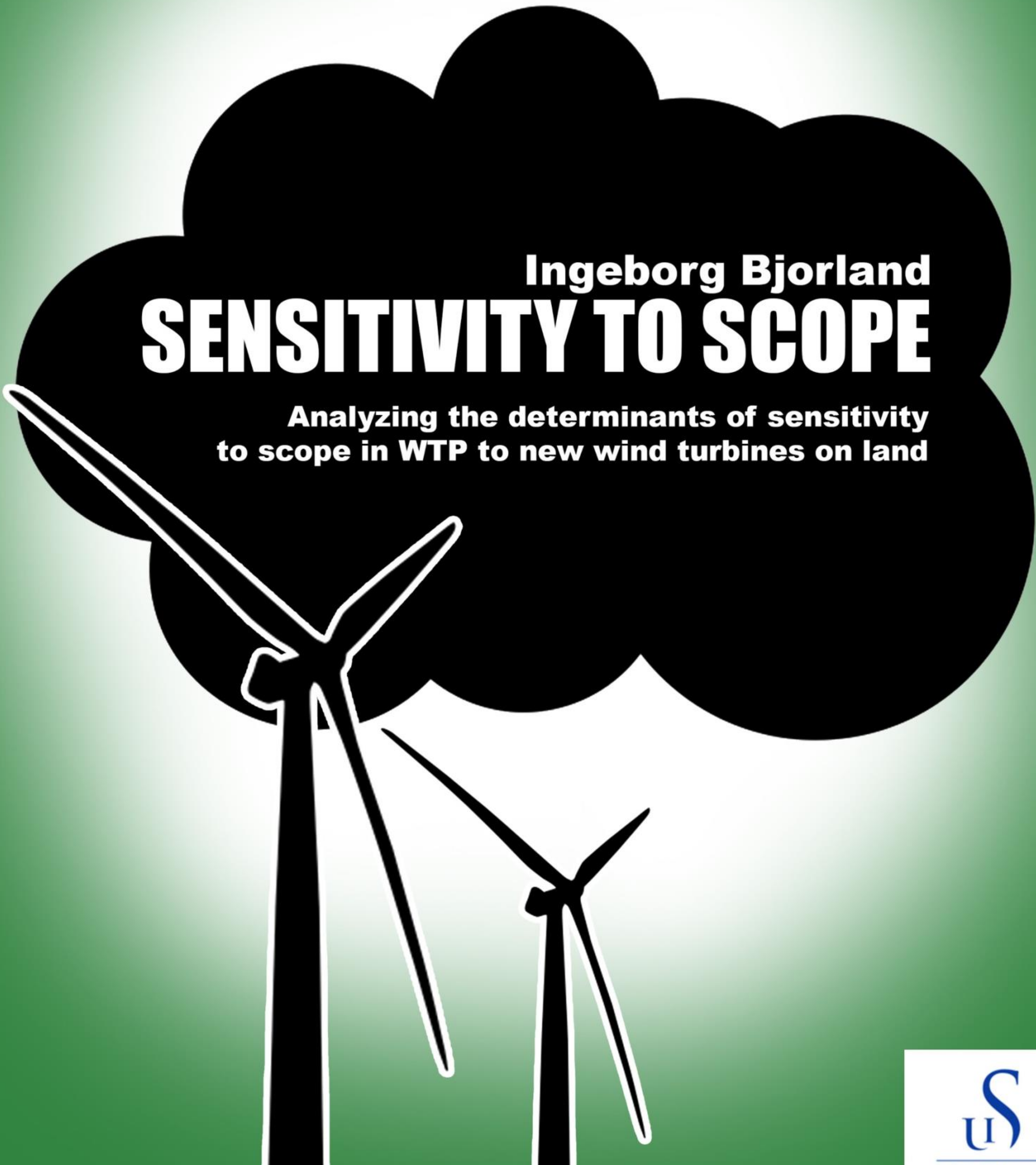
Ingeborg Bjorland

SENSITIVITY TO SCOPE

Analyzing the determinants of sensitivity to scope in WTP to new wind turbines on land



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Analyzing the determinants of sensitivity to scope in WTP to new wind turbines on land

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Ingeborg Bjorland,
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ABSTRACT

Although the topic of sensitivity to scope has grown considerably over the past 40 years, it is still a widespread debate about its validity towards stated preference methods (SP). This paper undertakes a quantitative examination of the phenomenon of sensitivity to scope through discrete choice experiment (DCE) method that hopefully provide a useful input into the debate of its validity. The purpose is to investigate the determinants of sensitivity to scope towards wind power by examining the citizens of Norway at the individual-level. This implies that attitudes and human behavior is taken account for, as most studies in the literature has ignored. Two separate estimates from the welfare measure of willingness to pay (WTP) is also used for comparisons, hence WTP preference and WTP space, to detect (if any) differences in the determinants.

The secondary data used were originally collected in April 2019, with a total of 821 respondents. The results indicate that individuals living in the county of Rogaland have slightly larger significant results than the opposing county of Oslo. Determinants that impact the overall scope sensitivities are socioeconomic variables such as age, gender, income, member of environmental organizations and use-values. However, there is no consistency over the different level of wind turbines and resulting in different determinants for each level examined. Additionally, the conventional willingness to pay preference respond better with the regression models. The results reveal low significance in all models conducted and this paper cannot confirm the concept of "more is better" for the environmental good. This is possibly due to the low acceptance rate of the survey, as well as many extreme values of scope arc elasticities that had to be removed. Moreover, positive and negative scope elasticities were run in separate models. It will therefore be necessary to conduct a similar study with a larger sample size for better representatives of the data and indication of the determinants.

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List of Abbreviations

CV	Contingent Valuation
DCE	Discrete Choice Experiment
SP	Stated Preference
RP	Revealed Preference
WTP	Willingness to Pay
WTA	Willingness to Accept
WTPP	Willingness to Pay Preference
WTPS	Willingness to Pay Space
OLS	Ordinary Least Squares
TEV	Total Economic Value

1. INTRODUCTION

Sensitivity to scope is the expectation from economic theory that an individual should be WTP more for a higher level or higher quality of a good (Søgaard et al., 2012). In non-market valuation, it is the property where individuals should be willing to pay more in order to obtain environmental amenities and avoid environmental “bads”. In other words, more wind power should be preferred to than less wind power, more conservation of endangered wildlife should be preferred to than less, more clean water should be preferred to than less, et cetera. Although several stated preferences (SP) studies have demonstrated scope sensitivity being present (e.g., (Smith & Osborne, 1996; Johnston et al., 2003; Brander, et al., 2007), other studies have not (e.g., Diamond et. al., 1993; Woodward & Wui, 2001). If the welfare measure of WTP is inconsistent with the economic theory when testing for scope, it implies that there is *scope insensitivity*. This issue has been discussed substantially in the literature and is a fundamental concern when reviewing the quality of the SP surveys.

As the credibility of the SP studies are questioned in the literature, the motivation for this master thesis is to examine scope sensitivity and cast light on the appropriate way of handling it in DCE studies. To the readers information, this study will only be looking at the effects from the individual-level and not the sample size as a whole. The thesis contributes to the literature by being the first environmental valuation study with DCE to examine scope effects at the individual respondent level. Additionally, there will be made comparisons of the two WTP estimates; WTP preference and WTP space.

The research question is as follows: ***“What are the determinants of sensitivity to scope in WTP to new wind turbines on land?”***. Based on the main question, the following questions this paper aim to answer is following:

1. Does exposure to the environmental good have an effect on the sensitivity to scope?
2. How does behavior and attitudes affect the sensitivity to scope?

This will be achieved by comparing secondary data sample from two different counties in Norway, by ordinary least squares (OLS) regressions. The geographic distribution of wind power in Norway is varying between the regions in East and West. In West, people in Rogaland are well exposed to wind turbines and windmill parks. In contrast to the East, people in Oslo will not catch an eye on any turbines. If scope sensitivity is present, then the WTP should vary as the size of the good measures changes (Lopes & Kipperberg, 2020). In other words, if the quantity of the wind turbines on land increases, then so should the WTP. Research show that the majority of the population in Norway and other countries are positive to wind power expansion (Breukers & Wolsink, 2007; Zerrahn, 2017; Hyland & Bertsch, 2018). However, the topic is to some degree controversial as people fear negative impacts such as harm on wildlife (Bergmann et al., 2006; Dai et al., 2015), noise emissions (Shepherd et al., 2011; Groth & Vogt, 2014; Zerrahn, 2017), visual landscape amenities (Meyerhoff et al., 2010) are just a few examples of the concerns. Although wind turbines on land are the main focus of the analyzes in this paper, it is worth mentioning that the same method could be utilized in other non-market valuation studies.

The paper is structures as follows: Chapter 2 will take a closer look at relevant literature and contributes with a table that summarize the literature reviewed. Given that there are limited DCE studies that specifically look at sensitivity to scope, evidence will be provided in other areas. In chapter 3, the theoretical framework and model constructions for environmental valuation is presented. Chapter 4 provides a brief overview of the survey design, followed by chapter 5 where model specification and hypothesis are presented. Results from the analysis is provided in chapter 6, whereas discussion and conclusion closes the paper in chapter 7.

2. LITERATURE REVIEW

In order to understand the nature of scope effects in environmental valuation, relevant literature has been identified. The articles included in this extensive literature review has been selected through standard research strategies by using keyword searches in Google Scholar and reference lists published in studies and textbooks on stated preference methods. It was attempted to include as many recent studies conducted on scope sensitivity mainly under environmental economics. However, with limited literature, older papers and other fields of non-market valuation studies has been included. For example, some studies included in this literature review look at WTP exclusively, but it is assumed that that the findings will be similar to scope effects.

Although testing for scope in DCE studies are to some extent addressed in the literature, discussion and research of this method is lagging behind compared to CV studies. A reason for this may be that CV studies detect insensitivity to scope or no sensitivity to scope more frequently than DCE studies, which create more empirical concerns for CV researchers than DCE researcher. A closer inspection of the literature is summarized in Appendix 2, where the table consist of 9 columns. The first column is the authors of the research and the year it has been published. The second column show the location of the study, third column is showing what good that has been valued, and the fourth column is showing what valuation method used. The fifth column show what econometric method that has been conducted. The following columns show if there has been scope discussion in the research, if the study has made estimations at the individual-level, whether an internal or external test is used and the last column show the scope results.

In the valuation literature, there have been numerous empirical attempts to estimate people's WTP for environmental goods. In most cases, it has been used economic values from SP, but another method that could have been utilized is the revealed preference (RP) method. The RP method can only measure use values, whereas SP method can measure both use and non-use value. Therefore, it comes to no surprise that the literature suggest that SP method is the best fit in the valuation setting of environmental goods. In the literature reviewed, all 41 studies use the SP method represented by either CV or DCE, where one study additionally included data from RP method (Adamowicz et al., 1994)[1]. However, critics have for long questioned the validity across the methods. One of the most common approaches to test the validity is through scope tests, which are considered being the best available test.

Scope sensitivity became a popular topic of discussion in the late eighties (and early nineties). Although the existence of this tests has been discovered earlier on, the concerns over scope effects were first questioned by Kahneman (1986). In his study of estimating the value of preserving fish stocks in Canada, he found no significant differences between the estimates of one single lake versus all lakes. He argued that respondents were indifferent to the size or quality of the non-use value for the environmental good, hence scope insensitivity. The critique was further discussed by Kahneman and Knetsch (1992). They argue that respondents are revealing their moral satisfaction to contribute to the provision of the good, instead of actually

[1] Adamowicz et al. (1994) compared a SP model and RP model for recreational site choice. They found no statistically significant difference between the results obtained from SP and actual data (RP)

purchasing it[2]. In the CV literature, some researcher argue that the method was consistent with sensitivity to scope (e.g., Loomis et al., 1993; Carson & Mitchell, 1993; 1995; Carson, 1997; Smith & Osborne, 1996), thus others support Kahneman and Knetsch (1992) and find insensitivity to scope (e.g., Desvousges *et al.*, 1993; Diamond et. al., 1993; Boyle et al., 1994).

The DCE literature also have studies traced back to nineties, such as Adamowicz et al. (1994), who was according to Hoyos (2010) is the first study having environmental resources as context. However, it was not after the year of 2000 that DCE became increasingly popular (e.g., Layton & Brown, 2000). Environmental goods being valued within DCE studies can include attributes that are well detailed. For example, what section of certain lakes and rivers that can be improved (e.g., Ando et al, 2020), what size of the biodiversity (e.g., endangered species) in a population that could be protected (e.g., Morse-Jones et al., 2012; Lew & Wallmo, 2011) and long agriculture and wildlife has protection before new developments in renewable energy technologies (Dimitropoulos & Kontoleon, 2009). However, regardless of what method that has been applied, scope tests have in most studies been ignored and excluded from the discussion. A repeating approach that slightly give some information in regards to scope effects is by categorizing the level of the good valued as either "*small*", "*medium*" or "*large*" (e.g., Brouwer et al., 1999, Dimitropoulos & Kontoleon, 2009; Drechsler et al., 2011; Mariel, Meyerhoff & Hess, 2015, Mattmann et al., 2016)[3].

Sensitivity to scope has also received attention from meta-analysis that is conducted on SP studies, and is included in the literature review since this method can shed light on important findings of the specific literature (Bateman & Jones, 2003). Several papers have shown the WTP estimates being realistic to different environmental goods being valued, hence sensitive to scope. For example, surface water quality improvements (Johnston et al., 2003), coral reefs conservation (Brander et al., 2007) and wetland conservation (Brouwer et al., 1999). Loomis & White (1996) and Smith & Osborne (1996) are two meta-analysis who particularly looked at scope effects. Both studies found WTP to be sensitive to scope for the change in size estimates. Despite the empirical evidence of the sensitivity to scope, there are also meta analyses who show no evidence of the phenomenon. For example, Woodward and Wui (2001) who found the size of wetland per acre to be insensitive to scope. Lindhjem (2007) share the same findings when looking at Scandinavians WTP for protection of forestry practices, where the size variable

[2] This is also referred to as "warm glow" effect
[3] Campbell & Hutchinson (2009) used similar notations: "*a lot of action",* "*some action"* and "*no action*".

was insensitive to scope.

Scope tests are not exclusive to research in the environmental context, other areas of non-market valuation studies have also conducted these tests[4]. For example, Søgaard et al. (2012) look at the WTP for cardiovascular disease and compare results from both sample-level and individual-level through the CV method. They applied two different scope tests, one for respondents risk reductions and one for travel costs. The results show mixed outcomes of scope effects at the different levels; at the individual-level, half of the participants failed the test whereas in the sample-level, the participants were sensitive to scope. Determinants such as age, level of information and quality of life played a role on the WTP estimates. The authors suggest that the various results of the two scope tests are dependent on the context, where issues of scope sensitivity may have been avoided by using another SP format such as DCE. This is supported by researcher in the literature who has found stronger evidence of scope sensitivity in DCE method compared to CV method when comparing the two methods (e.g., Foster & Mourato, 2003; Goldberg & Roosen, 2007; Jacobsen, 2008)[5].

It is important to understand the underlying causes and the potential consequences insensitivity to scope can have on the WTP estimates and economic theory in general. Carson et. al (2001) conducted a meta-analysis on several CV studies and argued that "*poorly executed survey design and administration procedures appear to be a primary cause of problems studies not exhibiting sensitivity to scope*" (Carson et. al., 2001, p. 183). Poor survey design that could set a question marks at the results and the validity has received support from other authors, such as Lindhjem (2007) and Heberlein et al., (2005). Carson et. al (2001) also identified several factors that might lead to the negative scope effects: *(1) vaguely described goods where the descriptions of the goods tend to confuse smaller (part) and larger (whole) goods, (2) questions that emphasize the symbolic nature of the good, (3) questions where the underlying metric on which respondents perceive the larger good is different from that on which respondents perceive the smaller good and (4) differences in the perceived probability of the different goods actually being provided* (Carson et. al., 2001, p. 200). A lot of these problems has been overcome through the DCE format, as it considerably collects more information in regards to participants' preferences and thus reduce the level of confusion. Preference heterogeneity

[4] Scope effects has been examined in other non-market valuation areas than the field of environmental economics, such as health services (e.g. Goldberg & Roosen, 2007), marketing (e.g. Urminsky & Kivetz, 2011), risk and uncertainty (e.g. Jones-Lee & Loomes, 1995) and psychology (Loureiro et al., 2013).
[5] To my knowledge, there are only one exception of finding higher WTP estimates in CV format than DCE (Boxall et al., 1996).

(Lopes & Kipperberg, 2020) and small sample sizes (Carson et al., 2001; Boyle et al., 1994) are other factors that has been identified as a source of scope insensitivity. Not unexpected, the WTP estimates changes considerably when excluding respondents who are insensitive (see for example, Søgaard et al., 2012).

The valuation literature has been using the WTP or willingness to accept (WTA) as a measure of welfare. However, from reviewing past studies of wind power valuations, the dominating welfare measure has been WTP[6]. One exception is the study by Dimitropoulos & Kontoleon (2009), who analyzed the local WTA new developments of wind farm in two Greek Aegean islands. They argue that this measure of welfare where the best fit when determining the local acceptance of wind power installations. The results show that siting/location and cooperation from authorities are more valued to the respondents than the number and height of turbines. Another finding showed that one island had higher WTA for the number and height of turbines, hence there are different levels of acceptance in the islands/location examined. Campbell and Hutchinson (2009) found similar spatial findings, but with WTP as welfare measure. One finding show that the WTP for rural landscape improvement vary across the spatial scope in the country. Respondents who lived close to the presented location, had a higher WTP than respondents who lived further away. This gives an indication that use-values may play a significant role for the total value and will have an impact on the sensitive scope effects of WTP.

As Smith and Osborne (1996) exemplified by comparing the ratio of two WTP estimates of an environmental good, the better quality or quantity should be greater than the ratio of the respective alternative. For example, saving 1,000 birds compared to 100,000 should imply that the WTP to save 100,000 should have at least 100 times greater than the WTP to save 1,000 birds (Smith and Osborne, 1996). However, this expectation of scope effects for the WTP estimates do not hold at a general basis and the literature have different findings. Desvousges et al. (1993) studied respondents WTP for to prevent (I) 2,000, (II) 20,000, or (III) 200,000 migrating birds from drowning in oil ponds in the Central Flyway between the Unites States and Canada. The result showed that the respondents were insensitive to scope, as there were no significant differences in the means of WTP between either one of the options. Boyle et al. (1994) did a similar survey by looking at respondents WTP for prevent killings of waterfowls.

[6] From the literature review, majority of the studies have used the conventional WTP preference as welfare measure, with the exception Badura et al. (2020) and Jacobsen et al. (2011) who use the modern approach of WTP space.

They find mixed scope effects in the results, where scope sensitivity appears to be present for saving 2,000 and 200,000 birds, but fails to pass for 2,000 and 20,000 birds.

A more recent study with similar survey design as Desvousges et al. (1993) found the WTP estimates to pass the scope tests (Hanemann, 2005)[7]. Loomis et al. (1993) reveal scope sensitivity in their study of forest conservation between two different areas in a forest located in south-eastern Australia. However, no significant differences in the WTP estimates were detected when adding an additional area. The same discovery is supported by Bateman et al. (2005), who found respondents to be insignificant in the WTP estimates for a higher level of protection of 4 to 400 remote mountain lakes in the UK. According to Loomis et al. (1993), the respondents may have important economic values in order to preserve a minimum threshold number of lakes. However, beyond this point the WTP of contribution to further protection of additional lakes will decrease.

Testing the responsiveness to scope can be split into two categories: external and internal. External scope tests are when two different magnitudes are valued by different respondents using between-samples (or split-samples) valued (Carson, Flores, & Meade, 2001). Internal scope tests are relying on within-responses where respondents are requested to make valuations based of different magnitudes (e.g. stating their WTP) of the good being valued (Carson, Flores, & Meade, 2001). In the CV literature, there is no definite answer on what tests is preferred. Some authors have utilized the internal scope tests (e.g., Søgaard et al., 2012), whereas others utilize the external test (e.g., Poe et al., 2005) or both (e.g., Giraud et al., 1999).

In the DCE literature, it is claimed by several authors that internal scope tests are the only appropriate tests (e.g., Adamowicz et al., 2011). One reason seems to be that it is less problems with internal scope tests (Smith & Osborne, 1996). However, some researchers argue that the reasons of convenience to the internal tests are caused by the respondents' desire to maintain their "*internal consistency*" towards their responses (Heberlein et al., 2005; Czajkowski & Hanley, 2009). Yet, the internal scope test will play an important role as it grants the opportunity to pairwise the WTP estimates and therefore control for heterogeneity (Czajkowski & Hanley, 2009). In the literature, several papers have attempted to compare DCE and CV and use

[7] Besides the different outcome of scope effects between the two studies (Desvousges et al., 1993; Hanemann, 2005), the main difference is that Hanemann (2005) express the number of birds killed through percentage and Desvousges et al. (1993) in absolute numbers.

between-sample to within-sample comparisons[8] (e.g., Foster & Murato, 2003). It is clear that the DCE literature is lacking evaluations of external scope sensitivity and was already addressed in the NOAA panel (Arrow et al., 1993), who claimed that ignoring this test would cause necessary estimates of SP studies to be lost. To my knowledge, Lew & Wallmo (2011) are the only researchers addressing external scope test exclusively through DCE.

Giraud et al. (1999) looked at the WTP to protect the Mexican spotted owl and 62 additional species that is unnamed[9]. This study specifically looked at scope effects, and found the respondents to have higher WTP estimates for the 62-unnamed species compared to the Mexican spotted owl through an external test. However, when testing for internal scope tests it showed no significant differences in the WTP. This study is lacking further discussion of the perceptions of the environmental good, where respondents are depending on only one single description of the owl versus the other species. This is opposing to White et al. (1997) who argue that the WTP is more symbolic than additive, and suggest that respondents base their answers in regards of the representation the species have within an area. As a consequence, the respondents may ignore the rarity or threat of one species and focus on familiar species[10]. In other words, one particular species may be representing the biodiversity more depending on the respondents' associations, compared to another species. Their result show mixed scope effects when estimating WTP for otter and water vole, where otter where the only good passing the scope test.

Estimations at the individual-level are a major gap in the literature, as sample-level are the standard approach for most SP studies. By conducting scope tests at the individual-level, it allows "… *for investigation of factors that could help explain scope insensitivity*" (Søgaard et al., 2012, p. 398) by narrowing the preferences to each participant. For the 41 studies reviewed, only six have estimations on individual-level (e.g., Alvarez-Farizo & Hanley, 2002; Casey et al., 2008; Heberlein et al., 2005; Søgaard et al., 2012; Khan & Zhao, 2019). Heberlein et al. (2005) specifically look at scope sensitivity for individual decision makers by expanding the scope tests to "attitudinal" and "behavioral" characteristics towards four environmental goods (water quality, spear fishing, wolves and biodiversity). Since… "*human behavior is complex*

[8] See Appendix A listed in Adamowicz et al. (2018) for a full literature review table of comparisons study of CV and DCE and what subject design that has been employed
[9] Poe et al. (2005) is an updated version of the study Giraud et al. (1999) and find mixed scope effects through dichotomous choice model
[10] White et al. (1997) use the term "flagship' hypothesis" to explain respondents' increased WTP for species that are well known by most people

and much is hidden behind averages" (Heberlein et al., 2005, p. 10), the authors argue that ignoring estimations at the individual-level can overlook important patterns of WTP and characteristics that may affect the behavior and validity. Their findings show that the standard approach for scope tests that compare average values can lead to false positives and false negatives. As of individual-level findings, they conclude that respondents with more knowledge and experience towards a part, tend to show higher economic values than the whole part (Heberlein et al., 2005). This is opposed to Kahneman and Knetsch (1992) who found a higher WTP for the whole part than to a section of the part. They suggest that respondents are revealing their WTP for moral satisfaction, rather than their actual preferences. However, shared findings of the two papers is that that respondents may shift their preferences towards the good being valued based on behavior and motivations.

When it comes to wind power, Mattmann et al. (2016) compared different studies from both CV and DCE through a quantitative meta-analysis when valuing the external effects from wind power production. They find sensitivity to scope from medium and large changes in externalities, such as air pollution, climate change, visual effects and biodiversity. However, the significance is not restricted to a specific externality. As wind turbines unfold negative externalities, Alvarez-Farizo & Hanley (2002) argue that they create a social cost that affect respondents in the sense of higher WTP to reduce these externalities. In their study, flora and fauna is more valued than the impacts on the landscape. Drechsler et al. (2011) and Mariel, Meyerhoff & Hess (2015) also look at externalities. Both studies share similar findings, where red kite population and settlement distance are statistically significant. This means that the respondents prefer to limit the impact turbines have on the red kite population and want to move the turbines further away. Wind farm size and turbine height were insignificant.

Dugstad et al. (2020) estimate scope sensitivity on respondents in Norway towards expansion of production of renewable energy in Norway[11]. The respondents were presented with different unit measurement, where half received the choice cards with "*new wind turbines*" as attribute and the other half with "*new production sites*" as attribute. All estimates were statistically significant with scope elasticity. An interesting finding from this paper is the reveal of unit

[11] Dugstad et al. (2020) additionally looked at scope effects through 22 previous DCE studies that are related to wind power preferences and 10 other studies from environmental economics. Through different scope attributes and functional forms on the wind power studies only, they conducted a total 50 estimations where 12 were scope sensitive, 9 were scope insensitive, whereas 19 estimates had insignificant utility coefficients and 10 were not possible to compute. The results from the scope elasticities support the lack of scope estimations and discussion in the literature. See table 1 and table 2 listed in Dugstad et al. (2020) for a full review of the scope estimates.

measurement having an impact on the WTP estimates. The authors point out "…*that choice of attribute representation may influence scope inferences in DCE studies, even when the difference in the available metrics seems innocuous from a design perspective*" (Dugstad et al., 2020, p. 16).

Majority of studies find positive WTP for renewable electricity in general (Zerrahn, 2017), however, the literature show evidence that wind power has received some oppositions from participants who are concerned with the environment. This indicates that people have positive WTP for renewable energy, but at the same time have negative WTP for the externalities caused by wind power. To summarize socio-demographic, attitudinal and behavioral findings from the literature, a large number has found income to be a significant predictor of WTP (e.g. White et al., 1997; Khan & Zhao, 2019). This is consistent with economic theory that suggest a positive relationship between the amount respondents are WTP and their income level.

Commonly, respondents who consume or use directly the environmental good are found to have higher WTP than passive respondents, and is observed in studies such as Desvousges et al. (1993) and Bateman et al. (2005). Age is commonly seen significant (but negative) to WTP, especially for protection and preservation studies (e.g., Søgaard et al., 2012; White et al., 1997; Mariel, Meyerhoff & Hess, 2015). Higher education is often positively related to WTP estimates (e.g., Meyerhoff et al., 2015; Khan & Zhao, 2019), where males seems to be WTP more for environmental improvements than females (e.g. Khan & Zhao, 2019). As expected, dedicated environmentalists or members of environmental organizations show a higher WTP for environmental programs (e.g., Longo et al., 2008). Respondents who are exposed and familiar to environmental improvement, as well as respondents living close by seems to have higher acceptance level and a higher WTP (e.g., Mariel, Meyerhoff & Hess, 2015; Zerrahn, 2017). It is believed that the same effects of WTP will occur when estimating sensitivity to scope.

From this literature review, it is clear that scope tests have not been prioritized in the literature. Discussions of the topic has received limited attention and estimations at the individual-level are rare. This paper will contribute to fill this missing gap in the literature to shed light on sensitivity to scope and make scope estimations at the individual-level. As reviewed, the main factors that potentially could lead to scope insensitivity or no scope effects seems to be poor survey design, small sample sizes, preference heterogeneity, warm glow effect and moral satisfactions. To ensure sufficient power, the survey obtained in this paper has targeted a sample size of 821 through the DCE method. As the main goal of this thesis is to find the determinants of WTP for scope sensitivity at the individual-level, the internal scope test will be relevant in order to detect different responses from single participants. Even though the internal scope test is suggested being the best fit for DCE, the external scope test will also be utilized to examine differences in preferences between multiple participants from the two regions of Oslo and Rogaland.

3. ENVIRONMENTAL VALUATION

Environmental valuation refers to the context of non-market valuation, with the aim to gain a monetary measure of the benefits (or costs) from the change in level of utility or welfare towards individuals or the society as a whole (Guijarro & Tsinaslandis, 2020; Mariel et. al, 2020, p. 1). Put in other words, the aim is to estimate how much the environment is worth to certain people or the society. In the environmental context, the level of utility comes from either environmental improvements or the consequences from environmental degradations (Guijarro & Tsinaslandis, 2020). The overarching goal is to give decision-makers the appropriate scientific information and tools for efficient policy-making and allocation of the resources.

3.1 Total economic value

In the environmental valuation literature, the total economic value (TEV) framework is often employed to identify the contribution of ecosystem services towards the welfare measures. TEV of an environmental resource is equivalent to the total amount of its use and non-use values[12]. Use values is what people derive directly from the use of the good, and includes values from *consumptive use* or *non-consumptive use*. Consumptive use values are involving direct consumption or use of the environment, which is often associated with damages or harvest of a resource, for example hunting animals to consume or harvesting timber for fuel. Non-consumptive values involve using the environment without harvesting the products, for example enjoying recreational and cultural amenities, such as water sports, wildlife and bird-watching (Alcamo, 2003). Non-use value is what people derive from indirectly using the good.

[12] There seems to be no standard approach how to divide the sub-classifications of use values and non-use values in the literature. In many cases, *option value* is included. This is the value people have from having the option to use the resource at any time. Note that different authors categorize the option values as either use-values or non-use values, although the analysis and treatment of the value is the same. This paper will follow the concept presented in Perman et al. (2011).

These values are either *existence value* or *bequest value*. Existence value is the value of simply knowing a resource exists without wishing to use or visit it personally (Horton et al., 2002). Bequest use value is the value of ensuring availability and sustainability of the resource in order for future generations to access the resource (Beaumont et al., 2007).

Figure 1*: Total economic value*

When determining the WTP for scope sensitivity, respondents will have elements from both use values and non-use values. It is expected to find different values towards the good being valued, as there are several underlying factors that could yield a more positive or negative WTP. For example, respondents who live closer to the wind turbines might use the wind parks for recreational purposes such as hiking (non-consumptive use), or respondents that are not well exposed to wind turbines might after all see the benefits of renewable energy for the next generations (bequest value). The TEV can be estimated through different valuation methods such as RP and SP. However, since non-use values is as important as use values in this study, the SP method is the only appropriate method to apply.

3.2 Ecosystem services

Ecosystem services are defined as the benefits that people obtain from ecosystems (MA, 2005) and is generated when ecosystems directly or indirectly contribute towards meeting human needs (Small, et al., 2017). Ecosystem services (ES) provide different levels of needs, where some services are essential for human existence (for example food and air) and others services are desired for the enjoyment (for example tourism and recreation). There are no standard categorizations of the ES, but the framework created by Millennium Ecosystem Assessment (MA, 2005) is widely accepted.

The MA framework distinguishes between four general categories and several subcategories, i.e. *provisioning*, *regulating*, *cultural* and *support*. Provisioning services are all the products obtained from the ecosystem, such as food, water, fuel and fiber. Regulating services are all benefits drawn from the regulation of ecosystem processes, such as air quality maintenance, water and air purification, control for pests and diseases and pollination. Cultural services are the non-material benefits people obtain from ecosystems, such aesthetic experiences, recreation and tourism. Support services are the services that allow for other ecosystem services to be present, but is not directly beneficial for people, such as production of oxygen, water cycling and soil formation. Support services differ from the other services as it is not directly beneficial for humans. However, it is essential for the functioning of provisioning, regulating and cultural services.

When it comes to wind power, there are several ecosystem services involved (see figure 2). For provisioning services, wind power provides renewable-sourced electricity. Unlike many other energy-related infrastructures where fuel is being processed, wind turbine's source of fuel is free. Wind turbines also have less impacts on birds, compared to other man-made threats such as windows, communication towers and pet cats (Hastik et al. 2015; Zerrahn, 2017). Although many authors in the literature conclude that wind turbines have negative impacts on the aesthetics (see for example Devine-Wright, 2005), the turbines can still be space efficient. For example, by installing new wind turbines on farms or agricultural land. The turbines will not occupy a lot of space and the farmers can still continue to work on their land. Installing a new turbine could also lead to local employment, and with more jobs it could additionally lead to an increase in housing in the region of the installment. It is worth noting, however, that there have been some arguments whether or not wind power should be considered to be an ecosystem service. Although the production of electricity is not produced by the environment itself, it can still be used. To avoid confusion, the term "eco-services" could be used (Mulder et al., 2015)[13].

For regulating services, wind energy is often seen as a contributor for climate regulation (Kermagoret et al., 2014). Wind turbines play a significant role for the environment and human

[13] Ecosystem services is often used as a synonym with the word "nature". Therefore, eco-systems seem to be a better fit to avoid confusion.

health, as it contributes to cutting back on carbon dioxide emissions and other air pollutants. Air pollutants, for example, have an effect on agricultural crops and could cause severe coughing and acute respiratory failure that might lead to asthma and pneumonia (Lera-Lopez et al., 2012). Through the contribution of less pollution, it will also strengthen the air flow quality. Turbine maintenance is needed in order for the wind turbines to remain safe and operate at the best behavior. Cultural services created by wind power involve recreational opportunities, such as doing activities (hiking, biking, etc.) at windmill parks. Support services from wind power is a cleaner air and water. Less pollution in the atmosphere will benefit other services such as lakes through less waste in the water and better water quality compare to other energy-related infrastructures such as nuclear power.

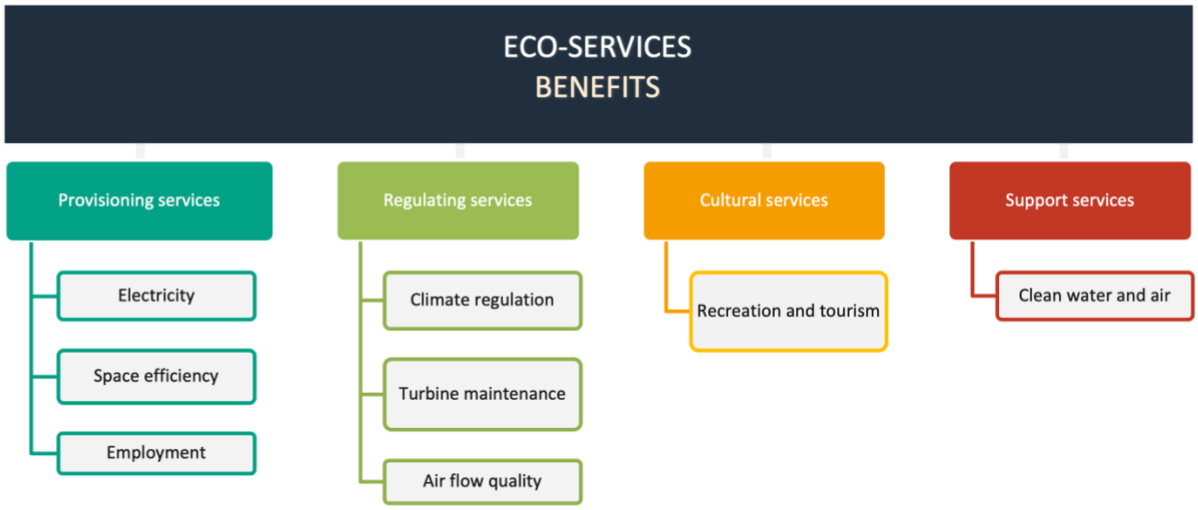

Figure 2: *Benefits towards eco-services from wind power*

By installing new wind turbines, there are ecosystem services that could be negatively affected either directly or indirectly (see figure 3). However, it will depend on several factors, such as where the location of wind turbines is installed and how well the planning phase from a management point of view has been organized. Provisioning services that could be affected are for example trees, which may lose the ability to store carbon if being removed. There could also be loss of exploitable area, and cause harm to wild animals and plants (such as birds and bats that has been discussed previously in the literature review). For regulation services, water regulation may be affected in the sense of removing rocks that serve as water purifications for lakes. For cultural services, it frequently has been triggering landscape related debates worldwide related to the noise from wind turbines and the unappealing aesthetic view. Also, it could potentially harm cultural heritage and cultural identity. For the support services, wind turbines may interrupt habitat and biodiversity.

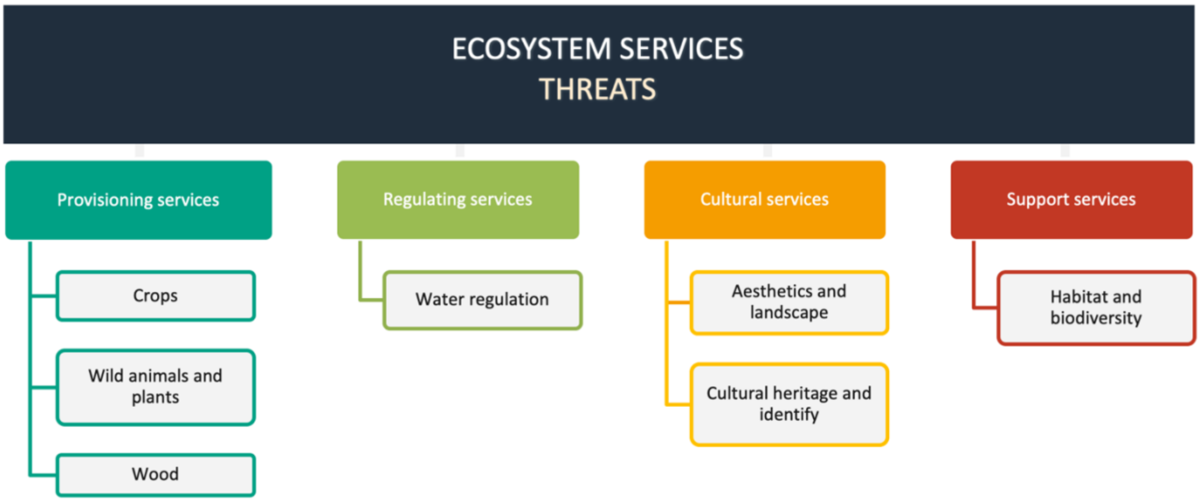

Figure 3: *Threats towards ecosystem services from wind power*

Despite the background of what wind power can contribute with, individuals must make trade-off decisions on whether the environmental advantages of wind power outweigh the disadvantages.

3.3 Stated preferences

Stated preference (SP) method is a survey-based economic technique used in the valuation literature to estimate welfare measures. SP involve asking individuals hypothetical questions about their WTP/WTA towards hypothetical changes in the level of provision (Perman, et al., 2003, p. 440). This method is mainly used to measure non-use values, but it can also be used to elicit information on use values (Perman, et al., 2003, p. 440). The aim is to indicate the possible responses between a range of questions, and establish the collective welfare measures for a particular good or service. Another common method that could be used is the revealed preference (RP) method, which rely on the actual decisions respondents have made. RP method has the limitation of only being able to measure use values. According to Bateman et al. (2005), this can cause some problems in situations where a portion of the total value for the environmental good can be an attribute for individuals who is classified as non-users. It is therefore more common is studies towards consumption of goods and services (use values), where the aim is to deduce individuals observed and real behavior.

Approaches to represent SP are either conducted by the CV method or DCE method. CV is the most widely technique used and is a survey approach that ask the respondents directly to evaluate their minimum or maximum WTP/WTA for a non-market good (Perry-Duxbury et al., 2019). The directness make it possible to get a single comprehensive measure of the welfare that is expressed in monetary values. The survey is usually designed in a simple format in order for respondents to understand the questions. DCE is a more modern technique with an increasing interest in in environmental studies. This survey approach use hypothetical scenarios and ask the respondents to choose between a set of options of attributes or characteristics, in order to indirectly valuate their estimation of WTP/WTA (Perry-Duxbury et al., 2019). Monetary values are included, alongside with other important attributes in the sequence of choices. The survey design is more complex than in CV, as more information is elicited from the respondents.

3.4 WTP construction

Since DCE are designed to reveal individuals preferences for non-market goods, the methodological approach is built on random utility theory from McFadden (1974). Through DCE, individuals are asked to make choices based on alternatives from a fixed status quo and an alternative that take on different values each time (Sennhauser, 2010). Expectations from a microeconomic perspective is that a rational individual will *always* make decisions that provide the highest expected utility. This concept originates from utilitarianism, which states that individuals are motivated to do what gives pleasure and avoid actions that incur pain (Perman et al., 2011, p. 59). Based on this idea, an indirect utility function could be constructed.

The indirect utility function will be used to measure the changes in welfare associated with a change in the environmental quality (Mariel, et al., 2020). It is an indirect function because the individuals think of their preferences in the sense of hypothetical consumption, and not on by the actual prices. The general function is following[14]:

$$(1)\ V\,(p, q, M)$$

Where **V** is the indirect utility function, **p** is an exogenous price vector, **q** is an environmental "good" and **M** is the exogenous consumer income from the budget constraint.

[14] The denotation and construction of the equations are adapted and inspired by the work of Dugstad et al. (2020)

By expanding the function, a tax fee or tax payment is added. In this case, it could represent a tax added to electricity bills for installing more wind turbines:

$$(2)\ V_j\ (p, q_j, M - F_j)$$

Where $\mathbf{F_j}$ is the tax/fee given by the presented scenario/alternative **j**. Since DCE researchers usually are interested in finding the non-marginal changes in amenity (or attribute) levels due to changes in policy and management regimes (Dugstad et al., 2020), welfare measure has to present and discrete changes in the environmental good q should be considered. Let us assume that $\Delta_s^A = q_s^A - q_s^0$ and $\Delta_s^B = q_s^B - q_s^0$, $\Delta_s^B > q_s^A$ represent two discrete changes in the environmental good (with increased improvements) and **s** to be the level of attribute. Then the measure of WTP (WTP^A and WTP^B) should be added into the indirect utility function such that:

$$(3)\ V_j\ (p^0, q^0, M) = V_j\ (p^0, q^j, M- WTP^j),\ j = A \text{ or } B$$

Where $\mathbf{WTP^j}$ can either be the change of WTP for either scenario/alternative A or B. The basic idea here is that individuals' will make choices based on the two options presented, for example installing 600 wind turbines (alt. A) or 3000 wind turbines (alt. B). Eventually, to test the responsiveness to scope, scope arc elasticity of WTP as defined in Whitehead (2016) could be calculated:

$$(4)\ \bar{E}_{WTP} \equiv \frac{\%\Delta WTP}{\%\Delta q_s} \equiv \left(\frac{WTP^B - WTP^A}{WTP^B + WTP^A/2}\right) / \left(\frac{\Delta_s^B - \Delta_s^A}{\Delta_s^B + \Delta_s^A/2}\right)$$

or simplified as:

$$(5)\ \bar{E}_{WTP} = \frac{\Delta WTP}{\Delta Q} \frac{\overline{Q}}{\overline{WTP}}$$

where **Q** is the quality measure of scope changes, Δ implies the change or difference in quality or WTP, where $\Delta q = q^1 - q^0 > 0, \Delta WTP = WTP^1 - WTP^0 \geq 0$. The **vinculum Q** is the average quality ($\frac{q^0+q^1}{2}$) and **vinculum WTP** is the average WTP ($\frac{WTP^0+WTP^1}{2}$).

3.5 Mixed logit models in WTP preference and WTP space

A common problem of stated preference model is the independence of irrelevant alternatives (IIA). The IIA restriction implies that the ratio of probability of choosing between two alternatives is independent of any other alternatives (Haab & McConnell, 2003). Models that have the IIA property will therefore prohibit different levels of substitution or complementarity between the choices. Mixed logit model, also known as random parameter logit model, is one of the most popular approaches for approximating any random utility models (McFadden & Train, 2000). Mixed logit models are able to estimate preference parameters that are fixed and allow preferences to vary across choices (Mariel et. al, 2020, p. 67). The model effectively resolves several limitations of standard logit models, such as putting ease on the IIA restriction, account for random taste variation (preference heterogeneity), unrestricted substitution patterns and correlation in unobserved factors over time (Train, 2002). The mixed logit equation for the probabilities are following:

$$(6)\ Prob(i_n|\theta) = \int \Pi_{t=1}^{T} \frac{\exp{(V_{int})}}{\Sigma_j^J \exp{(V_{jint})}} f(\beta|\theta) d\beta,$$

where $\boldsymbol{i_n}$ is the joint probability of preference for individual $\boldsymbol{n}$ over $\boldsymbol{J}$ alternatives (j = 1,2,3) for $\boldsymbol{T}$ choice cards specified as t = (1,2…,T). $\boldsymbol{f(\beta|\theta)}$ **i**s the parameter distribution for deterministic indirect utility $\boldsymbol{V_{int}}$.[15]

Mixed logit models can be estimated by the utility measurements of WTP. *Willingness to pay preference* (WTPP) is based on the conventional model parameterization, by specifying the distribution of the attribute coefficients in the utility function and deriving WTP as the ratio of the coefficient (Train & Weeks, 2005). Aside from using selected number of distributions, *willingness to pay space* (WTPS) is an alternative concept that was first introduced by Cameron and James (1987) and Cameron (1988) and was later investigated by Train & Weeks (2005)[16]. This approach is a re-parametrized model such that the coefficients can be directly interpreted as marginal WTP (Train & Weeks, 2005; Hole & Kolstad, 2012) for the attributes instead of the utility coefficients of the attributes. In other words, WTPS do not require to take the ratio of the coefficients as in WTPP.

[15] See Dugstad et al. (2020) p.14 for further details of the mixed logit model equation and the construction of it that has been used in first stage data for this study.

[16] Train & Weeks (2005) were the first to employ this concept in a DCE study.

Following the same denotation as Train & Weeks (2005), the WTPP is constructed as:

$$(7)\ U_{njt} = \alpha_n p_{njt} + \beta'_n x_{njt} + e_{njt}\ ,$$

where $\boldsymbol{\alpha_n}$ and $\boldsymbol{\beta_n}$ are random parameters for price and other non-monetary attributes, $\boldsymbol{x}$ is the non-price attributes and $\boldsymbol{e_{njt}}$ is the error term with the constant variance equal to $k_n^2(\frac{\pi^2}{6})$, with k_n being the scale parameter for individuals.

The WTP for attributes in WTPP will be $\frac{-\beta_n}{\mu_n}$. However, since the mixed logit model use both price and attribute as random parameters, the ratio of the variables is skewed. Train & Weeks (2005) show in their study that dividing equation (7) by k_n will not have any effect on behavior and creates a new error term. The new error term $\boldsymbol{\varepsilon_{njt}}$ is the IID extreme value type-one and equals to the constant variance of $\frac{\pi^2}{6}$:

$$(8)\ U_{njt} = \lambda_n p_{njt} + c'_n x_{njt} + \varepsilon_{njt}\ ,$$

where $\boldsymbol{\lambda_n}$ and $\boldsymbol{c_n}$ are the coefficients from utility which comes from $\lambda_n = \frac{\alpha_n}{\mu_n}$ and $c_n = \frac{\beta_n}{\mu_n}$. Train and Weeks (2005) have shown that equation (8) can be re-parameterized if the WTP for the attributes is given by the ratio of the utility coefficients $w_n = -\frac{c_n}{\lambda_n}$:

$$(9)\ U_{njt} = \lambda_n p_{njt} + (-\lambda_n w_n)'\, x_{njt} + \varepsilon_{njt},$$

which is the WTPS model.

Based on different assumptions of the two WTP models, it can result in different outcomes towards the distribution of WTP and how well it fits the data sample.

4. SURVEY DESIGN

This study will conduct a quantitative analysis by reconstructing secondary data that has undergone previous layers of analysis. The primary data was constructed to find scope in WTP for environmental attributes towards wind power preferences in Norway and is found in the work of Dugstad et al. (2020). The data collection was originally carried out in April 2019 through the professional research agency NORSTAT using the DCE method. All in all, the survey sample involved 821 respondents to represent the Norwegian population with respect to gender, age and location[17]. Half of those interviewed were living in Rogaland and the other half in Oslo. These two counties were specifically chosen as they encounter different levels of exposure to wind power. To illustrate the differences, Rogaland has approximately 250 wind turbines all the way from Egersund in South to Karmøy in North at the time of writing. In contrary, Oslo has none wind turbines installed to date and will likely not have any in the future.

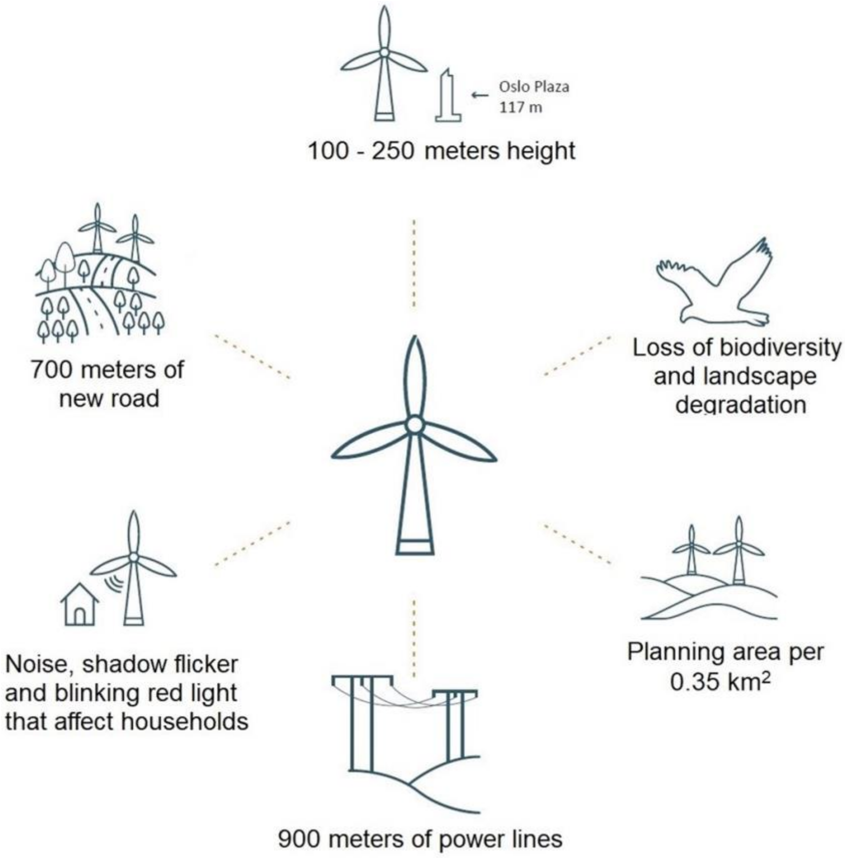

***Figure 4**: Externalities from wind turbines*

[17] A total of 4404 households were originally invited to participate in the survey. Out of 1101 participants who started the survey (response rate 24%), a total of 821 completed it.

Prior to finalizing the questionnaire, previous literature was carefully reviewed, several pilot tests were conducted and two focus groups were used in order to obtain crucial feedback. The survey started with questions towards the respondents general opinions, awareness and knowledge towards wind power in Norway (Dugstad et al., 2020)[18]. They were then given information about the National Framework for wind power[19], construction licenses and environmental effects from wind turbines such as noise, loss of biodiversity and visual effects. An illustration to summarize the externalities of wind turbines were presented to the participants (see figure 4), where they had opportunity to gain additional information by hovering their mouse over the keywords.

After the introduction, the respondents were given several choice cards and had to choose among the most preferred scenario. It was presented three scenarios for each choice card, status quo and two additional scenarios that represented expansion of energy production. For each scenario, it was included five attributes: *'new renewable energy production from all sources'*, *'new wind turbines'*, *'prioritized region for new wind power production'*, *'prioritized landscape type for new wind power production'* and *'change in household's monthly electricity bill'*. Figure 5 is an example of a choice card used in this survey. Finally, the respondents were given questions to identify their socio-economic characteristics, such as age, gender, education, income and location. See Dugstad et al. (2020) and Lindhjem et al. (2019) for further details of how the survey was conducted.

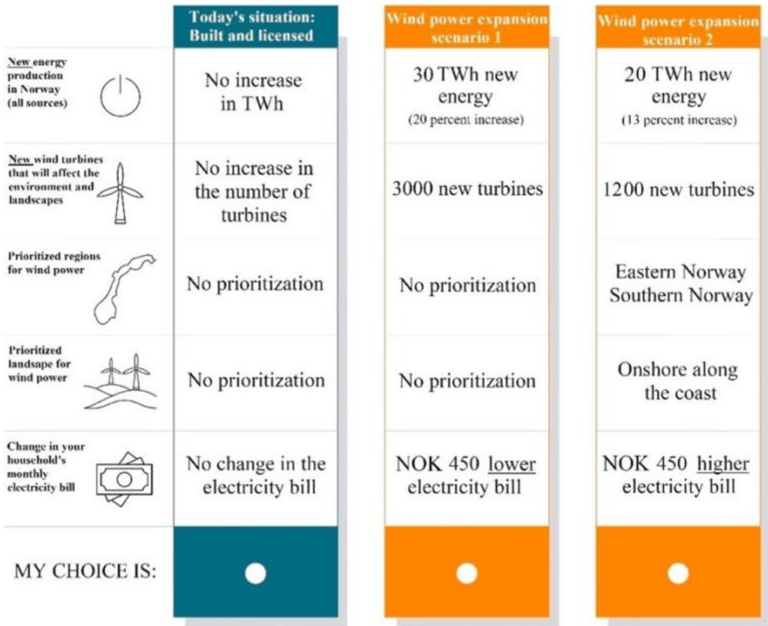

***Figure 5**: Illustrative choice card*

[18] Additionally, the survey included questions to obtain data of the respondents preferences towards wind power developments offshore. However, land-based wind power will be the main focus of this study.
[19] Norwegian Water Resources and Energy Directorate (NVE) prepared a proposal for a national framework for onshore wind power in 2019. http://publikasjoner.nve.no/rapport/2019/rapport2019_12.pdf. The survey conducted in this study is centred around this proposal.

5. MODEL APPLICATION

5.1 Model specification

In this study, the regression method by ordinary least squares (OLS) estimates will be used to show the effects the independent variables have on the dependent variable. The model is given in equation (10) and contains 27 independent variables. There will be conducted 24 different regression models with the same independent variables to examine if they have any influence on sensitivity to scope. However, the values from the dependent variable differs in each model. For simplicity, only one model will be illustrated.

$$
\begin{aligned}
SCOPE\_EL_{ijn} =\ & \beta_0 + \beta_1 \text{HH\_INC\_1000s}_{ijn} + \beta_2 \text{HH\_INC\_1000s2}_{ijn} + \beta_3 \text{AGE}_{ijn} \\
& + \beta_4 AGE2_{ijn} + \beta_5 EDU_{ijn} + \beta_6 EDU2_{ijn} + \beta_7 GENDER_{ijn} + \beta_8 MEMBER_{ijn} \\
& + \beta_9 NUM\_REC_{ijn} + \beta_{10} NUM\_REC\_MORE_{ijn} + \beta_{11} NO\_WT_{ijn} \\
& + \beta_{12} RED\_GAS_{ijn} + \beta_{13} REN_{ijn} + \beta_{14} NO\_CONCERN_{ijn} + \beta_{15} DIFF_{ijn} \\
& + \beta_{16} EF\_WILD_{ijn} + \beta_{17} EF\_LAND_{ijn} + \beta_{18} ICE\_WT_{ijn} + \beta_{19} LIGHT\_WT_{ijn} \\
& + \beta_{20} VIS\_WT_{ijn} + \beta_{21} NOISE\_WT_{ijn} + \beta_{22} AREA\_WT_{ijn} \\
& + \beta_{23} \text{HEIGHT\_}WT_{ijn} + \beta_{24} FUTURE\_DEVREG_{ijn} + \beta_{25} INFO_{ijn} \\
& + \beta_{26} SEEN\_WT_{ijn} + \beta_{27} SEEN\_WT\_OTHER_{ijn} + \varepsilon_{ijn}
\end{aligned} \tag{10}
$$

where $\boldsymbol{i}$ is the individual over $\boldsymbol{j}$ alternatives of wind turbines (j = 600-1200, 600-3000, 1200-3000), $\boldsymbol{n}$ is the county in Norway the respondents are from and $\boldsymbol{\varepsilon_i}$ is the error term for the regression models. All models will be estimated through the software program RStudio.

The dependent variable SCOPE_EL represent the scope arc elasticity described in equation (5). This variable is based on whether respondents live in Rogaland (ROG) or Oslo (OSLO), whether the scope arc elasticities are negative or positive towards the different levels of wind turbines (600-3000, 600-1200, 1200-3000), and lastly what estimation of WTP is used (WTPP or WTPS). See table 1 for an overview of the different values on the dependent variable that will be used in the regression models.

Table 1: *Overview of different values used as dependent variable*

REGION	SCOPE SIGN	WIND TURBINES
WTP SPACE		
ROG	+	600-3000
ROG	+	600-1200
ROG	+	1200-3000
ROG	+	600-3000
ROG	+	600-1200
ROG	+	1200-3000
WTP PREFERENCE		
ROG	-	600-3000
ROG	-	600-1200
ROG	-	1200-3000
ROG	-	600-3000
ROG	-	600-1200
ROG	-	1200-3000

REGION	SCOPE SIGN	WIND TURBINES
WTP SPACE		
OSLO	+	600-3000
OSLO	+	600-1200
OSLO	+	1200-3000
OSLO	+	600-3000
OSLO	+	600-1200
OSLO	+	1200-3000
WTP PREFERENCE		
OSLO	-	600-3000
OSLO	-	600-1200
OSLO	-	1200-3000
OSLO	-	600-3000
OSLO	-	600-1200
OSLO	-	1200-3000

For the majority of the demographic and socioeconomic variables, it was additionally included a quadratic term. This was added to allow more accurately effect of the variables, rather than assuming that the effects are linear. For example, the effect of income (HH_INC_1000s) could be positive up until a certain amount, let us say up to 500.000 NOK, and then after exceeding this amount become negative. Age (AGE), education (EDU) and income (HH_INC_1000s) have additional squared variables; AGE2, EDU2 and HH_INC_1000s2, whereas gender (GENDER) as of its obvious nature coded as a dummy variable. Table 2 provides an overview of the variables included in the regression model and the corresponding expected signs.

Use value and non-use value variables are all coded to dummy variables. Interaction variables (use values) towards how many trips for recreational activities where wind turbines are visual for the last 12 months are included (NUM_REC and NUM_REC_MORE) to see if it implies any changes in the scope effects. Externalities and attributes associated with use values towards wind turbines, such as the height (HEIGHT_WT), area used to new developments (AREA_WT), noise (NOISE_WT), visual effects (VIS_WT), flashing lights (LIGHT_WT) and ice throws (ICE_WT) are examined. Also, the non-use values associated with the effects wind turbines have on landscape (EF_LAND) and wildlife (EF_WILD) such as animals and plants are examined.

Dummy variables in regards to respondents attitudes towards environmental organizations (MEMBER), future developments of wind power (FUTURE_DEVREG) and more wind turbines (NO_WT). Also, their attitudes towards wind power in general being a good renewable source of energy (REN), willingness to reduce greenhouse gases (RED_GAS) and the level of concern wind power have on nature (NO_CONCERN) are added to the model. Respondents being familiar to the government's future plan for wind power developments (INFO), if they have seen wind turbines in Norway (SEEN_WT) or outside of Norway (SEEN_WT_OTHER) were also added to examine if knowledge and familiarity have an effect on the sensitivity to scope. Lastly, a dummy variable including the difficulty to answer the survey was added.

Table 2: *Overview of variable descriptions*

NAME	DESCRIPTION	CODING	SIGN
Scope-arc elasticity			
SCOPE_EL	Scope elasticity of respondents WTP responses (For 600-3000 wind turbines, 600-1200 wind turbines and 1200-3000 wind turbines)	Dependent variable	…
Demographics/ Socio-economics			
AGE	Respondents age in years	Continuous	-
AGE2	Square of respondents age	Quadratic	-
GENDER	Gender (0: Female, 1: Male)	Dummy	±
EDU	Respondents education level (1-3 lower than university degree, 4-6: university degree)	Dummy	+
EDU2	Square of respondents education level	Quadratic	+
HH_INC_ 1000s	Household income in thousands (NOK)	Continuous	+
HH_INC_ 1000s2	Square of respondents household income	Quadratic	+
Use values/ Non-use values			
NUM_REC	Respondents who have made trips for recreational activities where wind turbines are visual for the last 12 months *(0: One or more times, 1: None)*	Dummy	+
NUM_REC _MORE	Respondents who have made more than 13 trips for recreational activities where wind turbines are visual for the last 12 months *(0: More than 13 times, 1: Less than 13 times)*	Dummy	+

HEIGHT_WT	Respondents attitudes towards the effects from height of wind turbines *(0: Important, 1: Not important)*	Dummy	±
AREA_WT	Respondents attitudes towards the impact on area from wind turbines development *(0: Important, 1: Not important)*	Dummy	±
NOISE_WT	Respondents attitudes towards the noise effects from wind turbines *(0: Important, 1: Not important)*	Dummy	±
VIS_WT	Respondents attitudes towards the visual effects of wind turbines *(0: Important, 1: Not important)*	Dummy	±
LIGHT_WT	Respondents attitudes towards flashing light effects from wind turbines *(0: Important, 1: Not important)*	Dummy	±
ICE_WT	Respondents attitudes towards the ice throw effects from the wind turbines *(0: Important, 1: Not important)*	Dummy	±
EF_LAND	Respondents who find the effects wind turbines have on the landscape *(0: Important, 1: Not important)*	Dummy	±
EF_WILD	Respondents who find the effects wind turbines have on the wildlife *(0: Important, 1: Not important)*	Dummy	±
Attitudes			
MEMBER	Respondents who are member of an environmental organization *(0: No, 1: Yes)*	Dummy	+
FUTURE_ DEVREG	Respondents who want future developments of wind power in own region *(0: No, 1: Yes)*	Dummy	+
NO_WT	Respondents attitudes towards installation of new wind turbines *(0: Important, 1: Not important*	Dummy	±
REN	Respondents who believe wind power is the best source for renewable energy in Norway *(0: No, 1: Yes)*	Dummy	+
RED_GAS	Respondents who believe reducing greenhouse gases is important *(0: No, 1: Yes)*	Dummy	+
NO_ CONCERN	Respondents who believe the effects of wind power developments have on nature is not a concern *(0: Disagree, 1: Agree)*	Dummy	+
Knowledge / familiarity			
INFO	Respondents who are familiar to the government's future wind power development plan *(0: No, 1: Yes)*	Dummy	+
SEEN_WT	Respondent who has seen wind turbines in Norway *(0: No, 1: Yes)*	Dummy	+
SEEN_WT_ OTHER	Respondent who has seen wind turbines outside of Norway *(0: No, 1: Yes)*	Dummy	+
Difficulty of survey			
DIFF	Respondents evaluation towards the level of difficulty to answer the questions in the survey *(0: Hard, 1: Easy)*	Dummy	±

5.2 Hypothesis

<u>Demographics/ Socio-economics</u>

Regarding the different aspects that could affect the sensitivity to scope, demographic and socio-economic factors could explain some of the variation. Household income, gender, age and education are all factors that the valuation literature has identified to potentially have an effect on the good measured. Since this study is looking at different level of wind turbines (600-3000, 600-1200, 1200-3000), it will of interest to see if any of these factors impact the scope sensitivity. Hypothesis to the underlying research question from demographic and socio-economic perspective are following:

- **H1:** Individuals with higher income level have higher scope sensitivity towards installing new wind turbines.
- **H2:** Males have higher scope sensitivity towards installing new wind turbines.
- **H3:** Individuals who have higher education have higher scope sensitivity towards installing new wind turbines.
- **H4:** Age have negative effects on sensitivity to scope towards installing new wind turbines

<u>Use values/ Non-use values</u>

It is believed that use values will result in a higher sensitivity to scope than non-use values. Negative externalities towards wind turbines will be examined such as noise, ice throw, height, flashing lights, visual effects, area used for new wind power development for use values, and effect on land and wildlife for non-use values. Area for development and is believed to reveal lower sensitivity to scope for respondents who are concerned, and higher for respondents who are not concerned. Hypothesis to the underlying research question based on use values and non-use values are following:

- **H5:** Individuals who use the landscape area of existing wind turbines for recreational purposes have higher scope sensitivity towards installing new wind turbines.
- **H6:** Individuals who are not concerned with the negative externalities from wind turbines have higher scope sensitivity

Attitudes

As this paper exclusively look at the individual-level through DCE, the survey is designed to acknowledge respondents' behavior and attitudes towards wind power. This has rarely been examined and discussed in the environmental valuation literature, but could potentially reveal some new insights of the variation in scope sensitivity. Questions involved in the survey are for example attitudes to new wind power developments, renewable energy and greenhouse gases, whether or not they are (or want) to be a member of an environmental organization and so on. Hypothesis to the underlying research question based on attitudes are following:

- **H7:** Individuals who are members of environmental organizations are more sensitive to scope towards installing new wind turbines.
- **H8:** Individuals who are positive towards new wind power developments have higher scope sensitivity
- **H9:** Individuals who want to reduce greenhouse gases have higher scope sensitivity towards installing new wind turbines.
- **H10:** Individuals who believe wind power is a good source for renewable energy have higher scope sensitivity towards installing new wind turbines.

Knowledge / familiarity

It is assumed that respondents who have knowledge and are familiar with wind power have a higher scope sensitivity. Hypothesis to the underlying research question based on knowledge and familiarity are following:

- **H11:** Individuals living in Rogaland have higher scope sensitivity towards installing new wind turbines.
- **H12:** Individuals who have more knowledge have higher scope sensitivity towards installing new wind turbines.
- **H13:** Individuals who have experiences and are exposed to wind turbines are more sensitive to scope towards installing new wind turbines.

Difficulty of survey

Having in mind that the survey is complex, it is assumed to be some random errors involved. Based on the level of difficulty to answer the questions, it is expected to reveal lower scope sensitivity for respondents who found it difficult and higher for those who were neutral or found it easy. The hypotheses to the underlying research question based on the level of difficulty towards the survey is following:

- **H14:** Individuals who found it easy to answer the questions in the survey have higher scope sensitivity towards installing new wind turbines.

The null hypothesis for this papers is that there is no statistically significant correlation between the dependent and the independent variable. For the alternative hypothesis, there is a statistically significant correlation.

6. RESULTS & ANALYSIS

Throughout the survey, a number of respondents gave protest answers such as "*I don't know*", "*I'm not sure*" or "*I will not disclose*". For example, when asking about the degree of education, some respondents did not choose any options where different education levels were presented in the choice card, but rather "*I don't know/I'm not sure*". This could potentially introduce a certain level of uncertainty around the variables where it is missing the actual level/amount. However, to avoid missing responses, the average mean was used for these respondents. Scope elasticities higher than 2.5 and lower than -2.5 were considered as extreme values and therefore excluded from the analysis. The household income variable was introduced as intervals, but in order to have an explanatory variable, the midpoint for each interval was used.

Table 3 show the regressions results that were run with WTPS for all the wind turbine alternatives for both Rogaland and Oslo, using equation (10). The first three models represent the different level of wind turbines of Rogaland. The subscripts "600-3000 WT", "600-1200 WT" and "1200-3000 WT" in the models refer to the different level of wind turbines based on scope arc elasticity measurement. The last three models are the same as described above, but for the county Oslo. Table 4 show the regressions results that were run with WTPP for both counties. For the readers information, Table 3 and table 4 are only looking at the positive elasticities elicited from the respondents. The negative elasticities are run in separate models (see appendix 1).

As seen in table 3, no variables are significant at 1% and thus rejected at 99% confidence interval. However, several variables are significant at 5% and 10%. From model 1, all alternative hypotheses can be rejected, with the exception of hypothesis 6. The variable ICE_WT is statistically significant at the 5%, indicating that individuals who are not concerned with the externality of ice throw from the wind turbines have higher scope sensitivity. LIGHT_WT were also significant at 5% in the first model, but with negative parameter value. This show that the scope elasticity diminishes the closer the beaming lights of wind turbines are from individuals.

HEIGHT_WT are significant at 10% with the expected sign. Interestingly, FUTURE_DEVREG is significant at 5%, but with the unexpected sign. Indicating that there is a correlation between individuals who want future developments of wind turbines in Norway and the dependent variable. However, they move in the opposite directions. In other words, the higher scope sensitivity, the lower interest for new developments. On the other hand, it is reasonable to assume that individuals living in Rogaland prefer more developments than fewer. For model 2, individuals in Rogaland are statistically significant with negative parameter values for ice throws from wind turbines and the believe of wind power being the best source of renewable energy. All alternative hypotheses are rejected for model 2 and model 3, as model 3 has no significant variables.

From model 4, individuals living in Oslo have significant variable for INFO at the 600-3000 level of wind turbines, but again with the opposite sign as originally predicted. This indicates that respondents who were familiar with the government's future wind power development plan have negative sensitivity scope. This could make sense in the way that people in Oslo are not exposed to wind power and want to keep it that way. SEEN_WT is significant at 10% making the null hypothesis rejected at for H13. There are in fact a statistically significant relationship for NUM_REC and RED_GAS for the 1200-3000 level of wind turbines at respectively 5% and 10%. However, with negative sign. Model 6 have no significant variables and therefore all alternative hypotheses are rejected.

Table 3: *OLS - WTP space Rogaland VS Oslo*

	ROG 600-3000 WT	**ROG** 600-1200 WT	**ROG** 1200-3000 WT	**OSLO** 600-3000 WT	**OSLO** 600-1200 WT	**OSLO** 1200-3000 WT
	(1)	(2)	(3)	(4)	(5)	(6)
HH_INC_1000s	0.0001	-0.0001	0.00003	0.0004	-0.0001	0.0001
	(0.0002)	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0002)
HH_INC_1000s2	-0.00000	0.000	0.000	-0.00000	0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
AGE	0.008	0.019^{*}	-0.015	0.018	0.010	0.014
	(0.014)	(0.011)	(0.017)	(0.019)	(0.012)	(0.016)
AGE2	-0.0001	-0.0002	0.0002	-0.0003	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
EDU	-0.165	-0.011	-0.307	-0.040	0.026	-0.144
	(0.242)	(0.163)	(0.273)	(0.240)	(0.169)	(0.219)
EDU2	0.021	0.002	0.046	0.008	-0.004	0.028
	(0.034)	(0.025)	(0.040)	(0.036)	(0.025)	(0.033)
GENDER	0.033	-0.026	-0.017	-0.058	0.010	-0.016
	(0.083)	(0.064)	(0.103)	(0.107)	(0.063)	(0.092)
MEMBER	-0.004	0.153	-0.006	0.083	-0.031	-0.058
	(0.114)	(0.113)	(0.121)	(0.120)	(0.085)	(0.114)
NUM_REC	-0.017	-0.045	0.018	0.126	-0.137^{**}	-0.049
	(0.101)	(0.074)	(0.127)	(0.109)	(0.069)	(0.105)
NUM_REC_MORE	0.022	-0.037	0.030	-0.345	-0.042	0.099
	(0.104)	(0.081)	(0.116)	(0.243)	(0.140)	(0.234)
INFO	-0.025	0.017	0.088	-0.197^{*}	0.046	0.030
	(0.079)	(0.060)	(0.093)	(0.109)	(0.067)	(0.096)
SEEN_WT	0.137	-0.028	0.007	0.220^{*}	-0.001	-0.050
	(0.216)	(0.140)	(0.230)	(0.127)	(0.072)	(0.109)
SEEN_WT_OTHER	-0.274	-0.015	0.174	-0.173	-0.002	0.009
	(0.249)	(0.170)	(0.280)	(0.145)	(0.091)	(0.116)
FUTURE_DEVREG	-0.236^{**}	0.100	0.005	0.010	-0.030	-0.066
	(0.113)	(0.077)	(0.120)	(0.114)	(0.071)	(0.105)
NO_WT	-0.080	0.022	-0.081	-0.069	0.099	-0.122
	(0.077)	(0.068)	(0.094)	(0.107)	(0.068)	(0.091)
RED_GAS	0.074	-0.012	0.060	-0.099	-0.113^{*}	0.031
	(0.076)	(0.062)	(0.088)	(0.107)	(0.064)	(0.089)
REN	-0.148	-0.159^{**}	0.013	-0.137	0.043	0.072
	(0.107)	(0.067)	(0.109)	(0.127)	(0.074)	(0.101)
NO_CONCERN	0.012	-0.024	-0.094	-0.126	0.034	-0.034
	(0.099)	(0.072)	(0.112)	(0.115)	(0.071)	(0.103)
DIFF	-0.054	-0.005	-0.018	0.002	0.059	0.061

Table 3 *(Continued)*

	(0.079)	(0.062)	(0.096)	(0.112)	(0.067)	(0.089)
EF_WILD	-0.065	0.015	-0.054	0.123	0.123	0.075
	(0.101)	(0.077)	(0.119)	(0.130)	(0.081)	(0.114)
EF_LAND	0.051	-0.071	0.053	-0.049	-0.012	0.042
	(0.108)	(0.089)	(0.134)	(0.119)	(0.080)	(0.112)
ICE_WT	0.235**	-0.199*	-0.042	-0.070	-0.049	0.016
	(0.113)	(0.102)	(0.137)	(0.145)	(0.099)	(0.124)
LIGHT_WT	-0.235**	0.105	0.149	0.116	0.077	-0.046
	(0.112)	(0.085)	(0.141)	(0.151)	(0.089)	(0.130)
VIS_WT	-0.067	0.152*	0.004	0.079	-0.036	0.038
	(0.110)	(0.084)	(0.154)	(0.131)	(0.079)	(0.116)
NOISE_WT	-0.083	0.045	-0.006	-0.176	-0.022	-0.063
	(0.094)	(0.089)	(0.118)	(0.140)	(0.074)	(0.106)
AREA_WT	-0.058	-0.090	-0.063	0.084	-0.066	-0.148
	(0.096)	(0.086)	(0.126)	(0.128)	(0.081)	(0.096)
HEIGHT_WT	0.213*	0.097	-0.132	0.058	-0.051	0.040
	(0.125)	(0.101)	(0.161)	(0.138)	(0.091)	(0.111)
Constant	1.352**	0.056	1.162	0.344	0.373	0.680
	(0.638)	(0.472)	(0.807)	(0.696)	(0.461)	(0.619)
Observations	96	108	111	91	132	97
R^2	0.288	0.271	0.145	0.285	0.170	0.232
Adjusted R^2	0.005	0.025	-0.134	-0.022	-0.046	-0.068
Residual Std. Error	0.322 (df = 68)	0.263 (df = 80)	0.425 (df = 83)	0.417 (df = 63)	0.322 (df = 104)	0.373 (df = 69)
F Statistic	1.019 (df = 27; 68)	1.102 (df = 27; 80)	0.520 (df = 27; 83)	0.929 (df = 27; 63)	0.788 (df = 27; 104)	0.773 (df = 27; 69)

Note: ***p<0.01, **p<0.05, *p<0.1

Table 4 records the results of the estimation from WTPP. In model 1, the coefficient MEMBER is significant at 10% level. Which aligns with the hypothesis 7 and result in rejection of the null hypothesis. LIGHT_WT is significant at 10% in the first model, but with negative parameter value. In model 2, EF_WILD is negative at 10%, while HEIGHT_WT is statistically significant at 5% level. The latter is also significant at the same level in model 3. VIS_WT is significant at 10% level in model 3, but again with negative parameter value. This indicates that individuals gain negative scope effects for each new wind turbine added at the 1200-3000 level. This may be justified as more wind turbines are installed, at least to a certain point, the more concerned the respondents are with the visual effects.

For Oslo, the variable AGE is statistically significant, as seen in model 4. This indicates that when age increase with one year, for example from 26 to 27, then the sensitivity to scope is expected to increase by 0,03. AGE2, the square term of AGE, is negatively correlated with sensitivity to scope. At the level of 600-3000 wind turbines, residents in Oslo seems to have a higher sensitivity if they have seen wind turbines beforehand. In model 2, the variable to detect errors in the survey from difficulty of answering the questionnaires (DIFF) is negative correlated with scope with significance at 5% level.

In model 3, income (HH_INC_1000s) and the square term of income (HH_INC_1000s2) is significant at 10% level, while REN is significant at 1% level. For the latter, this result in rejecting the null hypothesis for H10 and support the hypothesis that believing that wind power is a good source of renewable energy impact the scope sensitivity in the positive direction. Finally, NOISE_WT and AREA_WT are both significant at respectively 5% and 1%, but again with negative parameter value. This show that people living in Oslo will have decreasing scope effects towards the externalities of noise and area used for developments of wind turbines.

Table 4: *OLS - WTP preference Rogaland VS Oslo*

	ROG 600-3000 WT	**ROG** 600-1200 WT	**ROG** 1200-3000 WT	**OSLO** 600-3000 WT	**OSLO** 600-1200 WT	**OSLO** 1200-3000 WT
	(1)	(2)	(3)	(4)	(5)	(6)
HH_INC_1000s	-0.0001	-0.0001	0.0002	0.0002	-0.0002	0.0003*
	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
HH_INC_1000s2	0.00000	0.00000	-0.00000	-0.00000	0.00000	-0.00000*
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
AGE	0.007	-0.006	-0.016	0.030**	-0.018	0.001
	(0.020)	(0.018)	(0.017)	(0.013)	(0.014)	(0.011)
AGE2	-0.0001	0.0001	0.0002	-0.0003**	0.0002	-0.00004
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
EDU	0.166	-0.012	0.052	0.061	0.078	-0.140
	(0.288)	(0.244)	(0.238)	(0.199)	(0.189)	(0.145)
EDU2	-0.028	-0.004	-0.008	-0.006	-0.015	0.017
	(0.041)	(0.039)	(0.033)	(0.030)	(0.028)	(0.022)
GENDER	-0.093	0.067	0.049	-0.048	0.021	0.011
	(0.126)	(0.123)	(0.087)	(0.091)	(0.074)	(0.072)
MEMBER	0.330*	0.080	-0.149	0.075	-0.078	0.059
	(0.182)	(0.179)	(0.123)	(0.108)	(0.104)	(0.077)
NUM_REC	0.033	0.055	-0.109	0.088	-0.086	0.033
	(0.130)	(0.126)	(0.114)	(0.094)	(0.079)	(0.075)
NUM_REC_MORE	0.026	0.074	-0.022	0.081	-0.058	0.171
	(0.164)	(0.144)	(0.119)	(0.209)	(0.156)	(0.260)
INFO	-0.054	0.057	-0.023	0.096	-0.006	-0.083
	(0.111)	(0.102)	(0.093)	(0.093)	(0.072)	(0.074)
SEEN_WT	-0.222	-0.083	-0.222	0.233**	-0.047	0.034
	(0.272)	(0.192)	(0.190)	(0.102)	(0.084)	(0.090)
SEEN_WT_OTHER	-0.216	-0.120	-0.170	-0.093	0.059	0.028
	(0.370)	(0.218)	(0.278)	(0.116)	(0.099)	(0.088)
FUTURE_DEVREG	-0.110	-0.052	-0.060	0.013	-0.077	-0.087
	(0.147)	(0.129)	(0.112)	(0.101)	(0.078)	(0.081)
NO_WT	0.051	0.063	-0.140	-0.097	-0.006	0.007
	(0.119)	(0.144)	(0.090)	(0.089)	(0.077)	(0.081)
RED_GAS	-0.043	-0.083	0.090	-0.098	-0.065	-0.078
	(0.116)	(0.103)	(0.084)	(0.089)	(0.070)	(0.069)
REN	0.101	0.067	0.099	-0.035	0.088	0.222***
	(0.121)	(0.099)	(0.097)	(0.110)	(0.088)	(0.074)
NO_CONCERN	0.029	0.088	-0.085	0.150	0.040	-0.039
	(0.131)	(0.134)	(0.098)	(0.098)	(0.078)	(0.088)
DIFF	0.053	-0.128	0.108	0.017	-0.156**	0.101

Table 4 *(Continued)*

	(0.130)	(0.109)	(0.092)	(0.099)	(0.074)	(0.071)
EF_WILD	-0.096	-0.220*	-0.004	-0.128	0.099	0.145
	(0.140)	(0.124)	(0.116)	(0.113)	(0.094)	(0.107)
EF_LAND	0.213	-0.197	0.004	-0.053	-0.001	-0.053
	(0.165)	(0.167)	(0.127)	(0.104)	(0.088)	(0.092)
ICE_WT	-0.275	-0.143	-0.069	0.104	-0.075	0.113
	(0.182)	(0.181)	(0.117)	(0.119)	(0.101)	(0.092)
LIGHT_WT	-0.296*	0.124	0.094	-0.017	0.051	0.031
	(0.158)	(0.176)	(0.108)	(0.121)	(0.094)	(0.089)
VIS_WT	0.222	-0.113	-0.210*	-0.012	-0.017	0.064
	(0.160)	(0.169)	(0.119)	(0.110)	(0.085)	(0.092)
NOISE_WT	-0.032	0.117	-0.066	0.079	-0.009	-0.234**
	(0.128)	(0.155)	(0.112)	(0.112)	(0.084)	(0.094)
AREA_WT	0.052	0.092	-0.025	-0.032	-0.078	-0.217***
	(0.142)	(0.152)	(0.112)	(0.108)	(0.090)	(0.082)
HEIGHT _WT	0.095	0.433**	0.275**	0.050	-0.008	0.028
	(0.208)	(0.184)	(0.130)	(0.115)	(0.096)	(0.088)
Constant	0.339	1.124	1.589**	-1.054*	1.690***	0.390
	(0.766)	(0.758)	(0.673)	(0.591)	(0.521)	(0.528)
Observations	79	76	111	106	152	148
R^2	0.367	0.326	0.260	0.310	0.135	0.298
Adjusted R^2	0.032	-0.053	0.019	0.070	-0.053	0.141
Residual Std. Error	0.402 (df = 51)	0.355 (df = 48)	0.398 (df = 83)	0.396 (df = 78)	0.397 (df = 124)	0.375 (df = 120)
F Statistic	1.096 (df = 27; 51)	0.860 (df = 27; 48)	1.077 (df = 27; 83)	1.295 (df = 27; 78)	0.720 (df = 27; 124)	1.891** (df = 27; 120)

Note: ***p<0.01, **p<0.05, *p<0.1

7. DISCUSSION AND CONCLUSION

Checking the validity with sensitivity to scope has received increasing interest among economists and is an instrument implemented to check if individuals are willing to pay more for a higher level or quality of a good. The main contribution of this thesis is to expand the literature by yield estimates of sensitivity to scope at the individual level based on a DCE survey. To my knowledge, this is the first attempt through the DCE method. It was also made an attempt to compare two competing models of WTP distribution, WTPP and WTPS, as there is no clear answer or criteria to what approach being the best fit for a given data set. This application to scope sensitivities will not only be relevant for environmental studies conducted on wind power, but also for other valuation studies.

The regression results revealed several unexpected effects and need some further discussion. By comparing the two WTP distributions that was derived from the mixed logit model, the conventional WTPP model were a better fit to the data than the corresponding WTPS. There seem to be increasing interest among economists to use the modern WTPS approach (e.g., Badura et al., 2020) with both empirical and conceptual evidence provided in the literature towards this approach. Therefore, it is worth noting that the results of this paper might be particular for this case where future applications might discover different outcomes.

Exposure and familiarity towards an environmental improvement has been brought up several times in the literature to reveal a higher sensitivity to scope. In the models that this present paper conducted, reveals that Rogaland corresponded slightly better with the hypotheses than Oslo. It is therefore fair to say that individuals living Rogaland have higher sensitive to scope. However, it was unexpected to find such low significance in the models and thus lack of evidence to support specific determinants of sensitivity to scope from WTP. Also, from a theoretical perspective, it is hard to accept the fact that respondents did not reveal the concept of “more is better” when looking at the values of the different levels of wind turbines.

The significant weaknesses are likely due to the overall sample size, as there were only 25% acceptance rate of the survey and all respondents who had estimations from the scope arc elasticity above 2.5 or below -2.5 were excluded. Also, negative scope estimates were run in separate models (see Appendix 1). The reason why it was decided to separate the negative and positive elasticities, were of the believe that the positive elasticities would reveal the determinants more significantly.

Moreover, a limitation of this study was to work with such a big data file that were extracted from the survey, where some data was decided upon to be excluded. Specifically, data concerning acceptance towards distance to wind turbines and the trustworthiness of the survey would be interesting to include in the models. As a result, potential variables that might have an impact on the result were ignored.

The main challange of this study is that there is little or no studies conducted before on this topic through the DCE method. Therefore, there is no legitimate papers for comparisons. The closest comparisons are the few studies in the CV literature, such as Heberlein et al. (2005) and Søgaard et al. (2012), that has implicitly looked at scope sensitivity at the individual-level. However, none has included a substantial number of socio-demographic variables nor use- and non-use values. It is therefore expected that readers remain critical to some of the estimates made in this paper.

I acknowledge that there could be some improvements to this work. Readers may raise some questions towards the regression models as to whether or not to consider a 10% confidence level being statistically significant, or not. In this paper, it is justified with the small sample size and future work might find it more reliable to include a bigger sample size. However, I believe that the findings in this study could encourage future work to give more attention to individual preferences, and not just across the sample as a whole. By turning the focus onto individual preferences, important patterns of WTP and characteristics of human behavior (that is often hidden behind averages) could be detected (Heberlein et al., 2005). An addition for future work would be to involve a cross-disciplinary collaboration with specialty within the field of psychology to get a broader behavioral insight. Moreover, future work may consider including more non-use values to get a more valid result of the total economic value. In this paper, it was only included two variables to capture this value, hence the effect wind turbines have on landscape and wildlife.

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9. APPENDIX

Appendix 1: Tables

Table 5: *OLS - WTP space Rogaland VS Oslo (Neg. elasticity)*

	ROG 600-3000 WT	**ROG** 600-1200 WT	**ROG** 1200-3000 WT	**OSLO** 600-3000 WT	**OSLO** 600-1200 WT	**OSLO** 1200-3000 WT
	(1)	(2)	(3)	(4)	(5)	(6)
HH_INC_1000s	0.0002*	0.0002*	0.0002**	-0.0001	-0.00003	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
HH_INC_1000s2	-0.00000*	-0.00000	-0.00000	0.00000	0.000	0.000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
AGE	0.006	-0.002	0.014*	-0.005	-0.013*	0.004
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.009)
AGE2	-0.0001	-0.00000	-0.0001*	0.00004	0.0001*	-0.00003
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
EDU	-0.047	-0.072	-0.219**	-0.010	-0.110	-0.074
	(0.090)	(0.092)	(0.106)	(0.124)	(0.094)	(0.134)
EDU2	0.006	0.011	0.030*	-0.0001	0.013	0.012
	(0.013)	(0.013)	(0.016)	(0.019)	(0.014)	(0.020)
GENDER	0.013	-0.067*	0.028	0.032	-0.021	0.022
	(0.037)	(0.038)	(0.045)	(0.050)	(0.042)	(0.056)
MEMBER	0.005	-0.010	-0.092	0.053	0.010	-0.028
	(0.048)	(0.047)	(0.058)	(0.056)	(0.049)	(0.062)
NUM_REC	-0.049	-0.047	-0.008	-0.009	0.037	0.074
	(0.052)	(0.054)	(0.064)	(0.051)	(0.043)	(0.055)
NUM_REC_MORE	0.015	-0.016	0.044	-0.055	-0.047	-0.316**
	(0.043)	(0.044)	(0.051)	(0.126)	(0.099)	(0.136)
INFO	-0.020	-0.039	0.074	0.133***	0.054	0.078
	(0.040)	(0.042)	(0.050)	(0.049)	(0.042)	(0.053)
SEEN_WT	-0.118	-0.028	-0.004	-0.097*	0.081	-0.041
	(0.076)	(0.083)	(0.094)	(0.057)	(0.050)	(0.061)
SEEN_WT_OTHER	0.070	-0.084	-0.024	0.022	-0.083	0.017
	(0.094)	(0.100)	(0.112)	(0.064)	(0.052)	(0.073)
FUTURE_DEVREG	-0.071	-0.049	-0.036	-0.022	-0.089*	0.138**
	(0.048)	(0.049)	(0.059)	(0.054)	(0.046)	(0.059)
NO_WT	0.072*	-0.039	0.078	0.010	0.015	0.027
	(0.042)	(0.042)	(0.052)	(0.055)	(0.045)	(0.061)
RED_GAS	0.007	0.046	0.022	0.008	-0.009	0.038
	(0.038)	(0.037)	(0.046)	(0.047)	(0.040)	(0.053)
REN	-0.022	0.008	-0.052	0.038	0.133***	-0.066
	(0.043)	(0.044)	(0.053)	(0.055)	(0.045)	(0.060)
NO_CONCERN	0.060	-0.102**	0.033	-0.009	0.096*	-0.015
	(0.050)	(0.049)	(0.061)	(0.059)	(0.050)	(0.063)
DIFF	0.010	0.064*	-0.053	0.011	0.016	0.008

Table 5 *(Continued)*

	(0.037)	(0.037)	(0.044)	(0.048)	(0.041)	(0.054)
EF_WILD	-0.104*	-0.017	0.036	0.077	0.043	-0.022
	(0.061)	(0.059)	(0.077)	(0.075)	(0.065)	(0.081)
EF_LAND	0.032	0.102*	-0.056	0.012	-0.023	0.050
	(0.065)	(0.061)	(0.076)	(0.072)	(0.056)	(0.080)
ICE_WT	-0.019	-0.003	0.001	0.045	0.053	0.002
	(0.047)	(0.046)	(0.056)	(0.059)	(0.051)	(0.066)
LIGHT_WT	0.005	0.063	0.051	-0.046	-0.053	-0.035
	(0.044)	(0.045)	(0.051)	(0.059)	(0.051)	(0.068)
VIS_WT	0.033	-0.043	-0.002	0.009	-0.002	0.036
	(0.053)	(0.056)	(0.063)	(0.062)	(0.053)	(0.069)
NOISE_WT	-0.051	0.021	0.013	-0.005	-0.045	-0.019
	(0.049)	(0.048)	(0.060)	(0.065)	(0.056)	(0.075)
AREA_WT	0.033	0.007	0.043	-0.038	-0.089*	-0.051
	(0.048)	(0.047)	(0.057)	(0.060)	(0.048)	(0.073)
HEIGHT _WT	0.046	-0.028	-0.043	0.045	0.041	0.129*
	(0.052)	(0.052)	(0.061)	(0.063)	(0.052)	(0.069)
Constant	-0.615**	1.240***	-0.687**	-0.540	-0.214	-0.524
	(0.268)	(0.277)	(0.315)	(0.374)	(0.306)	(0.407)
Observations	265	264	209	186	235	176
R^2	0.104	0.148	0.169	0.127	0.168	0.207
Adjusted R^2	0.002	0.051	0.045	-0.022	0.060	0.062
Residual Std. Error	0.275 (df = 237)	0.276 (df = 236)	0.285 (df = 181)	0.299 (df = 158)	0.287 (df = 207)	0.322 (df = 148)
F Statistic	1.019 (df = 27; 237)	1.524* (df = 27; 236)	1.367 (df = 27; 181)	0.853 (df = 27; 158)	1.552** (df = 27; 207)	1.429* (df = 27; 148)

Note: ***p<0.01, **p<0.05, *p<0.1

Table 6: OLS - WTP preference Rogaland VS Oslo (Neg. elasticity)

	ROG 600-3000 WT	ROG 600-1200 WT	ROG 1200-3000 WT	OSLO 600-3000 WT	OSLO 600-1200 WT	OSLO 1200-3000 WT
	(1)	(2)	(3)	(4)	(5)	(6)
HH_INC_1000s	0.0002*	-0.00000	0.0001	0.00004	-0.00003	0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
HH_INC_1000s2	-0.00000*	0.000	-0.00000	-0.00000	0.000	-0.00000*
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
AGE	-0.013*	-0.015**	0.017*	0.015	-0.010	0.013
	(0.007)	(0.006)	(0.009)	(0.011)	(0.007)	(0.017)
AGE2	0.0001	0.0002**	-0.0002*	-0.0002	0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
EDU	-0.082	0.102	-0.083	-0.061	0.015	0.004
	(0.101)	(0.084)	(0.135)	(0.131)	(0.094)	(0.217)
EDU2	0.012	-0.017	0.012	0.004	-0.005	0.005
	(0.015)	(0.012)	(0.020)	(0.020)	(0.014)	(0.033)
GENDER	-0.055	-0.035	-0.063	-0.033	-0.047	0.023
	(0.041)	(0.033)	(0.054)	(0.057)	(0.042)	(0.090)
MEMBER	0.030	0.060	-0.077	0.019	-0.027	-0.115
	(0.052)	(0.041)	(0.067)	(0.061)	(0.046)	(0.111)
NUM_REC	-0.033	0.109**	0.032	-0.068	0.046	0.018
	(0.063)	(0.048)	(0.079)	(0.056)	(0.045)	(0.096)
NUM_REC_MORE	-0.017	-0.030	0.013	0.007	-0.107	-0.038
	(0.048)	(0.039)	(0.060)	(0.165)	(0.131)	(0.213)
INFO	-0.002	0.024	0.142**	0.027	0.002	-0.102
	(0.044)	(0.035)	(0.059)	(0.057)	(0.042)	(0.091)
SEEN_WT	-0.090	0.037	-0.031	-0.094	0.002	-0.169*
	(0.089)	(0.074)	(0.112)	(0.064)	(0.049)	(0.101)
SEEN_WT_OTHER	0.017	-0.064	-0.108	-0.027	0.053	0.001
	(0.107)	(0.092)	(0.128)	(0.075)	(0.053)	(0.125)
FUTURE_DEVREG	-0.112**	-0.247***	0.046	0.084	-0.117**	0.215**
	(0.053)	(0.044)	(0.073)	(0.062)	(0.047)	(0.095)
NO_WT	0.084*	0.018	-0.084	-0.095	0.036	-0.053
	(0.046)	(0.035)	(0.065)	(0.062)	(0.046)	(0.095)
RED_GAS	0.067	0.075**	0.154***	-0.075	0.007	0.022
	(0.041)	(0.032)	(0.055)	(0.055)	(0.041)	(0.088)
REN	-0.040	0.105***	-0.089	-0.001	0.095**	-0.106
	(0.049)	(0.040)	(0.066)	(0.063)	(0.046)	(0.100)
NO_CONCERN	-0.029	-0.041	0.014	0.047	0.034	0.104
	(0.056)	(0.042)	(0.079)	(0.070)	(0.053)	(0.102)
DIFF	0.085**	0.002	-0.038	0.013	0.041	-0.062

Table 6 *(Continued)*

	(0.040)	(0.033)	(0.052)	(0.055)	(0.040)	(0.090)
EF_WILD	-0.171**	-0.051	-0.020	0.001	0.025	-0.015
	(0.067)	(0.053)	(0.098)	(0.084)	(0.065)	(0.118)
EF_LAND	0.125*	-0.094*	0.061	0.013	-0.002	-0.056
	(0.068)	(0.053)	(0.097)	(0.083)	(0.060)	(0.123)
ICE_WT	-0.010	0.006	0.052	0.013	0.102*	-0.077
	(0.051)	(0.042)	(0.068)	(0.068)	(0.052)	(0.118)
LIGHT_WT	0.026	0.010	0.025	-0.063	-0.073	0.188
	(0.049)	(0.040)	(0.063)	(0.066)	(0.050)	(0.121)
VIS_WT	0.057	0.096*	-0.111	-0.001	-0.032	-0.009
	(0.059)	(0.050)	(0.080)	(0.070)	(0.054)	(0.109)
NOISE_WT	0.013	-0.027	0.005	0.038	-0.035	-0.010
	(0.053)	(0.044)	(0.071)	(0.073)	(0.056)	(0.114)
AREA_WT	-0.011	0.012	0.011	0.010	-0.085*	-0.018
	(0.052)	(0.042)	(0.069)	(0.068)	(0.048)	(0.114)
HEIGHT _WT	-0.037	-0.014	0.030	0.097	-0.008	0.043
	(0.057)	(0.046)	(0.070)	(0.069)	(0.051)	(0.115)
Constant	-0.159	-0.515**	-0.678*	-0.541	-0.160	-0.611
	(0.304)	(0.244)	(0.392)	(0.428)	(0.312)	(0.617)
Observations	237	292	176	183	204	128
R^2	0.169	0.395	0.189	0.150	0.182	0.247
Adjusted R^2	0.062	0.334	0.041	0.002	0.057	0.044
Residual Std. Error	0.284 (df = 209)	0.257 (df = 264)	0.308 (df = 148)	0.335 (df = 155)	0.265 (df = 176)	0.437 (df = 100)
F Statistic	1.576** (df = 27; 209)	6.396*** (df = 27; 264)	1.275 (df = 27; 148)	1.017 (df = 27; 155)	1.454* (df = 27; 176)	1.216 (df = 27; 100)

Note: ***p<0.01, **p<0.05, *p<0.1

Appendix 2: Literature review

PAPER	LOCATION	GOOD BEING VALUED	VALUATION METHOD	ECONOME-TRIC METHOD	SCOPE DISCUSSION	INDIVIDUAL LEVEL	INTERNAL OR EXTERNAL	RESULTS: SCOPE SENSITIVITY
Adamowicz et al. (1994)	Canada	WTP to protect and restore recreation, fisheries, wildlife and stream ecology in Alberta	DCE	Multinomial logit models	No	No	Internal	N
Adamowicz et al., 2011	Canada	WTP for improved quality of drinking water	CV, DCE	Mixed logit model and latent class model	Yes	No	Internal	P
Alvarez-Farizo and Hanley (2002)	Spain	WTP for new wind turbines	CV, DCE	Conditional logit model and multinomial logit model	No	Yes	Internal	N/A
Ando et al. (2020)	US	WTP for improving aquatic health and reduce flooding	DCE	Multinomial logit models	No	No	Internal	N
Badura et al. (2020)	UK	WTP for spatial distribution of conservation interventions across landscapes	DCE	Multinominal logit model	No	No	Internal	M
Bateman et al. (2005)	UK	WTP for protecting remote mountain lakes in the UK	CV	Bivariate normal model	No	No	External	N
Boxall et al. (1996)	Canada	WTP for protecting moose population in Alberta	CV, DCE	Conditional logit model and binary logit model	No	No	Both	P
Boyle et al. (1994)	US	WTP for preventing loss of migratory waterfowl	CV	multinomial logit model	No	No	External	M
Brander et al. (2007)	Worldwide	WTP for conserving coral reefs	TC, PF, NFI, CV	Multinomial logit models	Yes	No	External	P

Brouwer et al. (1999)	North America, Europe	WTP for restoring and protecting wetlands	CV	Multinomial logit models	Yes	No	External	P
Campbell and Hutchinson (2009)	Ireland	WTP for rural landscape improvements	DCE	Multinomial logit models	No	No	Internal	M
Casey et al. (2008)	Brazil	WTA compensation for oil transportation in Amazon	DCE	Multinomial logit models	Yes	Yes	Internal	M
Czajkowski et al. (2009)	Poland	WTP for increased protection of an environmental resource	DCE	Nested Logit Model with Covariance Heterogeneity	Yes	No	Internal	M
Desvousges et al. (1993)	US	WTP for protecting migratory waterfowl	CV	multinomial logit mode l		No	External	N
Dimitropoulos and Kontoleon (2009)	Greece	WTA for new wind turbines	DCE	Multinomial logit models	No	No	Internal	N/A
Drechsler et al. (2011)	Germany	WTP for new wind turbines	DCE	Conditional logit model	No	No	Internal	P
Dugstad et al. (2020)	Norway	WTP for wind power	DCE	Mixed logit model	Yes	No	Internal	P
Foster and Mourato (2003)		WTP for charitable donations	CV, DCE	Mixed logit model	Yes	No	Both	P
Giraud et al. (1999)	US	WTP for protecting endangered wildlife	CV	Bivariate probit model	No	No	Both	P
Goldberg and Roosen (2007)	Germany	WTP for health risk reduction	CV, DCE	Bivariate probit model and mixed logit model	Yes	No	Both	M
Hanemann (2005)	US	WTP for protecting migratory waterfowl	CV	Multinomial logit model	No	No	External	P
Heberlein et al (2005)	US	WTP for the enviromental goods water quality, spear fishing, wolves and biodiversity	CV	Multinomial logit models	Yes	Yes	Both	M
Jacobsen (2008)	Denmark	WTP for biodiversity conservation	DCE	Multinomial logit and probit model	No	No	Internal	M

Jacobsen et al. (2011)	Denmark	WTP for nature preservation activities	DCE	Generalised mixed models	No	No	Internal	N
Johnston et al. (2003)	US	WTP for water quality improvements	CV, DCE	Meta-regression model	Yes	No	Both	P
Khan and Zhao (2019)	China	WTP for restoring and improving water quality	DCE	Multinomial logit model and Mixed logit model	No	Yes	Internal	N/A
Layton & Brown (2000)	US	WTP for preventing forest loss	DCE	Conditional logit model	Yes	No	Internal	P
Lew and Wallmo (2011)	US	WTP for protecting more species and improving protestion status of species	DCE	Random parameter logit models	No	No	External	M
Lindhjem (2007)	Scandinavia	WTP for protecting forests in Fennoscandian	CV, DC	Meta-regression model	Yes	No	Both	N
Longo et al 2008	UK	WTP for renewable energy	DCE	Conditional logit model	No	No	Internal	N/A
Loomis and White (1996)	US	WTP for protecting endangered species	CV	Linear and doble logit model	No	No	External	P
Loomis et al. (1993)	Australia	WTP for protecting forests in southeastern Australia	CV	Multinomial logit models	No	No	External	M
Mattmann et al. (2016)	Worldwide	WTP for new wind turbines	CV, DCE	Meta-regression model	Yes	No	Both	M
Mariel, Meyerhoff and Hess (2015)	Germany	WTP for new wind turbines	DCE	Conditional logit model	No	Yes	Internal	M
Meyerhoff et al. (2015)	Germany	WTP for conserving forest and different biodiversity	DCE	Multinomial logit models	No	No	Internal	N
Morse-Jones et al. (2012)	UK	WTP for wildlife conservation in Africa	DCE	Random parameter probit model	No	No	Internal	M
Poe et al. (2005)	US	WTP for protecting endangered wildlife	DC	Bivariate probit model	No	No	External	M
Smith and Osborne (1996)	US	WTP for mproved visibility at national parks	CV	Meta-regression model	Yes	No	External	P

Søgaard et al. (2012)	Denmark	WTP for cardiovascular disease screening	CV	Mixed logit model	Yes	Yes	Both	M
White et al. (1997)	UK	WTP for protecting threatened mammals	CV	Conditional logit model	No	No	External	M
Woodward and Wui (2001)	Worldwide	WTP for restoring and protecting wetlands	NFI, TC, RC, CV	Meta-regression model	No	No	Both	N

Note: N = No scope effects/insensitive to scope; P = Scope effects/sensitive to scope; M = mixed results
CV: contingent valuation; DCE: discrete choice experiment; DC; dichotomous choice, NFI: net factor input; PF: production function: RC: replacement cost; TC: travel cost

Appendix 3: Script

The full script can be provided upon request.
The script listed below is for model 2 in the WTPS regression on the negative elasticities.

```
#Adding the file into R
setwd("~/Desktop/UiS Master/Semester 4 /Dataset Master")
##DATA
Datacoll<-read.xlsx("datacollectionNORSTAT.xlsx")
ScopedataN2_2<-read.xlsx("WTP Turbines_negative_2.xlsx",sheet = 3)
dataN2_2<-merge(ScopedataN2_2,Datacoll, by.x="RESPID", by.y="respid",all.x=T,all.y=F,
sort=F)
dataN2_2$Male <- ifelse(dataN2_2$GENDER == '1', 1, 0)
dataN2_2$Female <- ifelse(dataN2_2$GENDER == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$MEMBER == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$MEMBER == '2', 1, 0)
dataN2_2$None <- ifelse(dataN2_2$NUM_REC == '1', 1, 0)
dataN2_2$One_or_more <- ifelse(dataN2_2$NUM_REC == '2', 1, 0)
dataN2_2$Less_than_13 <- ifelse(dataN2_2$NUM_REC_MORE == '1', 1, 0)
dataN2_2$More_than_13 <- ifelse(dataN2_2$NUM_REC_MORE == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$FUTURE_DEVREG == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$FUTURE_DEVREG == '2', 1, 0)
dataN2_2$Not_concerned <- ifelse(dataN2_2$FUTURE_DEVREG == '1', 1, 0)
dataN2_2$Concerned <- ifelse(dataN2_2$FUTURE_DEVREG == '2', 1, 0)
dataN2_2$Agree <- ifelse(dataN2_2$REN == '1', 1, 0)
dataN2_2$Disagree <- ifelse(dataN2_2$REN == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$RED_GAS == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$RED_GAS == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$INFO == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$INFO == '2', 1, 0)
dataN2_2$Easy <- ifelse(dataN2_2$DIFF == '1', 1, 0)
dataN2_2$Hard <- ifelse(dataN2_2$DIFF == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$SEEN_WT == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$SEEN_WT == '2', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$SEEN_WT_OTHER == '1', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$SEEN_WT_OTHER == '2', 1, 0)

setnames(dataN2_2, "no_household_income", "HH_INC")
dataN2_2$HH_INC <- case_when(dataN2_2$HH_INC == 1 ~ 100000,
                    dataN2_2$HH_INC == 2 ~ 300000,
                    dataN2_2$HH_INC == 3 ~ 500000,
                    dataN2_2$HH_INC == 4 ~ 700000,
                    dataN2_2$HH_INC == 5 ~ 900000,
                    dataN2_2$HH_INC == 6 ~ 1100000,
                    dataN2_2$HH_INC == 7 ~ 1300000,
                    dataN2_2$HH_INC == 8 ~ 1500000,
                    dataN2_2$HH_INC == 9 ~ 1700000,
                    dataN2_2$HH_INC == 10 ~ 2100000,
```

```
                        dataN2_2$HH_INC == 11 ~ 2300000,
                        dataN2_2$HH_INC == 12 ~ 2500000,
                        dataN2_2$HH_INC == 13 ~ 2700000,
                        dataN2_2$HH_INC == 14 ~ 2900000,
                        dataN2_2$HH_INC == 15 ~ 3100000,
                        dataN2_2$HH_INC == 16 ~ 3300000,
                        dataN2_2$HH_INC == 17 ~ 3500000,
                        dataN2_2$HH_INC == 18 ~ 3700000,
                        dataN2_2$HH_INC == 99 ~ NA_real_)

mean(na.omit(subset(dataN2_2$HH_INC, dataN2_2$HH_INC < 5000000)))
dataN2_2$HH_INC <- ifelse(is.na(dataN2_2$HH_INC) == TRUE,
mean(na.omit(subset(dataN2_2$HH_INC, dataN2_2$HH_INC < 5000000))),
dataN2_2$HH_INC)
dataN2_2$HH_INC_1000s <- dataN2_2$HH_INC/1000

dataN2_2$AGE2 <- dataN2_2$AGE^2
dataN2_2$HH_INC_1000s2 <- dataN2_2$HH_INC_1000s^2

mean(na.omit(subset(dataN2_2$EDU, dataN2_2$EDU < 80)))
dataN2_2$EDU2 <- dataN2_2$EDU^2

dataN2_2$No <- ifelse(dataN2_2$NO_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$NO_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$HIGHT_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$HIGHT_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$AREA_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$AREA_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$NOISE_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$NOISE_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$VIS_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$VIS_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$LIGHT_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$LIGHT_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$ICE_WT == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$ICE_WT == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$EF_LAND == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$EF_LAND == '2', 1, 0)
dataN2_2$No <- ifelse(dataN2_2$EF_WILD == '1', 1, 0)
dataN2_2$Yes <- ifelse(dataN2_2$EF_WILD == '2', 1, 0)


#Regression MODEL 1 - WTP SPACE ROGALAND --> 600-1200

model8<-
lm(ELASTICITY22~HH_INC_1000s+HH_INC_1000s2+AGE+AGE2+EDU+EDU2+GEND
ER+MEMBER+NUM_REC+NUM_REC_MORE+INFO+SEEN_WT+SEEN_WT_OTHER
+FUTURE_DEVREG+NO_WT+RED_GAS+REN+NO_CONCERN+DIFF+EF_WILD+EF
_LAND+ICE_WT+LIGHT_WT+VIS_WT+NOISE_WT+AREA_WT+HIGHT_WT,data=dat
aN2_2)
```

Appendix 4: Survey (short version)

Vennligst bekreft at de utfylte opplysningene under er riktige. Dersom opplysningene ikke er fylt ut eller er gale, kan disse besvares eller endres.

age
Hva er din alder?

zipcode
Hva er ditt postnummer?

gender
Er du mann eller kvinne?

- Mann
- Kvinne

fylke
Fylke:

fylke

kommune
Kommune:

kommune

Bilde3
Hva mener du bør være de viktigste miljø- og ressurspolitiske satsingsområdene i Norge?

Velg opptil 4 saker som er viktige for deg og din husholdning.

Verne jordbruksarealer	Økt bevaring av norske naturområder
Verne Lofoten og Vesterålen mot oljeutvinning	Fase ut hvalfangst
Elektrifisere oljeinstallasjoner til havs	Redusere utslipp av klimagasser
Redusere lokal luftforurensning	Bygge ut mer fornybar energi
Redusere norsk utvinning av olje og gass	Beskytte truede plante- og dyrearter
Bevare kulturminner	Forbedre håndtering av avfall fra industri og gruvedrift
Unngå naturinngrep	Annet, vennligst spesifiser:
Øke Norges selvforsyning av mat	

Bilde7

Etterspørselen etter strøm øker i Norge. Hvordan mener du vi best kan dekke dette behovet?

Velg opptil 3 alternativer.

- Redusere strømforbruk gjennom energisparing (Enøk)
- Bygge ut mer vindkraft i Norge
- Utvidelse av eksisterende, større vannkraftanlegg i Norge
- Geotermisk energi
- Produsere mer fra solenergi i Norge
- Bygge ut nye, småskala vannkraftanlegg i småelver i Norge
- Varmekraft
- Importere strøm fra utlandet
- Utbygging av gasskraftverk i Norge
- Annet, vennligst spesifiser: ______
- Vet ikke

Info2_Dagens_vindkraft

Dagens vindkraftproduksjon i Norge

I 2018 ble det produsert 4 terrawatt-timer (TWh) vindkraft i Norge, noe som tilsvarer omtrent 3 prosent av samlet kraftproduksjon. Ifølge prognoser kan vindkraftproduksjonen i Norge øke med 25 TWh innen de neste 10 årene. Det betyr en produksjon som er 6 ganger så stor som i dag.

Plassering og utbygging av vindkraftanlegg vurderes i disse dager av Norges vassdrags- og energidirektorat (NVE) i den nasjonale planen Nasjonal Ramme for vindkraft på land. Et vindkraftanlegg består av flere vindturbiner («vindmøller»). Nedenfor kan du se et bilde av et vindkraftanlegg og et bilde av en vindturbin.

Vindkraftanlegg	Vindturbin
	

Var du kjent med at myndighetene utarbeider en samlet plan, nasjonal ramme, for vindkraft på land i Norge?

Ja	○
Nei	○
Usikker	○

Info1_konsekvensialitet

Denne undersøkelsen gjennomføres av forskere ved blant annet Statistisk Sentralbyrå (SSB) og Universitetet i Stavanger og handler om produksjon av vindkraft Norge. Resultatene fra undersøkelsen vil være en del av myndighetenes informasjonsgrunnlag for beslutninger om fremtidige vindkraftskonsesjoner, både med hensyn til ønsket omfang, utbyggingstakt, og geografisk plassering. Din mening er derfor viktig for disse beslutningene.

Bilde8_Nasjonal_ramme

Nasjonal Ramme for vindkraft på land har identifisert 43 områder som vil vurderes som mulige plasseringer av nye vindkraftanlegg. Områdene er vist på kartet nedenfor.

Bilde11

Hva er den <u>nærmeste</u> avstanden du kan akseptere <u>å ha hytte</u> fra følgende?

	Under 500 meter	0,5-1 km	1-5 km	Over 5 km	Aksepterer ikke uansett avstand	Vet ikke
Høyspentlinjer	○	○	○	○	○	○
Industrianlegg	○	○	○	○	○	○
Hyttefelt	○	○	○	○	○	○
Vindkraftanlegg	○	○	○	○	○	○
Skogsbilvei	○	○	○	○	○	○
Mobilmast	○	○	○	○	○	○
Vannkraftanlegg	○	○	○	○	○	○
Boligfelt	○	○	○	○	○	○
Motorvei	○	○	○	○	○	○
Gruveanlegg	○	○	○	○	○	○

Bilde13

Om valgsituasjonene

Hver valgsituasjon har tre alternativer du kan velge mellom (se eksempel på tabell nedenfor, mer informasjon vil komme i tabellen i de neste skjermbildene). Det ***første alternativet*** beskriver status for vindkraftproduksjon i Norge etter realisering av alle vindkraftprosjekter som har blitt godkjent per dags dato. De ***neste to alternativene*** beskriver andre mulige utbyggingsscenarier for vindkraftproduksjon i Norge frem mot 2030. For hver valgsituasjon ber vi deg om å indikere det alternativet du liker best - altså ditt foretrukne scenario for vindkraftproduksjon i Norge.

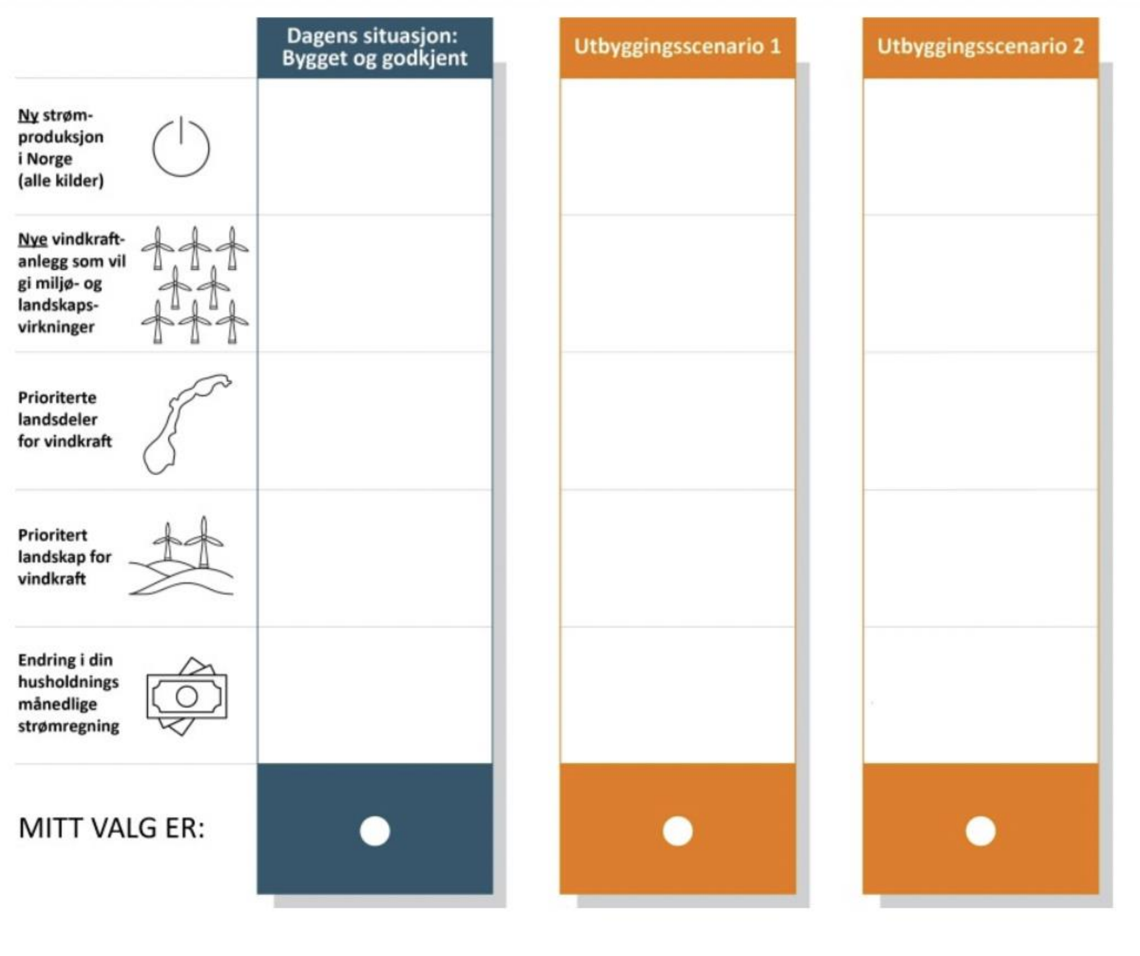
Bilde14

Om alternativene

Hvert alternativ består av fem egenskaper eller attributter som til sammen utgjør ett scenario for vindkraftproduksjon i Norge. Disse attributtene er:

1) Ny produksjon av strøm i Norge (alle kilder)
2) Antall nye vindkraftanlegg i Norge
3) Prioriterte landsdeler for vindkraftutbygginger
4) Prioriterte landskap for vindkraftutbygginger
5) Endring i månedlig strømkostnad for din husstand

Nivåene på disse attributtene vil variere over de ulike alternativene og valgsituasjonene.



Bilde15

ATTRIBUTT 1: Ny strømproduksjon i Norge

I 2018 ble det produsert 147 TWh i Norge (95 prosent vannkraft; 5 prosent varme- og vindkraft). I samme år var forbruket 137 TWh slik at Norge hadde nettoeksport på 10 TWh.

Til tross for at Norge er en nettoeksportør av strøm varier graden av selvforsyning og forsyningssikkerhet i ulike deler av landet og på ulike tider av året. Samtidig øker både innenlands og utenlands etterspørsel etter strøm. Det er befolkningsvekst, nye industrier, og elektrifisering av transportsektoren som er hovedårsakene til økt strømbehov i Norge.

Basert på det overordnede markedsbildet og signaler fra regjeringen og stortinget har NVE beregnet at Norges strømproduksjon kan øke til 180 TWh innen 2030. Ny strømproduksjon vil komme fra mer nedbør og tekniske oppgraderinger som øker kapasiteten i eksisterende vannkraftanlegg, småskala vannkraft, og andre fornybare energikilder som sol og vindkraft.

I valgsituasjonene blir du bedt om å ta stilling til vil ny strømproduksjon i Norge variere fra 0 til 30 TWh.

Hvordan stiller du deg generelt til økt strømproduksjon i Norge utover dagens nivå?

Svært negativ 1	2	3	Nøytral 4	5	6	Svært positiv 7
○	○	○	○	○	○	○

Bilde16x1

ATTRIBUTT 2: Antall nye vindturbiner i Norge

Ved utgangen av 2018 var det rett over 600 vindturbiner i drift på rundt 30 vindkraftanlegg i Norge. Disse produserte rundt 4 TWh i 2018 som tilsvarer 3 prosent av dagens strømforbruk. I tillegg har NVE godkjent omtrent 30 vindkraftanlegg, som nå enten bygges eller er under planlegging. Disse vil ha omtrent 600-700 nye, mer produktive vindturbiner med estimert produksjonskapasitet på rundt 9-10 TWh. Totalt vil dette bety omtrent 1200-1300 fordelt på 40 vindkraftanlegg i Norge, med samlet estimert produksjonskapasitet på 14 TWh (10 prosent av dagens strømforbruk).

Til hvilken grad er tallet på vindturbiner i drift/godkjent for bygging i Norge gitt ovenfor i tråd med det du trodde før du tok denne undersøkelsen?

- Antallet er lavere
- Antallet er høyere
- Antallet er omtrent det jeg forventet
- Jeg hadde lite/ingen kunnskap på forhånd

Bilde16x2

ATTRIBUTT 2: Antall nye vindkraftanlegg i Norge

Ved utgangen av 2018 var det rundt 30 vindkraftanlegg i Norge med rett over 600 vindturbiner i drift. Disse produserte rundt 4 TWh i 2018 som tilsvarer 3 prosent av dagens strømforbruk. I tillegg har NVE godkjent omtrent 30 vindkraftanlegg, som nå enten bygges eller er under planlegging. Disse vil ha omtrent 600-700 nye, mer produktive vindturbiner med estimert produksjonskapasitet på rundt 9-10 TWh. Totalt vil dette bety 40 vindkraftanlegg i Norge med 1200-1300 vindturbiner, med samlet estimert produksjonskapasitet på 14 TWh (10 prosent av dagens strømforbruk).

Til hvilken grad er tallet på antall vindkraftanlegg i drift/godkjent for bygging i Norge gitt ovenfor i tråd med det du trodde før du tok denne undersøkelsen?

- Antallet er lavere
- Antallet er høyere
- Antallet er omtrent det jeg forventet
- Jeg hadde lite/ingen kunnskap på forhånd

Bilde17_info2

ATTRIBUTT 2: Antall nye vindkraftanlegg i Norge

Vindkraftanlegg tidligere bygget i Norge har hatt behov for offentlig støtte. Fra 2022 vil denne støtten opphøre og bare bedriftsøkonomisk lønnsomme prosjekter vil bli bygget. NVE anslår at det kan bli bygget opp mot 100 nye vindkraftanlegg i Norge frem mot 2030, utover de 40 som allerede er i drift eller har blitt godkjent for bygging.

Avhengig av valgt teknologi (høyde, vingespenn, o.l.) kan et vindkraftanlegg med 30 vindturbiner dekke strømbehovet til mellom 10 500 og 13500 gjennomsnittlige norske husstander. Videre hjelper utbygging av vindkraft Norge med å innfri sine internasjonale forpliktelser med hensyn til fornybar energisatsing. I tillegg skaper vindkraftanlegg lokal næringsaktivitet, skatteinntekt til kommuner og arbeidsplasser, særlig i byggefasen.

Bilde17

Hvordan stiller du deg generelt til fremtidig utbygging av vindkraft i Norge utover dagens nivå?

Svært negativ 1	2	3	Nøytral 4	5	6	Svært positiv 7
○	○	○	○	○	○	○

Bilde18_info2

ATTRIBUTT 2: Antall nye vindkraftanlegg i Norge.

For å bygge vindkraftanlegg og distribuere strøm kreves infrastruktur. Basert på anleggene som er bygget i Norge i dag, krever en vindturbin i gjennomsnitt:

1) 900 meter kraftledning

2) 700 meter vei til ankomst og på anlegg

3) Et arealbeslag på 0,35 km^2 (omtrent 50 fotballbaner), hvor 2 til 3 prosent av dette går til fysiske inngrep som turbiner og veier.

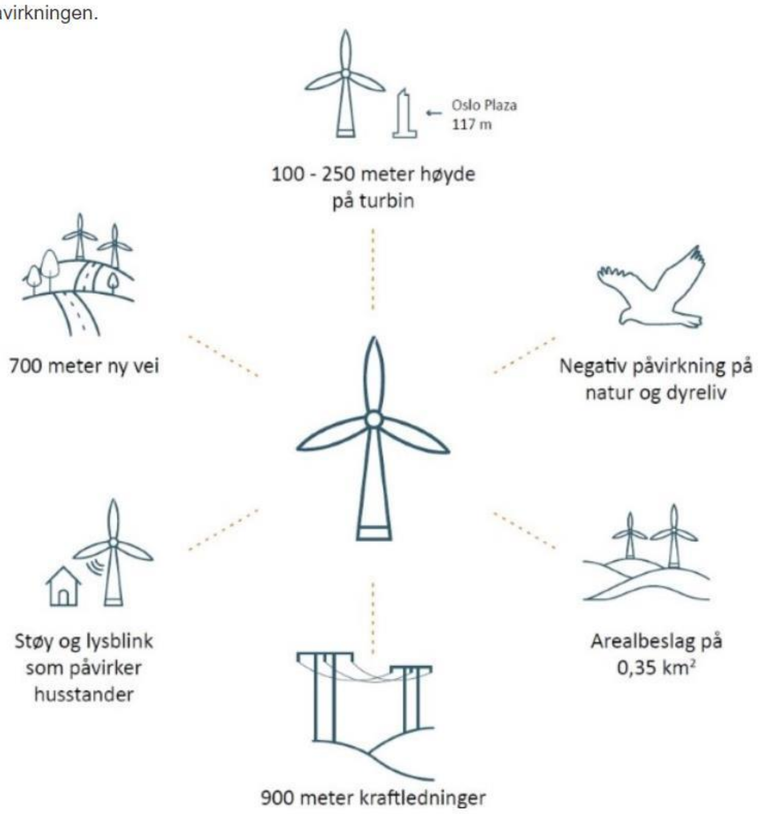
4) Nye turbiner som settes opp i Norge i dag er rundt 150-180 meter høye, målt fra bakken til tuppen av vingespissen. Eldre turbiner er i overkant av 100 meter høye. Framtidige vindturbiner kan bli opptil 250 meter høye. Turbinene kan være synlig på mange kilometers avstand.

I tillegg har forskning vist at vindturbiner kan påvirke personer som bor eller ferdes i nærheten gjennom støy-, skygge- og lyseffekter og visuelle endringer i kultur- og naturlandskap, samt ha negative konsekvenser for plante- og dyreliv (for eksempel fugledød).

Hold musepekeren over boksene i figuren under for å lære mer om disse konsekvensene.

Bilde18

Figuren under viser informasjon om vindturbiners naturpåvirkning. Hold pekeren over hver tegning for informasjon om påvirkningen.

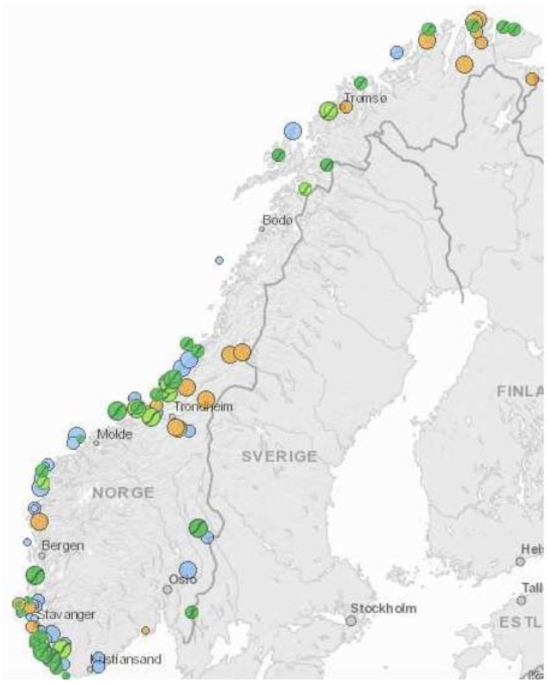


Bilde19

ATTRIBUTT 3: Prioriterte landsdeler for fremtidige vindkraftutbygginger

Det er gode vindressurser i hele landet. Nye vindkraftanlegg kan plasseres i alle fem landsdeler: Nord-Norge, Midt-Norge, Vestlandet, Østlandet, og Sørlandet.

Kartet nedenfor viser hvor det i dag produseres vindkraft og bygges nye vindkraftanlegg (grønne punkter), hvor det er gitt tillatelse til å produsere vindkraft (blå punkter) og hvor søknader om tillatelse til å produsere vindkraft er under behandling (oransje punkter).



Ønsker du fremtidig utbygging av vindkraft i den landsdelen du bor?

Ja	○
Nei	○
Vet ikke/ingen mening	○

I58

I valgsituasjonene blir du bedt om å ta stilling til hvilke landsdeler som blir prioritert for fremtidige utbygginger.

Bilde20

ATTRIBUTT 4: Prioritert landskap for fremtidige vindkraftutbygginger

Det er mulig å plassere vindturbiner i flere typer landskap:

- På land, langs kysten
- I åpent lavland og skogsområder i innlandet
- I fjellområder i innlandet

Bildene nedenfor illustrerer de tre landskapstypene som er mest aktuelle for fremtidig vindkraftutbygginger i Norge. Synlighet av turbinene vil variere med værforhold og topografi i de ulike landskapene.

På land langs kysten	**Åpent lavland og skog i innlandet**	**Fjellområder i innlandet**
		
Fjordlandskap, kystsletter og ås- og fjellkystlandskap.	Områder nedenfor skoggrensen i innlandet.	Åser og fjellområder uten etablert skog.

Hvilken landskapstype er viktigst for ditt friluftsliv og dine naturopplevelser?

På land langs kysten	◯
Åpent lavland og skog i innlandet	◯
Fjellområder i innlandet	◯
Ingen av disse er av spesielt viktig for meg	◯

i60

I valgsituasjonene du blir bedt om å ta stilling til varierer hvilken landskapstype som er prioritert for fremtidige vindkraftutbygginger.

Bilde21

ATTRIBUTT 5: Endring i månedlig strømkostnad for deg/din husstand

Fremtidig utbygging av vindkraft vil øke samlet kraftproduksjon i Norge. Det er likevel ikke sikkert at strømprisene i Norge blir lavere. Ifølge Norges vassdrags- og energidirektorat (NVE) kan strømprisen i Norge komme til å gå opp frem mot 2030.

Det er mange faktorer som påvirker strømprisen, blant annet 1) eksport til utlandet, 2) innenlands forbruk og 3) værforhold og klima.

I fremtiden kan derfor strømkostnaden for deg og din husstand gå opp eller ned i forhold til dagens nivå. En gjennomsnittlig norsk husstand brukte rundt 16 000 kWh i 2018 og hadde en månedlig strømregning (inkludert nettleie) på omlag kr 1 500.

Omtrent hvor mye betalte din husstand i en gjennomsnittlig måned i 2018?

- Min husholdning betaler ikke strøm
- Under 400 kroner per måned
- 400-800 kroner
- 800-1200 kroner
- 1200-1600 kroner
- 1600-2000 kroner
- 2000-2400 kroner
- 2400-2800 kroner
- Over 2800 kroner per måned
- Vet ikke

i62

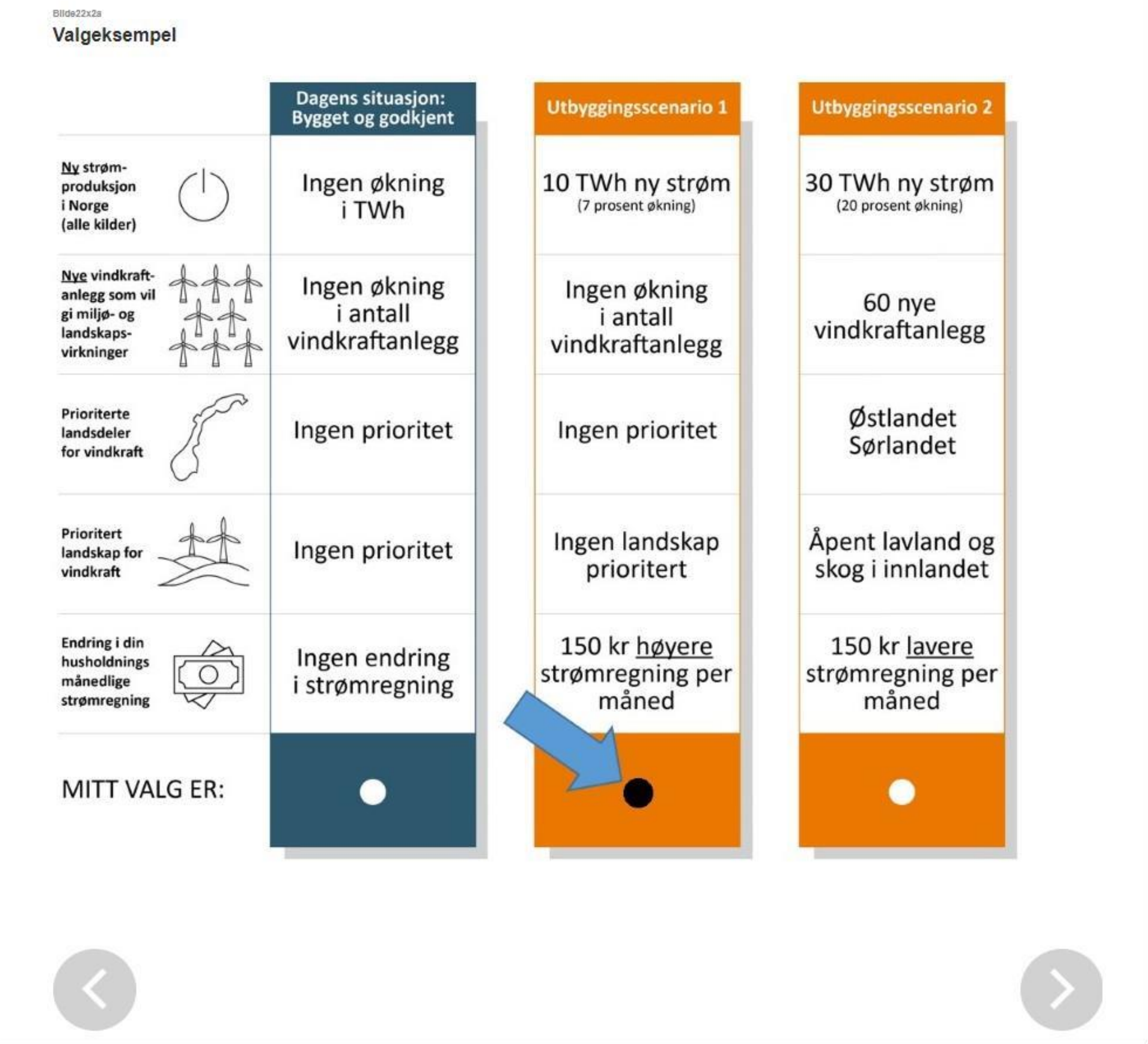
I de ulike alternativene presentert på de neste sidene varierer endring i månedlig strømregning (inkludert nettleie) fra en nedgang på 450 kroner til en økning på 450 kroner.

Bilde22x2b

Hvilket alternativ foretrekker du?

Hvis din husholdning kunne velge mellom dagens situasjon (40 vindkraftanlegg allerede i drift eller allerede godkjent) og to alternative scenarier for fremtidig vindkraftutbygging (utbyggingsscenario 1 og utbyggingsscenario 2) hvilket alternativ ville du da valgt?

Vi ber deg i de neste skjermbildene tenke nøye gjennom hva **ny strømproduksjon i Norge, nye vindkraftanlegg, prioriterte landsdeler, prioritert landskap,** og **endring i månedlige strømkostnader** betyr for deg og din husstand. Tenk spesielt nøye gjennom hvordan en endring i strømkostnad kan påvirke hvor mye din husstand har råd til å bruke på andre goder og tjenester.


Bilde22x2a
Valgeksempel
Dagens situasjon: Bygget og godkjent
Utbyggingsscenario 1
Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)
Ingen økning i TWh
10 TWh ny strøm
(7 prosent økning)
30 TWh ny strøm
(20 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger
Ingen økning i antall vindkraftanlegg
Ingen økning i antall vindkraftanlegg
60 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft
Ingen prioritet
Ingen prioritet
Østlandet Sørlandet
Prioritert landskap for vindkraft
Ingen prioritet
Ingen landskap prioritert
Åpent lavland og skog i innlandet
Endring i din husholdnings månedlige strømregning
Ingen endring i strømregning
150 kr høyere strømregning per måned
150 kr lavere strømregning per måned
MITT VALG ER:

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	30 TWh ny strøm (20 prosent økning)	10 TWh ny strøm (7 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	40 nye vindkraftanlegg	60 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Østlandet Sørlandet	Ingen prioritet
Prioritert landskap for vindkraft	Ingen prioritet	Åpent lavland og skog i innlandet	Ingen prioritet
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	150 kr høyere strømregning	450 kr lavere strømregning
MITT VALG ER:	○	○	○

Bilde22

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	Ingen økning i TWh	10 TWh ny strøm (7 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	Ingen økning i antall vindkraftanlegg	60 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Ingen prioritet	Østlandet Sørlandet
Prioritert landskap for vindkraft	Ingen prioritet	Ingen prioritet	Fjellområder i innlandet
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	150 kr lavere strømregning	450 kr høyere strømregning
MITT VALG ER:	○	○	○

Bilde22

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	10 TWh ny strøm (13 prosent økning)	20 TWh ny strøm (13 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	40 nye vindkraftanlegg	60 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Vestlandet	Nord-Norge Midt-Norge
Prioritert landskap for vindkraft	Ingen prioritet	På land langs kysten	Åpent lavland og skog i innlandet
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	450 kr lavere strømregning	150 kr lavere strømregning
MITT VALG ER:	○	○	○

Bilde22

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	30 TWh ny strøm (20 prosent økning)	20 TWh ny strøm (13 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	60 nye vindkraftanlegg	40 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Ingen prioritet	Østlandet Sørlandet
Prioritert landskap for vindkraft	Ingen prioritet	Ingen prioritet	På land langs kysten
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	450 kr lavere strømregning	450 kr høyere strømregning
MITT VALG ER:	○	○	○

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	Ingen økning i TWh	30 TWh ny strøm (20 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	Ingen økning i antall vindkraftanlegg	20 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Ingen prioritet	Vestlandet
Prioritert landskap for vindkraft	Ingen prioritet	Ingen prioritet	Ingen prioritet
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	450 kr lavere strømregning	150 kr høyere strømregning
MITT VALG ER:	○	○	○

Bilde22

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	20 TWh ny strøm (13 prosent økning)	Ingen økning i TWh
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	40 nye vindkraftanlegg	Ingen økning i antall vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Nord-Norge Midt-Norge	Ingen prioritet
Prioritert landskap for vindkraft	Ingen prioritet	Fjellområder i innlandet	Ingen prioritet
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	450 kr høyere strømregning	150 kr lavere strømregning
MITT VALG ER:	○	○	○

Hvilket alternativ foretrekker du?

Velg ett av de tre alternativene ved å trykke på en av knappene nederst i tabellen.

	Dagens situasjon: Bygget og godkjent	Utbyggingsscenario 1	Utbyggingsscenario 2
Ny strøm-produksjon i Norge (alle kilder)	Ingen økning i TWh	10 TWh ny strøm (7 prosent økning)	30 TWh ny strøm (20 prosent økning)
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	Ingen økning i antall vindkraftanlegg	20 nye vindkraftanlegg	60 nye vindkraftanlegg
Prioriterte landsdeler for vindkraft	Ingen prioritet	Østlandet Sørlandet	Vestlandet
Prioritert landskap for vindkraft	Ingen prioritet	Fjellområder i innlandet	På land langs kysten
Endring i din husholdnings månedlige strømregning	Ingen endring i strømregning	150 kr høyere strømregning	450 kr høyere strømregning
MITT VALG ER:	○	○	○

Bilde23a

Hvor viktige var de ulike egenskapene for tiltakene du valgte?

	Ikke viktig 1	2	3	Nøytral 4	5	6	Svært viktig 7
Ny strømproduksjon i Norge	○	○	○	○	○	○	○
Antall nye vindkraftanlegg	○	○	○	○	○	○	○
Prioritert landskap	○	○	○	○	○	○	○
Prioriterte landsdeler	○	○	○	○	○	○	○
Endring i strømkostnad	○	○	○	○	○	○	○

Bilde24b

Hva gjorde det vanskelig å svare på spørsmålene?

- Noe av informasjonen jeg ble gitt var vanskelig å forstå eller tolke
- Mange vurderinger måtte gjøres samtidig
- Spørsmålene var lite forståelige
- Det var vanskelig fordi det var så mange viktige tema
- Andre årsaker, vennligst spesifiser: ____

Bilde26

Hva er hovedårsaken til at du i mange av tilfellene valgte et av tiltakene og ikke «Dagens situasjon: bygget og godkjent»?

- Jeg synes vindturbiner er fine å se på
- Jeg velger det som er best for klimaet, uavhengig av hva det koster
- Jeg bare krysset av et tilfeldig valg utenom noen spesiell grunn
- Norsk vindkraft vil bidra til å bruke mindre ikke-fornybar energi i Europa
- Vindkraftutbygging er viktig for lokaløkonomier i landet
- For å øke norsk strømproduksjon
- Jeg valgte tiltaksalternativene som resulterte i lavere eller ingen endring i strømregning
- For min husholdning og meg er utbygging av vindkraft verdt det beløpet jeg valgte
- Jeg likte et av tiltaks-alternativene bedre, til tross for kostnaden
- Andre årsaker, vennligst spesifiser:
- Vet ikke

Bilde27

Du har i alle valgsituasjoner valgt alternativet i samme posisjon (dvs. lengst til høyre eller i midten). Hva er den primære årsak til dette?

- Det var det alternativet jeg likte best
- Jeg visste ikke hva jeg skulle velge
- Jeg interesserer meg ikke for temaet
- Jeg tror ikke at situasjonene er reelle.
- Man burde ikke verdsette naturen i kroner og ører
- Valgene var for vanskelige
- Andre årsaker, vennligst spesifiser:
- Vet ikke

Bilde28_CV_info

Vindkraft kan også produseres til havs (offshore)

Vindkraftanlegg kan stå på havbunnen eller være flytende hvis havdybden er stor. Vindkraft til havs vil ha liten til moderat effekt på naturmiljøet. Utbyggingsfasen påvirker livet på havbunnen, fiskebestander og sjøpattedyr, mens driftsprosessen vil ha liten effekt.

Vindkraftanlegg kan plasseres så langt til havs at de ikke er synlige fra land og slik at negativ påvirkning på andre kystaktiviteter som turisme, havbruk og sjøfart blir så liten som mulig.

Vindkraftanlegg til havs

Visste du før du fikk denne informasjonen at vindkraft også kan produseres til havs?

Ja	○
Nei	○

Bilde29

Vindkraft til havs vil kreve offentlig støtte

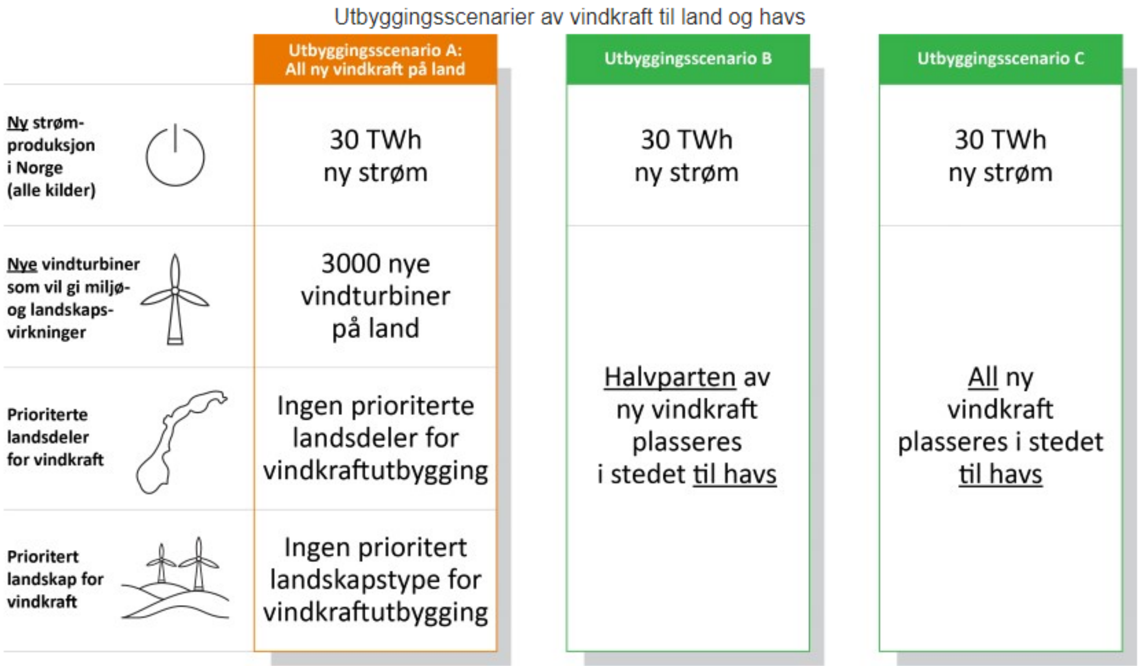
Produksjon av vindkraft til havs er dyrere enn på fastlandet på grunn av høyere bygge- og vedlikeholdskostnader. Vindkraft til havs krever derfor offentlig støtte.

Vi ber deg nå ta stilling til et utbyggingsscenario der 3000 vindturbiner settes opp på fastlandet i Norge innen 2030 (Utbyggingsscenario A). Disse 3000 vindturbiner kommer i tillegg til de 1200-1300 vindturbinene som allerede er satt opp eller godkjent av NVE. Ny strømproduksjon fra alle fornybare kilder i Norge øker da med 30 TWh.

Vi ber deg nå vurdere to alternative utbyggingsscenarier:

1) Utbyggingsscenario B: Halvparten av vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene settes opp og produseres til havs i stedet. Den andre halvparten er på fastlandet, spredt jevnt over relevante landsdeler og landskapstyper i Norge.

2) Utbyggingsscenario C: Hele vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene settes opp og produseres til havs i stedet, og ingen på fastlandet.



Ved å produsere den totale vindkraftproduksjonen fra de 3000 landbaserte vindturbinene til havs, kan miljø- og landskapsvirkningene på fastlandet unngås. Kostnadene ved å heller sette opp vindturbiner til havs vil finansieres gjennom en ekstra skatt på strømregningen innsamlet per måned over de neste 10 årene for alle husholdninger i Norge.

Hvordan ville du rangere disse utbyggingsscenariene etter hva du og din husholdning foretrekker?

Utbyggingsscenario A: Alle de 3000 vindturbinene plasseres på fastlandet, ingen til havs

Utbyggingsscenario C: Hele vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene settes opp og produseres til havs, og ingen på fastlandet.

Utbyggingsscenario B: Halvparten av vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene settes opp og produseres til havs. Den andre halvparten er på fastlandet, spredt jevnt over relevante landsdeler og landskapstyper i Norge.

Bilde29

Vindkraft til havs vil kreve offentlig støtte

Produksjon av vindkraft til havs er dyrere enn på fastlandet på grunn av høyere bygge- og vedlikeholdskostnader. Vindkraft til havs krever derfor offentlig støtte.

Vi ber deg nå ta stilling til et utbyggingsscenario der 100 vindkraftanlegg settes opp på fastlandet i Norge innen 2030 (Utbyggingsscenario A). Disse 100 vindkraftanlegg kommer i tillegg til de 40 vindkraftanleggene som allerede er satt opp eller godkjent av NVE. Ny strømproduksjon fra alle fornybare kilder i Norge øker da med 30 TWh.

Vi ber deg nå vurdere to alternative utbyggingsscenarier:

1) Utbyggingsscenario B: Halvparten av vindkraftproduksjonen fra disse 100 nye vindkraftanleggene settes opp og produseres til havs i stedet. Den andre halvparten er på fastlandet, spredt jevnt over relevante landsdeler og landskapstyper i Norge.

2) Utbyggingsscenario C: Hele vindkraftproduksjonen fra disse 100 nye vindkraftanleggene settes opp og produseres til havs i stedet, og ingen på fastlandet.

Ved å produsere den totale vindkraftproduksjonen fra de 100 landbaserte vindkraftanleggene til havs, kan miljø- og landskapsvirkningene på fastlandet unngås. Kostnadene ved å heller sette opp vindkraftanlegg til havs vil finansieres gjennom en ekstra skatt på strømregningen innsamlet per måned over de neste 10 årene for alle husholdninger i Norge.

Hvordan ville du rangere disse utbyggingsscenariene etter hva du og din husholdning foretrekker?

- Utbyggingsscenario B: Halvparten av vindkraftproduksjonen fra disse 100 nye vindkraftanleggene settes opp og produseres til havs. Den andre halvparten er på fastlandet, spredt jevnt over relevante landsdeler og landskapstyper i Norge.
- Utbyggingsscenario C: Hele vindkraftproduksjonen fra disse 100 nye vindkraftanleggene settes opp og produseres til havs, og ingen på fastlandet.
- Utbyggingsscenario A: Alle de 100 vindkraftanleggene plasseres på fastlandet, ingen til havs

Bilde30_info

Hva er utbyggingsscenario B verdt for deg og din husholdning? Da produseres i stedet halvparten av vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene til havs.

	Utbyggingsscenario A: All ny vindkraft på land	Utbyggingsscenario B	Utbyggingsscenario C
Ny strøm-produksjon i Norge (alle kilder)	30 TWh ny strøm	30 TWh ny strøm	30 TWh ny strøm
Nye vindturbiner som vil gi miljø- og landskaps-virkninger	3000 nye vindturbiner på land	Halvparten av ny vindkraft plasseres i stedet til havs	All ny vindkraft plasseres i stedet til havs
Prioriterte landsdeler for vindkraft	Ingen prioriterte landsdeler for vindkraftutbygging		
Prioritert landskap for vindkraft	Ingen prioritert landskapstype for vindkraftutbygging		

Vi ber deg først tenke på utbyggingsscenario B som er å i stedet produsere halvparten av vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene til havs.

Bilde30_Info

Hva er utbyggingsscenario B verdt for deg og din husholdning? Da produseres i stedet halvparten av vindkraftproduksjonen fra disse 100 nye vindkraftanleggene til havs.

	Utbyggingsscenario A: All ny vindkraft på land	Utbyggingsscenario B	Utbyggingsscenario C
Ny strøm-produksjon i Norge (alle kilder)	30 TWh ny strøm	30 TWh ny strøm	30 TWh ny strøm
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	60 nye vindkraftanlegg på land	Halvparten av ny vindkraft plasseres i stedet til havs	All ny vindkraft plasseres i stedet til havs
Prioriterte landsdeler for vindkraft	Ingen prioriterte landsdeler for vindkraftutbygging		
Prioritert landskap for vindkraft	Ingen prioritert landskapstype for vindkraftutbygging		

Vi ber deg først tenke på utbyggingsscenario B som er å i stedet produsere halvparten av vindkraftproduksjonen fra disse 100 nye vindkraftanleggene til havs.

Bilde30

Hva er det meste, om noe, din husholdning er villig til å betale i en *månedlig* skatt på strømregningen de neste 10 årene for å unngå miljø- og landskapsvirkningene ved innføring av utbyggingsscenario B?

Da produseres i stedet halvparten av vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene til havs. Resten produseres og settes opp på fastlandet.

Vi minner om at dersom du bruker penger på vindkraft til havs vil det redusere husstandens budsjett til andre goder. Hvis din husholdning foretrekker at det bare bygges vindkraft på fastlandet, kan du velge 0.

Klikk på markøren og dra den til ønsket beløp.

Månedlig beløp:

0	25	50	100	150	200	250	300	350	400	450	Mer enn 450	Vet ikke

Bilde30

Hva er det meste, om noe, din husholdning er villig til å betale i en *månedlig* skatt på strømregningen de neste 10 årene for å unngå miljø- og landskapsvirkningene ved innføring av utbyggingsscenario B?

Da produseres i stedet halvparten av vindkraftproduksjonen fra disse 100 nye vindkraftanleggene til havs. Resten produseres og settes opp på fastlandet.

Vi minner om at dersom du bruker penger på vindkraft til havs vil det redusere husstandens budsjett til andre goder. Hvis din husholdning foretrekker at det bare bygges vindkraft på fastlandet, kan du velge 0.

Klikk på markøren og dra den til ønsket beløp.

Månedlig beløp:

0	25	50	100	150	200	250	300	350	400	450	Mer enn 450	Vet ikke

Bilde31_info

Hva er utbyggingsscenario C verdt for deg og din husholdning? Da produseres i stedet hele vindkraftproduksjonen fra disse 100 nye vindkraftanleggene til havs.

	Utbyggingsscenario A: All ny vindkraft på land	Utbyggingsscenario B	Utbyggingsscenario C
Ny strøm-produksjon i Norge (alle kilder)	30 TWh ny strøm	30 TWh ny strøm	30 TWh ny strøm
Nye vindkraft-anlegg som vil gi miljø- og landskaps-virkninger	60 nye vindkraftanlegg på land	Halvparten av ny vindkraft plasseres i stedet til havs	All ny vindkraft plasseres i stedet til havs
Prioriterte landsdeler for vindkraft	Ingen prioriterte landsdeler for vindkraftutbygging		
Prioritert landskap for vindkraft	Ingen prioritert landskapstype for vindkraftutbygging		

Vi ber deg nå tenke på utbyggingsscenario C som er å i stedet produsere hele vindkraftproduksjonen fra disse 100 nye vindkraftanleggene til havs.

Bilde31

Hva er det meste, om noe, din husholdning er villig til å betale i en *månedlig* skatt på strømregningen de neste 10 årene <u>for å unngå miljø- og landskapsvirkningene</u> ved <u>utbyggingsscenario C</u>?

Da produseres i stedet <u>hele</u> vindkraftproduksjonen fra disse 3000 nye landbaserte vindturbinene til <u>havs</u>.

Vi minner om at dersom du bruker penger på vindkraft til havs vil det redusere husstandens budsjett til andre goder. Hvis din husholdning foretrekker at det bare bygges vindkraft på fastlandet, kan du velge 0.

Klikk på markøren og dra den til ønsket beløp.

Månedlig beløp:

0	25	50	100	150	200	250	300	350	400	450	Mer enn 450	Vet ikke

Bilde32

Du har ovenfor svart at du eller husholdningen din er villig til å betale for minst ett av tiltakene. Hva var den viktigste grunnen til dette?

- Redusere belastning på natur og dyreliv på fastland
- Øke mengde strøm produsert til havs
- 100 vindkraftanlegg på land har for store landskapskostnader, fordelene tatt i betraktning
- Områder hvor det kan bygges ut vindkraft på land betyr mye for meg
- Redusere produksjonsareal på fastlandet
- Jeg foretrekker at 100 vindkraftanlegg settes opp til havs selv om det koster mer for min husholdning
- Jeg velger det som er best for klimaet, uavhengig av hva det koster
- Det burde ikke settes opp flere vindkraftanlegg på fastlandet i Norge
- Andre årsaker, vennligst spesifiser:
- Vet ikke

Bilde34

Er det noen av følgende områder du mener en bør unngå å bygge ut vindkraft?

(Velg opptil 4 områder)

- Statlig sikrede friluftsområder (2400 områder, hvorav 90 prosent er i 100-meterssonen langs kysten)
- Viktige fugleområder (97 områder i Norge, som definert av Norsk Ornitologisk Forening)
- Kulturlandskap med nasjonal eller vesentlig regional interesse
- Kystlynghei-områder
- Fredete kulturmiljøer
- I spredt bebyggelse (3 bygninger eller mer per km^2)
- Nær tettbebyggelse (1 km buffersone)
- Potensielle verdensarvområder
- Nasjonale villreinområder
- Ingen av disse områdene bør sikres mot vindkraftutbygging

Bilde36

Ligger boligen din under 4 km fra?

Flere svaralternativer er mulig.

- Vindkraftanlegg
- Lavspentlinje eller transformator
- Høyspentlinje
- Ingen av disse
- Vet ikke

Bilde38

Omtrent hvor ofte har du foretatt fritidsaktiviteter der man kan se vindkraftanlegg de siste 12 månedene?

Tell alle aktiviteter som varte mer enn én time per dag som én dag.

- Ikke i det hele tatt
- Én gang (1 dag)
- 2-12 dager
- 13-24 dager
- 25 dager eller mer
- Vet ikke

Bilde39

Omtrent hvor ofte har du foretatt fritidsaktiviteter der man kan se kraftlinjer (både høyspent og mindre ledninger) i naturen de siste 12 månedene?

Tell alle aktiviteter som varte mer enn én time per dag som én dag.

- Ikke i det hele tatt
- Én gang (1 dag)
- 2-12 dager
- 13-24 dager
- 25 dager eller mer
- Vet ikke

Bilde47

Helt til slutt ber vi deg om å oppgi noe bakgrunnsinformasjon om deg selv og husholdningen din.

Er du medlem i en friluftsliv- og/eller miljøorganisasjon?

- Ja
- Nei
- Vet ikke

Bilde50

Hva vil du anslå at din personlige samlede brutto inntekt før skatt var i 2017?

Din samlede inntekt før skatten er trukket fra.

- Inntil 200.000 kr
- 200.001 – 400.000 kr
- 400.001 – 600.000 kr
- 600.001 – 800.000 kr
- 800.001 – 1.000.000 kr
- 1.000.001 – 1.200.000 kr
- 1.200.001 – 1.400.000 kr
- 1.400.001 – 1.600.000 kr
- 1.600.001 – 1.800.000 kr
- 1.800.001 – 2.000.000 kr
- 2.000.001 – 2.200.000 kr
- 2.200.001 – 2.400.000 kr
- 2.400.001 – 2.600.000 kr
- 2.600.001 – 2.800.000 kr
- 2.800.001 – 3.000.000 kr
- Mer enn 3.000.000 kr, spesifiser:
- Ønsker ikke å oppgi
- Vet ikke

Bilde51

Tror du at resultatene fra denne undersøkelsen vil bli brukt av myndighetene til planlegging av vindkraftutbygging?

- Ja
- Nei
- Usikker

Bilde53

Da er vi ferdige - er det noe annet du ønsker å si om undersøkelsen eller temaet vi har vært gjennom?

- [ ] ______
- [ ] Nei, ingen ekstra kommentarer

satisfaction

Hvor fornøyd eller misfornøyd er du med å besvare denne undersøkelsen?

Generell tilfredshet

☆☆☆☆☆

Emne

☆☆☆☆☆

Lengde

☆☆☆☆☆

Design

☆☆☆☆☆