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What drives people's opinions of electricity infrastructure? Empirical evidence from Ireland

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Abstract: Across the EU, significant infrastructure investment is needed in both generation from renewable energy sources (RES) and the electricity transmission system to meet the European targets on emission reduction and RES expansion. Experiences show, however, that citizens may object to new energy infrastructure in their localities which may cause delays in achieving the targets. To avoid such delays, it is crucial to understand what drives people's opinions. To explore people's opinions of different electricity generation and transmission technologies in Ireland, we conducted a nationally-representative survey. Concerning the drivers, we explicitly distinguish between socio-demographics, socio-psychological/political beliefs, and contextual/local factors. Our results show that people generally have positive views of RES technologies. While this indicates that Irish citizens agree with the move towards cleaner electricity sources, we find a reluctance amongst people to have these technologies located close to their homes. As for the drivers, we find that the respondents' socio-psychological and political beliefs are generally more important than most socio-demographics in driving their opinions and their tendency to oppose infrastructure development locally. This finding underlines the relevance for policy makers to understand which objectives people consider most important and how these judgements are related to their opinions of different energy technologies.

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1 Introduction

In order to reduce greenhouse gas emissions and mitigate climate change, the European Union aims for a 27% share of renewable energy sources (RES) in final energy consumption by 2030 according to its Framework for Climate and Energy. To meet the long-term goal of reducing EU-wide emissions to 80-95% below their 1990 levels by 2050, more than two thirds of gross final European energy consumption needs to be provided by RES. These targets will involve an increase in the proportion of RES in electricity generation from 25% today to at least 45% in 2030 and an almost entirely decarbonised electricity system by 2050 (EC, 2011). Since many of these new RES electricity generating facilities will be located far from the load centres (particularly in the case of wind power), the RES expansion necessitates an expansion of the power transmission grid to meet the resulting transport capacity requirements. In a nutshell, achieving the European climate targets will require significant energy infrastructure development in all member states. However, across the EU, experiences show that citizens may object to the construction of new energy infrastructure in their localities. While the socio-political acceptance of most RES technologies is generally high on an abstract level (Wüstenhagen et al., 2007; Van der Horst, 2007), the expansion of both RES generation and power grid infrastructure brings about challenges in terms of local opposition in many countries (Bell et al., 2005; Zoellner et al., 2008; Raven et al., 2009; Devine-Wright, 2011; Musall and Kuik, 2011; Guo et al., 2015).

To deliver on emission reduction, however, it is important that the deployment targets are achieved. Given that local opposition may cause delays in relation to the deployment (Ciupuliga and Cuppen, 2013), the achievement of the emission reduction targets is at risk. While this is a challenge across the EU, we focus on Ireland in this paper. The reasoning for this focus is threefold. *First*, with a target share of 40% of intermittent RES in electricity generation by 2020, Ireland ranks above the European average (37%), Denmark (35%) or Germany (35%) (SLR, 2014). *Second*, despite this ambitious target and the high RES potential available, to date research on opinions related to energy infrastructure in Ireland is rare. The National Economic and Social Council (NESC) commissioned research undertaken by SLR (2014) who focus on reviewing national legislation and international literature in relation to wind power development. In addition, they consider five individual sites of wind power development. Other research, Van Rensburg et al. (2015), investigates the probability of wind farm planning approval using revealed preferences whereas Brennan and Van Rensburg (2016) conduct a discrete choice experiment to analyse how willing people are to make tradeoffs to allow for wind power initiatives in their localities. However, what these three studies have in common is that they focus on wind power without considering the system effects including other sources of (renewable) generation or the grid. *Third*, in their energy white paper released in December 2015, the Irish government emphasise the challenges

related to local infrastructure siting concerns (DCENR, 2015). Moreover, they recognise the value of communication, sharing information and understanding different views to minimise opposition to infrastructure development. In order to support such communication, it is crucial in our opinion to understand the drivers of (local) opposition. However, while the above three studies for Ireland provide valuable insights, they do not explore the drivers of opinions in a nationally representative, empirical way.

We therefore conducted a nationally representative survey in Ireland aimed at understanding the drivers that shape people's views on an abstract versus a local level for different power generation and grid technologies. Concerning such drivers, Devine-Wright (2007) notes that opinions may be driven by personal (socio-demographic), socio-psychological (e.g., political and environmental beliefs) and contextual (e.g., technical) factors. Our survey therefore includes question blocks for each of these three groups of factors. In terms of the analytical evaluation, Devine-Wright (2007) emphasises that most of the existing literature is solely based on descriptive statistics. We overcome this shortcoming by applying econometric techniques in our analysis. To our knowledge, this paper is the first to use econometrics to determine the drivers of people's views of power generation and grid infrastructure technologies on different levels in Ireland. We find that attitudes towards RES generation technologies in Ireland are generally very positive. However, despite these positive attitudes there appears to be a degree of reluctance amongst people to have these technologies situated close to their homes. We find that age, income and sense of attachment to place are significantly related to people's subjective opinions of power-generating and grid technologies. We find that socio-psychological factors also play an important role in explaining subjective views. While we find that socio-demographic factors play an important role in explaining subjective opinions of some energy-related technologies, we find that they play a more limited role in explaining people's opposition to their construction in their areas of residences. Our results indicate that local opposition is more consistently driven by socio-psychological factors and technical considerations.

This paper is structured as follows. In Section 2, we provide a summary of the relevant literature. In Section 3, we describe the survey design and the basic background of the econometric techniques used for our analysis. In Section 4, we provide an overview of the data collected in the survey and a summary of the corresponding descriptive statistics. Subsequently, we present and discuss our results in Section 5. In Section 6, we summarise the main findings and derive policy implications. In addition, Appendix A provides further details concerning the structure and questions of our survey, Appendix B shows that our data are representative of the Irish population, and Appendix C provides additional results.

2 Related literature

Researchers have been studying people's willingness to accept locally-sited, energy-related infrastructure for many years, however early research on this topic was relatively scarce in the period of government-owned, vertically-integrated utilities. More recently, with the onset of privatisation of electricity generation, coupled with increases in geographically-diverse sources of RES generation technologies, this topic has become increasingly controversial and, thus, has received increased focus. Many papers (see for example Wolsink (2000); Bell et al. (2005); Devine-Wright (2005); Smith and Klick (2007)) have focused on the "Not In My BackYard" (NIMBY) phenomenon whereby, despite the high level of support for RES technologies on a national level, people are unwilling to support the construction of energy-related infrastructure close to their homes. Wolsink (2000) states that, beyond simple "NIMBYism", institutional contexts can also play a significant role. He notes that in the Netherlands projects tend to be decided on prior to public consultation which leads to opposition from the public, creating a barrier to the installation of additional wind-power capacity. Examples of other research that has tried to bring the discussion of local opposition beyond the NIMBY label includes Burningham (2000), Devine-Wright (2005) and Wüstenhagen et al. (2007) who discuss the nuances of social opposition and acceptance.

Further complexities in opposition to new technologies are hihglighted by Wolsink (2007b), who notes that acceptance tends to follow a U-shaped pattern whereby it is low upon announcement of a new development but subsequently increases once the technology is in place. Focussing on the potential role that policy can play, Assefa and Frostell (2007) note that acceptance levels are higher for existing relative to new technologies which may indicate a need to increase the provision of information campaigns. Increased public acceptance will, according to their research, shorten the time between announcement and installation of new technologies.

A comprehensive study of the factors that are likely to drive levels of public acceptance for new technologies is provided by Devine-Wright (2007). He notes that acceptance is driven by socio-demographic, socio-psychological and contextual/technical factors. In terms of socio-demographics, he highlights the links between age, gender and social class and local opposition. In terms of the socio-psychological factors, he finds that factors such as political beliefs, degrees of environmentalism, sense of attachment to one's area of residence, the level of trust between the local community and other project stakeholders, and perceptions of justice all drive the levels of opposition. Regarding the role of contextual factors in driving opinions, the scale and type of the energy infrastructure in question, the extent to which the community are involved in the ownership and planning of the project, and the proximity of the new infrastructure are all important.

Aitken (2010) also highlights the importance of trust to decrease local opposition. The importance of regulation is noted by Battaglini et al. (2012), who conclude from an EU-wide survey

(albeit with a small sample of 108 respondents) that enforcement of existing regulation and the creation of new legislation on the siting of energy-related infrastructure will increase public support. The issue of justice in the development of new infrastructure is highlighted by Ciupuliga and Cuppen (2013) who examine the construction of a new interconnector between France and Spain. They note that feelings of distributional injustice by local communities lead to a lack of local support which caused a delay of the project.

Bidwell (2013) conducted a survey of 375 households in Michigan, USA in 2010 to examine factors affecting support for wind-energy development and found that support levels were generally high. In terms of the drivers of support, he found that higher-level education was the only socio-economic characteristic that impacted people's support for wind farm development. Other factors that impacted upon support levels were gender, people's attachment to their area of residence and, most importantly, the expected impact on the local economy.

Of particular relevance to our study is a paper by Van Rensburg et al. (2015) who examine wind farm planning approval in Ireland. They analyse the role of the technology in question, the institutional processes and the endowments of the proposed wind farm site. Using a dataset of 354 planning applications they find that institutional factors, such as the duration of the appeals process and the decisions of local authorities, amongst other factors, play an important role.

While the survey conducted by Bidwell (2013) was not representative of the underlying population, Bertsch et al. (2016) conduct a nationally-representative survey of attitudes towards new energy-related infrastructure development in Germany. They find a high level of support nationally for RES development and of the grid reinforcement needed to achieve greater penetration of RES technologies. However, they find that opposition at the local level is higher. An important barrier to local acceptance is concerns regarding the impact of the infrastructure on the landscape. Furthermore, they find that older people are less likely to express a willingness to change their behaviour for the sake of the environment, and that people, relative to people living in urban areas, people in rural areas require a greater distance between their place of residence and the location of energy-related infrastructure in order to accept the siting of new infrastructure.

Other recent analyses of opposition to energy technologies includes Cohen et al. (2016) who conduct an econometric analysis of the willingness to accept transmission line expansion across the EU. An important finding from their analysis is that providing people with information regarding the potential benefits of grid expansion can significantly increase acceptance levels. The authors also look at the characteristics that are associated with acceptance and they find that income, gender, education and age are significantly related to levels of acceptance. Specifically, acceptance levels are higher for people on lower income levels, for males, for those without a college education and for younger respondents. Looking at acceptance levels across countries, they find that countries with higher levels of installed RES are less likely to accept new transmission lines.

3 Methods

3.1 Survey methodology

3.1.1 Survey design

In order to explore people's opinions of, and local opposition to, electricity generation and (grid) infrastructure technologies, we developed an online survey in four iterations. In the first step, an initial questionnaire was developed based on stated preference questions.[1] This initial questionnaire was pre-tested in two iterations. This resulted in the dropping of several items from the questionnaire along with adding new questions and several updates of question wording. In the third iteration, a "soft launch" was initiated followed by a nationally representative panel of the Republic of Ireland being drawn in the final stage (n=1,414) using the panel book of Research Now, an international online consumer panel company with approximately 54,000 panellists across Ireland. This panel is demographically representative of gender, age, region and principal-economic status in Ireland.

Most questions use a 5-point Likert scale response option (the few exceptions are noted below). Details of the question categories and response scales can be found in Appendix A. The different question categories and questions within each question block were randomized to avoid order effects (Sills and Song, 2002; Podsakoff et al., 2003). In addition, two screening questions were included in the middle and at the end of the survey to ensure data quality (Galesic and Bosnjak, 2009). We also excluded any respondents who took an exceptionally long or an exceptionally short time to complete the survey, specifically those whose time-to-complete was below the 1st percentile or above the 99th percentile of the distribution across respondents. Our final sample is comprised of $n = 1,044$ respondents. Since the respondents were given the option to choose "No experience or limited knowledge" for some questions, the exact sample size may differ for certain questions.

3.1.2 AHP and SWING weighting

In the econometric analyses (see Section 3.2 below for an overview), we analyse how people's views of different energy-related technologies can be explained by different factors, which, as outlined in the introduction, may be grouped into three categories: personal (socio-demographic), socio-psychological (e.g., political and environmental beliefs) and contextual (e.g., technical) (Devine-Wright, 2007). In order to elicit the required information and allow for such econometric analyses, the survey included two dedicated question blocks in addition to asking about the classical socio-demographic information. *First*, aimed at eliciting their political and environmental beliefs, the

[1] For an overview of the discussion on theories and elicitation strategies behind stated versus revealed preferences, see the works by Ben-Akiva et al. (1994), Kim et al. (2006) and Carson and Louviere (2011).

respondents were asked to provide subjective judgements of the relative importance of broader energy policy objectives. *Second*, aimed at measuring the impact of contextual factors, the respondents were asked to provide their opinions on specific (technical) project-related criteria. For the elicitation of this information itself, we use methods from the field of multi-criteria decision analysis (MCDA), including:

- AHP ("analytic hierarchy process"): a pairwise comparison method (Saaty, 1980), which we use for determining people's views on the relative importance of energy policy objectives.
- SWING weighting: a method to analyse the relative importance of different criteria (Edwards and Von Winterfeldt, 1986; Edwards, 1977), which we use for determining a ranking of different local, project-related technical criteria.

AHP: In order to elicit people's views of the relative importance of energy policy objectives (economic competitiveness, environmental sustainability, security of supply, social acceptance), the participants were asked for pairwise comparison statements as in AHP. The reason for choosing AHP is that experiences have shown that people find pairwise comparisons easy to understand (Lootsma, 2007). Pairwise comparisons, however, may lead to inconsistent preference statements. In order to check these statements for consistency, we calculated the so-called consistency ratio (CR, see Saaty (1980)) and removed inconsistent preference statements from the data set for the corresponding analyses. Generally, we consider preference statements with $CR < 0.2$ as consistent resulting in a sample size of $n = 856$. Note that Saaty (1980) suggests $CR < 0.1$ as consistency threshold, resulting in a sample size of $n = 603$ in our case. Since values of the CR have been discussed controversially in literature (Lane and Verdini, 1989; Salo and Hämäläinen, 1997; Franek and Kresta, 2014), as a robustness check we also ran the econometric analyses using $CR < 0.1$, to ensure that our results were not sensitive to the choice of the consistency ratio. We find that the results are not sensitive to the choice of the CR, therefore, we choose to use $CR < 0.2$ in order to preserve as large a sample size as possible.

SWING: In addition to asking the participants to rank high-level energy policy objectives as described above, they were asked to provide their subjective views of the importance of specific local, project-related criteria (impact on landscape, noise, etc.) individually on a 5-point scale. On this basis, weights (normalised to sum up to one) were calculated as in SWING weighting. The main reason for using SWING weighting, as opposed to AHP, when eliciting the importance of contextual factors is that the set of possible drivers is much larger than the set of energy policy objectives and experiences have shown that the share of inconsistent preference statements in pairwise comparisons increases with the amount of criteria to be compared (Chen et al., 2011; Bozóki et al., 2013).

3.2 Econometric methodology

3.2.1 Ordered logit model

In the survey respondents are, in the first instance, asked to express their subjective opinions on various energy-related technologies from "Negative" to "Positive" using a five-point Likert scale.[2] We analyse how people's views of these technologies are explained by socio-demographic characteristics, socio-psychological views and contextual factors using an ordinal regression model (for a detailed description refer to Long and Freese (2006)), as the responses follow an ordered sequence. The model is characterised by Equation 1:

$$Pr(Y = N|X_1, X_2, \ldots, X_k) = F(\beta_0 + \beta_1 + \beta_2 + ... + \beta_k) \tag{1}$$

N ranges in value from 1 to 5 where 1 is "Negative" and 5 is "Positive". The X's represent the explanatory variables in our model (the socio-demographic, socio-psychological and contextual factors), F is the standard logistic distribution, and the β terms are the coefficients on the explanatory variables.

The ordered logit model is also referred to as the *parallel lines* or the *parallel regressions* model as it assumes that for each explanatory variable the effect of that variable on each "step" of the ordinal scale is the same, this is known as the proportional odds assumption (POA). In other words, for a given X variable its effect on moving the Y variable from a value 1 to 2 ("Negative" to "Somewhat negative") is the same as its impact on moving the Y variable from a value of 2 to 3("Somewhat negative" to "Neutral"). As outlined by Long and Freese (2006) the POA means that running an ordered logit is equivalent to running $J - 1$ binary regressions assuming that the slope coefficients are identical across each regression (where J refers to the number of potential outcome values of the Y variable). The use of an ordered logit model is only appropriate when the POA holds.

There are a number of tests that can be applied to check if the POA holds which we apply to our data.[3] In cases where this assumption does not hold we model the relationship between people's opinions of technologies and their socio-demographic characteristics using the generalised ordered logit model. This model is the same as the ordered logit except that it allows the coefficients on the X variables to differ for different levels of the Y variable (i.e., across the $J - 1$ regressions). A detailed description of this model is provided by Williams (2006), who notes that the generalised ordered logit model is less restrictive than the ordered logit but more parsimonious than a multinomial logit model as it allows the parallel regression model to be applied for those

[2]The intermediate values being "Somewhat negative", "Neutral" and "Somewhat positive".

[3]This issue is discussed by, e.g., Peterson and Harrell Jr (1990) and Williams et al. (2006)

explanatory variables where the POA does hold. However, it does not impose this assumption where it is not appropriate. We convert the β coefficients to marginal effects which, as noted by Chernozhukov et al. (2009), are commonly used to quantify the effects of explanatory variables on a particular outcome. The marginal effects represent the change in the probability that a person will report a given opinion when the value of a particular X variable increases by one unit, holding the other X variables are at their mean values.

3.2.2 Logit model

Having examined people's subjective assessments of energy-related technologies, we look at the factors that predict whether or not those respondents who do not hold a negative opinion vis-à-vis a technology would still oppose the installation of such a technology in their area of residence. Thus, for each technology we define a "local opposition" dummy variable for those people *who do not have a negative opinion of that technology*, i.e., those people who, when asked to provide their subjective assessment of a technology, indicate that is is "positive", "somewhat positive" or "neutral". This variable takes a value of one if a person would oppose the siting of a technology either at a distance of greater than five kilometers from their area of residence or would oppose it regardless of distance, and zero otherwise.

As this variable only takes a value of zero or one we analyse local opposition within the framework of the standard logit model. The dependent variable, y_i, represents a person's expression of local opposition as defined above. The logit model assumes that underlying this observed y_i there is an unobserved latent variable, Y^*, such that:

$$Y^* = X\beta + \epsilon \tag{2}$$

In a logit model we observe:

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leq 0 \\ 1 & \text{if } y_i^* > 1 \end{cases} \tag{3}$$

As with the ordered logit model, we are looking at the probability of observing a given value of y_i, where the Xs are the explanatory variables and the β terms represent the coefficients on these variables. In the results table (Table 11) we present the estimated marginal effects.

4 Data

4.1 Overview of data collected in the survey

In order to collect data on people's attitudes towards the development of new, energy-related infrastructure in the Republic of Ireland, we conducted a large, nationally-representative online survey of the Irish population. This survey, which was conducted over a two-and-a-half week period from the end of May to the beginning of June 2016, was divided into a number of sections. In the first section of the survey we sought information on the respondents' views ("subjective assessments") of a number of technologies for generating electricity. We asked respondents for both their overall assessments of each technology and also for their more detailed opinions on specific project-related characteristics and local impacts of the technologies (for example, the effect of wind farms on the landscape); what we refer to as the "contextual factors". The second section repeated the same set of questions for grid infrastructure technologies. The technologies which we focused on in these two sections are listed in Table 1 below. In the third section we asked participants about the minimum distance which they would deem acceptable between their current place of residence and specific energy-related infrastructure. In sections four and five we sought information on the factors driving subjective opinions (see Section 3.1 above): In the fourth section, we sought people's opinions on the relative importance of energy policy objectives and, in addition, asked them to provide a ranking, in terms of importance, of various project-related criteria presented earlier in the survey. Finally, we asked respondents to provide information on their socio-demographic backgrounds such as their age, gender, employment status, income, area of residence and length of residence in that area.[4]

Table 1: Energy-related technologies

Power-generation technologies	Grid expansion technologies
Wind turbines	Above-ground electrical transmission line
Solar generation technologies	Underground electrical transmission line
Biomass power plants	
Gas-fired power plants	
Coal-fired power plants	

4.2 Descriptive statistics and preliminary findings

Before turning to the econometric analysis of our results, we first look at the overall characteristics of the survey respondents and responses. These statistics relate to the 1,044 respondents left in our

[4]A more detailed overview of the survey is given in Appendix A, and the entire survey can be accessed online.

sample after the basic data cleaning process. Table 2 presents an overview of the socio-demographic information on the survey sample. We first verified that this sample was representative of the overall population in terms of age, region and principal-economic status by comparing our data to data from the most recent Quarterly National Household Survey (QNHS) conducted by the Irish Central Statistics Office (CSO). The detailed results are displayed in the Figures 1 to 3 in Appendix B. They illustrate that our data are indeed representative of the Irish population.

Table 2: Summary statistics: Socio-demographic characteristics

Variable	Percent	Variable	Percent
Gender		*City dummy ("urban")*	
Female	54.12	Rural	66.00
Male	45.88	Urban	34.00
Age		*Tenure*	
15 - 19 years	4.89	Owner-occupied (OO)	64.85
20 - 24 years	11.3	OO - purchased via local authority scheme	2.3
25 - 34 years	16.76	Rented (owner not in residence)	28.45
35 - 44 years	18.01	Occupied rent free (and not owned)	1.05
45 - 54 years	15.52	Rent free to some residents (and not owned)	0.67
55 - 59 years	7.85	OO and rented out to some residents	0.96
60 - 64 years	6.13	Other	1.72
65 years or older	19.54		
Highest level of education		*Length of residence*	
Primary school	1.15	$<$ 1 year	3.74
Secondary 1 (Junior/Inter Certificate)	8.62	1-5 years	13.98
Secondary 2 (Leaving Certificate)	26.72	6-10 years	15.04
Post-secondary non-tertiary	22.03	11-20 years	21.36
Third level non-honours degree	20.88	$>$ 20 years	45.88
Third level honours degree or higher	20.59		
Income (€)		*Economic status*	
Less than 15,000	13.89	At work	43.49
15,000 to 30,000	33.75	Unemployed	10.82
30,000 to 50,000	26.9	Student	9.96
50,000 to 75,000	15.91	Engaged in home duties	10.15
75,000 or more	9.55	Retired from employment	21.36
		Other	4.21

In terms of gender, 46% of the respondents were male; this is slightly out of line with the results from the 2011 Census of population, according to which 49% of the population aged 15

Table 3: Subjective assessments of energy-related technologies (%)

Technology	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Wind	4.21	6.03	13.22	30.75	45.79
Solar	0.48	1.15	7.18	22.03	69.16
Biomass	1.63	4.21	19.54	36.97	37.64
Gas	7.66	22.8	40.13	21.07	8.33
Coal	26.34	33.62	27.3	9.58	3.16
Above-ground grid	13.51	29.89	33.52	18.01	5.08
Underground grid	1.34	2.68	20.69	32.09	43.2

and over are male.[5] The age profile of our respondents are broadly in line with the population (see Figure 1, Appendix B). The highest number of respondents are in the 35-44 and the 65+ age categories. It is particularly important that the oldest age category are adequately represented in our sample as the survey was conducted online. In terms of education levels, the highest category of formal education achieved was the Leaving Certificate (equivalent to having completed high school) for 27% of the sample. While approximately two-thirds of the sample had some degree of higher (i.e., post-secondary) education. It is likely that people may feel differently with respect to energy technologies depending on their tenure. For example, we may expect a more negative attitude to those technologies seen to harm the landscape by those who own their home as previous research (Sunak and Madlener, 2012) has shown that these technologies can negatively impact property values. Of the sample, 67% are owner-occupiers. There is evidence that a person's sense of "attachment to place" may impact their feeling towards the construction of new energy infrastructure (Devine-Wright, 2011); sense of attachment to place is likely to be high amongst the current sample as 46% of respondents have been living in their current area of residence for more than 20 years. In terms of economic status, our sample is broadly representative of the population. While the majority of the respondents are at work, a significant proportion of the sample are retired (again it is important given the online nature of the survey that this group be adequately represented; in our data, this group is actually somewhat over-represented, see Figure 3, Appendix B).

In terms of people's "overall judgment" of the technologies presented, Table 3 shows that there is a lot of variation across technologies. In general people feel very positively towards renewable sources of generation, in particular concerning solar generation technologies. Also of note is the large difference in people's views on above versus underground expansion of the transmission grid; whereas 43% of the population have positive views of underground grid expansion, only 5% of the respondents have positive views of above ground expansion. In terms of the more conventional

[5]The results from the 2016 Census are not yet available.

Table 4: Minimum acceptable distance of energy-related technologies from residence (%)

Technology	No experience/ Limited knowledge	0-1 km	1-5 km	>5 km	Oppose regardless
Wind	11.49	11.49	24.14	39.85	13.03
Solar	12.36	36.49	25.67	21.84	3.64
Biomass	28.07	3.93	16.19	37.84	13.98
Gas	20.88	2.3	13.51	40.23	23.08
Coal	16.86	2.2	7.38	29.98	43.58
Above-ground grid	15.52	8.52	18.49	34.39	23.08
Underground grid	15.61	27.97	23.37	26.72	6.32

sources of power generation, people appear to have overwhelmingly negative views of coal power, whereas attitudes towards natural gas are more neutral.

Table 4 shows that despite the positive views people have towards certain technologies, this does not guarantee that they will be happy to have such technologies installed near their homes. For example, while 77% of respondents report having a positive or somewhat positive opinion of wind power, only 36% of the respondents would be happy to have a wind farm constructed within five kilometers of their homes. On the other hand people's overwhelming positive opinions on solar technologies are reflected in their willingness to accept the construction of a solar generation plant near their place of residence.

The next two tables (Tables 5 and 6) look at the criteria used to create the SWING and AHP weight variables. Looking first at the criteria for which the SWING weights are created, the survey asked respondents to rank a number of contextual/technical factors in terms of their importance on a scale of 1-5. Table 5 shows that the respondents think that the effects on air quality, water quality and health are particular important with 60%, 61% and 69% of the respondents assigning an importance of 5 to these criteria respectively. While respondents were reluctant to designate any of the criteria as unimportant (a very low percentage of respondents assigned a 1 or a 2 to any criteria), people do appear to be less concerned about the effects on sound or local employment.

Finally, as noted previously the AHP weights are used to characterise people's views of the relative importance of energy policy objectives. We look at how people view the three standard pillars of energy policy (security of supply, economic effects and sustainability) and add to these a fourth objective which is social acceptance. Looking at the average AHP weights calculated for the respondents (and applying the 0.2 cut-off for the consistency ratio as discussed in Section 3.1.2), Table 6 shows that, on average, people place the highest degree of importance on reliability of supply followed by environmental sustainability and social acceptance, while economic viability is ranked as being the least important.

Table 5: Ranking of criteria in terms of their importance

Percentage of respondents who gave the following ranking (Note: 1 = unimportant; 5 = highly important)					
Criteria:	1	2	3	4	5
Air quality	4.89	2.87	15.13	16.95	60.15
Landscape	2.39	5.94	23.18	32.85	35.63
Environment	2.97	3.93	16.38	23.95	52.78
Local employment	2.68	7.66	31.99	33.14	24.52
Economy	2.87	6.7	27.3	34.96	28.16
Odour	3.26	5.17	22.99	28.64	39.94
Health	4.21	2.68	12.26	12.16	68.68
Sound	3.45	6.32	34.1	31.13	25.00
Technical safety	3.54	2.87	17.05	21.36	55.17
Water quality	3.93	2.01	14.56	18.49	61.02

Table 6: Relative importance of energy policy objectives: Calculated AHP weights

	Economic viability	Environmental sustainability	Reliability of supply	Social acceptance
Mean	0.19	0.27	0.30	0.24

5 Results and Discussion

5.1 Subjective opinions of energy-related technologies

Turning to the results of the ordered logit model, we look at the variables that predict people's overall subjective opinions of the energy technologies presented in Table 1. The factors we examined are grouped according to the three types of drivers identified by Devine-Wright (2007); socio-demographic, socio-psychological and contextual factors. As noted previously, the socio-psychological factors are proxied using the AHP weights, while the contextual factors are modelled using the SWING variables. The models are run for all the technologies listed in Table 1 but, due to space constraints, we focus our discussion on four of these technologies. We look in detail at subjective opinions of two power-generation technologies, one that is well-established and one with which people in Ireland are relatively less familiar; these are wind and biomass generation. We also consider two grid-related technologies, these are above ground and below ground transmission lines, and compare the drivers of opinions to these types of infrastructure for which people hold, according to the survey results presented in Table 3, contrasting views.

We first analyse the variables that explain people's subjective opinions of wind-powered generation technologies (see Table 7). Of the RES-generation technologies currently being used in

Ireland, wind power has by far the largest share and, as a result, is a technology with which people are generally familiar. Looking first at the socio-demographic variables, we find that age, length of residency and income are generally significant drivers of people's subjective views. Education is also significant for certain response categories. Looking first at response by age, here the reference category refers to those in the youngest age bracket (less than 24 years old). It would appear that, as we move from younger to older age categories, respondents are more likely to have a negative or neutral view of wind power, and less likely to have a positive view. A person's level of education is not generally, according to our results, a significant determinant of their views of wind power. The only exception is that, relative to respondents who have no formal education beyond intercert level, people with a leaving certificate are more likely to be in the neutral or "somewhat positive" age categories, but less likely to be in the positive category.

Similar to what was previously discovered by Devine-Wright (2007), we find that the length of time that a person has lived in their current residence can be a significant determinant of how they feel about energy-related infrastructure. Relative to people whose current period of residence has been less than 5 years, people who have been living in their home for more than 20 years are significantly more likely to have a "somewhat negative" view of wind power. These people may have a stronger sense of "attachment to place" and be more concerned about the potential negative impacts of wind turbines on, for example, the landscape. People who have been living for longer in their current homes are also less likely to express a "positive" view of wind turbines.

We find that a person's income level is significantly related to their feelings about wind-powered generation. People on higher incomes are significantly more likely to respond that their subjective opinion of wind power is a positive one, and less likely to express any of the other subjective opinions. In terms of the other socio-demographic variables, we find that neither a person's employment status, the area in which they live, their tenure type nor their gender have a significant relationship to how they feel about wind power.

We turn next to the socio-psychological drivers, as summarised by the AHP weights.[6] As, for each respondent, the AHP weights sum to one,[7] we omit one of these weights from our regressions (similar to the procedure used for estimating the effects of categorical variables). The omitted weight category is "Social acceptance". In terms of the weight that people place on the importance of economic competitiveness as an objective of energy policy, our results show that people who place a greater weight on this goal relative to social acceptance are less likely to have a "positive" view of wind power, and more likely to have a "'neutral" view. On the other hand,

[6] As noted previously, we base the main results on the AHP weights calculated using the less strict consistency ratio (CR$<$ 0.2) in order to keep as many respondents as possible in the sample. We subsequently verify that the results are robust to the use of the stricter consistency ratio (CR$<$ 0.1).

[7] Thus, they are an example of proportional composition data. For a discussion of this type of data refer to Aitchison (1982) and Van den Boogaart and Tolosana-Delgado (2013)

Table 7: Subjective assessment of wind power

	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Age					
Reference cat.: Younger than 25					
25 - 44	0.0134*	0.0216*	0.0409*	0.0306**	-0.106*
	(0.00788)	(0.0122)	(0.0219)	(0.0144)	(0.0546)
45 - 59	0.0231	0.0638**	0.0960***	-0.0678*	-0.115**
	(0.0172)	(0.0266)	(0.0359)	(0.0388)	(0.0576)
60 or older	0.0208*	0.0328*	0.0594**	0.0358***	-0.149**
	(0.0121)	(0.0180)	(0.0294)	(0.0120)	(0.0680)
Highest level of education					
Reference cat.: Primary school					
Leaving certificate	0.0148	0.0235	0.0437*	0.0294**	-0.111*
	(0.00952)	(0.0146)	(0.0252)	(0.0130)	(0.0603)
Post-secondary non-tertiary	0.00156	0.00254	0.00496	0.00418	-0.0132
	(0.00784)	(0.0127)	(0.0247)	(0.0201)	(0.0653)
Third level non-honours degree	0.000849	0.00138	0.00271	0.00232	-0.00726
	(0.00783)	(0.0127)	(0.0248)	(0.0209)	(0.0663)
Third level honours or above	0.00185	0.00301	0.00586	0.00492	-0.0156
	(0.00815)	(0.0132)	(0.0255)	(0.0206)	(0.0675)
Length of residency					
Reference cat.: Less than 5 years					
5 - 20 years	0.0114	0.0183	0.0351*	0.0272*	-0.0920*
	(0.00717)	(0.0112)	(0.0206)	(0.0145)	(0.0521)
More than 20 years	0.0150	0.0596***	0.00222	0.0682*	-0.145***
	(0.0129)	(0.0193)	(0.0274)	(0.0356)	(0.0557)
Income					
Reference cat.: Less than 15,000					
15,000 to 30,000	0.0155	-0.0219	-0.0223	-0.0903**	0.119**
	(0.0127)	(0.0149)	(0.0267)	(0.0384)	(0.0574)
30,000 to 50,000	-0.00787	-0.0130	-0.0261	-0.0257	0.0726
	(0.00606)	(0.00995)	(0.0202)	(0.0223)	(0.0579)
50,000 to 75,000	-0.0168***	-0.0283***	-0.0598***	-0.0773**	0.182***
	(0.00574)	(0.00920)	(0.0196)	(0.0336)	(0.0650)
75,000 or more	-0.0173***	-0.0293***	-0.0631***	-0.0882**	0.198***
	(0.00580)	(0.00938)	(0.0206)	(0.0403)	(0.0728)
Broad region					
Reference cat.: Border, Midlands, West					
Dublin and Mid-East	0.00839	0.0136	0.0262	0.0212	-0.0694
	(0.00594)	(0.00939)	(0.0176)	(0.0134)	(0.0455)
Mid-West, South-East and South-West	0.00551	0.00894	0.0173	0.0142	-0.0460
	(0.00533)	(0.00852)	(0.0162)	(0.0127)	(0.0424)
Employment					
Reference cat.: In employment					
Unemployed, student, home duties, other	0.00329	0.00535	0.0104	0.00874	-0.0278
	(0.00515)	(0.00831)	(0.0160)	(0.0130)	(0.0424)
Retired	0.000864	0.00141	0.00275	0.00235	-0.00738
	(0.00729)	(0.0119)	(0.0231)	(0.0194)	(0.0617)
Tenure					
Reference cat.: Owner-occupied					
Rented accommodation	-0.00456	-0.00748	-0.0149	-0.0139	0.0409
	(0.00488)	(0.00799)	(0.0161)	(0.0162)	(0.0448)
All other categories of tenure	0.00292	0.00472	0.00910	0.00720	-0.0239
	(0.0102)	(0.0164)	(0.0310)	(0.0221)	(0.0796)
Male dummy	-0.00400	-0.00654	-0.0128	-0.0112	0.0345
	(0.00405)	(0.00657)	(0.0128)	(0.0112)	(0.0344)
Urban dummy	-0.00593	-0.00973	-0.0193	-0.0180	0.0530
	(0.00435)	(0.00709)	(0.0141)	(0.0141)	(0.0391)
AHP variables					
Reference cat.: Social acceptance					
Economy	0.0388	0.0115	0.787***	-0.129	-0.709***
	(0.0576)	(0.0833)	(0.150)	(0.213)	(0.246)
Environment	-0.0937***	-0.153***	-0.300***	-0.261***	0.808***
	(0.0269)	(0.0398)	(0.0728)	(0.0714)	(0.186)
Reliability	-0.0252	-0.0411	-0.0806	-0.0702	0.217
	(0.0242)	(0.0392)	(0.0765)	(0.0673)	(0.205)
SWING variables					
Landscape	0.271*	0.442*	0.868*	0.755*	-2.336*
	(0.151)	(0.242)	(0.467)	(0.417)	(1.243)
Health	-0.696**	-0.312	-3.065***	1.761	2.313
	(0.343)	(0.519)	(0.930)	(1.189)	(1.563)
Environment	0.0868	0.142	0.278	0.242	-0.748
	(0.174)	(0.283)	(0.555)	(0.484)	(1.493)
Economy	-0.0926	-0.151	-0.297	-0.258	0.799
	(0.144)	(0.234)	(0.459)	(0.400)	(1.233)
Local employment	-0.143	-0.234	-0.459	-0.399	1.234
	(0.131)	(0.212)	(0.414)	(0.364)	(1.111)
Sound	0.417**	0.681***	1.336***	1.163***	-3.597***
	(0.165)	(0.258)	(0.489)	(0.450)	(1.288)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

those who place relatively more importance on environment concerns relative to social acceptance are, unsurprisingly, much more likely to have a positive view of wind power, and less likely to have any other view. We find no relationship between people's prioritisation of reliability of supply and their opinion of wind power.

Finally, we look at how contextual considerations, as measured by the SWING weights, affect people's attitudes towards wind-powered generation. From the results displayed in Table 7 we can see that concerns about landscape and sound have the greatest impact on whether people have positive views about this particular technology. People who place a high level of importance on these considerations are significantly less likely to hold a positive subjective opinion of wind power. Concerns about the economy, local employment and, surprisingly, the environment do not significantly determine people's subjective views on wind power. The fact that we do not detect a significant relationship between environmental concerns and views on wind power is particularly surprising given that people who considered this a relatively important pillar of energy policy did express significantly more positive views of wind power. It may be that more local concerns regarding the impact on landscape and sound trump environmental concerns.

We next consider another renewable generation technology, but this time one with which people in Ireland are generally less familiar, that is biomass. As in the case of wind power, we begin by looking at the relationship between people's socio-demographic characteristics and their subjective opinions on electricity generation from biomass. Table 8 shows that, in contrast to people's subjective assessment of wind power, older people are less likely to have a generally negative view of biomass, and more likely to have a generally positive view. For this generation technology, how long a person has been living in their current residence has no impact on their subjective assessment of it. However, once again we find a statistically significant relationship between a person's opinion vis-à-vis biomass and their income level. The signs on the income brackets follow the same pattern as was the case with wind generation: people with higher incomes are less likely to express a negative opinion on biomass and more likely to express a positive view.

Again we find that area and employment status are not significantly related to people's overall view of biomass. We find that, relative to owner-occupiers, people in other categories of tenure are significantly less likely to have positive views of biomass generation. We find that gender is also statistically significant; table 8 shows that males are more likely to have generally negative or neutral views of biomass generation and less likely to have positive views.

We turn next to the socio-psychological drivers of opinions, as measured by the AHP weights. We find that the relative importance that people ascribe to reliability of power supply as a policy pillar is unrelated to their view of biomass power generation. There is a significant, albeit weak, relationship between people's ranking of environmental concerns and their opinion of biomass generation. People who rank the environment as more important than social acceptance are more

Table 8: Subjective assessment of biomass

	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Age					
Reference cat.: Younger than 25					
25 - 44	-0.000349	-0.000927	-0.00442	-0.00139	0.00708
	(0.00245)	(0.00649)	(0.0310)	(0.00996)	(0.0499)
45 - 59	-0.00331	-0.00883	-0.0435	-0.0180	0.0737
	(0.00242)	(0.00614)	(0.0304)	(0.0163)	(0.0544)
60 or older	-0.00541*	-0.0145*	-0.0721*	-0.0339	0.126*
	(0.00310)	(0.00755)	(0.0372)	(0.0243)	(0.0705)
Highest level of education					
Reference cat.: Primary school					
Leaving certificate	-0.00412	-0.0110	-0.0543	-0.0233	0.0928
	(0.00270)	(0.00676)	(0.0334)	(0.0190)	(0.0607)
Post-secondary non-tertiary	-0.00448*	-0.0120*	-0.0599*	-0.0282	0.105*
	(0.00269)	(0.00666)	(0.0335)	(0.0219)	(0.0634)
Third level non-honours degree	-0.00389	-0.0104	-0.0517	-0.0231	0.0890
	(0.00269)	(0.00678)	(0.0341)	(0.0205)	(0.0631)
Third level honours or above	-0.00271	-0.00722	-0.0354	-0.0142	0.0595
	(0.00278)	(0.00723)	(0.0362)	(0.0181)	(0.0638)
Length of residency					
Reference cat.: Less than 5 years					
5 - 20 years	-0.00125	-0.00332	-0.0159	-0.00522	0.0257
	(0.00232)	(0.00613)	(0.0294)	(0.0103)	(0.0480)
More than 20 years	0.00215	0.00571	0.0270	0.00809	-0.0429
	(0.00257)	(0.00666)	(0.0310)	(0.00925)	(0.0491)
Income					
Reference cat.: Less than 15,000					
15,000 to 30,000	-0.00354	-0.00942	-0.0458	-0.0175	0.0762
	(0.00244)	(0.00610)	(0.0294)	(0.0138)	(0.0508)
30,000 to 50,000	-0.00482*	-0.0129**	-0.0637**	-0.0284	0.110**
	(0.00257)	(0.00617)	(0.0299)	(0.0181)	(0.0550)
50,000 to 75,000	-0.00386	-0.0103	-0.0519	-0.0248	0.0909
	(0.00254)	(0.00638)	(0.0327)	(0.0219)	(0.0625)
75,000 or more	-0.00505*	-0.0136**	-0.0702**	-0.0411	0.130*
	(0.00262)	(0.00635)	(0.0334)	(0.0303)	(0.0710)
Broad region					
Reference cat.: Border, Midlands, West					
Dublin and Mid-East	0.00225	0.00595	0.0279	0.00779	-0.0439
	(0.00225)	(0.00575)	(0.0262)	(0.00692)	(0.0406)
Mid-West, South-East and South-West	0.00260	0.00688	0.0321	0.00860	-0.0502
	(0.00219)	(0.00553)	(0.0248)	(0.00614)	(0.0378)
Employment					
Reference cat.: In employment					
Unemployed, student, home duties, other	-0.000388	-0.00103	-0.00490	-0.00155	0.00786
	(0.00189)	(0.00501)	(0.0239)	(0.00773)	(0.0385)
Retired	0.00286	0.00754	0.0345	0.00774	-0.0527
	(0.00340)	(0.00871)	(0.0380)	(0.00602)	(0.0554)
Tenure					
Reference cat.: Owner-occupied					
Rented accommodation	-0.00208	-0.00553	-0.0268	-0.00976	0.0442
	(0.00195)	(0.00503)	(0.0244)	(0.0104)	(0.0414)
All other categories of tenure	0.00859	0.0221	0.0894*	-0.000353	-0.120**
	(0.00660)	(0.0157)	(0.0526)	(0.0159)	(0.0592)
Male dummy	0.00443**	0.0117***	0.0558***	0.0172**	-0.0892***
	(0.00200)	(0.00450)	(0.0196)	(0.00747)	(0.0311)
Urban dummy	0.000758	0.00201	0.00949	0.00280	-0.0150
	(0.00179)	(0.00472)	(0.0222)	(0.00626)	(0.0349)
AHP variables					
Reference cat.: Social acceptance					
Economy	0.0428***	0.114***	0.540***	0.167***	-0.863***
	(0.0160)	(0.0326)	(0.132)	(0.0581)	(0.206)
Environment	-0.0151	-0.0401*	-0.191*	-0.0589*	0.305*
	(0.00934)	(0.0229)	(0.105)	(0.0353)	(0.166)
Reliability	-0.00217	-0.00576	-0.0274	-0.00847	0.0438
	(0.00917)	(0.0243)	(0.115)	(0.0357)	(0.184)
SWING variables					
Landscape	-0.0727	-0.193	-0.917	-0.284	1.466
	(0.0559)	(0.141)	(0.655)	(0.213)	(1.044)
Air quality	-0.0773	-0.205	-0.974	-0.301	1.557
	(0.0625)	(0.159)	(0.737)	(0.239)	(1.176)
Water quality	0.0167	0.0444	0.211	0.0652	-0.337
	(0.0680)	(0.180)	(0.856)	(0.265)	(1.368)
Health	-0.0781	-0.207	-0.985	-0.305	1.575
	(0.0716)	(0.183)	(0.859)	(0.275)	(1.370)
Environment	-0.00873	-0.0232	-0.110	-0.0340	0.176
	(0.0645)	(0.171)	(0.813)	(0.252)	(1.300)
Economy	-0.102	-0.270*	-1.283*	-0.397	2.051*
	(0.0656)	(0.162)	(0.742)	(0.251)	(1.184)
Local employment	-0.0229	-0.0606	-0.288	-0.0891	0.461
	(0.0518)	(0.137)	(0.647)	(0.201)	(1.035)
Odour	0.00514	0.0136	0.0648	0.0200	-0.104
	(0.0551)	(0.146)	(0.694)	(0.215)	(1.110)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

likely to have a generally positive view of biomass. Of the AHP variables, economic considerations are the strongest predictor of people's views of biomass; those who rank the economy as relatively more important are much less likely to have a positive view.

Finally looking at the impact of technological factors on subjective opinions vis-à-vis biomass generation, we find that in this case the SWING variables that are related to people's opinions of biomass generation are concerns about the economy, and this relationship is generally a weak one. Those who place a high importance on economic considerations are more likely to express positive views. This contrasts with the coefficient on the AHP-economy variables, but it is important to note that in this case we are looking at absolute importance, and not importance relative to any other objectives of energy policy.

We next turn our attention to people's view of the potential expansion of the transmission network, considering above and below ground expansion separately. We ask for their opinion on these two technologies separately as people's opinions on grid expansion differ greatly depending upon whether the lines are placed above ground or underground (as illustrated by Table 3. Looking first at expansion of the above ground network, this is a technology for which we find generally low levels of support.

Of the socio-demographic variables, once again age turns out to be a significant determinant. As people get older it appears that they are more likely to express negative opinions, and less likely to express neutral or "somewhat positive" views. Furthermore, people who have been living in their current residence for relatively longer periods of time appear to have more negative feelings towards above-ground grid expansion, and less likely to have neutral or positive views which concurs with the findings of Devine-Wright (2012). Again this indicates that people who have a stronger sense of attachment to place may be more concerned about the effect of energy-related infrastructure on the landscape.

We find a weakly significant relationship between income and views on above-ground grid expansion; people in the €50,000-€75,000 income bracket are less likely to express "somewhat positive" or positive views. People's principal economic status is also a significant predictor here. As Table 9 shows, relative to people in employment, those in the 'Unemployed, student, home duties, other" category generally have more negative and less positive views of above-ground grid expansion. Furthermore, people who are retired from employment are significantly less likely to express positive views. Tenure is also significant in the case of some views towards this technology. Relative to owner-occupiers, renters are significantly less likely to express a "somewhat positive" opinion of above-ground grid expansion, but slightly more likely to express a positive one.

Turning next to the relationship between people's prioritisation of energy policy objectives and their views on the expansion of the traditional above-ground transmission network, we find that only the relative importance of economic considerations is significant. An interesting result that

Table 9: Subjective assessment of above ground transmission expansion

	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Age					
Reference cat.: Younger than 25					
25 - 44	0.0912***	0.130***	-0.0813***	-0.115***	-0.0254***
	(0.0259)	(0.0295)	(0.0234)	(0.0265)	(0.00743)
45 - 59	0.191***	0.107**	-0.119***	-0.187***	0.00905
	(0.0536)	(0.0492)	(0.0462)	(0.0274)	(0.0167)
60 or older	0.283***	0.0949	-0.273***	-0.143***	0.0378
	(0.0737)	(0.0656)	(0.0497)	(0.0403)	(0.0266)
Highest level of education					
Reference cat.: Primary school					
Leaving certificate	-0.00436	-0.00768	0.00369	0.00679	0.00155
	(0.0219)	(0.0390)	(0.0183)	(0.0346)	(0.00796)
Post-secondary non-tertiary	0.0102	0.0171	-0.00898	-0.0150	-0.00336
	(0.0241)	(0.0393)	(0.0219)	(0.0340)	(0.00756)
Third level non-honours degree	-0.00113	-0.00197	0.000966	0.00174	0.000397
	(0.0233)	(0.0408)	(0.0198)	(0.0360)	(0.00822)
Third level honours or above	-0.0179	-0.0329	0.0143	0.0296	0.00692
	(0.0218)	(0.0422)	(0.0160)	(0.0388)	(0.00943)
Length of residency					
Reference cat.: Less than 5 years					
5 - 20 years	0.0285	0.0472	-0.0252	-0.0412	-0.00924
	(0.0202)	(0.0317)	(0.0184)	(0.0276)	(0.00634)
More than 20 years	0.0361*	0.0613*	-0.0310*	-0.0541*	-0.0123*
	(0.0201)	(0.0330)	(0.0175)	(0.0292)	(0.00706)
Income					
Reference cat.: Less than 15,000					
15,000 to 30,000	0.0302	0.0493	-0.0270	-0.0429	-0.00957
	(0.0212)	(0.0322)	(0.0197)	(0.0278)	(0.00632)
30,000 to 50,000	0.0337	0.0535	-0.0306	-0.0464	-0.0102
	(0.0234)	(0.0336)	(0.0222)	(0.0288)	(0.00646)
50,000 to 75,000	0.0428	0.0630*	-0.0402	-0.0540*	-0.0116*
	(0.0293)	(0.0361)	(0.0289)	(0.0304)	(0.00657)
75,000 or more	0.0361	0.0536	-0.0340	-0.0458	-0.00988
	(0.0328)	(0.0410)	(0.0325)	(0.0344)	(0.00725)
Broad region					
Reference cat.: Border, Midlands, West					
Dublin and Mid-East	0.0146	0.0249	-0.0127	-0.0218	-0.00493
	(0.0168)	(0.0279)	(0.0149)	(0.0244)	(0.00554)
Mid-West, South-East and South-West	0.00561	0.159***	-0.133***	-0.0267	-0.00501
	(0.0227)	(0.0393)	(0.0377)	(0.0308)	(0.0112)
Employment					
Reference cat.: In employment					
Unemployed, student, home duties, other	0.0322*	0.0525**	-0.0287*	-0.0458**	-0.0102**
	(0.0164)	(0.0250)	(0.0153)	(0.0216)	(0.00509)
Retired	0.0122	0.112*	-0.0795	-0.00257	-0.0421***
	(0.0331)	(0.0601)	(0.0515)	(0.0439)	(0.00994)
Tenure					
Reference cat.: Owner-occupied					
Rented accommodation	-0.0258	0.0302	0.0375	-0.0726**	0.0306*
	(0.0252)	(0.0439)	(0.0425)	(0.0311)	(0.0181)
All other categories of tenure	0.0527	-0.0736	0.189**	-0.231***	0.0630
	(0.0603)	(0.0755)	(0.0903)	(0.0595)	(0.0730)
Male dummy	0.00752	0.0131	-0.00645	-0.0115	-0.00262
	(0.0122)	(0.0212)	(0.0105)	(0.0186)	(0.00426)
Urban dummy	0.0120	0.0203	-0.0105	-0.0178	-0.00401
	(0.0143)	(0.0237)	(0.0128)	(0.0206)	(0.00468)
AHP variables					
Reference cat.: Social acceptance					
Economy	-0.00118	-0.0642	0.758***	-0.507***	-0.186***
	(0.126)	(0.222)	(0.240)	(0.186)	(0.0715)
Environment	0.0789	0.137	-0.0677	-0.121	-0.0275
	(0.0641)	(0.112)	(0.0557)	(0.0980)	(0.0229)
Reliability	-0.0903	-0.157	0.0774	0.138	0.0315
	(0.0723)	(0.126)	(0.0626)	(0.111)	(0.0257)
SWING variables					
Landscape	0.695*	1.209*	-0.596*	-1.066*	-0.242*
	(0.400)	(0.694)	(0.350)	(0.611)	(0.145)
Health	-0.0174	-0.0303	0.0149	0.0267	0.00608
	(0.516)	(0.897)	(0.442)	(0.791)	(0.180)
Environment	0.963	4.825***	-3.113**	-1.507	-1.168***
	(0.800)	(1.398)	(1.353)	(1.049)	(0.342)
Economy	-0.865*	-1.506*	0.742*	1.327*	0.302*
	(0.445)	(0.772)	(0.392)	(0.679)	(0.163)
Local employment	0.717*	1.248*	-0.615*	-1.100*	-0.250*
	(0.407)	(0.707)	(0.356)	(0.623)	(0.148)
Sound	0.319	0.556	-0.274	-0.490	-0.111
	(0.457)	(0.795)	(0.394)	(0.701)	(0.161)
Safety	0.542	0.944	-0.465	-0.832	-0.189
	(0.468)	(0.814)	(0.405)	(0.717)	(0.166)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

emerges from this model is that people's concern with reliability of supply as an energy policy objective does not affect how they feel about transmission grid expansion. We would expect that people who view reliability as being relatively more important would feel more positively about grid expansion; the fact that it is not significant suggests that people may not understand the importance of the grid for delivering electricity from generation sources to people's homes.

Finally, looking at how contextual factors explain people's subjective opinions on above-ground grid expansion, significant predictors are people's views on the importance of the effects of new energy infrastructure on the landscape, the economy, the environment and local employment. People who place a higher importance on the effects on the landscape are more likely to hold a negative view of transmission grid expansion, and less likely to have a positive opinion. The same holds true for people who place a high level of importance on the environmental effects. On the other hand, people who place a higher degree of importance on the macroeconomic impacts are less likely to have negative opinions vis-à-vis transmission grid expansion, and more likely to have positive opinions. This suggests a certain degree of pragmatism whereby people may see grid expansion as being necessary for macroeconomic growth. An interesting result is that while people view grid expansion as being good for the overall economy, they expect that it will have a negative impact on local employment levels. This may be related to concerns regarding the visual disamenity of grid lines.

People's view of expansion of underground transmission lines is an overwhelmingly positive one and therefore, in order to be able to run our statistical analysis, we must collapse people's opinions into three responsive categories as there are not a sufficient number of observations in the "negative" category.[8] Looking at the socio-demographic variables, many of the results for underground transmission expansion are in direct contrast with those of above-ground grid expansion (see Table 10). For example, we find that while age is an important predictor of people's views of both above and below ground grid expansion, the relationship goes in the opposite directions; older people are significant less likely to have negative views of this technology, and significantly more likely to have positive views. Income is also a significant explanatory variable in this case with negative opinions decreasing with increasing incomes levels and positive views increasing. We also find that, relative to owner occupiers, people in other categories of tenure are more likely to feel neutral about underground grid expansion, and less likely to feel positive.

Turning to the relative importance people place on energy policy objectives we find that, once again economic concerns is the only significant variable in this category. Interestingly, people who place a relatively greater importance on economic considerations relative to social acceptance are less likely to express both positive and negative views. Generally people who view economic

[8]The same holds true for solar-powered generation, the results of which are presented in the Appendix.

Table 10: Subjective assessment of under ground transmission expansion

	Generally negative	Neutral	Generally positive
Age			
Reference cat.: Younger than 25			
25 - 44	-0.00394	-0.0268	0.0307
	(0.00491)	(0.0334)	(0.0382)
45 - 59	-0.00975**	-0.0686**	0.0783**
	(0.00479)	(0.0326)	(0.0370)
60 or older	-0.0252***	-0.179***	0.204***
	(0.00728)	(0.0398)	(0.0451)
Highest level of education			
Reference cat.: Primary school			
Leaving certificate	0.00461	0.0303	-0.0350
	(0.00833)	(0.0533)	(0.0616)
Post-secondary non-tertiary	0.00172	0.0115	-0.0132
	(0.00807)	(0.0532)	(0.0613)
Third level non-honours degree	0.00399	0.0263	-0.0303
	(0.00859)	(0.0550)	(0.0636)
Third level honours or above	-0.00228	-0.0156	0.0178
	(0.00755)	(0.0520)	(0.0595)
Length of residency			
Reference cat.: Less than 5 years			
5 - 20 years	-0.00122	-0.00821	0.00942
	(0.00513)	(0.0347)	(0.0399)
More than 20 years	-0.00219	-0.0147	0.0169
	(0.00550)	(0.0370)	(0.0425)
Income			
Reference cat.: Less than 15,000			
15,000 to 30,000	-0.00313	-0.0213	0.0244
	(0.00516)	(0.0352)	(0.0403)
30,000 to 50,000	-0.0114**	-0.0799**	0.0913**
	(0.00515)	(0.0344)	(0.0391)
50,000 to 75,000	-0.00947*	-0.0677*	0.0772*
	(0.00517)	(0.0370)	(0.0418)
75,000 or more	-0.0121**	-0.0893**	0.101**
	(0.00510)	(0.0369)	(0.0415)
Broad region			
Reference cat.: Border, Midlands, West			
Dublin and Mid-East	-0.000301	-0.00203	0.00233
	(0.00484)	(0.0326)	(0.0374)
Mid-West, South-East and South-West	-0.00570	-0.0389	0.0446
	(0.00445)	(0.0300)	(0.0343)
Employment			
Reference cat.: In employment			
Unemployed, student, home duties, other	0.00160	0.0107	-0.0123
	(0.00438)	(0.0291)	(0.0335)
Retired	-0.0158**	-0.114**	0.130**
	(0.00682)	(0.0475)	(0.0535)
Tenure			
Reference cat.: Owner-occupied			
Rented accommodation	0.00280	0.0186	-0.0214
	(0.00472)	(0.0308)	(0.0355)
All other categories of tenure	0.0241	0.132*	-0.156*
	(0.0159)	(0.0687)	(0.0838)
Male dummy	-0.00564	-0.0380	0.0437
	(0.00397)	(0.0260)	(0.0298)
Urban dummy	0.000106	0.000716	-0.000822
	(0.00429)	(0.0289)	(0.0331)
AHP variables			
Reference cat.: Social acceptance			
Economy	-0.115**	0.689***	-0.574***
	(0.0547)	(0.179)	(0.187)
Environment	-0.0187	-0.126	0.145
	(0.0201)	(0.133)	(0.153)
Reliability	-0.00937	-0.0631	0.0724
	(0.0236)	(0.159)	(0.182)
SWING variables			
Landscape	-0.116	-0.782	0.898
	(0.115)	(0.764)	(0.877)
Health	-0.189	-1.272	1.460
	(0.155)	(1.019)	(1.170)
Environment	-0.187	-1.260	1.447
	(0.150)	(0.987)	(1.132)
Economy	0.0491	0.330	-0.380
	(0.132)	(0.888)	(1.019)
Local employment	-0.185	-1.246	1.431
	(0.126)	(0.821)	(0.942)
Sound	-0.0208	-0.140	0.161
	(0.141)	(0.948)	(1.088)
Safety	-0.0833	-0.561	0.644
	(0.141)	(0.942)	(1.082)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

considerations as being an important pillar of energy policy are more likely to have neutral opinions of underground transmission expansion, which again may signal a certain degree of pragmatism.

While a number of contextual considerations were important predictors of people's opinions of above-ground transmission expansion, none of the SWING variables are significantly related to their views on the expansion of the underground transmission network. This may be a result of the lack of variation in the dependent variable.

Thus, across the four technologies presented above, some general patterns emerge. People who place more significance on economic concerns relative to social acceptance are less likely to have a positive view of all four technologies. Indeed, in general, the relative importance of economic considerations as a pillar of energy policy is amongst the most consistently significant of the explanatory variables. People who place greater emphasis on environmental considerations are, unsurprisingly, more likely to have a positive view of wind-powered generation, but this is not a significant predictor of people's views of the other technologies presented. This may indicate that people do not necessarily see grid expansion as being necessary to facilitate increased penetration of wind power.

Looking at the socio-demographics, age is also a significant variable across the technologies; older age groups are more likely to have a negative view of wind-powered generation and of expansion of the above ground transmission network; this may suggest that landscape concerns are more important for older people. On the other hand, more positive views of biomass generation and underground transmission infrastructure are found amongst older groups. Age has often been found to be a significant driver of views towards energy-related technology, thus this finding concurs with international research in this area (Wolsink, 2007a; Zoellner et al., 2008; Bertsch et al., 2016). As with age, length of residency has a significant effect on people's attitudes towards wind and above-ground grid expansion; people who have been living in their current residence for a longer period of time are less likely to express positive opinions about wind-powered generation or above-ground grid expansion. Length of residency was also found to be a significant driver of views towards transmission grid expansion in the UK (Devine-Wright, 2012). Finally, we find that income is significantly related to people's views of all four technologies. We find people reporting higher income levels are more likely to express positive views towards generation from wind and biomass and underground grid technologies, but less likely to have positive views regarding expansion of the above-ground transmission grid. The results for the other energy-related technologies can be found in appendix C.

5.2 Examining local opposition

The results of Section 5.1 show that people have positive subjective perceptions of many energy-related technologies, in particular renewable generation technologies and underground transmission lines are favourably perceived. This concurs with much of the previous literature which finds that citizens of Germany (Bertsch et al., 2016), the Netherlands (Wolsink, 2007b,a) and the UK Bell et al. (2005); Van der Horst (2007) are strongly in favour of RES technologies. However, despite these expressions of positive opinions, there is ample evidence of objections to energy-related infrastructure when siting decisions are being made,[9] which may be analogous to the gap found in the literature between acceptance on a national versus a local level. This gap has been noted in numerous countries, for example in Germany (Bertsch et al., 2016), the UK (Devine-Wright, 2012) and the US (Scheer et al., 2013). Objections to local siting of energy-related infrastructure has often been referred to as "NIMBYism" (see section 1). Investigating whether or not such local opposition to siting decisions in Ireland can legitimately be characterised as NIMBYism is beyond the scope of this paper. However, we do look at local siting objections for various technologies amongst respondents who expressed a "Neutral", "Somewhat positive" or "Positive" subjective view of these technologies.

We refer to the opposition to infrastructure siting despite neutral or positive opinions of the technology in question as "local opposition". For each technology, for those respondents who expressed a "Neutral", "Somewhat positive" or "Positive" view towards it we define a local opposition dummy variable that equals to one if a person states that they would oppose a siting that was greater than five kilometers from their place of residence or that they would oppose it regardless of distance. Such situations create a clear conundrum for policy makers whereby people who do not have negative opinions regarding energy infrastructure still object to its construction. We look at what socio-demographic, socio-psychological and contextual factors explain such phenomenon.

For this model the outcome variable is a 0/1 dummy variable and thus, as discussed in Section 3.2, we look at how people's opinions are shaped by socio-demographic, socio-psychological and contextual considerations using a logit model. The results are presented in Table 11 below and once again represent the estimated marginal effects. For most technologies we find that age is not a significant predictor of local opposition. The only exception is solar-powered generation where, relative to people in the younger than 25 age category, people aged 25 to 44 or 45 to 59 are significantly more likely to express local opposition to the construction of solar power plants.

[9]For example, in March 2016 planning permission for a large new wind farm in the north-west of Ireland was "vigorously opposed" (Irish Times, 2016) http://www.irishtimes.com/news/ireland/irish-news/planning-refused-for-49-turbine-donegal-wind-farm-1.2585893. Other examples include the shelving of plans in 2014 for a large wind farm in the Midlands that would have exported power directly to the UK, and a petition signed by over 1,100 people in 2014 opposing the development of a large wind farm in the south-west of Ireland (Irish Examiner, 2014) http://www.irishexaminer.com/ireland/1100-people-sign-petition-opposing-wind-farm-plans-259476.html

Education is generally not a statistically significant predictor of local opposition. The only two exceptions are that, relative to people with a minimum level of formal education, people whose highest level of education is post secondary are more likely to express local opposition to wind farms and those with third level non-honours degrees are significantly less likely to oppose the local siting of gas-fired power plant. We had expected that local opposition may have been stronger amongst people who had been living in their current residences for longer periods of time but again we only find weak evidence of a significant relationship and, in fact, the sign on the coefficients are the opposite to what we expected. Table 11 shows that, relative to people who have been living in their homes for less than five years, those that have been living in their homes for more than 20 years are less likely to oppose the local siting of wind farms and biomass power plants. Contrary to the results of Devine-Wright (2012), we find that length of residence does not affect local opposition to grid expansion.

We find that household income is significantly correlated with local opposition to solar power; as income increases people are generally less likely to oppose the local siting of a solar plant. For coal-fired generation, relative to people in the lowest income bracket people earning between €15,000 and €30,000 and those earning more than €75,000 are significantly more likely to express opposition. For natural-gas-fired generation, relative to people in the lowest income bracket, people in the €50,000 to €75,000 bracket are more likely to oppose construction close to their homes, while people in the same income category are significantly less likely to oppose both above- and below-ground transmission lines.

The region in which people reside is also a significant predictor of local opposition for some technologies. Relative to people living in the Border, Midlands and Western (the "BMW") region, people in the Mid-West/South-East/South-West region are significantly more likely to reject nearby siting of wind farms and coal-fired power plants. This may be a region that has had less exposure to these energy generation infrastructure relative to the BMW region (exposure to wind farms in particular is likely to be highest in the BMW region) and there is evidence from the literature that opposition decreases with increased exposure to energy-related technologies. For example, Wolsink (2007b) notes that local acceptance of infrastructure may follow a U-shaped pattern whereby acceptance is low when the development is announced but subsequently increases once the infrastructure is in place.

We find that people in rental accommodation are less likely than owner-occupiers to oppose local siting of solar, coal and biomass generation plants, which may indicate that owner-occupiers are concerned about potential negative impacts of such infrastructure on property values or that they expect to remain longer in their homes and are therefore more worried about the potential impacts. Finally, we find that, across all technologies examined, local opposition is always lower amongst male respondents.

Table 11: Local opposition

Technology	Wind	Solar	Coal	Gas	Biomass	Above ground Transmission	Underground Transmission
Age							
Reference cat.: Younger than 25							
25 - 44	-0.045	0.192***	-0.097	-0.022	-0.023	0.133	0.039
	(0.068)	(0.067)	(0.087)	(0.087)	(0.071)	(0.088)	(0.071)
45 - 59	-0.029	0.169**	-0.103	-0.014	0.007	-0.004	-0.007
	(0.072)	(0.073)	(0.116)	(0.090)	(0.073)	(0.099)	(0.072)
60 or older	-0.018	0.084	-0.337	-0.118	-0.027	-0.071	-0.092
	(0.094)	(0.083)	(0.217)	(0.113)	(0.092)	(0.131)	(0.086)
Highest level of education							
Reference cat.: Primary school							
Leaving certificate	0.038	-0.016	-0.036	-0.148	0.013	-0.196	-0.099
	(0.083)	(0.061)	(0.085)	(0.103)	(0.079)	(0.123)	(0.070)
Post-secondary non-tertiary	0.135*	-0.081	-0.148	-0.170	-0.021	-0.084	-0.073
	(0.081)	(0.057)	(0.136)	(0.114)	(0.083)	(0.133)	(0.073)
Third level non-honours degree	-0.021	-0.050	-0.062	-0.218**	-0.133	-0.170	-0.011
	(0.088)	(0.061)	(0.103)	(0.110)	(0.092)	(0.131)	(0.078)
Third level honours or above	0.002	-0.007	-0.203	-0.114	-0.014	-0.028	-0.023
	(0.088)	(0.067)	(0.147)	(0.107)	(0.084)	(0.131)	(0.078)
Length of residency							
Reference cat.: Less than 5 years							
5 - 20 years	-0.075	0.011	-0.010	-0.078	-0.065	-0.003	0.001
	(0.065)	(0.053)	(0.059)	(0.074)	(0.065)	(0.088)	(0.062)
More than 20 years	-0.134**	-0.001	-0.008	-0.084	-0.143**	0.091	0.044
	(0.068)	(0.055)	(0.065)	(0.073)	(0.067)	(0.091)	(0.065)
Income							
Reference cat.: Less than 15,000							
15,000 to 30,000	-0.062	-0.113**	0.095*	0.061	-0.018	-0.017	-0.054
	(0.072)	(0.045)	(0.052)	(0.069)	(0.069)	(0.098)	(0.063)
30,000 to 50,000	-0.067	-0.183***	0.077	0.030	-0.074	-0.151	-0.107*
	(0.076)	(0.042)	(0.052)	(0.075)	(0.078)	(0.106)	(0.064)
50,000 to 75,000	-0.116	-0.206***	0.021	0.114*	-0.021	-0.318***	-0.146**
	(0.084)	(0.036)	(0.072)	(0.065)	(0.086)	(0.104)	(0.064)
75,000 or more	-0.024	-0.189***	0.109***	0.069	0.038	-0.151	-0.119*
	(0.093)	(0.037)	(0.035)	(0.078)	(0.085)	(0.127)	(0.071)
Broad region							
Reference cat.: Border, Midlands, West							
Dublin and Mid-East	0.050	-0.014	0.077	0.012	0.079	-0.060	0.017
	(0.058)	(0.047)	(0.049)	(0.057)	(0.052)	(0.078)	(0.054)
Mid-West, South-East and South-West	0.110**	0.046	0.101**	0.018	0.036	-0.048	0.008
	(0.052)	(0.044)	(0.044)	(0.053)	(0.048)	(0.078)	(0.051)
Employment							
Reference cat.: In employment							
Unemployed, student, home duties, other	-0.054	-0.005	0.023	0.057	0.050	-0.025	-0.055
	(0.055)	(0.043)	(0.048)	(0.054)	(0.050)	(0.079)	(0.049)
Retired	-0.024	0.015	0.023	0.057	0.044	-0.060	-0.071
	(0.082)	(0.064)	(0.073)	(0.067)	(0.068)	(0.117)	(0.071)
Tenure							
Reference cat.: Owner-occupied							
Rented accommodation	-0.044	-0.101***	-0.126*	-0.014	-0.104*	-0.104	-0.066
	(0.055)	(0.038)	(0.073)	(0.058)	(0.056)	(0.076)	(0.050)
All other categories of tenure	0.055	-0.044	-0.160	-0.011	0.061	-0.153	-0.128
	(0.104)	(0.074)	(0.187)	(0.116)	(0.102)	(0.156)	(0.083)
Male dummy	-0.070	-0.124***	-0.113***	-0.114**	-0.102**	-0.148**	-0.159***
	(0.044)	(0.035)	(0.042)	(0.045)	(0.041)	(0.062)	(0.041)
Urban dummy	-0.028	0.051	0.020	-0.032	-0.069	0.066	0.035
	(0.050)	(0.041)	(0.048)	(0.050)	(0.048)	(0.068)	(0.047)
AHP variables							
Reference cat.: Social acceptance							
Economy	-0.081	0.167	0.343	0.403	0.448*	0.011	0.389
	(0.289)	(0.219)	(0.296)	(0.293)	(0.272)	(0.412)	(0.262)
Environment	-1.243***	-0.809***	-0.054	-0.396	-0.397*	-0.952***	-0.669***
	(0.229)	(0.182)	(0.250)	(0.244)	(0.215)	(0.342)	(0.216)
Reliability	-0.725***	-0.562***	0.247	-0.384	0.047	-1.392***	-0.543**
	(0.259)	(0.207)	(0.261)	(0.244)	(0.242)	(0.368)	(0.239)
SWING variables							
Landscape	1.324	-0.382	-0.067	2.989*	3.770**	1.255	-0.818
	(1.449)	(0.995)	(1.332)	(1.553)	(1.541)	(2.131)	(1.448)
Air quality			0.765	-2.149	-1.724		
			(1.289)	(1.627)	(1.483)		
Water quality			3.977***	3.556**	4.971***		
			(1.520)	(1.737)	(1.725)		
Health	-2.874	-4.375***	-2.886*	-1.838	-1.343	-2.707	-5.079***
	(1.915)	(1.373)	(1.602)	(1.927)	(1.801)	(2.614)	(1.753)
Environment	1.646	-2.573*	-2.049	-1.436	-1.027	-1.783	0.035
	(1.923)	(1.415)	(1.491)	(1.863)	(1.740)	(2.665)	(1.744)
Economy	0.113	0.527	-1.037	-1.893	-1.469	-6.864***	-1.534
	(1.575)	(1.230)	(1.391)	(1.645)	(1.511)	(2.309)	(1.491)
Local employment	-1.181	-1.351	-2.856**	-1.201	0.688	-0.579	-0.100
	(1.438)	(1.098)	(1.256)	(1.438)	(1.354)	(2.045)	(1.355)
Sound	4.362***					0.299	3.149**
	(1.622)					(2.231)	(1.552)
Odour					3.049**		
					(1.463)		
Safety						-3.723	-1.874
						(2.330)	(1.526)
Observations	663	725	239	445	566	376	679

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Turning to the AHP variables, Table 11 shows that different socio-psychological factors tend to drive local opposition from what drive overall subjective opinions, as reported in Section 5.1. We find that, with the exception of a weakly significant coefficient on biomass generation, across all technologies, the importance that people place on economic impacts relative to social acceptance is not a significant determinant of local opposition. On the other hand, people who place a relatively high importance on environmental concerns are less likely to express local opposition to the siting of a wind farm, solar and biomass power plants and transmission lines (both above and below ground). Likewise, people who place a relatively high importance on reliability of supply relative to social acceptance are also less likely to oppose the local siting of wind or solar-powered generation plants, or transmission lines. These results indicate that efforts to improve people's understanding of the necessity of such technologies to reduce emissions and increase security of supply may reduce the level of local opposition to them.

Finally, turning to the contextual considerations, we find that people's concerns with the impact of infrastructure on the landscape is, perhaps surprisingly, only related to the likelihood that they will oppose the local development of gas or biomass generation, but is not significant in the case of other technologies. This is an important finding as it suggests that people are not motivated by the selfish concerns that the "NIMBY" label implies. People who are concerned about the impact of energy technologies on local water quality are also significantly more likely to oppose the siting of coal, gas and biomass generation plants. This indicates that policy makers and developers should assure local residents that new generation plants will not negatively impact upon water quality.

We find that people's concerns regarding the health impacts of energy technologies is a significant predictor of local opposition; people who place a relatively high importance on health impacts are less likely to oppose the local siting of solar and coal plants and underground transmission lines. This result indicates that people may be more concerned with any potential long-term impacts of climate change than with any more short-term potential health impacts of living close to these technologies. In the case of coal we do not wish to ascribe too much importance to this result given that it is based on the small number of respondents (N = 239) that had neutral, somewhat positive or positive views of this technology.

People who place a higher importance on environmental concerns are less likely to oppose solar generation plants. Respondents who place a higher importance on the macroeconomic impacts of energy infrastructure are less likely to express opposition to the local siting of above-ground transmission lines, possibly indicating that they are aware that this technology may be less costly than the alternative (i.e., underground transmission lines). Similarly, people who place a high importance on the impacts on the local economy (rather than the overall macroeconomic impacts) are less likely to oppose the local siting of coal-fired plants. We find evidence that people who place a high importance on the impact of wind farms and underground transmission lines on sound

have a greater likelihood of opposing local wind farm developments. And, regarding odour, the importance of this consideration does seem to affect people's opposition to biomass power plants.

6 Conclusions and Policy Implications

As discussed in this paper and outlined in the recent Government White Paper on Energy Policy (DCENR, 2015), a significant level of investment must be made in Ireland in both RES generation technologies and the electricity transmission system in order to reach our climate targets. The construction of such infrastructure will have associated direct and indirect costs. Many of the indirect costs will be borne by those living in the vicinity of such developments who may raise objections to them. As has been highlighted in the literature (see for example Ciupuliga and Cuppen (2013)), local objection can result in significant delays in infrastructure development. Given binding EU targets, the Irish government will want to avoid such delays as much as possible; a crucial first step in so doing is to understand the concerns of Irish citizens vis-à-vis energy-related infrastructure, and to examine the characteristics that are correlated with people's opinions of and opposition to energy-related technologies.

The results from our survey show that people in Ireland feel very differently about the various energy-related technologies presented to them. In general people feel positively disposed towards renewable generation technologies, particularly towards solar-powered generation. Views on wind and biomass generation are somewhat more muted, but still characterised by generally positive opinions. We find that people generally feel neutral about generation from natural gas but have negative views of coal power. Together, these results indicate that Irish citizens are supportive of the need to move to less-polluting sources of electricity. The need to invest in the transmission network to increase RES penetration may be less well understood. While people indicate high levels of support for underground transmission lines, attitudes towards the above ground grid are much more negative. Given that expanding the grid via underground cables is much more costly, policy makers may be interested to know what factors might explain such contrasting views.

The results of our econometric analysis show that the socio-demographic characteristics that are most consistently correlated with people's opinions on the technologies presented are age, income and, for some technologies, sense of attachment to place (as proxied by the length of time they have been living in their current locality). In general however, many of the socio-demographic characteristics that we consider do not seem to be important drivers of opinions. Our survey asks people to rank the relative importance of economic, environmental, security of supply and social acceptance concerns as key objectives of energy policy, and we estimate the extent to which the relative importance that people place on these concerns (which we refer to

as "socio-psychological" factors) explains their views. We consistently find that the importance people place on economic considerations is a significant driver of their subjective opinions. This suggests potential support for the government to pursue the least-cost emission-abatement strategy. However, the survey findings also show that people have a strong preference for underground, as opposed to above ground, transmission lines. As underground grid expansion is significantly more costly, this may suggest a need to educate citizens as to the relative costs of new technologies. For the power-generation technologies, environmental concerns are also generally important. However, environmental concerns do not appear to shape how people feel about transmission grid expansion which suggests that people may not appreciate that there is a need to reinforce the transmission grid in order to increase RES penetration. Overall, we do not find that concerns regarding security of supply are correlated with views of energy-related technologies, although the survey results do indicate that people consider this an important objective. Again, this suggests a role for policy in educating people about the link between transmission grid reinforcement and both environmental sustainability and security of supply.

When we look at how concerns over aspects related to the specific technologies drive people's opinions of them, some of our findings are intuitive while others are more surprising. Objections to the development of wind farms frequently bring up annoyance caused by visual disamenities and noise from the turbines and indeed we do find that these concerns are significant determinants of people's opinions of wind power. A surprising result is that while concerns about health impacts affect people's opinions of some of the generation technologies, they are not significantly related to views about grid expansion where we had anticipated they may be more important.

It could be expected that people who have negative opinions towards energy-related technologies would object to their construction within their broad area of residence. For people who have either neutral or generally positive opinions of them, we would not necessarily expect that they would object to their local siting. However, our results show frequent objections to the construction of infrastructure about which people do not generally hold negative opinions. Local opposition (amongst those who do not hold negative views) appears to often be correlated with income levels and gender but not, as we had anticipated, with length of residency in a locality. Looking at socio-psychological considerations as measured by the weights that people put on different energy policy objectives, unlike its role in driving subjective opinions, economic considerations do not play an important role in driving local opposition. On the other hand the relative importance that people place on environmental concerns and security of supply are significant predictors of local opposition to infrastructure siting. These results indicate that efforts to improve people's understanding of the necessity of such technologies to reduce emissions and increase security of supply may reduce the level of local opposition to them.

Opposition to the local siting of energy-related infrastructure is often labelled as "NIMBYism",

in particular in relation to the visual disamenities caused by wind farms and transmission lines. We find that concerns regarding the landscape are not significantly related to local opposition to either of these technologies, which suggests that people are not motivated by the selfish concerns that the "NIMBY" label implies. On the other hand people who state the impact on noise pollution is important are more likely to express opposition to the siting of a wind farm. Our results also indicate that concerns regarding the impacts on local water quality are a significant driver of local opposition. This finding suggests that policy makers and developers may need to do more to allay the concerns of local residents about the impacts of power generation technologies on the local water supply in order to decrease the likelihood of encountering local opposition to developments.

In terms of the policy implications, there are a number of positive messages that policy-makers can take away from this research. We find that socio-demographic characteristics, over which policy makers have limited control, generally play a minimal role in shaping subjective opinions and driving local opposition. On the other hand people's views on the relative importance of energy policy objectives do play a role. Policy makers need to understand which objectives people consider to be most important and how this weighting of objectives is related to opinions on energy technologies when designing policies and conveying them to the public. Furthermore, our research sheds insight on how contextual characteristics are related to overall opinions and to local opposition to siting decisions. When policy-makers are considering which technologies to support the installation of they should be cognisant of the contextual factors that shape the views of citizens. People's opposition to infrastructure siting may be less driven by obvious concerns such as tarnished landscape and more so than expected by impacts on the local water supply. Simply labelling local objections as "NIMBYism" is not helpful in designing policy solutions.

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A Survey structure and questions

Category 1: Personal judgement of technologies for generating electricity

Question block no.	1.1
Question text	Please indicate your overall personal judgement of each of the following technologies, without making comparisons between the various technologies.
Technologies to be judged	Coal-fired power plants, Gas-fired power plants, Biomass power plants, Wind turbines, Solar generation technologies
Scale of possible answers	1: positive, 2: somewhat positive, 3: neutral, 4: somewhat negative, 5: negative
Question block no.	1.2
Question text	Please review each of these technologies in terms of the listed criteria based on your personal judgement of them, without making comparisons between the technologies.
Technologies to be judged	Coal-fired power plants, Gas-fired power plants, Biomass power plants, Wind turbines, Solar generation technologies
Criteria for consideration (subset of the following depending on technology)	The landscape, Sound, Health, The environment, The economy, Local employment, Air quality, Water quality, Odour
Scale of possible answers	1: positive, 2: somewhat positive, 3: neutral, 4: somewhat negative, 5: negative, 6: No experience or limited knowledge

Category 2: Personal judgement of grid expansion technologies

Question block no.	2.1
Question text	Please indicate your overall personal judgement of each of the following technologies, without making comparisons between the various technologies.
Technologies to be judged	Above-ground electrical transmission line expansion, Under-ground electrical transmission line expansion
Scale of possible answers	1: positive, 2: somewhat positive, 3: neutral, 4: somewhat negative, 5: negative
Question block no.	2.2
Question text	Please indicate your overall personal judgement of each of the following technologies, without making comparisons between the various technologies.
Technologies to be judged	Above-ground electrical transmission line expansion, Under-ground electrical transmission line expansion
Criteria for consideration (subset of the following depending on technology)	The landscape, Sound, Health, The environment, The economy, Local employment, Technical safety
Scale of possible answers	1: positive, 2: somewhat positive, 3: neutral, 4: somewhat negative, 5: negative, 6: No experience or limited knowledge

Category 3: Distance between a new power plant / electrical transmission line and place of residence

Question block no.	3
Question text	Please imagine that one of the following power plants or transmission lines will be newly located in your area. What is the minimum distance between the plant/transmission line and your place of residence so that you would accept this construction?
Technologies to be judged	Coal-fired power plants, Gas-fired power plants, Biomass power plants, Wind turbines, Solar generation technologies, Above-ground electrical transmission line expansion, Under-ground electrical transmission line expansion
Scale of possible answers	1: 0-1 kilometres, 2: 1-5 kilometres, 3: $>$ 5 kilometres, 4: I would oppose regardless of distance, 5: No experience or limited knowledge

Category 4: Ranking the relative importance of policy objectives and project-related criteria

Question block no.	4.1
Question text	When planning the future energy system, numerous factors play a crucial role (for example economic and environmental concerns, the reliability of supply, and social acceptance). Please state your opinion on the relative importance of the item pairs listed below.
Item pairs	Compared to economic viability, environmental sustainability is ..., Compared to economic viability, reliability of supply is ..., Compared to economic viability, social acceptance is ..., Compared to environmental sustainability, reliability of supply is ..., Compared to environmental sustainability, social acceptance is ..., Compared to reliability of supply, social acceptance is ...
Scale of possible answers	1: ... absolutely more important, 2: ... more important, 3: ... slightly more important, 4: ... of equal importance, 5: ... slightly less important, 6: ... less important, 7: ... absolutely less important
Question block no.	4.2
Question text	When assessing the various electricity generation and grid expansion options, on a scale of 1 to 5 (where 1 = unimportant and 5 = highly important), how do you rank the following criteria in terms of their importance?
Criteria to be ranked	The landscape, Sound, Health, The environment, The economy, Local employment, Air quality, Water quality, Odour, Technical safety
Scale of possible answers	1: unimportant, ..., 5: highly important

Category 5: Socio-demographic characteristics

Question block no.	5
Question text	Scale of possible answers
In which region do you live?	1: Border, 2: Midland, 3: West, 4: Dublin, 5: Mid-East, 6: Mid-West, 7: South-East, 8: South-West
Next please indicate the area you live in.	County/City/Dublin area within the above region
How long have you been living in this area?	1: Less than one year, 2: 1-5 years, 3: 6-10 years, 4: 11-20 years, 5: More than 20 years
What is your gender?	1: Female, 2: Male
How old are you?	1: 15-19 years, 2: 20-24 years, 3: 25-34 years, 4: 35-44 years, 5: 45-54 years, 6: 55-59 years, 7: 60-64 years, 8: 65 years or older
Is the dwelling in which you live...?	1: Owneroccupied, 2: Owneroccupied having being purchased through a local authority scheme, 3: Being rented (owner not in residence in this household), 4: Not owned by occupant(s) and being occupied rent free, 5: Not owned by occupant(s) and rent free to some member(s) of the household only, 6: Owner occupied and rented out to some member(s) of the household, 7: Other (please specify)
What is the highest level of education or training you have attained?	1: Primary school, pre-primary or no formal education, 2: Secondary 1 (Junior/Inter Certificate), 3: Secondary 2 (Leaving Certificate), 4: Post-secondary non-tertiary (e.g. Technical or vocational qualification, Advanced certificate or Higher certificate), 5: Third level non-honours degree (e.g. National Diploma (HETAC/NCEA), Bachelor Degree (DIT), Diploma in Police Studies, 3 year Diploma or Ordinary Bachelor Degree at NFQ level 7), 6: Third level honours degree or higher, 7: Other (please specify)
At the moment are you ...?	1: At work, 2: Unemployed, 3: Student, 4: Engaged on home duties, 5: Retired from employment, 6: Other (please specify)
Can you state which of the following broad categories best represents the yearly income of your household before tax?	1: Less than 15,000 Euros, 2: 15,000 to 30,000 Euros, 3: 30,000 to 50,000 Euros, 4: 50,000 to 75,000 Euros, 5: 75,000 or more Euros

B Comparison of selected socio-demographic characteristics: Survey sample vs. Irish population

Figure 1: Survey sample - Age

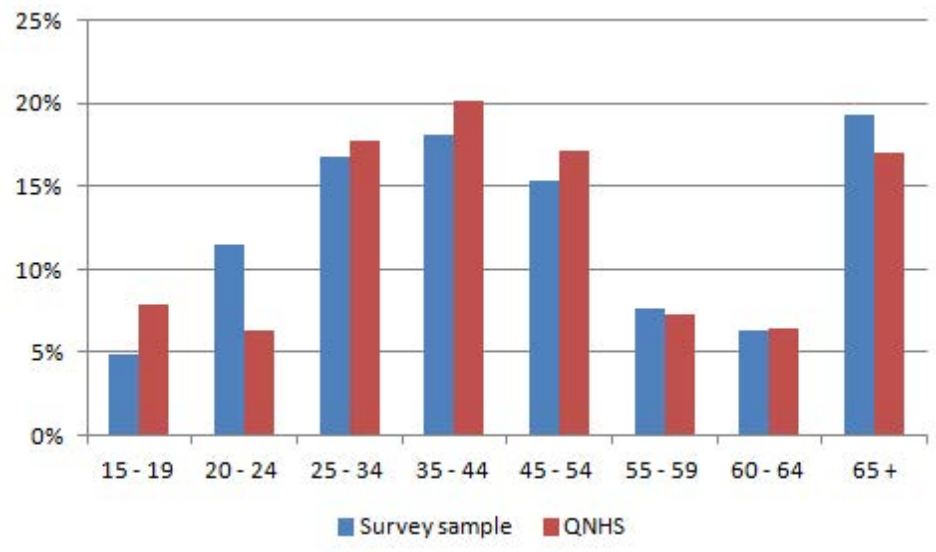


Figure 2: Survey sample - Region

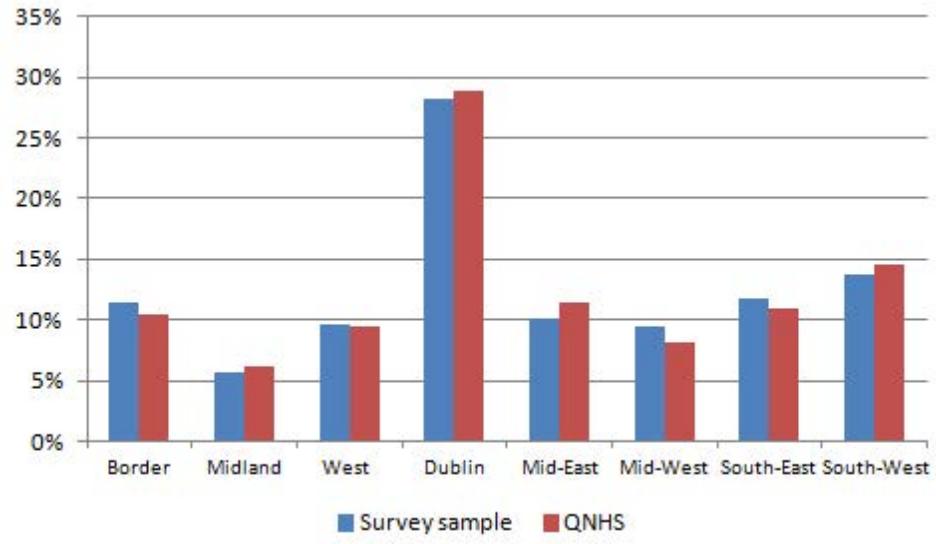
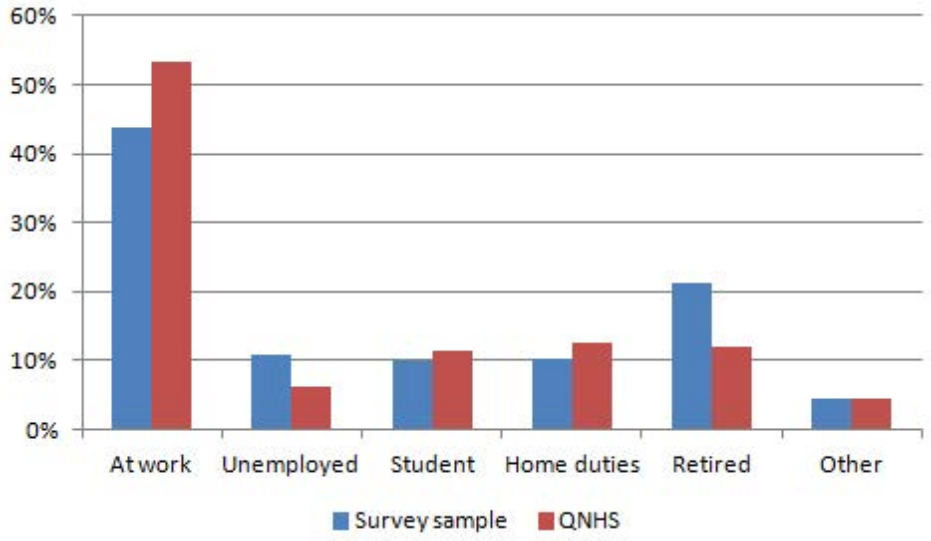


Figure 3: Survey sample - Principal Economic Status



C Additional results

Table 12: Subjective assessment of solar generation power plants

	Generally negative	Neutral	Generally positive
Age			
Reference cat.: Younger than 25			
25 - 44	0.00354	0.0244	-0.0279
	(0.00312)	(0.0201)	(0.0230)
45 - 59	0.000873	0.00606	-0.00693
	(0.00287)	(0.0198)	(0.0226)
60 or older	-6.62e-05	-0.000462	0.000528
	(0.00350)	(0.0244)	(0.0279)
Highest level of education			
Reference cat.: Primary school			
Leaving certificate	-0.00108	-0.00753	0.00861
	(0.00232)	(0.0162)	(0.0185)
Post-secondary non-tertiary	-0.00453**	-0.0321**	0.0366**
	(0.00230)	(0.0136)	(0.0154)
Third level non-honours degree	-0.00187	-0.0132	0.0150
	(0.00231)	(0.0159)	(0.0182)
Third level honours or above	-0.00275	-0.0194	0.0221
	(0.00239)	(0.0161)	(0.0183)
Length of residency			
Reference cat.: Less than 5 years			
5 - 20 years	0.00517	0.0353	-0.0405
	(0.00385)	(0.0239)	(0.0274)
More than 20 years	0.00651*	0.0446**	-0.0511**
	(0.00382)	(0.0226)	(0.0258)
Income			
Reference cat.: Less than 15,000			
15,000 to 30,000	-0.00136	-0.00949	0.0108
	(0.00200)	(0.0138)	(0.0158)
30,000 to 50,000	-0.00413*	-0.0291**	0.0332**
	(0.00222)	(0.0133)	(0.0151)
50,000 to 75,000	-0.00695***	-0.0495***	0.0565***
	(0.00256)	(0.0113)	(0.0127)
75,000 or more	-0.00162	-0.0114	0.0131
	(0.00264)	(0.0185)	(0.0211)
Broad region			
Reference cat.: Border, Midlands, West			
Dublin and Mid-East	0.00160	0.0111	-0.0127
	(0.00233)	(0.0158)	(0.0180)
Mid-West, South-East and South-West	0.00130	0.00903	-0.0103
	(0.00219)	(0.0149)	(0.0171)
Employment			
Reference cat.: In employment			
Unemployed, student, home duties, other	0.00114	0.00792	-0.00907
	(0.00207)	(0.0141)	(0.0162)
Retired	-0.00150	-0.0105	0.0120
	(0.00302)	(0.0211)	(0.0240)
Tenure			
Reference cat.: Owner-occupied			
Rented accommodation	0.00257	0.0177	-0.0203
	(0.00245)	(0.0161)	(0.0184)
All other categories of tenure	0.00824	0.0539	-0.0621
	(0.00726)	(0.0424)	(0.0492)
Male dummy	-0.000581	-0.00405	0.00463
	(0.00164)	(0.0114)	(0.0130)
Urban dummy	-0.00239	-0.0167	0.0191
	(0.00185)	(0.0121)	(0.0138)
AHP variables			
Reference cat.: Social acceptance			
Economy	0.0368**	0.257***	-0.294***
	(0.0146)	(0.0725)	(0.0817)
Environment	-0.0273**	-0.191***	0.218***
	(0.0129)	(0.0723)	(0.0821)
Reliability	-0.0148	-0.103	0.118
	(0.0120)	(0.0786)	(0.0898)
SWING variables			
Landscape	-0.0344	-0.240	0.274
	(0.0469)	(0.321)	(0.367)
Health	-0.156**	-1.088***	1.244***
	(0.0734)	(0.412)	(0.467)
Environment	-0.0967	-0.674	0.770
	(0.0682)	(0.436)	(0.497)
Economy	0.0303	0.211	-0.241
	(0.0588)	(0.406)	(0.464)
Local employment	-0.0428	-0.298	0.341
	(0.0545)	(0.370)	(0.422)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 13: Subjective assessment of gas-fired power plants

	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Age					
Reference cat.: Younger than 25					
25 - 44	-0.000904	-0.124***	0.00311	0.0295	0.0928***
	(0.0164)	(0.0360)	(0.0394)	(0.0388)	(0.0285)
45 - 59	-0.0334***	-0.107***	-0.0180	0.111***	0.0483***
	(0.00938)	(0.0301)	(0.0154)	(0.0341)	(0.0183)
60 or older	-0.0442***	-0.143***	-0.0320	0.150***	0.0693***
	(0.0117)	(0.0365)	(0.0230)	(0.0425)	(0.0260)
Highest level of education					
Reference cat.: Primary school					
Leaving certificate	-0.00200	-0.00594	0.000353	0.00551	0.00207
	(0.0130)	(0.0387)	(0.00193)	(0.0362)	(0.0137)
Post-secondary non-tertiary	0.0147	0.0411	-0.00636	-0.0364	-0.0131
	(0.0157)	(0.0414)	(0.0103)	(0.0350)	(0.0123)
Third level non-honours degree	-0.0134	-0.0412	-0.000909	0.0399	0.0157
	(0.0120)	(0.0384)	(0.00562)	(0.0388)	(0.0162)
Third level honours or above	-0.0258	0.0609	-0.0844**	0.0184	0.0310
	(0.0171)	(0.0534)	(0.0418)	(0.0457)	(0.0253)
Length of residency					
Reference cat.: Less than 5 years					
5 - 20 years	0.00260	0.00763	-0.000595	-0.00702	-0.00262
	(0.0107)	(0.0312)	(0.00273)	(0.0285)	(0.0106)
More than 20 years	-0.000654	-0.00193	0.000134	0.00178	0.000667
	(0.0109)	(0.0322)	(0.00223)	(0.0298)	(0.0111)
Income					
Reference cat.: Less than 15,000					
15,000 to 30,000	-0.0118	-0.0356	0.000794	0.0337	0.0130
	(0.0106)	(0.0324)	(0.00291)	(0.0315)	(0.0125)
30,000 to 50,000	-0.0130	-0.0398	-3.41e-05	0.0380	0.0148
	(0.0109)	(0.0341)	(0.00399)	(0.0338)	(0.0138)
50,000 to 75,000	-0.0125	-0.0386	-0.00131	0.0375	0.0148
	(0.0117)	(0.0376)	(0.00618)	(0.0385)	(0.0162)
75,000 or more	-0.00899	-0.0277	-0.000412	0.0266	0.0104
	(0.0134)	(0.0429)	(0.00496)	(0.0431)	(0.0177)
Broad region					
Reference cat.: Border, Midlands, West					
Dublin and Mid-East	-0.00699	-0.0208	0.00106	0.0194	0.00734
	(0.00912)	(0.0273)	(0.00182)	(0.0257)	(0.00986)
Mid-West, South-East and South-West	0.00550	0.0161	-0.00141	-0.0147	-0.00546
	(0.00894)	(0.0258)	(0.00296)	(0.0234)	(0.00863)
Employment					
Reference cat.: In employment					
Unemployed, student, home duties, other	0.00776	0.0225	-0.00217	-0.0205	-0.00759
	(0.00912)	(0.0260)	(0.00362)	(0.0233)	(0.00859)
Retired	-0.00221	-0.00657	0.000367	0.00611	0.00230
	(0.0129)	(0.0385)	(0.00168)	(0.0361)	(0.0137)
Tenure					
Reference cat.: Owner-occupied					
Rented accommodation	-0.0117	-0.0356	0.000268	0.0339	0.0131
	(0.00833)	(0.0257)	(0.00314)	(0.0253)	(0.0102)
All other categories of tenure	0.0128	0.0353	-0.00653	-0.0307	-0.0109
	(0.0205)	(0.0524)	(0.0156)	(0.0429)	(0.0145)
Male dummy	-0.0216***	-0.0637***	0.00447	0.0588***	0.0220***
	(0.00759)	(0.0215)	(0.00509)	(0.0200)	(0.00775)
Urban dummy	0.00289	0.00848	-0.000686	-0.00779	-0.00290
	(0.00813)	(0.0237)	(0.00226)	(0.0216)	(0.00802)
AHP variables					
Reference cat.: Social acceptance					
Economy	0.0361	0.106	-0.00746	-0.0982	-0.0368
	(0.0464)	(0.136)	(0.0125)	(0.126)	(0.0473)
Environment	0.186***	0.548***	-0.0385	-0.506***	-0.190***
	(0.0433)	(0.117)	(0.0431)	(0.108)	(0.0444)
Reliability	0.0488	0.411**	-0.611***	0.0369	0.115
	(0.0869)	(0.180)	(0.181)	(0.160)	(0.0710)
SWING variables					
Landscape	0.0413	0.122	-0.00854	-0.112	-0.0421
	(0.231)	(0.681)	(0.0489)	(0.629)	(0.236)
Air quality	-0.0350	-0.103	0.00724	0.0953	0.0357
	(0.265)	(0.780)	(0.0553)	(0.720)	(0.270)
Water quality	0.0707	0.208	-0.0146	-0.192	-0.0720
	(0.310)	(0.913)	(0.0661)	(0.843)	(0.316)
Health	-0.536*	-1.579*	0.111	1.458*	0.546*
	(0.314)	(0.915)	(0.137)	(0.846)	(0.320)
Environment	-0.0317	3.204***	-3.485***	0.777	-0.465
	(0.465)	(1.135)	(1.282)	(1.103)	(0.517)
Economy	-0.172	-0.506	0.0355	0.467	0.175
	(0.257)	(0.755)	(0.0663)	(0.697)	(0.261)
Local employment	-0.421*	-1.242*	0.0872	1.147*	0.429*
	(0.235)	(0.685)	(0.106)	(0.634)	(0.241)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 14: Subjective assessment of coal-fired power plants

	Negative	Somewhat negative	Neutral	Somewhat positive	Positive
Age					
Reference cat.: Younger than 25					
25 - 44	-0.0807**	-0.0331*	0.0693**	0.0392**	0.00536*
	(0.0350)	(0.0176)	(0.0307)	(0.0190)	(0.00318)
45 - 59	-0.0496	-0.0208	0.0429	0.0242	0.00330
	(0.0368)	(0.0187)	(0.0327)	(0.0199)	(0.00299)
60 or older	-0.0409	0.0536	-0.0680	0.0586	-0.00325
	(0.0522)	(0.0441)	(0.0484)	(0.0359)	(0.00513)
Highest level of education					
Reference cat.: Primary school					
Leaving certificate	0.0621	0.0159*	-0.0501	-0.0246	-0.00326
	(0.0473)	(0.00906)	(0.0366)	(0.0170)	(0.00246)
Post-secondary non-tertiary	0.159***	0.0179*	-0.117***	-0.0527***	-0.00687**
	(0.0553)	(0.00972)	(0.0358)	(0.0147)	(0.00294)
Third level non-honours degree	0.102*	0.0189***	-0.0792**	-0.0370**	-0.00485*
	(0.0527)	(0.00636)	(0.0376)	(0.0161)	(0.00261)
Third level honours or above	0.155***	0.0186**	-0.115***	-0.0520***	-0.00679**
	(0.0565)	(0.00932)	(0.0369)	(0.0153)	(0.00294)
Length of residency					
Reference cat.: Less than 5 years					
5 - 20 years	0.0239	0.00766	-0.0200	-0.0103	-0.00137
	(0.0362)	(0.0109)	(0.0299)	(0.0152)	(0.00207)
More than 20 years	0.0145	0.00487	-0.0122	-0.00635	-0.000851
	(0.0366)	(0.0122)	(0.0306)	(0.0159)	(0.00216)
Income					
Reference cat.: Less than 15,000					
15,000 to 30,000	-0.0711**	-0.0294*	0.0612**	0.0345*	0.00472
	(0.0352)	(0.0177)	(0.0310)	(0.0192)	(0.00308)
30,000 to 50,000	-0.0454	-0.0183	0.0391	0.0216	0.00294
	(0.0381)	(0.0180)	(0.0335)	(0.0199)	(0.00291)
50,000 to 75,000	0.000407	0.000138	-0.000342	-0.000179	-2.40e-05
	(0.0456)	(0.0154)	(0.0384)	(0.0200)	(0.00268)
75,000 or more	0.0327	0.00875	-0.0266	-0.0131	-0.00174
	(0.0564)	(0.0114)	(0.0443)	(0.0206)	(0.00276)
Broad region					
Reference cat.: Border, Midlands, West					
Dublin and Mid-East	-0.0272	-0.00976	0.0231	0.0123	0.00165
	(0.0312)	(0.0119)	(0.0266)	(0.0145)	(0.00203)
Mid-West, South-East and South-West	-0.0124	-0.00433	0.0104	0.00551	0.000740
	(0.0292)	(0.0105)	(0.0248)	(0.0132)	(0.00179)
Employment					
Reference cat.: In employment					
Unemployed, student, home duties, other	-0.00363	-0.00124	0.00306	0.00160	0.000215
	(0.0296)	(0.0103)	(0.0250)	(0.0131)	(0.00176)
Retired	0.105**	0.0189***	-0.0814**	-0.0379**	-0.00497*
	(0.0522)	(0.00638)	(0.0370)	(0.0158)	(0.00261)
Tenure					
Reference cat.: Owner-occupied					
Rented accommodation	-0.0420	-0.0167	0.0361	0.0199	0.00270
	(0.0286)	(0.0133)	(0.0251)	(0.0147)	(0.00221)
All other categories of tenure	0.0926	0.0119*	-0.0696	-0.0309*	-0.00401
	(0.0723)	(0.00634)	(0.0482)	(0.0185)	(0.00268)
Male dummy	0.0749***	0.0254***	-0.0630***	-0.0329***	-0.00442**
	(0.0245)	(0.00951)	(0.0209)	(0.0110)	(0.00206)
Urban dummy	-0.0329	0.0829**	-0.0240	-0.0121	-0.0140***
	(0.0328)	(0.0380)	(0.0349)	(0.0191)	(0.00541)
AHP variables					
Reference cat.: Social acceptance					
Economy	-0.436**	-0.0584	0.738***	-0.240**	-0.00369
	(0.206)	(0.231)	(0.219)	(0.118)	(0.0288)
Environment	0.601***	0.204***	-0.506***	-0.264***	-0.0354**
	(0.130)	(0.0579)	(0.113)	(0.0606)	(0.0142)
Reliability	0.301**	0.102*	-0.253**	-0.132**	-0.0178*
	(0.143)	(0.0524)	(0.122)	(0.0638)	(0.0103)
SWING variables					
Landscape	0.791	-0.127	-0.0407	-1.220**	0.597***
	(1.060)	(1.129)	(1.066)	(0.595)	(0.170)
Air quality	0.956	0.324	-0.804	-0.420	-0.0563
	(0.902)	(0.313)	(0.761)	(0.397)	(0.0569)
Water quality	1.870*	0.634*	-1.573*	-0.821*	-0.110
	(1.034)	(0.371)	(0.875)	(0.459)	(0.0714)
Health	0.608	0.206	-0.511	-0.267	-0.0358
	(1.044)	(0.357)	(0.879)	(0.459)	(0.0631)
Environment	1.546	0.524	-1.300	-0.679	-0.0911
	(0.992)	(0.350)	(0.837)	(0.440)	(0.0651)
Economy	-0.286	1.679	-1.175	-1.102*	0.883***
	(1.053)	(1.181)	(1.081)	(0.628)	(0.231)
Local employment	-0.611	-0.207	0.514	0.268	0.0360
	(0.772)	(0.264)	(0.650)	(0.339)	(0.0468)

Note: Based on a sample of 841 respondents. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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