Renewable and Sustainable Energy Reviews 226 (2026) 116451

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Winds of change: Surfing prospects for offshore wind energy in coastal Spain (Cádiz)

Belén Pérez-Pérez [a,*], Francisco Javier Rodríguez-Segura [b], Juan Carlos Osorio-Aravena [a], Pilar Díaz-Cuevas [c], Marina Frolova [a]

[a] University of Granada, Spain
[b] University of Cantabria, Spain
[c] University of Sevilla, Spain

A R T I C L E I N F O

Keywords:
Social perception
Seascape
Public opinion
Traditional activities
Wind power

A B S T R A C T

To accelerate the energy transition, Europe has adopted a strategy for deploy renewable energy onshore and offshore; however, in Spain, offshore wind energy has faced significant deployment challenges. This study aims to analyse whether public perception of offshore wind energy in the coastal areas of Tarifa and La Janda Litoral (Cádiz, Spain) has changed over the past decade. It also examines whether perceived impacts on local socio-economic activities have influenced acceptance levels of that technology. The majority of respondents did not express a clear rejection or acceptance of offshore wind energy, with neutral or undecided responses accounting for 52 % of the sample in 2013 and 48 % in 2023. Nevertheless, the overall perception of this energy source improved over the decade: the proportion of positive responses rose from 24 % in 2013 to 33 % in 2023. Furthermore, most of the arguments against offshore wind energy projects weakened between 2013 and 2023. For example, the share of respondents who considered these projects incompatible with traditional uses of the sea fell from 46 % to 28 %, indicating a growing consensus on the possibility of reconciling offshore wind development with existing maritime activities. The study also highlights discrepancies between the views of local residents and those of stakeholders and media reports. Therefore, bottom-up strategies that involve the population from the earliest stages of planning can be key to achieving European energy policy goals.

1. Introduction

Challenges related to energy supply and the impacts of climate change from fossil fuels have prompted a shift toward localised energy production as a transitional solution. Europe's strategy emphasizes deploying renewable energy systems both onshore and offshore to reduce greenhouse gas emissions and enhance energy independence. This focus has sparked debates over land use and landscape impacts, as well as the importance of energy planning at multiple spatial scales [1–4].

While social acceptance of wind energy has been theorised extensively, several key factors have shaped the public response [5]: procedural and distributive fairness, trust in key actors, and risk–benefit perceptions. Classic offshore energy reviews further highlight how offshore wind energy introduces distinct experiential and regional considerations relative to onshore development [6]. Comparative survey work near proposed offshore projects shows that perceived fairness of process, community voice, and trust remain strongly associated with support, even where baseline attitudes are favourable [7].

Some studies have examined how public attitudes toward wind farms evolve over time, finding that the constant presence of turbines can gradually improve local acceptance [8,9]. Others compare acceptance levels during the planning phase with those after commissioning, reporting that support often increases once projects become operational [10,11]. A third line of research explores the effect of proximity, showing that individuals distant from wind-farm sites tend to express higher acceptance than those living nearby [12,13]. However, several studies challenge these conclusions, arguing that attitudes toward energy sources are resistant to change and that empirical evidence for improving perceptions over time is limited [14,15]. Moreover, other work indicates that the mere existence of wind farms has little positive impact on public opinion but can significantly reinforce negative views [16].

* Corresponding author.
E-mail addresses: belenperez@ugr.es (B. Pérez-Pérez), javier.rodriguezsegura@unican.es (F.J. Rodríguez-Segura), jcosorio@ugr.es (J.C. Osorio-Aravena), pilard@us.es (P. Díaz-Cuevas), mfrolova@ugr.es (M. Frolova).

https://doi.org/10.1016/j.rser.2025.116451
Received 25 May 2024; Received in revised form 11 October 2025; Accepted 27 October 2025
Available online 14 November 2025
1364-0321/

Due to the extensive roll-out of onshore renewable energy systems, sites with optimal conditions are becoming saturated, driving significant landscape change [17–19]. This saturation has prompted both the repowering of existing wind farms and the development of offshore wind energy in EU-27 countries with favourable conditions [20].

Media coverage, shaped by local stakeholder discourse, plays a critical role in public acceptance of offshore wind development [21–23]. Several reasons have been proposed to account for negative reactions among coastal communities: limits to perceived local control and benefit-sharing, concerns about visibility, contested placement of turbines, community ownership and compensation arrangements; and visual exposure from the coast [24–26]. Moreover, potential impacts on the seascape [27,28] and on collective imaginaries [29,30] must be considered. The sea is not perceived as an empty space; its meaning is constructed as complexly as that of terrestrial environments [31]. This complexity is especially pronounced in coastal communities, where unique sociocultural values and a strong sense of identity are tied to the seascape [32,33]. Emotional attachment and place significance among residents further influence acceptance [34].

Recent work shows that visual acceptability is highly distance-sensitive, with offshore wind perceived more favourably as arrays are sited further from shore [35]. Early work already underscored that visual factors are pivotal, especially whether arrays are visible from the shoreline, establishing a baseline for subsequent distance-sensitivity findings [25]. Complementary research proposes concrete landscape-integration criteria (e.g., array layout and visibility management) to mitigate perceived visual intrusion of offshore installations [36]. At the same time, local industrial siting and supply-chain linkages can condition acceptance: evidence from a UK blade-manufacturing facility reports broad support driven by employment gains despite localised concerns over noise and views [37]. Indeed, offshore wind infrastructure can transform the offshore environment and adjacent coastline into a new type of marine space [28].

Aligning with an energy-justice perspective, recent scholarship argues that durable acceptance depends on transparent procedures, equitable sharing of benefits, and safeguards for potentially affected groups (e.g., fisheries and coastal livelihoods) [38]. This complements documented practice in mature markets, where technical working groups are used to co-produce data needs and structure conflict resolution [39]. Prior studies highlight that the absence of community ownership and credible benefit-sharing can fuel resistance; conversely, UK cases document how community funds and compensatory payments have helped normalise "their" offshore wind farms after initial opposition [24,26].

Although some studies have examined differences by residence, country of origin, or comparisons between local and state groups, no clear spatial preferences have emerged [40]. Conversely, others report that people prefer offshore over onshore wind—perceiving offshore turbines as less visually intrusive—while some challenge the assumption that coastal communities are more receptive, arguing that residents may not recognise tangible benefits and view the sea as a vital resource increasingly beyond their control [32]. Beyond proximity and time effects, acceptance of floating offshore wind also depends on attitudes towards existing offshore industries, as shown by national choice-experiment evidence from Norway [41]. Further, national-scale evidence suggests that sectoral identities and regional industrial cultures can shape acceptance of floating wind energy development [41]. Evidence from non-European settings similarly indicates that acceptance hinges on how environmental costs and local benefits are framed and shared, as shown by a national choice experiment on offshore wind in South Korea [42].

Finally, acceptance is dynamic on a macro level. A recent before-and-after analysis of the European energy crisis documents shifts in willingness-to-pay and attitudes toward offshore wind development, with support conditioned by distributional protections and credible market rules [43]. This emphasizes the value of trend-study designs with independent cross-sections to detect changes across policy cycles and energy price regimes [5,43].

In Spain, efforts to promote offshore wind energy development have thus far been unsuccessful. The country's planning and regulation framework can be divided into distinct phases. In the first phase, Royal Decree 1028/2007 established an administrative procedure for submitting and processing of offshore wind projects in Spanish territorial waters. In 2009, a Strategic Environmental Study of the Spanish coastline was conducted to identify exclusion zones, areas of compatibility and zones of limited compatibility for renewable energy projects [44]. However, this document attracted criticism: its national-scale grid mapping failed to reflect the specific territorial realities of coastal municipalities and sub-regions, and it provided no mechanisms for public participation in its preparation. Moreover, onshore siting of transmission lines and transformation substations, each under the remit of different administrations, led to jurisdictional disputes [45]. Against the backdrop of the economic crisis in the years following the approval of these regulations, immature technology, minimal institutional support and coordinated opposition from certain local groups and stakeholders—amplified by various media outlets—, Spain's initial foray into offshore wind stalled.

The second phase was launched in response to a European drive for energy self-sufficiency, heightened by vulnerabilities exposed during the war in Ukraine. Although the EU-27 renewed its emphasis on renewable, particularly offshore wind development, Spain made little headway in improving planning or regulation. Media reports documented strong public resistance to proposed projects off Cádiz, Almería, Catalonia, Galicia and the Canary Islands [46–49], and organised opposition movements emerged, such as StopParqueEólicoMarDeÁgata [50], which drafted a manifesto signed by 216 organisations and 218 academics. In this context, the Spanish government approved Royal Decree-Law 12/2021, suspending Royal Decree 1028/2007 (except for experimental installations) to pave the way for a new legislative framework to address identified shortcomings and provide necessary guarantees for offshore wind development.

In December 2021, the "Route map for the development of offshore wind power and sea-based energy resources in Spain" was published [51]. This document set a 3 GW target for floating wind power systems in 2030—equivalent to 40 % of the EU's target for that year. This commitment was reinforced in Royal Decree 150/2023, which approved the Plans for the Organization of the Maritime Space (POEM) for the five Spanish territorial-water demarcations, in force until 2027.

While public perception of wind energy has been examined in detail [13,52–55], studies focusing specifically on offshore wind remain scarce and yield mixed results, as many proposed projects are yet to be installed or are few in number [32]. In fact, no longitudinal studies on offshore wind have evaluated how these perceptions evolve over time. Moreover, no prior work has investigated how perceptions of offshore wind energy's effects on other socioeconomic activities have shifted over time, nor how these shifts relate to declining opposition or rising acceptance. This study therefore investigates whether attitudes towards offshore wind energy in the coastal areas of Tarifa and La Janda Litoral (Cadiz, Spain) have shifted over the past decade. We conducted a comprehensive analysis of nearly 500 survey responses, employing a mixed-methods approach that combined document review, structured questionnaires, and statistical analysis of quantitative data. In addition, we examined whether concerns about potential impacts on local socioeconomic activities affected acceptance of offshore wind projects, and we explored demographic variations—by age, gender and education level—in respondents' views. Finally, we compared public opinion in the study area with the perspectives of local stakeholders, seeking to understand the drivers of convergence or divergence between these groups.

Cádiz was our chosen focus of study because it concentrates features that recur across many coastal jurisdictions that can offer international insights. It has had over three decades of exposure to onshore wind, which indicates how prior conditions support offshore development.

More than two decades of proposed offshore projects have been placed there, which allows analysis of anticipatory perceptions shaped by prolonged planning, stakeholder contestation, and media coverage [21–23]. The coastal economy there contains many fisheries and much tourism which allows for issues of procedural and distributive fairness, trust, and risk–benefit perceptions to emerge [32,52–55]. The Atlantic bathymetry can be linked to other deep-water regions where similar technological pathways and stakeholders are emerging [41]. Combined with the EU's marine spatial planning context and the well-documented distance–visibility sensitivities of offshore arrays [35], Cádiz functions as a broadly instructive testbed for mechanisms that travel beyond Spain".

This study conducts to the literature and to the global science and technology audience by conducting a trend analysis on two temporal cross-sections (2013 and 2023) of the same target population in the coastal areas of Cádiz, Spain. Rather than employing a strictly longitudinal design that tracks the same individuals over time, our approach compares independent samples with similar sociodemographic characteristics at two different time points. We selected this design specifically to explore how local context and broader sociopolitical circumstances have shaped public perceptions of offshore wind energy over the past decade, while avoiding the potential biases associated with following a single cohort for such an extended period.

The article is organised as follows. Section 2 presents the case study and details the methodology. Section 3 and 4 respectively present and discuss the results. Section 5 outlines the study's limitations, and Section 6 offers the conclusions.

2. Study area and methodology

2.1. Study area

This research focuses on Tarifa and La Janda Litoral in the province of Cadiz, southern Spain. Historically dependent on fishing and agriculture, these coastal municipalities have been oriented towards tourism over the past decade. Cádiz leads Andalusia in onshore wind development, with 1395.79 MW installed—representing 39.6 % of the region's total. Within the province, Tarifa, Conil de la Frontera, Vejer de la Frontera and Barbate account for 663.85 MW (47.56 % of Cadiz's capacity and 18.83 % of Andalusia's). According to Díaz-Cuevas et al. [4,56], Tarifa alone hosts 548.17 MW across 32 wind farms, following the pioneering experimental wind power plant in Spain in 1982 and the first commercial onshore wind farm in 1995. Vejer de la Frontera has 107.88 MW from seven parks (48 turbines), Barbate has 7.80 MW in one park (24 turbines), and Conil de la Frontera currently has no onshore wind farms. Although thirteen offshore wind projects have been proposed

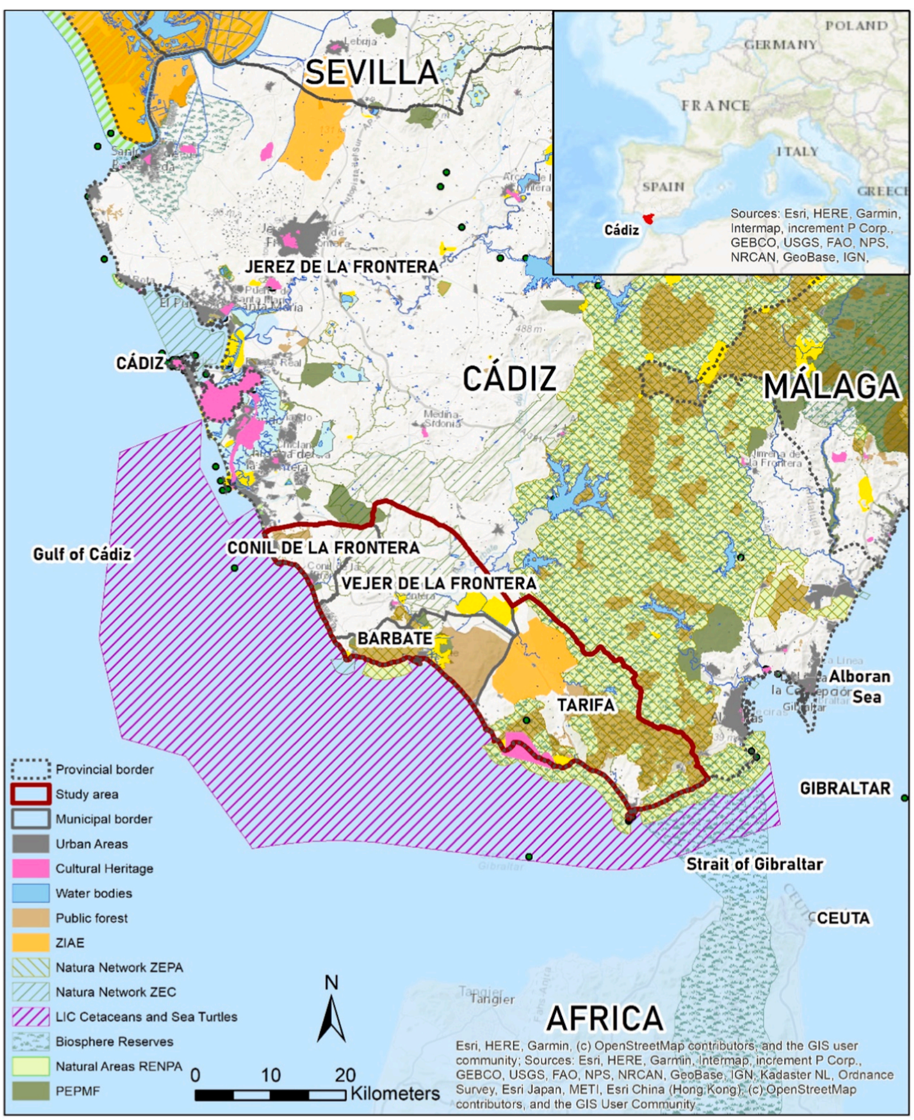

Fig. 1. Natural and Cultural Heritage in the Study Area. Source: drawn up by the authors, 2023.

along the Cádiz coastline, none have been established.

Between 2002 and 2012, the study area's population grew by 46.9 %, particularly in tourist hubs such as Conil de la Frontera and Tarifa. La Janda Litoral remains one of Spain's lower-income subregions: Vejer de la Frontera records the lowest average income, followed by Barbate, Conil de la Frontera and Tarifa. Unemployment rates also vary markedly—Barbate peaks at 33.7 % and Vejer at 27.7 %, both exceeding the provincial average, whereas Tarifa (19.2 %) and Conil de la Frontera (20.7 %) lie below it. Much of the area is protected for its high ecological value and biodiversity (see Fig. 1), with overlapping land- and sea-based designations. Additionally, several sites are listed as Assets of Cultural Interest (BIC), reflecting the region's rich heritage.

2.2. Methodology

The analysis of coastal resident's perceptions of offshore wind energy in Cádiz between 2013 and 2023 comprised three distinct stages:

Stage 1 – Questionnaire design. We adapted the 2013 survey instrument for 2023 by drawing on the original questionnaire used to compare social perceptions of offshore wind energy along Germany's North Sea coast and in La Janda Litoral and Tarifa, Spain. The questions used in this study derive from a broader survey that was used for a doctoral thesis [57] linked to the "Zukunft Küste – Coastal Futures" research project, funded by the German Federal Ministry of Education and Research (BMBF) (FKZ03F0404A). This project used offshore wind farming as a case study of changing maritime spatial use and examined its effects on the marine ecosystem, local economy, and infrastructure. Research on stakeholders conflicts and social values was integral to the project [58], confirming the survey's validity for our purposes. We retained key questions from the original questionnaire [59] on general attitudes toward offshore wind, its effects on employment, social welfare, energy issues, technological progress, competition with other socioeconomic activities, and seascape and environment consideration. Demographic data (gender, age and education level) were also collected to analyse potential changes in the specific opinions and perceptions of these groups. The full 2023 questionnaire is provided in Annex 1. To ensure strict cross-survey comparability, the 2023 questionnaire polled the same 2013 survey categories.

Stage 2 – Survey implementation. In 2013, the research team distributed paper copies and emailed the via local institutions, business, groups and associations of the study area. For 2023, we digitised the questionnaire using Google Forms and disseminated it through the same channels, supplemented by closed social-media groups (especially Facebook communities) common in the post-pandemic period [60]. Emails to local organisations further extended reach. Despite the difference in delivery, we used the same local channels (institutions, community groups, and closed municipal social-media groups) to ensure as wide a reach as in 2013, further ensuring comparability between the two surveys. This online approach was intended to maximum coverage and minimise sampling bias.

Stage 3 – Data processing and analysis. We processed and compared the 2013 and 2023 response sets by organising items into five thematic blocks (general opinion; employment and social welfare; energy aspects and technological progress; competition with other socioeconomic activities; and seascape and environment—see Annex 2). Responses were coded numerically, and we calculated means and standard deviations for the overall sample and for sub-groups defined by gender (men/women), age (14–20/21-35/36–50/51-65) and education level (primary/secondary/vocational training/university). The aim was to identify changes in perceptions of offshore wind energy and their variability in both periods. IBM SPSS Statistics software was used for all quantitative analyses. All analyses were conducted for the overall sample and stratified by gender, age group, and educational level. This stratified approach was applied to the 2013 and 2023 datasets to allow direct comparisons between subgroups and across time, and the results are presented in this disaggregated form throughout the paper.

We established three response-range categories for each item mean:

- From 1 to 1.67: "in favour", "agree" or "very important".
- From 1.68 to 2.33: "don't know" or "not sure".
- From 2.34 to 3: "against", "disagree" or "not important at all".

We also conducted Welch's t-tests to compare mean values of the acceptance between 2013 and 2023 as two independent groups. For each comparison we report the mean difference (2023–2013), 95 % confidence intervals (CI), and Hedges' g as a standardized effect size. A non-significant Welch's *t*-test (two-tailed, α=0.05)—i.e., a 95 % CI for Δ that spans 0—was taken as no statistically significant change over time. The analysis was performed at two levels: (i) aggregate (full sample) and (ii) by cohorts (gender, age group, and education level) to assess subgroup heterogeneity.

This research was designed as a trend study based on two temporal cross-sections (2013 and 2023) of the same target population. Unlike a strictly longitudinal design, tracking the same individuals over time, a trend study compares independent samples with similar sociodemographic characteristics at different time points. This method was selected because is optimal for explaining population-based results at two specific moments, avoiding distortions arising from cohort changes (e.g., shifts in age or educational over a decade). Our main objective was to assess how the local context and broader sociopolitical circumstances influenced perceptions of offshore wind energy.

In social perception research on renewable energy acceptance, descriptive statistics (means and standard deviations) are well established for detecting general attitudes shifts rather than developing predictive models [61,62]. The mean indicates the direction of change, while standard deviations provide crucial insights into response clustering (growing consensus) or dispersion (increasing heterogeneity) [63,64]. This dual interpretation enables identification of trends toward polarization or convergence in public perception. We complemented these summaries with Welch's t-tests comparing 2013 and 2023 means, reporting mean differences, 95 % CI, and Hedges' g, as an inference check consistent with our trend-study design.

3. Results

This section presents the main findings and a comparative analysis of the 2013 and 2023 surveys, aiming to detect shifts in public perception of offshore wind energy over the past decade. Table 1 summarises the sample characteristics: 194 valid responses in 2013 and 184 in 2023. In both surveys, respondents with a university education comprised the largest cohort, followed by those with vocational training. Between 2013 and 2023, the proportions remained similar, although the share of secondary and primary education participants declined slightly in the later survey.

We organise our comparative analysis into five thematic areas: i) perception of offshore wind farms; ii) employment and social welfare; iii) energy issues and technological progress; iv) competition with other socioeconomic activities; and v) seascape and environment.

3.1. Perceptions of future offshore wind farms

Using the established response range (1 = favour/agree/very important; 2 = 1 don't know/not sure; and 3 = 1 against/disagree/not important at all), general opinion on the installation of offshore wind farms in the study area remains neutral, with no clear position in favour or against. In 2013 the mean response indicated a slight tendency towards rejection (2.14 ± 0.765), which marginally declined in 2023

Table 1
Respondents in 2013 and 2023 by gender, age group and educational background.

Year	Gender		Age groups				Educational level			
	M	W	14–20	21–35	36–50	51–65	Primary	Secondary	Vocational Training	University
2013	45.4 %	47.9 %	12.8 %	27.9 %	40.8 %	18.4 %	7.3 %	19.1 %	24.2 %	49.4 %
2023	51.1 %	48.9 %	9.8 %	28.3 %	39.7 %	22.3 %	7.3 %	5.1 %	30.3 %	57.3 %

194 encuestas en 2013 y 184 encuestas en 2023

(2.11 ± 0.913). However, standard deviations were higher in 2023, reflecting increased variability in responses. A Welch's *t*-test indicated no statistically significant shift over time (Δ=−0.03, SE=0.087, t (≈358)=−0.35, p=0.73, 95 % CI [−0.20, 0.14], Hedges' g=−0.04).

Gender-disaggregated analysis (Table 2) shows that while both men and women remained undecided overall, women's mean perception score increase slightly from 2013 to 2023, whereas men's score decrease marginally, suggesting an overall shift among male respondents. Across all gender groups, dispersion increased in 2023. In any case, as shown in Table 3, a Welch's *t*-test indicated no evidence of a time shift among men or women. Age-group means also fell within the "don't know" category. However, the 14–20 and 51–65 cohorts expressed slightly less favourable views in 2023 compared to 2013, the 36–50 cohort remained unchanged, and the 21–35 cohort showed improved perceptions. In every age group, standard deviations rose in 2023, again indicating greater heterogeneity of opinion. Also in every age group, Welch's *t*-test indicated no statistically significant shift.

When stratified by educational level, no clear opinion was observed in either year. Yet respondents with primary and vocational education recorded less favourable means in 2023 than in 2013, while those with secondary and university education showed improvements. Standard deviation increased for nearly all educational cohorts, signalling a broader spread of views. However, Welch's *t*-test showed no change over time in every educational level group.

3.2. Employment and social welfare

Respondents attributed greater importance to social welfare issues in 2023 than in 2013 (Fig. 2, left), with results less dispersed. Likewise, attitudes toward the effects of offshore wind power on employment and social welfare improved in 2023 (Fig. 2 right), although standard deviations increased, indicating more varied opinions despite the overall positive shift.

Table 4 reveals that both men and women rated employment and social welfare more highly in 2023, with men showing a slightly positive shift. For questions concerning the importance of these issues, standard deviations were lower in 2023 than in 2013, indicating that the results on these issues are less dispersed in 2023.

Analysing age groups, all cohorts regarded social welfare, equitable benefit distribution, employment and the use of public funds as the most important considerations. In most age brackets, mean scores for perceived effects of wind energy on employment and social welfare rose between 2013 and 2023, except among 21-35-year-olds, who exhibited a slight opposite trend. For importance ratings, standard deviations declined in 2023, pointing to more uniform views across age groups.

When stratified by education, almost all cohorts assigned more importance to employment and social welfare in 2023, with this effect intensifying at higher education levels. Conversely, when asked about potential impacts of offshore wind on these domains, mean scores indicated that respondents placed less emphasis on such impacts in 2023. Here, standard deviations were lower for importance ratings but higher for impacts, reflecting wider dispersion of views on potential adverse effects.

3.3. Energy issues and technological progress

Respondents rated the importance of energy balance and security, economic profitability and cost stability more highly in 2023 than in 2013 (Fig. 3, left). Conversely, technological progress was deemed less critical in 2023, as evidenced by an increase in mean scores. Negative associations with offshore wind regarding energy balance and security, economic profitability and generation costs diminished between 2013 and 2023 (Fig. 3, right).

Table 5 disaggregates these shifts by gender, age and education. In 2023 men placed greater emphasis on energy security, economic efficiency and cost, while perceiving the impact of offshore wind on these domains as less significant. Women, by contrast, assigned higher importance to stable and cost-effective generation and to technological progress, yet rated the general impacts of offshore wind energy issues less prominently. For both sexes, variability in importance ratings declined in 2023, whereas dispersion increased.

Age-cohort comparisons reveals that 14–20, 36–50 and 51-65-year-olds accorded greater importance to energy and technology issues in 2023, except for stable and cost-effective generation, while 21-35-year-olds showed a slight decline. This pattern holds for both general energy-technology and specific questions on offshore wind's effects on security and cost-efficiency. Overall, all age groups exhibited more positive impact perceptions in 2023.

Educational stratification indicates that, overall, respondents in 2023 prioritised stable generation, energy balance, economic profitability and cheaper electricity. However, those with primary and vocational qualifications regarded these factors as less relevant, and all groups placed lower importance on technological progress compared to 2013. With respect to perceived impacts on energy security, energy balance and economic profitability, most educational groups registered higher mean scores in 2023, suggesting growing uncertainty about

Table 2
Opinions about offshore wind parks in 2013 and 2023 according to gender, age group, and educational level (1–1.67 In Favour; 1.68–2.33 Don't Know; 2.34–3.00 Against). Changes in the averages: Decreases in blue; increases in pink; and green if they stay the same.

Year	Gender		Age groups				Educational level			
	M	W	14-20	21-35	36-50	51-65	Primary	Secundary	Vocational Training	University
2013	2.11±0.74	2.16±0.78	2.05±0,80	2.29±0.70	2.07±0.77	2.00±0.79	2.17±0.93	2.00±0.80	2.00±0.75	2.21±0.73
2023	2.05±0.92	2.18±0.90	2.28±0.95	2.12±0.94	2.07±0.91	2.12±0.87	2.31±0.85	1.89±1.05	2.04±0.91	2.13±0.91

Table 3
Welch's *t*-test results on opinions about wind farms in 2013 and 2023 according to gender, age group, and educational level.

Dimension	Cohort	Δ (2023–2013)	SE	t (Welch)	95 % CI low	95 % CI high	Hedges g
Gender	Men	−0.06	0.123	−0.49	−0.30	0.18	−0.07
	Women	0.02	0.125	0.16	−0.22	0.26	0.02
Age	14–20	0.23	0.275	0.84	−0.31	0.77	0.26
	21–35	−0.17	0.161	−1.05	−0.49	0.15	−0.2
	36–50	0.00	0.137	0.00	−0.27	0.27	0.00
	51–65	0.12	0.188	0.64	−0.25	0.49	0.14
Educational level	Primary	0.14	0.343	0.41	−0.53	0.81	0.15
	Secondary	−0.11	0.374	−0.29	−0.84	0.62	−0.13
	Vocational	0.04	0.164	0.24	−0.28	0.36	0.05
	University	−0.08	0.116	−0.69	−0.31	0.15	−0.10

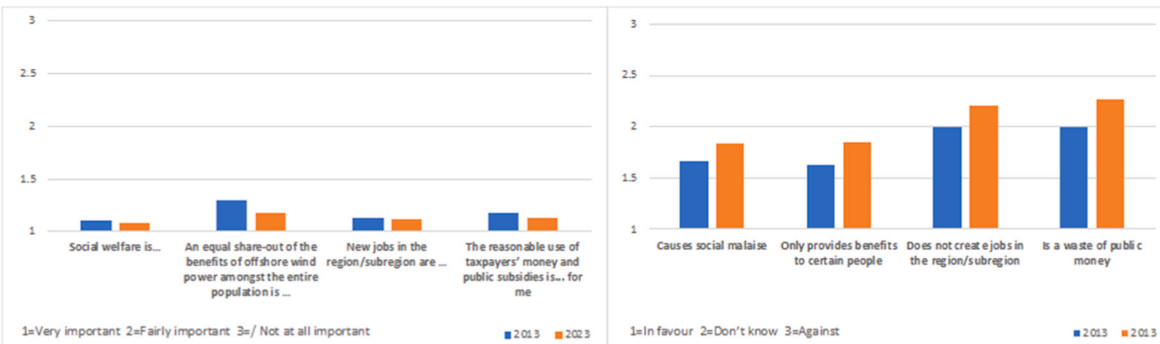

Fig. 2. Average scores for opinions about offshore wind power, employment and social welfare in 2013 and 2023. Source: Drawn up by the authors based on SPSS results.

adverse effects, while associations between offshore wind and technological progress strengthened, as reflected by decreasing means.

3.4. Competition with other socioeconomic activities

Coastal residents consistently rate existing socioeconomic activities as highly important. As shown in Fig. 4 (left), the 2023 survey recorded higher mean importance scores for shared use of wind farms, safeguarding fisheries, preventing maritime accidents and maintaining property values. Conversely, tourism declined in perceived importance, reflected by a rise in mean scores (i.e. less importance) compared to 2013. Fig. 4 (right) likewise indicates a diminished perception of negative impacts: whereas in 2013 many respondents believed offshore wind might harm tourism, conflict with fishing, increase accidents at sea, and depress property prices, by 2023 most had not a clear view on these impacts.

Table 6 details mean differences by gender, age and education. Both men and women in 2023 prioritised compatibility of wind farms with existing uses of the sea. Women placed greater emphasis on preserving fisheries, while and men were more concerned with stable property values. The importance rating for tourism and accident prevention increased. Standard deviations rose for most items, signalling a broader dispersion of views in 2023 than in 2013. When considering impact perceptions, all items in the second block showed higher mean scores (i.e. lower perceived impact) in 2023, with general rise variability.

Age-cohort analysis reveals that, although every group continued to value key socioeconomic activities (shared use of offshore wind farms, tourism, fisheries and property values) the 36–50 cohort assigned less importance to farm sharing and tourism in 2023 than in 2013, mirroring a downward trend across all groups for tourism. Importance of fisheries fell among respondents 36 and over, while accident-prevention declined for all but the 21–35 group. Interest in property-value stability rose for all except those aged 14–20. In nearly every cohort, standard deviations increased in 2023, indicating more heterogeneous responses.

Regarding perceived impacts, most age groups registered higher mean scores—suggesting reduced concern over offshore wind's interference with other socioeconomic activities. However, the 21–35 cohort displayed lower means on certain impact items, indicating a lack of clarity about the compatibility of wind energy with other uses and its effect on tourism and property prices. Consistently, standard deviations were higher across age groups in 2023, reflecting greater diversity of opinion.

For educational strata, mean importance scores shifted variably between 2013 and 2023. Respondents with primary education attributed greater importance to nearly all activities, whereas those with vocational or university qualifications showed activity-specific variations. Among secondary-educated participants, importance declined across most activities except for the shared use of offshore wind farms. Standard deviations for importance ratings were lower at primary levels and higher among more educated cohorts. Concerning perceived impacts of offshore wind farms on other socioeconomic activities, most educational groups registered higher mean scores in 2023—indicating a move toward the "Don't know" responses. An exception is the primary-education group, whose lower means suggest a transition from being unclear in 2013 to recognising tourism and fisheries impacts as important in 2023. Across nearly all questions and education levels, standard deviations increased, reflecting wider dispersion in responses.

3.5. Seascape and the environment

Local perceptions of offshore wind's compatibility with the seascape and environment improved between 2013 and 2023. Respondents placed greater importance on seascape and environmental aspects in 2023 (Fig. 5 left), yet they regarded the potential impacts of offshore wind on these dimensions as less significant than in 2013 (Fig. 5, right).

Table 7 shows mean differences by gender, age group and education levels. Both men and women rated seascape and environmental aspects more highly in 2023, while perceiving impacts as less important. Standard deviations varied by item but increased overall for impacts questions, indicating greater response variability in 2023.

Table 4
Offshore wind power, employment and social welfare according to gender, age and educational level (1–1.67 In favour/Very important; 1.68–2.33 Don't know/Fairly important; 2.34-3.00 Against/Not at all important). Changes in the averages: Decreases are highlighted in blue; increases in pink; and those that stay the same in green.

		Year	Gender		Age Groups				Educational level			
			M	W	14-20	21-35	36-50	51-65	Primary	Secondary	Vocational Training	University
Block 1 (Very important/Fairly important/ Not at all important)	Social welfare is..	2013	1.12±0.39	1.11±0.40	1.22±0.60	1.20±0.53	1.06±0.23	1.03±0.18	1.17±0.38	1.15±0.43	1.15±0.47	1.07±0.32
		2023	1.06±0.28	1.09±0.32	1.11±0.32	1.04±0.19	1.07±0.30	1.12±0.40	1.23±0.59	1.11±0.33	1.09±0.35	1.03±0.17
	An equal share-out of the benefits of offshore wind power amongst the entire population is …	2013	1.31±0.64	1.26±0.57	1.17±0.49	1.43±0.73	1.22±0.51	1.28±0.64	1.33±0.49	1.16±0.44	1.34±0.70	1.30±0.62
		2023	1.18±0.46	1.19±0.47	1.17±0.38	1.19±0.44	1.18±0.50	1.20±0.45	1.23±0.43	1.22±0.44	1.31±0.63	1.08±0.30
	New jobs in the region/subregion are..	2013	1.13±0.40	1.12±0.39	1.13±0.45	1.18±0.48	1.09±0.28	1.09±0.38	1.08±0.27	1.13±0.42	1.18±0.50	1.10±0.33
		2023	1.10±0.33	1.14±0.38	1.17±0.38	1.10±0.29	1.04±0.20	1.27±0.54	1.23±0.43	1.33±0.50	1.07±0.26	1.08±0.30
	The reasonable use of taxpayers' money and public subsidies is...for me	2013	1.20±0.52	1.17±0.50	1.39±0.65	1.16±0.47	1.11±0.43	1.18±0.52	1.08±0.27	1.24±0.49	1.21±0.55	1.13±0.45
		2023	1.06±0.28	1.20±0.47	1.11±0.32	1.12±0.32	1.15±0.46	1.12±0.40	1.08±0.27	1.22±0.44	1.19±0.47	1.08±0.30
Block 2 (In favour/Don't know Against)	Causes social malaise	2013	1.72±0.81	1.62±0.69	1.65±0.64	1.82±0.77	1.67±0.78	1.48±0.71	1.69±0.75	1.70±0.72	1.48±0.67	1.79±0.79
		2023	1.81±0.82	1.87±0.87	2.06±0.87	1.85±0.80	1.86±0.88	1.68±0.82	1.69±0.85	2.22±0.97	1.78±0.86	1.88±0.83
	Only provides benefits to certain people	2013	1.69±0.85	1.54±0.74	1.64±0.86	1.68±0.84	1.57±0.77	1.50±0.76	1.54±0.77	1.73±0.80	1.46±0.77	1.68±0.82
		2023	1.88±0.91	1.81±0.86	2.56±0.78	1.65±0.81	1.78±0.88	1.90±0.88	2.08±0.95	2.33±0.86	1.65±0.85	1.91±0.89
	Does not create jobs in the region/subregion	2013	2.06±0.77	1.93±0.78	2.30±0.92	2.12±0.74	1.88±0.69	1.82±0.80	1.77±0.83	2.15±0.87	1.83±0.69	2.06±0.75
		2023	2.20±0.83	2.20±0.82	2.44±0.85	1.98±0.87	2.37±0.75	2.07±0.81	1.92±0.86	2.22±0.97	2.26±0.80	2.25±0.81
	Is a waste of public money	2013	1.95±0.77	2.02±0.77	2.22±0.73	2.12±0.79	1.86±0.72	1.84±0.76	1.77±0.72	2.18±0.71	1.88±0.81	2.01±0.75
		2023	2.30±0.81	2.21±0.81	2.44±0.78	2.08±0.83	2.34±0.74	2.24±0.88	1.85±0.89	2.33±0.86	2.20±0.78	2.35±0.80

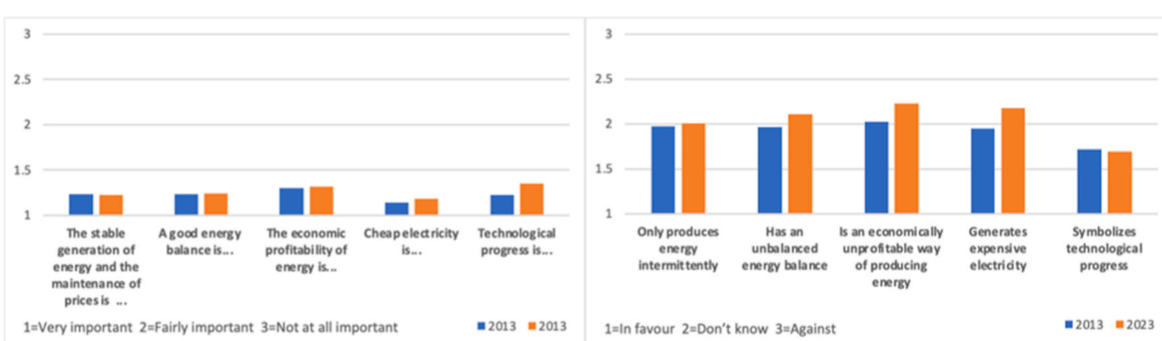

Fig. 3. Changes in opinions about energy issues and technological progress between 2013 and 2023. Source: Drawn up by the authors based on SPSS results.

Age-cohort analysis reveals that 14–20 and 21-35-year-olds assigned higher importance to seascape matters in 2023, with the 21–35 group doing likewise for environmental aspects. In contrast, the 36–50 and 51–65 cohorts regarded these questions as less relevant. Standard deviations rose for older age groups (36–50 and 51–65) across all items and were more variable among younger groups.

Educational strata exhibited two contrasting trends in importance ratings for 2023. Primary-educated respondents continued to prioritise seascape issues, whereas other cohorts showed lower means, signalling diminished salience of seascape considerations. For environment and conservation items, most groups recorded higher means, indicating reduced importance, except those with primary or university education, who maintained strong concern for compatibility of offshore installations with nature conservation. Standard deviations for importance

Table 5
Aspects relating to energy and technological progress and offshore wind power in relation to gender, age groups and level education (1–1.67 In favour/Very important; 1.68–2.33 Don't know/Fairly important; 2.34–3.00 Against/Not at all important). Changes in the averages: Decreases are highlighted in blue; increases in pink; and those that stay the same in green.

		Year	Gender		Age groups				Educational level			
			M	W	14-20	21-35	36-50	51-65	Primary	Secondary	Vocational Training	University
Block 1 (Very important/Fairly important/ Not at all important)	The stable generation of energy and the maintenance of prices is...	2013	1.25±0.55	1.23±0.49	1.39±0.68	1.33±0.62	1.13±0.37	1.19±0.47	1.08±0.27	1.27±0.51	1.24±0.53	1.21±0.50
		2023	1.13±.0.39	1.32±0.59	1.39±0.60	1.23±0.42	1.21±0.55	1.17±0.49	1.15±0.37	1.19±0.39	1.31±0.60	1.14±0.42
	A good energy balance is...	2013	1.27±0.52	1.19±0.47	1.30±0.55	1.31±0.62	1.16±0.36	1.17±0.37	1.08±0.27	1.19±0.39	1.23±0.53	1.24±0.50
		2023	1.19±0.51	1.29±0.58	1.33±0.59	1.25±0.48	1.23±0.59	1.20±0.55	1.08±0.27	1.33±0.50	1.30±0.60	1.20±0.52
	The economic profitability of energy is…	2013	1.34±0.60	1.27±0.51	1.39±0.58	1.36±0.63	1.25±0.49	1.23±0.56	1.31±0.48	1.47±0.67	1.20±0.51	1.28±0.54
		2023	1.27±0.53	1.38±0.64	1.44±0.70	1.23±0.42	1.33±0.60	1.37±0.69	1.46±0.66	1.56±0.72	1.31±0.60	1.25±0.53
	Cheap electricity is...	2013	1.12±0.34	1.16±0.42	1.17±0.49	1.16±0.46	1.14±0.38	1.07±0.25	1.08±0.28	1.15±0.36	1.15±0.47	1.15±0.42
		2023	1.16±0.47	1.20±0.47	1.28±0.57	1.12±0.32	1.14±0.45	1.29±0.60	1.23±0.59	1.11±0.33	1.09±0.29	1.21±0.53
	Technological progress is…	2013	1.13±0.40	1.29±0.59	1.32±0.56	1.27±0.61	1.12±0.37	1.19±0.47	1.00±0.00	1.29±0.52	1.21±0.52	1.19±0.49
		2023	1.34±0.68	1.36±0.65	1.33±0.68	1.33±0.61	1.29±0.65	1.49±0.74	1.31±0.63	1.44±0.52	1.35±0.70	1.29±0.63
Block 2 (In favour/ Don´t know/Against	Only produces energy intermittently	2013	1.91±0.68	2.03±0.61	2.09±0.75	2.06±0.68	1.91±0.65	1.87±0.50	1.69±0.63	2.09±0.64	1.78±0.62	2.05±0.64
		2023	2.06±0.81	1.96±0.77	1.94±0.80	1.88±0.73	2.15±0.81	1.95±0.83	1.69±0.85	2.11±0.78	2.02±0.78	2.07±0.79
	Has an unbalanced energy balance	2013	1.91±0.56	2.00±0.51	1.96±0.56	2.04±0.57	1.94±0.52	1.84±0.51	1.85±0.68	1.97±0.52	1.88±0.55	2.00±0.52
		2023	2.19±0.75	2.03±0.72	2.33±0.68	2.02±0.75	2.11±0.69	2.15±0.82	1.77±0.83	2.22±0.83	2.02±0.68	2.21±0.73
	Is an economically unprofitable way of producing energy	2013	1.99±0.70	2.05±0.67	2.09±0.86	2.18±0.62	1.94±0.66	1.94±0.66	1.77±0.72	2.15±0.79	1.95±0.62	2.07±0.66
		2023	2.28±0.80	2.19±0.80	2.44±0.70	2.17±0.83	2.21±0.78	2.27±0.86	2.00±1.00	2.33±0.86	2.15±0.78	2.35±0.76
	Generates expensive electricity	2013	1.95±0.59	1.97±0.56	1.96±0.56	2.04±0.60	1.91±0.55	1.87±0.60	1.92±0.76	2.06±0.49	1.93±0.46	1.93±0.61
		2023	2.20±0.77	2.16±0.71	2.39±0.85	2.08±0.76	2.22±0.69	2.15±0.76	1.85±0.68	2.11±0.92	2.13±0.77	2.25±0.71
	Symbolizes technological progress	2013	1.56±0.80	1.87±0.84	1.82±0.95	1.71±0.84	1.66±0.82	1.75±0.80	1.32±0.65	1.66±0.86	1.79±0.76	1.76±0.87
		2023	1.68±0.87	1.70±0.72	1.39±0.69	1.73±0.77	1.66±0.80	1.83±0.86	1.85±0.68	1.44±0.72	1.65±0.73	1.68±0.84

ratings generally declined, reflecting more consistent responses.

Regarding perceived impacts on seascape, environment, and nature conservation, most respondents reported "don't know" or perceived no impacts, reflecting a lack of clear opinions. The primary-education cohort was the exception, assigning greater importance to seascape impacts. Across all educational levels, standard deviations increased markedly for impact questions, indicating wider dispersion of views compared to 2013.

4. Discussion

This paper analyses the evolution of public attitudes toward offshore wind farms in southern Spain. Although some studies have examined perceptual changes in this area [32], they relied on stakeholder interviews, whereas our research utilises population surveys—an approach not previously documented. Having both sets of analyses enables comparison between community opinions and those of local agents and media. Moreover, no prior work has investigated how perceptions of offshore wind energy's effects on other socioeconomic activities have shifted over time, nor how these shifts relate to declining opposition or rising acceptance.

Our findings (see Table 2 and Fig. 2) reveal that respondents held no definitive position on offshore wind energy projects in either 2013 or 2023. Nevertheless, by 2023 overall attitudes had grown more favourable, suggesting an emerging trend toward acceptance. This information can be used to engage public early in offshore-wind planning, ensuring they are well informed and their views considered so that, once projects mature, they are less vulnerable to manipulation by biased groups. This contrasts with onshore wind energy projects, which generally well accepted [8,9,11].

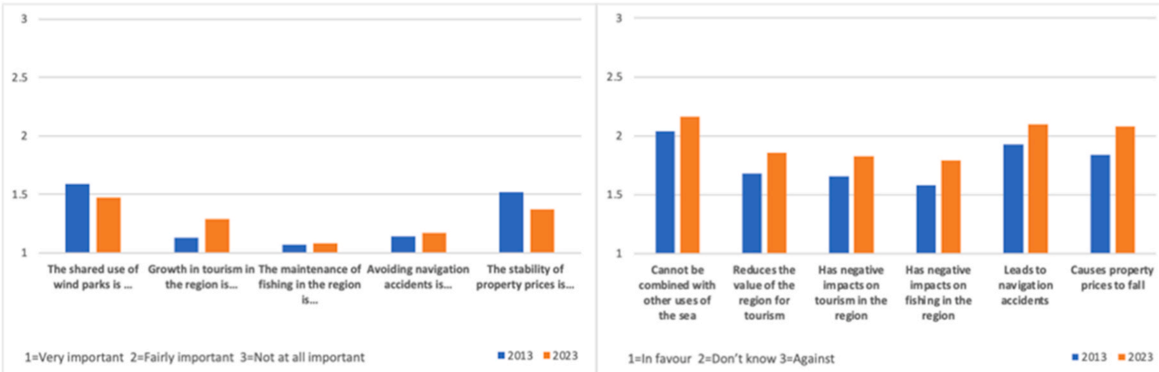

Fig. 4. Changes in opinions regarding the relationship between offshore wind power and other socioeconomic activities between 2013 and 2023. Source: Drawn up by the authors based on SPSS results.

Acceptance improved from 2013 to 2023 for both men and women and across nearly all educational levels and age groups, except for those with vocational training (see Figs. 3 and 4). The 21–35 age group exhibited the greatest gain, perhaps reflecting their exposure to onshore wind farms throughout their lives and the hiatus in new installations following the withdrawal of renewable-energy premiums after the 2011 economic crisis. These trends echo Firestone et al.'s [65] forecast of rising offshore-wind acceptance in subsequent years and Todt et al.'s [66] observation that opposition to the Mar de Trafalgar wind power project might soften under changing circumstances. Likewise, Smith et al. [67] and Cronin et al. [68] report higher acceptance after projects commissioning. In contrast, Frolova et al. [32], found strong local resistance rooted in deep cultural ties to the sea and concerns over compatibility with traditional economic activities. Our data—especially the increased standard deviations across gender, age, and educational **(see** Tables 4 and 5**)—**suggest similarly diverse attitudes.

Moreover, respondents in 2023 attributed greater importance to employment and social-welfare benefits (see Table 4), and views on offshore wind's impacts in these domains grew more positive. With respect to gender analysis, men recorded larger shifts in acceptance than women. All age groups valued employment and social welfare, except the eldest cohort, whose emphasis waned slightly. Higher-educated groups consistently placed greater weight on these issues, with their importance rising over time, while those with primary or vocational background placed less emphasis. Most age group also registered more "don't know" responses concerning impacts, except the 21–35 group, which trended more decisively. Secondary- and vocational-education cohorts perceived greater negative impacts in 2023 than in 2013. These findings reinforce earlier works showing that fair and equitable distribution of benefits and burdens fosters acceptance [41,69,70] and underscore the importance of demonstrable commitments to coastal communities and tangible local benefits [21,71–73].

Respondents in 2023 attributed greater importance than in 2013 to stable energy generation, price stability, balanced supply, economic profitability and electricity costs (see Table 5), and they increasingly viewed offshore wind projects as contributing to these aspects. However, gender differences emerged: men assigned greater importance to energy and technological factors in 2023, while women's shifts varied by specific question. Younger groups (14–20 and 21–35) showed significant rises in the importance attached to energy and technological issues over the decade. All educational levels rated these matters as important—except for those with vocational training. These results suggest a growing confidence that wind and other renewable energy sources can replace fossil-based systems, mitigate climate change and bolster energy independence, in line with Firestone et al.'s findings [61].

In 2023, most respondents also assigned greater importance than in 2013 to preserving other socioeconomic activities (see Table 6)—including shared use of offshore wind farms, fisheries, maritime accidents prevention, and property-price stability. Gender- and age-disaggregated analyses confirm that while the relative importance of specific question varies, both men and women perceive the impacts of offshore wind on these activities to be lower than a decade earlier. Education comparisons reveal that those with secondary education (followed by university graduates) attributed the highest importance to maintaining local activities. For all groups except primary-educated respondents, perceived impacts of wind energy on these domains declined; primary-educated participants, uniquely, reported increased concern on some items.

In 2023, respondents expressed less concerned about the compatibility of offshore wind farms with other socioeconomic activities, even as variability in views increased compared to 2013. This appears to contradict earlier studies emphasising the challenges of coexisting uses of the sea, such as fishing and navigation [32,67,72,74–76]. Other researchers warn that undersea cabling can disrupt fisheries and recommend regulatory measures to limit shore connections [23]. In our surveys, uncertainty persisted around shipping impacts, likely because offshore wind parks occupy extensive marine areas. Agreements often grant exclusive access, complicating coexistence in the absence of pre-emptive legal frameworks and comprehensive marine spatial planning [74]. Meanwhile, tourism's importance to local residents declined despite its growth in the region, and perceived conflicts between offshore wind and tourism waned, although some studies still highlight tourism's vulnerability to offshore wind parks externalities [75,76].

Environmental and seascape conservation questions garnered higher importance ratings in 2023 than in 2013 (see Table 7). In gender terms, men considered these issues more highly than women. Regarding age, younger groups placed greater importance on seascape and environmental concerns, whereas older respondents assigned them less priority. Participants with secondary and university education both showed increased concern for these dimensions over time; by contrast, primary- and vocational-education groups only assigned greater importance to maintaining an attractive seascape.

Concerns about seascape value loss due to wind farms declined across genders, age groups and education levels between 2013 and 2023—except among 21-35-year-olds and respondents with primary education, who perceived seascape impacts as more significant in 2023. This overall reduction in negative perceptions may reflect growing familiarity with wind turbines, easing acceptance of offshore wind projects [77]. Conversely, Frolova et al. [32] report that adverse experiences with onshore wind farms can heighten opposition to offshore developments.

Despite impacts concerns—particularly regarding seascape effects—these could be mitigated through careful siting, lighting systems and consideration of local meteorological conditions during offshore wind project design and implementation [78]. Our findings diverge from studies emphasising biodiversity concerns as primary

Table 6
Interactions between offshore wind power and socioeconomic activities by gender, age group and educational level (1–1.67 In favour/Very important; 1.68–2.33 Don't know/Fairly important; 2.34–3.00 Against/Not at all important).

		Year	Gender		Age groups				Educational Level			
			M	W	14-20	21-35	36-50	51-65	Primary	Secondary	Vocational Training	University
Block 1 (Very important/Fairly important/ Not at all important)	The shared use of offshore wind parks is…	2013	1.63±0.72	1.54±0.72	1.78±0.73	1.53±0.73	1.47±0.62	1.74±0.81	1.55±0.82	1.69±0.71	1.67±0.71	1.49±0.70
		2023	1.48±0.74	1.46±0.73	1.39±0.69	1.44±0.75	1.48±0.74	1.51±0.74	1.31±0.63	1.33±0.50	1.46±0.74	1.48±0.75
	Growth in tourism in the region is…	2013	1.13±0.39	1.14±0.40	1.05±0.22	1.18±0.48	1.09±0.33	1.15±0.44	1.17±0.38	1.09±0.39	1.08±0.35	1.16±0.42
		2023	1.28±0.66	1.30±0.60	1.33±0.68	1.31±0.61	1.29±0.67	1.24±0.58	1.00±0.00	1.56±0.88	1.28±0.59	1.31±0.67
	The maintenance of fishing in the region is…	2013	1.05±0.21	1.10±0.36	1.00±0.00	1.16±0.46	1.04±0.20	1.06±0.24	1.08±028	1.00±0.00	1.08±0.35	1.10±0.34
		2023	1.07±0.30	1.08±0.30	1.11±0.32	1.10±0.35	1.05±0.28	1.07±0.26	1.00±0.00	1.22±0.44	1.04±0.19	1.09±0.34
	Avoiding navigation accidents is…	2013	1.12±0.35	1.14±0.43	1.09±0.41	1.22±0.50	1.10±0.34	1.09±0.29	1.15±0.37	1.00±0.00	1.18±0.50	1.15±0.41
		2023	1.15±0.46	1.23±0.52	1.33±0.59	1.17±0.47	1.15±0.46	1.22±0.52	1.31±0.63	1.33±0.50	1.19±0.47	1.16±0.48
	The stability of property prices is…	2013	1.68±0.73	1.39±0.59	1.59±0.59	1.49±0.68	1.48±0.63	1.68±0.83	1.42±0.66	1.52±0.62	1.47±0.64	1.59±0.73
		2023	1.32±0.64	1.42±0.67	1.61±0.77	1.29±0.49	1.30±0.63	1.49±0.77	1.38±0.76	1.78±0.66	1.28±0.59	1.35±0.65
Block 2 (In favour/ Don't know /Against)	Cannot be combined with other uses of the sea	2013	2.05±0.69	2.04±0.64	1.96±0.82	2.20±0.70	1.94±0.59	2.09±0.58	1.92±0.64	2.09±0.76	1.98±0.53	2.10±0.64
		2023	2.17±0.87	2.16±0.79	2.50±0.85	2.00±0.81	2.23±0.80	2.10±0.86	2.15±0.89	2.33±0.00	2.15±0.85	2.17±0.82
	Reduces the value of the region for tourism	2013	1.68±0.80	1.63±0.77	1.65±0.88	1.80±0.90	1.56±0.70	1.79±0.85	1.58±0.77	1.79±0.84	1.63±0.81	1.71±0.89
		2023	1.95±0.94	1.78±0.90	2.17±0.98	1.71±0.87	1.90±0.93	1.85±0.96	1.92±0.95	2.22±0.97	1.76±0.88	1.93±0.94
	Has negative impacts on tourism in the region	2013	1.71±0.58	1.46±0.62	1.67±0.85	1.76±0.82	1.54±0.74	1.73±0.76	1.62±0.76	1.71±0.82	1.51±0.74	1.73±0.80
		2023	1.85±0.89	1.81±0.87	2.22±0.87	1.87±0.84	1.73±0.88	1.80±0.90	1.54±0.77	2.44±0.88	1.72±0.81	1.88±0.91
	Has negative impacts on fishing in the region	2013	2.01±0.69	1.46±0.62	1.30±0.47	1.64±0.66	1.61±0.69	1.61±0.65	1.62±0.76	1.53±0.67	1.43±0.59	1.70±0.67
		2023	1.86±0.81	1.71±0.76	2.06±0.87	1.71±0.75	1.77±0.79	1.80±0.81	1.54±0.77	2.11±0.92	1.65±0.73	1.86±0.79
	Leads to navigation accidents	2013	2.01±0.69	1.87±0.65	1.68±0.71	1.98±0.70	1.94±0.61	2.09±0.68	1.85±0.68	1.87±0.07	1.90±0.62	2.02±0.68
		2023	2.11±0.79	2.09±0.71	2.17±0.78	1.98±0.75	2.08±0.75	2.24±0.73	1.92±0.76	2.11±0.78	1.93±0.77	2.21±0.73
	Causes property prices to fall	2013	1.82±0.71	1.86±0.68	1.67±0.73	2.06±0.68	1.75±0.67	1.88±0.66	1.54±0.77	1.78±0.65	1.90±0.65	1.92±0.71
		2023	2.21±0.80	1.94±0.77	2.56±0.70	1.88±0.75	2.12±0.76	2.05±0.86	2.08±0.86	2.56±0.88	1.94±0.78	2.15±0.77

objections [27], and from stakeholders groups prioritising marine conservation [32]. Such disparities may arise from inconsistent media reporting and limited public engagement with scientific evidence, leaving many unaware of environmental risks outlined in recent research (e.g. Lloret et al. [79]). In this block of questions, variability in valuations of seascape and conservation fell, while dispersion in impact assessments rose (see Table 7), signalling more homogeneous esteem for environmental benefits but increasingly diverse views on potential harms.

Surveys over the past decade reveal a notable divergence between public opinion and the controversy highlighted in the local media. When seeking expert comment, local media outlets typically consult the most prominent stakeholders—whose perspectives may not represent marginalised groups [80]—leading media coverage [46–49] to mirror the views recorded, as pointed out by Frolova et al. [32]. Such reporting is often more negative than local public opinion and can skew the discourse on offshore wind by privileging selected arguments. As a key source of scientific and technological knowledge, the press plays a central role in shaping public meanings, despite reflecting only a segment of opinion [81,82]. At times, media framing amplifies controversy of offshore wind by focusing exclusively on particular concerns [83]—such as seascape alteration, restricted fishing areas or navigation

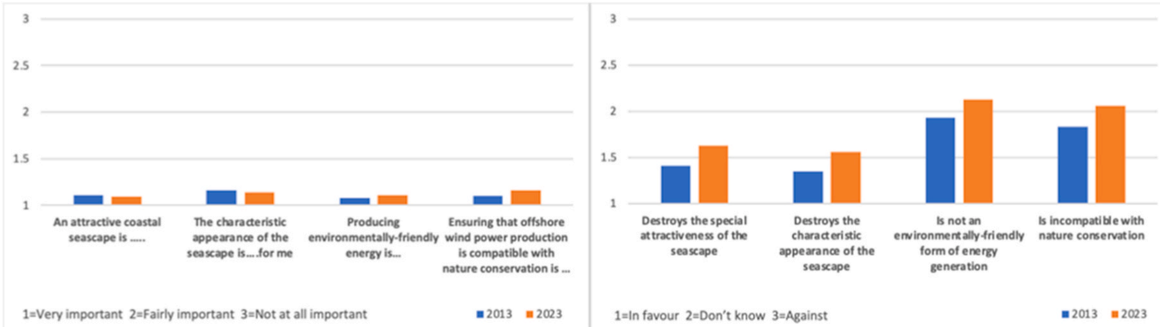

Fig. 5. Tendencies between 2013 and 2023 regarding aspects related to seascape and the environment. Source: Drawn up by the authors based on our analysis of the SPSS results.

Table 7
Most highly valued aspects in relation to landscape and the environment according to gender, age group and educational level (1–1.67 In favour/ Very important; 1.68–2.33 Don't know/Fairly important; 2.34–3.00 Against/Not at all important). Changes in the averages: Decreases are highlighted in blue; increases in pink; and those that stay the same in green.

		Year	Gender		Age groups				Educational level			
			M	W	14-20	21-35	36-50	51-65	Primary	Secondary	Vocational Training	University
Block 1 (Very important/Don't know/ Not at all important)	An attractive seascape is..	2013	1.07±0.25	1.15±0.47	1.09±0.28	1.24±0.56	1.01±0.11	1.12±0.41	1.00±0.00	1.09±0.28	1.21±0.56	1.09±0.33
		2023	1.06±0.28	1.11±0.38	1.06±0.23	1.10±0.29	1.07±0.30	1.12±0.45	1.00±0.00	1.00±0.00	1.13±0.39	1.06±0.27
	The characteristic appearance of the seascape is....for me	2013	1.23±0.50	1.11±0.38	1.35±0.57	1.21±0.54	1.07±0.26	1.17±0.46	1.15±0.37	1.24±0.50	1.17±0.49	1.13±0.40
		2023	1.12±0.38	1.17±0.43	1.00±0.00	1.17±0.38	1.11±0.39	1.22±0.52	1.33±0.81	1.11±0.33	1.17±0.42	1.12±0.38
	Producing environmentally-friendly energy is…	2013	1.09±0.33	1.06±0.31	1.05±0.21	1.15±0.46	1.04±0.26	1.06±0.24	1.00±0.00	1.00±0.00	1.13±0.46	1.08±0.31
		2023	1.09±0.31	1.13±0.40	1.39±0.69	1.08±0.26	1.04±0.26	1.15±0.35	1.33±0.51	1.44±0.72	1.15±0.40	1.03±0.17
	Ensuring that offshore wind power production is compatible with nature conservation is	2013	1.10±0.33	1.09±0.39	1.15±0.48	1.17±0.48	1.07±0.31	1.00±0.00	1.38±0.76	1.07±0.25	1.15±0.48	1.08±0.35
		2023	1.14±0.45	1.19±0.44	1.33±0.59	1.13±0.34	1.14±0.48	1.17±0.44	1.33±0.51	1.22±0.44	1.17±0.42	1.12±0.40
Block 2 (In favour/ Don't know /Against)	Destroys the special attractiveness of the seascape	2013	1.53±0.81	1.28±0.63	1.17±0.57	1.52±0.73	1.34±0.71	1.55±0.86	1.23±0.59	1.35±0.73	1.47±0.79	1.43±0.74
		2023	1.62±0.90	1.63±0.88	1.94±0.99	1.50±0.80	1.64±0.90	1.61±0.91	1.33±0.81	2.11±1.05	1.59±0.83	1.64±0.91
	Destroys the characteristic appearance of the seascape	2013	1.47±0.79	1.24±0.61	1.17±0.57	1.52±0.81	1.31±0.68	1.31±0.69	1.92±0.76	1.30±0.68	1.40±0.76	1.40±0.74
		2023	1.56±0.87	1.56±0.83	1.89±1.02	1.42±0.75	1.60±0.86	1.51±0.87	1.33±0.51	2.11±1.05	1.52±0.81	1.58±0.87
	Is not an environmentally-friendly form of energy generation	2013	2.06±0.85	1.81±0.82	1.78±0.92	2.00±0.85	1.88±0.83	2.06±0.82	1.92±0.76	1.91±0.91	1.90±0.85	1.97±0.84
		2023	2.13±0.93	2.13±0.87	2.44±0.85	1.94±0.91	2.12±0.89	2.24±0.88	2.17±0.75	2.44±0.88	2.09±0.91	2.14±0.91
	Is incompatible with nature conservation	2013	1.90±0.85	1.76±0.84	1.82±0.90	1.94±0.90	1.76±0.79	1.85±0.79	1.92±0.79	1.97±0.89	1.73±0.78	1.86±0.85
		2023	2.10±0.90	2.02±0.84	2.39±0.85	1.87±0.84	2.05±0.89	2.17±0.86	2.50±0.83	2.56±0.88	1.93±0.82	2.09±0.90

hazards—which have proven effective in influencing acceptance levels [22,84]. Furthermore, Sokoloski et al. [85] demonstrate that both supporters and opponents of offshore wind power tend to underestimate the opposition's level of support, creating pluralistic ignorance and false-consensus effects. In Cadiz, this may foster the misperception that the coastal population uniformly opposed offshore wind projects. Such reporting can impede access to balanced information and distort the decision-making process [22,86].

These studies suggest that the choice of participatory tools crucially determines whose voices are heard. To capture a genuine cross-section of local views, engagement strategies should combine multiple methods (surveys, workshops, focus groups and digital platforms) thereby ensuring that diverse and heterogeneous stakeholder perspectives are systematically included.

Although our findings are specific to Cádiz, they offer insights relevant to other coastal regions considering offshore wind projects. Patterns such as the influence of age and educational level, and the gradual normalisation of wind turbines in the landscape, are likely to emerge elsewhere. In areas where projects have not yet been commenced, populations often hold unclear views about their potential impacts—presenting an opportunity to implement participatory strategies from the outset of planning, thereby enhancing local compatibility and reducing opposition. Simultaneously, these results underscore the need for further research in diverse contexts, accounting for local specificities when examining how contextual changes influence public perceptions of offshore wind energy. For instance, the 2023 Greek study by Gkeka-Serpetidaki & Tsoutsos [36] reported highly positive attitudes toward offshore wind development, with respondents noting no visual impact or adverse effects on other economic sectors such as tourism.

Our trend evidence suggests that normalisation is more likely to occur where visibility and distance is managed, participation processes are credible, and benefit-sharing is of important at the local level [5,7,24–26,39]. Education and age gradients appear to interact with trust and perceived procedural/distributive fairness, shaping support trajectories over time [5,7,38]. Moreover, given policy and price volatility, planners should design engagement and compensation instruments that contain clear rules, transparent eligibility, staged payments, and contingencies, while aligning with guidance on durable stakeholder processes in mature markets [39].

Consistent with international evidence, our Cádiz results align with distance and visibility sensitivities [25], the roles of trust and fairness [7,38], and gradual normalization with sustained exposure [5]—while context-specific factors (e.g., tourism–fisheries economies, likely floating technology pathways in deep waters, and Spain's permitting/MSP trajectory) condition the magnitude and speed of change [38,41]. These results could be used as mechanism-informed guidance for Mediterranean, North Sea, Baltic, and Atlantic settings, noting explicitly where Cádiz converges with or departs from published estimates from those regions.

5. Limitations

This study has some limitations that should be acknowledged. First, although the samples are sufficiently broad to reflect the population of the coastal municipalities of Cádiz, they represent snapshots at two discrete time points rather than a continuous assessment of the public.

Second, the questionnaire dissemination methods differed between 2013 (paper and email) and 2023 (primarily online via email and WhatsApp). This shift may under-represent individuals with limited internet access; however, internet penetration is now nearly universal. Furthermore, we used the same local channels (institutions, community groups, and closed municipal social-media groups) which remain prevalent in the post-pandemic period to ensure wide reach and mitigate general survey fatigue.

Third, our trend-study design compares two independent samples from the same population rather than tracking individual respondents over time. While this approach is well suited for detecting broad, stratified shifts in public perceptions, it does not capture changes at the individual level.

These limitations warrant caution when interpreting the results. Nevertheless, the consistency of the patterns across sociodemographic groups (gender, age and educational level) and the convergence with previous qualitative studies in the region bolster confidence in the validity of the identified trends.

This study relies on repeated cross sections; as such, findings are associational rather than causal. Future research could include panels tracking individuals over time, differences with comparable municipalities, or event studies around regulatory milestones.

6. Conclusions

This paper analyses the evolution of public attitudes toward offshore wind farms in southern Spain. The study reveals that, over the research period, most respondents neither clearly accepted nor rejected offshore wind energy, although overall perceptions became more positive. While ambiguity about full support persists, most arguments against offshore wind projects weakened in 2023 compared to 2013, and there was broader agreement that these projects can be reconciled with traditional maritime uses. These findings are a valuable contribution to energy policy and encourage European, national, regional and local decision-makers to adopt renewed approaches to social acceptance of offshore wind farms, improving public participation and awareness.

In parallel, respondents placed greater value on social welfare, equitable benefit-sharing and local job creation. These aspects should be prioritised when seeking to build support for offshore wind development. Local public opinion in 2023 also attached greater importance to seascape and environmental conservation, although uncertainty remains about offshore wind's impacts on these aspects; nonetheless, the overall perception of these impacts improved.

At the same time, despite heightened emphasis on compatibility of wind energy with others socioeconomic activities and uses of the sea, perceived negative impacts declined. Views shifted from anticipating adverse effects on fisheries and tourism to greater uncertainty about such impacts. Broad marine spatial planning will therefore be essential to prevent unintended consequences for other socioeconomic activities.

The study also reveals discrepancies between stakeholders and resident perspectives. Stakeholders tended to express stronger opposition to offshore wind, potentially reflecting different interests, heightened sensitivity to environmental conservation and seascape values, and higher education levels.

Overall, we conclude that there is no generalised rejection of offshore wind energy among coastal populations. In contrast to prevalent media narratives, the general public remains undecided about whether the impacts of this technology are positive or negative. This underscores the need to explore how media discourse shapes public opinion and to identify the sources on which news outlets rely.

To deepen the understanding of social perceptions of offshore wind energy, we recommend bottom-up engagement strategies that capture the diversity of local views—beyond the most prominent voices. Larger sample groups and improvements in data-collection procedures would also yield more consistent results.

Author statement

Belén Pérez-Pérez: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data Curation, Writing – Review & Editing, Visualization, Supervision. Francisco Javier Rodríguez-Segura: Conceptualization, Methodology, Software, Formal análisis, Investigation, Data Curation, Writing – Review & Editing, Visualization. Juan Carlos Osorio Aravena: Conceptualization, Methodology, Validation, Formal analysis Investigation, Data Curation, Writing – Review & Editing, Visualization, Supervision. María Pilar Díaz-Cuevas: Investigation, Validation, Writing – Review & Editing, Visualization, Supervision. Marina Frolova: Conceptualization, Methodology, Writing – Review & Editing, Visualization, Supervision. Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

Funding for open access charge: Universidad de Granada/CBUA.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rser.2025.116451.

Data availability

The data that has been used is confidential.

References

[1] Requejo J. La energía regresa al territorio. In: Delgado-Jiménez F, Fernandez Álvarez-, editors. Transición energética y construcción social del territorio ante el reto del cambio climático y el nuevo marco geopolítico. Aranzadi – Karnow; 2023 (*in press*).

[2] Smil V. Energy in world history. first ed. New York: Routledge; 2019. https://doi.org/10.4324/9780429038785.

[3] Díaz-Cuevas P, Pita López MF, Fernández Tabales A, Limones Rodríguez N. Energía eólica y territorio en Andalucía: diseño y aplicación de un modelo de potencialidad para la implantación de parques eólicos. Invest Geográficas 2017;67:9–29. https://doi.org/10.14198/INGEO2017.67.01.

[4] Díaz-Cuevas P, Márquez-Sobrino P, Pérez-Pérez B. Transición energética en espacios naturales protegidos andaluces. Limitaciones y criterios de planificación. In: XXVIII Congreso de la Asociación Española de Geografía. La Rioja; 2023. p. 1045–53.

[5] Ruddat M. Public acceptance of wind energy – concepts, empirical drivers and some open questions. Wind Energy Sci 2022;7:1679–91. https://doi.org/10.5194/wes-7-1679-2022.

[6] Haggett C. Understanding public responses to offshore wind power. Energy Policy 2011;39(2):503–10. https://doi.org/10.1016/j.enpol.2010.10.014.

[7] Firestone J, Kempton W, Lilley MB, Samoteskul K. Public acceptance of offshore wind power: does perceived fairness of process matter? J Environ Plann Manag 2012;55(10):1387–402. https://doi.org/10.1080/09640568.2012.688658.

[8] Wheeler R. Reconciling windfarms with rural place identity: exploring residents' attitudes to existing sites. Sociol Rural 2017;57(1):110–32. https://doi.org/10.1111/soru.12121.

[9] Wilson GA, Dyke SL. Pre-and post-installation community perceptions of wind farm projects: the case of Roskrow Barton (Cornwall, UK). Land Use Policy 2016;52: 287–96. https://doi.org/10.1016/j.landusepol.2015.12.008.

[10] Krohn S, Damborg S. On public attitudes towards wind power. Renew Energy 1999;16(1–4):954–60. https://doi.org/10.1016/S0960-1481(98)00339-5.

[11] R Warren C, Lumsden C, O'Dowd S, Birnie RV. 'Green on green': public perceptions of wind power in Scotland and Ireland. J Environ Plann Manag 2005;48(6): 853–75. https://doi.org/10.1080/09640560500294376.

[12] Gipe P. Wind energy comes of age, 4. USA: John Wiley & Sons, Inc.; 1995.

[13] Wolsink M. Wind power implementation: the nature of public attitudes: equity and fairness instead of 'backyard motives'. Renew Sustain Energy Rev 2007;11(6): 1188–207. https://doi.org/10.1016/j.rser.2005.10.005.

[14] Devine-Wright P. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. Wind Energy: An International Journal for Progress and Applications in Wind Power Conversion Technology 2005;8(2):125–39. https://doi.org/10.1002/we.124.

[15] Sovacool BK. The cultural barriers to renewable energy and energy efficiency in the United States. Technol Soc 2009;31(4):365–73. https://doi.org/10.1016/j.techsoc.2009.10.009.

[16] Kontogianni A, Tourkolias C, Skourtos M, Damigos D. Planning globally, protesting locally: patterns in community perceptions towards the installation of wind farms. Renew Energy 2014;66:170–7. https://doi.org/10.1016/j.renene.2013.11.074.

[17] Frolova M, Pérez B. El desarrollo de las energías renovables y el paisaje: algunas bases para la implementación de la Convención Europea del Paisaje en la política energética española. Cuad Geogr Univ Granada 2008;43:289–309. Retrieved from, https://dialnet.unirioja.es/servlet/articulo?codigo=3027527.

[18] Trainor AM, McDonald RI, Fargione J. Energy sprawl is the largest driver of land use change in United States. PLoS One 2016;11:e0162269. https://doi.org/10.1371/journal.pone.0162269.

[19] Van Zalk J, Behrens P. The spatial extent of renewable and non-renewable power generation: a review and meta-analysis of power densities and their application in the US. Energy Policy 2018;123:83–91. https://doi.org/10.1016/j.enpol.2018.08.023.

[20] Qu Y, Hooper T, Swales JK, Papathanasopoulou E, Austen MC, Yan X. Energy-food nexus in the offshore environment: a macroeconomic analysis on offshore wind energy and seafood production in Scotland. Energy Policy 2021;149:112027. https://doi.org/10.1016/j.enpol.2020.112027.

[21] Heidenreich S. Out of sight, out of mind? Controversy over offshore wind energy in Norway's news media. Sci Cult 2016;25(4):449–72. https://doi.org/10.1080/09505431.2016.1183609.

[22] Schmidt A. Need for a wind of change? Use of offshore wind messages by stakeholders and the media in Germany and their effects on public acceptance. J Environ Plann Manag 2017;60(8):1391–411. https://doi.org/10.1080/09640568.2016.1221799.

[23] Firestone J, Hoen B, Rand J, Elliott D, Hübner G, Pohl J. Reconsidering barriers to wind power projects: community engagement, developer transparency and place. J Environ Pol Plann 2018;20(3):370–86. https://doi.org/10.1080/1523908X.2017.1418656.

[24] Haggett C. Over the sea and far away? A consideration of the planning, politics and public perception of offshore wind farms. J Environ Pol Plann 2008;10(3): 289–306. https://doi.org/10.1080/15239080802242787.

[25] Ladenburg J, Dubgaard A. Preferences of coastal zone user groups regarding the siting of offshore wind farms. Ocean Coast Manag 2009;52(5):233–42. https://doi.org/10.1016/j.ocecoaman.2009.02.002.

[26] Bush D, Hoagland P. Public opinion and the environmental, economic and aesthetic impacts of offshore wind. Ocean Coast Manag 2016;120:70–9. https://doi.org/10.1016/j.ocecoaman.2015.11.018.

[27] Kempton W, Firestone J, Lilley J, Rouleau T, Whitaker P. The offshore wind power debate: views from Cape Cod. Coast Manag 2005;33(2):119–49. https://doi.org/10.1080/08920750590917530.

[28] Gee K. Offshore wind power development as affected by seascape values on the German North Sea coast. Land Use Policy 2010;27(2):185–94. https://doi.org/10.1016/j.landusepol.2009.05.003.

[29] Short L. Wind power and English landscape identity. In: Pasqualetti MJ, Gipe P, Righter RW, editors. Windpower in view. Energy landscapes in a crowded world. China: Academic Press; 2002. p. 43–59. https://doi.org/10.1016/B978-012546334-8/50003-6.

[30] Pasqualetti MJ. Living with wind power in a hostile landscape. In: Pasqualetti MJ, Gipe P, Righter RW, editors. Windpower in view. Energy landscapes in a crowded world. China: Academic Press; 2002. p. 153–72. https://doi.org/10.1016/B978-012546334-8/50009-7.

[31] Schmidt-Höhne F. Die Meere in uns. Eine psychologische Untersuchung über das Meer als Bedeutungsraum, 17; 2019. Tredition, Hamburg.

[32] Frolova M, Pérez-Pérez B, Herrero-Luque D. Diverse responses of coastal communities to offshore wind farming development in Southern Spain. Morav Geogr Rep 2002;30(4):324–39. https://doi.org/10.2478/mgr-2022-0021.

[33] Lamy J, de Bruin WB, M I, Azevedo, Morgan MG. Keep wind projects close? A case study of distance, culture, and cost in offshore and onshore wind energy siting. Energy Res Social Sci 2020;63:101377. https://doi.org/10.1016/j.erss.2019.101377.

[34] Devine-Wright P, Wiersma B. Understanding community acceptance of a potential offshore wind energy project in different locations: an island-based analysis of 'place-technology fit'. Energy Policy 2020;137:111086. https://doi.org/10.1016/j.enpol.2019.111086.

[35] Cranmer A, Broughel A, Ericsion J, Goldberg M, Dharni K. Getting to 30 GW by 2030: visual preferences of coastal residents for offshore wind farms on the US East Coast. Energy Policy 2023;173:113366. https://doi.org/10.1016/j.enpol.2022.113366.

[36] Gkeka-Serpetsidaki P, Tsoutsos T. Integration criteria of offshore wind farms in the landscape: viewpoints of local inhabitants. J Clean Prod 2023;417:137899. https://doi.org/10.1016/j.jclepro.2023.137899.

[37] Getor R, Ramudhin A, Keivanpour S. Social acceptability of a wind turbine blade facility in Kingston upon hull. J Clean Prod 2022;379:134859. https://doi.org/10.1016/j.jclepro.2022.134859.

[38] Skjølsvold TM, Heidernreich S, Henriksen IM, et al. Conditions for just offshore wind energy: addressing the societal challenges of the North Sea wind industry. Energy Res Social Sci 2024;107:103334. https://doi.org/10.1016/j.erss.2023.103334.

[39] Brunbauer M, et al. Effective stakeholder engagement for offshore wind energy development: the State of New York's fisheries and environmental technical working groups. Mar Coast Fish 2023;15(6):e10236. https://doi.org/10.1002/mcf2.10236.

[40] Ladenburg J, Knapp L, Petrovic S. Distance to offshore wind farms and onshore wind power spillover relations and the willingness to pay for Farshore large-scale wind power development. SSRN 2023:4390647. https://doi.org/10.2139/ssrn.4390647. 1-40.

[41] Nytte S, Navrud S, Alfnes F. Social acceptance of new floating offshore wind power: do attitudes towards existing offshore industries matter? Renew Energy 2024;230: 120855. https://doi.org/10.1016/j.renene.2024.120855.

[42] Kim HJ, Kim JH, Yoo S. Social acceptance of offshore wind energy development in South Korea: results from a choice experiment survey. Renew Sustain Energy Rev 2019;113:109253. https://doi.org/10.1016/j.rser.2019.109253.

[43] Linnerud K, Dugstad A, Rygg BJ, Gilpin GS, Holden E. Energy crisis and social acceptance of offshore wind – a before-and-after analysis. Energy 2025;325: 136049. https://doi.org/10.1016/j.energy.2025.136049.

[44] MITYC. Estudio Estratégico Ambiental del Litoral Español para la Instalación de Parques Eólico Marinos. http://aeeolica.org/uploads/documents/562-estudio-estrategico-ambiental-del-litoral-espanol-para-la-instalacion-de-parques-eolicos-marinos_mityc.pdf. [Accessed 28 January 2024].

[45] Pérez B. Perspectivas de desarrollo y ordenación territorial y paisajística de la energía eólica off-shore en España. Nimbus: Revista de climatología, meteorología y paisaje 2010;25:175–86. Retrieved from, http://repositorio.ual.es/bitstream/handle/10835/1463/Art.175-186.pdf?sequence=1&isAllowed=y.
[46] Diario de Cádiz Chipiona. Todos los candidatos, en un debate sobre energía eólica marina. Por un horizonte sin molinos realiza el acto para que los candidatos expliquen su visión. https://www.diariodecadiz.es/noticias-provincia-cadiz/Chipiona-candidatos-debate-energia-marina_0_475452592.html; 2011 (accesed 15 Decmeber 2024).
[47] Diario de Cádiz. El proyecto de parque eólico frente a La Caleta de Cádiz acumula "muchas debilidades". https://www.diariodecadiz.es/cadiz/proyecto-parque-eolico-Caleta-Cadiz-acumula-muchas-debilidades_0_1651636852.html. [Accessed 15 December 2023].
[48] Confidencial El. La lucha contra el impacto de los molinos de viento llega en Cádiz mar adentro. https://www.elconfidencial.com/espana/andalucia/2022-02-16/lucha-impacto-molinos-viento-cadiz_3374195/. [Accessed 15 December 2023].
[49] Información Andalucía. Impactos del parque eólico marino en Cádiz: ruido, pérdida de calidad de aire y agua. https://andaluciainformacion.es/andalucia/1026500/impactos-del-parque-eolico-marino-en-cadiz-ruido-perdida-de-calidad-de-aire-y-agua/. [Accessed 15 December 2023].
[50] StopParqueEólicoMarDeÁgata. https://stopparqueeolicomardeagata.org/. [Accessed 10 January 2024].
[51] MITECO. Hoja de Ruta Eólica Marina y Energías del Mar en España. https://www.miteco.gob.es/es/prensa/211210hreolicamarinayenergiasdelmarenespana_tcm30-533945.pdf. [Accessed 16 December 2023].
[52] Devine-Wright P. Rethinking NIMBYism: the role of place attachment and place identity in explaining place-protective action. J Community Appl Soc Psychol 2009;19(6):426–41. https://doi.org/10.1002/casp.1004.
[53] Bidwell D. The role of values in public beliefs and attitudes towards commercial wind energy. Energy Policy 2013;58:189–99. https://doi.org/10.1016/j.enpol.2013.03.010.
[54] Firestone J, Bates AW, Prefer A. Power transmission: where the offshore wind energy comes home. Environ Innov Soc Transit 2018;29:90–9. https://doi.org/10.1016/j.eist.2018.06.002.
[55] Nadaï A, Labussière O. Landscape commons, following wind power fault lines. The case of seine-et-marne (France). Energy Policy 2017;109:807–16. https://doi.org/10.1016/j.enpol.2017.06.049.
[56] Díaz Cuevas P, Fernández Tabales A, F Pita López M. Energía Eólica y Paisaje. Identificación y cuantificación de paisajes afectados por instalaciones eólicas en Andalucía. Boletín de la Asociación de Geógrafos Españoles 2016;71:397–430. https://doi.org/10.21138/bage.2288.
[57] Gee K. Trade-offs between seascape and offshore wind farming values: an analysis of local opinions based on a cognitive belief framework. Doctoral dissertation, Niedersächsische Staats-und Universitätsbibliothek Göttingen) 2013. https://tethys.pnnl.gov/sites/default/files/publications/Gee-2013-Dissertation.pdf.
[58] Lange M, Burkhard B, Garthe S, Gee K, Kannen A, Lenhart H, Windhorst W. Analyzing coastal and marine changes: offshore wind farming as a case study. Zukunft Küste-Coastal Futures 2010. https://tethys.pnnl.gov/sites/default/files/publications/Lange-2010-Coastal-Changes.pdf.
[59] Pérez Pérez B. Aplicación de técnicas de investigación social para la gestión y ordenación de paisajes emergentes de energías renovables. Granada: Universidad de Granada; 2006.
[60] Rodríguez-Segura FJ, Osorio-Aravena JC, Frolova M, Terrados-Cepeda J, Muñoz-Cerón E. Social acceptance of renewable energy development in southern Spain: exploring tendencies, locations, criteria and situations. Energy Policy 2023;173:113356. https://doi.org/10.1016/j.enpol.2022.113356.
[61] Wüstenhagen R, Wolsink M, Bürer MJ. Social acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 2007;35(5):2683–91. https://doi.org/10.1016/j.enpol.2006.12.001.
[62] Batel S. Research on the social acceptance of renewable energy technologies: past, present and future. Energy Res Social Sci 2020;68:101544. https://doi.org/10.1016/j.erss.2020.101544.
[63] Devine-Wright P. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. Wind Energy: An International Journal for Progress and Applications in Wind Power Conversion Technology 2005;8(2):125–39. https://doi.org/10.1002/we.124.
[64] Firestone J, Kempton W, Lilley MB, Samoteskul K. Public acceptance of offshore wind power across regions and through time. J Environ Plann Manag 2012;55(10):1369–86. https://doi.org/10.1080/09640568.2012.682782.
[65] Firestone J, Kempton W, Krueger WA. Public acceptance of offshore wind power projects in the USA. Wind Energy: An International Journal for Progress and Applications in Wind Power Conversion Technology 2009;12(2):183–202. https://doi.org/10.1002/we.316.
[66] Todt O, González MI, Estévez B. Conflict in the sea of Trafalgar: offshore wind energy and its context. Wind Energy 2011;14:699–706. https://doi.org/10.1002/we.446.
[67] Smith H, Smythe T, Moore A, Bidwell D, McCann J. The social dynamics of turbine tourism and recreation: introducing a mixed-method approach to the study of the first US offshore wind farm. Energy Res Social Sci 2018;45(2018):307–17. https://doi.org/10.1016/j.erss.2018.06.018.
[68] Cronin Y, Cummins V, Wolsztynski E. Public perception of offshore wind farms in Ireland. Mar Pol 2021;134:104814. https://doi.org/10.1016/j.marpol.2021.104814.
[69] Warren CR, McFadyen M. Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. Land Use Policy 2010;27(2):204–13. https://doi.org/10.1016/j.landusepol.2008.12.010.
[70] Agterbosch S, Meertens RM, Vermeulen WJ. The relative importance of social and institutional conditions in the planning of wind power projects. Renew Sustain Energy Rev 2009;13(2):393–405. https://doi.org/10.1016/j.rser.2007.10.010.
[71] Walker BJ, Wiersma B, Bailey E, Community benefits E. Framing and the social acceptance of offshore wind farms: an experimental study in England. Energy Res Social Sci 2014;3:46–54. https://doi.org/10.1016/j.erss.2014.07.003.
[72] Glasson J, Durning B, Welch K, Olorundami T. The local socio-economic impacts of offshore wind farms. Environ Impact Assess Rev 2022;95:106783. https://doi.org/10.1016/j.eiar.2022.106783.
[73] Haraldsson M, Raoux A, Riera F, Hay J, Dambacher JM, Niquil N. How to model social-ecological systems?–A case study on the effects of a future offshore wind farm on the local society and ecosystem, and whether social compensation matters. Mar Pol 2020;119:104031. https://doi.org/10.1016/j.marpol.2020.104031.
[74] Salvador S, Ribeiro MC. Socio-economic, legal, and political context of offshore renewable energies. Wiley Interdiscip Rev: Energy Environ 2022;12(2):e462. https://doi.org/10.1002/wene.462.
[75] Rudolph D. The resurgent conflict between offshore wind farms and tourism: underlying storylines. Scott Geogr J 2014;130(3):168–87. https://doi.org/10.1080/14702541.2014.914239.
[76] Westlund H, Wilhelmsson M. The socio-economic cost of wind turbines: a Swedish case study. Sustainability 2021;13(12):6892. https://doi.org/10.3390/su13126892.
[77] Ladenburg J, Möller B. B, Attitude and acceptance of offshore wind farms—The influence of travel time and wind farm attributes. Renew Sustain Energy Rev 2011;15(9):4223–35. https://doi.org/10.1016/j.rser.2011.07.130.
[78] Bishop ID, Miller DR. Visual assessment of off-shore wind turbines: the influence of distance, contrast, movement and social variables. Renew Energy 2007;32(5):814–31. https://doi.org/10.1016/j.renene.2006.03.009.
[79] Lloret J, Turiel A, Solé J, Berdalet E, Sabatés A, Olivares A, Sarda R. Unravelling the ecological impacts of large-scale offshore wind farms in the Mediterranean Sea. Sci Total Environ 2022;824:153803. https://doi.org/10.1016/j.scitotenv.2022.153803.
[80] Chambers R. Whose reality counts, 25. London: Intermediate technology publications; 1997.
[81] Heidenreich S. Out of sight, out of mind? Controversy over offshore wind energy in Norway's news media. Sci Cult 2016;25(4):449–72. https://doi.org/10.1080/09505431.2016.1183609.
[82] Alessi J. The battle for cape wind: an analysis of Massachusetts newspapers and their framing of offshore wind energy. Vermont: University of Vermont; 2017.
[83] Entman RM. Framing: toward clarification of a fractured paradigm. J Commun 1993;43(4):51–8. https://doi.org/10.1111/j.1460-2466.1993.tb01304.x.
[84] Fischlein M, Feldpausch-Parker AM, Peterson TR, Stephens JC, Wilson EJ. Which way does the wind blow? Analysing the state context for renewable energy deployment in the United States. Environ Policy Gov 2014;24(3):169–87. https://doi.org/10.1002/eet.1636.
[85] Sokoloski R, Markowitz EM, Bidwell D. Public estimates of support for offshore wind energy: false consensus, pluralistic ignorance, and partisan effects. Energy Policy 2018;112:45–55. https://doi.org/10.1016/j.enpol.2017.10.005.
[86] Lakoff G. Why it matters how we frame the environment. Environ Commun 2010;4(1):70–81. https://doi.org/10.1080/17524030903529749.

Update

Renewable and Sustainable Energy Reviews

Volume 227, Issue , February 2026, Page

DOI: https://doi.org/10.1016/j.rser.2025.116562

Renewable and Sustainable Energy Reviews 227 (2026) 116562

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Erratum to “Winds of change: Surfing prospects for offshore wind energy in coastal Spain (Cádiz)” [Renew Sustain Energy Rev 226 (2026) 116451]

Belén Pérez-Pérez [a,*], Francisco Javier Rodríguez-Segura [b], Juan Carlos Osorio-Aravena [a], Pilar Díaz-Cuevas [c], Marina Frolova [a]

[a] University of Granada, Spain
[b] University of Cantabria, Spain
[c] University of Sevilla, Spain

The publisher regrets that the following acknowledgment statement, which was provided by the author during the proofing stage, was not included during the production process:

"Funding for open access charge: Universidad de Granada/ CBUA"

This acknowledgment was added to the article after its publication.

The publisher would like to apologise for any inconvenience caused.

DOI of original article: https://doi.org/10.1016/j.rser.2025.116451.

* Corresponding author.
E-mail address: belenperez@ugr.es (B. Pérez-Pérez).

https://doi.org/10.1016/j.rser.2025.116562

Available online 29 November 2025