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Forecasts for Land-Based Wind Deployment in the United States:

Wind Industry Survey Results

Ryan Wiser, Robi Nilson, Joe Rand, Ben Paulos
Lawrence Berkeley National Laboratory

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Content and Objectives

- High-Level Findings
- Methods & Respondents
- More-Detailed Results

Project Objectives

Recent land-based wind deployment in the United States has been sluggish, and expectations for future growth have moderated in recent years.

Berkeley Lab conducted a brief survey of wind industry stakeholders to better understand barriers and solutions.

The focus of the survey was on land-based wind projects in the United States – not offshore wind or distributed small wind projects.

Originally intended to serve internal information needs but results interesting enough to make public.

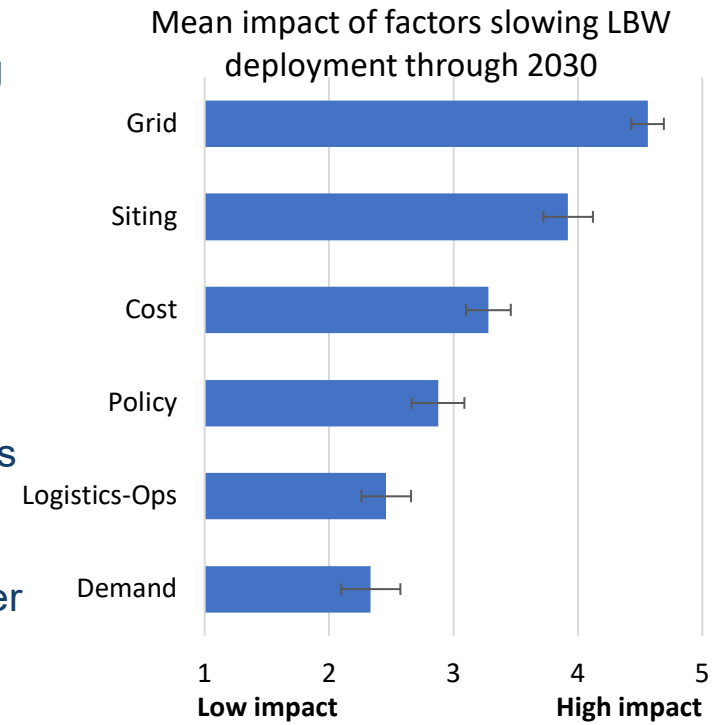
High-Level Findings

(1) Both near- and longer-term land-based wind (LBW) deployment forecasts may be too high

- 81% of respondents think that the most-recent 5-year forecasts (2024-2028) for land-based wind deployment are too high
  - 57% believe forecasts overestimate deployment by 10% or more
- Under business-as-usual conditions, the majority of respondents (52%) consider longer-term deployment forecasts of 25 GW per year "very unlikely", while one respondent deemed it "almost impossible"

(2) Grid and siting challenges are highest among factors slowing LBW deployment

- Grid challenges - especially transmission and interconnection - have the largest impact on slowing land-based wind deployment through 2030
  - Siting challenges also have a major impact
  - Cost-related challenges are also notable
- Specifically, interconnection backlogs are the most severe challenge, followed closely by transmission constraints and then community opposition
  - Specific policy and cost factors, e.g., tax credit and tariff risks, inflation, also have high impacts
  - On the other hand, demand for wind power, technology advancement, and a range of logistics and operational issues as well as other policy, cost and grid factors are not seen as significant challenges

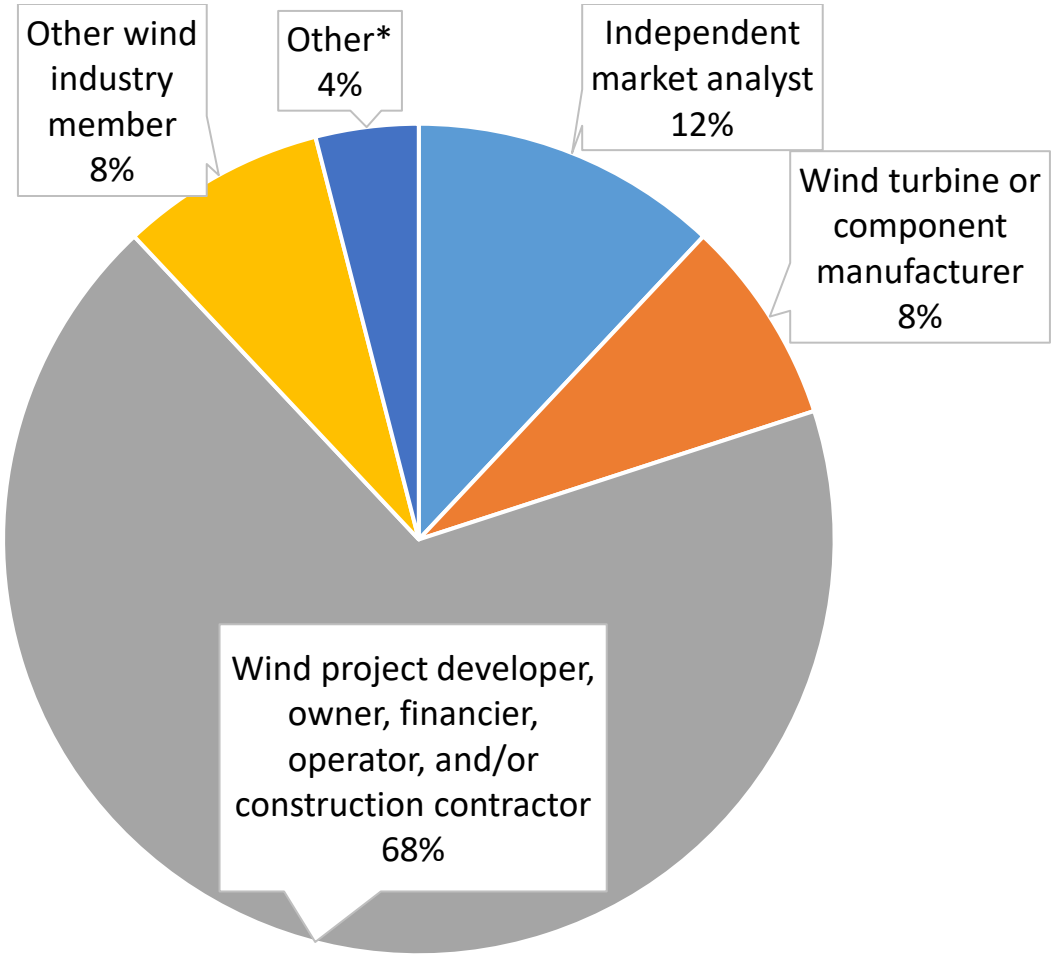


(3) Enabling higher deployment levels in the longer-term relies most significantly on solutions to grid and siting challenges

- Key solutions include, for example:
  - Expanding the transmission network and unblocking interconnection queues
  - Reducing challenges related to siting, permitting, and community opposition
- Fourteen respondents (56%) noted grid-related solutions as the "most important tangible action" to significantly increase land-based wind deployment in the U.S.; another seven (28%) noted siting and permitting solutions

Methods and Respondents

- Survey Methods
  - Brief, online survey
  - Issued on Nov. 13, 2024
  - Responses by Dec. 2, 2024
- Survey Sample
  - Total number: 65
  - Focus on developers/owners/operators, market analysts, manufacturers, other industry
- Survey Respondents
  - Total number = 25
  - Response rate = 38%

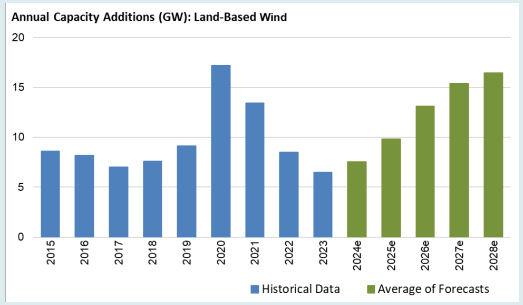


*The one "Other" identified as a "Non-profit and philanthropic advisor"

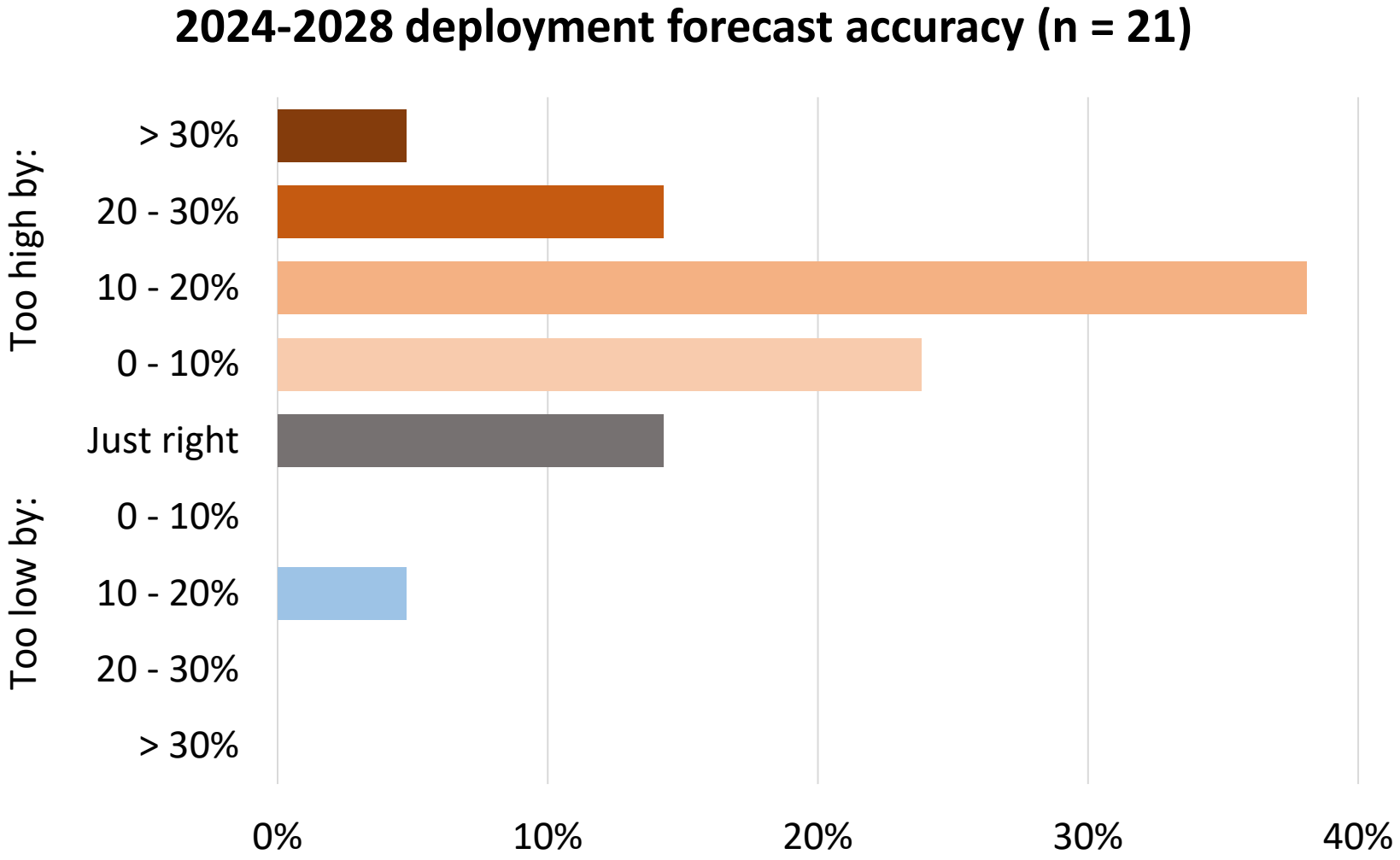
Question 1: Recent 5-year forecasts for land-based wind deployment (62.5 GW from 2024-2028, average 12.5 GW/year): too high, or too low?

QUESTION

Recent forecasts for land-based wind deployment in the US average 7.5 GW in 2024, rising to 9.8 GW in 2025 and then continuing to increase to 16.4 GW in 2028 (see figure). The total amount of expected land-based wind capacity added over this 5-year period is ~62.5 GW. This equals an average annual deployment of 12.5 GW per year and can be compared to the 6.5 GW deployed in 2023 and the 11 GW/year average from 2019-2023.



Do you think the above 5-year forecast for growth in land-based wind capacity in the United States (62.5 GW, or an average of 12.5 GW per year) is:



Question 2: Broad factors that may slow land-based wind deployment through 2030: which will have the largest impact?

QUESTION

Expectations for future growth in land-based wind deployment in the United States seem to have moderated over the last two years. Third-party analyst forecasts for deployment in the near- to medium- term (i.e., through 2030) have declined since the passage of the Inflation Reduction Act. Recent deployment has been sluggish. We would like your opinion on the factors that may be reducing expectations for land-based wind deployment in the near- to medium- term, through 2030.

For each of the following six broad factors, please rate the level of impact each one is likely to have on slowing land-based wind deployment through 2030.

Grid: Transmission and interconnection limitations to accessing low-cost sites

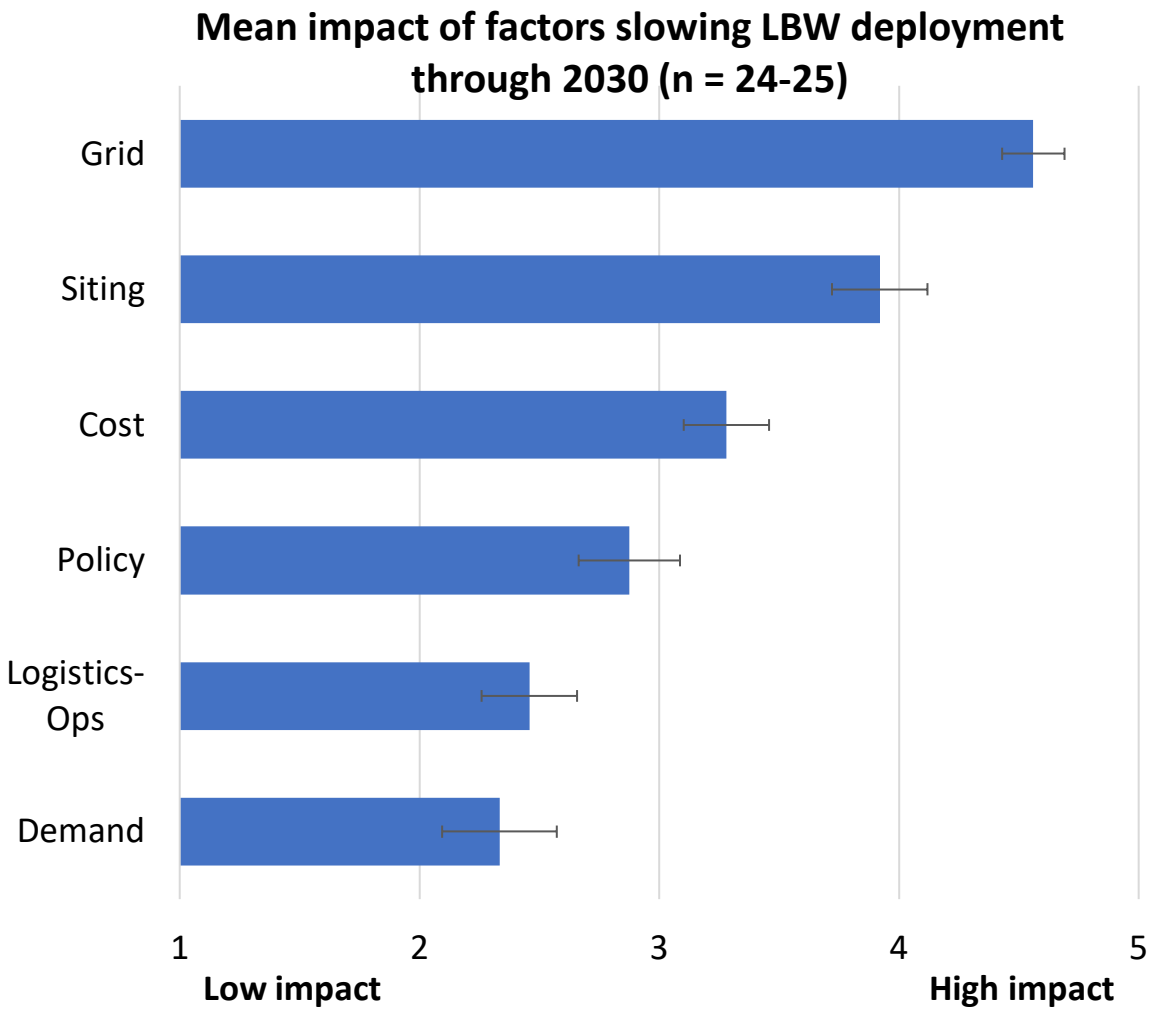
Siting: Siting, permitting, and community opposition challenges

Cost: Higher costs due to interest rates, inflation, import tariffs, and/or low technology

Policy: Uncertainty in or insufficient federal and state policy support

Logistics & Operations: Challenges related to supply chains, transportation, workforce, and/or turbine reliability

Demand: Economic competition with other sources of electricity (e.g., natural gas and solar)



Error bars show standard error of the mean

Question 2: Broad factors that may slow land-based wind deployment through 2030: additional details

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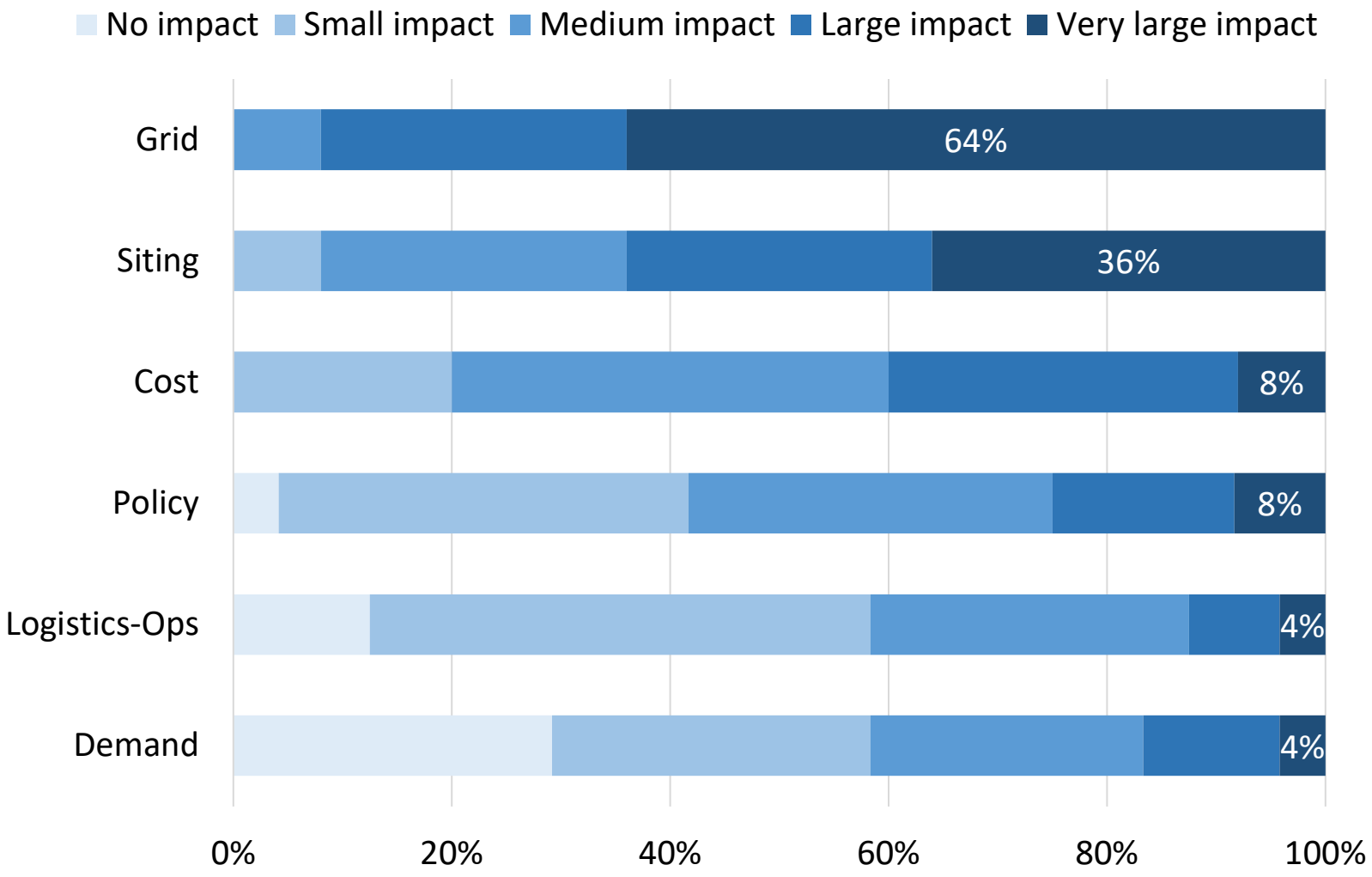
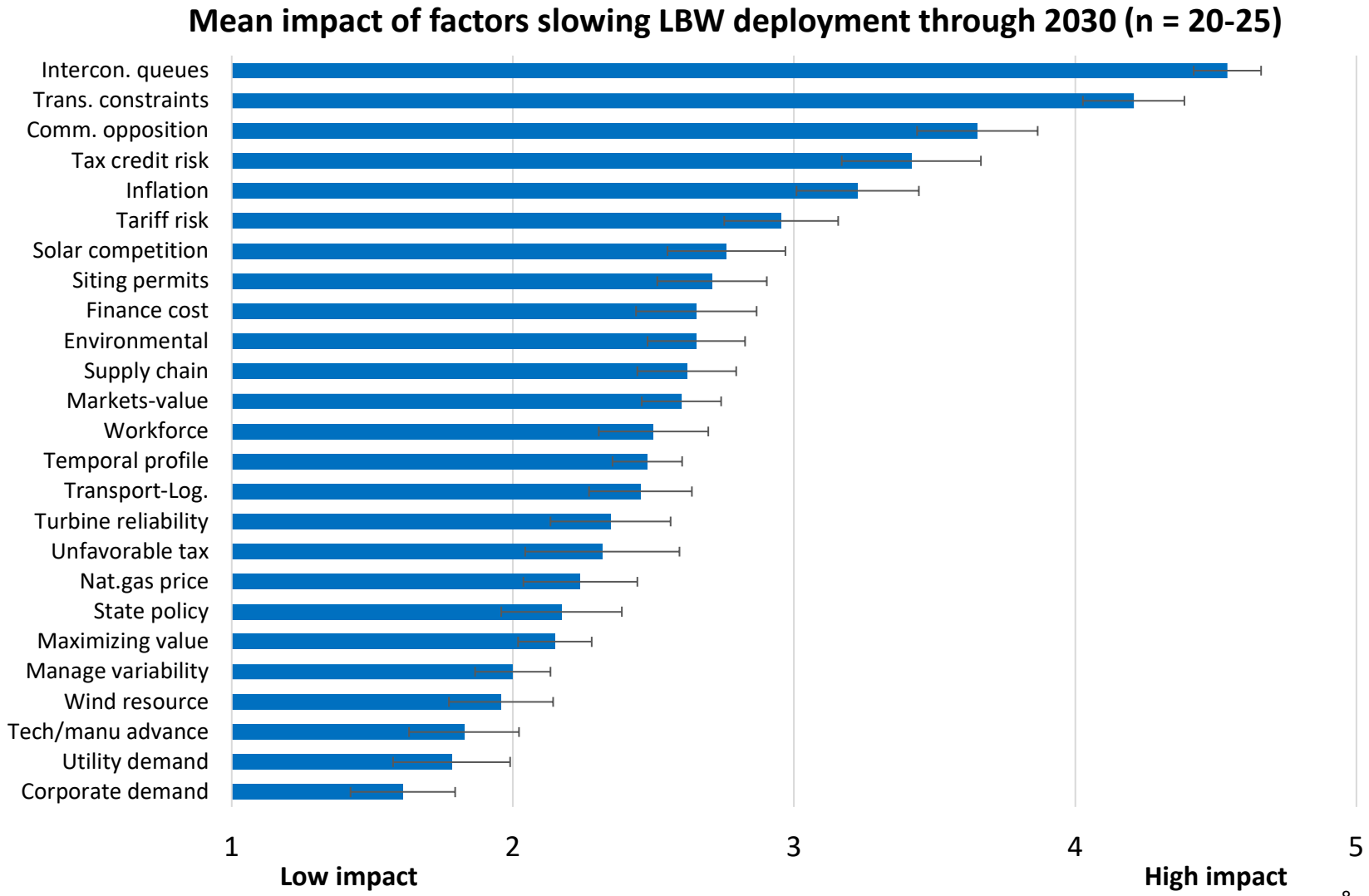


Question 3: More-specific factors that may slow land-based wind deployment through 2030: which will have the largest impact?

QUESTION

In this question, we go a layer deeper and identify a large number of specific factors that may be reducing expectations for land-based wind deployment over the near- to medium-term (through 2030).

Please rate the level of impact each one is likely to have on slowing land-based wind deployment through 2030.



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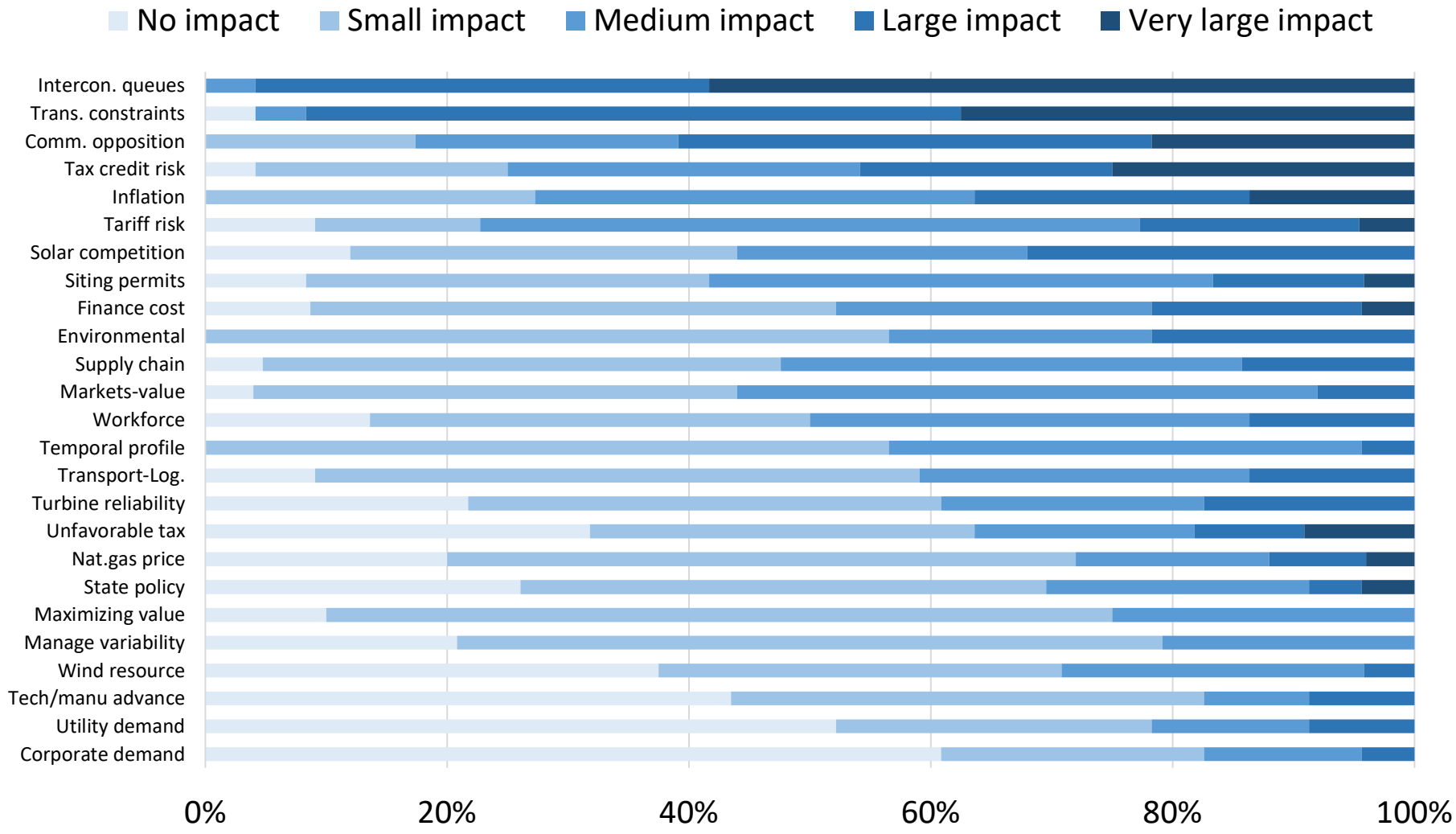
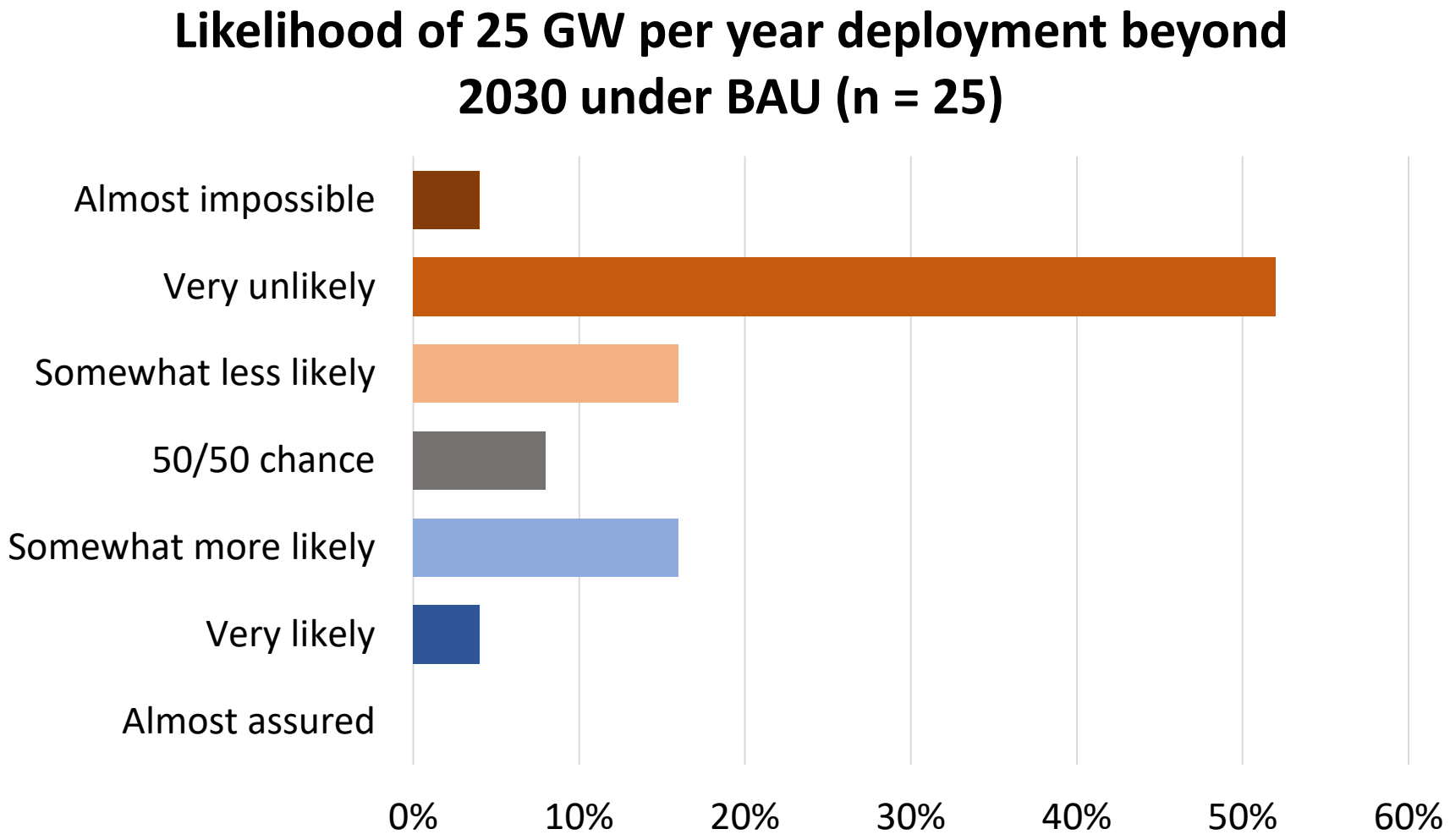


Question 4: Some forecasts suggest 25 GW or more of additions each year after 2030: too high, or too low?

QUESTION

Let's now turn to longer-term possibilities, beyond 2030. Some forecasts for land-based wind deployment after 2030 have the US adding 25 GW or more per year.

Under a business-as-usual future (without major changes to policies, markets, technologies, institutions, and other factors), how likely do you think it is that the United States will be able to deploy an average of 25 GW per year or more of land-based wind, after 2030?



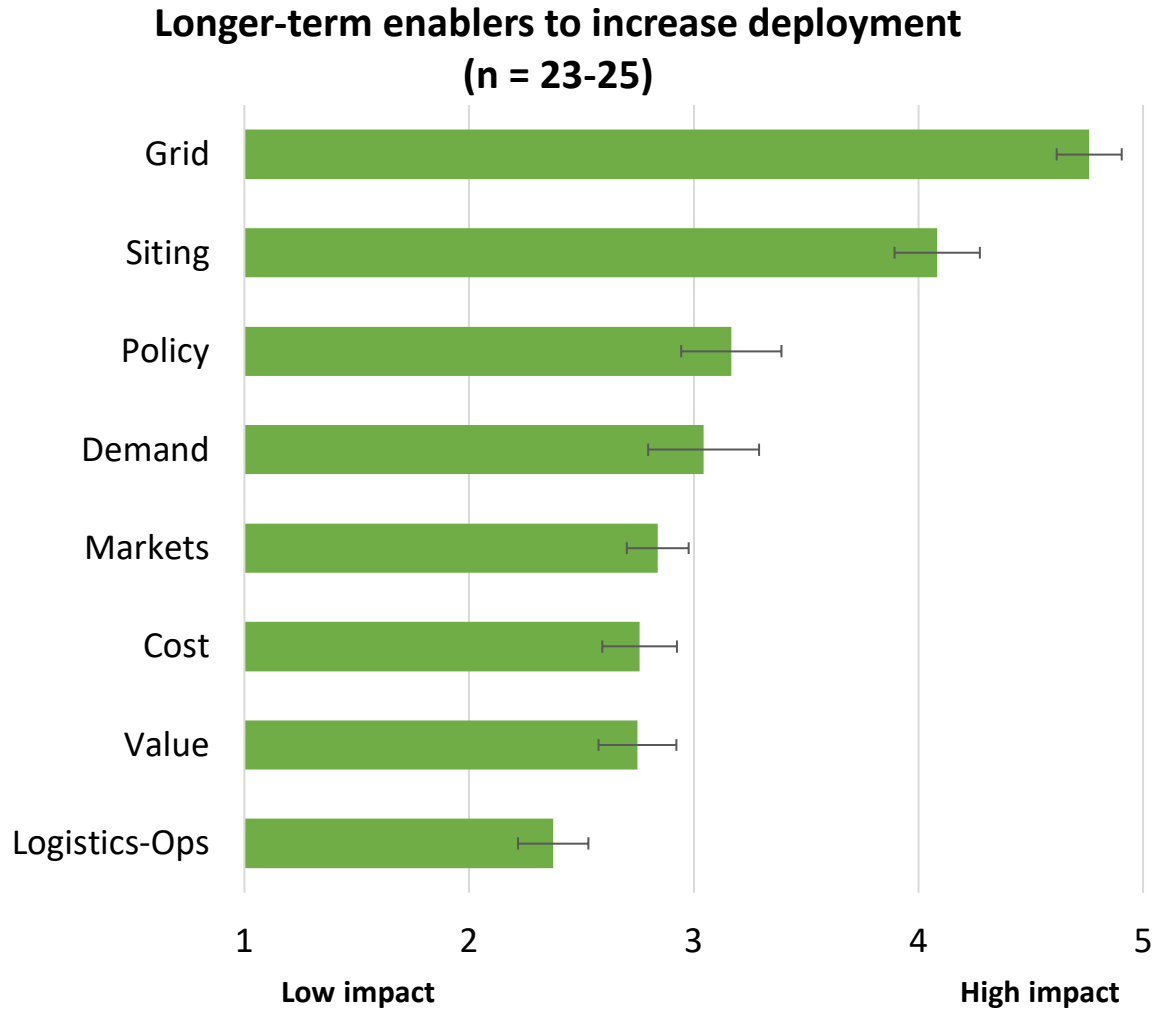
Question 5: Broad enablers to approach higher-end, longer-term forecasts for land-based wind: which will have the largest impact?

QUESTION

Again, thinking about the longer-term (after 2030), what are the most critical enablers to approach these higher-end forecasts for land-based wind?

For each of the following eight broad enablers, please rate the level of impact each one is likely to have in enabling longer-term land-based wind deployment.

Grid: Expanding the transmission network and unblocking interconnection queues
Siting: Reducing challenges related to siting, permitting, and community opposition
Policy: Enhancing federal and state policies to directly or indirectly support wind energy
Demand: Increasing offtaker (e.g., corporate and utility) interest in and demand for wind energy
Markets: Organized power markets and grid operations that better manage wind's variability, value wind's services to the grid, and offer merchant sales opportunities
Cost: Technology and manufacturing advancements to further reduce the cost of wind energy
Value: Enhancing the value of wind by pairing with storage or through more advanced turbine and plant designs
Logistics & Operations: Addressing challenges related to supply chains, transportation, workforce, and/or turbine reliability



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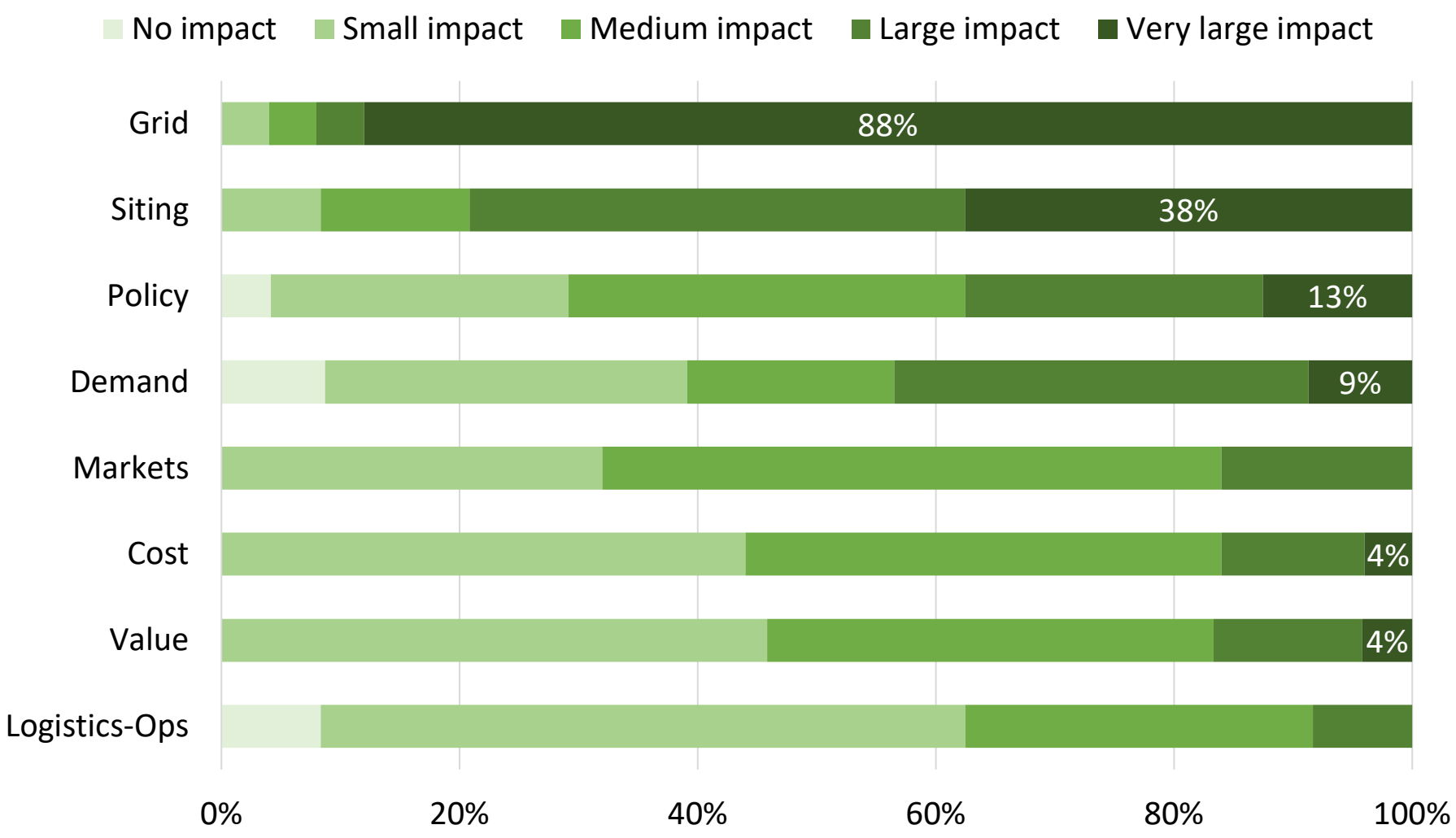
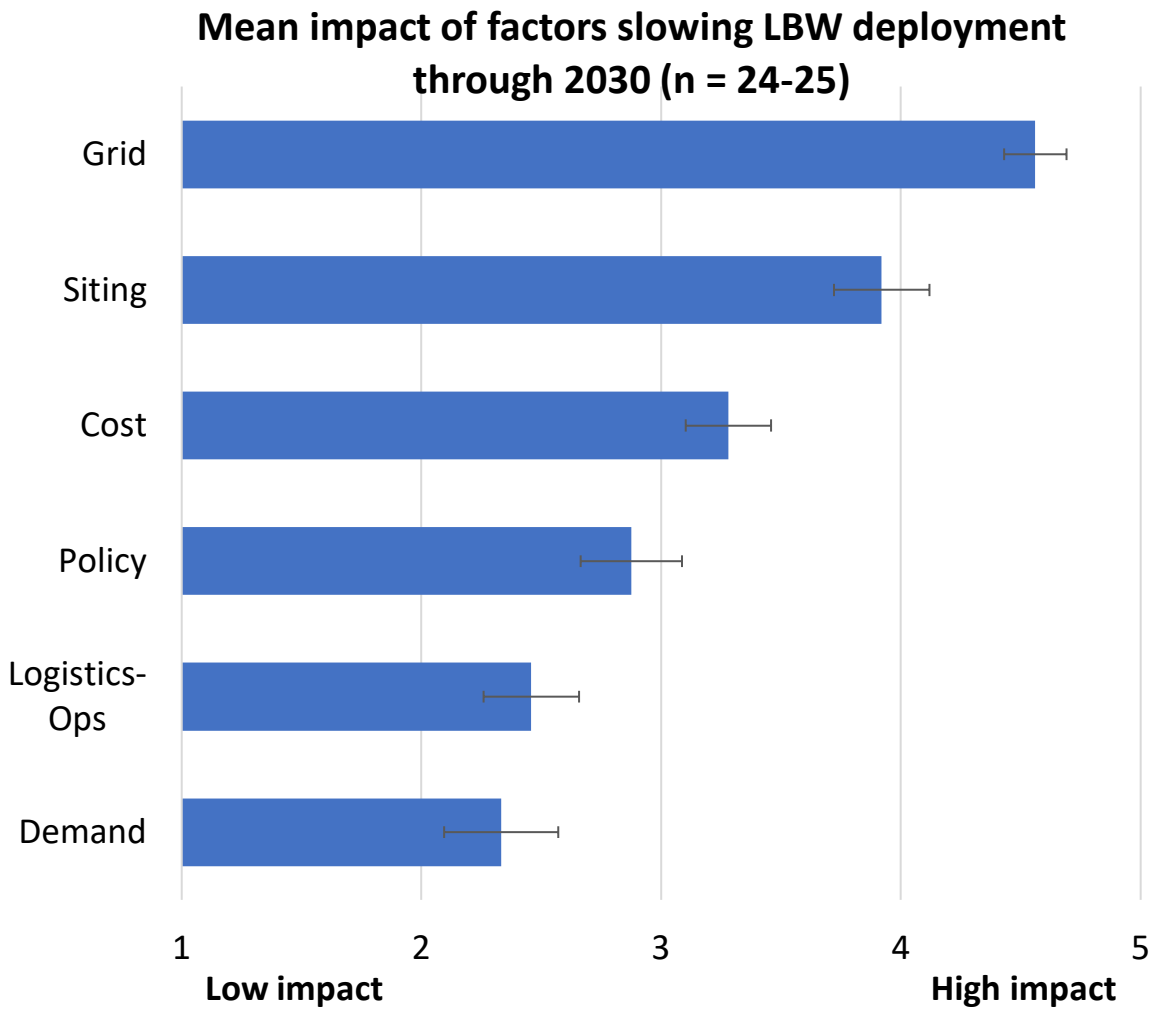
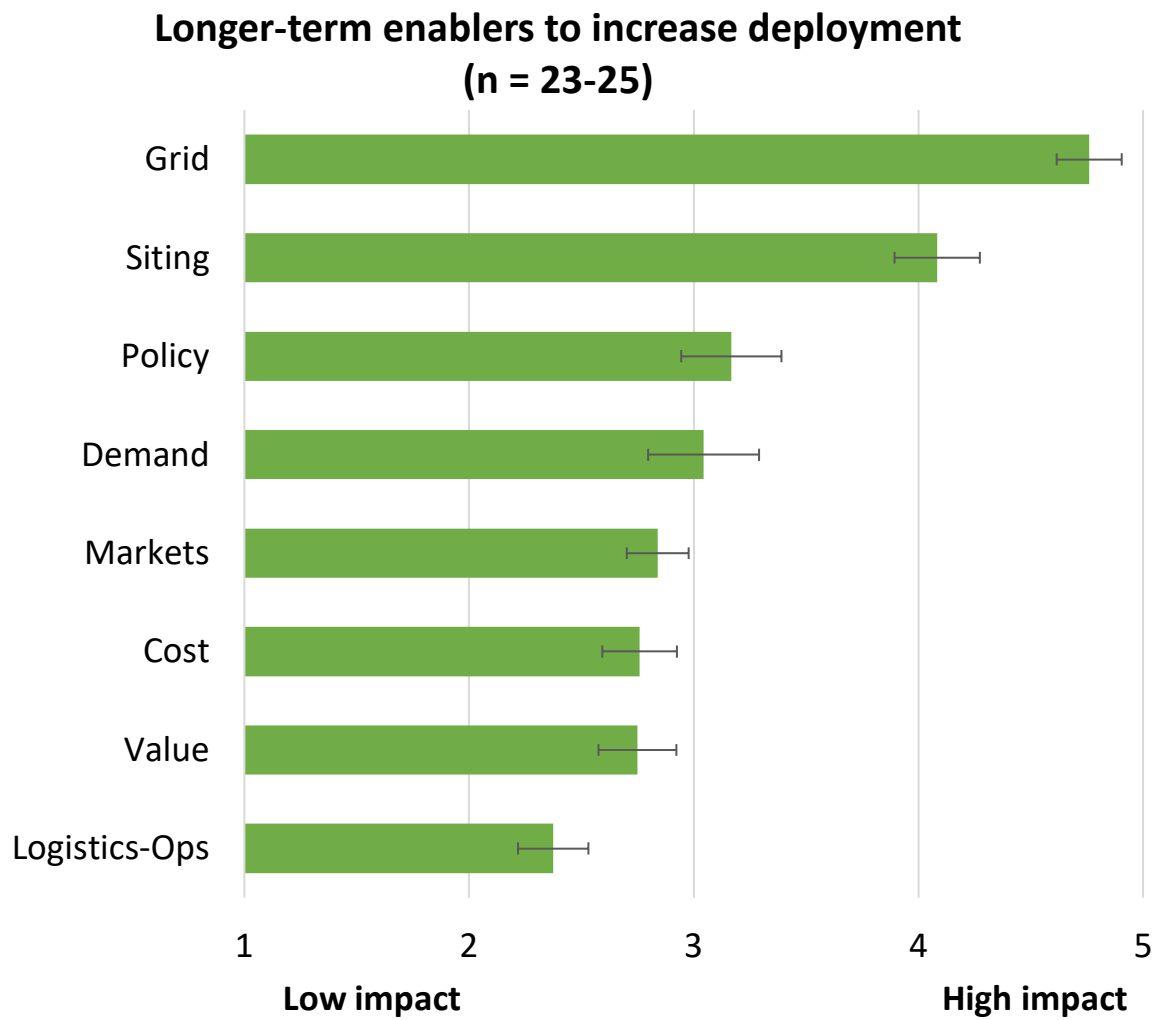


Question 2 vs. 5: Comparing broad factors that may slow deployment through 2030 to the enablers that may increase deployment after 2030





Question 6: Open-ended question on single most-important tangible action to increase land-based wind deployment

QUESTION

What is the single, most-important tangible action that you would recommend to significantly increase land-based wind deployment in the United States?

Grid / Transmission / Interconnection (14 responses)
Improved transmission capacity across the country
Expanding transmission networks into high wind resource areas
Better transmission build out
Policy action that makes new interstate transmission build attractive at both ends of the line, rather than at only one end (Power prices are raised at one end of the line when congestion is mitigated)
Build transmission, which will help address the interconnection and siting issues, and wind (and wind+storage) will be increasingly important as we approach 2040 as the cheapest source of carbon-free energy for our increasingly flexible (and energy-hungry) loads and storage resources
Double the rate of success of wind through the queues
Interconnection processes and transmission buildout to support evolving grids from centralized power plant model to distributed generations throughout the grid. Federal permitting streamlined interstate corridors, etc. These projects cannot move anywhere without updated and expanded grid. BPA line utilization is 46% on average. Not much better across the country. Regardless of permitting or community issues.
Resolving grid issues through a combination of modernixing and expanding the grid
Build many more transmission lines
Build more transmission
Improve interconnection system
Transmission build out and streamlined permitting to process
Speed up interconnect queue and transmission permitting processes
High voltage, bulk transmission

Question 6: Open-ended question on single most-important tangible action to increase land-based wind deployment

QUESTION

What is the single, most-important tangible action that you would recommend to significantly increase land-based wind deployment in the United States?

Siting / Permitting (7 responses)
Profit-sharing with host communities as a way of overcoming local opposition
State siting policies that prevent local governments from prohibiting responsible wind energy projects through restrictive ordinances, bans, or permit rejections
Siting / addressing lack of community support
Remove the blinking lights on turbines to minimize view shed impact during night time hours. Close second, interregional transmission planning reform to enable exports from SPP to both coasts.
Improved siting/permitting environment
Standardized, streamlined permitting process at the local ordinance level
Establish certainty around the permitting process at state and federal levels while continuing the existing efforts to more rapidly expand transmission line build out and grid enhancements

Question 6: Open-ended question on single most-important tangible action to increase land-based wind deployment

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What is the single, most-important tangible action that you would recommend to significantly increase land-based wind deployment in the United States?

Policy / Tax Credits (3 responses)
Finalization of all US Treasury guidance related to production tax credits
IRA green hydrogen tax credit is not repealed and Texas becomes the leading market for wind, solar and green hydrogen end use products
Long-term policy certainty on tax credits and tariffs

ENERGY MARKETS & POLICY

Contact
Ryan Wiser: rhwiser@lbl.gov

Related Publications
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Appendix: Response options for question 3

Shortened Responses Shown on Slides 8/9	Full Response Option
Comm. Opposition	Community opposition resulting in siting permit rejections and/or restrictive ordinances
Environmental	Environmental concerns (e.g. wildlife, wetland, decommissioning, waste, land-use)
Siting permits	Siting permit requirements that are too uncertain, cumbersome, and/or lengthy (for reasons other than community opposition or environmental)
Wind resource	Physical lack of remaining high-quality wind resource sites
Intercon. Queues	Interconnection queue backlogs, costs, and uncertainties
Trans. Constraints	Lack of available transmission to low-cost wind sites and related grid congestion
Manage variabilty	Challenges managing the variability of wind energy on the grid
Markets-value	Organized power markets that are incomplete and/or that do not fully value wind's services to the grid (e.g., challenges accessing "capacity market" revenue)
Nat.gas price	Low natural gas prices that drive low wholesale power prices
Solar competition	Competition with solar electricity and related solar deployment
Temporal profile	Temporal profile of wind that pushes down its value in wholesale power markets
Maximizing value	Wind plants that do not maximize value in wholesale market (e.g., few hybrid plants with storage)
Corporate demand	Lack of sufficient corporate demand for wind energy
Utility demand	Lack of sufficient utility demand for wind energy
Unfavorable tax	Unfavorable tax credit guidance from the US Treasury Department
Tax credit risk	Risk that federal tax credits will be repealed or made less valuable
State policy	Lack of sufficient state policy support for wind energy
Finance cost	High cost of wind project financing (debt interest rates & equity returns)
Inflation	Increased wind equipment and installation costs due to inflation
Tariff risk	Risk of increased wind equipment costs due to import tariffs
Tech/manu advance	Slow advancements in wind technology and manufacturing
Supply chain	Supply chain challenges, shortages, and related cost impacts
Transport-Log.	Transportation and logistics challenges as turbines get larger
Turbine reliability	Wind turbine reliability problems and related failures
Workforce	Hard to find a sufficient skilled wind workforce

Appendix: Companies represented in survey responses

ACP	Orsted
Apex	Pattern
Avangrid	RES
Clearway	Rysted
DNV	Scout
EDF	Siting Clean
Engie	Synergistic
Invenergy	Vestas
NextEra	Wood Mackenzie