Spatial Preferences for the Location of Offshore Wind Farms

François-Charles Wolff*, Pierre-Alexandre Mahieu, Brice Trouillet***, Alexia Pigeault**** and Nicolas Rollo*****

Abstract – To achieve its renewable energy production targets, France is aiming to create 50 new offshore wind farms by 2050. In line with the debate on maritime planning organised by the *Commission nationale du débat public,* (CNDP – French National Commission for Public Debate), a mixed survey combining economics and geography was conducted to study the spatial preferences of French households in terms of the location of these future offshore wind farms. The results of this discrete choice experiment show that respondents prefer the offshore wind farms to be located far from the coasts without overlapping with marine protected areas or fishing grounds, and are opposed to wind farms that have an insufficiently local link to the land. Support for the project, consisting of 50 offshore wind farms, however, remains mixed, with almost 30% of respondents opposed. Nevertheless, the level of support for the project does not change people's preferences in terms of the location of the offshore wind farms.

JEL: Q42, Q51, R52
Keywords: offshore wind farm, spatial preferences, discrete choice experiment

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In France, the Law on Energy Transition for Green Growth (known as the LTECV and published in the Official Journal on 18 August 2015) and the Law on Energy and Climate (known as the LEC and published in the Official Journal on 8 November 2019) set ambitious targets for reducing greenhouse gas emissions and diversifying energy sources, in line with the targets of the European Union. These laws explicitly established the 2050 carbon neutrality target in the legislative framework, meaning that France should be emitting only as much greenhouse gas as it absorbs across its territory by this date. Under the LEC, France has set itself the target of reaching 33% renewable energy in its final energy consumption by 2030, which requires it to produce 40% of its electricity from renewable sources by that date.[1]

Since 2005, there has been significant development in renewable energy. The importance of renewable sources in final energy consumption rose by 11.5 points between 2005 and 2022, in line with increasing investments made to foster their development (SDES, 2023). This increase is primarily based on four branches of the renewable energy sector: wind, photovoltaic, biodiesel and heat pumps. These branches, however, differ greatly in terms of their development potential in France: for example, the lion's share of hydropower potential, another renewable energy source, has, to date, already been exploited. Moreover, this positive dynamic has not led to the achievement of the European targets in terms of the share of renewable energy in final gross energy consumption. For example, at the end of 2022, this share was 20.7%, up 1.4 points compared with 2021, although the target for 2020 was set at 23% (Eguienta & Phan, 2023).[2]

Against the backdrop of increasing demand for electricity, quick and large-scale development of new sources of renewable energy production is necessary if France is to remain on track with its targets. Wind power, which has become the country's second largest source of renewable electricity, plays a key role in the low-carbon strategy. Currently ranked third in Europe behind Germany and Spain (with the two highest global positions occupied by China and the USA), wind power has undergone significant development in France since the early 2010s, with power output doubling between 2014 and 2022. Recently, the focus shifted to offshore wind power, which is now in full development (Box 1), and France is now aiming to create 50 new offshore wind farms by 2050.

Irrespective of any technological brakes that may be applied, the development of offshore wind power cannot take place without strong support from the general population. Gaining a better understanding of the potential brakes and the opportunities perceived by the general public is therefore a key question in ensuring the deployment of the future wind farms and thereby making offshore wind power France's largest source of renewable energy in the near future. The installation of offshore wind farms raises numerous questions in terms of location, which relate to, for example, their distance from the coast, their potential impact on marine protected areas or fishing grounds, the links that they may create with the coastal regions, in particular through the creation of jobs, or even their greater or lesser concentration along the coastline.

Following a principle similar to that used in the broad national debate launched in January 2019 in response to the Yellow vest movement, the *Commission nationale du débat public* (CNDP) organised a debate between 20 November 2023 and 26 April 2024 around maritime planning. The CNDP is an independent authority that guarantees the right to information and participation in projects and policies that may impact the environment. The debate, which was broken down by the different coastal regions of mainland France, enabled anyone who wished to take part in discussions on the exploitation of the sea in various zones, such as offshore wind farms, marine protected areas, plastic pollution, sustainable fishing, maritime transport and even sea mining.[3] With a view to providing academic expertise, the CNDP enlisted researchers from Nantes University to contribute to the part of the debate focussing on spatial planning (defined as a public action for a given region seeking a balance between economic development, inclusion of environmental considerations and satisfaction of social needs) of offshore wind turbines.

The aim of this study is to specify the most preferred location for offshore wind farms among French households. To achieve this goal, a mixed approach combining economics and geography was implemented to examine spatial preferences for offshore wind power. This consisted in introducing cartographic visualisation elements relating to the location of future offshore wind farms as part of a survey conducted in March 2024 by a polling organisation among a sample of almost 2,400 respondents representative of the French population in terms

1. *https://www.ecologie.gouv.fr/dispositifs-soutien-aux-energies-renouvelables.*
2. *https://www.statistiques.developpement-durable.gouv.fr/media/6390/download?inline*
3. *https://www.debatpublic.fr/la-mer-en-debat*

Box 1 – **Emergence and Development of Offshore Wind Power in France**

Wind power has become the second largest source of renewable electricity in France and plays a key role in the low-carbon strategy. By late 2023, French wind power had a power output of 23.5 gigawatts (GW), made up of 22 GW from onshore wind and 1.5 GW from offshore wind. This was a little below the targets of 24.1 GW for onshore wind and 2.4 GW for offshore wind established under the multi-year energy plan (SDES, 2024). French onshore wind power is now well developed, with around 8,000 turbines across almost 2,000 different sites, with Hauts-de-France and Grand Est having the highest number. It must, however, deal with a twofold limitation due, on the one hand, to the variability of exposure to wind and, on the other hand, to the options available for storing the energy produced in this way. Acceptability by the population is also a key challenge and new installation projects have, since the Climate and Resilience Law of 22 August 2021,[(a)] been subject to public utility surveys.

Given this background, French wind power development policy has been redirected towards offshore wind power which, despite increased installation costs and storage issues, allows the country to target greater power capacities while also reducing the constraints linked to land occupation. Activity in this area in France is now in full flow, with an initial wind farm in operation in Saint-Nazaire (the Banc de Guérande wind farm, 0.48 GW) and two at Saint-Brieuc (off Baie de Saint-Brieuc, 0.5 GW) and Fécamp (Hautes Falaises offshore wind turbines, 0.5 GW) which have begun producing electricity. Nine other projects are currently in the deployment phase along the west and north coasts of France.[(b)] Continuing with this momentum, France is now seeking to create 50 new offshore wind farms by 2050 and is, in particular, banking on offshore floating wind turbine technology, with capacity to produce 45 GW of electricity. This technology can be deployed far from the coast, across a much greater maritime area than fixed wind power, thereby offering greater flexibility and a potentially less significant impact on the landscape.

The need to rapidly develop renewable energy production led to a change in the legislative framework with the publication of the Law on the Acceleration of Renewable Energy Production (*Accélération de la Production d'Énergies Renouvelables*, APER)[(c)] in the Official Journal of 11 March 2023. The aim of this change was to simplify the procedures required to develop these energy sources, with an increased role for regional authorities and other local stakeholders. In particular, the law brings to the fore a regional planning arrangement aimed at coordinating renewable energy projects (Title II) and provides specific regulatory provisions for the development of offshore renewable energy production installations (Title IV). Specifically, each French coastal area must have a map of the maritime areas prioritised for the installation of offshore turbines and the local authorities in the vicinity of areas in which future wind farms will be installed will be required to provide an opinion. These measures are a follow-up to the Law for a State that Fosters a Society of Trust of 10 August 2018 (*État au Service d'une Société de Confiance*, ESSOC), which introduced greater flexibility into the documentation for wind power developers, and the need for a public debate before calls for tenders, and to the Law for the Acceleration and Simplification of Public Action of 7 December 2020 (*Accélération et Simplification de l'Action Publique*, ASAP), which authorised the organisation of public debates at the level of coastal region rather than wind farm.

[(a)] *https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043956924*
[(b)] *https://www.eoliennesenmer.fr*
[(c)] *https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000047294244*

of age and sex, in parallel to the broad public debate organised by the CNDP. The questionnaire is essentially based on a discrete choice experiment (DCE) specifically designed for this occasion. This method, widely used by economists, involves presenting respondents with a series of scenarios, each composed of different alternatives. These alternatives are defined by several attributes, whose levels vary across the scenarios (Hanley *et al.*, 2001). This DCE approach was complemented by a more direct approach consisting in asking individuals to rank, by order of importance, first the various attributes, and then their levels for each attribute, which allowed us to test the robustness of the DCE results.

After reviewing the main lessons learned from the DCE application on wind power, the article then details the attributes and their levels used in the survey and the methodology implemented. It then examines how respondents ranked both the different attributes considered for the future wind farm installations and the levels of these attributes, as well as the preferences expressed through the DCE. Lastly, it discusses the acceptance of developing offshore wind power along the French coastline with the installation of 50 offshore wind farms and concludes on the limits of the study carried out.

1. Lessons Learned From DCEs Relating to Wind Power

The DCE is used in various fields (Mahieu *et al.*, 2017). After transport and marketing, it moved into agriculture, environment and health. Peyron *et al.* (2021, box 1, p. 71) describe how this method can be applied to preferences for access to genetic information. In the environmental field, numerous goods, services and technologies have been assessed using this approach. Renewable energy is no exception, especially wind power, which poses recurrent issues surrounding acceptance by the population, both locally and nationally, whether on- or offshore, and which often leads to legal appeals by citizen associations in France and elsewhere. It is therefore important to understand the brakes and opportunities perceived by the general public as regards this technology.

Mattmann *et al.* (2016) propose a meta-analysis using 17 DCE studies. They highlight the fact that wind turbine preferences have been studied on all continents across the globe, with surveys targeting different groups (visitors, local residents, etc.) and using different administrative methods (online surveys, face-to-face surveys, etc.). Several externalities were taken into consideration in the choice of attributes, particularly those relating to climate change, landscape and biodiversity. Another key finding of this summary is that the majority of studies relate to onshore wind turbines. More recently, Joalland & Mahieu (2023) examined offshore wind turbines based on a literature review of 12 published DCE articles. The authors show that the externalities in the studies conducted to date generally relate to biodiversity and landscape, but that other externalities, for example the impact on fishing, do not feature. All the cited studies relate to a single wind farm, whether planned or under construction. An ambitious large-scale or national study remains to be carried out given that a group of countries (UK, Germany, Netherlands, Italy, Norway and France) is seeking mass deployment of this technology.[4]

In their online survey conducted in France in 2021, Joalland & Mahieu (2023) proposed a large-scale offshore wind turbine deployment project to respondents. The results show that respondents are very sensitive to the potential impact of wind turbine deployment on fishing, expressed in the form of a change in the number of jobs in this sector and a change in the provenance of marine products. It therefore seems of interest to test whether other effects of the large-scale deployment of wind farms are likely to influence their acceptability, for example through a greater or lesser concentration of offshore wind farms along the coastline. More generally, the social acceptability of a given wind farm project is not necessarily the same as the acceptability associated with mass deployment of wind power.[5] This raises new questions, such as the interconnection of different wind farms and the common rules that apply. In addition to the spatial aspect, the temporal dimension also plays a role. Mass deployment takes more time than building a single wind farm and is relatively final given that it would be difficult to dismantle several thousand wind turbines.

To date, only two other DCEs have been conducted in France before the work carried out by Joalland & Mahieu (2023). Westerberg *et al.* (2013) conducted a face-to-face survey over the summer of 2010 among tourists on the beaches of Languedoc-Roussillon in order to study the acceptability of establishing an offshore wind farm, with emphasis placed on the distance from the coast. Other attributes sought to examine whether the potential visual disturbance could be offset by the recreation of reefs associated with the offshore wind farms or by the adoption of a coherent environmental policy. The authors showed that, in general, tourists preferred the wind farm to be at a great distance from the coast. Kermagoret *et al.* (2016) carried out a DCE in October 2013 to examine the preferences of local communities regarding various compensatory measures as part of an offshore wind farm project in Baie de Saint-Brieuc. Their questionnaire was conducted among recreational users of the bay, with the aim of evaluating their preferences regarding various compensation options. The study showed that the type of compensation proposed following the establishment of a wind farm could have an impact on project acceptance.

Defining common rules for all future wind farms requires reliable information on the preferences of the general public. If the results of the studies into preferences are not obtained under suitable conditions, these rules may subsequently be contested. Contrary to the work conducted by Joalland & Mahieu (2023) in which only the DCE method was applied, this article also studies the ranking of attributes and their levels. One of the main advantages of the direct ranking method is that it requires low cognitive effort from the respondent. This explains why this type of ranking-based approach has been widely used in areas other than wind energy (Gonzalez, 2019). This study also distinguishes itself from previous research in the two following dimensions. Firstly, the spatial dimension is present for the four attributes used in the survey, while no previous study has looked exclusively at spatial aspects. Secondly, a cartographic approach using pictograms has been adopted to make the attributes and their levels clearer.

4. https://www.euractiv.fr/section/energie-climat/news/reseaux-eoliens-offshore-400-milliards-deuros-seraient-necessaires-pour-atteindre-les-objectifs-de-2050/
5. Ladenburg & Skotte (2022) propose large-scale deployment of the DCE for Denmark.

2. A Survey on Spatial Preferences for Wind Farms

A questionnaire comprising around 20 questions was drawn up by a team of geographers and economists from Nantes University affiliated to the mixed research unit *Littoral - Environnement - Télédétection - Géomatique* (LETG – Coastal zone, Environment, Remote Sensing, Geomatics) and the *Laboratoire d'Économie et de Management de Nantes Atlantique* (LEMNA – Nantes Atlantic Management and Economics Laboratory).[6] This collaboration sought to apply an economic method, the DCE, while drawing on geographic expertise to address the spatial aspects and deepen understanding of maritime planning. The responses obtained were to be communicated to policymakers and were likely to have an influence on the rules to be established for building new offshore wind farms.[7]

The questionnaire was organised into three main sections. Firstly, six initial questions sought to specify individual characteristics, such as the respondent's sex, year of birth, education and place of residence. However, there was no question on income, as this type of question was deemed too intrusive. Next, respondents were asked to express their spatial preferences for the installation of these future wind farms based on four distinct attributes: distance from the coast; overlapping installation with other (economic or environmental) assets; their link to the land; and the concentration of offshore wind farms. Lastly, respondents were invited to specify their level of knowledge of wind farms and certain maritime issues, their support (or lack thereof) for the installation of 50 offshore wind farms along the French coastline by 2050, and lastly the optimum number of wind farms that should be installed along the French coastline.

Two distinct approaches were used to analyse spatial preferences. The first was based on a DCE in which participants were asked to select one of three alternatives, with each scenario corresponding to a combination of distinct attribute levels (Box 2). This choice exercise had to be carried out six times. The second approach was based on a direct ranking of criteria for the location of wind farms, with two stages. Firstly, respondents had to rank the four attributes from 1 (the most important) to 4 (the least important), i.e. an inter-attribute ranking. Secondly, respondents were asked, for each attribute, to rank the three levels proposed from 1 (the most appreciated) to 3 (the least appreciated), i.e. an intra-attribute ranking.

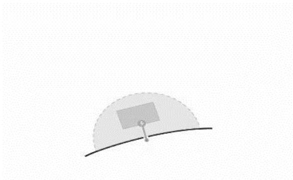
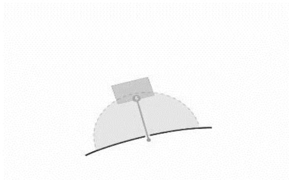
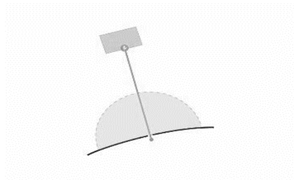
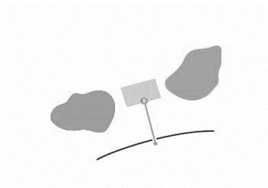
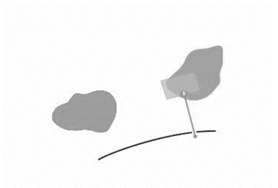
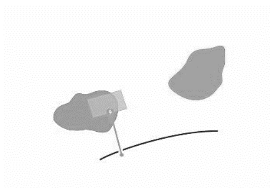
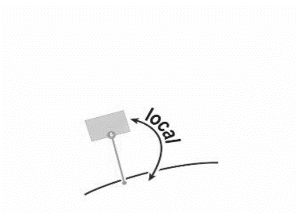
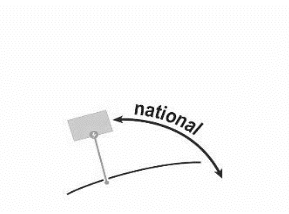
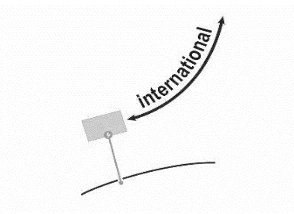
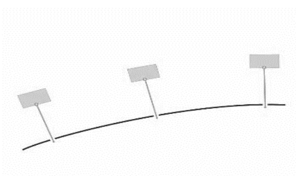
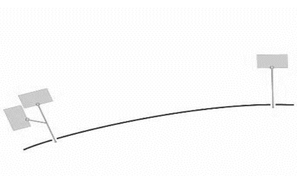
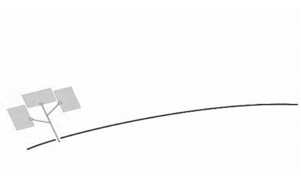
The four attributes were selected based on a literature review (Joalland & Mahieu, 2023). Their description as used in the questionnaire is detailed in Box 2. The first attribute was the distance from the coast at which the wind farms should be installed. Distance will have an impact on visibility from the seashore. It can also influence electricity production and the costs for connecting and installing the wind turbines. The second attribute specified whether the installation would be located outside fishing grounds and/or marine protected areas (i.e., overlapping with other assets). The installation and operation of offshore wind turbines may impact fishing activities in and around offshore wind farms and may also change marine environments. The third attribute was the link to the land. The construction and maintenance of wind turbines will be a source of job creation at local, national or international level. The same applies to the sourcing of materials required for wind farm construction. Lastly, the fourth attribute related to the concentration of wind farms along the coastline. The dispersion of the offshore wind farms, or conversely their concentration within the same area, may have an impact on other activities connected with the sea (water-based recreational activities, for example).

Three levels were proposed for each attribute. For example, the distance from the coast could be low, medium or high. As regards its overlapping with other assets, the wind farm may sit in fishing grounds, marine protected areas or no such areas. The link to the land could be primarily local, primarily national or primarily international. Lastly, the concentration of wind farms along the coastline could be low, medium or high. For each attribute, the choice was made to use a cartographic approach when carrying out the questionnaire to allow respondents to directly visualise the various attribute levels and thereby objectify each of the situations described. Table 1 shows the various pictograms used for the attribute levels.

In the DCE proposed, respondents were invited to choose between different combinations of attributes. More specifically, they were required to choose a scenario (corresponding to a specific combination of four attribute levels illustrated by pictograms) from a series of three. This was done six times. Two sets of 18 scenarios,

6. *https://letg.cnrs.fr/ and https://lemna.univ-nantes.fr/.*
7. *This point was highlighted from the start of the questionnaire. The literature on the consequentiality (Carson & Groves, 2007)that are not (or are not yet suggests that it is important for the quality of the responses that respondents believe that their responses may actually have an impact on any decisions made.*

Table 1 – **Visualisation of attribute levels**

Attributes	Levels		
Distance from coast	 Distance from coast is low	 Distance from coast is medium	 Distance from coast is high
Overlapping installation	 The wind farm is not entitled to overlap fishing grounds or marine protected areas	 The wind farm is entitled to overlap marine protected areas	 The wind farm is entitled to overlap fishing grounds
Link to the land	 The link to the land is mostly local	 The link to the land is mostly national	 The link to the land is mostly international
Concentration of wind farms	 The wind farm concentration along the coastline is low	 The wind farm concentration along the coastline is medium	 The wind farm concentration along the coastline is high

Wind farm · Electrical connection cable · Visibility from the seashore · Fishing ground · Marine protected area

Sources: Authors' illustration.

presented in Box 2, were selected and respondents were randomly presented with one of these two sets. An efficient design approach (Rose & Bliemer, 2009) was used with Ngene software to select the two sets of 18 scenarios that were proposed. This approach consists in using existing information as effectively as possible to increase the accuracy of estimates, based on prior information about the value or sign of the coefficients. Each respondent stated their preferred scenario from among the three offered, without ranking the two unselected scenarios.[8] One of the original features of the survey is that spatial preferences are measured in two distinct ways, either based on a conventional DCE or using a ranking of both attributes (inter) and their levels (intra). The DCE and ranking places were selected randomly so as to remove any contamination bias when carrying out the questionnaire, as DCE responses may influence ranking responses, and vice versa.

The survey was carried out online over the period from 19–28 March 2024 by the company Easypanel, with a target of 2,400 completed questionnaires.[9] Semi-structured interviews and a pre-test with 30 people were carried out in advance in order to ensure that the questions asked were well understood and relevant. The

8. The exercise consisting in ranking all the alternatives (Caparrós et al., 2008) was not used so as to limit the cognitive burden imposed on respondents.

9. Easypanel specialises in market studies carried out online. It uses a panel of over 120,000 members from across mainland France who have stated their willingness to participate in online market studies. Panellists are paid in exchange for their participation in various tasks, one of which is completing online surveys.

sample of 2,400 individuals was created so as to be representative of the French population in terms of age and sex, using a quota method. In total, 3,218 people agreed to respond to the survey and, of those, 2,401 completed the questionnaire in full, giving a complete response rate of 74.6%. The following two restrictions were applied to the complete questionnaires. Firstly, three questionnaires were removed as there was no indication of sex. Secondly, questionnaires from 8 respondents aged under 18 or over 76 were excluded. The final sample consists of 2,390 respondents.

Table 2 shows the main respondent characteristics. There are slightly more women than men

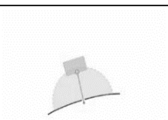
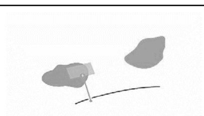
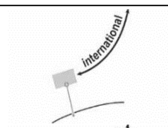
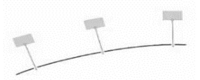
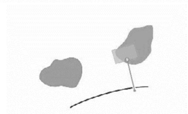
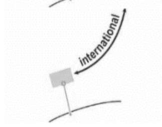
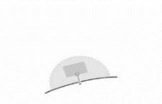
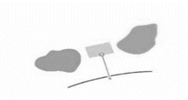
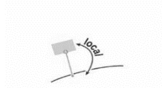
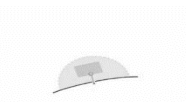
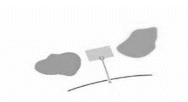
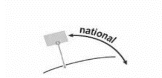
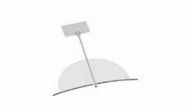
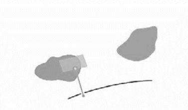
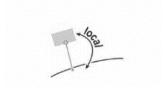
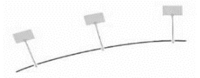
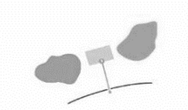
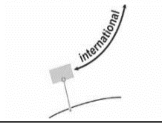
Box 2 – **Description of the Survey**

After a short series of questions on the sociodemographic characteristics of respondents, the questionnaire discusses the installation of the initial offshore wind farm off the coast at Saint-Nazaire and the plan to install 50 wind farms across French coastal regions. It immediately underlines the fact that several questions are to be asked regarding the construction of these future wind farms.

- “At what distance should these wind farms be installed? The distance of these wind farms from the coast will impact their visibility from the seashore. It will also influence electricity production and the costs for connecting and installing the turbines.”
- “Should these wind farms be placed outside of fishing grounds and marine protected areas? The construction of the turbines and their operation may impact fishing activities in and around the wind farms, and may change marine environments.”
- “Where should jobs be located and where should the materials required to build the turbines come from? The location of the jobs created to build and maintain the turbines may be local, national or even international. The same applies to the sourcing of the materials used.”
- “Should the wind farms be concentrated or spread out along the coastline? The concentration of wind farms within one area may have an influence on other activities linked to the sea, such as fishing, or boating or recreational activities.”

The questionnaire then specifies the pictograms. These are shown in Table 1. Immediately after this, the questionnaire specifies (for a proportion of respondents drawn at random, those who see the DCE first) that each respondent will now make a series of six choices: “Each time, there will be a choice of three different options (A, B or C), which describe different rules for the installation of offshore wind farms. Please give your preferred option (A, B or C). The amount of electricity produced is the same for all three options.” All the scenarios presented to the respondents are summarised in Table A.

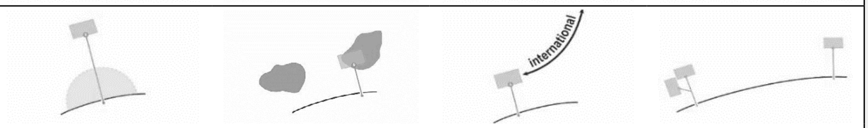
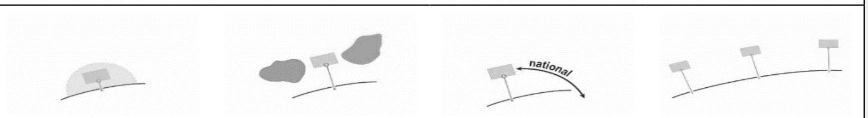
Table A – **The two sets of DCE scenarios**

Block 1		Distance	Overlapping installation	Link to the land	Concentration
Choice 1	A				
	B				
	C				
Choice 2	A				
	B				
	C				

➔

Box 2 – *(contd.)*

Table A – *(contd.)*

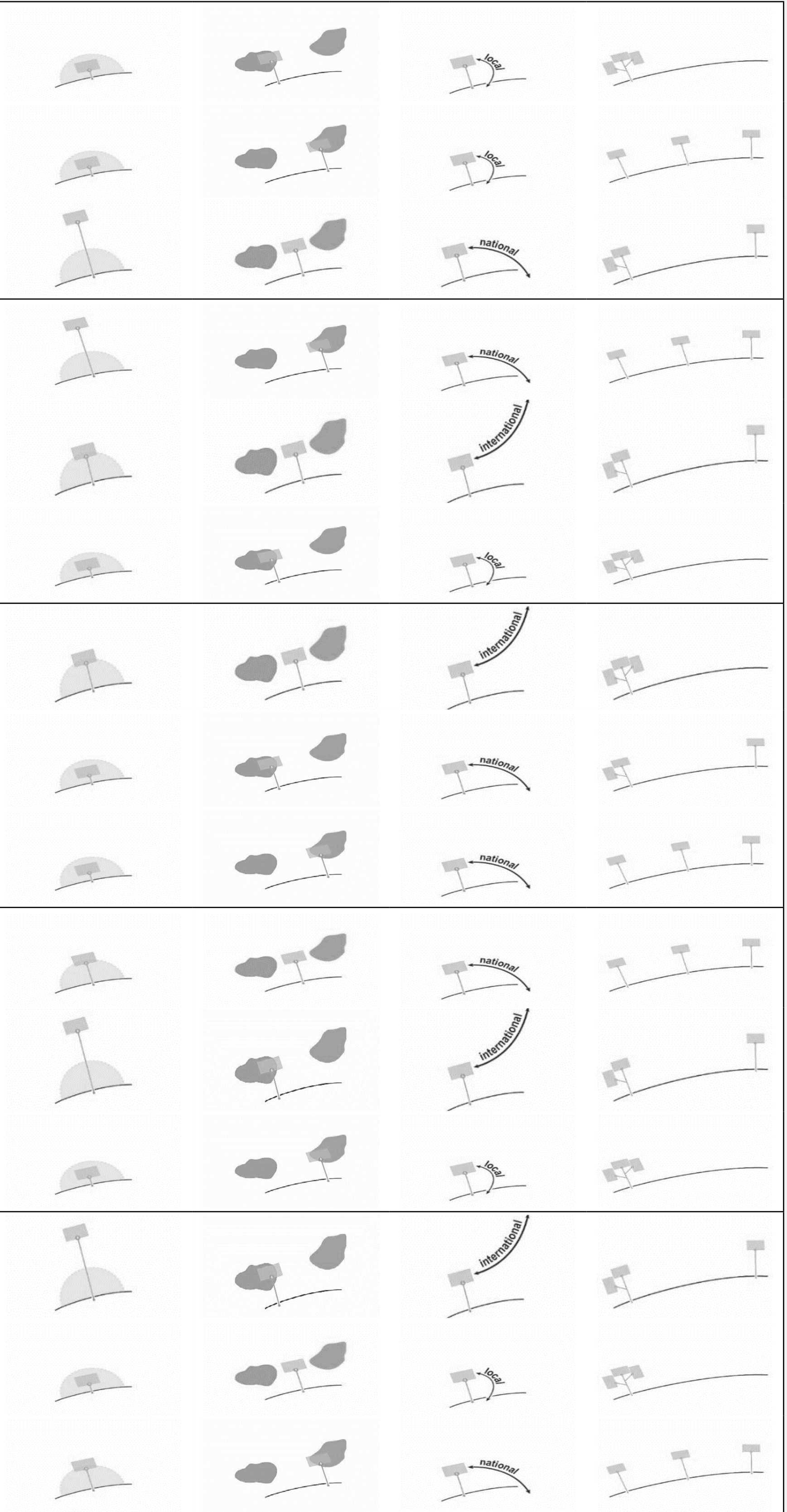
Choice 3	A				
	B				
	C				
Choice 4	A				
	B				
	C				
Choice 5	A				
	B				
	C				
Choice 6	A				
	B				
	C				
Block 2		Distance	Overlapping installation	Link to the land	Concentration
Choice 1	A				
	B				
	C				

➔

Box 2 – *(contd.)*

Table A – *(contd.)*

Choice 2	A
	B
	C
Choice 3	A
	B
	C
Choice 4	A
	B
	C
Choice 5	A
	B
	C
Choice 6	A
	B
	C



Wind farm | Electrical connection cable | Visibility from the seashore | Fishing ground | Marine protected area

Sources: Authors' illustration. A block was assigned randomly to each respondent.

➔

Box 2 – *(contd.)*

The DCE used has two specific features. Firstly, similarly to Kermagoret *et al.* (2016), it was decided that, for this questionnaire, the cost of the programme would not be included in the choice set. For example, it would have been possible to mention an increase in electricity bills by a certain amount following the installation of future wind farms. However, it is very difficult to accurately quantify the costs generated by the installation and operation of wind farms installed off the coast, with expenditure differing depending on the location in question. The lack of reduction in operating costs of wind farms in operation makes the exercise very hypothetical. The counterpart to this lack of cost attribute is that it is not possible to calculate willingness to pay for the different attributes (Hanley *et al.*, 2001). However, it is possible to calculate the disutilities (in case of a negative sign) or the gains (in case of a positive sign) associated with the levels of each attribute.

Secondly, the DCE does not offer a status quo option, such that respondents were not able to choose none of the alternatives proposed in the experiment. In a DCE, the status quo is very often included as an additional option. This makes it possible to assess the relative value of new options compared to a current or future situation in which no supplementary measure is implemented. The inclusion of a status quo option helps us to understand whether the new options are sufficiently attractive to encourage respondents to change their behaviours or choices. The DCE used here assumes that the installation of wind farms is not an objective that can be called into question and that only the location is up for discussion. This allows us to avoid the status quo bias whereby some people have a natural tendency to prefer the status quo even if the alternatives proposed are objectively better. This also reduces the number of uninformative responses. Some participants may systematically choose the status quo if they do not want to take the time and make the effort to assess the different alternatives offered.

Table 2 – **Description of the sample**

Variables		Total	Men	Women
Sex	Male	0.488	1.000	0.000
	Female	0.512	0.000	1.000
Age	18-29 years old	0.172	0.186	0.159
	30-44 years old	0.264	0.262	0.266
	45-59 years old	0.290	0.284	0.296
	60-76 years old	0.274	0.268	0.279
Education	Below *baccalauréat* level	0.215	0.210	0.221
	Baccalauréat	0.241	0.226	0.255
	2 years of higher education	0.219	0.221	0.217
	3 years of higher education	0.136	0.142	0.132
	More than 3 years of higher education	0.188	0.201	0.176
Department	No sea border	0.621	0.634	0.608
	Sea border	0.379	0.366	0.392
Knowledge of wind farms	Very poor	0.315	0.237	0.391
	Poor	0.529	0.549	0.511
	Good	0.155	0.214	0.099
Knowledge of maritime issues	Very poor	0.293	0.215	0.367
	Poor	0.505	0.530	0.482
	Good	0.202	0.255	0.151
Number of observations		2,390	1,166	1,224

Sources: Wind power DCE; authors' calculations.

(51.2% compared with 48.8%). The average age of respondents is 47.5 years old. The proportion of participants aged between 60 and 76 is 27.4%, while those aged 29 and under are the least represented (17.2%). In terms of education, 21.5% of respondents do not have a *baccalauréat* (high-school diploma) and 18.8% have at least one qualification equivalent to a bachelor's degree. The respondents have a relatively remote connection to the sea and the offshore wind farms: 62.1% live in a department that does not border the sea and the majority of participants state that they have low to very low knowledge of both wind farms (84.4%) and maritime issues (79.8%).

3. Rankings of Attributes and Attribute Levels

Respondents were invited to give rankings for the different attributes based on two dimensions. Firstly, they were asked to rank the different attributes (inter level). Secondly, they were asked to rank the attribute levels (intra level).

Table 3 shows the results of the attribute ranking by perceived importance (inter-attribute level), with rankings from 1 for the attribute deemed to be the most important to 4 for the attribute deemed to be the least important. The distance between the wind farms and the coast is the attribute considered to be the most important by the participants, with 43.4% ranking this first. This concern regarding the proximity of the offshore wind farms to the coast is linked to the expected impact on the landscape. The attribute with the second most common first-place ranking is the overlapping installation of turbines with other assets, whether these are fishing grounds or marine protected areas (37.9%). Conversely, the link to the land and concentration are the attributes deemed to be the least important: only 10% of participants rank one or the other of these in the top position: 10.4% for the link to the land and 8.3% for concentration. The roles played by distance and overlapping installation with other assets suggest a certain prioritisation of environmental concerns, although the attribute associated with distance may also refer to considerations of an economic (in particular as costs for installation and operation are higher for more remote wind farms) or landscape-specific nature.[10]

Figure I provides, for each individual characteristic, the rankings given by the respondents. There are some differences, in particular in terms of sex and age. For example, men see distance as a slightly more important issue than women. Distance is ranked first by 46.6% of men compared with 40.4% of women. Participants aged 45 and above also see distance as more important. Distance is the main concern for 60–76-year-olds (in 48.2% of cases), compared with just 33.0% for those aged 18 to 29. Installation overlapping with marine protected areas or fishing grounds is the most important attribute for women (43.4%), 18–29-year-olds (39.3%), 30–44-year-olds (43.9%), and graduates with three years of higher education (42.9%) or more (44.1%). Whatever the individual characteristics, the attributes associated with the link to the land and concentration of offshore wind farms play a secondary role. For these two attributes, the 18–29-year-olds are the group that most often place these in first position.

Each respondent also established a hierarchy of the four attributes. Of the 24 possible combinations, five represent over 50% of the rankings observed (52.6% exactly).[11] The four most common rankings all place either distance or overlapping installation in the first and second positions. There is a real hierarchy among the preferences expressed as the preferred profile was selected 13 times more often by respondents than the least valued profile. It is also possible to draw up a typical respondent profile based on the ranking provided. The most common ranking (overlapping installation, distance, link to the land, and concentration) is characterised by an overrepresentation of women and higher-education graduates. Conversely, for the second most common ranking, which has distance in first place, respondents are, on average, older (49.5 years old compared with 47.5 years old across the entire sample), are more likely to live in departments that border the sea, and state that they have a better level of understanding of wind farms.

Respondents were also invited to rank the different attribute levels (intra-attribute level). These rankings are independent in the sense that each respondent is required to provide an attribute-by-attribute ranking, without being

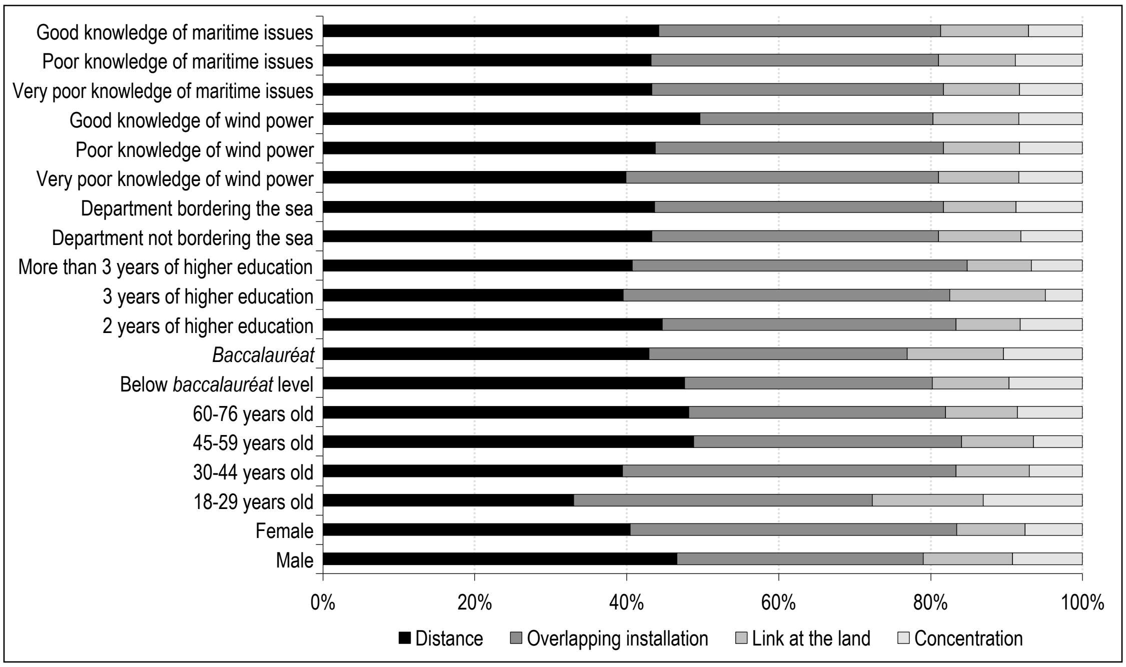
10. The landscape issue is also linked to economic concerns. For example, high visibility of wind farms from the coast may lead to losses in property value (Skenteris et al., 2019).
11. The results are shown in Table S1 of the Online Appendix.

Table 3 – **Ranking of attributes (by order of importance) for wind farms**

Ranking	Distance	Overlapping installation	Link to the land	Concentration
1 (the most important)	0.434	0.379	0.104	0.083
2	0.289	0.291	0.238	0.182
3	0.155	0.208	0.299	0.338
4 (the least important)	0.122	0.122	0.359	0.397
Observations	2,390	2,390	2,390	2,390

Sources: Wind power DCE; authors' calculations.

Figure I – **Preferred attributes and respondent characteristics**



Sources: Wind power DCE; authors' calculations.

shown the specific levels associated with the other attributes, as is the case for a DCE. The results are shown in Figure II.

In the case of distance, a high distance is preferred by respondents with 58.1% ranking this level first. The lowest distance was ranked in third place by 58.6% of respondents. Preferences converge strongly for the attribute associated with overlapping installation. A large majority of respondents rank the level of installation with no overlapping with other assets in first place (71.1%). Installation overlapping with a marine protected area is the lowest ranked attribute level (third) by 47.1% of respondents. The local dimension of the link to the land is the level ranked first by 57.7% of respondents, while 73.5% rank the international dimension in third place. Lastly, the rankings for the concentration attribute are heterogeneous. While the low concentration level is ranked first by 42.6% of respondents, conversely, 39.5% prefer a high concentration of wind farms.

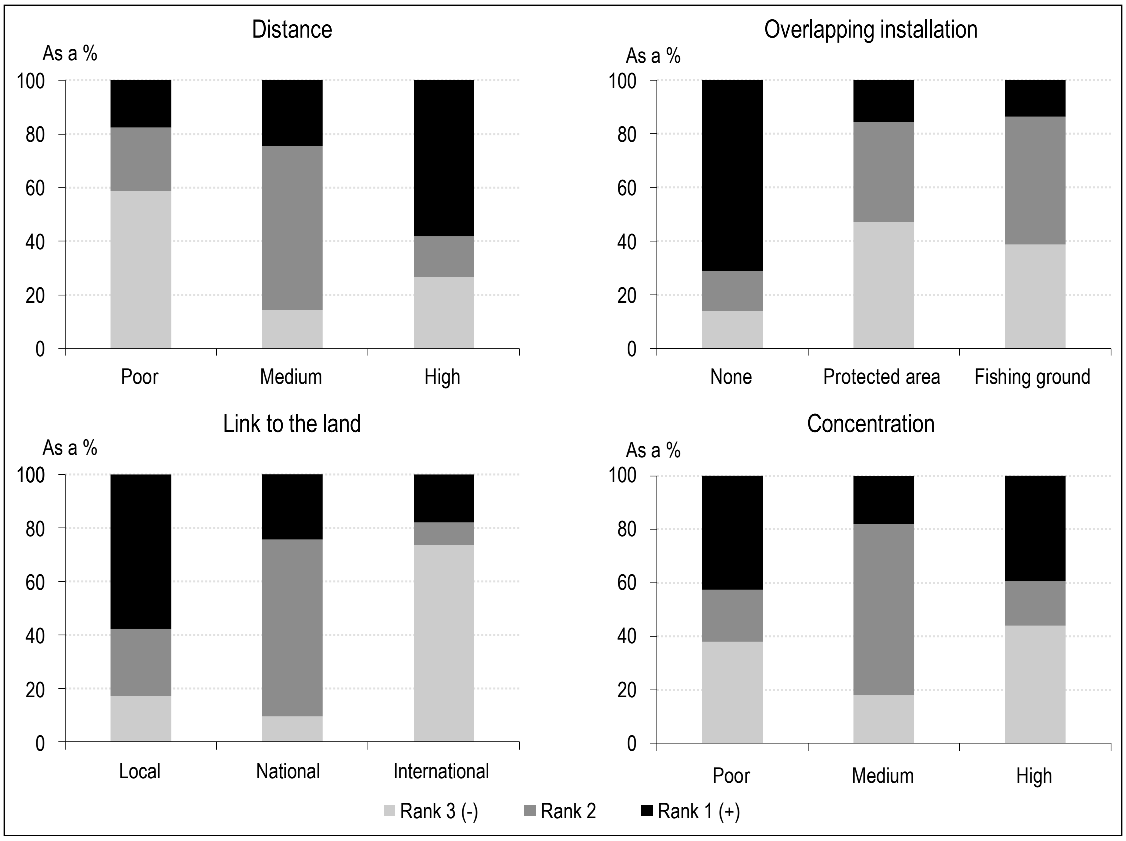
It is of interest to look at the most frequently observed rankings for the three attribute levels and the typical respondent profile associated with each attribute.[12] In almost half of cases (48.2%), the preferred ranking for the distance attribute has high (far from coast) in first place, followed by medium, and lastly low (close to coast). These respondents are more likely to be women (57.0% compared with 51.2%) and are older than the average (49.7 years old compared with 47.5 years old). The second most common ranking has the medium level in first place for distance. For the second and third rankings, the high distance level (far from coast) is in last place. In 71.1% of cases, no overlapping with other assets is the preferred level for the two most frequently observed rankings.

Conversely, preferences between fishing grounds and marine protected areas are relatively mixed. Over half of respondents (54.0%) rank the alternatives for the link to the land attribute in the same way, with a local link first, followed by national and then international. For this attribute, the people who give this ranking are most often women and a little older than the average. Lastly, the two most frequent rankings for wind farm concentration have low concentration in first place (followed by medium and then high), or high concentration in first place (followed by medium and then low). The choice made varies depending on the location of the respondents, with those living in departments bordering the sea having a greater preference for a low concentration of offshore wind farms.

As information on the ranking of attribute levels is collected, it is possible to determine the preferred wind farm combination of each individual using the level for each attribute that is ranked first. The data show a high level of

12. *The results are shown in Table S2 of the Online Appendix.*

Figure II – **Ranking of attribute levels**



Sources: Wind power DCE; authors' calculations.

heterogeneity in the preferred arrangements for the wind farms. Among the 81 possible scenarios, the first 10 reported in Table 4 make up just 51.9% of all cases. The most frequently cited scenario (13.6%) is characterised by a high distance from the coast, no overlapping with other assets, a local link to the land, and a high concentration of offshore wind farms. The second most frequent scenario (12.9% of cases) is identical to the first for three of the four attributes, differing only by a low concentration of offshore wind farms. Conversely, the third scenario, with a shorter distance from the coast, was chosen by less than 5% of participants. None of the first 10 scenarios involves overlapping installation with other assets (marine protected areas or fishing grounds).

It is also possible to look at the extent to which the preferred scenarios vary by sex, age category and whether or not the department of residence borders the sea (Table 5). Two main results emerge. Firstly, the proportion of respondents reporting the same preferred scenario based on the rankings of the attribute levels remains low, varying between 11.9% for men and 15.3% for women. Secondly, the preferred scenario always combines the same three attribute levels for distance (high), overlapping installation (no overlapping with other assets) and link to the land (local). Only the concentration attribute shows variability. While the highest concentration predominates among both men and women, and among the under 40s, the lowest concentration features, conversely, in the most frequently observed ranking for the over 40s. People living in a department that borders the sea rank a scenario involving a high concentration first.

4. Factors Determining Inter- and Intra-Attribute Preferences

In the survey, some respondents are invited to rank attributes (inter dimension) or their levels (intra dimension). While this allows us to understand, by definition, the attribute (inter) or their levels (intra) that are preferred by respondents, we opted to explain the rank given for each attribute or their levels using a rank-ordered logit model (Allison & Christakis, 1994). This constitutes an extension of the standard ordered logit model. It is based on a random utility model whereby respondents are faced with a series of choices composed of J attributes (inter) or attribute levels (intra).

Table 4 – **Preferred scenarios based on rankings of attribute levels**

Rank	Prop. (%)	Distance	Overlapping installation	Link to the land	Concentration
1	13.6				
2	12.9				
3	4.9				
4	4.4				
5	4.0				
6	3.4				
7	3.3				
8	2.8				
9	2.6				
10	2.4				

Wind farm Electrical connection cable Visibility from the seashore Fishing ground Marine protected area

Reading note: The scenario with "a high distance from the coast, no overlapping installation, a local link to the land and a high concentration" is preferred by 13.6% of respondents.
Sources: Wind power DCE; authors' calculations.

Each respondent ranks the attributes or their levels based on associated utility levels. The utility is assumed to be the sum of a deterministic component and a residual random component, the different residuals being assumed to be independent and identically distributed based on a type I extreme value distribution. The deterministic component may include variables describing the attributes (inter) or levels (intra) as well as variables for interactions between the respondent characteristics (for example, their sex and age) and the factors relating to the attribute levels. Conversely, as the sociodemographic characteristics of a given respondent are unchanging for the different attributes or attribute levels, the coefficients associated with these variables are not identified. The likelihood of the rank-ordered logit model is equivalent to the likelihood resulting from a series of sequential choices in which each respondent indicates their preferred attribute or attribute levels

Table 5 – **Preferred scenarios by respondent characteristics**

Variables	Prop. (%)	Distance	Overlapping installation	Link to the land	Concentration
Men	11.9				
Women	15.3				
Age: 18-29 years old	11.2				
Age: 30-44 years old	14.7				
Age: 45-59 years old	14.1				
Age: 60-76 years old	14.8				
Department: No sea border	13.2				
Department: Sea border	14.7				

Wind farm; Electrical connection cable; Visibility from the seashore; Fishing ground; Marine protected area

Reading note: Among men, the preferred scenario, chosen by 11.9%, consists of "a high distance from the coast, no overlapping installation, a local link to the land and a high concentration".
Sources: Wind power DCE; authors' calculations.

from among all remaining attributes or attribute levels.[13]

The inter-attribute dimension is examined initially. In the first regression, only indicator variables corresponding to each attribute are taken into consideration, with the reference attribute being distance. The results presented in Table 6 show that the three attributes relating to overlapping installation, link to the land and concentration of wind farms all have a significantly lower probability of being ranked at the top than distance. The marginal effects, however, differ depending on the attribute as the coefficients obtained for the link to the land and concentration of wind farms are much higher in terms of absolute value (around 1 compared with 0.1 for overlapping installation). The attribute measuring concentration is ranked lowest: a Wald test indicates that the coefficients associated with the link to the land and concentration differ significantly from one another (with a statistical value equal to 8.84 for the test, p = 0.003).

Terms for the interaction between attributes and individual characteristics were then added as explanatory variables.[14] Compared with distance (the reference attribute), the overlapping installation attribute is given a higher rank by women and people with higher levels of education, while those aged 45–76 afford this attribute relatively less importance. The same applies

13. Respondents firstly choose their preferred attribute or alternative from among the series of J possible attributes or alternatives, then they choose their second favourite attribute or alternative from among the J-1 attributes or alternatives still possible, and so on.
14. The results are shown in panel B of Table S3 of the Online Appendix.

Table 6 – **Factors explaining the ordered ranking of attribute levels (inter)**

Variables	Attributes		
	Overlapping installation	Link to the land	Concentration
Attribute (*Ref.*: distance)	−0.112*** (0.040)	−0.973*** (0.042)	−1.074*** (0.040)
Observations (respondents)	9,560 (2,390)		
Log pseudolikelihood	−6,958.3		

Notes: The coefficients are obtained by estimating rank-ordered logit models, with the calculation of the robust standard errors given in brackets. The significance thresholds are 1% (***), 5% (**) and 10% (*).
Sources: Wind power DCE; authors' calculations.

for respondents stating that they have a good level of knowledge of wind power. In the case of the link to the land and concentration, age is the key factor in the differences in preferences. The rank given to the link to the land is higher for the youngest people, while those aged 45–76 are less sensitive to this attribute. The latter age group also gives a lower rank to the concentration of wind farms than those aged 18–30.

Secondly, rank-ordered logit models are estimated to explain the preferences relating to the different levels for each attribute (intra dimension). It is assumed that the rankings given for each level are independent from the other levels. The results are presented for each attribute in Table 7. For distance from the coast, the probability of a high ranking increases very significantly for medium distances and even more so for high distances (panel A1). The attribute level of no overlapping installation is very clearly the preferred option when it comes to any possible overlapping with other assets (panel A2). The attribute level that contributes most negatively to the final ranking is the installation of an offshore wind farm within a

Table 7 – **Factors explaining the ordered ranking of attribute levels (intra)**

Variables	Alternatives		
Panel A1: Distance attribute			
	Low	Medium	High
Alternatives	*Ref.*	0.801*** (0.032)	0.999*** (0.053)
Observations (respondents)	7,170 (2,390)		
Log pseudolikelihood	−3,938.0		
Panel A2: Overlapping installation attribute			
	None	Protected area	Fishing ground
Alternatives	*Ref.*	−1.319*** (0.051)	−1.180*** (0.047)
Observations (respondents)	7,170 (2,390)		
Log pseudolikelihood	−3,711.6		
Panel A3: Link to the land attribute			
	Local	National	International
Alternatives	*Ref.*	−0.325*** (0.036)	−1.630*** (0.060)
Observations (respondents)	7,170 (2,390)		
Log pseudolikelihood	−3,513.8		
Panel A4: Concentration attribute			
	Low	Medium	High
Alternatives	*Ref.*	0.105*** (0.033)	−0.147*** (0.051)
Observations (respondents)	7,170 (2,390)		
Log pseudolikelihood	−4,259.2		

Notes: The coefficients are obtained by estimating rank-ordered logit models, with the calculation of the robust standard errors given in brackets. The significance thresholds are 1% (***), 5% (**) and 10% (*).
Sources: Wind power DCE; authors' calculations.

marine protected area, with the two levels linked to marine protected areas and fishing grounds differing significantly ($chi^2 = 15.5$ and $p = 0.001$).

There are also very significant differences between the three levels associated with the link to the land attribute. Here, the national and, in particular, international dimensions reduce the probability of the link to the land attribute being at the top of the ranking (panel A3). The situation is more varied for the attribute associated with wind farm concentration. When compared with a low concentration level, the probability of a better ranking increases as concentration rises to medium but, conversely, falls when concentration is high (panel A4). This can be explained by the fact that medium concentration is very often placed in second place by respondents (in over 60% of cases), who are more likely to rank low or high concentration in first place.

For each attribute, it is also possible to look at the influence of the individual characteristics by adding interaction terms combining these characteristics with the different levels of the attribute in question. Several interesting results emerge from the estimated regressions.[15] In terms of distance, the ranking positively correlates with the medium and high levels for women. Age effects appear very clearly, with, for example, those aged 45–59 and, especially, those aged 60 and over exhibiting a much stronger preference for high distances. This is also the case for those with higher levels of education, holding at least a bachelor's degree. Conversely, participation in the maritime planning debate correlates negatively with the likelihood of giving a high rank to medium or high distances. Very few individual characteristics influence the ranks given for the levels associated with overlapping installation. Women give lower rankings than men to both the national and international dimensions. The probability of a high rank for the international dimension decreases sharply across the different age categories.

5. Rank Order Versus Preferred Choices

As part of the DCE, respondents were invited to choose between different combinations of attribute levels. Each respondent stated their preferred scenario from among the three offered, without ranking the two unselected scenarios.[16] The data collected make it possible to create a panel at individual level as each person made six individual choices from three scenarios in each case. The variable to be explained is therefore the probability that scenario j is chosen by respondent i. The specification used is a conditional logit model known as McFadden's choice model (McFadden, 1974). This model supposes that each respondent chooses the scenario that maximises their utility from among the three offered. The utility U_{ij} of scenario j for individual i includes a deterministic part, modelled as a linear function of the alternatives for each attribute and the characteristics of the individuals, and a random disturbance. While this model is characterised by its simplicity and ease of interpretation, it does, nevertheless, assume that respondents' preferences are homogeneous.[17]

The results of the conditional logit model for the DCE are presented in Table 8. The respondent characteristics are not taken into consideration in the estimated regression, but their inclusion has no particular impact on the coefficients for the attribute levels, as shown in Table S8 of the Online Appendix. The interpretation of the results is based on odds ratios, which correspond to the exponentials of the coefficients estimated and are presented in Table S9 of the Online Appendix.

Compared with a low distance from the coast, the probability that the scenario is chosen is 1.43 times higher when characterised by a medium distance, and 1.75 times higher for a high distance. The distance level is therefore a highly distinguishing factor in respondents' decisions. In the case of overlapping installation with another asset, the likelihood that a scenario is chosen falls by around 45% where that asset is a marine protected area or a fishing ground. Furthermore, it is not possible to reject the assumption that the coefficients obtained for these two types of area are identical (the statistical value for the associated test is 0.56, $p = 0.456$). Clearly, these are the most significant marginal effects associated with these two attributes (distance and overlapping installation). By way of comparison, the likelihood that a given scenario is chosen falls by 10.8% where this scenario includes a national dimension and by 28.8% where the link to the land is international. Lastly, respondents exhibit a preference for a low concentration of wind farms across the territory. The probability that a scenario is chosen falls by 13.7% where the concentration of wind

15. The results of the regressions are presented in Tables S4, S5, S6 and S7 of the Online Appendix.
16. The exercise consisting in ranking all the alternatives (Caparrós et al., 2008) was not used so as to limit the cognitive burden imposed on respondents.
17. For a formalised presentation of the conditional logit model applied to the DCE, see the report written by Hauber et al. *(2016). It is also possible to estimate more complex models by taking into consideration the heterogeneity of respondent preferences. Estimating a mixed logit model with random parameters leads to similar results as those presented in this article.*

Table 8 – **Effect of alternatives on preferred scenarios (DCE)**

Variables	Modalities		
Distance attribute	Poor	Medium	High
	Ref.	0.361***	0.560***
		(0.037)	(0.051)
Overlapping installation attribute	None	Protected area	Fishing ground
	Ref.	−0.606***	−0.638***
		(0.039)	(0.049)
Link to the land attribute	Local	National	International
	Ref.	−0.115***	−0.339***
		(0.031)	(0.044)
Concentration attribute	Poor	Medium	High
	Ref.	−0.148***	−0.114***
		(0.028)	(0.040)
Observations (respondents)	43,020 (2,390)		
Log pseudolikelihood	−15,440.8		

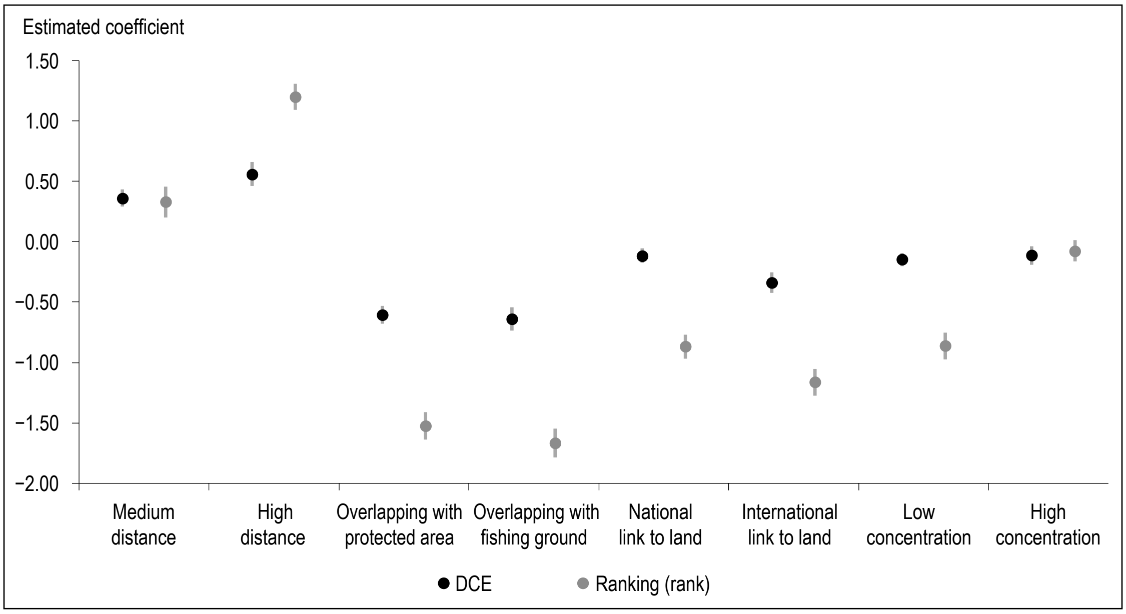
Notes: The coefficients are obtained by estimating a McFadden's choice model, with the calculation of the robust standard errors given in brackets. The significance thresholds are 1% (***), 5% (**) and 10% (*). The coefficients associated with the constants are not given.
Sources: Wind power DCE; authors' calculations.

farms is medium and by 10.8% in the case of high concentration.

The survey allows us to compare the preferences expressed for the various attributes based on the DCE, in which each respondent chooses one scenario, against those expressed through ordered rankings for each attribute. Starting from these rankings, a binary variable created for each attribute indicates the choice preferred by the respondent (awarding of rank 1). This approach enables us to understand the preferred scenario in terms of levels for the four attributes from among the 81 possible scenarios, where the DCE specifies six preferred scenarios from among 18 offered (in groups of three). It is therefore possible to reconstruct a complete factorial design based on rankings by criteria, such that each person would choose a single scenario from a possible 81.[18] Here, the compar-

18. *One difference, however, is derived from the fact that, in a complete factorial design for a DCE, each respondent visualises the alternatives associated with the other attributes for each scenario. The reconstruction used here is based, conversely, on an assumption of attribute independence.*

Figure III – **Comparison of preferences: DCE versus ranking**



Notes: The reported coefficients are obtained by estimating the McFadden's choice models, estimated based on the DCE and the preferred choice constructed based on rankings of alternatives per attribute. The 95% confidence intervals are established using robust standard errors.
Sources: Wind power DCE; authors' calculations.

ison relates to the results of two McFadden's choice models: on the one hand, that given in Table 8 and corresponding to the DCE; and on the other hand, a conditional logistic regression explaining the preferred scenario from among all possible scenarios (constructed based on rankings of levels per attribute).

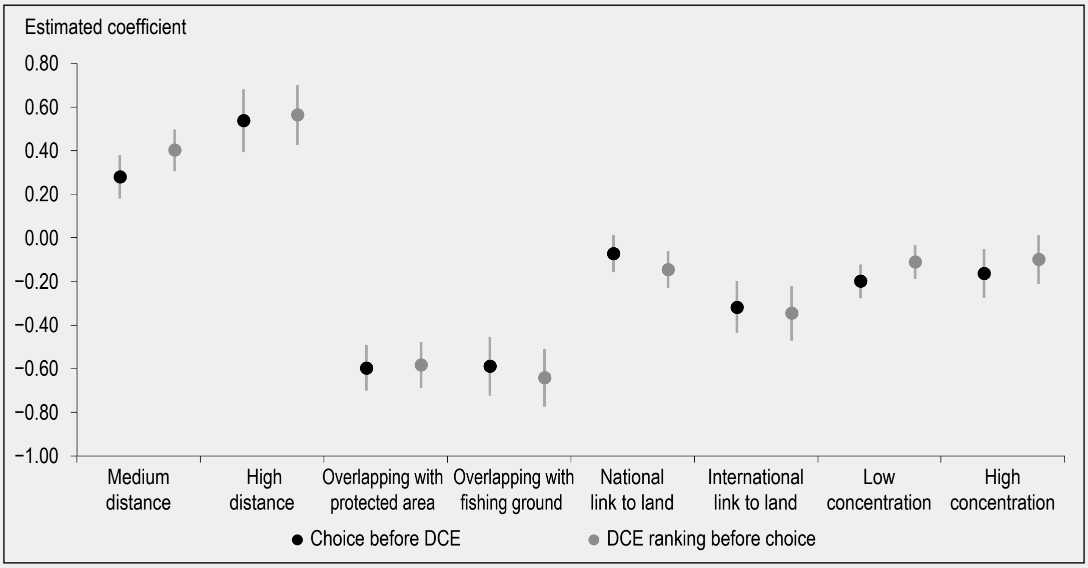
Figure III shows the coefficients estimated in the two cases, along with the associated confidence intervals. On the one hand, the preferences for the attribute levels are similar for the two approaches, DCE and ranking (the estimated coefficients have the same sign). Respondents prefer high distances, no overlapping installation, a local link to the land and a low concentration. On the other hand, there are some relatively significant differences between the estimated coefficients. For example, the preference for a high distance emerges much more clearly in the ranking-based approach than in the DCE approach. The effects associated with an overlapping installation are also much stronger (in terms of absolute value) with the rankings (for both marine protected areas and fishing grounds) and the same can be said for the national and international levels associated with the link to the land. One explanation for the much higher coefficients associated with a high distance and potential overlapping installations where the approach prioritises rankings by attribute (intra dimension) may result from the fact that distance and overlapping installation are the attributes ranked first and second when respondents are invited to rank the different attributes (inter dimension). Box 3 shows that the results obtained are not affected by the order of the rankings of the attributes and their levels and the DCE in the survey.

Box 3 – **Positioning of the DCE and Ranking Exercises within the Questionnaire**

The existence of two distinct ways of measuring spatial preferences, namely the DCE and the ranking of attributes and their levels, raises the question of whether one method may potentially contaminate the other. This dimension can be studied given the random order of the DCE and ranking exercises in the questionnaire.

Figure A shows that the randomly chosen order (DCE then ranking, or ranking then DCE) has no influence on the preferences expressed during the DCE. In a conditional logit model supplemented with variables bringing together the alternatives and the place of the DCE within the survey, none of the interaction terms is significant. The Chi-squared value associated with the test of nullity of all the interaction terms is 5.49 (p = 0.483). Another way of taking into consideration any potential contamination is to include only responses from the first exercise (DCE or inter- and intra-attribute ranking) carried out by each individual in the statistical analysis. In this way, it would be as though each individual had conducted just one exercise, either the DCE or the inter- and intra-attribute ranking. The responses to the first exercise could then be compared between the two groups (those completing the DCE first and those giving the ranking first). This does not affect the results obtained.

Figure A – **Effect of the order in which the DCE is carried out on the preferred scenarios (DCE)**



Notes: The reported coefficients are obtained by estimating the McFadden's choice models, estimated using sub-groups (choice before DCE ranking, DCE ranking before choice). The 95% confidence intervals are established using robust standard errors.
Sources: Wind power DCE; authors' calculations.

6. Beyond the Attributes, What Is the Appetite for Offshore Wind Farms?

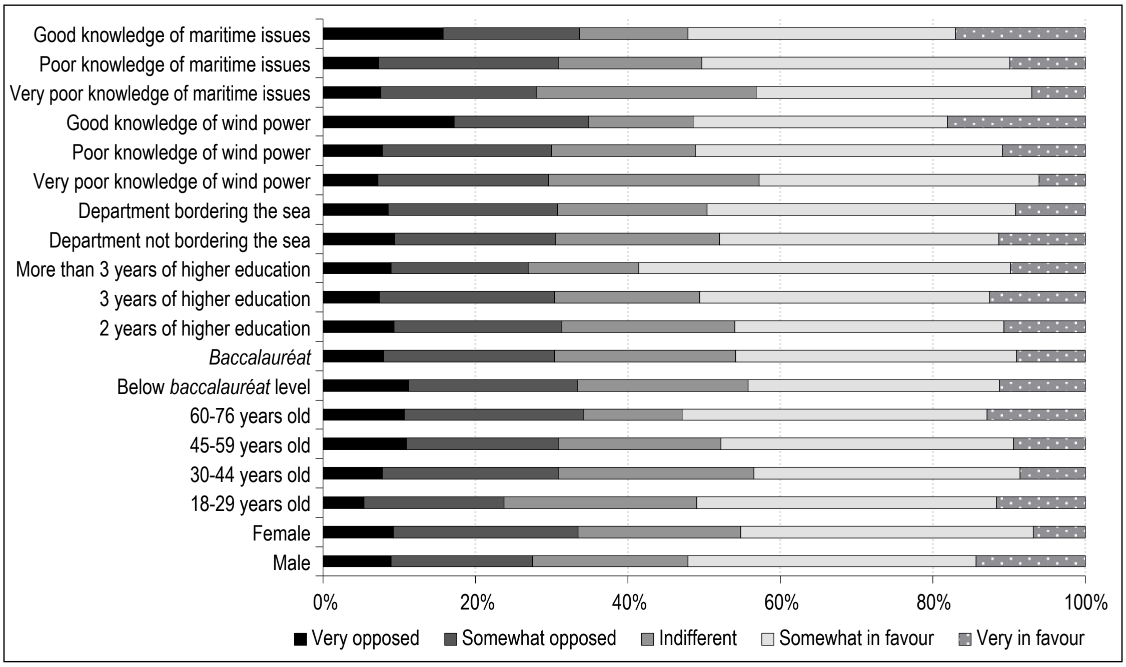
Finally, the lessons to be learned from this study on spatial preferences for wind farms are very clear. Respondents want wind farms to be situated at such a distance that they are no longer visible from the coast and do not interfere with assets already present in the area, such as marine protected areas or fishing grounds. They are also against offshore wind farms with a remote link to the land, at national and, in particular, international level, and tend to favour a scenario in which there is a low concentration of offshore wind farms. Preferences are mixed when it comes to this latter attribute, with almost identical proportions of respondents placing low and high wind farm concentration in first place. These lessons are important to policymakers who will be required to make decisions regarding the locations of future wind farms that the executive powers have planned to install.

By asking respondents to make choices or give rankings, albeit hypothetically, this study assumes that those respondents have a certain level of interest in the construction of future wind farms, of which 50 are planned. The possibility of a status quo, which could, for example, be a situation in which no new wind farms or fewer than the planned target of 50 are installed, was not mentioned at any point in the questionnaire where respondents were invited to give their preferred scenarios in the DCE and the rankings for the attributes and their levels. At the very end of the questionnaire, two follow-up questions allowed respondents to provide more information on their attitudes towards the construction of the planned wind farms, irrespective of their preferred attributes.

Firstly, each respondent specified the extent to which they were (or were not) in favour of the establishment of 50 wind farms along the French coastline by 2050. There were five possible responses, ranging from "very opposed" to "very in favour". The responses are widely divergent. Although almost half of respondents said they were "somewhat in favour" (38.1%) or "very in favour" (10.5%) of the planned installation of 50 wind farms, 21.5% of respondents stated they were "somewhat opposed" and 9.1% were "very opposed" (with 20.8% indifferent).

Secondly, respondents had the option to state the number of wind farms they would want to see installed along the French coastline if they had the choice. Here, too, responses showed very moderate support for the target of 50 wind farms. Only 13.9% stated they were in favour of installing at least 50 wind farms, while 39.9% mentioned a target of between 17 and 49 wind farms. The responses to these two questions are also very consistent among themselves. Among respondents who are very or somewhat opposed to the installation of 50 wind farms, around 3% of respondents stated they were in favour of installing at least 50 wind farms (this proportion

Figure IV – **Support for the construction of 50 wind farms**



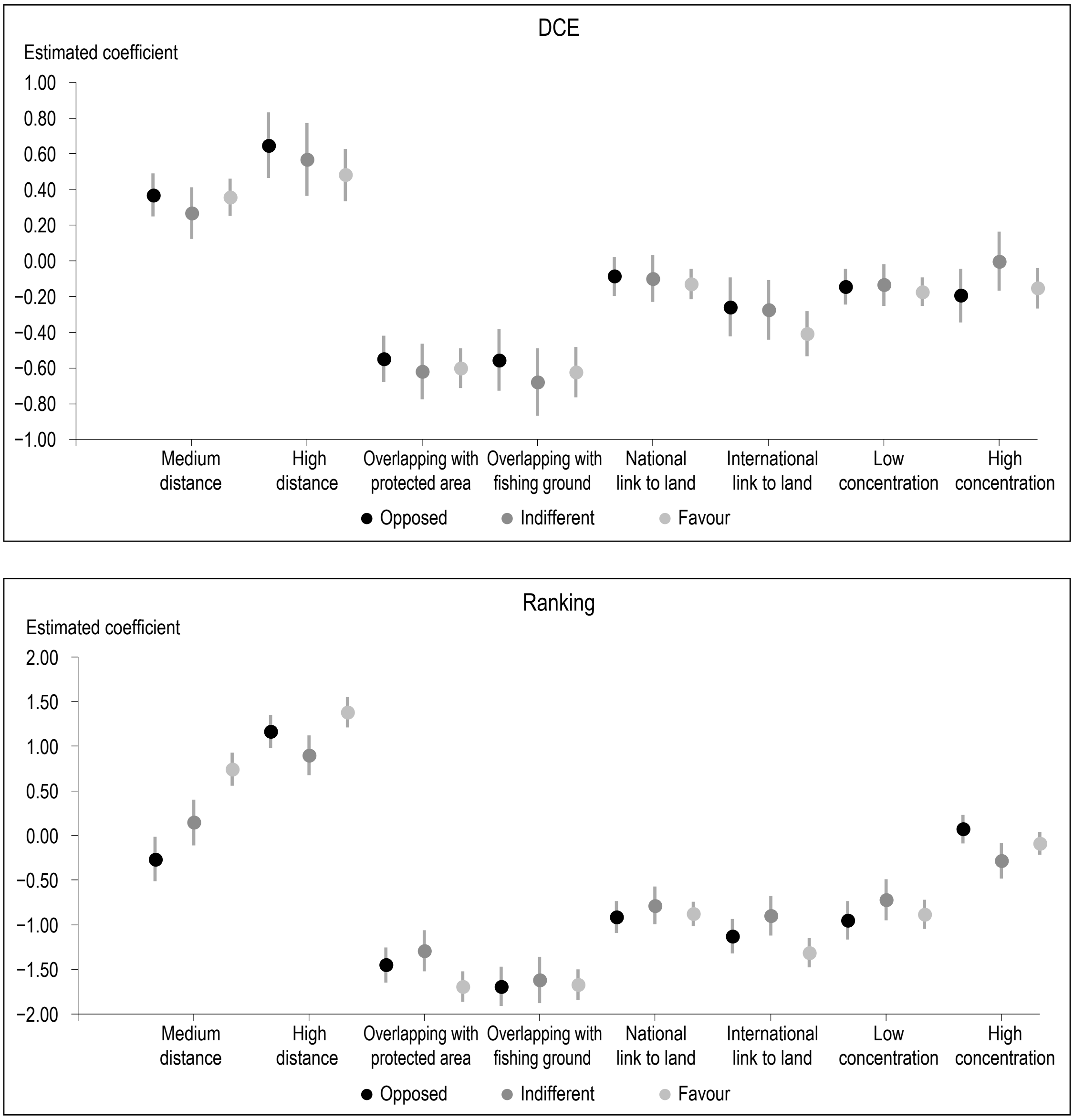
Sources: Wind power DCE; authors' calculations.

is 14.6% for somewhat favourable responses and 53.4% for very favourable responses).

The individual characteristics are clearly correlated with higher or lower support for the project to construct 50 wind farms. Figure IV once again highlights the role played by the sex and age of respondents as influencing factors. Firstly, the proportion of people who are somewhat or very opposed is significantly higher among women than men (33.5% compared with 27.5%), with a higher number of the latter very in favour of the project (14.3% compared with 6.9%). Secondly, young people aged between 18 and 30 are the least opposed to the project (23.7%) and those aged between 60 and 76 are the most opposed (34.2%). The proportion of people who state they are somewhat in favour is much higher for those with a qualification above bachelor's level. Lastly, having a good knowledge of wind power plays a divisive role: among these respondents, while the proportion who are indifferent to the construction of 50 wind farms is very low (13.7%), this group also has the highest number of respondents who are very opposed to wind farms (17.3%) and very in favour (18.1%).

The measured level of support for the objective of constructing 50 wind farms along the coastline may, ultimately, lead us to reflect on the quality of the responses in terms of the choice

Figure V – **Support for the construction of 50 wind farms and preferences for attribute alternatives**



Notes: The reported coefficients are obtained by estimating the McFadden's choice models, estimated based on the DCE and the preferred choice constructed based on rankings of alternatives per attribute. The 95% confidence intervals are established using robust standard errors.
Sources: Wind power DCE; authors' calculations.

and ranking exercises. If respondents show a level of indifference to the installation of wind farms, they should give little importance to the different attributes and their levels and, therefore, give random responses, as they do not feel fully involved in the questionnaire. This possibility, however, does not seem very credible as it broadly contradicts the results discussed above, which highlighted clear choices in terms of the attributes and their levels. It is still interesting to know whether, depending on their support for the construction project, respondents expressed different preferences for the attributes and their modalities.

Figure V shows the preferences for the attribute levels obtained from the DCE and the ranking-based approach, with respondents classified by whether they are opposed to, indifferent to or in favour of the planned construction of 50 wind farms. The results are, on the whole, very consistent. Firstly, for the DCE, at no point is there any deviation for the estimated coefficients for the different attribute levels based on the level of support for the planned installation. Secondly, the coefficients associated with the preferred choice differ, essentially, for the distance attribute. Whether they are in favour of or opposed to the planned installation, respondents have a very strong preference for a large distance from the coast. Conversely, only those in favour are also more in favour of an intermediate distance. Ultimately, the breakdown by degree of support tends to confirm the secondary roles of the attributes of link to the land and concentration (as compared with distance and overlapping installation), for which none of the levels stands out significantly (national link for those opposed or indifferent with the DCE approach, high concentration for those opposed or in favour with the ranking-based approach).

* *
*

In conclusion, this study reveals several lessons of interest to the CNDP, which is responsible for organising the debate on the sea and, as part of this, offshore wind development.[19] Respondents have a clear preference for offshore wind farms being far from the coast and not interfering with marine protected areas or fishing grounds. Conversely, their choices are less pronounced when it comes to the concentration of these offshore wind farms within the maritime space. Acceptance of the planned installation of these wind farms remains a key issue. It appears to be relatively low, with almost 30% of respondents stating that they are somewhat or very opposed to this expansion of offshore wind power. This reticence does not, however, negate the quality of the responses regarding preferences for wind farm attributes and their associated attribute levels.

While this study provides valuable information that allows us to guide future decisions regarding the installation of wind farms in France, it also highlights the diversity of opinions in the planning of wind power projects. The main limit to this work is that it has been conducted at aggregate level across all regions, without taking into consideration their distance from the ongoing projects. It would be interesting to study whether individuals who live relatively close to ongoing projects respond in the same way as others who live near the coast or even the rest of the French population. Likewise, it could be interesting to look at whether preferences diverge depending on coastal area, as it could be appropriate to propose rules for the installation of wind turbines that take into consideration the preferences of those who live in the vicinity. □

19. Some of the results linked to this research are included in the CNDP report here: https://www.debatpublic.fr/sites/default/files/2024-06/DSF-Compte-rendu.pdf

Link to the Online Appendix:
www.insee.fr/en/statistiques/fichier/8562080/ES545_Wolff-et-al_OnlineAppendix.pdf

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