



Build public trust: Six factors for increasing wind power acceptance

In the European Union, efforts to streamline permitting for renewable energy projects, such as the Wind Power Action Plan (2023), aim to accelerate the transition to net-zero carbon energy systems.

Although wind power is widely recognized as an important form of clean renewable energy, the rapid deployment of wind farms can lead to concerns, conflicts, and opposition within local communities. The changing political landscape and regulations in the European Union and globally also contribute to uncertainties about the future in local communities.

Recommendations for the decision-makers and wind power developers:

1. Take concerns about the impacts of wind turbines on people seriously and address them transparently by leveraging scientific knowledge.
2. Apply the mitigation hierarchy (first avoid, then mitigate, and, if necessary, compensate) to minimize the negative impacts of wind power on nature.
3. Clearly articulate both market and non-market benefits and costs and integrate them into the decision-making process.
4. Involve communities in the planning process from the very beginning of projects.
5. Ensure that all voices, including the silent majority and ethnic minorities, are appropriately considered in decision-making.
6. Support communities in understanding the connection between wind power and the broader benefits of the clean energy transition.

Wind power in different countries

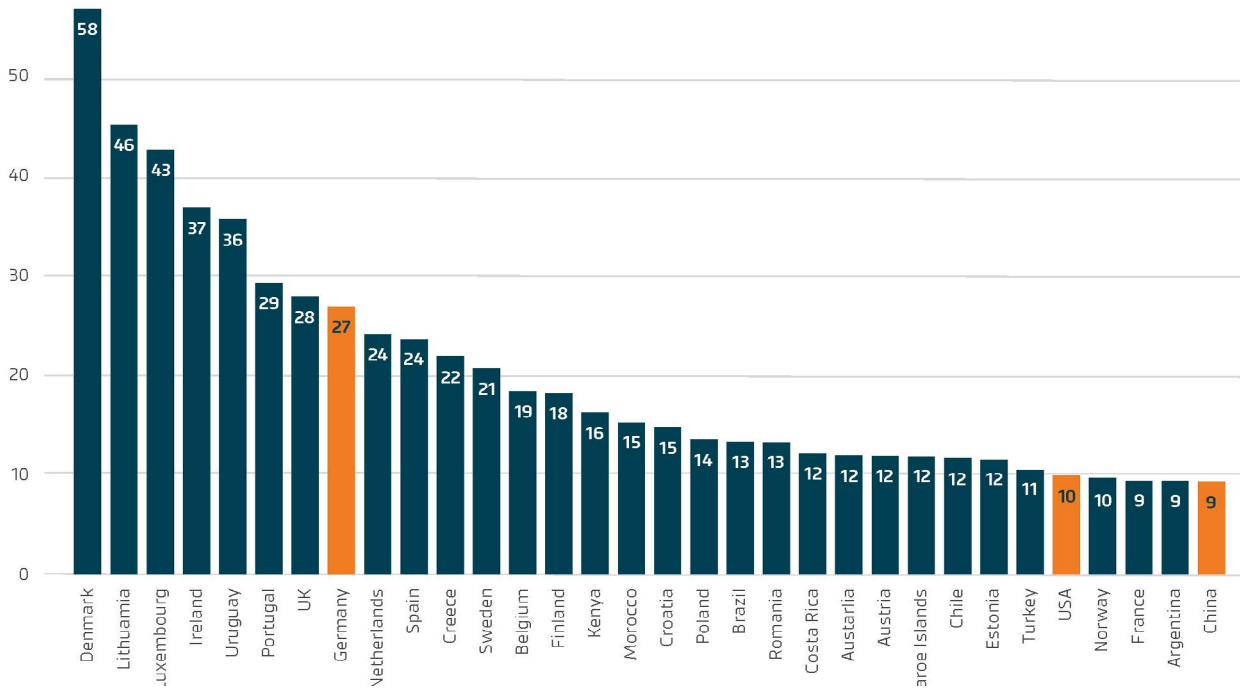


Figure 1 | Share of wind in total electricity production as a percentage (%) in 2023. Countries with the highest wind power capacity are highlighted in orange. Data from <https://ember-climate.org/topics/wind/>.

The electricity generation capacity from wind has increased alongside the global demand for electricity. Denmark generates more than half of its electricity from wind, more than any other country in the world (Figure 1). The European Union is approaching a 20% share of wind in its electricity demand (International Energy Association IEA 2024). Meanwhile, China, the USA and Germany have the largest wind power capacities globally, though not the largest share of their electricity.

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Given that countries are at different stages of wind power development, this internationally produced policy brief offers an opportunity to share information and experiences on best practices that promote a sustainable and socially acceptable transition to clean energy, including wind power.

Factors of acceptance

Acceptance can be defined as positive or neutral attitudes towards a wind power project (Hübner et al. 2023). Six factors contribute to the social acceptance of wind energy projects: 1) impacts on people, 2) impacts on nature, 3) impacts on the economy, 4) trust in the planning process, 5) social norms, and 6) attitudes towards the clean energy transition (Figure 2).

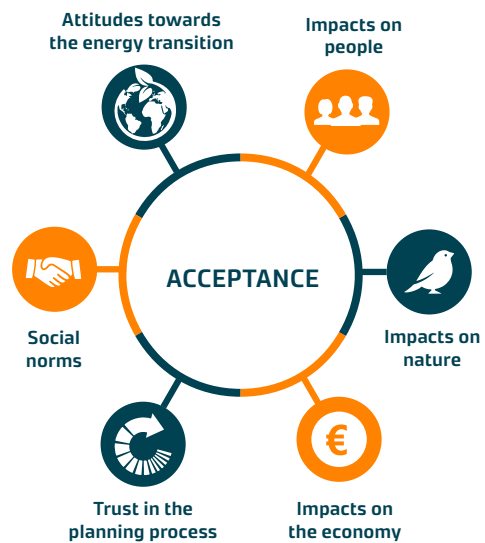


Figure 2 | Factors of acceptance. Adapted from the drivers of acceptance by Hübner et al. (2023), where impacts on people and nature were originally classified as a single driver.

Recommendation 1: Impacts on people

Take concerns about the impacts of wind turbines on people seriously and address them transparently by leveraging scientific knowledge.

The effects of wind power, such as noise and shadow flicker caused by spinning turbine blades, are well known and can be mitigated. Research shows no evidence of direct effects of wind turbines on human health, however low-frequency sound can cause strong annoyance among residents living close to wind turbines. Changes to the landscape also impact acceptance: people tend to be more willing to accept wind power projects in urban areas than in leisure areas.

- **Understand impacts:** Support wind energy developers in understanding the impact of perceived or potential risks on people's health and quality of life.
- **Address annoyance:** Address even single cases of strong annoyance, as they may lead to opposition. Standardize the term 'annoyance' and include self-reported stress symptoms in its definition (Hübner et al. 2019).
- **Mitigate:** Use modern technologies, such as noisereducing Dino-tails, to minimize noise and flicker.
- **Use natural shields:** Utilize forests that provide a landscape-level shield from noise and flicker near residential areas as part of longer-term solutions.



Recommendation 2: Impacts on nature

Apply the mitigation hierarchy (first avoid, then mitigate, and, if necessary, compensate) to minimize the negative nature impacts of wind power.

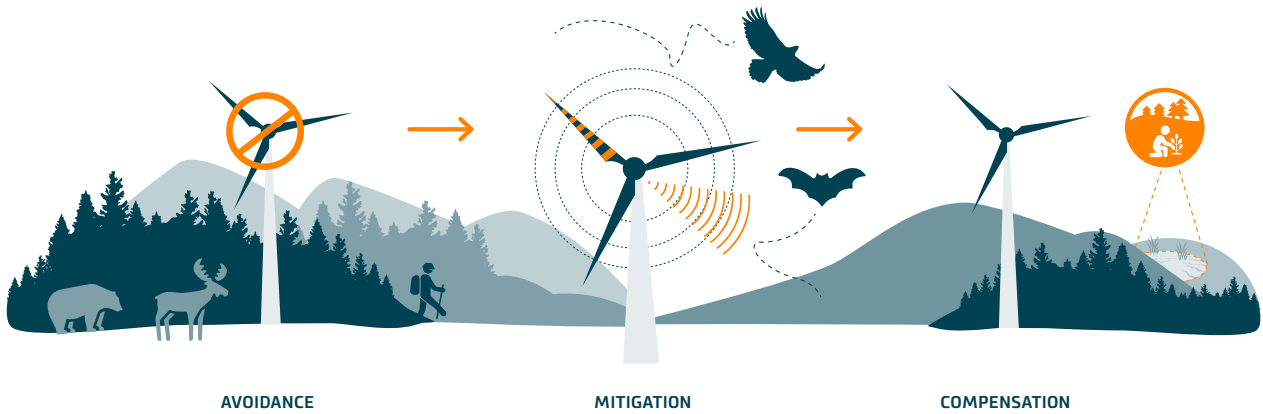


Figure 3 | Mitigation hierarchy suggested for wind power projects.

The negative impacts on wildlife populations raise concerns among people and reduce local acceptance of wind power. Direct effects include collision mortality and disturbance caused by noise and flickering lights, while indirect effects involve the degradation and fragmentation of natural habitats. Together, these effects can lead to a decline in wildlife populations, which can be particularly critical for threatened species. Wind power companies should apply the mitigation hierarchy to alleviate negative biodiversity impacts (Figure 3).

"Wind power companies should apply the mitigation hierarchy to alleviate negative biodiversity impacts."

- **Avoid:** Place wind turbines in wastelands, and degraded areas with low biodiversity and implement distance thresholds based on scientific evidence, especially for threatened species. When scientific data is lacking, apply the precautionary principle.
- **Mitigate:** Regularly use detection and deterrence devices, along with collision prevention measures such as radars, turbine coloring, cut-in wind speeds, and operational control during bird migration.
- **Compensate:** If avoiding functional habitat loss is not possible, compensate by creating high-quality habitat in nearby areas through protection or restoration efforts.
- **Indirect positive impacts:** Investigate and clearly communicate the less obvious indirect positive impacts of wind energy on cleaner air and water, and therefore on nature.

Recommendation 3: Impacts on the economy

Clearly articulate both market and non-market benefits and costs, and integrate them into the decision-making process.

Wind power projects can impact other livelihoods, such as tourism and recreation, reindeer herding in the north, or, in the case of offshore wind power, fishing. Benefits and costs may also be unevenly distributed, as landowners may receive rent for the land leased for the turbines, but other residents perceiving impacts may not. In addition to identifying and clearly presenting benefits and costs, new economic instruments are needed to address the growing equity issues within communities.

- **Articulate:** Clearly articulate local benefits and costs in terms of livelihoods, landowner rental payments, municipal economy, tax revenues, and employment effects.
- **Develop economic instruments:** To address increasing equity problems, develop economic instruments, such as land use change fees, equity principles for monetary revenues in the community, and mechanisms to trade landscape values.
- **Local non-market benefits and costs:** Identify, articulate, and integrate changes in landscape, recreation, and nature values, into decision-making.

Recommendation 4: Trust in the planning process

Involve communities in the planning process from the very beginning of projects.

Local communities often feel that they do not have a meaningful say in the planning process for wind power projects. Early engagement with local people increases trust and acceptance, and valuable local knowledge help influence turbine placement. A multi-way process is needed beyond mere consultations, as mutual support, respect and inclusivity are crucial (Figure 4).

- **Trust comes first:** Build a ‘bridge’ between developer and the host community at an early stage.
- **Appropriate involvement:** Ensure that stakeholders are involved at the appropriate level in decisions that are most important to them.
- **Development vision:** Adhere to the local development vision, supported by thorough and transparent impact studies, to identify suitable sites.
- **Recognize negative impacts:** Support developers in identifying the negative impacts of their projects on nature, and ensure they take steps to avoid, mitigate, or compensate for these impacts.

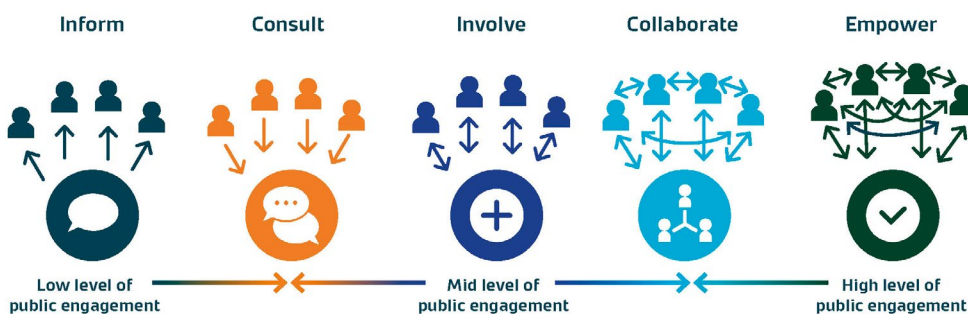


Figure 4 | Spectrum of engagement, adapted from the International Association for Public Participation (<https://iap2.org.au/resources/spectrum/>).

Recommendation 5: Social norms

Ensure that all voices, including the silent majority and ethnic minorities, are appropriately considered in decision-making.

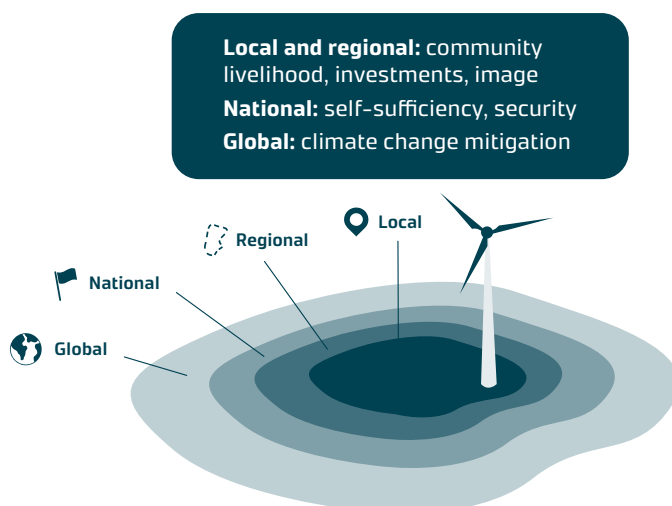
Wind power projects are often constructed in rural areas. Communities may have experienced other large-scale industrial projects, such as hydropower, mining or tourism, which have influenced their daily lives. The new project may be the “last drop for the community” and trigger greater resistance than if the region’s history or culture was not taken into account. Conversely, if the wind power project is the first industrial-scale investment in the community, residents may not be accustomed to such developments. In these situations, opponents may become more active than supporters or neutral residents, who are often in the majority.

- **Engage the silent majority and ethnic minorities:** Use low-threshold methods such as surveys to elicit the views of all groups in a balanced manner. Take opposition seriously.
- **Address conflicting interests:** Acknowledge and address conflicting interests within the community. Prioritize and engage those directly impacted over those who are unaffected.
- **Balance the discussion:** Share stories and examples of how renewable energy has supported local identity and livelihoods, alongside any challenge faced.

Recommendation 6: Attitudes towards the clean energy transition

Support communities in understanding the connection between wind power and the broader benefits of the clean energy transition.

When people understand how a wind power project contributes to the benefits of clean energy transition at different scales, they are more likely to support it (Figure 5). While the transition alone may not be a convincing argument for many locals, associated benefits, such as investments, enhanced community livelihood, a positive image, and potential long-term environmental improvements, can make the project more attractive.



- **Communicate relevance:** Clearly communicate the relevance of the energy transition and its goals and acknowledge the importance of local and regional contributions to these goals.
- **Connect to strategies:** Link local renewable energy projects to relevant local, regional, or national strategies, investments, and value chains. Explain how a specific project helps achieve these goals.
- **Explain environmental effects:** The construction and operation of wind farms inevitably affect their surrounding environment and biodiversity. However, with proper mitigation measures in place, the long-term benefits of wind power outweigh these effects, as it helps mitigate climate change and its associated impacts.
- **Foster ownership:** Involve communities in developing these strategies to foster a sense of ownership.

Figure 5 | The benefits of wind power at different scales.

Research needs

- **Nature and environment:** habituation of wildlife to wind power, impacts and distance thresholds for modern large turbines, impacts on soil biota and ecosystems, impacts of offshore wind power, life-cycle impacts of wind power, indirect and direct positive impacts on biodiversity.
- **Economy:** models to intergrate local non-market benefits and costs in decision making, ownership models.
- **Planning process:** use of digital participation tools to investigate opinions of younger groups, positive landscape planning procedure including empowered citizens, collaborative approaches and co-creation. Proactive energy siting discussions within and between local communities.
- **Communities:** methods for building community preparedness before the project begins, assessment of meaningful community benefits, internal conflicts and conflict resolution in local communities, changing patterns of local acceptance over time.
- **Annoyance of people:** specific annoyance situations and win-win situations, proportion of strongly annoyed residents in different countries and regions, longitudinal studies on long-term impacts on people, measures and their effectiveness to mitigate annoyance, standardized annoyance definition.

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