Consumers' Willingness to Pay Research

Appendices

July 2012

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APPENDIX A

Topic Guide

2383
Consumers' WTP Research
Group Topic Guide (Main, final)

Moderator: .....

Group: .....

Date: .....

Time: .....

Venue: .....

Good evening... My name is … and I work for an independent market research company called Accent. We are conducting research for National Grid looking at household consumers' views on the impact of National Grid's electricity infrastructure on the landscape. By 'electricity infrastructure' we mean overhead lines, pylons and substations.

Thank you very much for agreeing to help us with this research and for being here this evening.

The research is being conducted in accordance with the Code of Conduct of the Market Research Society (MRS) and also with the Data Protection Act, with whom Accent is registered. This means that everything you say here this evening is confidential and will not be attributed to you personally.

The discussion is audio-recorded. This is standard market research procedure and is to ensure accuracy – so I do not have to try to remember what you have said – and for analysis purposes only. The recordings will not be passed to any third party not associated with the research project, and I assure you that none of your comments will be attributed to you by name.

The discussion will last around 120 minutes.

Can I stress that we are looking for your views. There are no right or wrong answers. I hope you will all contribute to the discussion.

Participants introduce themselves — 5 mins (10)

- name and age
- household composition
- occupation
- hobbies

Affordability — 5 mins (15)

- First of all, let's think about your main household bills. As a prompt, we've taken these figures from the web. They are for an average household per week. **Showcard A**
- Do they look about right? If not, in what way? How much do think you spend, on average, on the following each week? Discuss
- Would you say your household expenditure has changed over the last couple of years in light of the economic climate?
  - In what way? **Probe**

Landscape usage 5 mins (20)

- Let's think now about the countryside. First of all, what do you understand by National Park?
- And what do you understand by AONB?

Showcard C

- Do you visit the countryside frequently/now and again/hardly ever/not at all?
- Where?
  - Locally, further afield?
  - Particular parts of the countryside, beauty spots, SSSIs (Sites of Special Scientific Interest), places of historic interest, other rural locations, National Parks, AONBs etc
  - What national parks do you know, locally/further afield? Which do you visit?
  - What AONBs do you know, locally/further afield? Which do you visit? (No AONBs in Scotland)
  - How far do you travel to visit the countryside?
- What are the main reasons you visit the countryside/don't visit the countryside?
  - Recreation
    - drive/walk/run/cycle/
    - particular activities
  - Work
    - Eg agriculture
- What types of recreation do you and your family pursue, if any, in the local rural/natural landscape?
  - Where in the local area do people go (name of sites), how often do they go, distance travelled, are there any similar sites for same recreational activities nearby (how far)
- What makes an area in the countryside attractive to you? **Probe**

Understanding of National Grid 10 mins (30)

- What do you associate National Grid with? What do you think National Grid does?
- What is your perception of National Grid?
  - What does National Grid do well?
  - What do they do less well?
- Have you ever had any contact with National Grid?
  - Probe nature of contact?
    - How long ago?
    - Satisfaction with contact (**briefly**)

- Explanation of the structure of the electricity industry [**Showcard B**]
  - the electricity supply chain
  - identify National Grid's areas of responsibility in the electricity supply chain
  - pie chart of breakdown of electricity bill; electricity transmission 4% of the bill (average annual electricity bill is £424 pa), so transmission costs are approximately £17-20 pa – let's say £17-20

  - who is your energy supplier; throughout this discussion we are talking about National Grid, *not* your energy supplier.
  - how much is your electricity bill? (Note if estimates or actual, and check for dual fuel); how does it compare

Views on transmission infrastructure 15 mins (45)

- What do you think about electricity infrastructure in the countryside? **Probe for overhead lines, pylons and substations**
  - Necessary/unavoidable
  - Ugly/an eyesore
  - Quite attractive – industrial architecture
  - Don't mind them
  - Don't notice them

- Are there any places in the countryside where you remember seeing electricity infrastructure?

- Are there some parts of the countryside, or different types of countryside, where electricity infrastructure is:
  - more acceptable
  - less acceptable
  - less of an intrusion
  - more of an intrusion
  - **Probe** for overhead lines, pylons and substations for different parts of types of countryside eg
    - What do you think about electricity infrastructure in national parks or AONBs specifically?
    - Are you thinking about national parks or AONBs that you know, or in general
    - Is it more acceptable to have electricity infrastructure in some national parks or AONBs than others? **Probe (refer back to Showcard C)**
    - Does it matter to you if electricity infrastructure can be seen from a national park or AONB? Why/why not?

- Let's look at some different landscapes with pylons. **Showcard D with pylons**
- For each: what impact do you think the pylon has on the landscape? **Probe for strength of feeling (positive or negative) and for references to landscape type etc**

- **Showcard D without pylons.** This is how these landscapes would look without pylons. For each landscape: how much difference does it make to you to have the pylon removed from the landscape? Do some landscapes benefit more than others? Which landscapes benefit most from having the pylon removed? Does the pylon not matter so much for some? Why?
- **Probe for strength of feeling and for references to landscape type etc**
- Who would benefit from having the pylon removed? In what way?

Alternatives to Pylons 25 mins (70)

- What alternatives do you think there may be to pylons and overhead lines? **Probe**
  Are you aware of any alternatives being put in place? If so, where?

Introduce alternatives

There are a number of alternatives to pylons, overhead lines and substations. These include undergrounding, planting more screening trees, choosing other routes and new pylon design. In the pictures we've just looked at, there may have been undergrounding or a different route may have been chosen. Where trees are planted, they may only provide a screen for the infrastructure (pylon or substation) from a certain vantage point – for example for a particular view or from a particular village etc.

- Where do you think **undergrounding** would be most appropriate? Less appropriate? Why?
  - What are the benefits of undergrounding? Who for?
  - What are the downsides?
  - Is it different for specific landscape types, eg national parks, AONBs or for rural areas generally? **Probe**
  - Where would you **prefer** to see more undergrounding to lessen the impact of electricity transmission infrastructure? **Probe for landscape type/location**
  - Where would you be **less** keen to see more undergrounding to lessen the impact of electricity transmission infrastructure? **Probe for landscape type**

  - **Showcard E (undergrounding images)**: does this change your views on undergrounding? If yes, in what way? **Probe**
  - Remember that significant work is required to build and to decommission pylons too.

- Where do you think **planting more trees** would be most appropriate? Less appropriate? Why?
  - What are the benefits of planting more trees? Who for?
  - What are the downsides? eg
    - Only effective for a particular sightline **(refer back to image of hill top pylon as example)**
    - Time for trees to grow
  - Is it different for specific landscape types, eg national parks, AONBs or for rural areas generally? **Probe**
    - Where would you **prefer** to see more trees planted to lessen the impact of electricity transmission infrastructure? **Probe for landscape type/location**
    - Where would you be **less** keen to see more trees planted to lessen the impact of electricity transmission infrastructure? **Probe for landscape type**

- Where do you think **choosing other routes** would be most appropriate? Less appropriate? Why?
  - What are the benefits of choosing other routes? Who for?
  - What are the downsides? eg
  - Is it different for specific landscape types, eg national parks, AONBs or for rural areas generally? **Probe**
    - Where would you **prefer** to see other routes chosen to lessen the impact of electricity transmission infrastructure? **Probe for landscape type/location**

- Where would you be **less** keen to see other routes chosen to lessen the impact of electricity transmission infrastructure? **Probe for landscape type**

Introduce undergrounding distribution pylons

- National Grid could choose to leave their infrastructure ie the large pylons in place and, instead, remove the smaller, distribution pylons and replace them with undergrounding. **Showcard F**
- Where do you think **undergrounding to replace distribution pylons** would be most appropriate? Less appropriate? Why?
  - What are the benefits of undergrounding distribution power lines? Who for?
  - What are the downsides? eg
  - Is it different for specific landscape types, eg national parks, AONBs or for rural areas generally? **Probe**
    - Where would you **prefer** to see undergrounding distribution power lines to lessen the impact of electricity infrastructure? **Probe for landscape type/location**
    - Where would you be **less** keen to see undergrounding to replace distribution pylons to lessen the impact of electricity infrastructure? **Probe for landscape type**

Introduce new pylon

- There is a new design of pylon, known as the T pylon. **Showcard G**
- What do you think of the new design? How does it compare with the more traditional pylon design? What is its impact on the countryside compared with the traditional pylon?
- Where do you think **replacing pylons with a new design of pylon** would be most appropriate? Less appropriate? Why?
  - What are the benefits of the new design of pylon? Who for?
  - What are the downsides? eg
  - Is it different for specific landscape types, eg national parks, AONBs or for rural areas generally? **Probe**
  - Where would you **prefer** to see the new pylon to lessen the impact of electricity transmission infrastructure? **Probe for landscape type/location**
    - Where would you be **less** keen to see the new pylon to lessen the impact of electricity transmission infrastructure? **Probe for landscape type**

  - Are there any particular national parks or AONBs that you think should be prioritised for reducing the impact of electricity infrastructure? Why/why not? **Probe**
- Which would you say would be your top five?

Current vs New Infrastructure 5 mins (75)

National Grid will be building new infrastructure over the next few years, for example to connect to low carbon power stations. The types of infrastructure and the routes chosen will be considered in consultation with local communities and other stakeholders.

- Do you think National Grid should be focusing their attention on mitigating the impact of **existing** electricity infrastructure on the landscape or do you think they should focus on **new** infrastructure?
- Why?
- What are the advantages of focusing on existing infrastructure? Disadvantages? Who wins? Who loses?
- What are the advantages of focusing on new infrastructure? Disadvantages? Who wins? Who loses?

So, looking at those five measures again, undergrounding to replace transmission pylons, planting more trees, changing the route, undergrounding to replace distribution pylons and replacing old pylons with the new design, which do you prefer? Or do you prefer to leave things as they are? Is it the same for all landscape types? Why/why not?

- **Showcard H (ranking for existing infrastructure first and then for future infrastructure)**: discuss responses

- All that we have discussed so far can be said to mitigate the visual impact of transmission infrastructure on the landscape. How would you word that? Eg
  - To improve the look of existing infrastructure in National Parks and AONBs
  - To reduce the visual impact of existing infrastructure on National Parks and AONBs
  - To lessen the visual impact of existing infrastructure on National Parks and AONBs
  - Ways to improve the look of existing infrastructure on National Parks and AONBs
  - etc

Willingness to Pay 35 mins (110)

Read out: National Grid wants to understand whether electricity customers want them to work on lessening the visual impact of current electricity transmission infrastructure on the landscape.

National Grid operates in a regulated environment. The regulator requires them to work in consultation with their customers and this research is a part of that consultation process.

What you say here this evening will inform how much National Grid can spend on lessening the impact of infrastructure on the landscape.

- First of all, do you think that everyone should pay the same amount towards putting in place a number of different measures to lessen the impact of electricity infrastructure on the landscape? For example, should people who live near National Parks or in AONBs pay more or not? **Probe**

- Now I want you to think about how much you personally would consider paying towards putting in place different measures to lessen the impact of electricity infrastructure on the landscape. Remember that currently your average annual electricity bill includes £17-20 for transmission, and remember to consider all your other household bills.

For information:
- Miles of overhead lines in National Parks, 119 miles (3% of the network)
- Miles of overhead lines in AONB, 243 miles (5% of the network)
- In Scotland Scottish Power have 38 miles of overhead lines in one National Park (3% of their network).
- *We don't have figures for SSE who also cover an area of Scotland but they have told me in the past they don't have much of their infrastructure in designated landscapes.*

Moderator note: if no wtp, rephrase and ask about pylons, substations etc as they become due for replacement: What would they prefer – to replace them with the same pylons etc or to replace all or some with the following…

Undergrounding

- If National Grid could underground **all** lines that run across all national parks and AONBs, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **all** lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **50%** of lines that run across all national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **50%** of lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **25%** of lines that run across all national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **25%** of lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

New Pylon Design (show picture again)

- If National Grid could replace **all** the pylons that run across national parks and AONBs with the new T pylon (Showcard), how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could replace **all** the pylons that run across, say, the ten best national parks and AONBs with the new T pylon, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could replace **50%** of the pylons that run across national parks and AONBs with the new T pylon, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could replace **50%** of the pylons that run across, say, the ten best national parks and AONBs with the new T pylon, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
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  what is the maximum you would be prepared to pay?

- If National Grid could replace **25%** of the pylons that run across, say, the ten best national parks and AONBs with the new T pylon, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

Plant Trees

- If National Grid could plant trees to screen **all** the pylons that run across national parks and AONBs from key sight lines, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could plant trees to screen **all** the pylons that run across, say, the ten best national parks and AONBs from key sight lines, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could plant trees to screen **50%** of the pylons that run across national parks and AONBs from key sight lines, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
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  what is the maximum you would be prepared to pay?

Removing distribution pylons and undergrounding

- If National Grid could underground **all** distribution power lines that run across all national parks and AONBs, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **all** distribution power lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **50%** of distribution power lines that run across all national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could underground **50%** of distribution power lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
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  what is the maximum you would be prepared to pay?

Rerouting

- If National Grid could reroute **all** lines that run across national parks and AONBs, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could reroute **all** lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
  what is the maximum you would be prepared to pay?

- If National Grid could reroute **50%** of lines that run across all national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
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- If National Grid could reroute **50%** of lines that run across, say, the ten best national parks and AONBs, but leave everything else as it is, how much would you be prepared to pay on top of the £17-20 you currently pay, for each for the next ten years?
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  what is the maximum you would be prepared to pay?

If still no wtp, ask for maximum prepared to pay for preferred measure in most valued landscape.

Wrap and Close — 5 mins (120)

- How easy did you find it to think about how much you would be willing to pay?
- Have your views on National Grid changed at all as a result of this discussion?
  - In what way?

- If you could say one thing to the Executive Director of National Grid Electricity Transmission, what would you say?

Thank you very much.

APPENDIX B

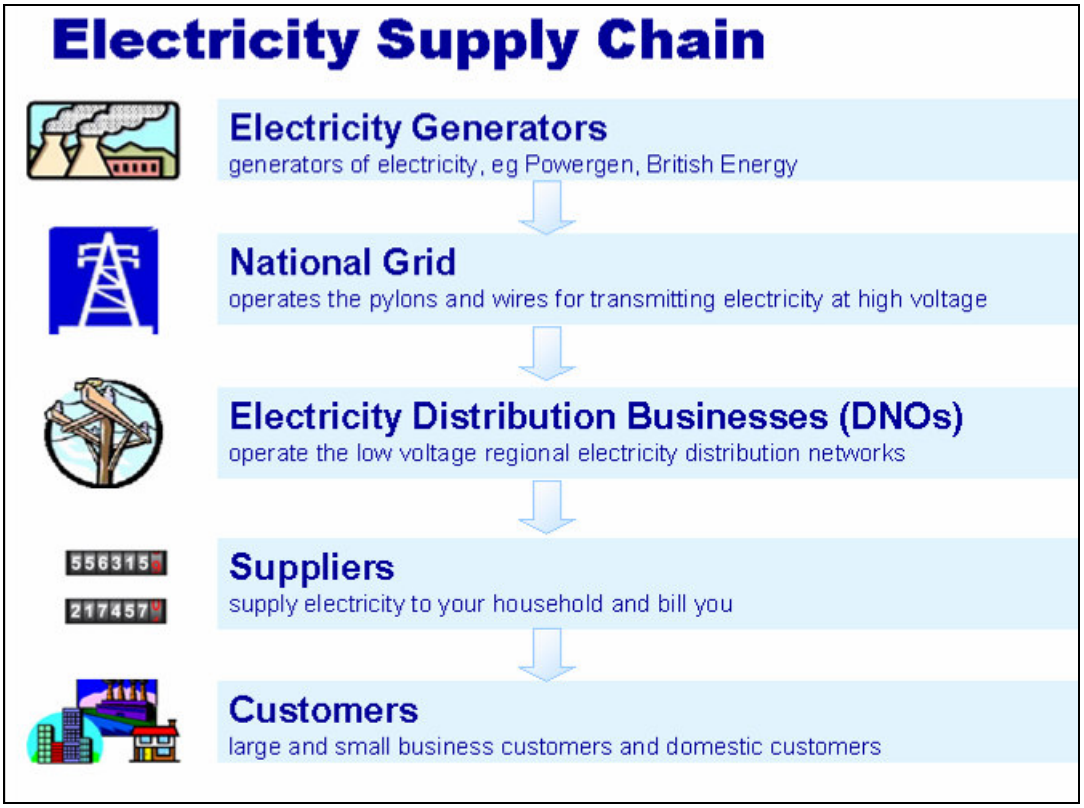
Qualitative Show Material

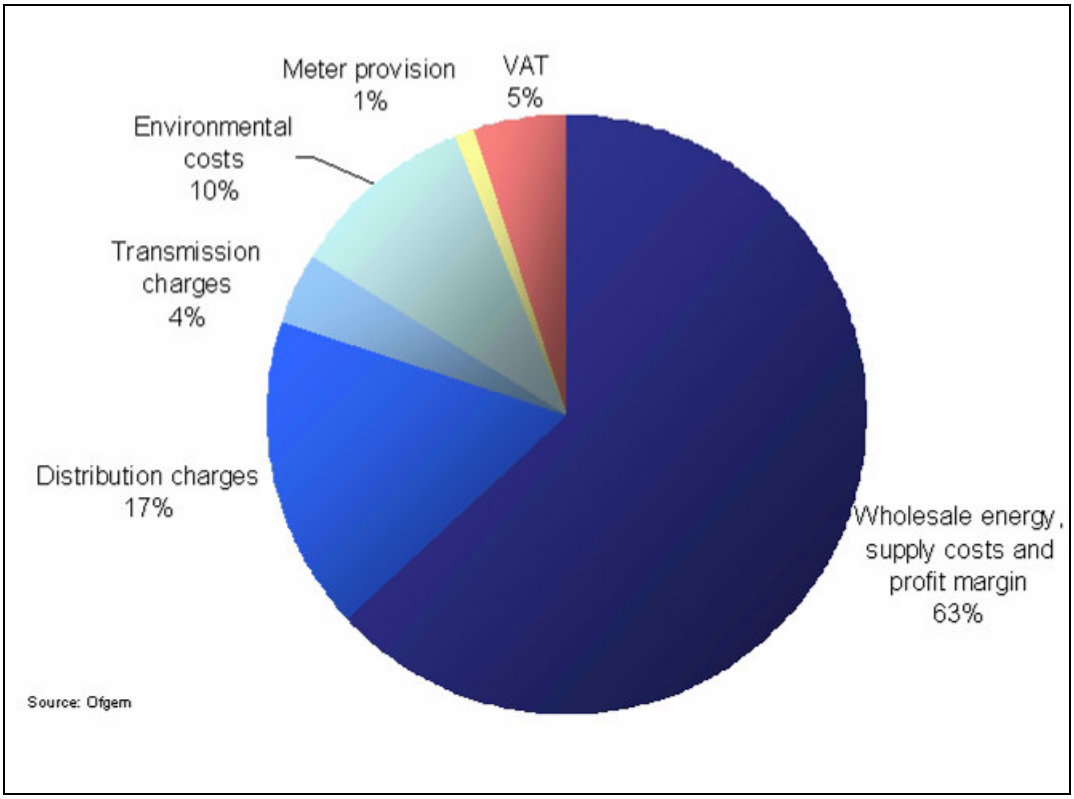
Showcard A: Average Weekly Household Spend

The table below shows average weekly household spend on a number of items. How does your household spend compare?

	Average spend £	My house-hold spend £
Food and non alcoholic drinks	80	
Clothing and footwear	25	
Housing (inc water, refuse collection etc), fuel and power	60	
Household goods and services	30	
Health	10	
Transport	60	
Communication	15	
Recreation and culture	40	
Education	10	
Restaurants and hotels	35	
Alcoholic drinks, tobacco	10	
Miscellaneous	35	
Other expenditure items (inc council tax, mortgage interest, credit card interest, road tax, charity donations etc)	90	
TOTAL	**500**	

Showcard B


Electricity Supply Chain
Electricity Generators
generators of electricity, eg Powergen, British Energy
National Grid
operates the pylons and wires for transmitting electricity at high voltage
Electricity Distribution Businesses (DNOs)
operate the low voltage regional electricity distribution networks
Suppliers
supply electricity to your household and bill you
Customers
large and small business customers and domestic customers


Meter provision 1%
VAT 5%
Environmental costs 10%
Transmission charges 4%
Distribution charges 17%
Wholesale energy, supply costs and profit margin 63%
Source: Ofgem

SHOWCARD C

National Parks

There are 15 designated National Parks

In England, Scotland and Wales, including mount

moorlands, woods and wetlands.

They are areas of protected countryside that

everyone can visit, and where people live,

work and shape the landscape.

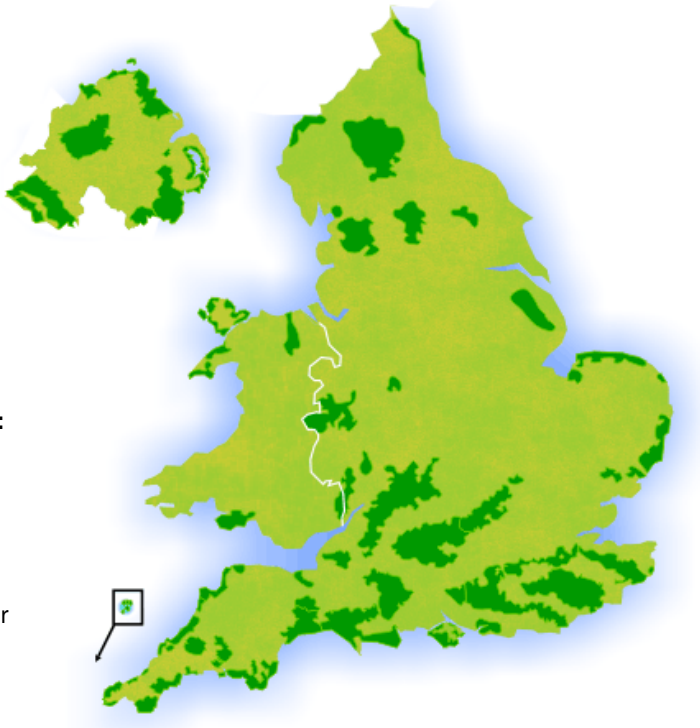
- Brecon Beacons
- Broads
- Cairngorms
- Dartmoor
- Exmoor
- Lake District
- Loch Lomond
- New Forest
- Northumberland
- North York Moors
- Peak District
- Pembrokeshire Coast
- Snowdonia
- South Downs
- Yorkshire Dales

AONBs

The AONBs of England and Wales are:

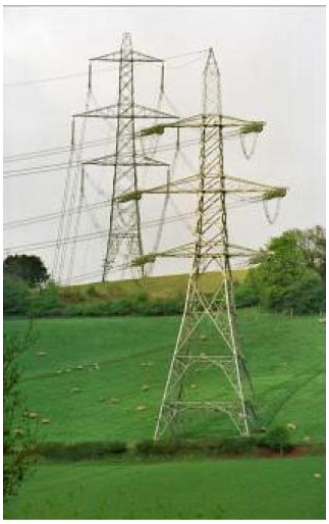
England

- Arnside and Silverdale
- Blackdown Hills
- Cannock Chase
- Chichester Harbour
- Chilterns
- Cornwall
- Cotswolds
- Cranborne Chase and West Wiltshire Downs
- Dedham Vale
- Dorset
- East Devon
- Forest of Bowland
- Howardian Hills
- High Weald
- Isle of Wight
- Isles of Scilly
- Kent Downs
- Lincolnshire Wolds
- Malvern Hills
- Mendip Hills
- Norfolk Coast
- North Devon
- North Pennines
- North Wessex Downs
- Nidderdale
- Northumberland Coast
- Quantock Hills
- Shropshire Hills
- Solway Coast
- South Devon
- Suffolk Coast and Heaths
- Surrey Hills
- Tamar Valley
- **England and Wales:**
- Wye Valley AONB / Dyffryn Gwy AoHNE
- **Wales**
- Bryniau Clwyd AoHNE / Clwydian Range AONB
- Gwyr AoHNE / Gower AONB
- Llyn AoHNE (Lleyn AONB)
- Ynys Mon AoHNE / Anglesey AONB



SHOWCARD D: WITH PYLONS

(shown to participants as individual images, A5 size)

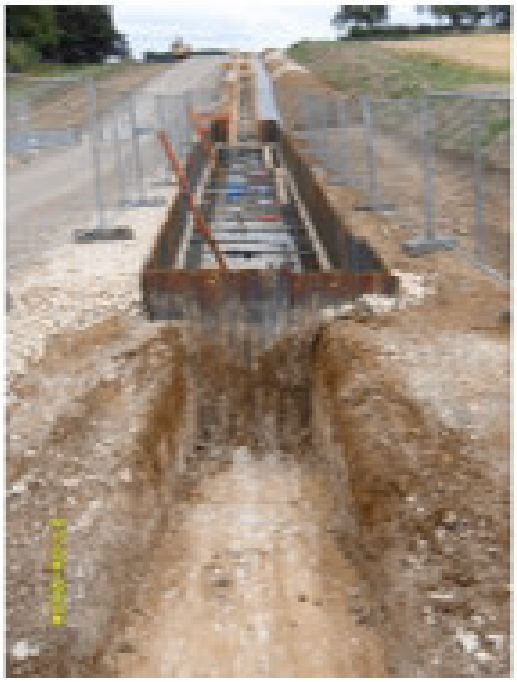


SHOWCARD D: WITHOUT PYLONS

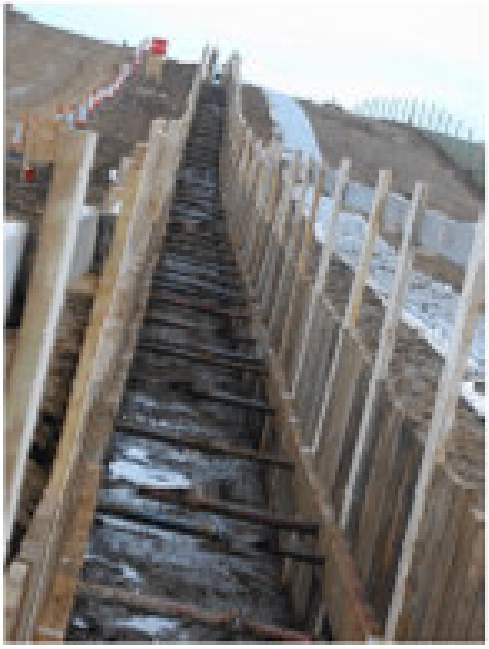
(shown to participants as individual images, A5 size)

SHOWCARD E: UNDERGROUNDING

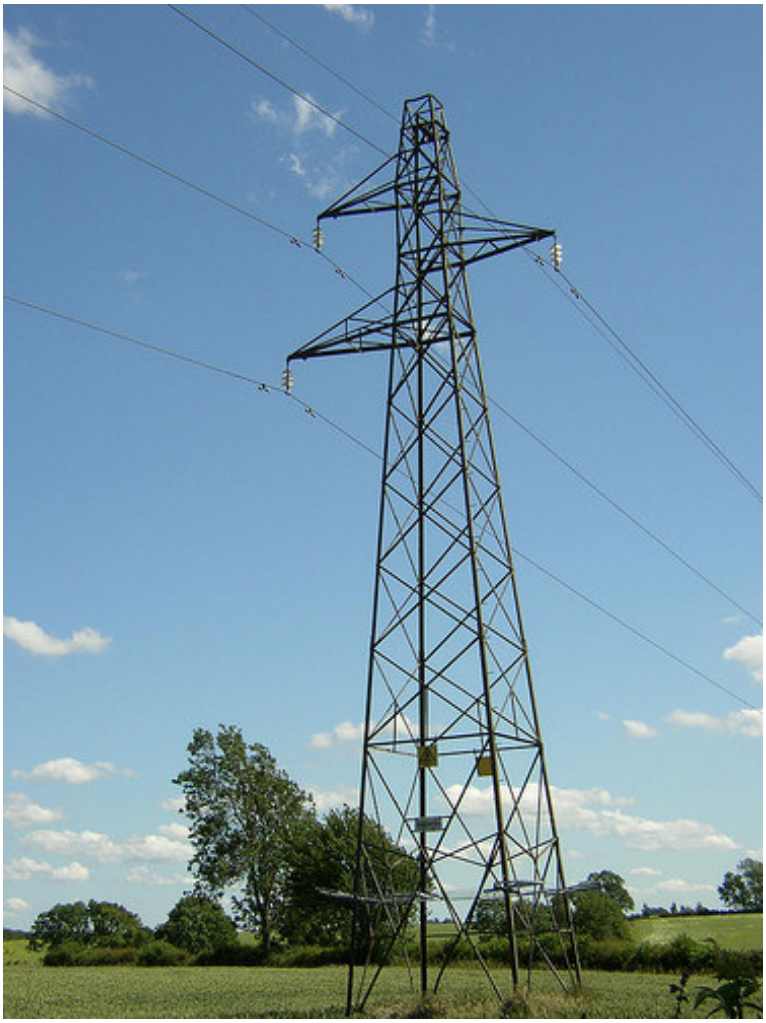
BRAMLEY-DIDCOT (GORING GAP)



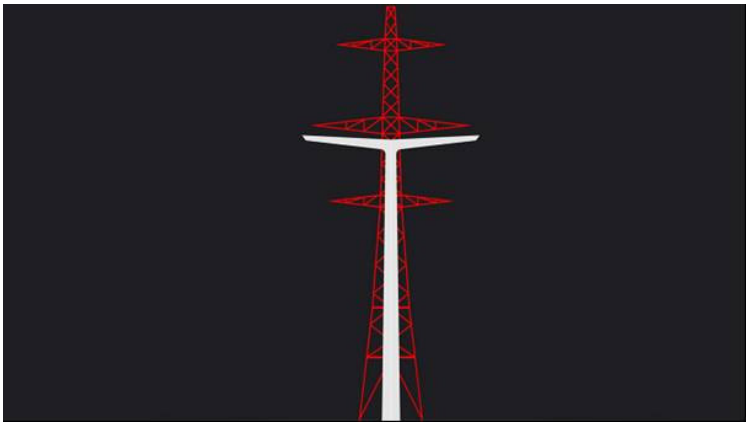
NEWBY-NUNTHORPE (SECOND YORKSHIRE LINE)



SHOWCARD F: DISTRIBUTION PYLON



SHOWCARD G: T-PYLON



SHOWCARD H

Name: .....

Please put these in order of preference, by assigning a score of 1 to your most preferred and a score of 6 to your least preferred.

Existing infrastructure

	National Parks	AONBs	Other rural locations	Overall
Pylons				
Undergrounding transmission power lines				
Planting more trees (screening)				
Undergrounding distribution power lines				
New pylon design				
Choosing other routes				

Please put these in order of preference, by assigning a score of 1 to your most preferred and a score of 6 to your least preferred.

Future infrastructure

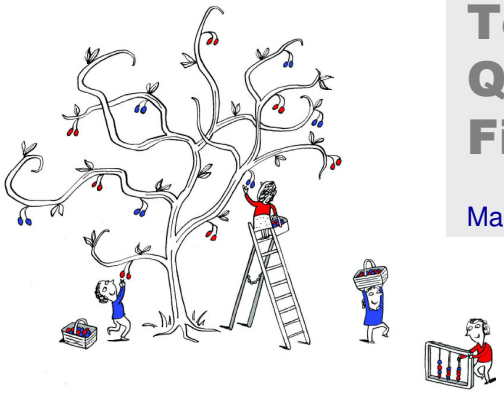
	National Parks	AONBs	Other rural locations	Overall
Pylons				
Undergrounding transmission power lines				
Planting more trees (screening)				
Undergrounding distribution power lines				
New pylon design				
Choosing other routes				

APPENDIX C

Qualitative Presentation

Consumers' WTP Research: Top Line Qualitative Findings

March 2012



Accent

Ten extended (2-hr) focus groups

- Ten extended (2-hour) focus groups with bill payers
  - Manchester: ABC1 16-39 yrs
  - Plymouth: ABC1 16-39 yrs
  - Scarborough: C2DE 16-39 yrs
  - Birmingham: C2DE 40-59 yrs
  - Carmarthen: ABC1 40-59 yrs
  - Glasgow: C2DE 40-59 yrs
  - Ipswich: C2DE 40-59 yrs
  - Arundel: ABC1 60+ yrs
  - London: C2DE 60+ yrs
  - Perth: C2DE 60+ yrs
- Mixed gender
- Minimum 2 'users' of countryside per group

Accent

slide 2

Affordability: "Everything has gone up except our wages, particularly…"

Petrol/diesel

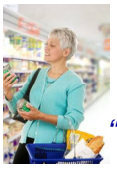
"That's knocked the Sunday drive on the head"

Scarborough

Entertainment

"I used to go to the pub every week. Not any more"

Manchester



Food

"Morrison's loss is Lidl's gain"

Plymouth

Gas/electricity

"I go and sit in the library during the day; it's warm there"

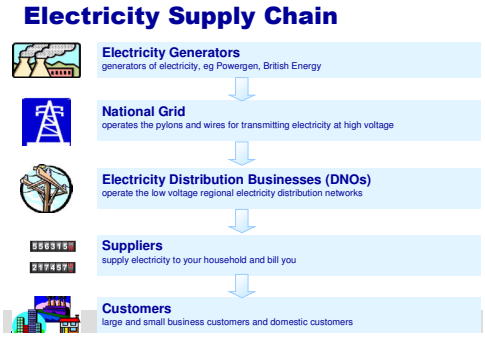
Hammersmith

Accent

slide 3

Understanding of National Grid

- **Not clear**
  - **"Generates electricity"**
  - **"Carries electricity"**
  - **"Distributes electricity**
  - **"Supplies electricity"**
  - **"Gas and electricity"**
- **Show material essential to clarify**



Accent

slide 4

Understanding of Landscape Designations

National Parks

- **"Have special planning permission"**
- **"Protect wildlife"**

AONBs

- **Mostly drew a blank**
- **"Areas of national beauty?"**

They have been designated so that they can be protected and that should count for something

Accent

slide 5

Attitude Towards Countryside

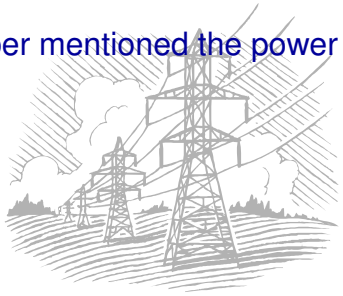
- Beautiful countryside …
  - is green
  - allows you to see the sky
  - is where not many people go
  - is peaceful, serene
  - (has a nice pub)
- Small number of 'non users' indifferent
  - Glasgow participants most indifferent
- But most had a view

Accent

slide 6

Initial Views on Electricity Infrastructure

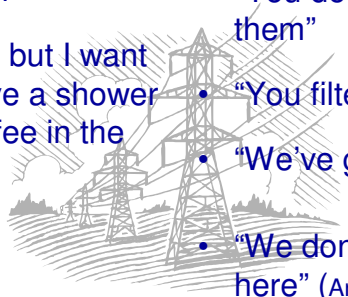
- Pylons top of mind and most easily envisaged
- Arundel participants knew of substation nearby
- Very small number mentioned the power lines



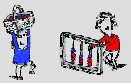
Accent slide 7

Initial Views on Electricity Infrastructure (Pylons)

Mostly pragmatic; small number of negative comments	Familiarity a strong feature of general acceptance
• "A necessary evil"	• "You don't really notice them"
• "I don't like them but I want to be able to have a shower and a cup of coffee in the morning"	• "You filter them out"
	• "We've grown up with them"
• "An eyesore"	• "We don't have many round here" (Arundel)
• "They march across the countryside	• "They're iconic"



Accent slide 8



Visual Impact of Infrastructure on Landscapes: 1

- Mostly negative responses
  - they dominate; they spoil the countryside; you wouldn't want to walk there
- Small number not concerned
  - it's a picture of two pylons; they don't bother me

- Almost all positive responses
  - it looks so much better; now it's somewhere you'd want to go
- Small number not concerned
  - I hate to say this but it almost looks as though something is missing

Accent

slide 9

Visual Impact of Infrastructure on Landscapes: 2

- Mostly neutral responses
  - it's not very pretty anyway; it's bleak; the farmer gets paid
- Small number were negative
  - it's worse against the sky;

- Mostly neutral responses
  - it doesn't make any difference; it's still not very attractive countryside
- Small number were positive
  - of course its better

Accent

slide 10

Visual Impact of Infrastructure on Landscapes: 3

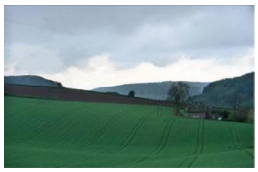
- Mostly accepting of infrastructure
  - there's already a man-made structure there; the landscape is already busy; they seem to fit in
  - it may be because we're looking down on it
- Very small number were negative
  - they still spoil the countryside

- Mixed responses
  - it doesn't make much difference; we didn't mind the pylons in the first place
  - of course it's better without them

Accent slide 11

Visual Impact of Infrastructure on Landscapes: 4

- Mixed responses
  - they seem to follow the contours
  - that looks like lovely countryside and it's ruined



- Mixed responses, depending on initial stance
  - largely indifferent
  - it's obviously better without the pylons

Accent slide 12

Visual Impact of Infrastructure on Landscapes: 5

- Almost all negative responses
  - it's right against the sky; it dominates; it shouldn't be there
  - awful for the people living in those houses
- Very small number not concerned
  - they don't bother me

- All thought this landscape was improved by removing the pylon

Accent

slide 13

Visual Impact of Infrastructure on Landscapes: 6

- Mixed responses
  - some thought the pylons against the sky ruined the countryside
  - some thought the countryside was not particularly beautiful in the first place

- Therefore, mixed responses to removal of pylon

Accent

slide 14

Visual Impact of Infrastructure on Landscapes: 7

- Almost all negative responses
  - it's looks like a really beautiful place and it just ruins it
  - the lines are worse than the pylon
  - not only do you have the pylons and the lines, but it's reflected, so you get it twice
- Very small number not concerned
  - it may just be a filled in gravel pit, an old quarry; there may be seven more lakes near
- Everyone thought the scene improved by the removal of the pylon
  - but is it just because it's a lovely photo with a moody sky?
  - water scene generated strongest responses

Accent slide 15

Awareness of Alternatives to Pylons

- Undergrounding spontaneously mentioned in all groups
  - and assumed to be very expensive
  - images of undergrounding work gave some pause for thought, but view that we should a have a thought for the future
  - Carmarthen group had experience of large scale project to put in new gas main, so pragmatic about work involved
- Small number in each groups aware of new pylon design competition

Accent slide 16

Suggestions for Lessening Visual Impact of Infrastructure

- Widespread view that each location/landscape should be assessed on its own merits and a mix of measures employed, as considered most appropriate
- Participants also suggested
  - pylons could be placed alongside motorways or railways
  - undergrounding could be done in coordination with other engineering works eg
    - new or widening motorways
    - new gas mains (as in Carmarthen area)
    - other utilities work
- Some really not concerned
  - "I wouldn't crusade, I wouldn't protest for it." (Glasgow)
  - "There are other things to worry about." (Scarborough)

Accent slide 17

Measures to Lessen Visual Impact of Transmission Infrastructure

- Participants presented with
  - undergrounding
  - screening with trees
  - rerouting
  - undergrounding distribution infrastructure, and
  - new pylon

Accent slide 18

Undergrounding

- Widely considered to be the ideal alternative
  - in a perfect world
  - but concerns about the cost
  - and short term impacts on tourism
- Would be favoured for national parks and AONBs
  - some concern that undergrounding may cause harm to wildlife habitats
  - but also a view that we should consider future generations

Accent slide 19

Screening through Planting More Trees

- Some participants struggled to understand how this might help
  - how tall would the trees have to be?
  - how long would they take to grow?
- Image helped demonstrate how screening may work
- In favour of tree screening where suitable
- Important that trees should fit with existing natural vegetation, particularly if planting in designated areas
- Could help screening infrastructure visible *from* designated areas

Accent slide 20

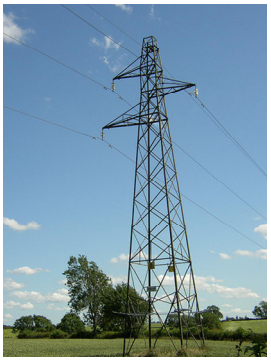
Choose Other Routes

- Some support for this measure
- Although downside is that it may simply move a problem to another location, some sympathy with view that some landscapes may be less "damaged"
  - water scene an example
- However, would not want existing pylons moved purely for cosmetic reasons
  - unnecessary expense
  - "you put it in the wrong place, you fix it"

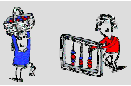
Accent slide 21

Underground Distribution Infrastructure Instead

- Participants split regarding undergrounding of distribution infrastructure
- Some thought that the smaller distribution pylons are less intrusive, so it's better to keep them
- Others thought that as they are nearer to where people live, it would be better to underground them

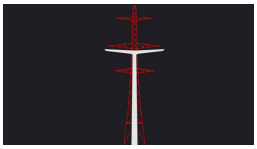


Accent slide 22



New Pylon Design

- The T pylon was universally liked
- Could be acceptable in AONBs
- Questions regarding its height and how far apart they are *cf* current infrastructure
  - diagrammatic comparison with transmission pylon not helpful: need *in situ* scaling
  - have any been put up in this country yet?



Accent

slide 23

Current vs New Infrastructure?

- Participants spontaneously raised the issue of current vs future infrastructure
- Emphasis should be on future infrastructure, with existing infrastructure only being replaced or rerouted as it came to the end of its natural life

- Don't spend money for something that is…
  - purely cosmetic
  - prettification/beautification for the sake of it
  - "I'm surprised that they are considering such niceties in the current economic climate"

Accent

slide 24

Willingness to Pay

- Participants acknowledged that the costs of any measures to lessen the visual impact of electricity infrastructure on the landscape would inevitably be reflected in their bills
- Initially, for most, no wtp
  - "Perhaps if you'd asked us in more affluent times we'd have given different answers"
  - "I would need 10 good reasons why this is necessary. It's because of this, that, the benefit to me will be this, the benefit to others will be that etc etc
- Participants recognised how their views had changed when it came to talk of money, but they have absolutely no means of affording anything more

Accent slide 25

Willingness to Pay

- A little wtp mostly from ABC1 and rural groups
  - Birmingham (C2DE, 40-59 yrs)
    - a couple would pay £5 a year more
  - Plymouth (ABC1, 16-39 yrs)
    - a couple would pay £10-£50 a year "to keep infrastructure off Dartmoor"
  - Carmarthen (ABC1, 40-59 yrs)
    - couple would pay £10-£50 a year; "there's two in my household, that's £1 a week – perhaps go without the Sunday paper or a cappuccino
  - Arundel, ABC1, 60+ yrs
    - a couple would pay £10-£20 a year
- But with emphasis on future infrastructure, and on existing infrastructure only when it needs replacing

Accent slide 26

No Willingness to Pay

- No wtp from C2DE groups (apart from Birmingham) including three rural groups, plus one ABC1 urban group
  - Manchester (ABC1, 16-39 yrs)
  - Scarborough (C2DE, 16-39 yrs)
  - Ipswich (C2DE, 40-59 yrs)
  - Glasgow (C2DE 40-59 yrs)
  - London (C2DE, 60+ yrs)
  - Perth (C2DE, 60+ yrs)
- Participants across all groups suggested
  - funding should come out of company profits, and particularly suppliers' profits
  - National Grid should get more than 4%

Accent slide 27

Willingness to Pay

- Participants found it difficult to discuss extent of mitigation
- Preference for future infrastructure
- And existing infrastructure only as and when it needs replacing
  - would then have to be a tranche, say 10 pylons in one go

Accent slide 28

Conclusion → Implication

Context

Generally not a huge appetite for visual mitigation of current infrastructure – a 'necessary evil'	Include questions on attitude to infrastructure to measure extent of these attitudes
Financial squeeze felt strongly and impacts WTP	Include questions to assess financial situation and to determine if zero WTP is driven by protest or constraint
Strong dislike of replacing infrastructure unnecessarily	Set choice of replacement location in context of consultation
Preference for investment in new rather than replacement infrastructure	Ask for relative priority through direct questioning even though not included in the SP

Accent

slide 29

Conclusion → Implication

Extent and location of mitigation

Mitigation in different types of areas is viewed differently and priority is placed on mitigation in NPs and AONBs	Concentrating effort on these areas is logical for respondents
But understanding of NP/AONB limited	Definition and explanation of terms is required in the questionnaire
Extent of wide-ranging mitigation eg 'all lines in a National Park' is difficult for respondents to value	Need to explain the levels of 'extent' variable in concrete terms (number of miles)

Accent

slide 30

Conclusion → Implication

Mitigation in different types of landscapes

The response to before and after pictures of the pylons was strongly influenced by the qualities of the individual pictures (eg type of landscape, angle and view)	Recommend that images of pylons are **not** used in the SP as they inevitably introduce bias – use careful descriptions instead
Different response to pylons in different types of landscapes eg farmland, near water	Test priorities for mitigation in different types of landscape to provide extra information to National Grid when planning mitigation about which landscape types are priorities to consumers – outside of the SP

Accent

slide 31

Conclusion → Implication

Method of mitigation

Undergrounding seen as 'best' solution to improving visual impact	'Top level' of any 'type of mitigation' variable
Screening, rerouting, undergrounding distribution infrastructure are challenging to communicate	Include detailed descriptions in the questionnaire to communicate the implications of each method
Undergrounding distribution infrastructure instead makes little sense to respondents	Exclude from the stated preference
T pylon is liked, many are aware of it, but not all have a clear image of them	Use visual material to communicate what the pylon looks like

Accent

slide 32

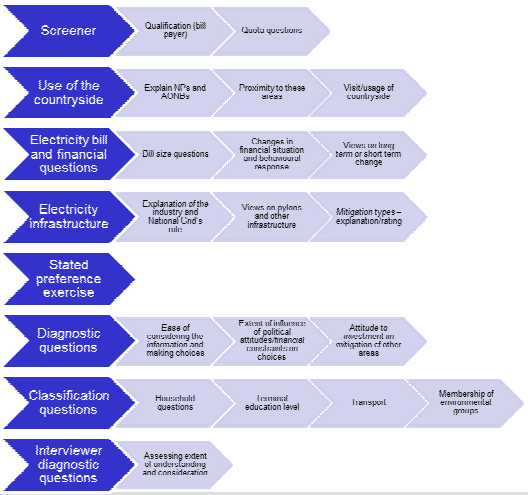
Conclusion → Implication

Payment

Acceptance that, if payment made, everyone should pay via bill towards mitigation	Suggests financial variable using additions to electricity bill will be workable
WTP amounts ranged from £5 to £50 per year	Gives indication of range for financial variable, though lower values are appropriate as these are only from those who are WTP
Consumers find it confusing to think about increases stretching over a long period	Give context of the 8 year investment program for cost increases

Accent

Proposed questionnaire structure



Accent

slide 34

Stated Preference Exercise – Proposed Structure

- Context of the SP is to look only at realistic work program that could be achieved within the 8 year investment period
- Single exercise comprising 4 variables:
  - Location of mitigation work – type of area
  - Extent of mitigation
  - Method of mitigation
  - Cost to bill payer

Accent slide 35

Proposed variables and levels

Variable	Level 1	Level 2	Level 3	Level 4
Location	National Parks	AONBs	Rural areas outside of NPs/AONBs	
Extent of mitigation	5 miles	10 miles	20 miles	50 miles
Method	Undergrounding	Replacement with new T-pylons	Screening with trees	Rerouting
Bill	+£2 added to current annual bill for the duration of the work program	+£5	+£10	+£20

Accent

APPENDIX D

Quantitative Questionnaire

Consumers' WTP Research: Main Quantitative Questionnaire

Introduction

Good morning/afternoon/evening. My name is ..... and I am calling from a company called Accent. Accent is an independent market research company and we are carrying out research for National Grid looking at people's views on pylons and other infrastructure in the countryside.

Please can I speak to the person who is responsible, either solely or jointly, for paying your household's electricity bill?

As I say, we are carrying out research for National Grid looking at people's views on pylons and other infrastructure in the countryside. Do you think I could ask you some quick questions to check you are eligible to take part in the research?

Q1. Is your home connected to mains electricity?

Yes
No **THANK AND CLOSE**

Q2. Thinking about your main residence, do you pay for, or contribute to paying for, the electricity your household uses?

Yes – I pay for my household's electricity in full
Yes – I contribute to paying for my household's electricity
No – I do not contribute to paying for my household's electricity
Don't know

Q3. Still thinking about your main residence, do you have a role in deciding your household's supplier of **mains electricity**?

Yes – I am the sole decision-maker
Yes – I am a joint decision-maker
No – I do not contribute to the decision
Don't know

IF Q2 = 3 OR 4 AND Q3 = 3 OR 4 ASK TO SPEAK TO PERSON RESPONSIBLE FOR PAYING OR CONTRIBUTING TO PAYING THE ELECTRICITY BILL AND REPEAT INTRO. IF NOT AVAILABLE THANK AND CLOSE

Q4. Which region do you live in?

East Midlands
East
London
North East
North West
South East
South West
West Midlands
Yorkshire & Humberside
Scotland
Wales

CHECK QUOTAS

Q5. Would you describe where you live (ie in your main residence) as …?

Urban (ie population over 10,000)
Rural – Town and Fringe
Rural – Village)
Rural – Hamlet & Isolated Dwelling
CHECK QUOTAS

Q6. Record gender

Male
Female
CHECK QUOTAS

Q7. Which age band do you fall into?

16 to 17
18 to 24
25 to 34
35 to 44
45 to 54
55 to 64
65 to 74
75+
CHECK QUOTAS

Q8. Which of the following best describes your current working status?

Working full time - working 30 hours per week or more
Working part time - working between 8 and 29 hours per week
Full time student
Not working but seeking work or temporarily unemployed or sick
Not working and not seeking work
Retired on a state pension only
Retired with a private pension
House person, housewife, househusband, full-time carer etc
Other (please specify)

Q9. What is the occupation of the chief income earner in your household? This could be you: the Chief Income Earner is the person in your household with the largest income.

IF RETIRED, WITH A COMPANY OR PRIVATE PENSION, OR OTHER PRIVATE MEANS, PLEASE THEN ANSWER BASED ON THAT PERSON'S PREVIOUS OCCUPATION THEN CODE FOR SEG.

CHECK QUOTAS

Thank you, you are eligible to take part in the research. I would be very grateful if you could spare around 20 minutes to run through some questions with me. You do need to have some materials in front of you which I can email to you right now so we can continue with the interview.

Interviewer: completing the interview in real time must be your preferred option at all times

1. email now **SEND EMAIL THEN AND PROCEED**
2. cannot continue with interview now **SEND EMAIL THEN BRING UP APPOINTMENT BOX**
3. do not have access to email **BRING UP APPOINTMENT/ADDRESS BOX**
4. no **ATTEMPT TO REASSURE & PERSUADE; IF STILL NO, THANK & CLOSE**

Introduction to Main Survey

Thank you very much for agreeing to take part in this survey. We are conducting research for National Grid looking at household consumers' views on the visual impact of electricity infrastructure on the landscape. By 'electricity infrastructure' we mean overhead lines, pylons and substations.

The questionnaire will take around 20 minutes. Any answer you give will be treated in confidence in accordance with the Code of Conduct of the Market Research Society. You do not have to answer questions you do not wish to and you can terminate the interview at any point.

When answering these questions, please think about the property that you consider to be your main residence.

Can I check you have your materials ready to refer to? These will have either been sent in the post or by email. And what is the reference number on the materials? **INTERVIEWER: CHECK THE NUMBER IS CORRECT AND PROCEED OR RE-SCHEDULE AS APPROPRIATE.**

1 Correct – **PROCEED**
2 Incorrect – **GO TO APPOINTMENTS SCREEN AND RE-SCHEDULE, RE-SENDING MATERIALS**

Landscapes

I would like to talk to you first about the countryside. As you may already know, there are a number of protected landscapes in the UK. We will be referring to Areas of Outstanding Natural Beauty (AONBs) in England and Wales, to National Scenic Areas (NSAs) in Scotland, and to National Parks in England, Scotland and Wales. We have sent you some information on these; please look at this [**Showcard A**] now.

Q10. Do you live in or near an Area of Outstanding Natural Beauty (AONB) or a National Scenic Area (NSA)? By near, we mean no more than an hour's drive.

Yes, live in an AONB or NSA
Yes, live near an AONB or NSA
No
Don't know

Q11. Do you live in or near a National Park? By near, we mean no more than an hour's drive.

Yes, live in a National Park
Yes, live near a National Park
No
Don't know

LOGIC CHECK: Q10 and Q11 cannot both = 1

Q12. **IF Q10 = 1, GO TO Q13.** How often do you visit an Area of Outstanding Natural Beauty or a National Scenic Area? Would you say you visit an Area of Outstanding Natural Beauty or a National Scenic Area…

Every day
At least once a week
At least once a fortnight
At least once a month
At least three or four times a year
At least once or twice a year
Hardly ever
Never
Don't know

Q13. **IF Q11 = 1, GO TO Q14.** How often do you visit a National Park? Would you say you visit a National Park …

Every day
At least once a week
At least once a fortnight
At least once a month
At least three or four times a year
At least once or twice a year
Hardly ever
Never
Don't know

Q14. **IF Q5 = 3 OR 4, GO TO Q15**: And how often do you visit other rural areas? Would you say you visit them…

Every day
At least once a week
At least once a fortnight
At least once a month
At least three or four times a year
At least once or twice a year
Hardly ever
Never

Q15. **IF Q10 = 1 OR IF Q12 = 7 OR 8 OR 9, EXCLUDE AONB/NSA**
IF Q11 = 1 OR IF Q13 = 7 OR 8 OR 9, EXCLUDE NATIONAL PARK;
IF Q14 = 7 OR 8, EXCLUDE OTHER RURAL AREAS .
What activities do you do when you visit an AONB/NSA, a National Park or other rural areas? (**Do not read out; multi**)

AONB or NSA
National Park
Other rural areas

Work
Holiday
Visit family/friends
Visit specific places of interest
Drive
Cycle/run/walk

Other (please specify)

Electricity Bill

Q16. Thinking now about your electricity bill, how does your household pay for its electricity?

Direct Debit
Standing Order
Credit or Debit Card
Payment card (a swipe card which allows you to pay your bill at a Post Office or PayPoint outlet. This is NOT the same as the card used for some prepayment meters)
Prepayment meter (that is, through a card, key or token)
Other (please specify)

Q17. Do you currently pay your electricity bill …

…weekly
…monthly
…quarterly (every three months)
…every six months
…annually
…other
…don't know

Q18. How much is your electricity bill? You can say how much a week, a month, a quarter, half a year or a year – whichever is easiest for you. If you're not sure, please give your best estimate. If you have dual fuel, please deduct the amount you pay for gas.

£ per week
£ per month
£ per quarter
£ per six months
£ per year
Don't know

Q19. Please say if that is an estimate or not.

Estimate
Exact amount

Q20. **IF Q18 = 5, GO TO Q23. IF Q18 = 6, GO TO Q21.** That would make your annual electricity bill £##. Does that seem right to you?

Yes
No

Q21. **IF Q20 = 1, GO TOQ23.**The average electricity bill is currently £424 pa. Does that seem about right for you?

Yes
No

Q22. **IF Q21 = 1, GO TO Q23.** What would be a more accurate figure for your annual electricity bill?

£…..

Household Bills

Q23. Thinking now about your household bills over the past two years, for each of the following, would you say they have…

1 increased dramatically
2 increased quite a bit
3 increased a little
4 stayed the same
5 dropped
6 not applicable

a food
b petrol/diesel
c gas
d electricity

Q24. Removed after pilot

Q25. Removed after pilot

Q26. Removed after pilot

Q27. And which of the following statements most closely describes your situation?

a my household income has gone down in the past two years
b my household income has stayed the same in the past two years
c my household income has increased a little in the past two years, but not in line with price increases
d my household income has increased in the past two years and has kept up with/grown faster than price increases

LOGIC CHECK; CANNOT ANSWER D = 4 OR 5 AND A, B OR C = 4 OR 5

Q28. **IF Q27 = 2 GO TO INTRO2.** And thinking about how long all these changes are likely to last, which of the following statements best describes your opinion?

1 I think they are short term, likely to last no longer than a year
2 I think they are likely to last 1 to 2 years
3 I think they are likely to last 2-5 years
4 I think they are likely to last longer than 5 years

INTRO2

I'm going to ask you now to consider the transmission infrastructure. We have sent you an illustration of how the electricity supply chain works so please have a quick look at it (**Showcard B**). Throughout this interview, I want you to focus on **transmission**, that is, transmitting high voltage electricity using large pylons, overhead lines and substations, all run by National Grid (in England and Wales) and Scottish Power and SHETL (in Scotland). As you will see from **Showcard C**, 4% of your electricity bill goes towards the cost of transmission.

The interview does not concern distribution infrastructure – that is, the smaller pylons and wooden poles (that look like telegraph poles) that carry the electricity to customers.

Q29. How strongly do you agree or disagree with the following statements regarding the visual impact of electricity transmission infrastructure (that is the largest pylons, overhead power lines and substations) on the countryside? Please use a scale of 1 to 5, where 1 equals strongly disagree and 5 = strongly agree.

1 strongly disagree
2 disagree
3 neither agree nor disagree
4 agree
5 strongly agree

a It is necessary and unavoidable
b It is ugly and an eyesore
c I don't feel strongly about it
d I really don't notice it
e It is industrial architecture/heritage

Q30. **(Interviewer: refer respondent to Showcard D and read out…)**

There are currently 4,440 miles of overhead electricity transmission lines and pylons in England and Wales:

119 miles in National Parks
257 miles in Areas of Outstanding Natural Beauty
4,064 miles in other areas

There are a number of ways the transmission companies could lessen the visual impact of this existing transmission infrastructure on the landscape. One way would be to put some of the lines **underground**. Undergrounding involves large-scale engineering projects although, in time, the land will 'green' over.

They could also plant more trees to **screen** substations, and screen pylons and transmission lines from particular vantage points or beauty spots.

Another way would be to **reroute** some of the transmission infrastructure, with new routes being chosen in consultation with local communities and other stakeholder groups.

Or they could replace some of the transmission pylons with the new pylon, known as the **T-pylon**. The T-pylon is some two thirds the height of a transmission pylon but there may have to be more of them.

So, of these four, which would be your preferred means of lessening the visual impact of **existing** transmission infrastructure on the countryside?

1st
2nd
3rd
4th

Undergrounding
Screening with trees
Rerouting
Replace existing pylons with T Pylon

Stated Preference

As we have just discussed, various ways of lessening the visual impact of existing transmission infrastructure are possible.

We are now going to look at some options for work that could be done over the next 8 years.

The options vary regarding what can be done and over what distance, in different parts of the countryside. The areas in which improvements can be made and the number of miles that could be covered would be agreed in close consultation with all stakeholders. For each, there would be an extra cost which would be passed on to all bill payers

You would pay the extra amount on your current annual bill and the increase will stay in place for the duration of the 8 year work programme.

You will see four options at a time and, for each set of four, we want to know which you would prefer.

Your choices are important and will help National Grid and Scottish Power to determine whether or not to invest in lessening the visual impact of existing transmission infrastructure and in what way.

Remember, your bill currently is £xxx. Your bill might rise anyway because of inflation, because of other investments made in either the transmission or other parts of the network or because of other developments in the electricity market.

Please consider the choices presented from the perspective of your own household only and remember all your other household outgoings.

SP GAME

Q32. Thinking about the different types of countryside where there are currently transmission pylons, please look at **Showcard E** and say which of these countryside types would be your **first choice** for lessening the visual impact of the infrastructure? And which would be your **second**? And which would be your **third**?

1st
2nd
3rd

a farmland
b open countryside
c rolling countryside
d hills
e near farm houses
f near houses
g near water
h moors
i coastal areas

Diagnostic questions

Q33. I would now like to ask you a few questions about the choices you have just made. First, how easy did you find it to visualise the transmission infrastructure we were asking you about?

Very difficult
Difficult
Neither easy not difficult
Easy
Very easy

Q34. **IF Q33 = 3, 4 OR 5, GO TO Q35.** Why do you say that?

Q35. How easy did you find it to think about the different ways of lessening the visual impact of the transmission infrastructure that we presented to you?

Very difficult
Difficult
Neither easy not difficult
Easy
Very easy

Q36. **IF Q35 = 3, 4 OR 5, GO TO Q37**… Why do you say that?

Q37. How easy did you find it to make the choices about spending more money?

Very difficult
Difficult
Neither easy not difficult
Easy
Very easy

Q38. **IF Q37 = 3, 4 OR 5, GO TO Q39.** Why do you say that?

Q39. When you were thinking about your choices, to what extent did you consider the following?

Not at all
A little
Quite a bit
A great deal

Whether the propositions would benefit the country as a whole
Whether the propositions would benefit your local community
Whether the propositions would have a negative impact on your personal financial situation
Whether the propositions would have a benefit for the future

Q40. Please say how strongly you agree or disagree with the following statements. Please use a scale of 1 to 5 where 1 equals strongly disagree and 5 equals strongly agree.

1 strongly disagree
2 disagree
3 neither agree nor disagree
4 agree
5 strongly agree

a I do not think the countryside would be improved by lessening the visual impact of the transmission infrastructure
b I do not think it is a good use of money at this time to lessen the visual impact of the transmission infrastructure on the countryside
c I would find it difficult to pay any more on my electricity bill
d I think there is a need to lessen the visual impact of existing transmission structure on the countryside
e I think it is fair that customers should be asked to pay for these improvements

Q41. National Grid and Scottish Power will have to put in place more infrastructure over the next 8 years to connect new sources of electricity. This will be done in close consultation with local communities and other stakeholders. In terms of lessening the visual impact of transmission infrastructure, do you think National Grid/Scottish Power should prioritise …

a … **existing** infrastructure in protected areas

b … **existing infrastructure in protected areas** but only when it comes to the end of its natural life and needs replacing

c … **future** infrastructure

d … all **existing** infrastructure in protected areas and **future** infrastructure equally

e … **existing** infrastructure in protected areas, when it needs replacing, and future infrastructure

Q41a There are other areas of infrastructure in the UK where investment could be made. How important do you consider investment in each of these areas to be? Please use a scale of 1 to 5, where 1 equals not at all important and 5 equals very important.

1 not at all important
2 not important
3 neither important nor unimportant
4 important
5 very important

a Investment in renewable energy sources
b Investment in high speed rail links
c Investment in cleaning of rivers and other waterways
d Investment in building more roads
e Investment in making homes more energy efficient

Classification Questions

Q42. The following questions are for classification only, and to help us with our analysis.

First, thinking about your home, that is, your main place of residence, which of the following best applies to you?

Please remember that transmission lines are the high voltage power lines carried on the biggest pylons.

I can see transmission lines and pylons from my house, and they are nearby
I can see transmission lines and pylons from my house, but only in the distance
I can see transmission lines and pylons from my neighbourhood, and they are nearby
I can see transmission lines and pylons from my neighbourhood, but only in the distance
I can't see any transmission lines and pylons from where I live
Don't know

Q43. Which of the following fuel sources do you in your home for…

	Cooking	Heating	Lighting
Mains electricity			
Another form of electricity			
Oil			
Mains gas			
Another form of gas eg LPG			
None of these			

Cooking
Heating
Lighting

Mains electricity
Another form of electricity
Oil
Mains gas
Another form of gas, e.g. LPG
None of these

Q44. Do you generate your own electricity using any of the following methods?

Solar panels
Heat pump
Wind turbine
Other (please specify)
None of these

Q45. Do you spend 10% or more of your total household income each year on the energy you use? Please consider both gas and electricity, and any other form of energy you use in your home.

Yes, 10% or more
No, less than 10%
Don't know

Q46. Is the house or flat in which you live...?

Owned outright - without mortgage
Owned with a mortgage or loan
Rented from the council
Rented from a housing association
Rented from someone else
Rent free

Q47. What is the highest educational level that you have achieved to date?

Secondary school, high school, NVQ levels 1 to 3, etc.
University degree or equivalent professional qualification, NVQ level 4, etc.
Higher university degree, doctorate, MBA, NVQ level 5, etc.
Still in full time education
Don't know
Prefer not to answer

Q48. Deleted after pilot

Q49. Deleted after pilot

Q50. To which of the following ethnic groups do you consider you belong?

White
Mixed
Asian
Black
Chinese
Other ethnic group
Prefer not to answer

Q51. How many adults aged 18 or over including yourself, are there in your household?

1
2
3
4
5
1 or more

Q52. How many children, aged 17 or under are there in your household for the following age groups?

None
1
2
3
4 or more
Prefer not to say

children aged under 5 years old
children aged 5 to 10 years old
children aged 11 to 15 years old
children aged 16 to 17 years old

Q53. Are you a member of any of the following?

National Trust
National Trust for Scotland
English Heritage
RSPB
Wildfowl and Wetlands Trust
The Woodland Trust
Campaign to Protect Rural England
Campaign for National Parks
Friends of the Earth
Greenpeace
Ramblers Association

Any other environmental interest group (specify)

Q54. What is your total household income before deductions?

Up to £5000
£5, 001 - £10,000
£10,001-£15,000
£15,001-£20,000
£20,001-£30,000
£30,001-£40,000
£40,001-£50,000
£50,001-£60,000
£60,001-£70,000
£70,001-£80,000
More than £80,000

Prefer not to say

Thank you

MRS Code of Conduct text etc

Interviewer questions

Q55. In your opinion, did the respondent understand what he/she was being asked to do in the questions?

Did not understand at all
Did not understand very much
Understood a little
Understood a great deal
Understood completely

Q56. Which of the following best describes the amount of thought the respondent put into responding?

Gave the questions no consideration
Gave the questions little consideration
Gave the questions some consideration
Gave the questions careful consideration
Gave the questions very careful consideration

Q57. Which of the following best describes the degree of fatigue shown by the respondent?

Lost concentration in the later stages
Lessened concentration in the later stages
Maintained concentration with a deal of effort throughout the survey
Maintained concentration with some effort throughout the survey
Easily maintained concentration throughout the survey

CLOSE

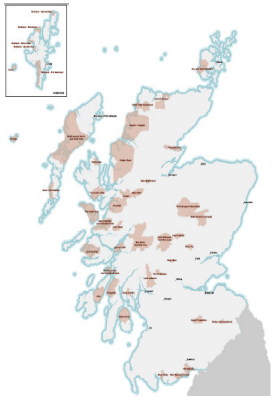
APPENDIX E

Quantitative Show Material

SHOWCARD A: DESIGNATED LANDSCAPES

Areas of Outstanding Natural Beauty (AONBs)

An Area of Outstanding Natural Beauty is a landscape that is protected because of its distinctive character and outstanding natural beauty. There are 38 of these areas in England & Wales, including areas such as the Cotswolds, the Mendip Hills and the North Pennines.



National Scenic Areas (NSAs)

A National Scenic Area represents the best areas of the type of scenic beauty popularly associated with Scotland. There are 40 NSAs mainly in the more remote and mountainous areas of Scotland, including Ben Nevis, Glen Coe, Jura and North Arran.

National Parks

A National Park is an area protected because of its scenic value, wildlife or cultural heritage. There are 13 National Parks in England & Wales, including the Lake District and Snowdonia and two in Scotland (Loch Lomond and The Trossachs, and the Cairngorms).

SHOWCARD B: ELECTRICITY SUPPLY CHAIN (we are talking about electricity transmission only)

Electricity Generators
generators of electricity, eg Powergen, British Energy

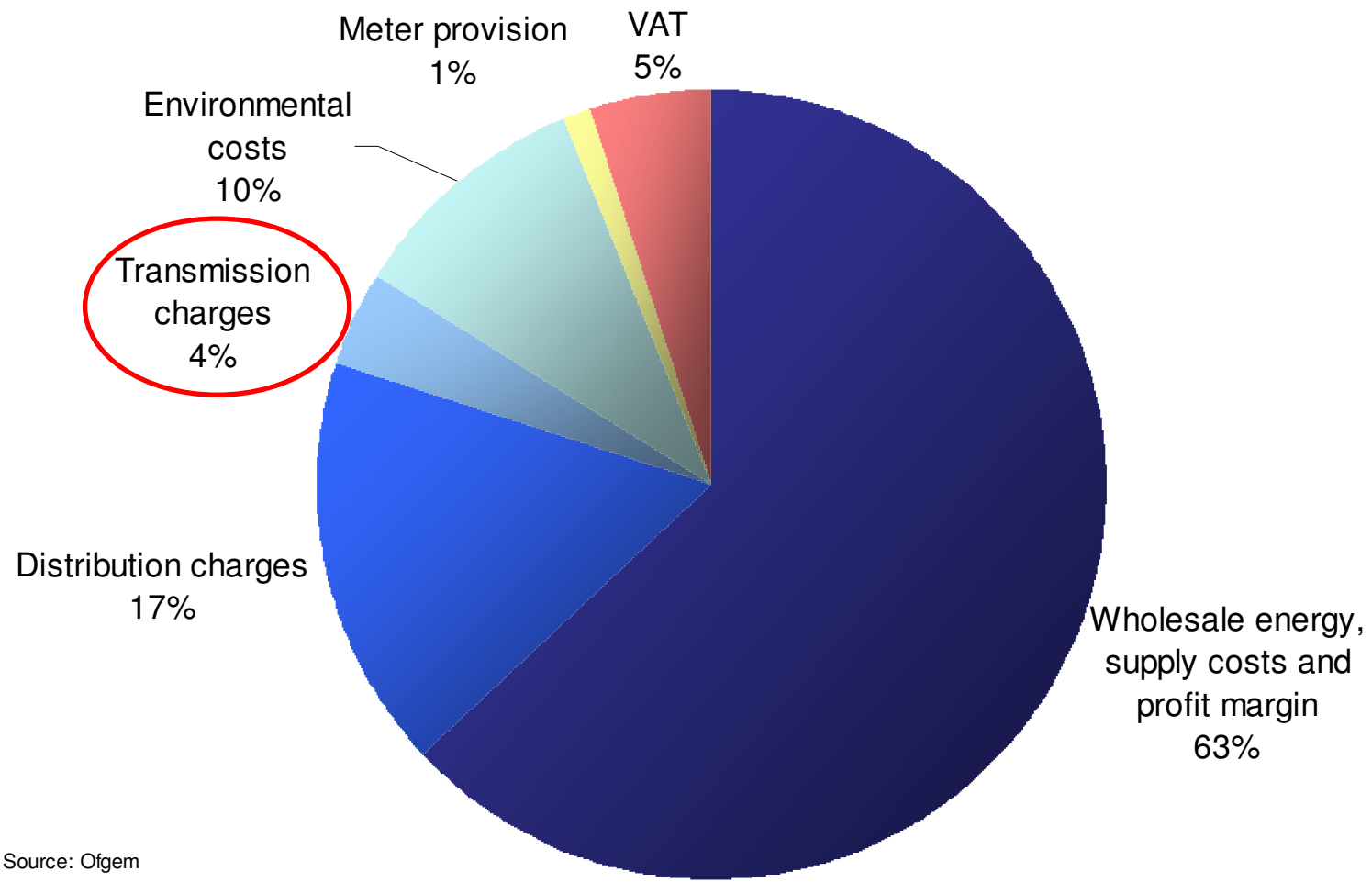
National Grid (England & Wales), Scottish Power & SHETL (Scotland)
operates the pylons and wires for transmitting electricity at high voltage

Electricity Distribution Businesses (DNOs)
operate the low voltage regional electricity distribution networks

Suppliers
supply electricity to your household and bill you

Customers
large and small business customers and domestic customers

SHOWCARD C: BREAKDOWN OF ELECTRICITY BILL



Source: Ofgem

SHOWCARD D: WAYS TO LESSEN THE VISUAL IMPACT OF ELECTRICITY TRANSMISSION INFRASTRUCTURE ON THE COUNTRYSIDE

There are currently 4,440 miles of overhead electricity transmission lines and pylons in England and Wales:

- 119 miles in National Parks
- 257 miles in Areas of Outstanding Natural Beauty
- 4,064 miles in other areas

There are a number of ways the transmission companies could lessen the visual impact of this existing transmission infrastructure on the landscape.

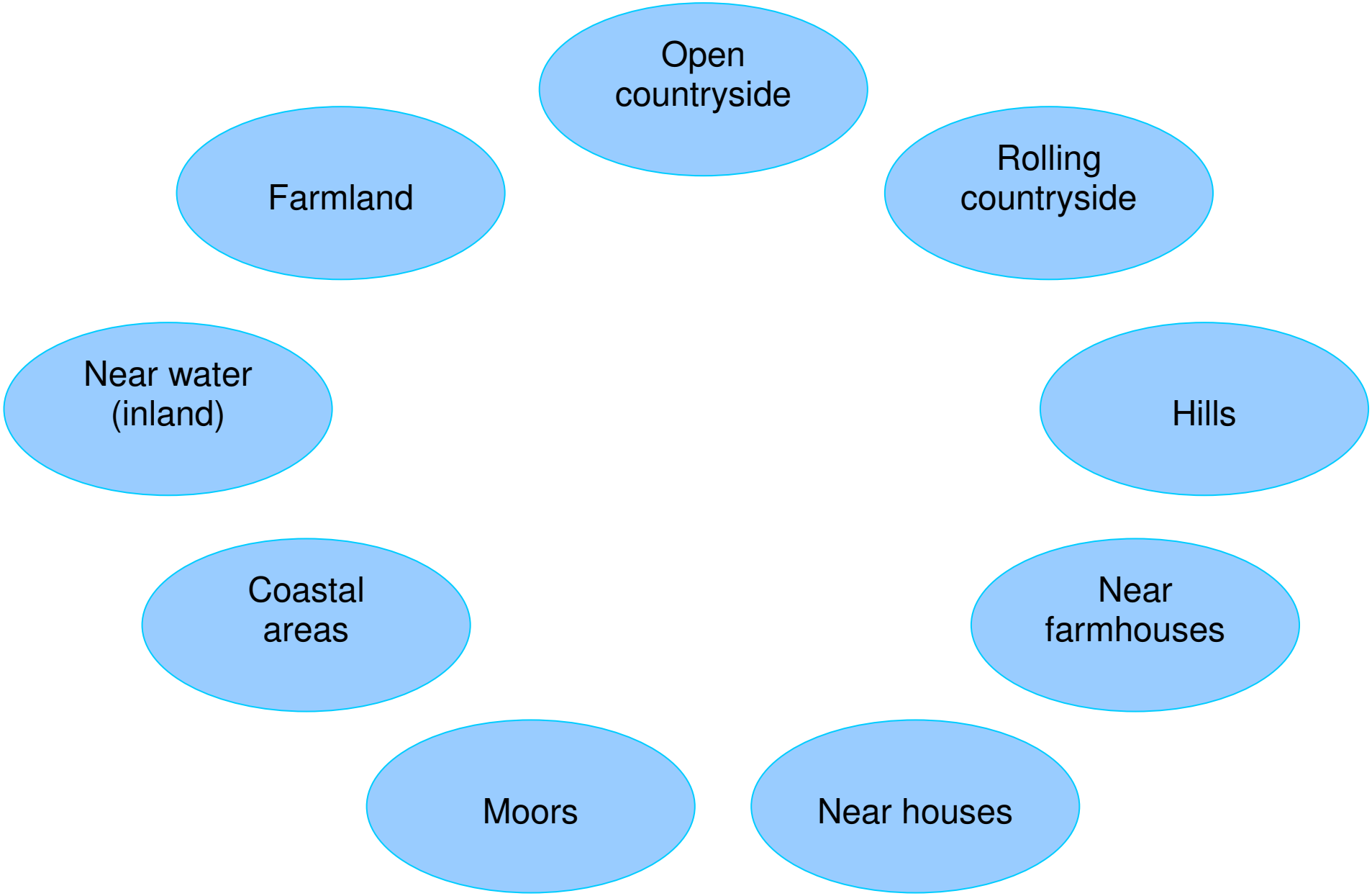
One way would be to put some of the lines **underground**. Undergrounding involves large-scale engineering projects although, in time, the land will 'green' over.

They could also plant more trees to **screen** substations, and screen pylons and transmission lines from particular vantage points or beauty spots.

Another way would be to **reroute** some of the transmission infrastructure, with new routes being chosen in consultation with local communities and other stakeholder groups.

Or they could replace some of the transmission pylons with the new pylon, known as the **T-pylon** (see artist's impression, right). The T-pylon is some two thirds the height of a transmission pylon but there may have to be more of them.

SHOWCARD E: LANDSCAPE TYPES



Example Stated Preference Exercise

Please look at Choice Card 2

	Option A	Option B	Option C	Option D
Location of Work	Areas of Outstanding Natural Beauty /National Scenic Areas	Other rural areas	Leave as now	National Parks
Number of miles covered	50 miles	5 miles	Zero	10 miles
Measure	Undergrounding	Screening with trees	None	Rerouting
Cost	£20 added to your current annual bill, to stay in place for the duration of the work programme	£10 added to your current annual bill, to stay in place for the duration of the work programme	Zero	£2 added to your current annual bill, to stay in place for the duration of the work programme

From the 4 scenarios given, which option do you prefer?

○ 1. Best ○ 2. Best ○ 3. Best ○ 4. Best

Which option is your least preferred?

○ 1. Worst ○ 2. Worst ○ 3. Worst ○ 4. Worst

And of the two remaining options, which do you prefer?

○ 1. Second ○ 2. Second ○ 3. Second ○ 4. Second

APPENDIX F

Quantitative Respondent Profile

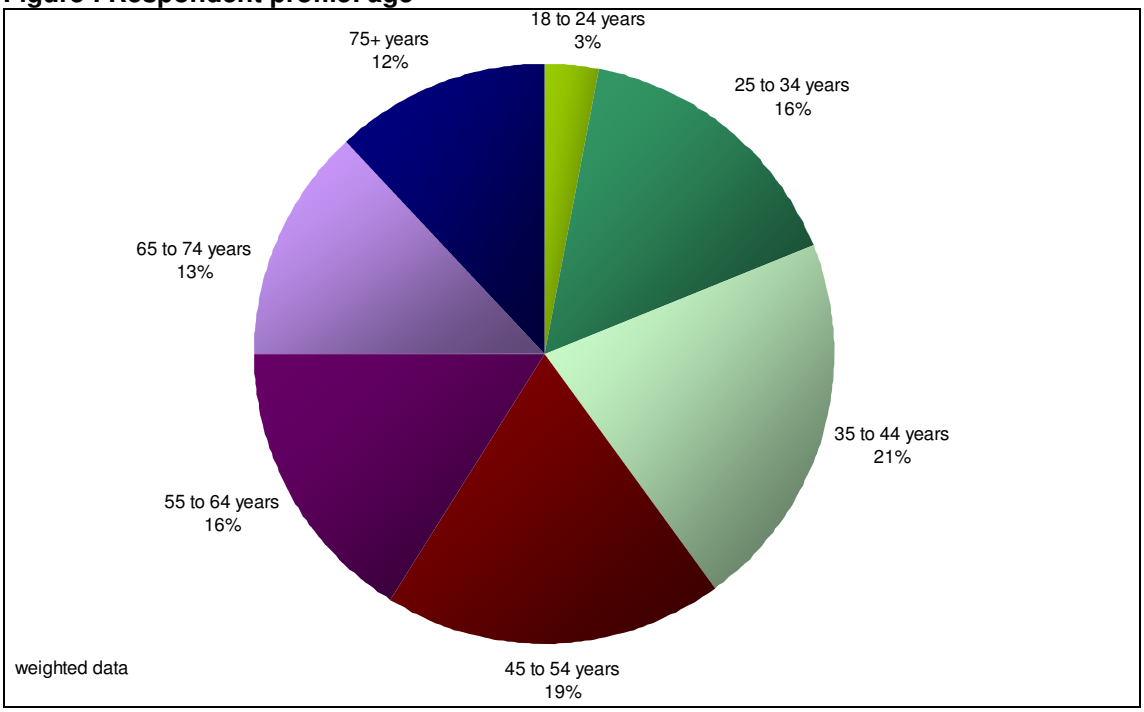
RESPONDENT PROFILE

Socio-Demographics

As has been detailed in Section 2.3 of the report, the quantitative data was weighted to ensure national representation in terms of age, gender, socio economic grade, urban/rural location, and region.

Respondent profile by age (weighted) is shown in Figure below.

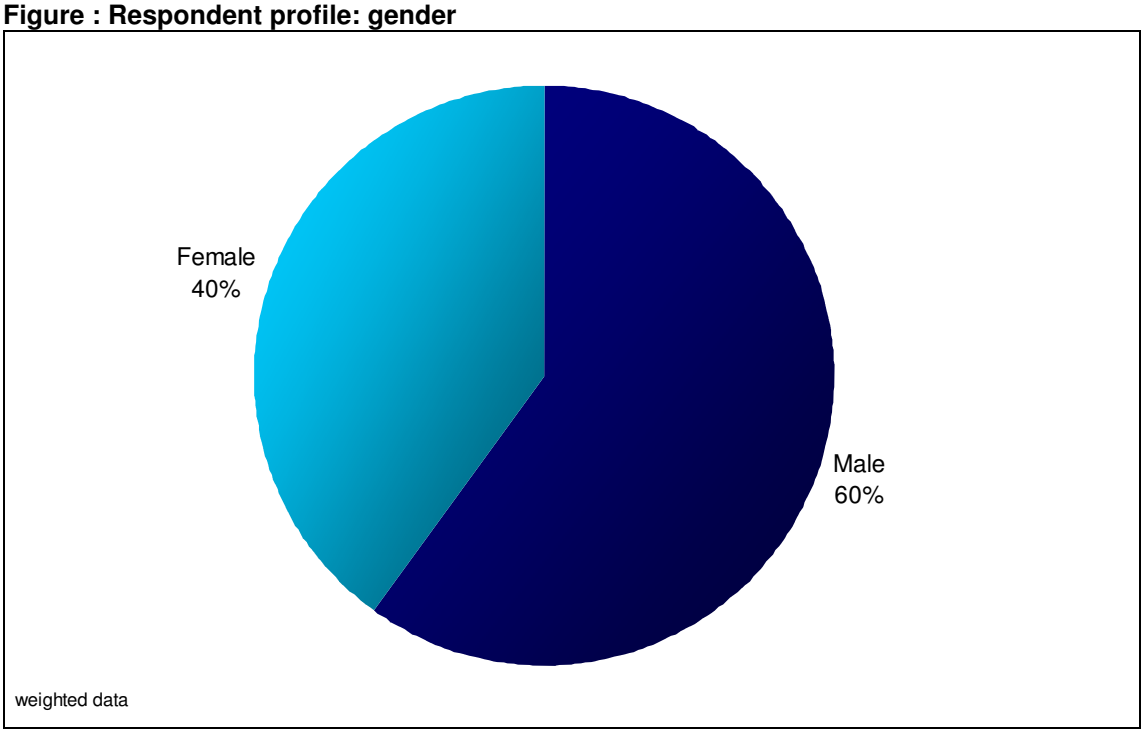
Figure : Respondent profile: age



Base: 1002

Respondent profile by gender (weighted) is shown in Figure below.

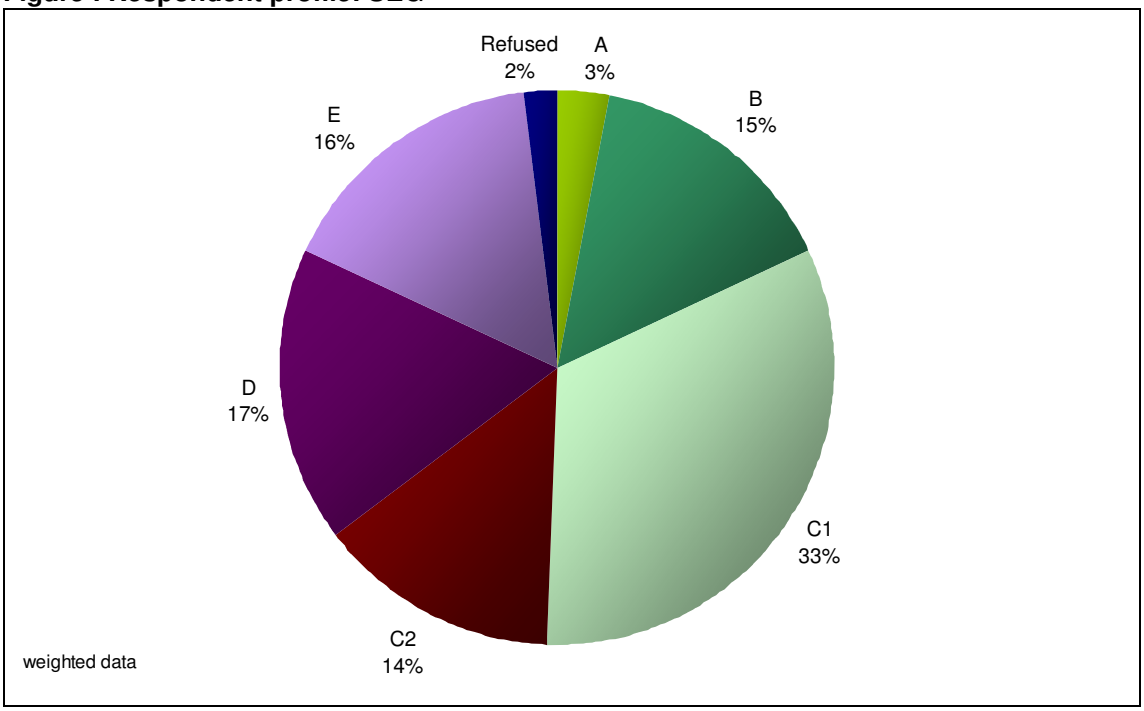
Figure : Respondent profile: gender



Base: 1002

Respondent profile by SEG (weighted) is shown in Figure below.

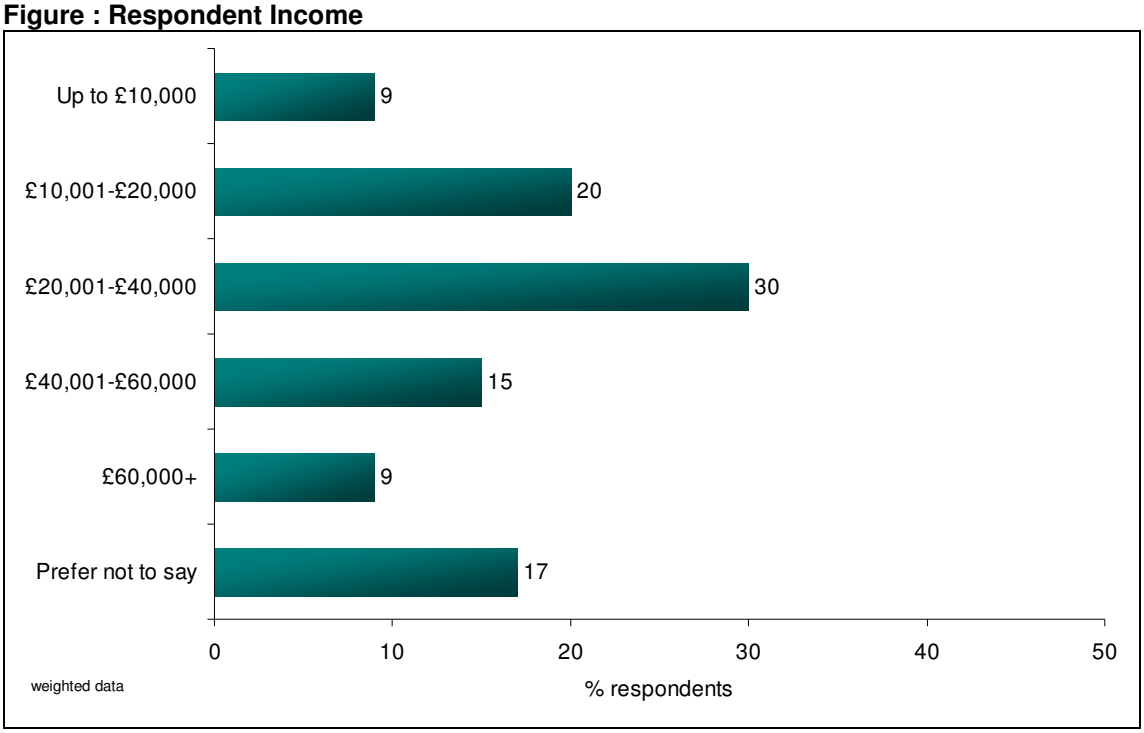
Figure : Respondent profile: SEG



Base: 1002

Respondent total household incomes (before deductions) ranged from less than £5,000 (3%) to over £80,000 pa (4%). Banded income levels are shown in Figure .

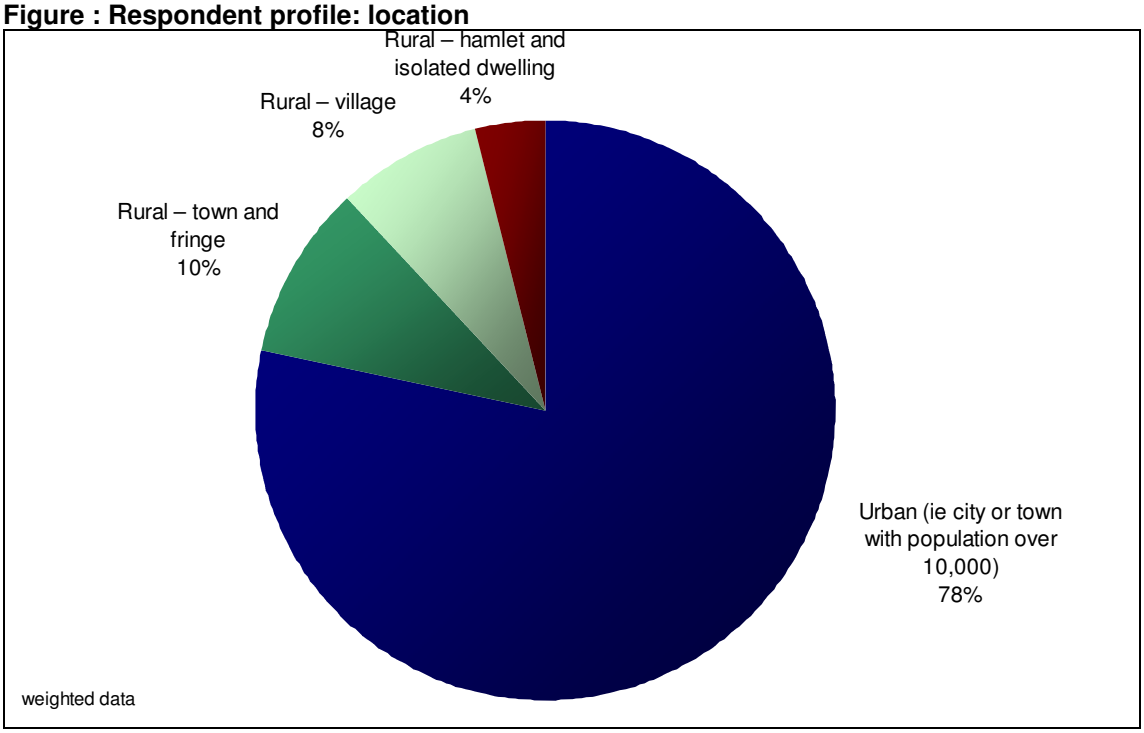
Figure : Respondent Income



Base: 1002

Respondent profile by location (weighted) is shown in Figure below.

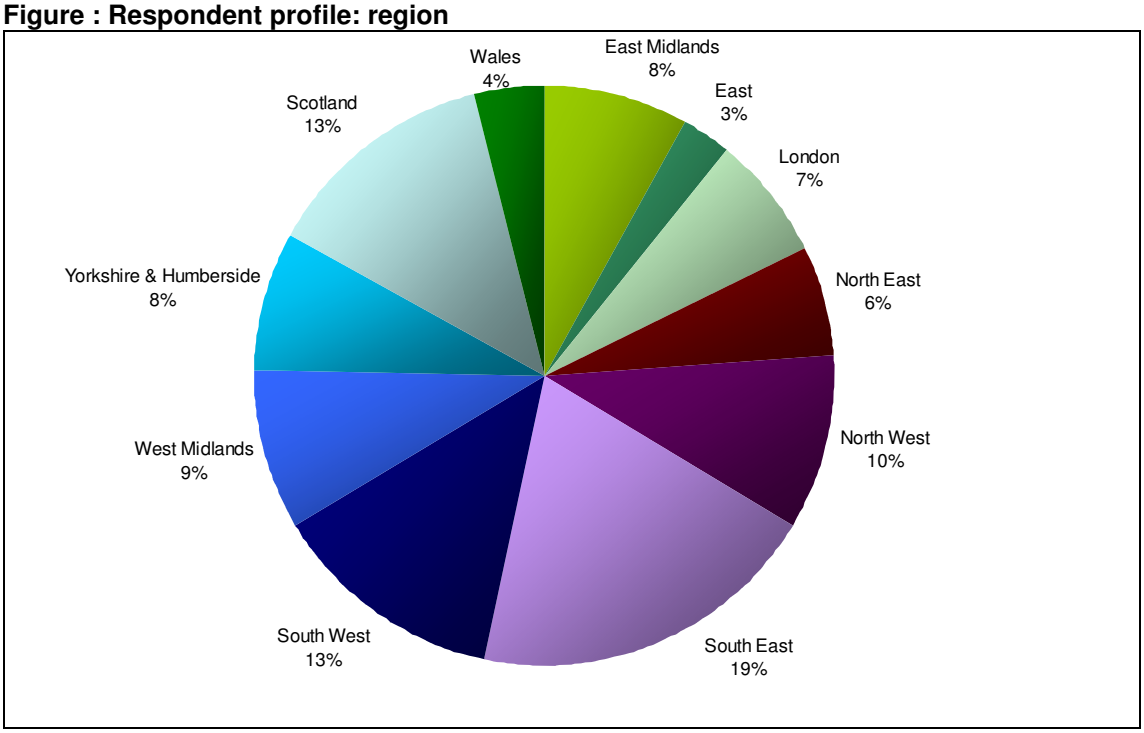
Figure : Respondent profile: location



Base: 1002

The respondent base comprised customers across England (86%), Scotland (13%) and Wales (4%). Respondent profile by detailed region (weighted) is shown in Figure .

Figure : Respondent profile: region

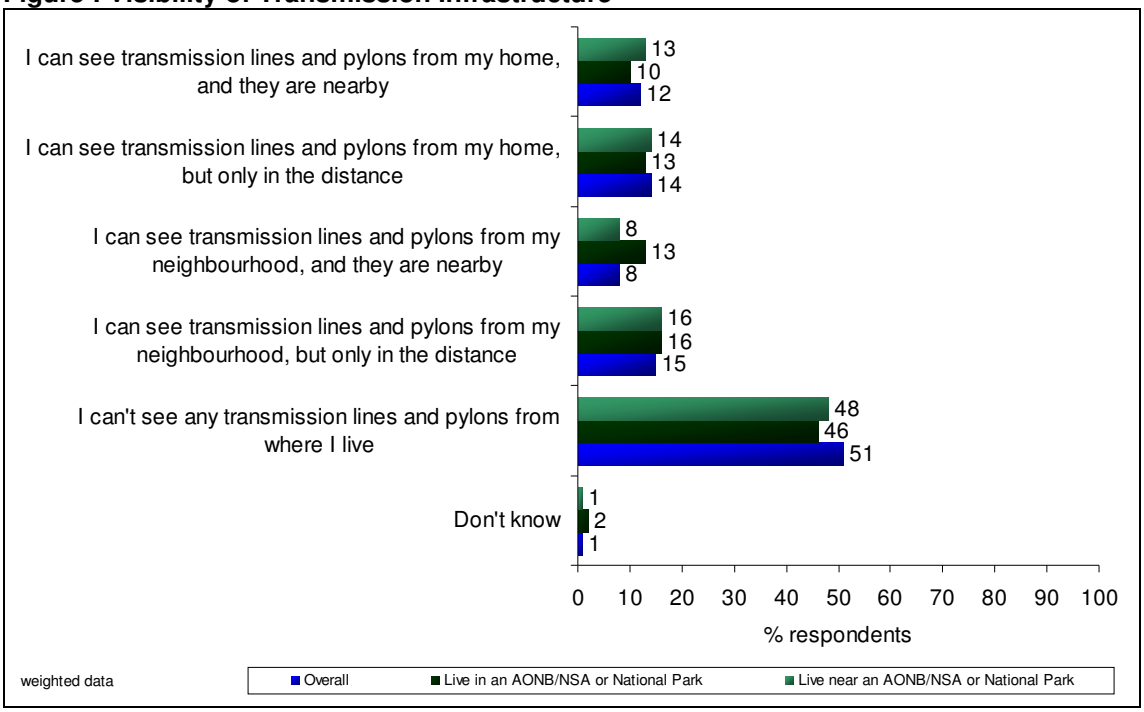


Base: 1002

Visibility of Transmission Infrastructure from Home

Half (51%) of respondents cannot see any transmission infrastructure from their home.

Figure : Visibility of Transmission Infrastructure

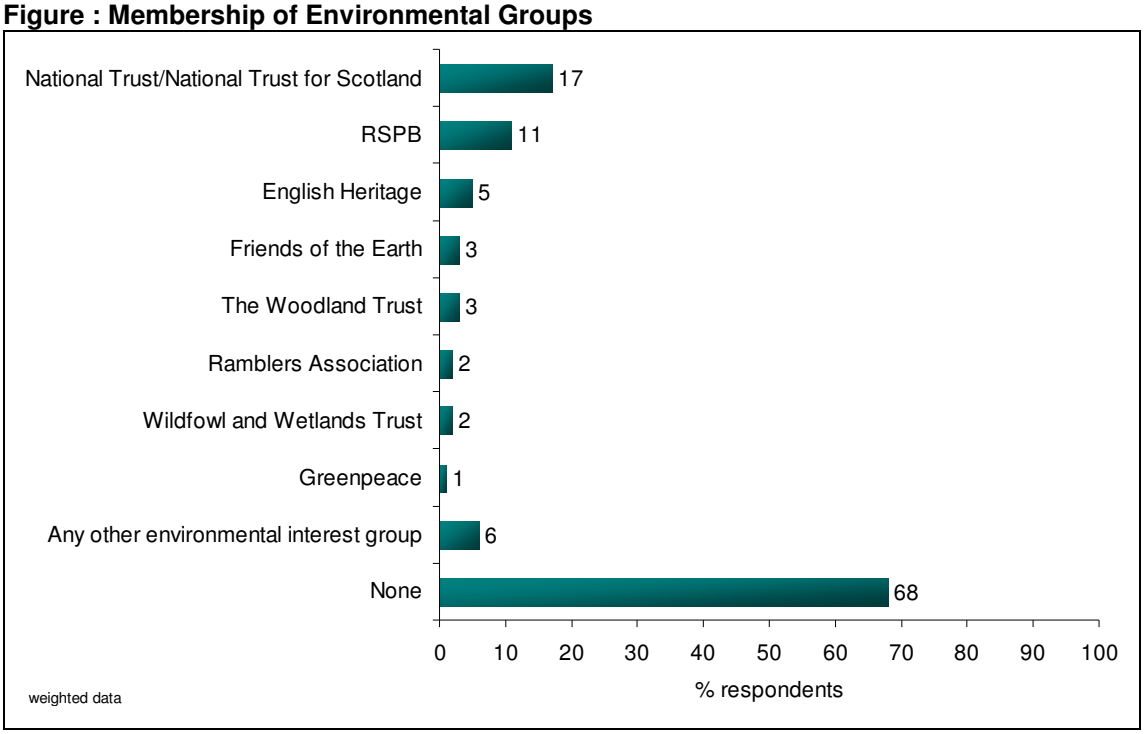


Base: 1002

Membership of Environmental Organisations

Just over two thirds (68%) of respondents do not belong to any environmental group. Among those that do, most (17%) belong to the National Trust or National Trust for Scotland. A further 11% belong to the RSPB.

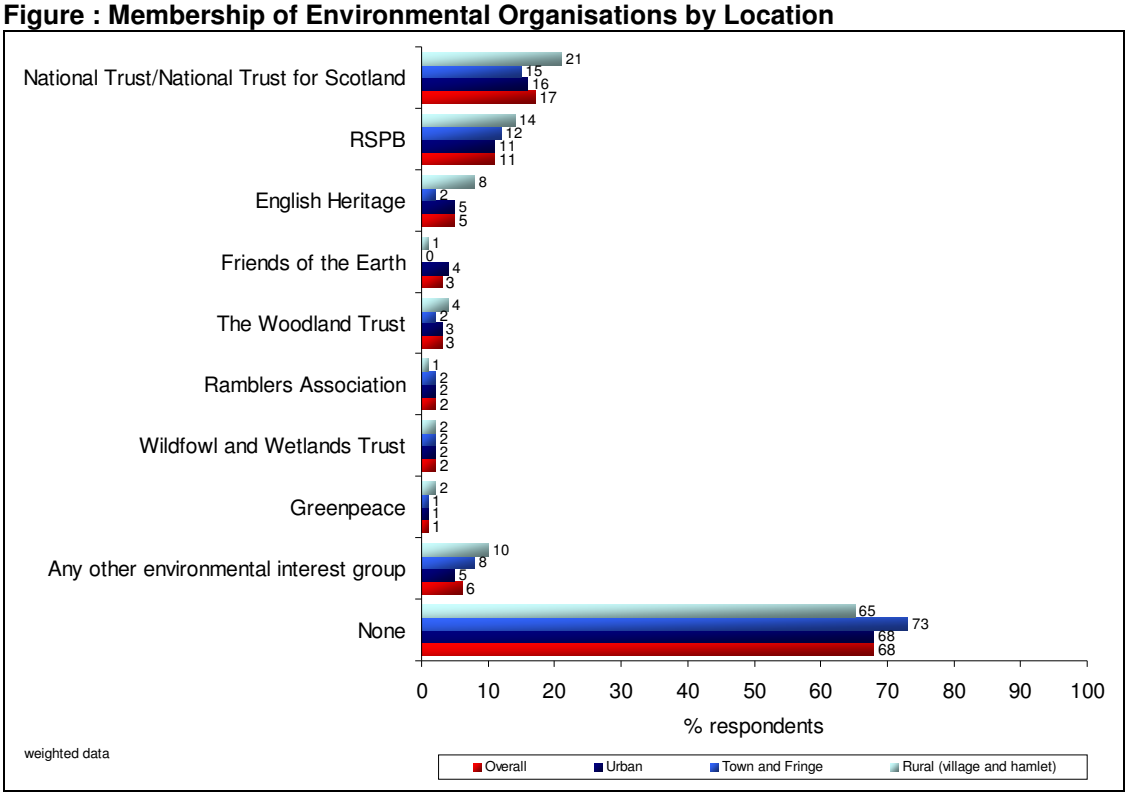
Figure : Membership of Environmental Groups



Base: 1002

Respondents living in rural areas are slightly more likely to belong to the National Trust or National Trust for Scotland than those living in urban areas (21% *cf* 16%). They are also slightly more likely to belong to the RSPB (14% *cf* 11%) but, as Figure shows, there is little different in membership levels by location.

Figure : Membership of Environmental Organisations by Location



Base: 1002

Respondent Diagnostic Questions

Respondents were asked a number of questions to determine how easy they had found to complete the survey. The questions were:

- how easy did you find it to visualise the transmission infrastructure we were asking you about?
- how easy did you find it to think about the different ways of lessening the visual impact of the transmission infrastructure that we presented to you?
- how easy did you find it to make the choices about spending more money?

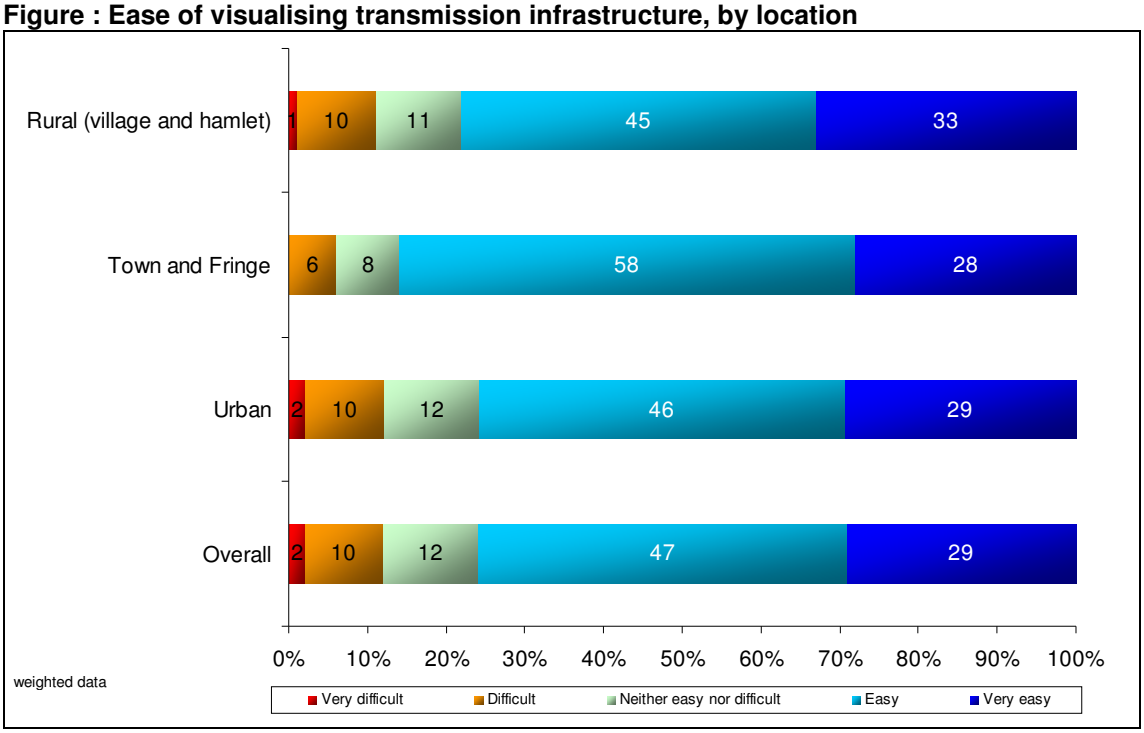
The majority (76%) say they found it easy to visualise the transmission infrastructure; this rises to 80% for the 55-64 year old age group (see Figure).

While 12% overall say they found it difficult to visualise the transmission infrastructure, 10% of those who visit an AONB/NSA or National Park at least once a month and 10% of those who visit another rural area at least once a month also found it difficult. In addition, 12% of those who live in and 11% of those who live near an AONB/NSA or National Park also found it difficult.

Respondents living in rural (town and fringe) areas found it easier than respondents in other locations to visualise the transmission infrastructure, with 86% saying it was easy, as Figure shows.

Respondents living in urban locations (75%) and respondents in rural (village and hamlet) locations (78%) also found it easy to visualise transmission infrastructure.

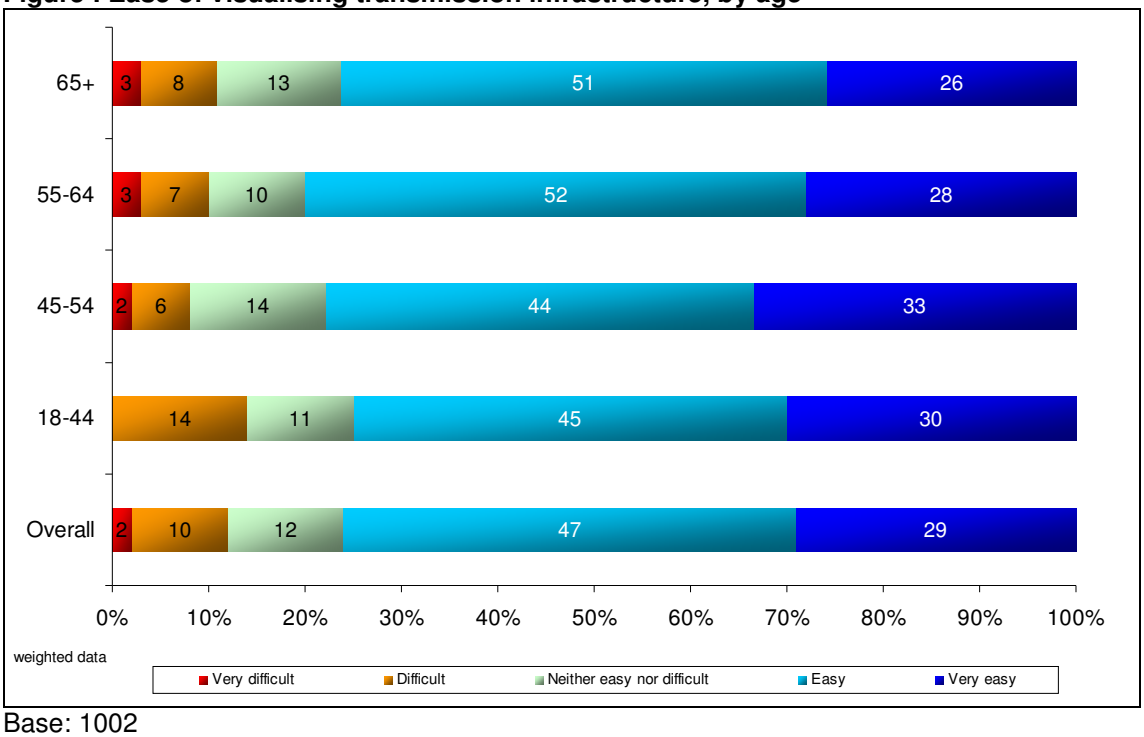
Figure : Ease of visualising transmission infrastructure, by location



Base: 1002

The younger age group (18-44) are more likely to find it difficult to visualise the transmission infrastructure (14%) although none say they found it very difficult.

Figure : Ease of visualising transmission infrastructure, by age

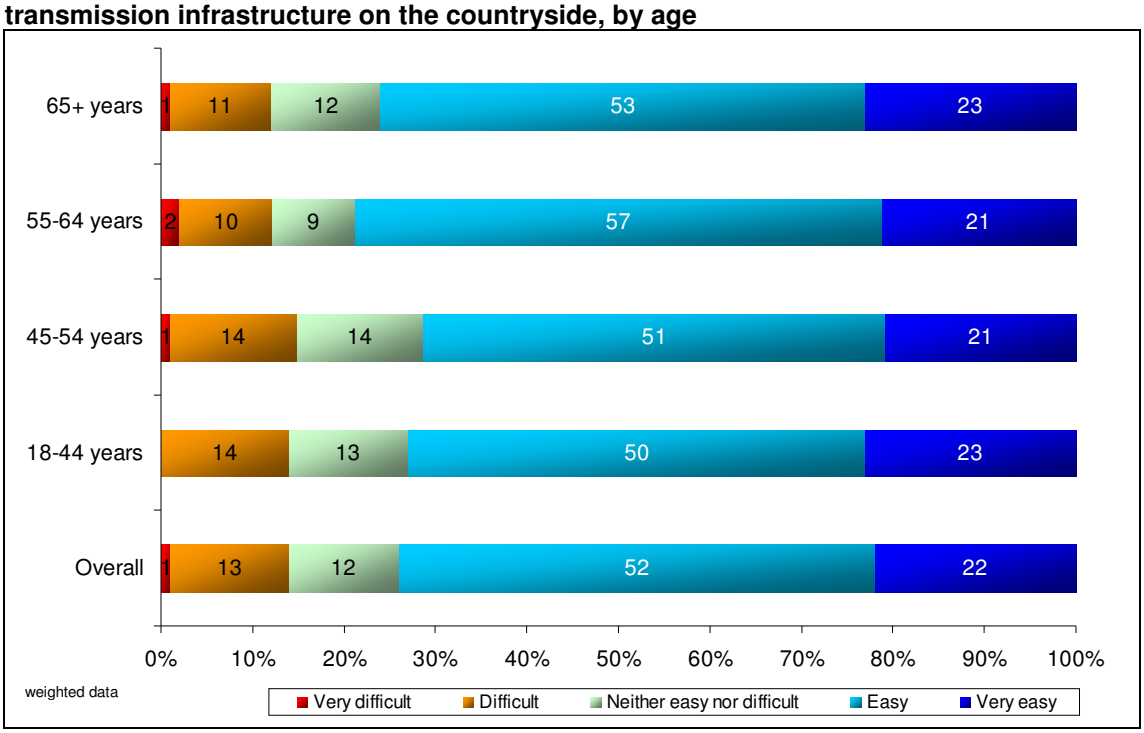


Base: 1002

Three quarters (74%) of respondents overall found it easy to visualise the measures to lessen the visual impact of transmission infrastructure on the landscape, while 14% overall found it difficult.

Older respondents found it easier to visualise the different measures to lessen the visual impact of the infrastructure; 78% of those aged 55-64 years old and 76% of 65+ year olds say they found it easy compared to 73% of 18-44 year old and 72% of 45-44 year olds (see Figure).

Figure : Ease of visualising the different measures to lessen the visual impact of transmission infrastructure on the countryside, by age

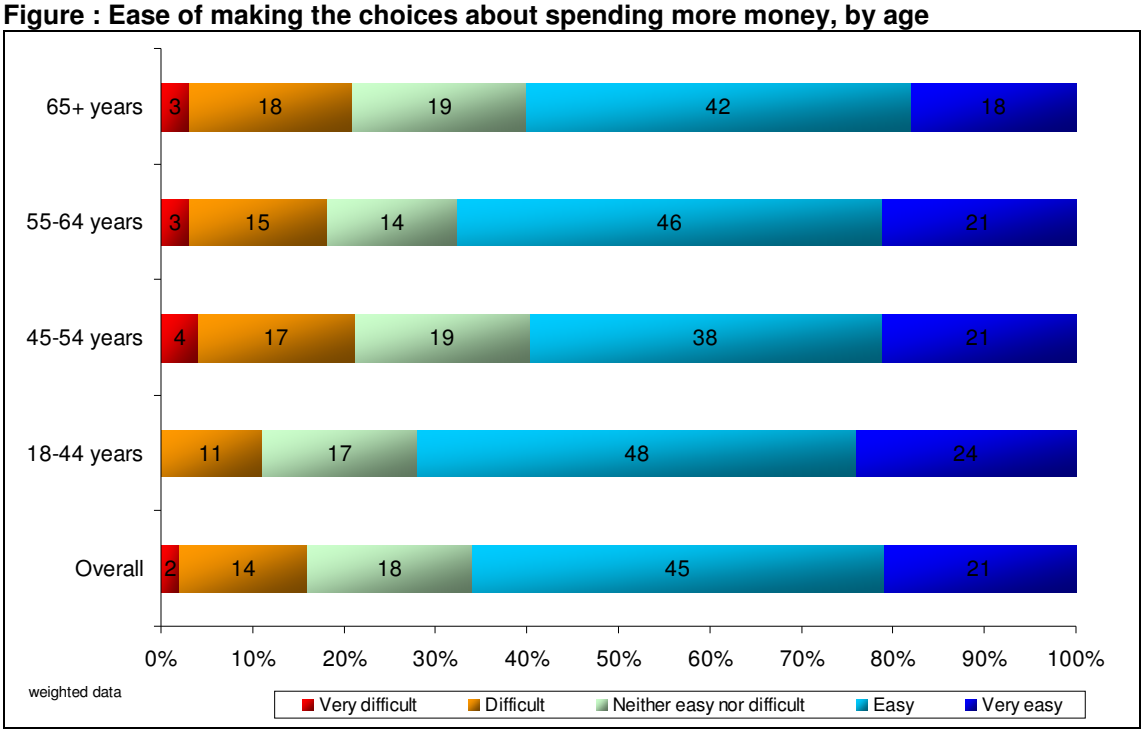


Base: 102

Respondents found it less easy to make the choices about spending more money: just 66% overall said they had found it easy. There is no difference by SEG, with 66% of ABC1 and C2DE respondents also finding it easy.

There are, however, some differences by age, as Figure shows. The younger age group (18-44 years) found it easier than other age groups, with 72% saying they found it easy. In contrast, just 60% of 65+ year olds and 59% of 45-54 year olds found it easy to make choices about spending more money.

Figure : Ease of making the choices about spending more money, by age



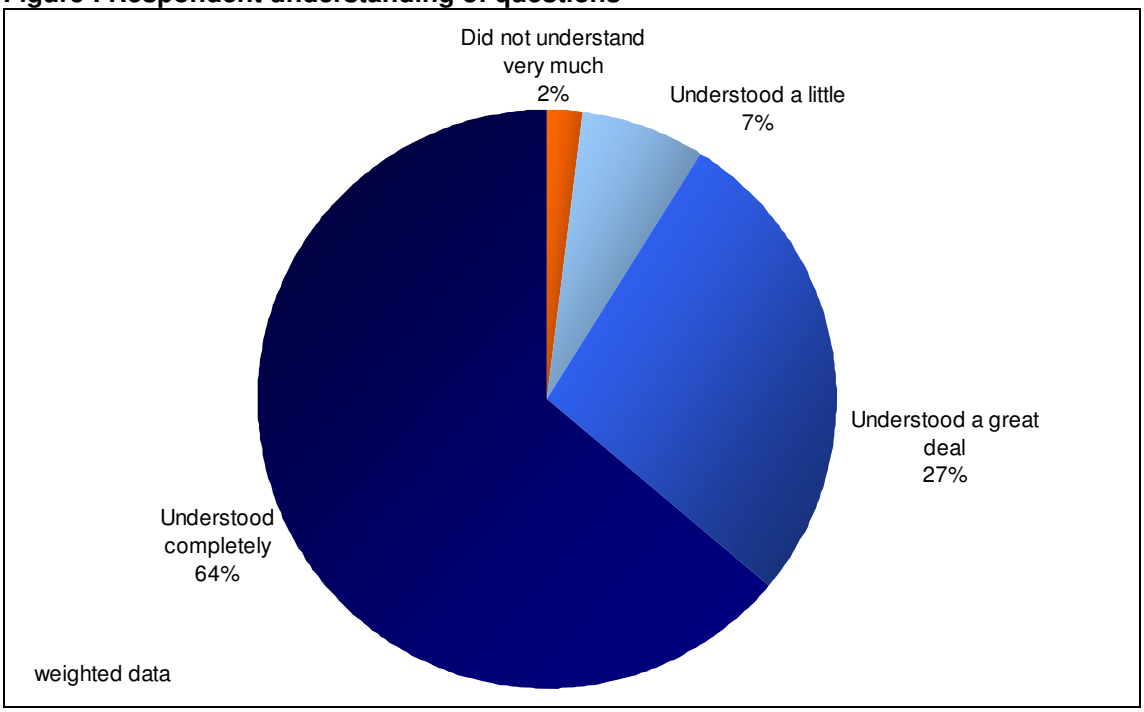
Base: 1002

Interviewer Diagnostic Questions

Interviewers assessed the level of understanding and consideration for each respondent.

In the view of the interviewers, 91% of respondents understood completely or at least a great deal what they were being asked to do in the questions. Just 2% were thought not to have understood very much. Figure shows the level of respondent understanding.

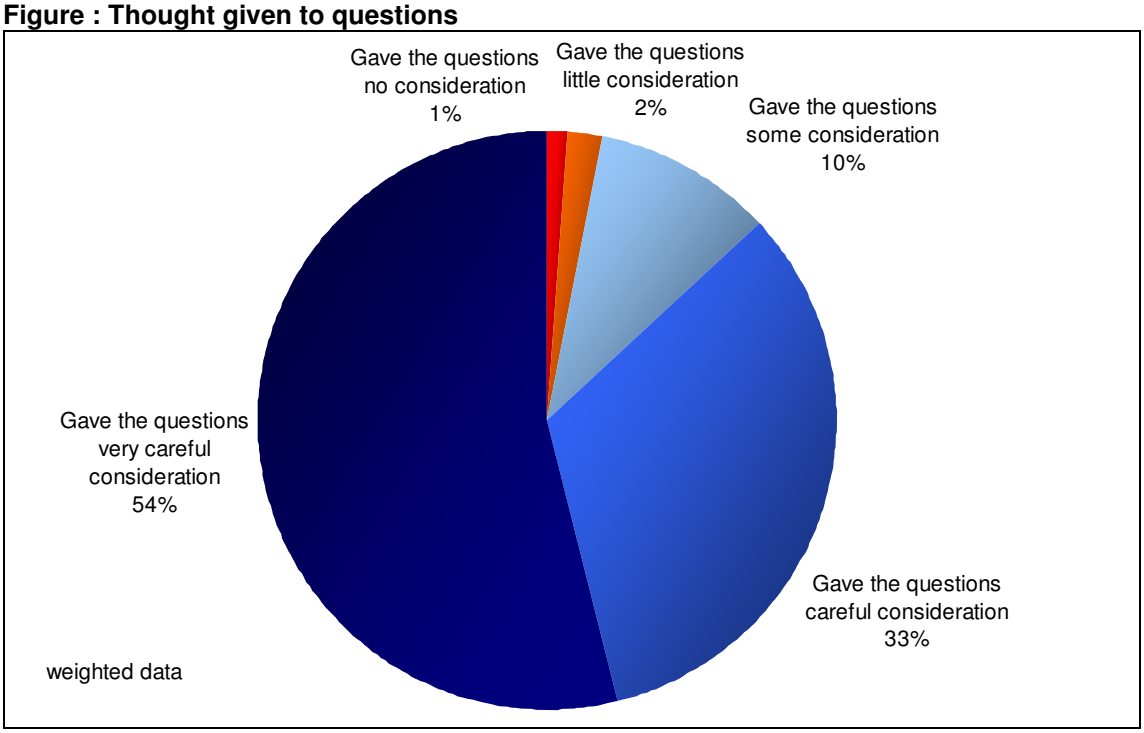
Figure : Respondent understanding of questions



Base: 1002

In terms of the level of thought respondents were considered to have given to the questions, 87% were thought to have give at least careful consideration. Ten per cent gave some consideration while 3% were thought to have given little or no consideration. Figure shows the level of thought given by respondents to the questions.

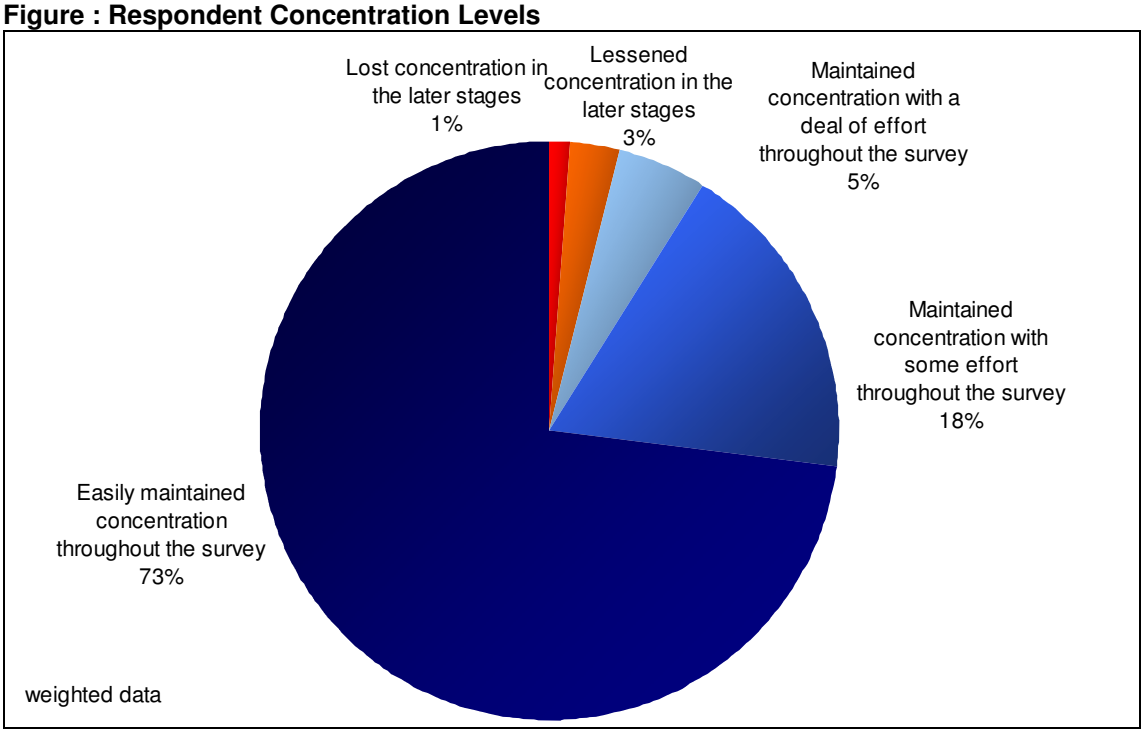
Figure : Thought given to questions



Base: 1002

In the view of the interviewers, nearly three quarters (73%) of respondents easily maintained concentration throughout the survey, and a further 18% maintained concentration with some effort. Just 3% lessened or lost concentration in the later stages of the interview. Figure shows interviewer assessment of respondent levels of concentration.

Figure : Respondent Concentration Levels



Base: 1002

APPENDIX G

Econometric Modelling

Econometric Modelling

The data were collected using a choice experiment in which respondents provided a full preference ranking of four alternative scenarios, each of which included the "no mitigation" option available at zero cost. The other three options each involved a specific type of power-line mitigation located in a National Park, or an Area of Outstanding Natural Beauty/National Scenic Area (AONB/NSA), or in other rural areas. To avoid order effects these scenarios were rotated. The mitigations were defined in terms of the mitigation type (replacement with T-pylon, rerouting, screening or undergrounding) and in terms of the length of the tract to mitigate (5, 10, 20 and 50 miles). As discussed earlier the design was a fraction of the full factorial, which was orthogonal optimal in the differences, with a D-optimal index of 99.32%.

With a sample of 1002 respondents the total number of full ranks is 4008. Each full rank of four alternatives can be "exploded" to generate three sets choice: one from four alternatives from which the best option is selected, the second from which the worst alternative was selected from the remaining 3 alternatives. In the last choice set only two alternatives remain – the two intermediate ones. From this the best is selected. The total number of choice sets was therefore made of 12,024, made up of 12 choices for each respondent.

In the case of data obtained with the twice repeated best-worst approach on a choice set with four alternatives denoted $\{A_1, A_2, A_3, SQ\}$ the analyst identifies three responses $\{y^{1b}, y^{1w}, y^{2b}\}$, where the superscripts denote first best, first worst and second best. These lead to the following preference ordering $\{ y^{1b} \succ y^{2b} \succ y^{r} \succ y^{1w} \}$, where the superscript r denotes the residual alternative. This ordering can be interpreted as observationally equivalent to a sequence of four discrete choices from choice sets with a gradually decreasing number of alternatives. Such an interpretation gives rise to the so-called rank-ordered logit model:

$$\Pr(y^{1b} \succ y^{2b} \succ y^{r} \succ y^{1w}) = \Pr(y^{1b} \mid y^{2b}, y^{r}, y^{1w}) \Pr(y^{2b} \mid y^{r}, y^{1w}) \Pr(y^{1w} \mid y^{r})$$

Invoking the typical assumptions of a sequence of independent logit choice probabilities each full ranking gives the following product of logits:

$$\Pr(y^{1b} \succ y^{2b} \succ y^{r} \succ y^{1w}) = \frac{\exp(v^{1b})}{\sum_{j \in 1b,2b,1w,r} \exp(v^{j})} \times \frac{\exp(v^{2b})}{\sum_{j \in 2b,1w,r} \exp(v^{j})} \times \frac{\exp(v^{r})}{\sum_{j \in 1w,r} \exp(v^{j})},$$

where v denotes the indirect utilities of the relevant alternatives, which take the linear-in-the-parameter scaled by the scale factor λ, or, in the willingness-to-pay space specification approached here:

$$v^{j} = \lambda \times \left(-price + \sum_{k=1}^{K} \beta_k x_k \right),$$

where

$$\lambda = \exp(s_1 + s_2 D_2 +)$$

so as to ensure a strictly positive value. Here the dummy variable D_2 takes the value of one to denote a choice made in a choice set with two alternatives, zero otherwise. This captures any scale difference associated with lower cognitive effort in the choice context with lower number of alternatives.

In fact, because the choice data are made up of choice sets with alternatives in the number of four (best choice), three (worst choice) and two (second best choice), they pose different cognitive challenges to respondents, who have to exert more cognitive effort in selecting from the first choice set. This is because the first set has four alternatives to be evaluated for the first time, as opposed to the three and two of the second and third choice sets, which are based on alternatives already evaluated in the first choice task. As such, following the prescription in the literature (Louviere and Swait 1993) as well more recent findings (Scarpa et al. 2010, Rose and Collins 2010), the models estimated here fitted a different scale parameter for the choice sets with three and two alternatives. These scale parameters (denoted s_1 and s_3) were found to be significantly different from zero, which indicates that scale differences are relevant.

Apart from the cost to respondent, which was coded numerically, all the data relating to the attributes of the alternatives were coded using dummy coding, with the exception of the lengths of the mitigation, which were coded used linear piece-wise effects, as follows: 5 miles { 1, 0, 0, 0 }; 10 miles { 1, 1, 0, 0 }; 20 miles { 1, 1, 1, 0 } and 50 miles { 1, 1, 1, 1 }. This incremental coding allows for non-decreasing marginal utility and avoids the potential occurrence of non-monotonic effect along a dimension of expected benefits.

Estimation and Derivation of WTP Values

Initially, this data was fitted to a random utility logit model specified in the preference space. Utility was specified as a function of mitigation type (replacement with T-pylon, screening, rerouting and undergrounding), location of mitigation (National Parks, AONBs/NSAs and other rural areas) and length of the mitigation (5, 10, 20 and 50 miles). The convergence values from the logit models were then used to find WTP values and the specification search was continued from a random utility model specified in the WTP space. This facilitates interpretation of the coefficients that are expressed now in monetary units of each effect. This also facilitates the interpretation of the standard errors of the estimates that define their accuracy. For further details on this the reader is referred to the existing literature employing WTP-space random utility models (see Appendix H, Literature Review).

All models were estimated using the software BIOGEME and were based on maximum likelihood estimates. These were obtained by maximizing the sample log-likelihood which was weighted to make the sample representative of the population. A satisfactory model was identified with a specification search which proceeded by testing down an initially large model that included all the variables of interest and their interactions. The search used criteria of fit such as the Akaiki information criteria and the significance of the single coefficients to establish which models to retain. The chosen model is “Model 1” reported in Table . This is the model employed to derive the estimates for WTP reported in Table . Subsequent models (Model 2 and Model 3) were derived by building on the basic structure of Model 1.

Model 2 differs from Model 1 in that the separate effects of mitigation in AONBs/NSAs and in National Parks which were found to be significant for 20 miles and 50 miles, respectively, were merged into a single common effect across the two sites taking place

at mitigation lengths of 20 miles. Such constraint though reveals itself to be a significant one since the value of the log-likelihood at a maximum drops from -11,942 down to -11,952.

In Model 3 we include interaction variables between being a respondent that lives near or in an AONB/NSA and the WTP for mitigations in such areas. We also introduce a similar interaction variable between being a respondent who stated that s/he has visited a National Park at least once and their WTP for mitigation in National Parks. These effects are estimated to be positive, as expected, and of GBP2.14 and 2.69, respectively. Such an estimate provides a theoretical validity check on the core model. Interactions variables provide the expected coefficient signs and magnitude once included in the core model.

Table : Estimates from WTP-space random utility specifications from best-worst choice data

	Model 1 (best model)			Model 2			Model 3		
Final log-likelihood:	-11942.851			-11952.871			-11938.020		
	Value	Std err	t-test	Value	Std err	t-test	Value	Std err	t-test
Common effect at 5 miles length across all mitigation measures	8.68	0.50	17.47	8.61	0.49	17.6	7.49	0.545	13.74
Undergrounding effect at 50 miles	2.65	0.99	2.67	3.06	0.96	3.19	3.19	0.97	3.3
Common effect at 50 miles length across all mitigation measures	1.41	0.50	2.84	1.36	0.49	2.81	1.35	0.50	2.69
T-pylon effect at 5 miles length across all locations	-6.93	0.54	-12.96	-6.96	0.54	-12.93	-7.20	0.56	-12.98
Rerouting effect at 5 miles length across all locations	-7.98	0.55	-14.44	-8.10	0.55	-14.67	-8.33	0.57	-14.57
Screening effect at 5 miles length across all locations	-5.91	0.54	-10.97	-5.67	0.53	-10.67	-5.80	0.54	-10.69
Screening effect across all lengths and locations	5.88	0.55	10.79	5.78	0.54	10.72	5.87	0.55	10.65
Undergrounding effect across all lengths and locations	4.72	0.61	7.8	4.72	0.59	7.95	4.91	0.61	8.01
Effect of 20miles at AONBs	2.87	0.53	5.45						
Effect of 50miles at NPs	2.38	0.98	2.43						
Common effect at 20 miles for AONBs and NPs				1.71	0.44	3.85	1.96	0.46	4.3
Effect of people living near AONBs on WTP for mitigation in AONBs							2.14	0.58	3.68
Effect of respondents who took at least one trip to NPs on WTP for mitigation in NPs							2.69	0.57	4.76
s1 overall scale effect	-3.07	0.05	-59.46	-3.07	0.05	-60.63	-3.08	0.05	-60.06
s2 scale effect for binary choices	0.563	0.06	8.91	0.58	0.06	9.29	0.58	0.06	9.32

Discussion of the WTP estimates from Model 1

By adequately composing the contributions of marginal WTP estimates from Model 1 for all the possible scenarios of 3 location types × 4 lengths of intervention × 4 types of mitigation we derived 48 estimates of WTP and report them in Table . Moving from the top block of 4 rows to the bottom block the estimates refer to increasingly long tracts of mitigation (5 miles, 10 miles, 20 miles and 50 miles). From top to bottom benefit estimates are expected to increase by block. Within each block moving from the left column (other rural areas) to the middle one (National Parks) and to the right one (AONBs) the benefits from mitigation values vary by location. Finally moving from top rows down to the bottom within each block the estimates vary by mitigation measures. Benefit estimates are expressed in additional pounds per household added to the bill for the duration of the programme (8 years).

Across mitigation types undergrounding is valued most, followed by screening and then by replacement with T-pylons, with rerouting least valued. Estimates are significantly different across mitigation measures, except for those between pylons and rerouting. Across locations the benefit increase via interaction effects with length and locations (e.g. 20 miles and AONBs) and with mitigation-specific effects at some length (e.g. undergrounding at 50 miles).

Focusing on the top block, which relates to a tract of 5 miles, the model predicts that undergrounding and screening are the most valued with point estimates of £13.40 and £8.65. T-pylons are valued at a distant £1.75 and rerouting at less than a pound (£0.70). These benefit estimates are not sensitive to the first distance class of 10 miles across the three locations. The first increase is noticed for AONBs/NSAs at 20 miles, while at 50 miles there is a jump in estimates across all locations, with the strongest increase experienced by mitigation in National Parks and AONBs/NSAs, but there is no statistical difference across the point estimates of the two locations (ie the differences in values are likely to be due to sampling error).

For engineering purposes one might be tempted to use these estimates to derive per mileage benefits arising from the mitigation of transmission power lines. So, for example, in National Parks the same benefit is estimated for undergrounding up to 50 miles. This implies that for two sets of increases in length there is no sensitivity to scope.

The per mile benefit estimate at the 49th mile is £13.4/49 = £0.27. This jumps to £0.39 at the 50th mile. In terms of computing benefits, a per mile computation is unlikely to have been the thought process respondents generally undertook in evaluating the impact of mitigation of visual intrusion. It would appear more appropriate to assign these values to categories of mitigation projects spanning those distances. For 50 mile projects benefits in National Parks and in AONBs/NSAs are worth between 75% and 90% more than in other rural areas for T-pylons; between 113% and 136% more for rerouting; between 23% and 28% more for screening; and between 34% and 37% more for undergrounding. So, given a mitigation measure, the strongest relative effect of location on benefits is observed for rerouting, followed by T-pylons, whereas the location effects given the other mitigation measures at this length of intervention are not large in relative terms.

At lengths of 20 miles the location with strongest benefits are AONBs/NSAs for both rerouting (more than 5 times those of other locations) and T-pylons (2.6 times), while

the effects over screening and undergrounding remains minor, respectively 33% and 21% more.

Table : Inferred point estimates of marginal WTP for different mitigation scenarios from choice data (£ per household per year for 8 years, standard errors in brackets from Hessian)

Measure	Location		
	In other rural areas	in National Parks	in AONBs/NSAs
at least 5miles			
T-pylons	1.75 (0.82)	1.75 (0.82)	1.75 (0.82)
rerouting	0.70 (0.85)	0.70 (0.85)	0.70 (0.85)
screening	8.65 (0.81)	8.65 (0.81)	8.65 (0.81)
undergrounding	13.40 (0.57)	13.40 (0.57)	13.40 (0.57)
at least 10 miles			
T-pylons	1.75 (0.82)	1.75 (0.82)	1.75 (0.82)
rerouting	0.70 (0.85)	0.70 (0.85)	0.70 (0.85)
screening	8.65 (0.81)	8.65 (0.81)	8.65 (0.81)
undergrounding	13.40 (0.57)	13.40 (0.57)	13.40 (0.57)
at least 20 miles			
T-pylons	1.75 (0.82)	1.75 (0.82)	4.62 (0.92)
rerouting	0.70 (0.85)	0.70 (0.85)	3.57 (0.97)
screening	8.65 (0.81)	8.65 (0.81)	11.52 (0.93)
undergrounding	13.40 (0.57)	13.40 (0.57)	16.27 (0.81)
at least 50 miles			
T-pylons	3.16 (0.98)	5.54 (1.24)	6.03 (1.04)
rerouting	2.11 (0.87)	4.49 (1.32)	4.98 (1.00)
screening	10.06 (0.86)	12.44 (1.23)	12.93 (0.99)
undergrounding	14.81 (0.71)	19.84 (1.50)	20.33 (1.38)

In the report these figures are reported as they provide central estimates and are conservatively shown with a 0,74 correction for hypothetical bias. The rationale for this is discussed in the main report

For purposes of sensitivity testing, however, rather than using the model to derive point estimates of WTP, and to further take care to caution against the potential over-estimation of benefits one can use lower bound point estimates from an adequately computed cautionary confidence interval.

For example, using the asymptotic sampling distribution of the estimator one can derive the benefit values that, under random sampling, would be exceeded in 90 percent or 95 of the samples. Denote these, respectively, as B_{90} and B_{95}. Using the central point estimate of the asymptotic sampling distribution reported in table 2, denoted as B, and their asymptotic standard errors *s* the values of interest can be derived as:

$$B_{90} = B + \Phi^{-1}(0.1)s = B - 1.2816\ s$$

$$B_{95} = B + \Phi^{-1}(0.05)s = B - 1.6448\ s$$

where $\Phi^{-1}(\cdot)$ is the inverse of the standard normal c.d.f.

The standard errors can be derived in at least two different ways, from the information matrix derived from the Hessian or from the sandwich estimator (BHHH). Since the

WTPs for different scenarios are all linear function of random variables, the variances are derived from an extension of the formula:

$$\mathrm{Var}(aX + bY) = a^2\mathrm{Var}(X) + b^2\mathrm{Var}(Y) + 2ab\mathrm{Cov}(X,Y)$$

In this case a=b=1 because the effects are all dummy coded, while X and Y are the coefficient estimates from the WTP-space model. So, the formula is simplified to:

$$\mathrm{Var}(\mathrm{WTP}) = \mathrm{Var}(X + Y) = \mathrm{Var}(X) + \mathrm{Var}(Y) + 2\mathrm{Cov}(X,Y)$$

And the standard errors are derived as the squared root of the variances of each estimate so derived.

To further caution against over-estimation of benefit the resulting values of the lower bounds from the cautionary confidence intervals at 95% are scaled by 0.74 to account for hypothetical bias and are reported in Table 3. Note that some of the estimates (e.g. re-routing) are negative, indicating that these marginal WTPs are to be considered as zeros.

Table 3: Inferred lower bounds of cautionary 95% of marginal WTP estimates for different mitigation scenarios from choice data (£ per household per year for 8 years)

Measure	Location		
	In other rural areas	in National Parks	in AONBs/NSAs
at least 5miles			
T-pylons	0.30	0.30	0.30
rerouting	-0.52	-0.52	-0.52
screening	5.41	5.41	5.41
undergrounding	9.23	9.23	9.23
at least 10 miles			
T-pylons	0.30	0.30	0.30
rerouting	-0.52	-0.52	-0.52
screening	5.41	5.41	5.41
undergrounding	9.23	9.23	9.23
at least 20 miles			
T-pylons	0.30	0.30	2.30
rerouting	-0.52	-0.52	1.46
screening	5.41	5.41	7.39
undergrounding	9.23	9.23	11.06
at least 50 miles			
T-pylons	1.14	2.60	3.20
rerouting	0.50	1.71	2.47
screening	6.40	7.70	8.37
undergrounding	10.09	12.86	13.36

Serial Non Participation and Zero WTP Behaviour

A number of respondents engaged in a non-participatory behaviour (224 which, once re-weighted, accounted for 215 or 21.46% of the 1002 respondents in the sample), which is consistent with being willing to pay nothing extra for power line mitigation. This is half the frequency reported in Figure 4 (page 6) of the Brunswick report. This might be due to the indirect way by which monetary valuations are achieved with the choice experiment approach. In fact, with this approach respondents are asked to make

tradeoffs across alternative scenarios, some of which imply a payment via a tariff increase. This format might be less conducive to outright statements of zero WTP than when this option is offered in a menu of payment options for a single alternative, which is what is typically done in contingent valuation settings.

The 215 respondents who chose as favourite option (1st best) the status quo option with zero cost in all four choice tasks are consistent with holding a zero WTP for at least all the scenarios included in the four choice sets. This behaviour is often referred to as "serial-non participation" or "non-trading". To evaluate whether these respondents had plausible economic reasons (as opposed to reasons to protest against the survey instrument) the socio-economic data were used for further investigation.

The cross tabulation of the variable serial non-participants compared with participants on some socio-economic and attitudinal variables indicates that serial non-participants do not differ significantly from participants with regard to SEG or income band. Serial non-participants are significantly more likely to strongly agree that 'I would find it hard to pay more on my electricity bill'. They are also significantly more likely to disagree with the attitudinal statement 'It is fair that customers should be asked to pay for these improvements' and to agree that 'I do not think it is a good use of money at this time'. They are also less likely to agree that 'I do not think the countryside would be improved by lessening the visual impact of the transmission infrastructure' and more likely to disagree that 'I think there is a need to lessen the visual impact of existing transmission structure on the countryside' (see Table 4) In other words, serial non-participants differ significantly from participants in all of:

- attitudes indicating that they do not see the need for mitigation
- attitudes that indicate that they feel generalised payment is unfair, and
- claimed constraints on affordability.

Table 4: Variation in attitudes and ability to pay by serial non-participation

Attitude statement	Group	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
		%	%	%	%	%
I do not think the countryside would be improved by lessening the visual impact of the transmission infrastructure	serial non-participants	7	33	11	33	16
	participants	37	34	13	10	7
I do not think it is a good use of money at this time to lessen the visual impact of the transmission infrastructure on the countryside	serial non-participants	3	12	7	36	41
	participants	17	30	18	22	13
I would find it difficult to pay any more on my electricity bill	serial non-participants	4	9	14	22	51
	participants	11	31	18	22	18
I think there is a need to lessen the visual impact of existing transmission structure on the countryside	serial non-participants	20	34	15	22	8
	participants	3	14	17	39	28
I think it is fair that customers should be asked to pay for these improvements	serial non-participants	40	23	9	22	6
	participants	14	21	22	33	11

To further investigate this issue a series of binary logit models were estimated by maximum likelihood. The explanatory variable was whether a respondent engaged trading, and displayed a positive willingness to pay for mitigation. The explanatory variables are described in Table . The model "Logit 1" reports the long regression with all the various candidate explanatory variables, many of which display a t-value smaller than 1.96 in absolute value and are hence not statistically significant. The model Logit 2 is a model that retains the most significant variables.

It is noteworthy how the pattern of significance suggests that those who show positive willingness to pay have plausible attitudinal economic reasons to do so. The overall picture suggests that they do so with high likelihood when strongly agreeing with the statement that: "... there is a need to lessen the visual impact of existing transmission structure on the countryside", and that they are more likely to state to be willing to pay if they have visited an AONB/NSA at least once.

On the other hand they were not likely to be amongst those who state to be willing to pay when strongly agreeing with the statement: "I do not think it is a good use of money at this time to lessen the visual impact of the transmission infrastructure on the countryside", or when they strongly agree they "would find it difficult to pay any more on my electricity bill". Note also that seeing pylons or transmission lines in their daily life is also correlates positively with being willing to pay, but is excluded from model Logit 2 because it is borderline insignificant at conventional levels. This shows that those who experience transmission lines may be more likely to find them to be interfering with their visual enjoyment of the landscape, and consequently are more likely to engage in trading for mitigation.

Table : Binary logit models for explaining the serial non-participation in best-worst choice experiments

Final log-likelihood:	Logit 1			Logit 2		
	-424.836			**-437.146**		
	Value	**Std err**	**t-test**	**Value**	**Std err**	**t-test**
	1.47	**0.31**	**4.81**	**1.37**	**0.20**	**6.82**
Having visited at least once:						
An Area of Outstanding Natural Beauty/National Scenic Area	0.66	0.25	2.59	0.59	0.21	2.89
A National Park	-0.19	0.22	-0.84			
Strongly Agree to:						
"I think it is fair that customers should be asked to pay for these improvements"	0.17	0.37	0.46			
"the visual impact of electricity transmission infrastructure is necessary and unavoidable"	-0.17	0.20	-0.83			
"the visual impact of electricity transmission infrastructure is ugly and an eyesore"	0.40	0.22	1.80			
"I think there is a need to lessen the visual impact of existing transmission structure ..."	1.37	0.28	4.89	1.43	0.27	5.33
"I do not think it is a good use of money at this time to lessen the visual impact of the transmission infrastructure ..."	-1.16	0.20	-5.75	-1.08	0.20	-5.49
"I would find it difficult to pay any more on my electricity bill"	-1.21	0.19	-6.28	-1.18	0.19	-6.25

Having children of age:						
16 to 17	0.73	0.39	1.87			
11 to 15	-0.80	0.24	-3.29	-0.59	0.23	-2.63
5 to 10	0.55	0.31	1.76			
under 5	0.40	0.35	1.16			
number of children	-0.15	0.11	-1.41			
Live in/near AONB/NSA or National Park, or can see pylons						
Respondent lives in AONB/NSAs	-0.14	0.28	-0.51			
Respondent lives in National Park	0.81	0.58	1.40			
Respondent lives near a National Park						
Respondent lives in hamlet, isolated dwelling and villages	-0.15	0.19	-0.75			
Respondent can see pylons	0.29	0.18	1.64			

APPENDIX H

Literature Review

Stated Preference Studies To Value The Benefits Of Undergrounding In Natural And Rural Landscapes:

Literature Review

Riccardo Scarpa – 11 May 2012

Summary

This annex provides a review of the international literature on studies conducted to value the benefits from mitigation of the impact of high voltage transmission lines focusing on those conducted by means of stated preference methods. The review reveals a very heterogeneous landscape in terms of value estimates, methods and unit of reference. Apart from many hedonic studies based on variation of property values, a number of stated preference methods have been employed using both contingent valuation and choice based methods of the type employed in our study. In terms of estimating the benefit from reduction of visual intrusion in the countryside or in protected areas the literature is very limited. The present study is one of those with largest sample sizes across the reviewed studies. Very few studies tried to explore the sensitivity to scope of mitigation.

Visual intrusion of power lines has been a source of some concern and generally judged to be an undesirable feature in the landscape. However, latent class analysis of attitudinal data towards various forms of landscape intrusion (Soini et al., 2009) shows that heterogeneity of taste is substantial. In this study, conducted in the Finnish countryside, two thirds of respondents showed a negative attitude towards transmission lines, ten per cent showed a positive attitude towards it while the remaining quarter felt indifferent about it.

In the literature there are few studies focusing on the economic evaluation of the external costs of electricity transport networks, such as High Voltage Transmission Lines (HVTL). A number of these studies employed hedonic pricing as an econometric technique to derive values. For example, in the USA these include, in chronological order, Kinnard (1967), Colwell and Foley (1969), Colwell (1990), Kroll and Priestley (1992), Kung and Seagle (1992) and Delaney and Timmons (1992) while Canada Des Rosiers (2002) is an example of a Canadian study. In the European context, two hedonic pricing studies focus HVTL impacts on real estate in the UK; Gallimore and Jayne (1999) and Sims and Dent (2005).

A very recent study employs the same hedonic technique to specifically estimate the value of undergrounding in the city of Perth, Western Australia (Marsden Jacob Associates, 2011). Other examples involve the cost of proximity to *high-voltage transmission* infrastructure (Gregory and von Winterfeldt 1996; Hamilton and Schwann 1995; Ignelzi and Priestley 1991; Kinnard and Dickey 1995; Sims and Dent 2005), which is known to affect households in a quite different fashion from low voltage distribution infrastructure. High voltage infrastructure typically has a larger scale and is rarely situated on extended

residential property areas. Most significantly these costs are primarily associated with perceived health risks associated with electromagnetic fields generated by high-voltage wires.

As in many other contexts related to benefit estimation for public goods, stated preference (SP) data analysis is now more frequently employed in assessing economic values associated with transmissions of power lines. Other non-market values of electricity networks have been subject of numerous SP studies. For example, the reliability of supply improvements have been valued using contingent valuation (Carlsson and Martinsson 2007; Layton and Moeltner 2005) and choice experiments (Accent 2008; Beenstock, Goldin et al. 1998; Carlsson and Martinsson 2008).

A first study partially dedicated to the estimation of the cost of visual intrusion of overhead lines is to be found in Garrod and Willis (1998). In this the authors report the results of a contingent ranking stated preference survey conducted on 932 respondents sampled at selected canal locations. The study looked at the intrusion caused by pipe bridges, pylons and cable crossings put in place by utilities across canals managed by British Waterways in inland waters. The study focused on one per cent reduction, and found that 1% reduction in pylons was valued £290,000 in 1995 currency which, using the retail price index, gives a today figure of £435,000.

In a study based on double-bounded contingent valuation data collected from 252 respondents Rosato et al. (2004) estimate the willingness to pay for undergrounding of all overhead lines in Italy to €527,13 per household. This is equivalent to £417 in 2012 terms using the retail price index and the average exchange rate for £/€ in 2003. Unfortunately this study does not provide different estimates by location types.

A large scale (N=1,459) contingent valuation study of an entire region in North-Western Italy (Piedmont) is reported in Giaccaria, Frontuto and Dalmazzone (2010), who used data collected in 2007. They employed double bounded contingent valuation data merged with geo-referenced variables obtained from a GIS. These variables included proximity to power lines, built as a distance decay indicator, and local context features such as density of power lines, presence of other linear infrastructures, and local environmental amenity.

The CV question was a referendum take-it-or-leave-it option concerning the removal (not explicitly the undergrounding) of 5km stretch of HVTL from the respondent's municipality. The size of the stretch relates to the average length of HVTL crossing the municipal administrative districts in that region.

The specific reference to a tract of HVTL in the place of residence of the respondent is one of the distinguishing features of this CV scenario. Further, the study separates three sub-samples, on the basis of a pre-pilot that showed significant differences in WTP dependent on proximity to the HTVL and also on perceived damage by such proximity, mostly in terms of perceived loss of property value. Each sub-sample was assigned a different bid vector in the CV exercise. The 95% confidence interval for the WTP estimates for the removal of a 5km stretch of HTVL were €178-€200 in the case of ordinary damage,

€512-€626 for intermediate damage, and €2,758-€4,748 for heavy damage. However, these values were for HTVL removal across urban, semi-urban and rural areas and the authors do not differentiate across locations.

Another study on the benefits of undergrounding overhead power lines in an urban context is reported in Navrud et al. (2007) on data collected between 1998 and 1999. These authors use a bill increase as a payment mechanism for a CV study on various stretches of lines to be placed underground in Oslo, Norway. They elicited WTP using a payment card for each stretch.

Similar to Giaccaria et al. (2010) this study also used sub-samples based on proximity to the line since differences in WTP were strongly associated to proximity. With a sample of size N= 601 they found 10% of the sample had no WTP, while the remainder of the data was used to obtain a regression explaining stated WTP on the basis of various characteristics. The authors conclude in their cost-benefit exercise that "the social benefits of avoiding landscape destruction from overhead transmission lines by far exceed the additional costs of underground cables that avoid this landscape destruction".

A literature search on the specific issue of benefit estimation from undergrounding distribution cables in rural or conservation areas soon reveals that this specific topic has not been the subject of much academic research. More benefit studies are available for undergrounding power and other types of distribution cables in residential areas.

This is probably due to the fact that the practice of undergrounding has been adopted since the early 1990s in many new residential developments in Australia, New Zealand and the USA. For example, it was in response to previous studies which evidenced the lack of reliable benefit estimates that in 1998 the Australian Government (Commonwealth Department of Communications Information Technology and the Arts 1998) and the New South Wales economic regulator (Independent Pricing and Regulatory Tribunal 2002) classified most household benefits from such operations as unquantifiable. Similar conclusions were reached five years later in 2007 in the United States (InfraSource Technology 2007).With a few exceptions, that are discussed at some length in what follows, it seems that few studies have attempted to value the overall household benefits from undergrounding (including amenity and safety benefits), in conservation areas, areas of natural outstanding beauty and national park or similarly protected areas.

Atkinson, Day and Mourato (2006) report estimates of the WTP for different pylon (tower) designs for high voltage transmission lines (HVTL), as well as undergrounding, from data collected in 2001. They conducted a multiple contingent valuation study on a face to face sample of rural (N=394) and urban (N=391) residential households, which were stratified on the basis of four progressive distance bands from the lines so as to capture distance effects.

A distinctive feature of their approach, which is also featured in another paper (Atkinson, et al 2004), is the indirect approach taken to elicit *negative* willingness to pay

when a less desirable tower design is substituted by a more desirable one. This WTP is proxied by the time and cost respondents are willing to commit to oppose the change. Positive WTP, instead, was elicited by assuming a one-off increase in the electricity bill.

Their results in the 2006 book chapter show a mild distance decay effect for WTP for undergrounding, the distribution of which had a median of £8.53 (£11 in current terms) and a mean of £65.53 (£84.5 in current terms) (£58.12 (£75 in current terms) in the urban sample, while the rural sample had a mean of £72.42 (£93.3 in current terms)). They then report WTP estimates for new designs of HVTL towers all of which had a median of £0. The design with the highest mean was the one-pole tower with a value estimate of £4.86 (£6.26 in current terms) (£6.50 (or £8.38 in current terms) in the urban sample, while the rural sample had a mean of £3.30 or 4.25 in current terms). WTP values were elicited using a payment ladder and were one-shot contributions (not periodical payments) sampling from 34 locations in England and Wales (17 urban and 17 rural).

A second study concerning undergrounding in rural areas for the purpose of removing the landscape intrusion due to HVTL towers is reported in Marazzi and Tempesta (2005) and the data collection was conducted in 2002. This study was published in the Italian technical journal and reports both WTA and WTP estimates for undergrounding. Estimates were obtained using dichotomous choice referendum CV and were framed around the Italian legislative scenario, which uses public funds for the progressive undergrounding of HVTL in rural areas, at the rates of 500km/year (318.7 miles/year).

Respondents were shown images of a flat rural area with and without visual intrusion. The bid amounts were expressed in terms of Euro/year in changes of taxes. A total of 553 respondents were interviewed (face-to-face) split into a WTA treatment (281) and a WTP one (272). The estimated WTP to enjoy the benefits from undergrounding is €180 (£142 in current terms) for the median and €155 (£122 in current terms) for the mean. The WTA estimates to give up these benefits are about 2.5 times those of the WTP. Specifically they were €385 (£304 in current terms) for the median and €456 (£360 in current terms) for the mean. Significant differences were found between the urban and rural sub-samples, with the latter displaying higher estimates for both WTP and WTA.

The estimates from the two studies are not very comparable because the data collection and the bid definitions—one a stock and the other a flow—are very different. However, the estimates from the Italian study seem difficult to take as realistic. They are very high to be yearly payments and they imply very large present values.

A third research paper was found that explored stated preference based estimates of WTP from undergrounding of electricity cables. This study, by McNair et al. (2011), was conducted in Canberra, Australia. It did not, however, explore undergrounding HVTL in rural or protected areas, but lower voltage distribution lines in urban and residential developments. So, it is not directly relevant in terms of type of good, but it is of interest because it uses choice experiments as a stated preference technique, as utilised in this study.

The study provides two scenarios, one with undergrounding and the second is the status-quo, which is referenced to the specific household conditions. The other attributes comprise the number and average duration of power cuts per year in the presence and absence of written notice.

The split sample included 1,163 households who responded to a single choice task (the single bounded format) and 292 households responded to a sequence of four choice tasks (the repeated binary, format).

The questionnaire was administered on-line. The results were obtained by fitting a binary logit model to the choice data and indicated an estimated mean of WTP that has a 95% confidence interval of A$5,440-A$8,253, with a point estimate of A$6,838 (at current exchange rate approximately of £4,400), the estimated median is A$4,000 (at current exchange rate approximately of £2,540). The study also investigates many sources of value heterogeneity across respondent characteristics.

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Study	Location	Method	Sample size	What valued	Estimate in original currency	in today GBP terms
Garrod and Willis (1998).	British inland waters	Choice ranking	932	pipe bridges, pylons and cable crossings	1% reduction in pylons was valued £290,000	£435,000
Rosato et al. (2004)	Italy	Double bounded CV	252	undergrounding of all overhead lines in Italy	€527,13	£417
Giaccaria, Frontuto and Dalmazzone (2010).	Piedmont, Italy	Double bounded CV	1019	5km stretch of HVTL from the respondent's municipality	Low perceived damage €178-€200	£128-144
Giaccaria, Frontuto and Dalmazzone (2010).	Piedmont, Italy	Double bounded CV	98	5km stretch of HVTL from the respondent's municipality	Intermediate perceived damage €512-€626	£368-450
Giaccaria, Frontuto and Dalmazzone (2010).	Piedmont, Italy	Double bounded CV	77	5km stretch of HVTL from the respondent's municipality	large perceived damage €2,758-€4,748	£1983-3414
Navrud et al. (2007).	Oslo	Payment card CV	601	Undergrounding parts of overheads in Oslo	separate estimates by distance to power lines and links	
Atkinson, Day and Mourato (2006)	UK		785	WTA and WTP for undergrounding and various designs for transmission towers	mean for undergrounding £65.53	£84.5
Marazzi and Tempesta (2005)	Veneto, Italy	Double bounded CV	553	WTA to give up undergrounding and WTP to obtain them	WTP = €155 and WTA = €456	WTA=£304-WTP=£122
McNair et al. (2011),	Canberra, Australia	Choice Experiments	1163+292	Undergrounding of lower voltage distribution networks	AUD6,838	£4,000