, this type of bias is difficult to overcome given that a survey instrument is used. One way to analyse the effects would be to try to validate the results using revealed preferences techniques (see the discussion of validation below).

Information bias

Information bias occurs if non-neutrality or inaccuracy in information presented to respondents influences their responses. Related to this is the issue of relational bias where the description of the good presents information about its relationship to other public or private commodities that influences a respondent's WTP amount.

Informational bias is particularly important if the issue is not well understood by respondents. For example, if respondents do not fully understand the impact of an environmental good on their wellbeing, they may not be able to value it accurately.

Focus groups and/or pilot tests prior to the fieldwork may help establish the level of knowledge among respondents and can be used to ensure that the information provided as part of the survey is sufficient for the respondent to give informed responses without causing survey fatigue and non-respondent bias.

Interviewer and sponsor bias

Interview bias can arise in telephone or face-to-face surveys where the presence of an interviewer can influence responses. Respondents may give a WTP that differs from the true WTP in order to please or gain status in the eye of the interviewer. This effect can be avoided with well-trained interviewers.

Similarly, respondents may give WTP responses that differ from their true valuation in an attempt to comply with the presumed expectations of the survey sponsor (or assumed sponsor).

Anchoring bias

As already discussed, setting the price attributes for choice modelling and determining price and bid levels in some contingent valuation formats (payment cards, bidding games and dichotomous

choice) can be difficult and the chosen levels may influence WTP estimates. This can be referred to as anchoring bias (is also sometimes termed stating point bias or range bias).

This is best mitigated through pilot studies and/or focus groups before the final questionnaire goes into field. Essentially, this should ensure that the lowest price is low enough that most respondents will accept it while the highest price is so high that most people will reject it (Whittington, 1998).

Response uncertainty

Surveys may in general suffer from measurement errors. For example, in open-ended contingent valuation surveys it is common to observe clustering of respondents around certain numbers (e.g. 5, 10, 25, 50, and 100). It is very rare to achieve responses that are not whole numbers. Similarly, if respondents are presented with a price (as in choice modelling formats and in bidding games, dichotomous choice formats and payment card formats in contingent valuations) there may be a problem with 'yea-saying' i.e. respondents say yes even if they might not really mean yes perhaps because they believe that it is the right answer.

The most common way to deal with measurement errors is to use follow-up questions to ascertain whether there are widespread problems related to measurement errors. For example, respondents may be asked to rate on a scale from 1 (lowest level of certainty) to 10 (highest level of certainty) how certain they are about the response(s) they have provided. It is then common only to include responses if the level of certainty is 8 or above.

It is also worth mentioning that the payment card and dichotomous choice formats for contingent valuations, typically, yield interval data and this means that the exact WTP for a particular individual cannot be inferred unless follow-up open-ended questions are used to arrive at the exact WTP.

Hypothetical bias

The hypothetical nature of the scenarios presented to respondents can lead to inflated WTP values in surveys. It is believed that individuals overstate their WTP by a factor of two to three when faced with hypothetical rather than actual payments (Fujiwara and Campbell, 2011). This is particularly the case when respondents value public goods such as the environment or visual amenity. Hypothetical bias is likely to be lower for private goods. It is still debated why hypothetical bias arises but it has been linked to non-commitment bias and strategic bias.

Non-commitment bias

Non-commitment bias arises when respondents overstate their true WTP because they do not face a budget constraint and do not consider substitute goods within the world of the hypothetical scenario. Including simple reminders of substitutes and real world constraints into the questionnaire have been suggested as possible mitigating options (Fujiwara and Campbell, 2011).

Strategic bias

Hypothetical bias can also be caused by strategic bias where respondents deliberately misreport their WTP and/or preferences in order to try to influence results and achieve a more desirable outcome for themselves. Respondents may have incentives to respond strategically to the

questionnaire if they believe that the outcome of the survey will affect decisions about whether or not to supply a good; whether or not to improve the quality; and the price respondents will have to pay for the provision of the good. If respondents believe that their responses will influence provision of the good and its quality, they may have an incentive to overstate their WTP for the good. However, if respondents believe that the outcome of the survey will influence the price, they may have an incentive to understate their WTP.

Some have argued that true WTP is revealed when respondents both believe that provision of the non-market good depends on their stated WTP **and** that they will have to pay the amount they state (Fujiwara and Campbell, 2011).

Cheap talk scripts

Cheap talk scripts may be employed in an attempt to reduce hypothetical bias. It does so by essentially explaining the problem of hypothetical bias to respondents and asking respondents to refrain from it. However, while some have argued that cheap talk can reduce WTP in hypothetical markets to levels similar to actual payments (Accent, 2010), the script and the information provided may also introduce other biases.

Protest valuations

Respondents with a positive true WTP may put forward a zero stated valuation due to, for example, ethical objections to the idea of paying for the good under consideration.

It has become common practice to allow respondents to have a zero value in contingent valuation questionnaires because this means that respondents are not forced into making a choice that is unrealistic. However, this also means that zero bids can have several interpretations:

- Protest bids: An individual does provide a zero bid as a form of protest.
- True zero bids: An individual holds a zero value.
- Misleading bids: Zero bids caused by response uncertainty, strategic bias, information bias, etc.

If protest bids and misleading bids are not identified through follow up questions, and their responses consequently excluded from the statistical analysis, then biased estimates of the value of the good will result.

2.6.1 Validation of results

When possible and where other studies are available, the results of the WTP survey should be compared with:

- Results obtained using other methodologies e.g. revealed preference methodologies (such as travel cost and hedonic pricing methods) or life satisfaction methodologies.
- The findings of cross-study analyses (e.g. meta-analysis).

In addition analysis should be undertaken to assess whether results are in line with prior expectations based on economic theory, other empirical results and intuition. For example, it is common to expect that WTP increases with income. Such hypotheses should be tested.

2.7 Conclusions

The final step of a WTP survey is to draw conclusions with respect to consumers' average, median or typical WTP for the non-market good in question. The conclusions should take into account the potential biases, any mitigating options what have been used and the validity of the results. If there are potential issues with validity and biases, these should be clearly outlined as part of the conclusions.

3 Evaluation of company surveys on customers' WTP

In their Strategy Decision document,¹ Ofgem stated:

"In response to stakeholders' requests for a measure in RIIO-T1 reflecting the Authority's statutory duties in relation to designated areas we intend to introduce an allowance per TO to reduce the visual impact of existing infrastructure in national parks (NP) and areas of outstanding natural beauty (AONB)" (Paragraph 4.61).

Ofgem then described the requirement placed on the TOs as follows:

- *"The amount of the allowance will be based on consumer willingness to pay analysis. We expect companies to undertake this analysis with consumers over a range of mitigation options, eg by tree planting near substations through to undergrounding of lines".*
- *"Companies should provide information on consumer willingness to pay as part of their well-justified business plans to help inform the value of the allowance that would be appropriate over RIIO-T1".*

This chapter provides an assessment of the arguments and WTP consumer surveys undertaken by TO and presented to Ofgem as part of their business plans. The section reviews the evidence presented by each of the following TOs in turn:

- National Grid Electricity Transmission Limited (NGETL)
- Scottish Power Transmission Limited (SPTL)
- Scottish Hydro Transmission Limited (SHETL)

Neither SPTL nor SHETL have provided information on consumer WTP to Ofgem. The scope of our work was restricted to reviewing the business plan information submitted by the TOs and did not extend to discussing these issues with the TOs or survey companies used by the TOs to undertake the fieldwork.

3.1 National Grid Electricity Transmission Limited (NGETL)

NGETL has provided a number of documents to Ofgem and also made the information available on their website. As part of our review of the WTP survey, we have taken the following material into account:

- NGETL (2011) RIIO-T1: Stakeholder engagement process
- Brunswick (2011a) Attitudes to Energy Transmission: Summary of Key Findings
- Brunswick (2011b) Final questionnaire: Attitudes to energy transmission
- Brunswick (2011c) Utility survey (data tables)

¹ Ofgem, Strategy for the next transmission price control – RIIO-T1 Outputs and incentives. This is available at: <http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionoutput.pdf>.

3.1.1 Summary and evaluation of the approach used to survey customers' WTP

Objectives

The WTP survey is part of a more general consumer survey which in turn is part of a wider stakeholder engagement also including other types of stakeholders.

The purpose and objectives of the consumer survey are not clearly stated in the description of the stakeholder engagement process². However, the document does describe what topics are covered by the survey. In particular, NGETL states:

"The survey covered:

- a) Consumers' views on the makeup of their gas and electricity bills and whether the transmission element represented value for money*
- b) Consumers' views on their willingness to pay for the undergrounding of existing and new electricity transmission power lines*
- c) Consumers' views on the reliability of their electricity service" (p 19).*

The consumer survey was carried out by Brunswick and further details of the objectives of the survey are provided in Brunswick's summary of the findings of consumer survey³. The document states:

"The primary objectives of the research study were:

- To better understand current levels of knowledge of energy bill composition among bill payers/decision makers.*
- To better understand attitudes to undergrounding, including how much bill payers/decision makers would be willing to pay for undergrounding new and existing transmission lines.*
- To explore attitudes towards the reliability of the electricity network, including the value and importance bill payers/decision makers place on network reliability" (p 1).*

These topics are all covered by the survey and results in these areas are summarised in the RIIO-T1 document summarising the stakeholder engagement process.

The primary focus of our review of the consumer WTP study is the second point in both of the two descriptions of the research above. In particular, the review focuses on consumers' WTP for undergrounding of existing electricity transmission power lines.

In this context it should be noted that NGETL's description of the topics covered by the survey does not exactly align with Ofgem's request for WTP data in two respects:

² NGETL (2011), 'RIIO-T1: Stakeholder engagement process', July 2011.

³ Brunswick (2011a) Attitudes to Energy Transmission: Summary of Key Findings

- Ofgem asked for WTP related to a range of options for mitigating visual amenity impacts and not just undergrounding. However, NGETLs survey focuses only on WTP for undergrounding to reduce the visual impact of infrastructure.
- Ofgem asked for a WTP analysis which in our understanding is not the same as “*consumer views*” of WTP. Whereas views are simply views on the issue, a WTP analysis requires questions designed to elicit WTP **and** analysis of the resulting data. We note that Brunswick’s description of the objectives provide more details and specifies that the survey should provide a better understanding of “*how much bill payers/decision makers would be willing to pay*”. However, Brunswick’s description of the objectives of the survey also does not specify analysis of the WTP data as an objective.

The description of the objectives provided by NGETL defines the target population as “*consumers*”. NGETL⁴ narrows this further and describes the target population as “*domestic consumers in England and Wales*” (p 20). A review of the questionnaire further reveals that a requirement for receiving the questions on WTP for undergrounding is that respondents live in households with mains electricity and Brunswick describe the target population as “*bill payers/decision makers across England and Wales*” where “*decision makers were classified as those people who are involved in the decision over which Energy Company supplied their household’s electricity*”.

The selected target population seems reasonable. Although undergrounding and the resulting improvement in visual amenity is a public good implying that even consumers outside England and Wales may value it, undergrounding by NGETL is likely to be paid for by electricity consumers in England and Wales only. The WTP estimate should therefore reflect the views of consumers in that area.

Methodology

A contingent valuation approach has been applied and two different approaches to contingent valuation have been used. First, a simple open ended contingent valuation approach has been applied and has been implemented in a fairly standard way in the questionnaire.

In addition, a payment card type contingent valuation approach seems to have been attempted. However, the implementation is not standard and it is somewhat unclear if the question is instead an attempt at a choice experiment. In particular, the payment scale used in the question is limited to six points (e.g. for NPs £0, £0.75, £1.50, £2.10, £2.85 and £3.55) rather than being defined as intervals as is best practice in a payment card contingent valuation question (e.g. £0-£0.75, £0.75-£1.50, etc.). At the same time the six scenarios vary i.e. there is variation in how much line (in miles and percentage) is undergrounded for each level of payment. In contingent valuation survey design, question attributes should in general be fixed such that WTP can be elicited. However, in a choice experiment it would be possible to vary attributes but in that case attribute levels and especially the price attribute levels should be varied across respondents in order to make WTP estimation possible. This does not appear to have been done in the payment card type question and hence it cannot be classified as a choice experiment or as a contingent valuation question. Throughout our review we will, however, refer to the approach as the “payment card approach”.

⁴ NGETL (2011), ‘RIIO-T1: Stakeholder engagement process’, July 2011.

NGETL and Brunswick only provide little discussion of the rationale for choosing the selected two approaches to evaluating WTP for undergrounding. No discussion of the decision to use an open-ended contingent valuation approach is provided and for the payment card approach (referred to as “prompted questions”) Brunswick states⁵:

“[The] prompted questions were not designed to produce the figure for the proportional increase on top of existing bills which the average bill payer/decision maker would be willing to pay for undergrounding in a particular area. Rather, these questions were developed to understand participants’ preferred option, when provided with a range of costed alternatives, including the option not to pay anything extra. The results for the prompted questions are best used as a measure of public sentiment on the options presented – not the precise amount consumers would be willing to pay for undergrounding” (p 5).

Brunswick therefore clearly acknowledges the drawbacks of the chosen payment card approach in terms of eliciting WTP estimates.

Compared with other valuation studies the two valuation methods applied do not seem entirely up-to date and in line with best practice:

- As discussed previously an increasing number of valuation studies use choice modelling techniques (and most commonly choice experiments) and Accent (2010) generally recommends the use of choice modelling over contingent valuation methods.
- In cases when contingent valuation methods are applied, traditional payment card and dichotomous choice methods are the most popular formats and it has been found that the dichotomous choice format tends to give the most theoretically consistent results. These two contingent valuation formats are recommended by Accent (2010) for contingent valuations.
- A review of recent academic literature on WTP for underground installation of transmission lines have used either a traditional payment card contingent valuation approach (Navrud et al, 2008; Atkinson et al , 2006) or a choice experiment approach (McNair et al, 2011).

Survey design

The questionnaire contains many of the aspects that should be included in a stated preference survey. Table 3 provides an overview of the specific components of the questionnaire as well as our comments on how this compares with best practice.

We highlight a number of potential conclusions that relate to the survey design:

- First, the questionnaire contains a number of questions relating to energy use. These questions are useful sampling, background and context setting questions. Questions relating to payment for energy and in particular electricity are useful as context setting questions and may remind respondents of their budget constraints ahead of the valuation exercise. However, for these questions to effective reminders of the budget constraint

⁵ Brunswick (2011a) Attitudes to Energy Transmission: Summary of Key Findings

they should be placed directly before the valuation question but there are relatively many questions between the questions about payment for electricity and the questions about WTP for undergrounding. We also note that expenditure on electricity as a proportion of income is perhaps the most useful proxy of respondents budget constraint but it does not work as a reminder of the budget constraint in the questionnaire because it is placed towards the end of the questionnaire and importantly after the valuation questionnaire. We note that there may also be a good argument for placing this particular question towards the end of the questionnaire because respondents may perceive the information as sensitive and if placed at the beginning of the questionnaire might refuse to respond to the question and/or questionnaire. Therefore placing the question at the beginning of the questionnaire could increase non-response bias.

- A number of questions relate to awareness and attitudes. These questions are mainly directed towards meeting the other objectives of the consumer survey and are of relatively little relevance to the WTP analysis. However, questions relating to awareness of the breakdown of electricity charges could serve as a useful context setting question and a test of consumer awareness of what electricity transmission and transmission charges in particular are. Although we acknowledge that the survey had multiple objectives, we note that a more focused survey might have been better in terms of meeting the WTP objective. It is well known that the risk of non-response bias increases in lengthy questionnaires. Furthermore, if the questionnaire had been more focused it might also have been possible to use a more elaborate valuation design and/or test other ways of improving visual amenity.
- The final set of background questions relate to the specific topics of the WTP study i.e. whether respondents can see high voltage pylons from their home and to what extent respondents use NPs and AONBs. These are important background questions and we would expect that the responses to these questions would impact the WTP of respondents. We note that the questions are placed after the valuation questions but it might have been preferable to place the questions before the valuation questions in order to remind respondents of the impact undergrounding would have on them as individuals before asking them to state their WTP for undergrounding.
- The choice of methodology and its appropriateness was discussed above. However, a few additional comments on the implementation are in place:
 - Firstly, we note that, in line with best practice, all main concepts and terms used in the valuation questions are defined and explained. It is, however, unclear, if respondents were provided pictures showing the different types of electricity transmission pylons. The use of pictures might be better at ensuring that respondents understand which pylons would be affected by the policy change and which would not.
 - Second, no clear reminder of the budget constraint is provided although the question text does specify that the cost *"would be on top of what your household currently pays for electricity"*. Given that questions related to bill size and payment are not placed immediately before the valuation question a clearer reminder of the budget constraint could have been included.
 - Third, it is not clear whether respondents have understood that the WTP questions relate to the undergrounding of all lines in each area. The questions refer to existing lines without using the word "all". This places some doubt on the interpretation of the results and could have been clarified by using the word "all" or assessed using focus groups or follow-up questions.

- Fourth, we also note that no explanation of how and by whom the undergrounding will be done is provided and no description of substitutes and complements to undergrounding is provided. While it is usual best practice to provide this type of information, it is arguably of less importance in this specific case because details on how and by whom undergrounding would be done seem unlikely to have an impact on valuations.
- Fifth and in line with best practice, 'don't know' and 'no-choice' options are included and respondents are given the option to provide a zero valuation in both the open-ended and payment card approach.
- The questionnaire contains some good follow-up questions. In particular, follow-up questions are used to determine respondents' views on the importance of undergrounding and views on who should pay for undergrounding. We note that the question on who should pay for undergrounding provides information about whether respondents see visual amenity as a public good. If it is seen as a public good, everyone should be paying for undergrounding. We also note that the question is correctly placed after the valuation question. If the question had been placed before the valuation question, it might have biased WTP responses and caused an increase in protest valuations from respondents who do not think they should be required to pay for undergrounding.
However, among the follow-up questions is also a question asking respondents to reassess their responses when the total WTP for undergrounding for new and existing lines from the payment card approach are added up. Depending on the response to the question, respondents are asked to revisit and change their responses to the payment card questions. This type of question is not standard in WTP surveys and it introduces endogeneity in choices i.e. final choices are conditional on earlier choices. This is problematic if the data is to be analysed using econometric methods.
We also note that no follow-up questions are aimed specifically at understanding the reasons for zero responses, 'don't know' responses and 'would prefer not to answer' responses. This could make it difficult to exclude protest valuations.

Table 3: Evaluation of specific survey components: Introduction and background questions			
Survey component		Before/ after valuation	Comments
Introduction		Before	The introduction does not mention the WTP component of the survey instead the introduction simply says <i>'The questions are simple and straightforward and are about the energy you use and how it is delivered to your home'</i> .
Background questions			
Use of energy			
	Use of gas and electricity from mains and responsibility for payment and decision making in the area	Before	Primarily relevant from a sampling point of view
	Payment method for energy, frequency of payments, bill size and proportion of income spent on energy	Partly before and partly after	Primarily relevant as background questions. Because the questions (except proportion of income spent on energy) are placed before the valuation question the questions also serve to set the valuation question into context and possibly remind respondents of their budget constraints.
	Use of different fuel sources for cooking, heating and lighting and use of renewable or other sources	After	Primarily relevant as background questions. Could also have been used to set the valuation questions into context but this would have required placing the questions before rather than after the valuation questions.
Awareness and attitudes			
	Awareness of the relative size of the components of energy charges	Before	Useful as context setting question and to test prior awareness
	Attitudes to energy transmission: Is it value for money?	Before	Not relevant for analysis of WTP for undergrounding of existing (and new) lines.
	Experiences and importance of reliability of supply including a contingent valuation question for reliability of supply	After	Not relevant for analysis of WTP for undergrounding of existing (and new) lines.
	Willingness to reduce consumption at prearranged points in time to reduce bills and achieve wider environmental benefits	After	Not relevant for analysis of WTP for undergrounding of existing (and new) lines.
Experiences with NPs, AONBs and visual effects of high voltage power lines			
	View of transmission lines from home (nearby or in the distance)	After	Useful as background question and to test current impact of high voltage power lines for individual consumers.
	Use of NPs and AONBs (live vs. visit)	After	Useful as background question and to test actual use of NPs and AONBs.

Source: London Economics

Table 4: Evaluation of specific survey components: Valuation scenario

Survey component	Before/ after valuation	Comments
Information and descriptions provided		
A description of what power lines are considered. The description used is: <i>'The next set of questions is about overhead electricity transmission lines. These are the high voltage power lines carried on the biggest pylons. We are not seeking your views on the smaller pylons or wooden poles which carry lower voltage power lines.'</i>	N/A	The information provided in relevant for the research question Could have been useful to show a picture of the different types of electricity transmission pylons
Information about electricity transmission: <ul style="list-style-type: none"> - Transmission lines can be placed either overhead or underground. - Most existing transmission lines are overhead and miles of overhead lines in NPs, AONBs and other areas. - Miles of new lines to be build over the next 10 years and information that it may be 'unavoidable' that these lines sometimes go through NPs and AONBs. 	N/A	The information provided in relevant for the research question However, no explanation of how and by whom the undergrounding will be done and no description of substitutes and complements to undergrounding.
A description of what is meant by a national park and what is meant by an area of outstanding natural beauty.	N/A	The information provided in relevant for the research question
Questions to infer a respondent's WTP for undergrounding of both existing and new lines. For existing lines a distinction is made between lines in national parks, areas of outstanding beauty and other areas.		
Open-ended contingent valuation (Q14a and Q14b)	N/A	Standard implementation of this type of question. In line with best practice 'don't know' and 'no-choice' options are included and respondents are given the option to provide a zero valuation. No reminder of budget constraints but a reminder that the amount <i>"would be on top of what your household currently pays for electricity"</i> .
Payment card type contingent valuation approach (Q16 and Q17)	N/A	Not a typical or best practice implementation of a payment type contingent valuation question. No reminder of budget constraints but a reminder that the amount <i>"would be on top of what your household currently pays for electricity"</i> . In line with best practice 'don't know' and 'no-choice' options are included and respondents are given the option to provide a zero valuation.

Source: London Economics

Table 5: Evaluation of specific survey components: Follow up questions

Survey component	Before or after valuation	Comments
Would respondents really be willing to pay what they have stated that they would be willing to pay on the payment card type questions (Q18)? If respondents say no to the follow-up question they are asked to respond to the payment card questions again (Q16 and Q17). This process continues until the respondents confirm at Q18 that they would be willing to pay what they had stated in Q16 and Q17.	After	This type of question is not standard in WTP surveys. By asking respondents to reconsider their valuations it introduces endogeneity in choices i.e. final choices are conditional on earlier choices. This is problematic if the data is to be analysed using econometric methods.
The importance of undergrounding new and existing transmission lines (Q19a and Q19b).	After	This is a good follow-up question. If respondents have stated a high WTP but provide a low response to this question the WTP estimate is probably inflated.
Views on who should pay for undergrounding (Q20 and Q21)	After	A good follow-up question and correctly placed after the valuation question. The question provides information about whether respondents see visual amenity as a public good. If it is seen as a public good, everyone should be paying for undergrounding. If the question had been placed before the valuation question it might have biased WTP responses and caused an increase in protest valuations.
Socioeconomic and demographic characteristics: gender, age, region, employment status, socio-economic group, educational attainment, income and household size.	Partly before and partly after	In line with best practise.

Source: London Economics

Sampling

According to Brunswick who administered the survey for NGETL⁶, “the survey was conducted online with 1,000 domestic electricity bill payers/decision makers across England and Wales” (p 1) and “to reach 1,000 electricity bill payers/decision makers, a nationally representative survey of 1,049 individuals was completed” (p 1).

Brunswick further explains that respondents were selected randomly from an online market research panel and that target quotas were used to ensure that the targeted sample was representative in terms of age, gender, region, settlement type and socio-economic group.

⁶ Brunswick (2011a) Attitudes to Energy Transmission: Summary of Key Findings

Brunswick presents two arguments for choosing to administer the survey online:

- *“First, fieldwork had to be conducted within a relatively limited timeframe; online research allows for a shorter fieldwork period than either face-to-face or telephone surveys”.*
- *“Second, many of the questions in the survey required respondents to read through a considerable amount of information before answering, or make trade-offs between a series of alternative options. The online survey allowed respondents to read detailed questions at their own pace before entering a response; it would not have been possible to provide this level of detail over the telephone”.*

We acknowledge that online surveys are faster to run, less expensive and in many cases better than telephone surveys when large amounts of information needs to be presented to respondents and when respondents are asked to make complex trade-offs between different scenarios. However, a concern with online surveys is often that certain vulnerable groups may not be well represented in the sample. The reviewed material does not document to what extent the unweighted sample matches population statistics; nor does it attempt to document whether vulnerable groups are underrepresented in the sample.

Finally, we note that weights have been applied to ensure that final figures based on the sample accurately represent the profile of the population of England and Wales. Weighting ensures that groups that are underrepresented in the sample are given a higher weight when results are presented. This in turn reduces the risk of non-response bias i.e. bias that arises because respondents differ from non-respondents in a systematic way.

It is in line with best practice to apply weights when target quotas set for the representative sample are not met exactly (target quotas are rarely met exactly in practice). However, as mentioned above no information is provided about the extent to which the sample characteristics match population characteristics and hence the extent to which target quotas are met. Therefore, it is not possible to assess whether significant reweighting has been done after the fieldwork was completed. Significant reweighting can be problematic because very large weights applied to a few observations (because those observations are seriously underrepresented) makes the results more sensitive to outliers.

Analysis

Supporting material available on NGETL's website⁷ provides the following analysis of the survey responses:

- detailed **frequency tables** for all survey questions;
- **cross tabulations** of all survey questions with
 - age;
 - gender;
 - region;
 - socio-economic group; and
 - area (urban, town, village, hamlet).

⁷ Brunswick (2011c) Utility survey

- for most questions **cross tabulations** with:
 - method of payment for electricity and gas (pre-payment vs. post payment);
 - size of bill for electricity and gas (high, medium low);
 - whether transmission of electricity and gas is good value for money (good, neither, poor);
 - certainty of size of bill for electricity and gas; and
 - occasionally cross tabulations with other variables.
- **mean and standard deviation** of responses to all questions and for all of the subgroups above.

We note these frequency tables, descriptive statistics and cross-tabulations are also provided for both the open-ended contingent valuation questions and the payment card questions. In addition, the responses are provided by the following variables:

- importance of undergrounding (important vs. not important);
- whether respondents can see pylons from home (nearby, in the distance and not at all); and
- whether respondents confirmed their responses to the payment card question immediately or after an additional revision.

No other analysis such as additional descriptive statistics or regression analysis is presented in any of the documents reviewed (but graphical representations of some frequency tables were included elsewhere).

Analysis of open ended contingent valuation questions

Although the supporting material provides very detailed information, much of the information is not presented or discussed in the 'RIIO1: Stakeholder engagement process' document or in Brunswick's summary of the key findings. We acknowledge that it would not be feasible to present results at the same level of detail in the main reports; nor would it be desirable.

However, we find it very surprising that the results of the open-ended contingent valuation are not presented or discussed at all in 'RIIO1: Stakeholder engagement process' or in Brunswick's summary of the key findings. This is despite the stated objective of understanding "*how much bill payers/decision makers would be willing to pay for undergrounding*" and despite the fact that Brunswick in their summary of the key findings acknowledge that the payment card approach cannot be used to elicit an estimate of consumers' WTP for undergrounding.

In the discussion of visual amenity and WTP for undergrounding Brunswick state that "*the following results are based on responses to the prompted [payment card] questions, which we believe provide the best insight into attitudes to undergrounding*" (p 6). No arguments supporting this claim are presented; nor are any explanations given as to why the open-ended contingent valuation responses are excluded altogether. A good analysis of WTP based on the chosen survey should in our view have focused first on the responses of the open-ended contingent valuation questions and then on the results of the payment card approach.

We also note that in our view the supporting material (and the main analysis) should present both the mean WTP and the median WTP of on the open-ended contingent valuation questions because of the different policy implications of the two statistics.

The reasons behind the high number of zero responses, 'don't know' responses and 'would prefer not to answer' responses to the open-ended questions should also have been explored in greater detail, in order to reduce the impact of protest valuations. This could have been done e.g. by cross-tabulating with use of national parks; views on who should pay for undergrounding; and other key questions. More analysis of the results (and cross-tabulations already provided in the supporting material) could have been used to make an assessment of which observations should be excluded from the calculation of the median and mean.

Finally, we would have liked to see application of more advanced statistical and econometric models to understand response behaviour for the open-ended contingent valuation questions.

Analysis of results from payment card approach

In 'RIIO1: Stakeholder engagement process' and in Brunswick's summary of the key findings the analysis of WTP for undergrounding was based only on the results from the payment card type questions. The analysis presented in both documents is based only on the results presented in the frequency tables.

Given the non-standard implementation of the payment card contingent valuation question and the non-standard follow-up question, it is not obvious that more advanced analysis methods could have been applied.

Bias assessment and mitigation

NGETL and Brunswick do not explicitly discuss potential biases and any steps that have been taken to reduce biases. However, our analysis has given rise to some concerns about potential biases but there are also signs that some biases have been considered (implicitly if not explicitly); particularly at the survey design stage. We discuss biases and the extent to which they have been accounted for below.

Non-response bias

Non-response bias occurs when individuals who respond to a survey systematically differ from non-respondents. There are some signs that the risk of non-response bias has been taken into account. First, more sensitive questions about income and expenditure on fuel as a percentage of income have been placed towards the end of the questionnaire, presumably in an attempt to ensure that respondents were not discouraged from completing the questionnaire by being asked sensitive questions at the beginning.

Second, some consideration seems to have been given to the length and complexity of the questionnaire. Non-response bias would be expected to increase with the length and complexity because the longer the questionnaire the more likely it is that only highly interested and dedicated respondents complete it. Brunswick further reports that the average time taken to complete the survey was 18 minutes. We note that this is slightly longer than the 15 minutes stated in the introduction to the questionnaire and we note that it is perhaps slightly longer than desirable and may be due the fact that a large number of topics were addressed in the questionnaire. Therefore, in our view a more focused questionnaire could have yielded more reliable WTP estimates.

Finally, we note that the analysis provided by NGETL and Brunswick lacks a comparison between population and (unweighted) sample characteristics. If the sample systematically differs from the population, it may be a sign of non-response bias.

Position and importance bias

As discussed previously, we have some concerns about possible position bias related to the design of the questionnaire:

- It would have been desirable to place the questions about use of NPs and AONBs and visibility of pylons from home **before** the valuation questions, in order to frame the valuation questions better and get respondents to consider the impact undergrounding would have on them as individuals before providing an estimate of their personal WTP for undergrounding.
- The follow-up question (Q18) to the payment card type question is very atypical and we worry that this type of question leads to endogeneity problems and could bias the results. However, we note that relatively few respondents changed their response to the payment card type question after Q18 and we find this reassuring.
- It appears that there was no randomisation of the order of the valuation questions. Randomisation would be beneficial in terms of reducing potential position bias and randomisation of the order of the contingent valuation questions on new lines, existing lines in NP, existing lines in AONBs and existing lines in other areas could have allowed for an analysis of potential position bias as well as been a way to mitigate the effects.

It is likely that results are influenced by importance bias i.e. the survey itself suggests to the respondent that undergrounding has value. This type of bias is difficult to overcome but the extent to which it is present could be analysed by comparing the results with the results of a revealed preference analysis. We note that there are no attempts to do so in the material provided by NGETL.

Information bias

Information bias occurs if non-neutrality or inaccuracy in what is presented influences responses. We note that there are signs of low awareness of electricity transmission in the survey. In particular, a third of respondents were not able to estimate the relative size of the components of their bill and respondents who did provide an estimate overestimated the share of the bill associated with transmission.

This suggests that careful consideration should be given to consumer awareness of the issues being valued. Very detailed information about undergrounding, the length of overground transmission lines and NPs and AONBs is provided to survey respondents. However, there is no indication that respondents' understanding of the survey script and the explanations provided has been tested before the field work began.

Interviewer and sponsor bias

Because an online survey instrument was used it is unlikely that the responses suffer from interviewer bias. We also note that the survey sponsor (NGETL) was not mentioned in the survey introduction. This could imply that the risk of sponsor bias is reduced but at the same time it may

make respondents less likely to agree to participate because they do not know who the sponsor is and respondents may make incorrect assumptions about who the sponsor is.

Anchoring bias

There is little risk of anchoring bias in the open-ended contingent valuation question because no list of values is presented to the respondents.

However, we note that responses to the payment card type question are likely to be influenced by anchoring because the range of values essentially limit the WTP that respondents can express through the question. The range of values given on the payment card should reflect the range of WTP values that respondents have in reality and not be based on estimates of what it would actually cost to underground existing line. It may be difficult *ex ante* to determine the range of values that reflects the range of consumers' WTP. Therefore, it is generally recommended to use focus groups to inform the choice of values and/or adjust the range based on pilot tests of the questionnaire. There is no indication that focus groups or pilot tests have been used to inform the questionnaire design and there is no indication that adjustments to the scale have been done after a pilot test. In addition, the question is placed after the open-ended contingent valuation questions and may therefore be influenced by the respondent's choice in the open-ended question.

Response uncertainty

In open-ended contingent valuation surveys, it is common to observe clustering of responses around certain numbers (e.g. 5, 10, 25, 50, and 100). The extent to which this occurs has not been explicitly demonstrated.

In the payment card approach there may also be response uncertainty because there can be a problem with 'yea-saying' i.e. respondents say yes even if they might not really mean yes. The extent to which this is the case has also not been analysed explicitly.

However, we note that in both cases some information has been provided in the supporting material which allows for an assessment of the extent of response uncertainty. In both the open-ended question and the payment card approach there is a tendency that respondents who consider undergrounding important also are prepared to pay more to make it happen. We would have expected to see a more detailed exploration of the links between the valuations provided and the follow-up questions on the importance of undergrounding and in particular we would have liked to see an assessment of whether any observations should be excluded because of significant response uncertainty. A given response is likely to be highly uncertain if a respondent has indicated that it is not very important to underground existing lines and at the same time has provided a high valuation in the questionnaire (and vice versa).

We also note that the wording of the valuation questions may give rise to response uncertainty. In particular, respondents are asked to indicate their WTP in all future and presumably for all existing line to be undergrounded. However, our experience with this type of research suggests that respondents may have difficulties making decisions over very long time periods. As a result we are concerned that respondents do not fully account for the fact that the increase in their bill is permanent and affecting all future periods. As a result respondents may overestimate their WTP.

The costs would probably be clearer to respondents if the payment was framed as a one-off payment or as annual payment over a specified period e.g. 5 years.

Hypothetical bias

The hypothetical nature of the scenarios presented to respondents can lead to inflated WTP values in surveys; particularly when respondents value public goods such as visual amenity. In this case, it is particularly important to include reminders of budget constraints in the question. As discussed above there is no direct reminder of the respondents' budget constraints in the valuation questions but information is provided that undergrounding would lead to increased electricity charges.

Hypothetical bias can also be caused by strategic bias i.e. respondents have incentives to respond strategically because they believe that the outcome of the survey will impact the decision to underground existing line or the cost of electricity to consumers. In our view the questionnaire strikes the right balance between indicating that the WTP stated by respondents impacts both that provision of the non-market good and the amount consumers would have to pay. We therefore view the risk of strategic bias as relatively limited. However, we note that this could have been tested further in focus groups and/or pilot tests of the questionnaire.

Protest valuations

Although the survey does provide for the possibility that respondents can give no-choice answers (I would rather not provide an answer) and 'don't know' answers, it would have been appropriate to analyse and assess zero responses further. In particular, we would have liked to see more attempts to distinguish protest valuations from true zero valuations. Protest valuations should then have been excluded from the analysis.

There are three broad ways of doing this:

- analysing zero responses in a regression model;
- using a follow-up question asking respondents who provide a zero valuation why they provided a zero valuation; or
- asking respondents whether they agree with the concept of undergrounding before they provide a WTP valuation and then only asking those who say 'yes' to provide a WTP valuation (this approach was used by Atkinson et al, 2006).

Conclusions

Based on the information provided in the frequency tables for the payment card type contingent valuation questions, Brunswick and NGETL conclude that:

- “when it comes to paying, undergrounding is a complex issue that can polarise opinion” – the responses indicate that respondents have very different WTP for undergrounding with half of all respondents being willing to pay to underground some existing lines in NPs and AONBs and the other half either not wishing to pay extra for undergrounding in these areas or not providing an answer; and
- there is less appetite for undergrounding existing lines in Other Rural Areas than in NPs or AONBs.

Finally, based on the responses to the payment card questions and the follow-up question where respondents are asked to reconsider their responses to the payment card questions, Brunswick and NGETL provide an estimate of the total WTP for undergrounding of new and existing lines. Overall, NGETL⁸ concludes that: *When totalling up all the categories for existing and new lines, providing an average payment figure can be somewhat misleading when, as is the case here, a data set is characterised by a large standard deviation. However, the mode, median and mean are included below for reference.*

- a) *The mean for the total amount bill payers/decision makers would pay for undergrounding is £9.24*
- b) *The mode for the total amount bill payers/decision makers would pay for undergrounding is £0.00 (i.e. nothing extra)*
- c) *The median for the total amount bill payers/decision makers would pay for undergrounding is £4.54” (p 39).*

NGETL also concludes that additional qualitative stakeholder research with students and members of the Department for Environment and Climate Change's (DECC) youth group suggested that *“The majority would be willing to pay an extra £5 per year on their electricity bill. Most would pay an extra £10, some would pay an extra £20 and a small minority would be willing to pay an extra £50. Please note this was only a small sample size and is not statistically sound” (p 39).*

NGETL does not conclude specifically on the size of consumers' total WTP for undergrounding of existing lines or for the WTP for undergrounding in NPs or AONBs. However, from the frequency tables we note that the average WTP based on the open-ended contingent valuation questions are:

- £7.22 per year for all existing infrastructure in National Parks (p 301);
- £7.76 per year for all existing infrastructure in Areas of Outstanding Natural Beauty (p 309); and
- £3.76 per year for all existing infrastructure in other rural areas (p 317).⁹

We note that these WTP are additive i.e. the average total WTP for undergrounding of all existing infrastructure is £18.74 per year. This is much higher than the estimates provided based on the payment card approach.

The differences may be due, at least partly, to the fact that the payment card approach estimates WTP conditional on the selected price-length combinations. In particular, the approach sets an upper limit to the WTP valuation a respondent could provide. In our view the payment card approach therefore underestimates average WTP.

⁸ NGETL (2011), 'RIIO-T1: Stakeholder engagement process', July 2011.

⁹ Brunswick (2011c) Utility survey

Validation of results

Finally, we note that no attempts have been made to validate the results by comparing them to results from other similar studies on WTP for undergrounding. In addition, no attempts have been made to validate the results using alternative methodologies e.g. revealed preference methods.

There is also no discussion and assessment of the extent to which results are in line with prior expectations. However, we note that the data tables provided in the supporting material provides reassurance that the results are in line with intuition. For example, there is evidence that the WTP is higher for respondents:

- who are in higher socio-economic groups and therefore are more likely to have a high income level;
- who can see pylons from their home; and
- who consider undergrounding important.

We note that recent literature on undergrounding of transmission lines also suggest that the WTP for undergrounding may be significant.¹⁰ Navrud et al; (2008) estimate the external costs from the aesthetic impacts of transmission lines on the landscape in the Oslo area and asked respondents how much they would be willing to pay in terms of increased household electricity prices to replace existing overhead power lines with cables buried underground. Their estimates are in the range of €10 to €20 for a single transmission line of 5 km.

In the UK Atkinson et al (2006) analyses the loss of utility that is experienced by local residents which can be attributed to the close proximity of high voltage electricity transmission lines and towers, in a rural and urban landscape. The study estimates average WTP as a one-off payment at £65.53 (with a 95% confidence interval of £54-79 to £76.16).

Finally, McNair et al (2011) estimated WTP to replace existing overhead power cables with a new underground network in Canberra Australia. They report estimates of A\$6,838 per household which is very high (approximately £4,000).

3.1.2 Assessment of the quality of the survey results

In our view the results of NGETL's consumer survey provides decent information about consumer views on paying for undergrounding of existing transmission lines. NGETL rightly point out that consumers have very different willingness to pay for undergrounding and that there is more appetite for undergrounding in NPs and AONBs than in other rural areas.

However, as discussed above the material provided also raises a number of concerns. Most importantly we note that the purpose of a WTP study is to derive a theoretically consistent welfare measure. In our view, it is far from clear that the two methods employed by NGETL and Brunswick, their implementation and the analysis provided yield good estimates of consumers' WTP.

¹⁰ However, typically the literature does not assess WTP for undergrounding a whole system, but rather focuses on specific lengths of line.

In our view the implementation of the payment card approach is flawed and it is not demonstrated sufficiently that the value points provided in the different scenarios reflect the range of WTP values that respondents have. We are concerned that the approach leads to underestimation on WTP because responses are limited to the valuation points provided. In our view the responses to the question can at best be used to provide an indication of consumer views on undergrounding. The question should not be used to obtain estimates of WTP.

Given these considerations, we are very surprised that so little attention is given the open-ended contingent valuation questions also included in the questionnaire. In our view, these questions provide the best estimates of WTP for undergrounding given the survey design. However, the framing of the open-ended questions also gives rise to some concerns. In particular, it is not clear to us that respondents have sufficiently taken into account the impact that undergrounding would have on them as individuals (i.e. the impacts on their budget, the impact on their use of NPs and AONBs and the impact on pylons they can or cannot see from their home).

We are also not convinced that NGETL has accounted sufficiently for protest responses and as a result we have real doubts that the average WTP estimates provided in the supporting material are welfare consistent. It is generally the case that the study could have benefitted from further analysis of the responses (e.g. calculation of median WTP, estimation of respondents' propensity to provide a zero response, estimation of a bid function).

Finally, we note that the average (and median) WTP in the sample only provides a good estimate of the population's WTP if appropriate sampling techniques are applied such that the sample can be viewed as nationally representative. We view the selected sampling approach and sample size as good and note that, consistent with best practice, weights have been applied to bring the sample characteristics in line with population characteristics. However, information on the extent to which unweighted sample characteristics match population characteristics is lacking. This also implies that there is no information which allows for an assessment of whether vulnerable groups are underrepresented because the survey is administered online.

Overall, we believe that the most significant problem relates to the methodology used. In particular, the focus on undergrounding as the only mitigation option, the apparent lack of a theoretically consistent welfare measure and the flawed implementation of the payment card approach. The lack of analysis of the results is the next most significant drawback, followed by the poor implementation and framing that we discuss above. The latter affect the interpretation of the results of the open-ended questions, which we believe are relatively more reliable estimates of WTP than those provided by the payment card approach used in this case (although subject to the limitations identified).

However, with the above caveats we believe that the average WTP derived from the open-ended questions could be used as a rough estimate of consumers' WTP for undergrounding in England and Wales.

3.1.3 Feedback, questions and recommendations for further work

Although the provided material, in our view, does give a rough estimate of consumers WTP in England and Wales that could be used to set an allowance for undergrounding, we would recommend Ofgem to provide feedback to NGETL and to ask for further work to be undertaken.

Providing feedback

In terms of providing feedback to NGETL, we would be happy for Ofgem to pass on our evaluation and assessments of the WTP component of NGETL's consumer survey to NGETL and Brunswick. Our evaluation and assessments points to a number of positive features in the work undertaken by NGETL and Brunswick but we also highlight a number of specific concerns and provide specific suggestions as to how these concerns could be addresses.

Questions

We would then recommend that Ofgem asks NGETL to explain:

- 1) Why the survey focuses only on undergrounding and not on other mitigating option?
- 2) Why an open-ended contingent valuation approach and a payment card type approach has been chosen for the WTP component of the survey?
- 3) Why a non-standard implementation of the payment card approach has been used? What are the benefits of the selected approach and how have the scenarios included been calibrated?
- 4) Why the open-ended contingent valuation questions are not analysed and discussed in more detail?
- 5) Whether focus groups and stakeholder consultations have been used to inform the survey design? And if so in what way?
- 6) Whether a pilot test of the questionnaire has been carried out? And if so what the results showed?
- 7) How the estimates presented relate to those previously published in the literature (i.e. does existing literature provide support validating the estimates presented)?

Recommendations for further work

In our view, more could be done to analyse, validate and discuss the results of the current survey and this could potentially improve confidence in the results considerably. However, because of our concerns associated with the selected methodology and the implementation and framing, some problems are unlikely to be resolved unless a new WTP survey is undertaken. In addition, we emphasise that the potential costs associated with using flawed estimates may be significant; especially considering the magnitude of the total WTP presented in chapter 4. Therefore, Ofgem may wish to request an entirely new survey and analysis to be undertaken. We therefore provide recommendations for further work at two levels:

- improvements using the current survey results; and
- improvements using a new survey.

Improvements to analysis using the current WTP survey

In our view, the analysis and discussion of the current WTP survey could be improved in several respects and this could improve confidence in the results provided. In particular we would recommend:

- Addressing the questions outlined above in the business plan or supporting material.

- Extending the analysis of the open-ended contingent valuation questions and including this analysis in the main report. More specifically we would recommend:
 - Providing an estimate of the median WTP for the open-ended contingent valuation question as this may be a better measure to use to set the allowance.
 - Analysing zero responses in an attempt to identify protest valuations. This could be done through careful consideration of the links between zero valuations and the stated importance of undergrounding. Additionally, it could involve an estimation of the propensity to provide a zero response. This would provide a better understanding of why and who provide zero responses.
 - Expanding the analysis of interactions between WTP estimates and other key questions e.g. the importance of undergrounding and the use of NPs and AONB. This could be done by providing simple cross tabulations and where illustrative graphical representations of the results.
 - Estimating a bid function to analyse in more detail what explains differences in stated WTP.
- Including a discussion of the validity of the results comparing the results to other studies in the area and confirming whether the results confirm prior expectations.
- Providing a comparison of population and (unweighted) sample characteristics to facilitate an assessment of whether there is significant non-response bias, whether vulnerable groups are properly represented in the online sample and whether the applied weights significantly risk exacerbating potential issues related to outliers.

Improvements to analysis using the new WTP survey

The steps outlined above do not address our main concerns related to the choice and implementation of valuation methods. If Ofgem wishes to address these concerns and minimise the risks of costs associated with poor WTP estimates for improved visual amenity, we would recommend that the best practice methodology outlined above is followed and in particular we would recommend:

- Using a more focused survey designed only to estimate WTP. This would ensure that more time and resources can be devoted to the valuation component.
- Possibly expanding the scope of the valuation question to also include other types of mitigating options that could improve visual amenity.
- Using a choice experiment or alternatively a traditional payment card contingent valuation approach and applying appropriate and up-to-date statistical and econometric methods to analyse the data. Our preference would be to use a choice experiment to undertake the analysis. This would allow NGETL to directly elicit estimates of WTP that are conditioned socio-economic characteristics and, in addition, would be better suited for a survey design testing multiple mitigating options.
- If a payment card contingent valuation approach is pursued, we recommend that careful consideration is given to potential protest valuations when the survey is designed. In particular, we would recommend that respondents are asked whether they approve of undergrounding and, if they do, then are asked to provide a valuation. Alternatively, a follow-up question should be added to elicit the reasons why some respondents provide zero-responses.
- Using focus groups to pre-test the questionnaire and gain knowledge about consumer awareness about the topic in question. This could reduce information bias.

- Including clearer reminders of respondents' individual budget constraints in the question or asking questions about fuel expenditure immediately before the valuation questions.
- Asking respondents about their experiences with pylons (can they see them from home and how close by) and use of NPs and AONBs **before** the valuation questions. This could also reduce information bias.
- Considering adding some face-to-face surveys with vulnerable groups in order to allow for an assessment of whether WTP is different for vulnerable groups than for the population as a whole.

3.2 Scottish Power Transmission Limited (SPTL)

SPTL's response is limited to the following statement:

*"We broadly support Ofgem's proposal to introduce an allowance for each transmission company to reduce the visual impact of existing infrastructure in National Parks and Areas of Outstanding Natural Beauty, to be considered on a case by case basis. In our licence area, this would potentially apply to the proposed new overhead line in Dumfries and Galloway. This reinforcement would be funded under an uncertainty mechanism and in due course, as the detailed engineering design is scoped and developed, we will provide more information on consumer willingness to pay to help inform the value of the allowance that would be appropriate over RIIO-T1."*¹¹

As we understand the Ofgem request outlined above, SPTL have not provided the information requested. The response seems to recognise that Ofgem's request was made in the context of existing infrastructure, but refers to the possibility of undergrounding a proposed new overhead line and of collected WTP information in the context of that proposed new infrastructure. There appears to have been no attempt made to understand WTP in respect of existing infrastructure.

3.3 Scottish Hydro Electric Transmission Limited (SHETL)

In SHETL's response,¹² they make the following statement:

"We are not proposing to invest in the forthcoming period to specifically improve the visual impact of existing assets. The cost of such measures would be extremely high and we do not believe that the case can be made for customers to pay for this. Thus it is our intention to address stakeholders' concerns when we build new, or refurbish, existing assets. Our focus will be on continuing to engage relevant stakeholders on a project-by-project basis to ensure that we minimise the visual impact of our activities, both through our site selection process and the identification of appropriate mitigation."

Elsewhere in the document (pp17-19), SHETL describe their position further. They refer to a 'Green Paper' consultation in February¹³ and a 'White Paper consultation' in June. The Green Paper does

¹¹ SP Transmission, RIIO T1 Business Plan – Section 3: Our Outputs Strategy, Ref: 2011_SPT_Narrative_S3 Our Outputs Strategy, 28 July 2011 (pages 9-10).

¹² SHETL, Supporting Document 06: Reporting on our Environmental impact (Page 4).

¹³ SHETL, Keeping the lights on And supporting growth, February 2011, downloaded on 8 September 2011, http://www.ssepd.co.uk/uploadedFiles/TPCR5_Green_Paper.pdf

not appear to make any direct reference to options for reducing the visual amenity impacts of existing infrastructure. The White paper refers to concerns about visual amenity raised by stakeholders and raises the possibility of an Environmental Improvement Fund. This would be a ring-fenced sum of money “that could be called upon by affected parties to address specific environmental impacts”. In Supporting Document 06, SHETL state that only one stakeholder made specific reference to this, suggesting that the offer of increased spend over and above planning requirements should be made during the planning process.

It may be the case that the costs of measures to reduce the visual amenity impacts of existing infrastructure exceeds consumer WTP. Nevertheless, SHETL have provided no evidence in Supporting Document 06 to support this assertion, either on the cost or the benefit side. The consultation above does not appear to us to be a serious attempt to engage with customers about the specific issue of options to address the visual amenity impacts of existing infrastructure and their willingness to pay for such measures.

4 Advice to Ofgem on how to apply the results of the WTP studies

4.1 Summary of TO responses

Scottish Power Transmission Limited and Scottish Hydro Electric Transmission Limited have not completed consumer willingness to pay studies for options to mitigate visual amenity impacts from existing infrastructure.

- SPTL state that they support an allowance for such options but then say that it should be used on a case by case basis in respect of new infrastructure, with supporting WTP evidence provided on a case by case basis.
- SHETL say that they do not intend to invest in such measures in respect of existing infrastructure because they are too expensive and they do not believe that the case can be made for customers to pay for them. No supporting evidence is provided in support of these assertions.

NGETL has undertaken a consumer survey with a WTP component aimed at understanding WTP for undergrounding of existing and new lines. No analysis has been carried out for other possible mitigating options. Although little analysis of the results of the survey has been undertaken, the supporting material suggests that consumers on average have the following WTP for undergrounding (based on the open-ended contingent valuation questions):

- £7.22 per year for all existing infrastructure in National Parks;
- £7.76 per year for all existing infrastructure in Areas of Outstanding Natural Beauty; and
- £3.76 per year for all existing infrastructure in other rural areas.

The results of the survey also suggest a high dispersion in WTP. However, as discussed above there are a number of potential issues with these estimates and we would recommend further analysis to be carried out to validate and check the results.

4.2 Potential next steps for Ofgem

4.2.1 SPTL and SHETL

One potential response from Ofgem could be to not provide any allowance to these TOs in respect of visual amenity mitigation options for existing infrastructure, either through the RIIO-T1 process or through any associated uncertainty mechanism. However there is a possibility that this outcome would not be consistent with the wishes of consumers and it would not be consistent with Ofgem's overall approach to the current price review which has a strong focus on engagement with stakeholders. The only alternatives that we can suggest are that:

- 1) Ofgem requires these TOs to undertake the required programme of work in respect of WTP;
- 2) Ofgem undertake the WTP work themselves; or
- 3) Ofgem draws on the work undertaken by NGETL in order to estimate WTP for these TOs.

We have listed the options above in the order that we think would be preferable. Although option 3 is likely to be the least costly option, we prefer options 1 and 2 to option 3 because it is quite possible that WTP varies significantly between regions and so WTP estimates from the National Grid area may not be good estimators for WTP in the SPTL and SHETL areas. Whichever option Ofgem prefer, a first step would be to clarify the TO's positions with them. We discuss option 3 in further detail below.

4.2.2 NGETL

With respect to NGETL, we see four possible approaches for setting an allowance for mitigating visual effects of transmission lines:

- 1) Ofgem requires NGETL to undertake a new consumer WTP survey in line with best practice and the recommendations outlined in chapter 3;
- 2) Ofgem undertakes a new WTP consumer survey themselves;
- 3) Ofgem requires NGETL to improve the analysis and presentation of the current WTP survey based on the recommendations provided in chapter 3; or
- 4) Ofgem uses existing NGETL estimates based on the open-ended contingent valuation approach to set an allowance for undergrounding of existing transmission lines.

In our view, a new consumer survey following the steps outlined in our best practice section would yield the best results and be the only way to address our key concerns about the selected methodology and its implementation. However, we acknowledge that there are significant costs associated with this approach (and hence options 1 and 2 above). Nevertheless, these costs are minor compared to the potential costs involved if the estimates used are wrong and compared to the size of the potential allowance.

A second best approach would be to require NGETL to undertake additional analysis of the open-ended contingent valuation questions, in order to overcome some of the concerns we have raised with respect to the WTP analysis. We consider option 4 the least preferable option because of the inherent problems with the WTP estimates. However, below we outline how this approach could be used.

Setting an allowance for NGETL based on existing NGETL WTP estimates

Based on the WTP figures supplied by NGETL it is possible to calculate a rough estimate of total WTP per year for consumers in England and Wales. This can then be used as an input in a cost-benefit analysis of undergrounding which will inform the decision of whether or not to set an allowance for undergrounding of electricity transmission lines and if so what the allowance for undergrounding should be. We note that given the survey methodology chosen it is not possible to set an allowance for other mitigating options than undergrounding because consumers' WTP for other mitigating options are unknown and likely to be different from the WTP for undergrounding.

How to use the WTP estimates in a cost benefit analysis

There were a total of 22.3m dwellings in England¹⁴ in 2009 and a total of 1.3m dwellings in Wales¹⁵. Given that sampling has been carried out at household level this suggests that:

- the total WTP for undergrounding of all existing lines (119 miles) in **National Parks** in England and Wales is £170m per year¹⁶; and
- the total WTP for undergrounding of all existing lines (257 miles) in **Areas of Outstanding Natural Beauty** in England and Wales is £183m per year¹⁷.

These figures can be interpreted as the total annual visual amenity benefits to consumers in England and Wales if all existing lines are undergrounded. However, we note a weakness in the way the question is worded - respondents were asked to state the WTP in terms of an increase in the annual cost of electricity. As noted before this causes response uncertainty and it also makes it more difficult to apply the results in a cost-benefit analysis.

However, there may also be other costs and benefits of undergrounding. For example, another benefit of undergrounding may be improved security of supply. On the other hand undergrounding could also be costly and involve both an immediate upfront cost of putting the lines underground and ongoing costs e.g. a negative environmental impact, limits on the use of the land, increased maintenance costs.¹⁸

We would therefore recommend that Ofgem only sets an allowance for undergrounding if the total benefits of undergrounding exceed the total costs. In other words, a full cost-benefit analysis should be carried out and the WTP figures above (or improved figures if obtained) should be used as an input to that analysis.

In this context, we note that the material provided by NGETL and Brunswick¹⁹ does provide some indication of what the costs of undergrounding would be in NPs and AONBs in England and Wales:

- In **National Parks** “£3.55 [per year per household] would be enough to underground all transmission power lines” (p 6). This corresponds to a cost of £84m per year for undergrounding of all existing lines in NPs.
- In **Areas of Outstanding Natural Beauty** “£7.70 [per year per household] would be enough to underground all transmission power lines” (p 7). This corresponds to a cost of £182m per year for undergrounding of all existing lines in AONBs.

¹⁴ English Housing Survey: Housing Stock Report 2009. <http://www.communities.gov.uk/documents/statistics/pdf/1937212.pdf>. Estimate for 2009.

¹⁵ Dwelling stock estimates, 2009-10 for Wales. <http://wales.gov.uk/docs/statistics/2011/110126sdr132011en.pdf>. Estimate for 31 March 2010.

¹⁶ $(22.3m + 1.3m) \times £7.22 = £170.392m$

¹⁷ $(22.3m + 1.3m) \times £7.76 = £183.136m$

¹⁸ National Grid (2009), Undergrounding high voltage electricity transmission: The technical issues. <http://www.nationalgrid.com/NR/rdonlyres/A7B84851-242F-496B-A5E8-697331E15504/36546/UndergroundingTheTechnicalIssues5.pdf>

¹⁹ Brunswick (2011a) Attitudes to Energy Transmission: Summary of Key Findings

This suggests that the annual benefits associated with improved visual amenity for consumers (and hence total benefits) are larger than the estimates of the costs of undergrounding provided by NGETL and Brunswick. However, it is very unclear what these cost estimates include and whether they can be seen as estimates of the total costs associated with undergrounding or just the upfront costs of putting existing lines underground. Therefore, further analysis is required to ensure that all costs are accounted for. In addition, whereas it is reasonable to assume that the benefits of visual amenity are constant over time (although subject to social discounting) this is not a plausible assumption for costs. A significant proportion of the costs will be upfront costs and further analysis is required in order to determine when costs and benefits are likely to arise. This analysis would ensure that cost and benefit streams are discounted in line with the recommendations of the HM Treasury Green Book.

We would recommend that the cost-benefit analysis is undertaken separately for undergrounding in NPs and in AONBs because the benefits of improved visual amenity differ significantly for the two types of areas. In this context we note that the WTP estimates translate into £1.4m per year per mile of overhead electricity line in NPs and £0.7m per year per mile of overhead line in AONBs.

Ofgem also has the option of undertaking cost-benefit analysis at different levels of aggregation:

- responses to the survey are disaggregated by region (English regions and Wales) and so separate WTP estimates for each region could be used as the basis for regional cost benefit analyses;
- assuming that the WTP per mile of line is constant within NPs and AONBs, respectively, Ofgem could carry out a cost-benefit analysis for selected NPs and AONBs. For example, there might be some NPs where the costs of undergrounding per mile are lower because the ground is of a better type for undergrounding, so a cost-benefit test could be applied to undergrounding for that NP only;
- similarly, Ofgem could consider using WTP per mile estimates to undertake the cost-benefit analysis at an even more disaggregate level e.g. for a section of transmission lines within a NP.

However, we note that the assumption of constant WTP per mile might not be valid given that respondents to the survey were not asked to provide different WTP estimates for different NPs and AONBs. Further work would be required to determine whether the assumption of constant WTP per mile of line holds. This might for example be tested in a choice experiment where attribute levels are variable.

How to set the allowance

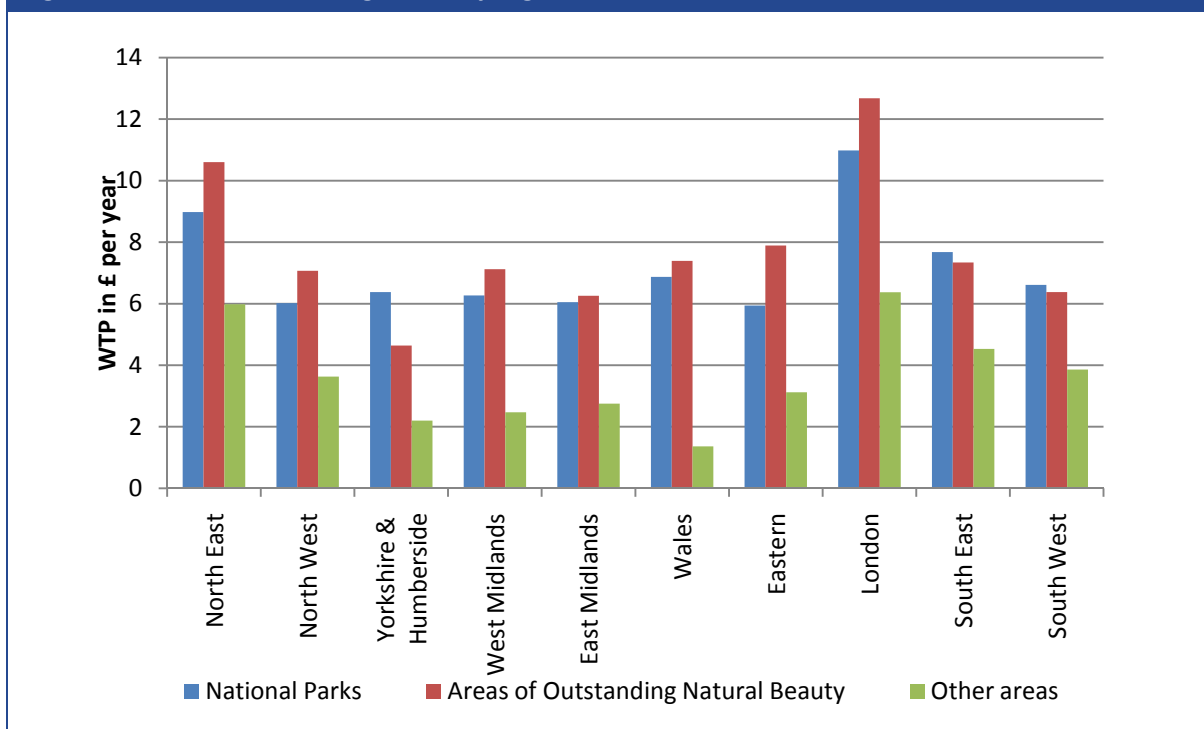
If the cost benefit analysis concludes that the benefits of undergrounding exceeds the costs in a given area, we would recommend that Ofgem sets an allowance for NGETL to underground all existing lines in that area. For example, if the cost benefit analysis shows that the benefits exceeds that cost of undergrounding in NPs then Ofgem should set an allowance for undergrounding of all existing lines in NPs in England and Wales, though we note that, as discussed above, Ofgem could investigate the use of a different level of geographic aggregation within England and Wales.

The allowance should be cost based i.e. set equal to the actual cash costs of undergrounding for NGETL, in a way that is consistent with the general approach to the price control. This might for example involve taking account of the scope for efficiency gains and allowing a return on any

increases in net asset values. This ensures that consumers will not be required to pay more than the actual costs and that consumers rather than NGETL will benefit from the difference between the costs and the benefits.

Ofgem may also wish to consider imposing constraints in terms of where undergrounding is undertaken. The WTP results suggest that undergrounding varies significantly by region (Figure 3) and that respondents have a higher WTP if they can see pylons from their home. As a result, Ofgem may wish to require NGETL to prioritise undergrounding of existing lines in NPs and AONBs in regions with a high average WTP or in NPs and AONBs close to regions with a high WTP. We note that the WTP is particularly high in the North East and in London and as a result Ofgem may want to require NGETL to prioritise undergrounding in NPs and AONBs in or close to these regions.

Figure 3: Variation of average WTP by region



Source: London Economics based on Brunswick (2011c) Utility survey

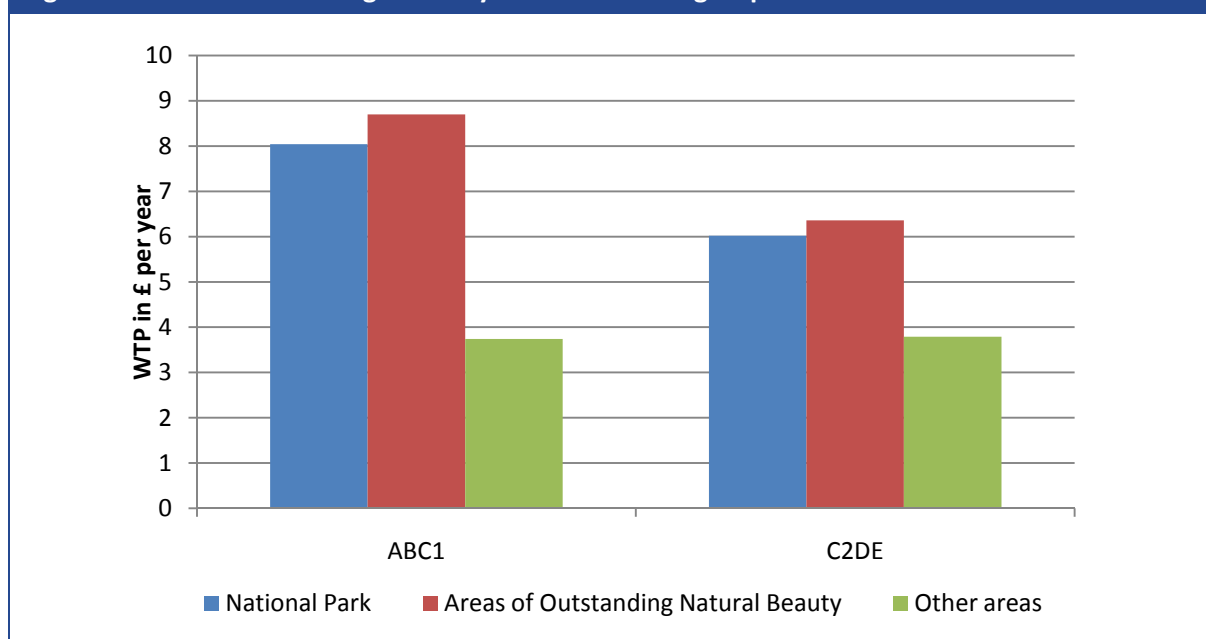
Having determined the allowance, Ofgem would potentially also need to take a view on how these costs are recovered from end consumers. In this context, it is worth noting that NGETL²⁰ concludes based on the survey that “sharing the cost of undergrounding equally among all bill payers is the most popular payment option. For National Parks and AONBs, socialisation is supported by around 50% of bill payers. It is twice as popular as just charging those living nearby” (p 39). This suggests that the cost of undergrounding can be split between all NGETL consumers. This also suggests that it would be appropriate to use the WTP estimates obtained based on the full sample of consumers in England and Wales even at more disaggregate regional levels because the cost of undergrounding should be distributed across consumers in England and Wales.

²⁰ NGETL (2011), ‘RIIO-T1: Stakeholder engagement process’, July 2011.



However, Ofgem may wish to consider splitting the cost unequally between consumers in order to take into account that the WTP varies by socio-economic group (Figure 4). Such an approach could be argued to improve the fairness of the system. However, it is not obvious how this could be implemented. We suggest that Ofgem treat any additional undergrounding spend in the same way as the treat other similar expenditure in the price control.

Figure 4: Variation of average WTP by socio-economic group



Source: London Economics based on Brunswick (2011c) Utility survey

Using NGETL estimates to set an allowance for SPTL and SHETL

The WTP estimates provided by NGETL could be used to inform a cost benefit analysis for SPTL and SHETL and hence determine whether an allowance should be set as part of the price review.

This would, however, require assuming that the annual WTP per household in Scotland is the same as in England and Wales. There is an estimated 2.4m households in Scotland²¹. This implies that, assuming the same average WTP as in England and Wales, Scottish households would in total be willing to pay the following amounts for undergrounding of existing transmission lines:

- £17m per year in National Parks in Scotland; and
- £19m per year in AONBs in Scotland.

These amounts should be allocated to the two TOs according to either the number of miles of transmission lines in NPs and AONBs or according to the size of the population living in the two areas.

²¹ <http://www.gro-scotland.gov.uk/files2/stats/household-estimates/he-10/households-dwellings-est-2010.pdf>. Estimate for mid 2010.

However, we note that we have serious concerns about using this methodology to set the allowance for the Scottish TOs. Firstly, we have seen from NGETL's survey that WTP is much lower in rural areas e.g. in Wales compared to more urban areas. This might imply that the average WTP estimates for England and Wales significantly overestimates the average WTP of Scottish consumers who would be required to pay for undergrounding in Scotland.

Secondly, this methodology does not take into account that the composition of the population in Scotland (in terms of personal characteristics) could be significantly different from the population in England and Wales. Ofgem may wish to apply a more sophisticated approach to try to account for such differences in population characteristics and the possible impact on WTP.

Finally, the method does not account for the fact that there may be more or less miles of transmission lines in NPs and AONBs in Scotland and that the WTP estimates obtained for England and Wales are conditional on the full length of line being put underground.

Therefore, we view it as highly questionable that this method would provide good estimates of Scottish consumers' WTP for improved visual amenity. As a result a cost-benefit analysis using these results could be seriously misinformed.

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