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Public receptivity in China towards wind energy generators: A survey experimental approach

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ABSTRACT

China leads the world's wind energy market, but little has been written about public receptivity towards wind energy generators in China. To fill this gap, we pursue a survey experimental approach to examine explanations for receptivity based on evidence from OECD countries as well as the importance of public knowledge in augmenting public acceptance of wind energy generators in China. We find that Chinese respondents are sensitive to siting near their residences, to cost considerations when imposed on them directly, to wildlife externalities, and to noise from turbines. Interestingly, Chinese respondents seem to be concerned about radiation, a finding unprecedented in the literature, and are less assured by scientific assurances that radiation is not a problem. Instead, the Chinese central government is best suited to address concerns about this topic. Targeted information provision to the public can improve public knowledge about aspects of wind energy of concern. Hence, the Chinese central government can promote wind energy deployment not just because it is an authoritarian government determined to get things done, but also because it can provide relevant information to reduce potential public resistance.

1. Introduction

Wind power is a critical component in the worldwide effort to reduce greenhouse gas emissions. Wind is the fastest growing renewable energy source in the global energy mix, contributing to 4.4 percent of the world's electric power usage in 2017 (BP, 2018). The global wind power capacity in 2014 was more than seven times that a decade ago (Global Wind Energy Council, 2018). Wind energy has experienced tremendous popularity in China, whose proportion of the world's annual newly installed capacity increased from less than 10 percent in 2006 to 49 percent in 2010. The Chinese central government has laid out a blueprint for wind development up to 2050, with wind power capacity goals set at 400 GW by 2030 and 1000 GW by 2050 (International Energy Agency & Energy Research Institute, 2011).

Although utility-scale wind turbine facilities can meet the technical challenge of achieving renewable energy goals if they are deployed at a sufficiently high rate, the success of this effort will depend in part upon augmenting public receptivity by increasing public knowledge of wind turbine technology and its impacts. While extant works have documented these issues extensively in OECD countries, less is known about the transferability of these findings to other countries (Devine-Wright, 2005; Groothuis et al., 2008; Hui et al., 2018; Mallett, 2007; Nadaï, 2007; Savvanidou et al., 2010; Warren et al., 2005; Wolsink, 2007; Wüstenhagen et al., 2007). In developing countries like China that have been or will be actively promoting wind energy development, citizens may discount environmental costs to a higher degree to realize real or perceived economic benefits (Bord et al., 1998; Burningham et al., 2007) or feel differently about having wind facilities in their neighborhoods.

Previous research has shown that NIMBYism, socioeconomics, aesthetics, environmental impacts, safety and health risks, and planning and siting processes are critical determinants for public receptivity of wind turbines (Devine-Wright, 2004; Drewitt and Langston, 2006; Eltham et al., 2008; Krohn and Damborg, 1999; Rand and Hoen, 2017; Swofford and Slattery, 2010). Designing and siting wind facilities with these considerations in mind can minimize public resistance to utility-scale wind energy deployment, but it is crucial to determine the specific concerns in each national setting. In China, anecdotes suggest that the public is concerned about glass fiber dust, birds kill, and noise pollution from wind power generators (Sun, 2007; Tang and Liu, 2009; Wu, 2007). While there has not been reported, large-scale protests against wind power installations, the Chinese public has protested against the siting of chemical plants and incinerators (Steinhardt and Wu, 2016).

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As wind turbines become more popular in urban areas, it is crucial to understand how the public may receive such energy generators.

Pursuing an online survey experimental approach, this paper examines these claims as well as the importance of public knowledge in augmenting public acceptance of wind energy generators in China. To our knowledge, there have so far been only two quantitative studies on this topic; one focuses exclusively on the residents of the City of Jiuquan (Guo et al., 2015) and the other samples urban and rural residents in Shandong Province (Yuan et al., 2015). The Jiuquan study finds that residents exhibit an overall "not in my backyard, but not far away from me" attitude for the prospects of environmental burden and economic gain, respectively. The Shandong study identifies consistent concerns over environmental quality and general support of developing wind power, but such support is contingent upon age, income, education, and location of residency. While both studies are informative, neither one accounts for whether knowledge of the different design aspects and impacts of wind technologies (e.g., differences between vertical and horizontal wind turbines) might address different aspects of the public's concern. Conducted on a national urban sample in China, our study draws inferences based on statistical analyses of individual-level effects and experimental survey question designs.

The rest of the paper is organized as follows. Section 2 describes our survey methodology and sample characteristics. Section 3 explains the effects of conventional explanatory variables on public acceptance. Section 4 summarizes insights into the importance of public knowledge in augmenting public support. Section 5 discusses the results and their policy implications. Section 6 concludes the study.

2. Online survey

We designed an online public opinion survey, which featured several close- and open-ended questions and an embedded experiment.[1] Scholars conducting online survey research on China have increasingly resorted to local services providers that utilize indigenous Web 2.0 services to distribute and collect survey responses (Mei and Brown, 2018). We did the same for our study. This approach has the same benefits as using Qualtrics or Survey Monkey in Western contexts as well as similar disadvantages such as having samples that are biased towards the more urban, educated, and younger individuals. However, our study is specifically designed to study the preferences of Chinese urbanites, so this is not a disadvantage. Furthermore, we address the political desirability concern (i.e., endorsing the state out of fear of being monitored by the state) towards the end of Section 4.

Our contracted, locally based commercial survey company tested and implemented our survey on popular public online forums and websites. Based on the qualitative answers in the 50 responses at the pilot stage, we added additional questions to probe the reasoning behind some of their responses further. The survey company implemented our revised version. The survey company inserted items to test whether respondents were paying attention and used the time spent finishing the survey as an indicator of response effectiveness. For responses that showed a lack of focus or were completed too quickly, the survey company screened them out and collected 1003 effective responses from urban residents.[2]

All of our respondents had to be at least 18 years old, and they could complete the survey either on a computer or via a mobile device. The company had a built-in system to identify the respondent's IP address to avoid multiple entries from the same respondent. The company was also able to verify the respondent's self-reported location against his or her IP address. The respondents were made aware that the survey company collected their IP addresses. We included details of the survey and the summary statistics of our sample in the Supplemental Material. We also added a map of respondents' locations, juxtaposed with a map of China's wind power, to help readers get a rough sense of respondents' potential exposure to wind energy generators.

Our research design consists of two parts. The first part of the survey delves into siting, pricing, and visual preferences. The second part involves two interventions with the provision of new knowledge. The first survey experiment tests the effect of education about the different qualities of vertical vis-à-vis horizontal wind turbine on public acceptance. The second survey experiment centers on how knowledge about potential radiation from wind energy generators affects acceptance.

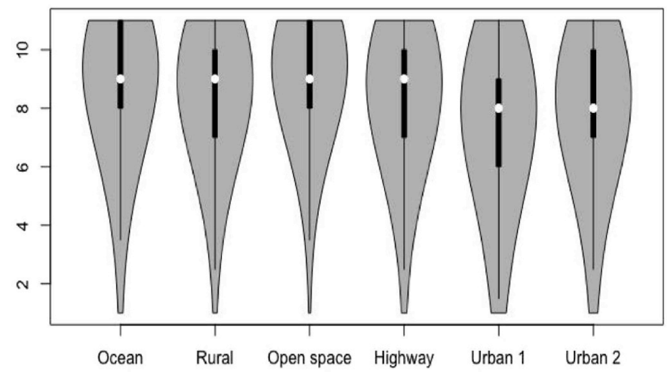

Fig. 1. Support for the placement of wind turbines in six locations.[3]

3. Conventional explanatory variables

Extant works inform us that an individual's response to a hypothetical or proposed energy project depends on his or her assessment of the likely impact that a particular technology will have on them personally and on their community (i.e., socially). Social scientists call these evaluations "personal" and "sociotropic," respectively (Kinder and Kiewiet, 1981). Based on the literature to date, we know that the support for wind energy is high and that public acceptance of wind energy generators hinges upon factors such as siting preferences, cost implications, and visual impacts. The following subsections will address these considerations in that order.

3.1. Siting preferences and NIMBYism

NIMBYism refers to the phenomenon where local residents oppose the proximity of facilities (e.g., wind turbines, power plants, industrial facilities, affordable housing projects, mental health facilities) to their homes despite the general support of such facilities (Schively, 2007). Research has shown that the acceptance of proposed wind power projects tends to decrease with a citizen's residential proximity to electricity generation facilities (Firestone and Kempton, 2007; Firestone et al., 2012; Petrova, 2013). We hypothesize that this is likely to be right in China as well, given that NIMBYism is a universal human instinct.

To explore the existence of NIMBYism, we presented location choices and distance conditions to the respondents and asked whether they would strongly support, somewhat support, remain ambivalent about, somewhat oppose, or strongly oppose wind turbines. Among six different locations, respondents were least supportive of placing wind turbines in urban environments (Fig. 1). Respondents became more

[1] This research was approved by the IRB at Stanford University.

[2] 1003 is a reasonable number of effective survey responses in the context of China. The two extant works on public acceptance of wind energy collected 1316 (Yuan et al., 2015) and 698 (Guo et al., 2015) effective responses, respectively. A quick look at energy survey studies on China suggests that the collected interview or online responses range between the low hundreds and a little over a thousand. Our respondents live in urban areas, and thus are traditionally more remote from wind turbines in real life. In this case, they may physically see wind turbines while riding on a train or driving on a highway.

[3] A violin plot is a handy and informative data visualization tool. It is similar to a box plot, but also has a rotated kernel density plot on each side. In addition to showing summary statistics such as median and interquartile ranges, the violin plot also shows the full distribution of the data.

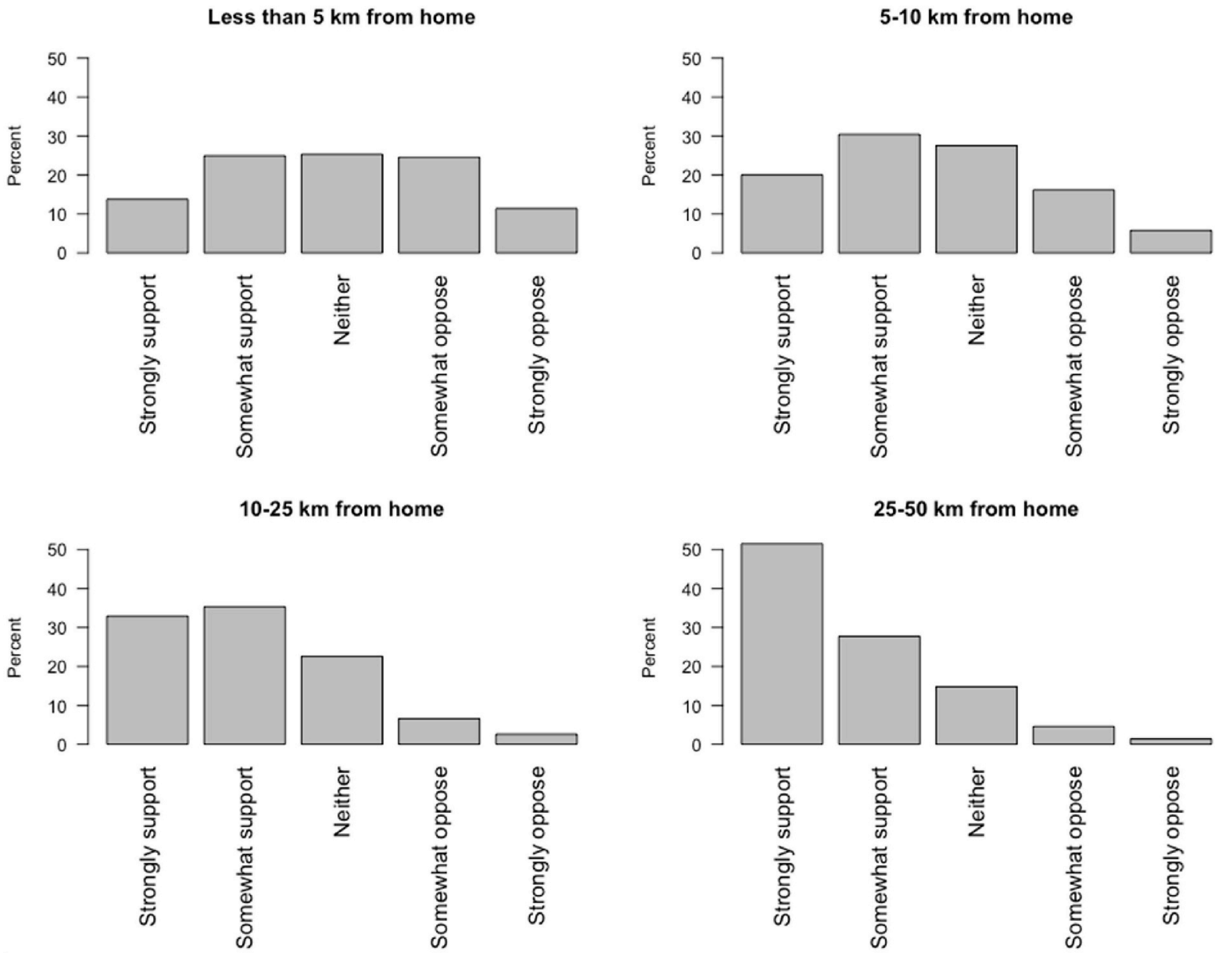

Fig. 2. Respondent reaction to the distance of wind turbines from home.

supportive of the placement of wind turbines when it is further away from their homes (Fig. 2).

We assessed the individual determinants for wanting to place vertical wind turbines the furthest away (i.e., 25–50 km from home). Based on existing studies, the individual characteristics we considered were gender, age, education, income, employment status, home ownership, marital status, children, grandchildren, city tier, and belief about climate change (Hui et al., 2018). At this point, we were agnostic about which explanatory variables would be most critical for Chinese respondents, so we performed best subset selection to derive a set of variables that explained the most variation in the outcome. We then regressed support for vertical wind turbines 25–50 km from home on this set of selected variables via OLS. The results are shown in Table 1.

The study of NIMBYism in China is relatively new and burgeoning (Johnson, 2010; Steinhardt and Wu, 2016; Wasserstrom, 2009). These studies focus primarily on the middle class who utilize government-sanctioned public consultation channels to oppose the construction of chemical plants, waste incineration plants, and such near the vicinity of their neighborhoods. Similarly, in our case of wind turbines, the level of support for vertical wind turbines increased as they are further away from home. Also, we find in Table 1 that respondents with higher household income (and most often the people with the strongest NIMBY preferences) were more likely to prefer sites further away from their homes. Other demographic variables are mostly statistically insignificant, which is consistent with extant works and further suggests that demographic variables do little to explain the support for or attitudes towards wind energy (Firestone et al., 2015; Jacquet and Stedman, 2013; Mulvaney et al., 2013).

Table 1
Support for vertical wind turbine, 25–50 km from home.

	25–50 km from home
Male	0.10** (0.04)
Grandparent	0.17 (0.10)
Some college	−0.08 (0.08)
Bachelor's degree	−0.01 (0.08)
Graduate degree	−0.08 (0.10)
Married	−0.09 (0.05)
Income 60-100 k RMB	0.17* (0.08)
Income 100-150 k RMB	0.24** (0.08)
Income 150-200 k RMB	0.29** (0.09)
Income > 200 k RMB	0.38*** (0.10)
Age 26-30	0.07 (0.07)
Age 31-40	0.05 (0.07)
Age 41-50	0.14 (0.07)
Age 51-60	−0.03 (0.09)
2^{nd}-tier city	0.07 (0.05)
3^{rd}-tier city	0.16** (0.05)
Global Warming: within a few years	−0.10 (0.07)
Global Warming: lifetime	−0.36*** (0.07)
Global Warming: future generations	0.03 (0.11)
Global Warming: never happen	−1.65** (0.61)
Global Warming: don't know	−0.57*** (0.17)
Observations	1002

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

3.2. Cost implications

We find that cost aversion exists among Chinese respondents, though with some interesting caveats. Namely, we identify insensitivity

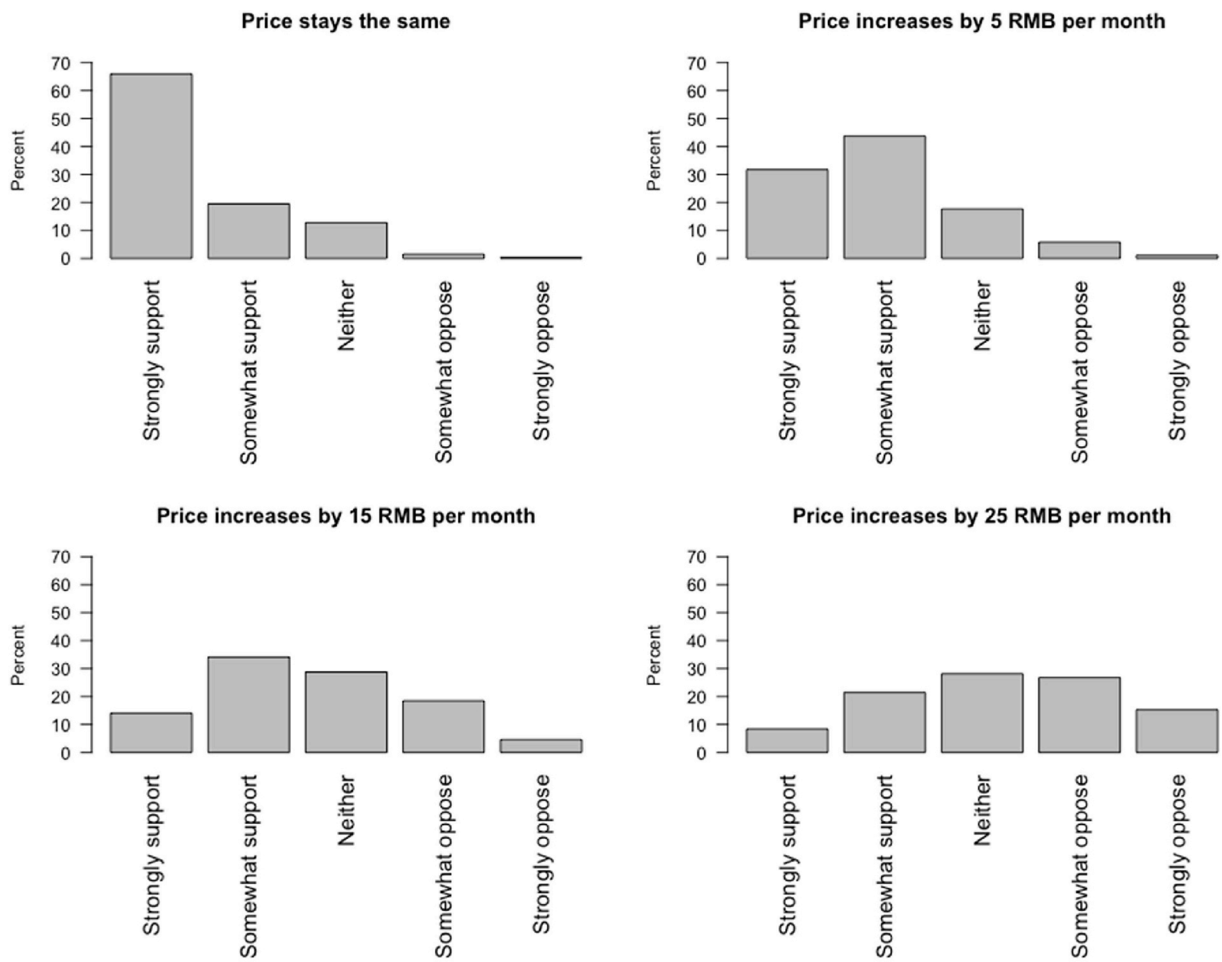

Fig. 3. Respondent reactions to monthly electricity bill price increases due to the use of wind energy.

Table 2
Support for vertical wind turbine, with a price increase of 25 RMB per month.

	25 RMB per month
Parent	−0.14 (0.13)
Grandparent	−0.25 (0.16)
Some college	−0.07 (0.14)
Bachelor's degree	0.04 (0.13)
Graduate degree	−0.01 (0.17)
Employed	0.23* (0.11)
Married	0.31* (0.13)
Income 60-100 k RMB	0.06 (0.14)
Income 100-150 k RMB	0.29* (0.14)
Income 150-200 k RMB	0.43** (0.16)
Income > 200 k RMB	0.79*** (0.18)
Age 26-30	−0.09 (0.11)
Age 31-40	−0.31** (0.12)
Age 41-50	−0.45*** (0.13)
Age 51-60	−0.24 (0.15)
2nd-tier city	0.20* (0.08)
3rd-tier city	0.20* (0.08)
Global Warming: within a few years	−0.13 (0.12)
Global Warming: lifetime	−0.14 (0.12)
Global Warming: future generations	−0.07 (0.18)
Global Warming: never happen	−0.97 (1.03)
Global Warming: don't know	0.28 (0.29)
Observations	1002

***p < 0.001, **p < 0.01, *p < 0.05.

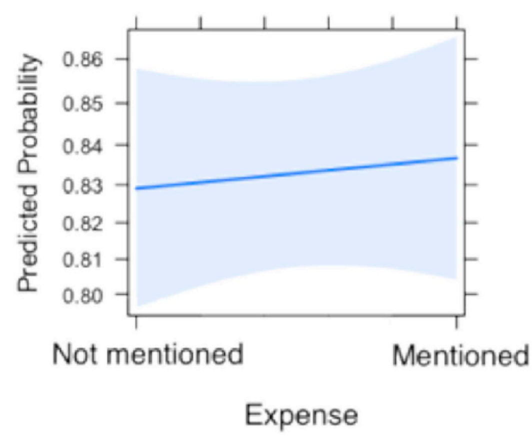

Fig. 4. Insensitivity to expense among Chinese respondents.

to expenses and sensitivity to electricity price increases among Chinese respondents. In this section, we present our results and spell out speculations about why the caveats.

To explore the aversion to higher prices, we presented electricity price conditions to the respondents and asked whether they would strongly support, somewhat support, remain ambivalent about, somewhat oppose, or strongly oppose electricity generation from wind turbines. In general, the enthusiasm faded as their monthly electricity bill increased (Fig. 3).

As with understanding siting preferences, we performed best subset selection to determine the set of variables that accounted for the most variation in the outcome. We then regressed support for wind turbines with a 25 RMB/month increase (about one-eighth of an average household's monthly electricity bill) in electricity bill on this set of

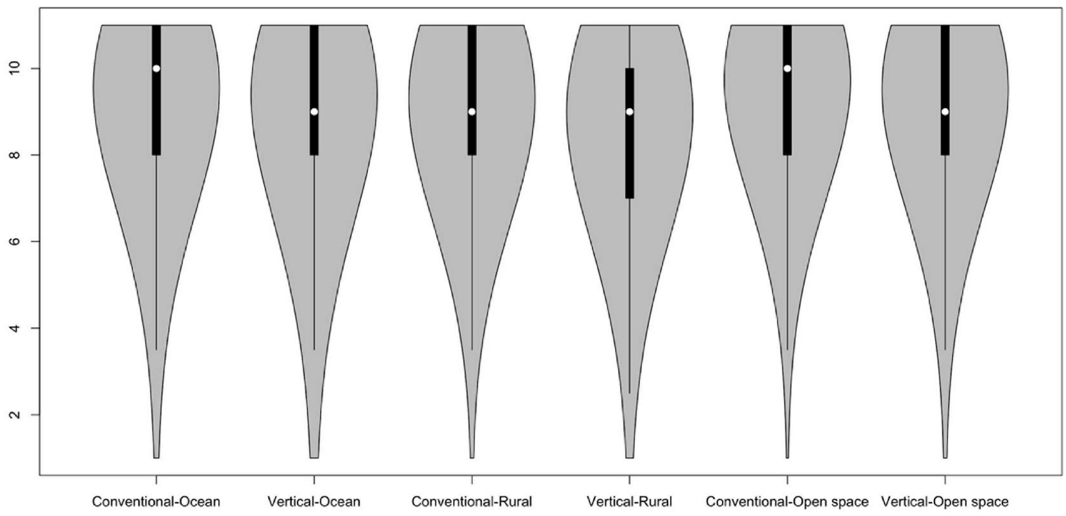

Fig. 5. Three pairwise comparisons between conventional (horizontal) and vertical wind turbines in three locations: ocean, rural area, and open space.

selected variables via OLS. The results are shown in Table 2. As we can see, the higher the household income, the more the respondent was willing to pay a higher electricity rate. Being married or employed full-time were also positively correlated with a willingness to pay more.

However, when it was not explicitly stated that individual households would bear the additional costs, Chinese respondents appeared to be insensitive to expenses. In a survey experiment, we informed respondents at random that generating electricity from vertical rather than horizontal wind turbines would incur higher expense did not induce a decrease in support for vertical wind turbines (Fig. 4).[4] What accounts for seemingly inconsistent findings? We think that the answer is that when respondents were not told that they would personally incur the higher costs of electricity generated by vertical wind turbines, they may have assumed that the government would subsidize the increment in electricity price as it has been done in a number of localities (Liu et al., 2013).

3.3. Visual impacts

So far, many existing studies have documented the usually negative visual impact that wind turbines have on their surrounding landscape; that is, wind turbines are an eyesore, and shadow flicker created near turbines is another source of visual annoyance (Bush and Hoagland, 2016; Gipe, 1993; Pasqualetti et al., 2002; Rule, 2014). However, very few works have delved into how the public reacts to the appearances of different kinds of wind turbines. This inquiry will offer some insight into what aspects of a wind turbine's appearance make it more appealing to the public.

We provided the respondents with three pairwise comparisons of horizontal and vertical wind turbines in three different locations. Vertical wind turbine advocates argue that people should prefer the substantially smaller height of the vertical turbines because they would blend in better with the surrounding landscape, including near residential areas. To test this, we showed respondents pairwise pictures of both types of turbines in the ocean, rural areas, and open space settings. Contrary to the vertical wind turbine advocates' expectations, we find that for each of these three locations, Chinese respondents on average preferred the design of the horizontal wind turbine to that of the vertical wind turbine, as shown in the violin plot in Fig. 5.

[4] In the survey, this question was presented before the question about monthly electricity bill increases, so there was no priming that the expenses may translate into electricity costs borne by households at this point.

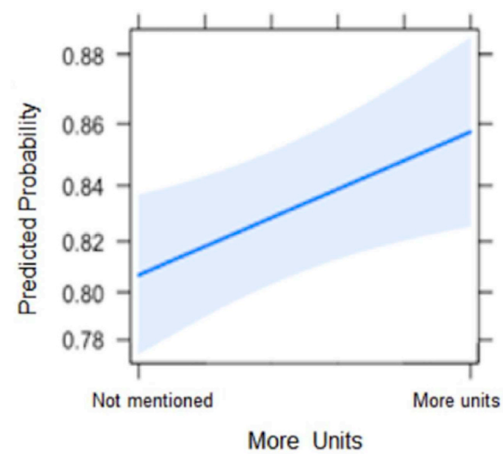

Fig. 6. Preference for the number of units required per unit of electricity generated.

Besides visual preferences, we tested how cumulative impacts created by the size, number, and clustering of turbines influenced public acceptance. Some studies have documented public concerns over these aspects (Petrova, 2013; Walker et al., 2014). In one study, respondents in California disliked the fact that vertical wind turbines were required in greater quantity to generate the same amount of electricity as their horizontal counterparts (Hui et al., 2018). However, some European studies do not identify an active link between the number of turbines and negative attitudes (Krohn and Damborg, 1999; Pohl et al., 2012). In China, the clustering and quantity of vertical wind turbines did not discourage the respondents from showing support, which is more similar to the European cases than to the California case (Fig. 6).

4. The importance of knowledge in public acceptance

The information-deficit model holds that public attitudes or behaviors are a result of a deficiency in knowledge (Gross, 1994). In the realm of the public understanding of science, scholars have documented that public opposition to new technologies is a result of information deficiency (Bauer et al., 2007; Sturgis and Allum, 2004) and that information provision and education contribute to the support for a technology (Nisbet and Scheufele, 2009; Ziman, 1991). In the realm of wind energy, scholars have found ample evidence that providing the correct information to the public can solicit more support for the

Fig. 7. Wind turbines in urban China.[5].

development of energy projects (Burningham et al., 2015; Cass and Walker, 2009; Jones and Eiser, 2009; Kaldellis, 2005; Krohn and Damborg, 1999; Strachan and Lal, 2004).

Because not all citizens will have useful information about new technology, including renewable energy technology, their perceptions will necessarily be uncertain to some degree and subject to possible change under different information conditions (Bidwell, 2016). The purpose of our experimental survey design is to test how the provision of knowledge affects these perceptions.

In this study, we compare the implementation of two different types of wind turbines in China. China not only has the world's largest wind power capacity but also dominates the smaller-scale, vertical wind turbine market. In 2014, nearly 40 percent of the cumulative capacity of the world's vertical wind turbines was in China (GlobalData, 2015). Wind turbines are not just seen on the sea or in open spaces, but also along highways and railways and in urban areas (Fig. 7). While vertical and horizontal wind turbines are not nearly at a similar level of technological development and are not replacements for one another, the aim of comparing them in the survey is to get at public acceptance of different qualities of wind energy generators.

Vertical and horizontal wind turbines have distinct advantages and disadvantages (Dabiri, 2011). Vertical turbines are smaller than horizontal ones, but produce less energy per unit and hence require more units. Horizontal wind turbines in the wrong place can result in many bird and bat deaths while vertical turbines might cause fewer. The comparison of these different technologies tests the sensitivity of public receptiveness to particular design features.

4.1. Intervention: knowledge about turbine features and effects

To understand which aspects about wind turbines would boost or undermine public support, we compared and provided information about vertical wind turbines with their horizontal counterparts regarding height, impact on wildlife, noise, ease of installation, number of units required per unit of electricity generation, and the costs incurred in generating one unit of electricity. These six aspects correspond to six pieces of facts. Compared to horizontal wind turbines, vertical wind turbines:

1) are 90% shorter;
2) kill 90% fewer birds and bats;
3) generate 50% less noise;
4) can be installed without specialized equipment;
5) require more units to generate power (i.e., smaller units in greater quantity);
6) may cost 25% more per kilowatt hour generated.

Each respondent was presented with three out of six randomly selected facts. By randomly assigning facts to the respondents, we were able to gauge the impact of each feature on the support for wind turbines and understand the tradeoffs among these features. The facts that vertical wind turbines are shorter, less lethal to birds and bats, less noisy, and easier to install all registered positively to varying degrees with respondents (Fig. 8).

4.2. Intervention: knowledge about radiation from turbines

According to the qualitative responses to our pilot surveys, about 30 percent of respondents expressed concerns over potential radiation (辐射 *fúshè*) coming from the operation of wind turbines, although there was no mention at all about radiation in the pilot survey. These radiation concerns are unusual. Wind turbines do not cause radiation nor pose a health hazard to people nearby, though noise above a certain level and within a certain distance may contribute to sleep disturbance for some people (Knopper and Ollson, 2011). The science community has debunked conspiracy theories about the infrasound and electromagnetic radiation from wind turbines (Radcliffe, 2015). To our knowledge, the concern over radiation from wind energy generators has not been documented by any previous study. We conjecture that this unwarranted connection may arise due to the conflation of noise with radiation, or may be induced by the anxiety from North Korea's experimentation with nuclear weapons, or prompted by recent nuclear reactor leakage in Japan. The threats posed by North Korea and Fukushima fueled real panic among the Chinese public. After Fukushima, consumers living in China's eastern coastal cities and Beijing rushed to stores to stockpile iodized table salt in an attempt to shield themselves from radiation-induced illnesses and secure uncontaminated food sources. The salt rush triggered the central government to warn against the hoarding of salt, stating that it was "totally unfounded" (China Real Time Report, 2011). The public concern over radiation, potentially fueled by unscientific rumors, will be an interesting area to explore in future research.

Regardless of the cause of concern over radiation, we further probe what would erase or eliminate some of the unwarranted fear and suspicion. We randomly presented the respondent with one of three statements:

1) The radiation effect from vertical wind turbines remains unknown;
2) Scientists have proved that vertical wind turbines do not cause radiation;
3) Relevant departments within the central state have determined that vertical wind turbines do not cause radiation.

As shown in Fig. 9, compared to the null scenario 1), the treatment effect of scenario 2) is on average 0.00. By contrast, compared to the baseline, scenario 3) boosted the probability of support by six percentage points (from 0.81 to 0.87) and this effect was significant at the $p \leq 0.05$ level. That is, an average respondent felt no difference between not knowing and being assured by the scientist. However, when

[5] URLs for these images: http://www.ftchinese.com/story/001066930?archive, http://www.china.com.cn/photochina/2007-05/09/content_8223207.htm, and http://www.chinabaike.com/t/31267/2014/0602/2375844.html.

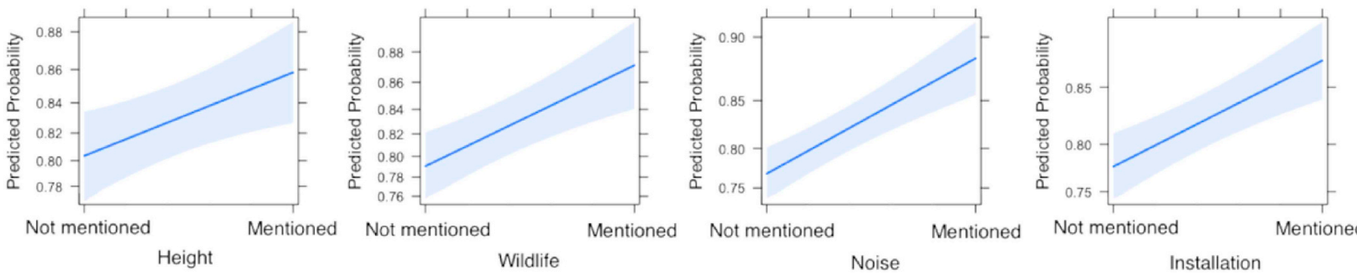

Fig. 8. Support for particular features of wind turbines.

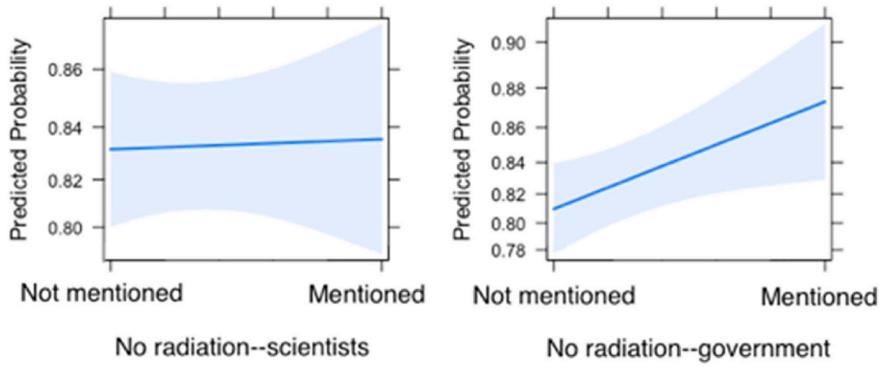

Fig. 9. The effect of the source of no-radiation assurance on acceptance of wind energy generators.

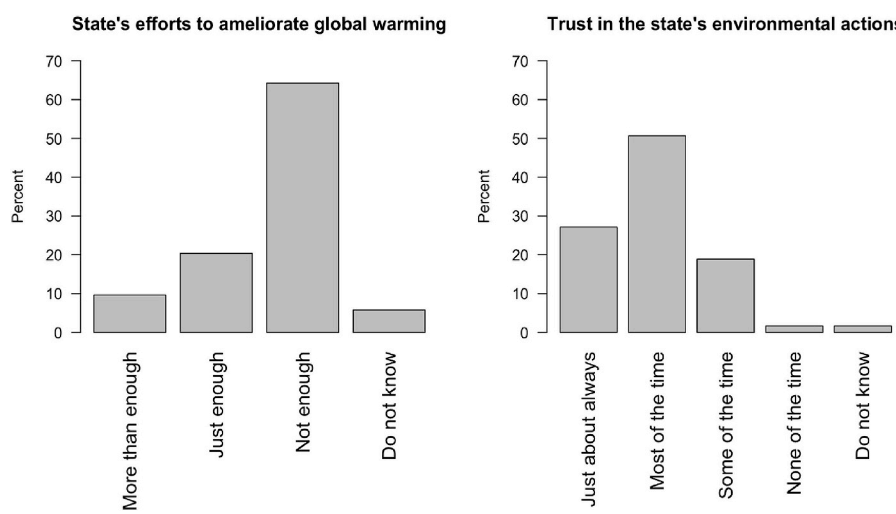

Fig. 10. Respondent's assessment of state efforts to fight climate change and their trust in the government's environmental actions.

respondents were being informed by relevant departments within the state about the nonexistence of radiation, they responded favorably to vertical wind turbines.

This effect could either reflect a genuine trust in the authority of the government or a falsified preference or both. The concept of preference falsification was put forth and developed by a social scientist, Timur Kuran, who believed that people's stated preferences respond to social influences but not to their genuine wants. The concept has been applied to explain unexpected revolutions (Kuran, 1991). In this light, it is not impossible that some respondents falsified their stated preferences in response to an authoritarian regime. Nevertheless, a significant segment of the respondents may genuinely trust the state. For instance, in our survey, while 64 percent of respondents agreed that the state is not making enough efforts to ameliorate global warming, 78 percent (27 percent "just about always" and 51 percent "most of the time") expressed trust in the state's actions to protect the environment (Fig. 10). Indeed, other studies have documented a high level of trust in the government in China. For example, according to the 2018 Edelman Trust Barometer, 84 percent of China's general population, which include 89 percent of the informed public, trust their government, the highest among people of 28 countries surveyed (Edelman Trust Barometer, 2018). Given this finding, the suspicion over radiation could not be addressed by scientists alone; the central government needs to be involved in advancing the use of wind power, especially in or close to urban areas. This finding also opens an exciting future research venue; that is, who wields scientific authority in China, and why?

5. Conclusion and policy implications

The results of our study suggest that Chinese citizens are generally supportive of the development of wind energy but are sensitive to the siting of wind turbines near their residences and to cost considerations when imposed on them directly. Household income is highly and significantly correlated with the level of NIMBYism and support for higher electricity rate due to electricity generation from wind. Aesthetically, Chinese respondents are not discouraged by the clustering of wind turbines in any given landscape.

Results from our survey experiments highlight the importance of knowledge provided in improving public receptivity of wind energy generators. By comparing design and impact features between horizontal and vertical wind turbines, we find that Chinese respondents would prefer vertical over horizontal wind turbines in areas where birds and bats could be killed in large numbers. They also preferred turbines with less noise. One very intriguing finding worth probing into in future research is that Chinese citizens seemed to be more concerned about radiation and less assured by scientific assurances that radiation is not a problem. It appeared that the central state rather than scientists wields scientific authority for the public.

Several policy implications, aimed at minimizing potential public resistance to utility-scale wind energy deployment, emerge from this paper. Following the first set of results based on conventional explanatory variables for public acceptance, we find that less wealthy neighborhoods, where the level of NIMBYism is lower, may be more receptive to placing wind turbines in or near their communities, especially if doing so comes with monetary incentives provided by the government. In these communities, the government might consider subsidizing increased expenses in electricity generation because households that command relatively lower income appeared to be less supportive of wind energy due to increased costs imposed on them directly. These are important policy implications, especially given that public resistance could become more salient as the public becomes richer and wind turbines populate more urban areas.

Following the second set of results from survey experiments on information provision, we identify the following policy implications. In communities where wildlife impacts and noise pollution are of utmost concern, vertical wind turbines may be a good option, and the local government would receive less resistance from local communities if it can highlight the strengths of vertical wind turbines in reducing noise and bird kill. On the issue of radiation, the Chinese central government rather than the scientists would be best suited to address concerns about this topic. Hence, the Chinese central government can promote wind energy deployment not just because it is an authoritarian government determined to get things done, but also because it can provide relevant information to reduce potential public resistance.

Finally, this paper lays out the foundation for at least two interesting future inquiries. The first question is: who wields scientific authority in China, and why? Future research can explore the source of public trust in the central state, including its influence over public perception of science and its control over the spread of rumors. Future research can also delve into how the type, as well as the country and prestige of the scientist's affiliation, may affect public trust in the scientist's authority. Types of institutions may include university, company, state-sanctioned think tank, and independent non-profit organization. The second question is: what is the source of public concern over radiation? Previously, this paper has discussed potential explanations, such as media effects of publicizing widely North Korea's testing of nuclear missiles and Japan's nuclear leakage. Moreover, there are different types of radiation. Future research can probe into the particular kinds of radiation that concern the public if the public can differentiate between different types of radiation.

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Appendix A. Supplementary data

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