U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2018 Distributed Wind Market Report: Summary

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2018 Distributed Wind Market Report

Purpose, Scope, and Data:

- Publicly available annual report summarizing the U.S. distributed wind market
- Analyzes distributed wind projects of all sizes and details the U.S. small wind market
- Separate DOE-funded reports on land-based and offshore wind
- Data sources include AWEA, FAA, EIA, USDA, U.S. Treasury, state agencies, turbine manufacturers, installers, and others detailed in Appendix B of report

Report Authors

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Available at: https://energy.gov/windreport

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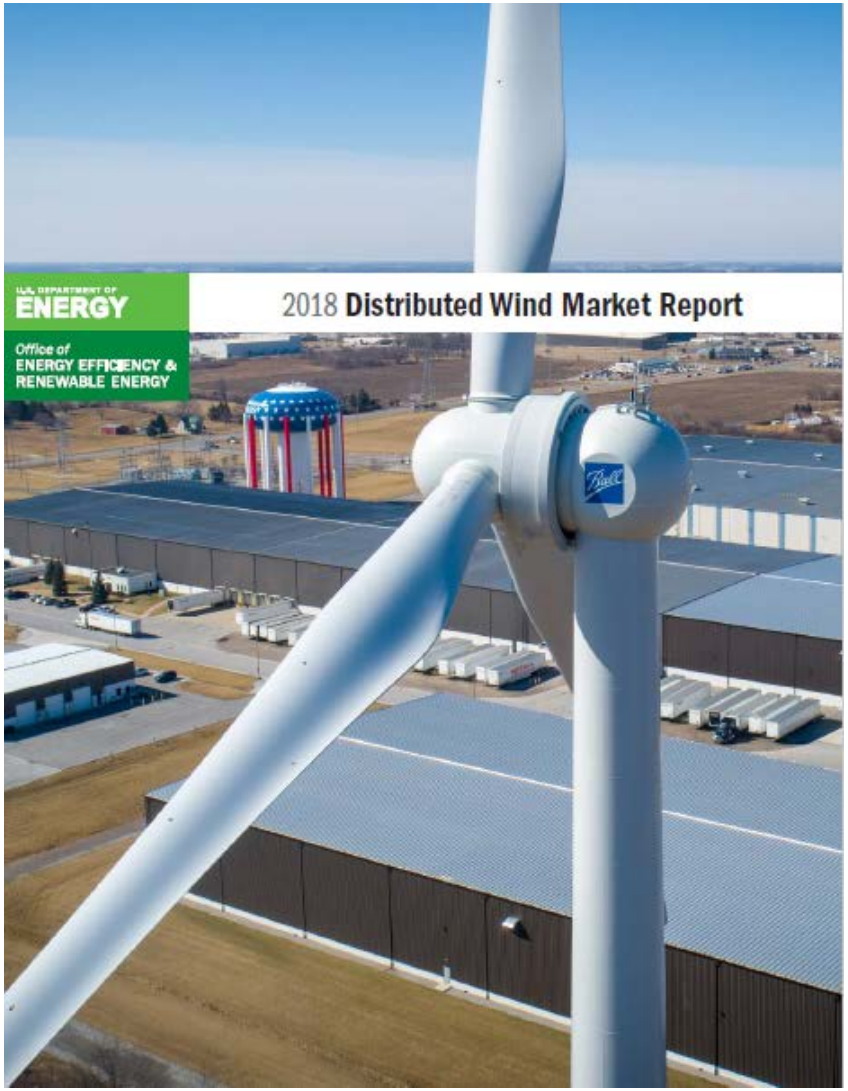
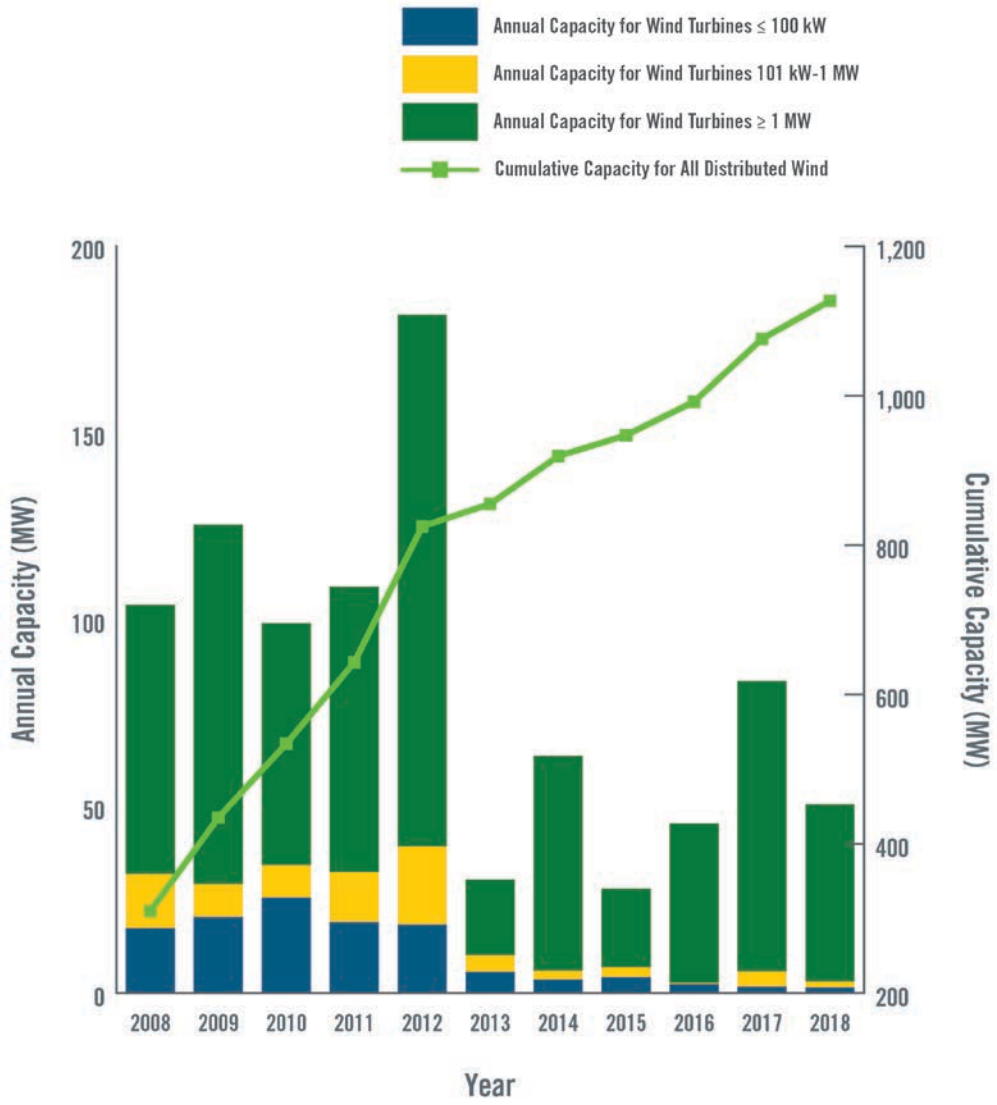


Key Findings

- 12 states added 50.5 MW of new distributed wind capacity in 2018, representing 2,684 units and $226 million in investment.
- Cumulative U.S. distributed wind installed capacity now stands at over 1.1 GW.
- A total of 47.4 MW came from distributed wind projects using large-scale turbines (greater than 1 MW in size).
  - A total of 70% of that 47.4 MW was installed by just three developers in three states – California, Ohio, and Rhode Island.
  - Distributed wind projects for utility customers using large-scale turbines accounted for 47% of documented capacity installed in 2018.
- The domestic small wind market remained weak in 2018, and U.S. small wind exports also dropped.
  - A total of 1.5 MW of small wind (turbines up through 100 kW in size) capacity was deployed in the United States in 2018. This is down from 1.7 MW in 2017, driven by changing federal and state policy environments and continued competition from low-cost solar PV.
  - Small wind exports from the United States dropped to just under 1 MW in 2018, down from 5.5 MW in 2017, driven primarily by changes in the feed-in tariff programs of export countries.

U.S. Distributed Wind Deployment

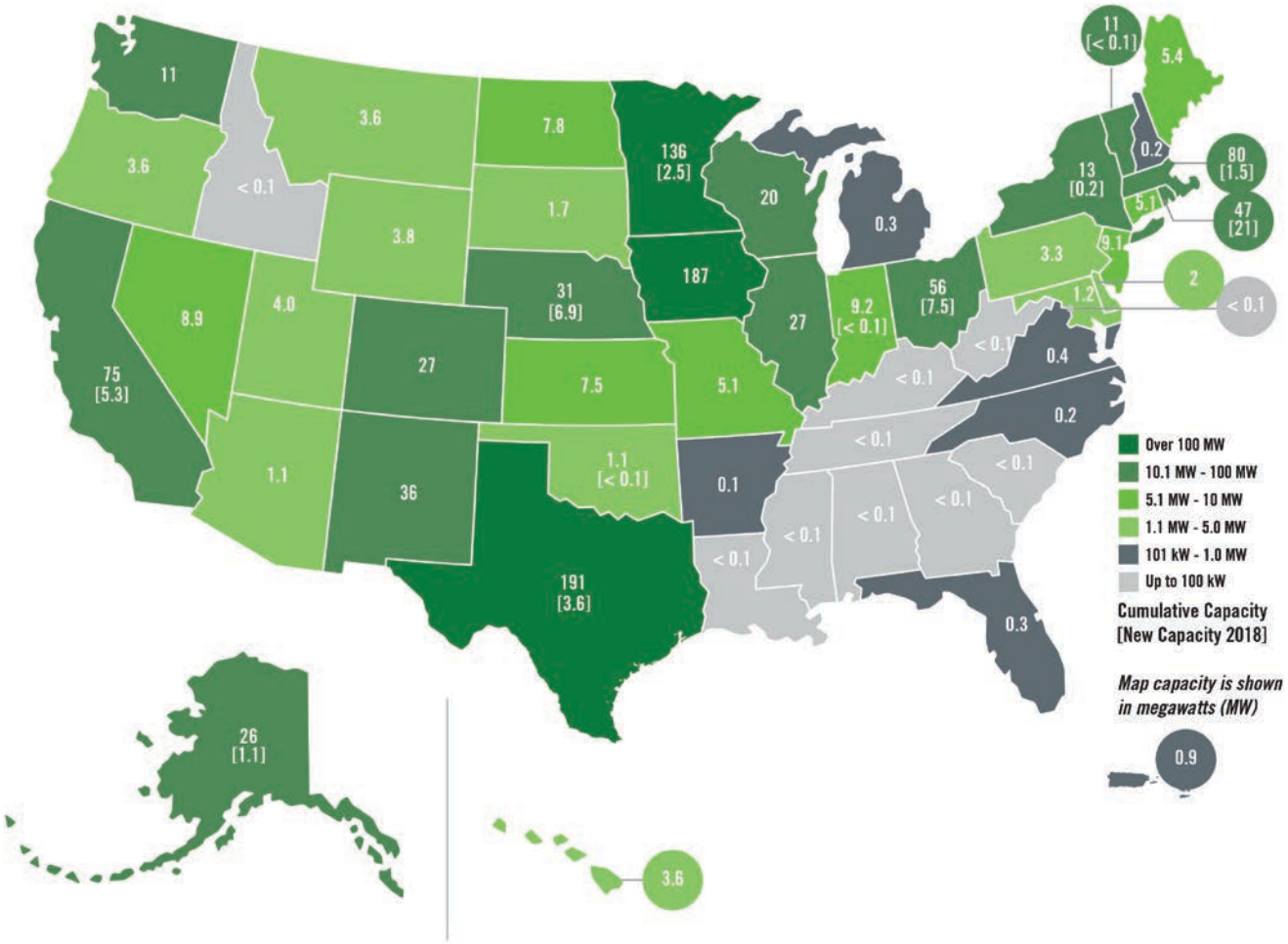
- In 2018, cumulative distributed wind capacity reached 1,127 MW from over 83,000 wind turbines across all 50 states, Puerto Rico, the U.S. Virgin Islands, and Guam.
- The 50.5 MW of distributed wind capacity deployed in 2018 represents $226 million in investment.
  - 47.4 MW came from projects using large-scale turbines (greater than 1 MW in size)
  - 1.6 MW came from projects using mid-size turbines (101 kW to 1 MW in size)
  - 1.5 MW came from projects using small wind turbines (up through 100 kW in size).



U.S. distributed wind capacity

U.S. Distributed Wind Deployment

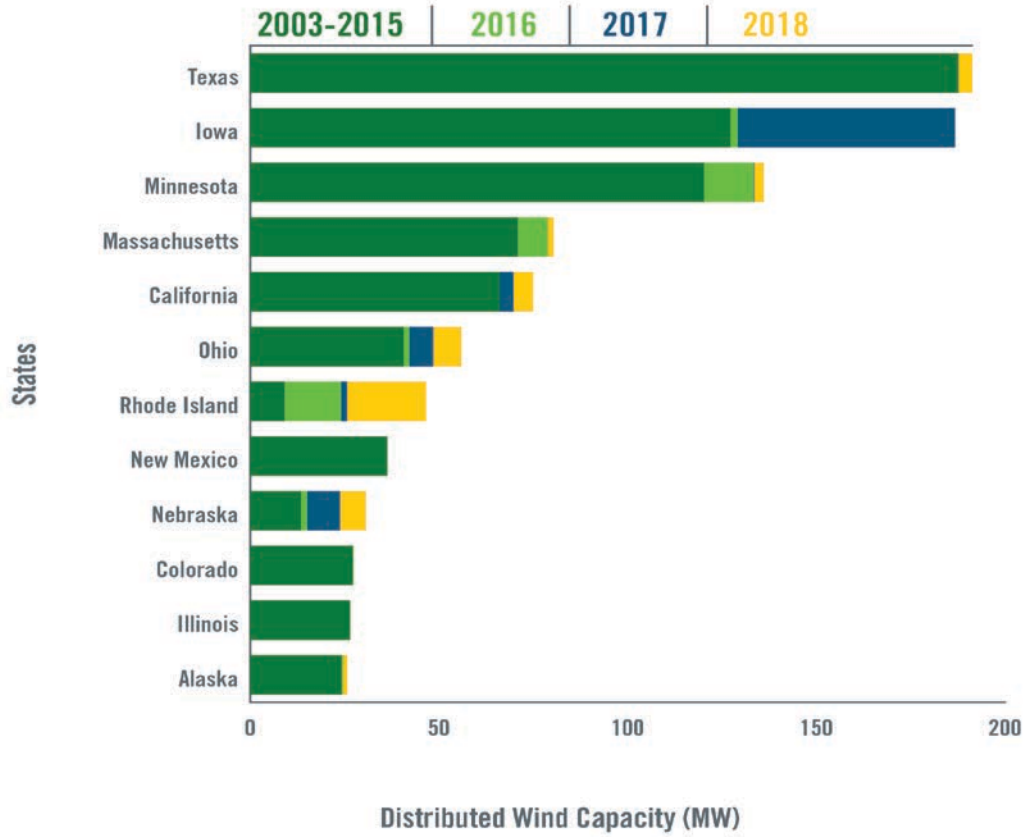
- In 2018, new distributed wind projects were documented in 12 states.
- Rhode Island, Ohio, and Nebraska led the United States in new distributed wind power capacity in 2018 as a result of large-scale turbine projects.
- Texas, Iowa, and Minnesota have the highest cumulative distributed wind capacity values.



U.S. cumulative (2003–2018) and 2018 capacity additions for distributed wind capacity by state

U.S. Distributed Wind Deployment

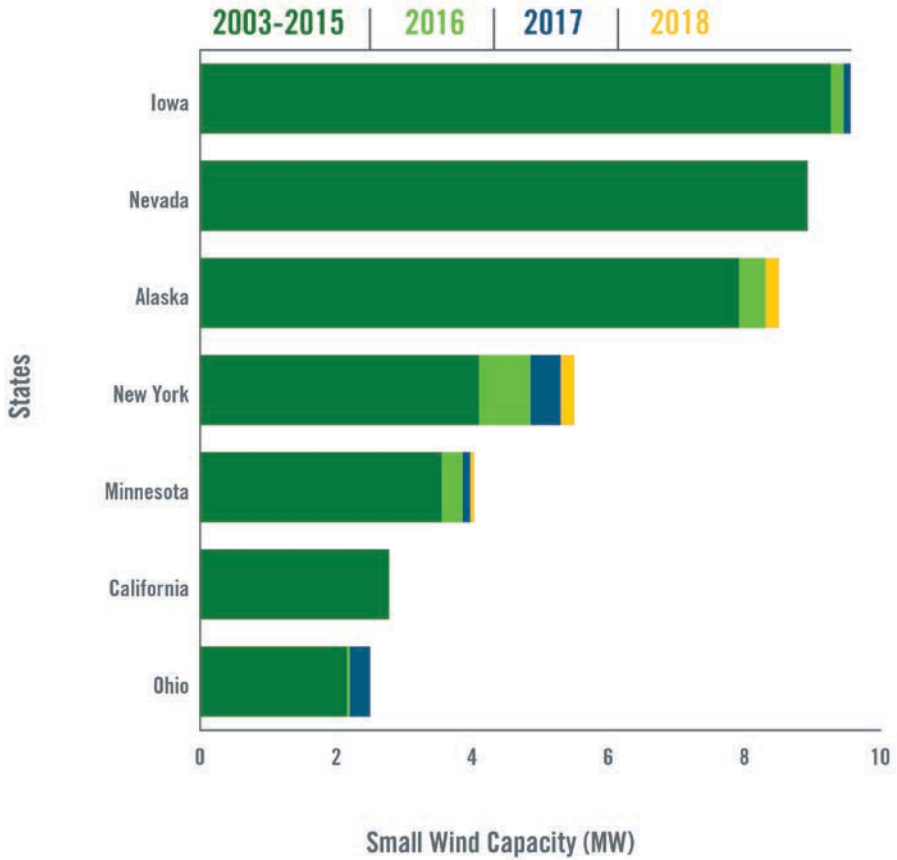
Texas, Iowa, and Minnesota remain the top three states for distributed wind capacity, although Iowa had no new documented projects in 2018 and Rhode Island's 21 MW account for almost half of the new capacity added in 2018.



States with distributed wind capacity greater than 20 MW, 2003–2018

U.S. Distributed Wind Deployment

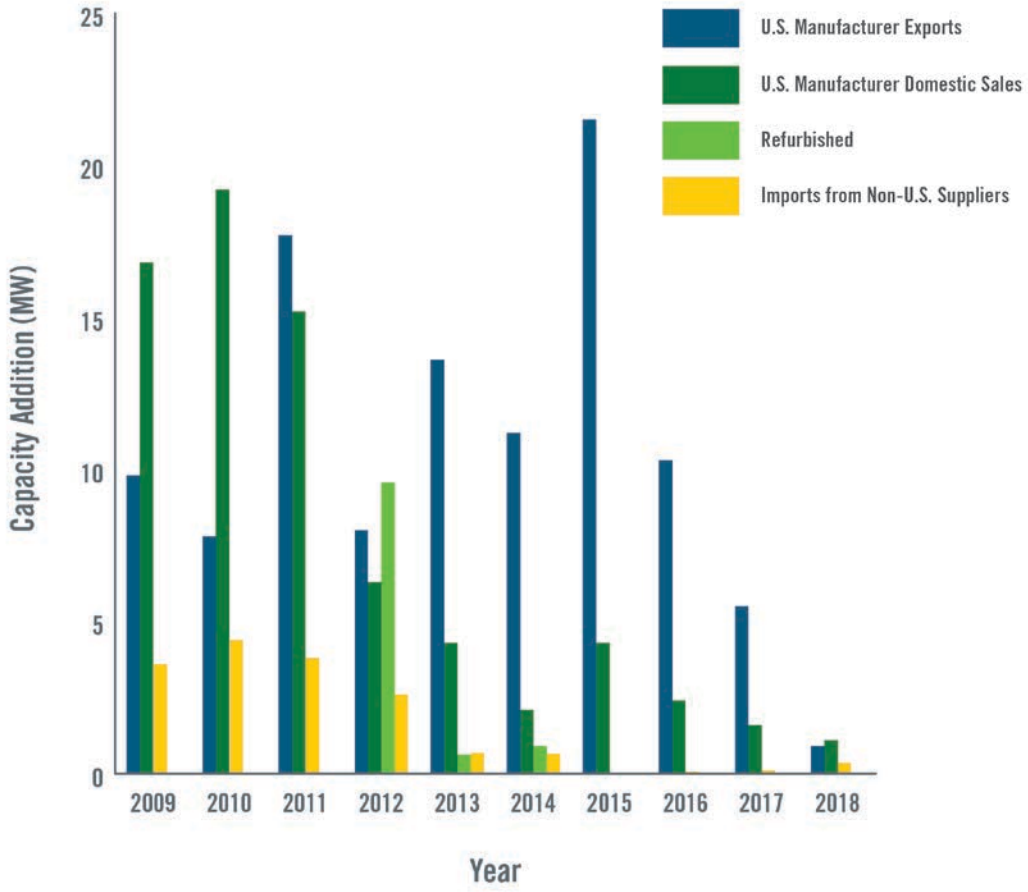
With the declining market, there were few documented small wind projects in 2018. Iowa, Nevada, and Alaska remain the top three states for deployed small wind capacity in the United States.



States for small wind capacity greater than 2 MW, 2003–2018

U.S. Distributed Wind Projects, Sales, and Exports

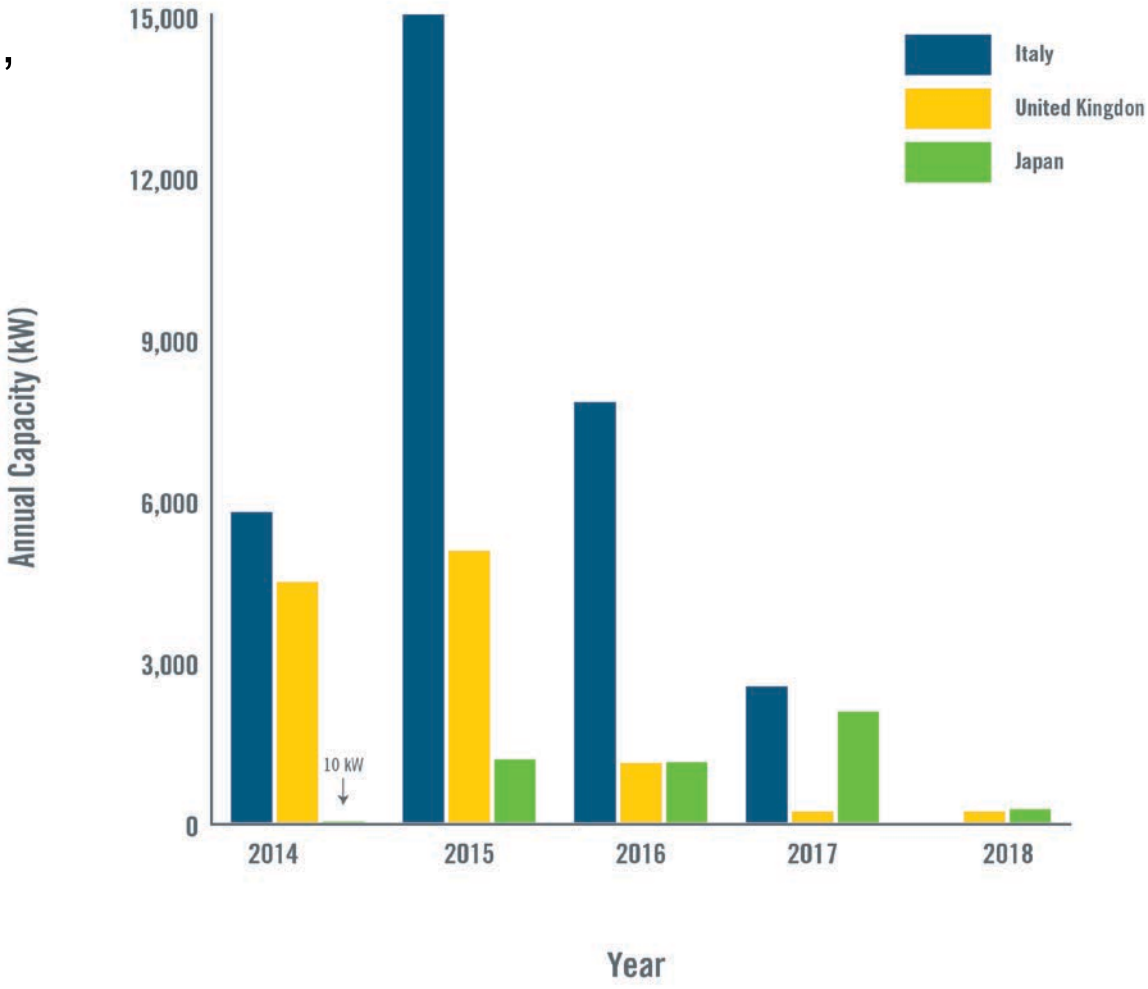
U.S. small wind manufacturers accounted for 76% of the 2018 U.S. domestic small wind sales capacity.



U.S. small wind turbine sales and exports, 2008–2018

U.S. Distributed Wind Projects, Sales, and Exports

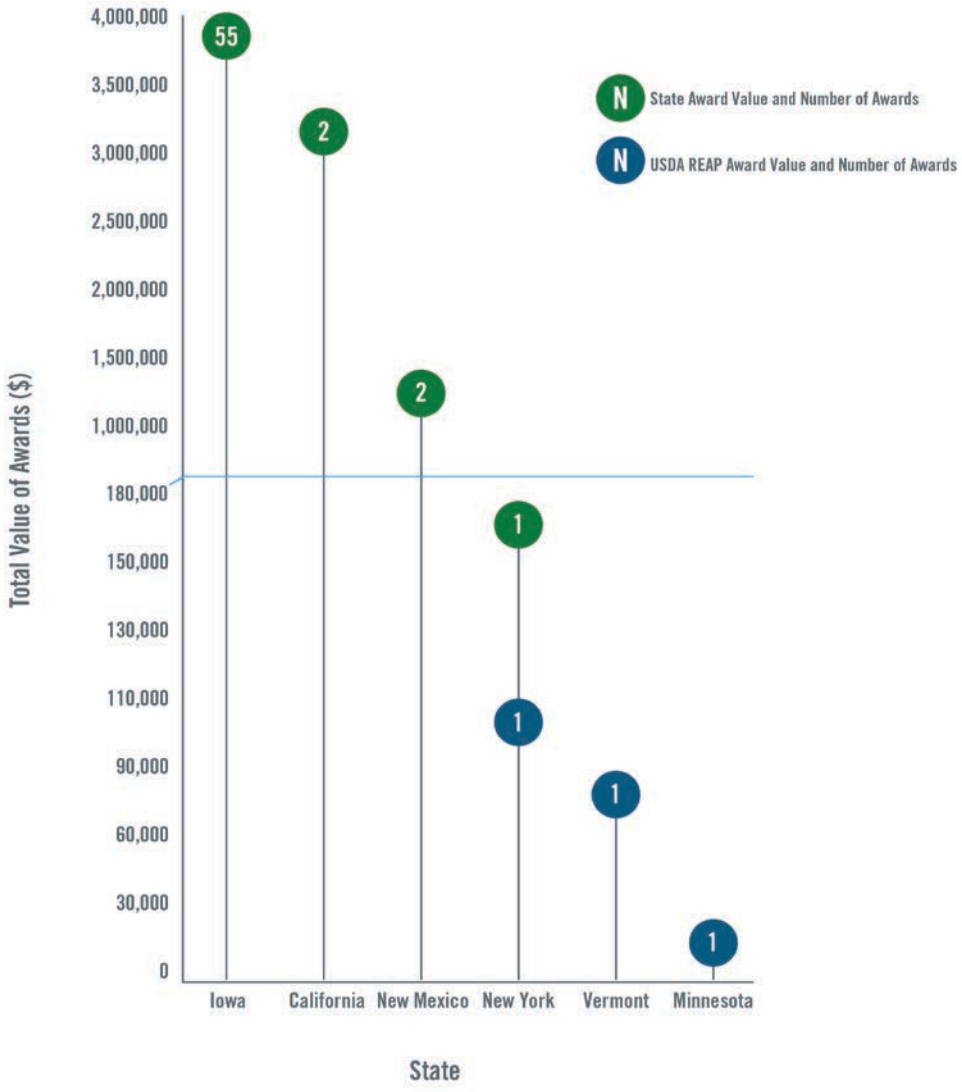
- Italy, the United Kingdom, and Japan have been key export markets for U.S. small wind turbine manufacturers in recent years.
- In 2015, 99% of U.S. small wind turbine manufacturers' exports went to these three countries. This dropped to 47% to the United Kingdom and Japan, and no exports to Italy in 2018.



Key small wind export markets for U.S. manufacturers, 2014–2018

Policies, Incentives, and Market Insights

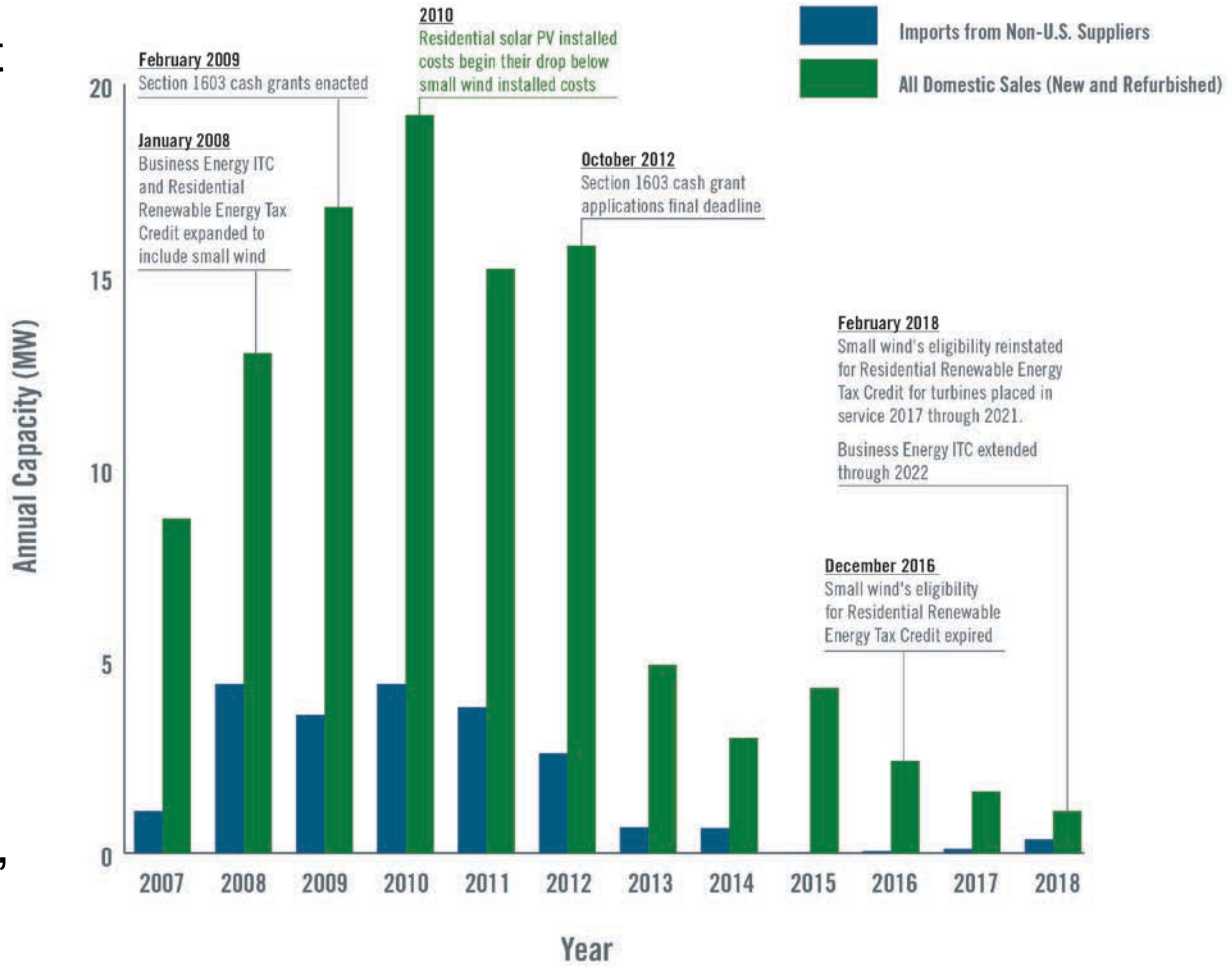
- The combined value of state rebates, production-based incentives, production tax credits, and U.S. Department of Agriculture Rural Energy for America Program grants given to distributed wind projects in 2018 was $8.9 million.
- Fewer states are providing incentives for distributed wind compared to past years.



2018 U.S. distributed wind incentive awards

Policies, Incentives, and Market Insights

- Many small wind projects are not yet cost effective without federal policy support. The introduction of incentive funding and the ending of programs have a direct impact on the amount of small wind sales in the United States.
- The U.S. Treasury reported a peak of $63 million of Section 1603 grant payments in 2012, but no new grants were reported in 2018, signaling the possible end of these payments.



U.S. small wind sales and federal policies, 2007–2018

Policies, Incentives, and Market Insights

Three new turbine models, the Hi-VAWT Technology Corporation DS3000, the Bergey WindPower Excel 15, and the Primus AIR 30 / AIR X, were certified in 2019. The Hi-VAWT DS3000 is the first vertical-axis wind turbine to demonstrate conformance to the AWEA standard and be certified by the ICC-Small Wind Certification Council.

Certified small wind turbines

Applicant	Turbine	Date of Initial Certification	Certified Power Rating[a] @ 11 m/s (kW)	Certification Standard
Bergey WindPower	Excel 10[b]	11/16/2011	8.9	AWEA
Bergey WindPower	Excel 15[b]	6/4/2019*	15.6	AWEA
Dakota Turbines	DT-25[b]	7/18/2018	23.9	AWEA
Eocycle Technologies, Inc.	EO20 / EO25[c]	9/21/2017	22.5 / 28.9	AWEA
Hi-VAWT Technology Corporation/Colite Technologies	DS3000[b]	5/10/2019	1.4	AWEA
Lely Aircon B.V.	LA30[b]	1/13/2017	27.2	AWEA
Primus Wind Power	AIR 30/AIR X[d]	1/25/2019	0.16	IEC
Primus Wind Power	AIR 40/Air Breeze[d]	2/20/2018	0.16	IEC
SD Wind Energy, Ltd.	SD6[b]	6/17/2019 (renewed)**	5.2	AWEA
Xzeres Wind Corporation	Skystream 3.7[b]	12/19/2011	2.1	AWEA

[a] Power output at 11 m/s (24.6 mph) at standard sea-level conditions. Manufacturers may describe or name their wind turbine models using a nominal power, which may reference output at a different wind speed (e.g. 10 kW Bergey Excel 10).

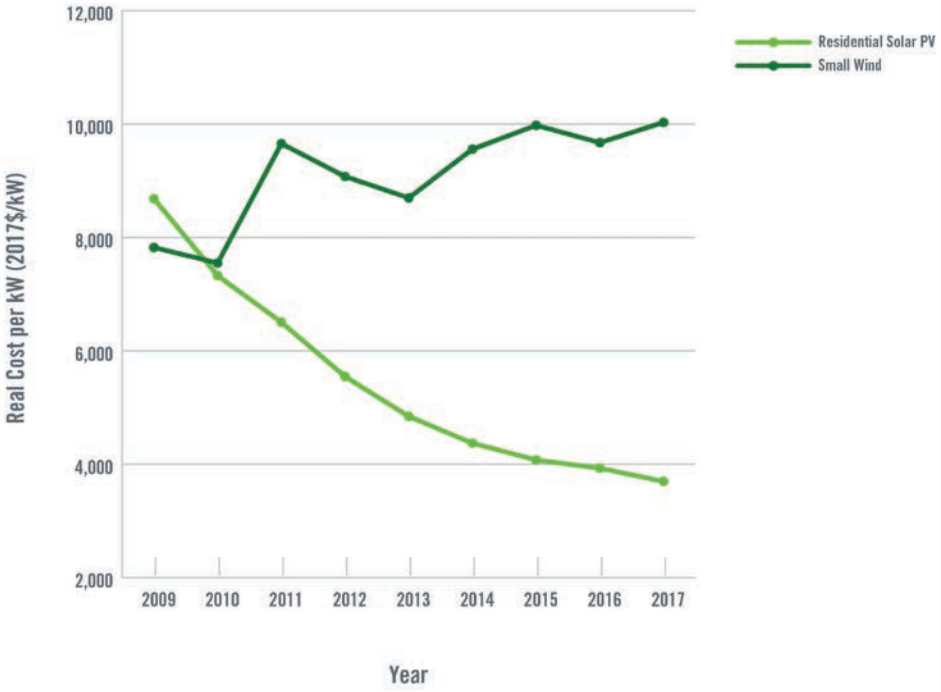
[b] Certified by SWCC, [c] Certified by SGS, [d] Certified by DEWI-OCC, UL

*The Excel 15 has completed the power performance test and ICC-SWCC has certified the results as of report publication, but the turbine model must complete the duration test before ICC-SWCC can grant full certification.

**The SD6 turbine model certification is a renewal of the Kingspan Environmental KW6, but under a new model name because of new ownership.

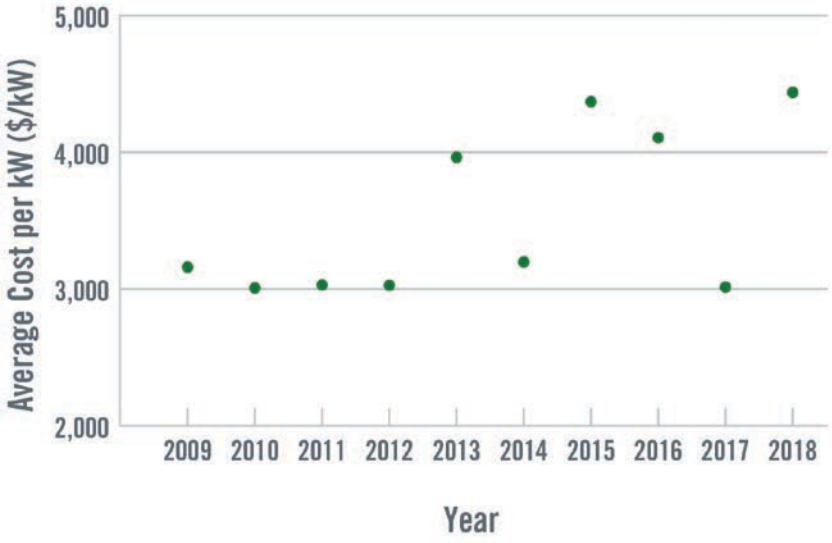
Distributed Wind Cost Trends

Average small wind installed costs have increased since 2009 and have been fairly flat since 2014, in contrast to residential solar PV costs which have steadily decreased.



Small Wind and Residential Solar PV Installed Costs, 2009–2017

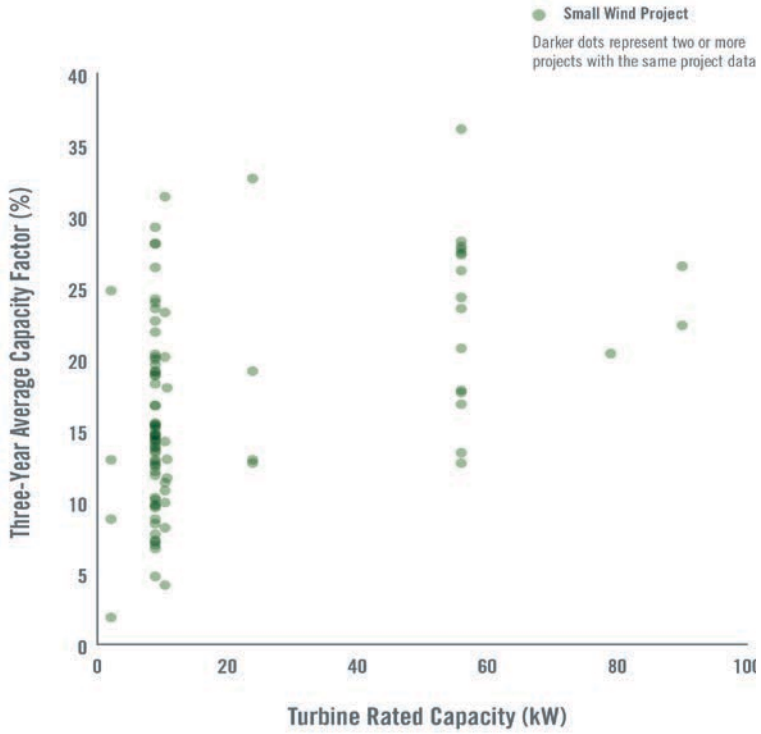
Average installed costs for projects using turbines greater than 100 kW varies year to year, likely because of sample size variation.



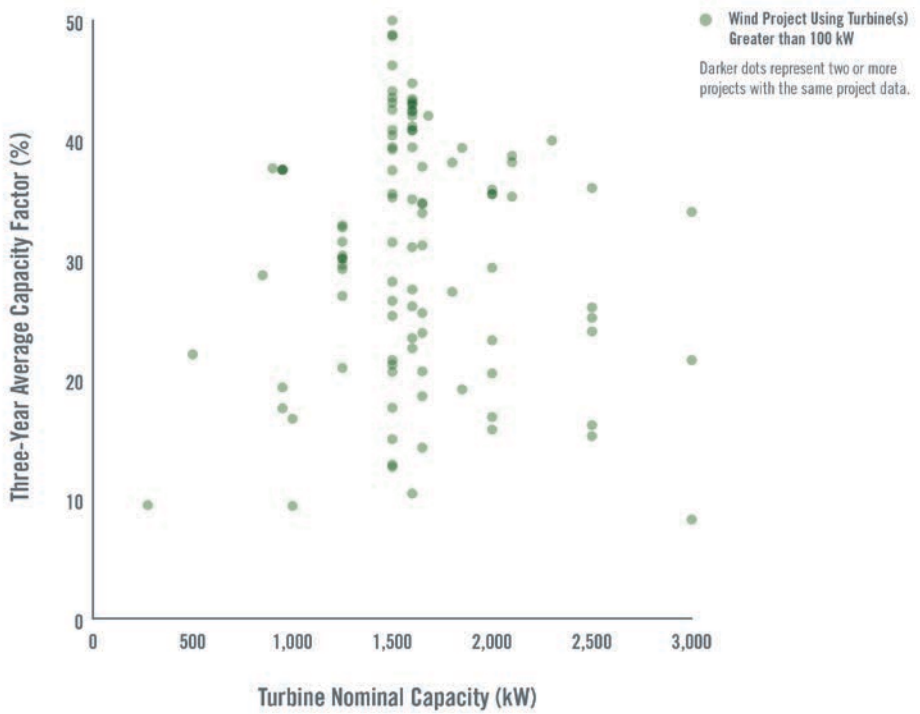
Installed Costs for Projects Using Turbines Greater than 100 kW, 2009–2018

Turbine Performance

Wind resource variability, turbine operational variability, turbine technology, and site-specific conditions contribute to the wide range of capacity factors exhibited by distributed wind projects



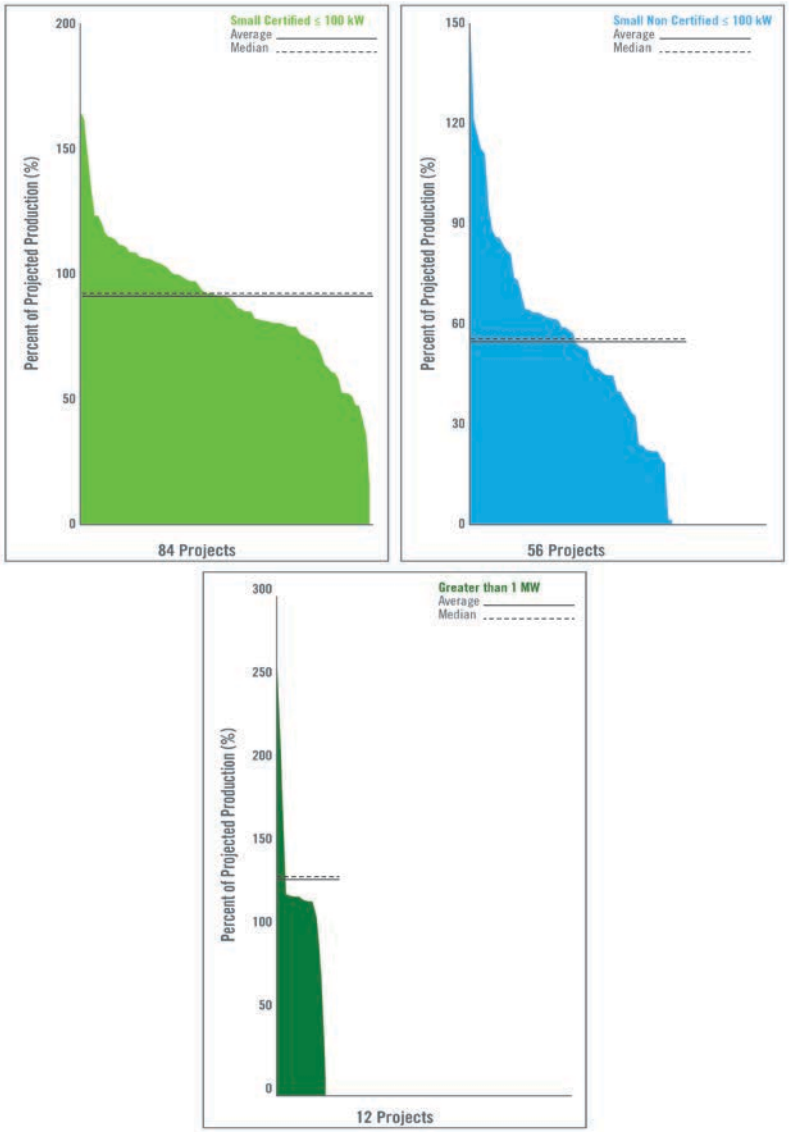
Small wind capacity factors



Capacity factors for projects using turbines greater than 100 kW

Turbine Performance

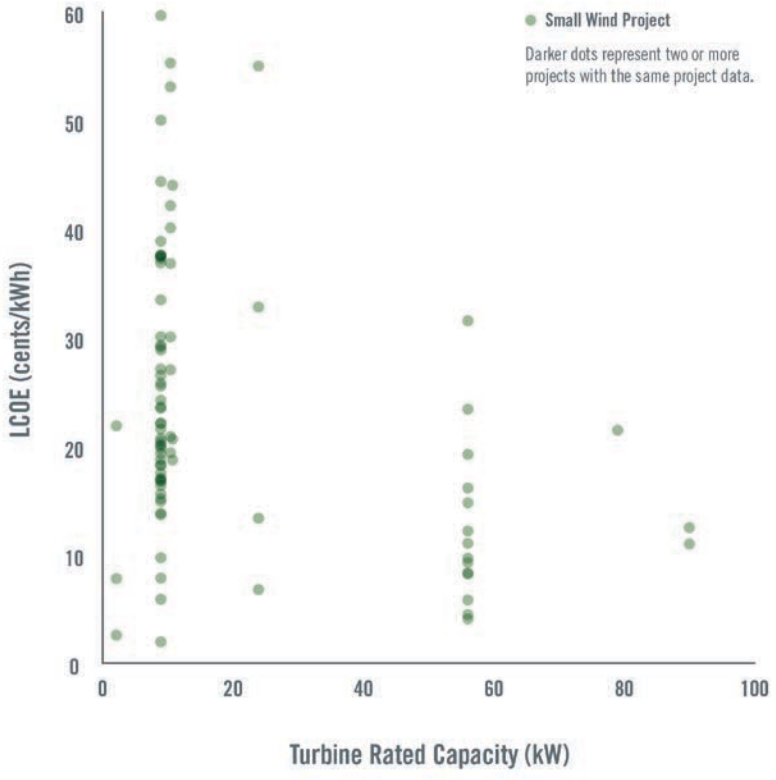
- Actual performance does not always match projected performance.
- Distributed wind projects using large-scale turbines generally achieved higher generation values than predicted.
- Small wind turbines generally achieved lower generation values than predicted, and non-certified small wind turbines are likely to underperform considerably.



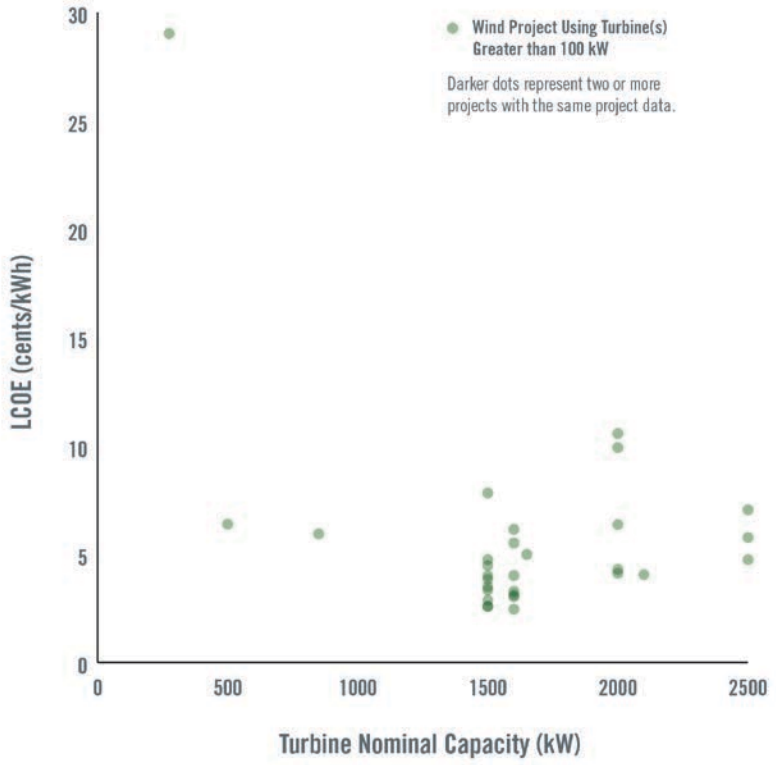
Actual performance for USDA REAP and NYSERDA projects

Levelized Cost of Energy

Distributed wind projects also display a range of values for LCOE, particularly for small and mid-size turbines.



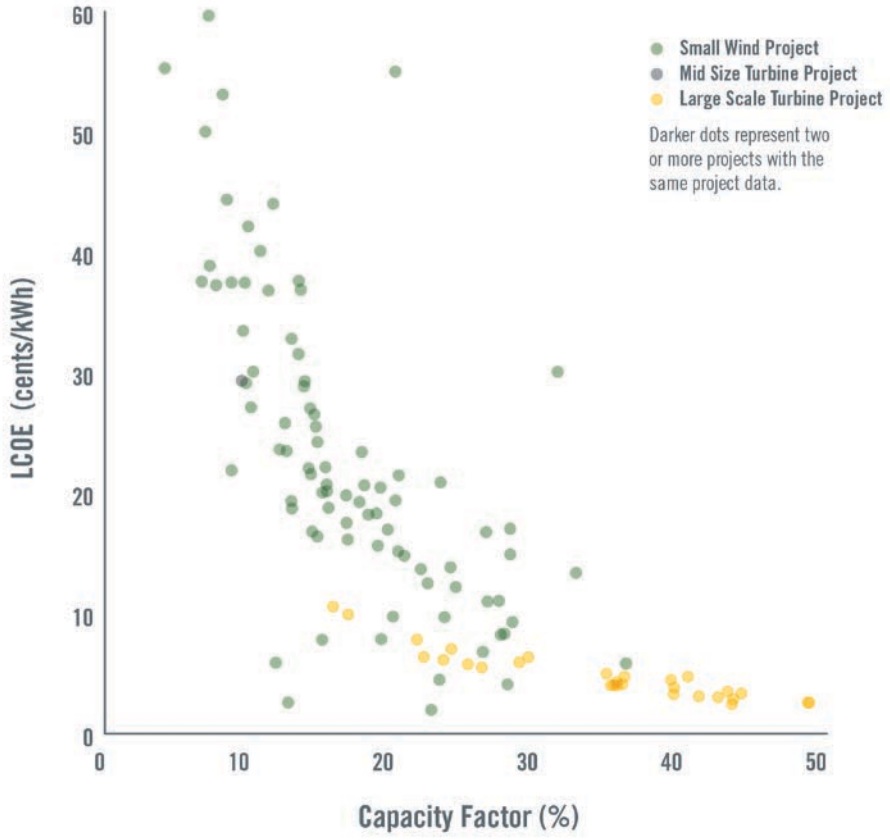
Small wind LCOEs



LCOEs for projects using turbines greater than 100 kW

Levelized Cost of Energy and Performance

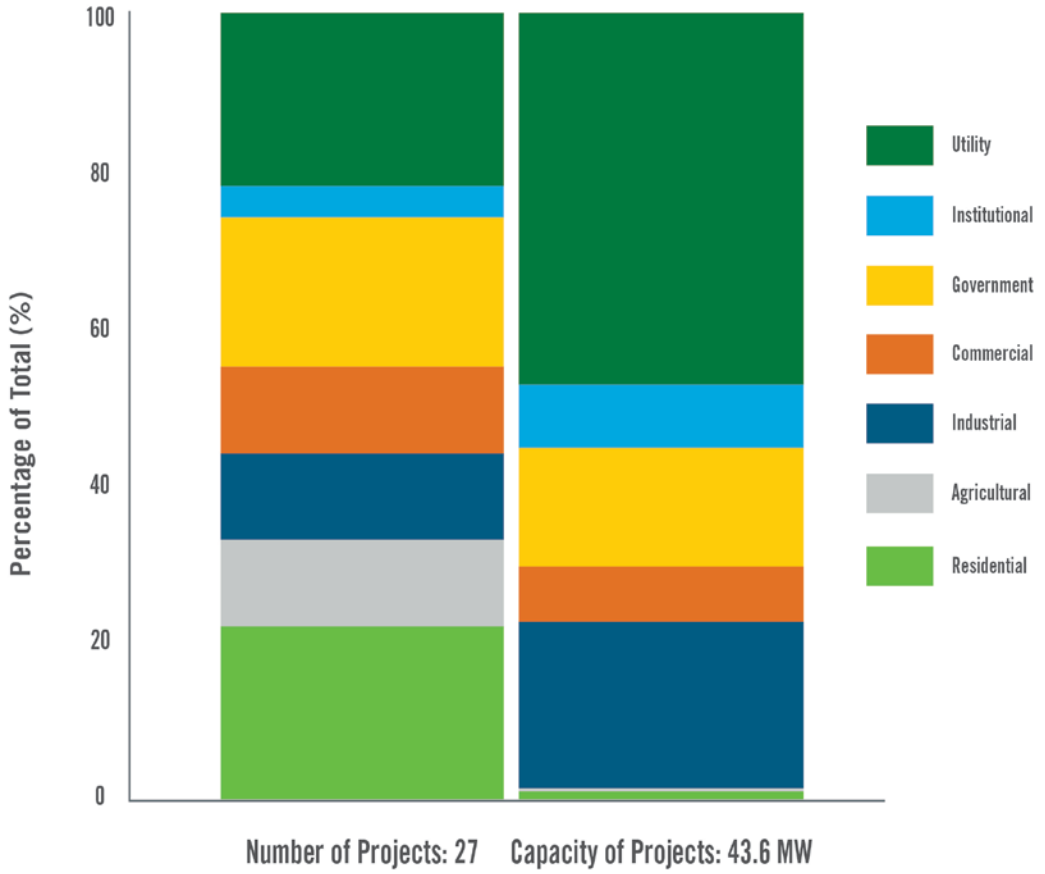
In general, the higher the project's capacity factor, the lower the LCOE. Large-scale turbine projects tracked for this report are more likely to have both high capacity factors and lower LCOEs.



Distributed Wind System LCOE and Capacity Factors

Distributed Wind Markets

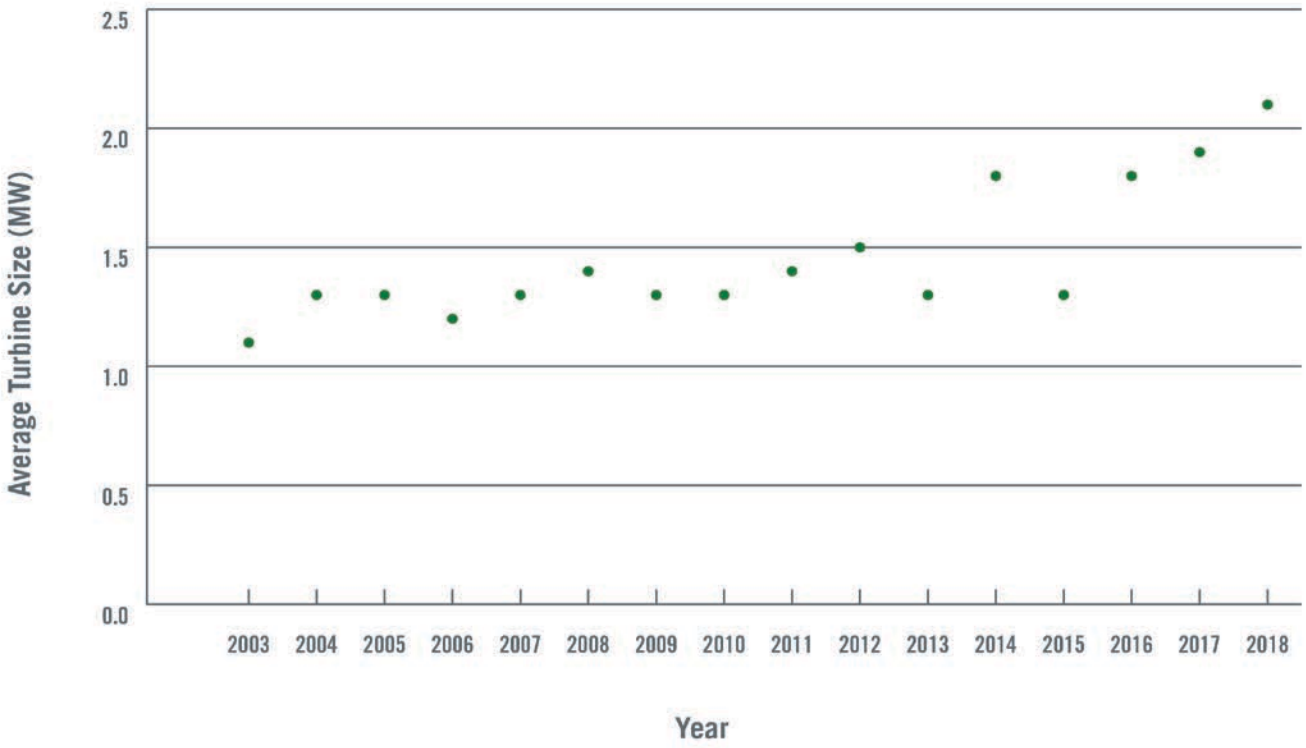
- Projects for utility customers represented accounted for 47% of the distributed wind capacity deployed in 2018.
- Commercial and industrial projects represented almost 29% of the capacity documented in 2018.
- Using smaller turbines, agricultural and residential customers accounted for just 1% of the documented capacity, though many small wind project were not documented in 2018 and off-grid applications are not tracked at the project level.



Distributed wind customer types by number and capacity of projects

Distributed Wind Markets

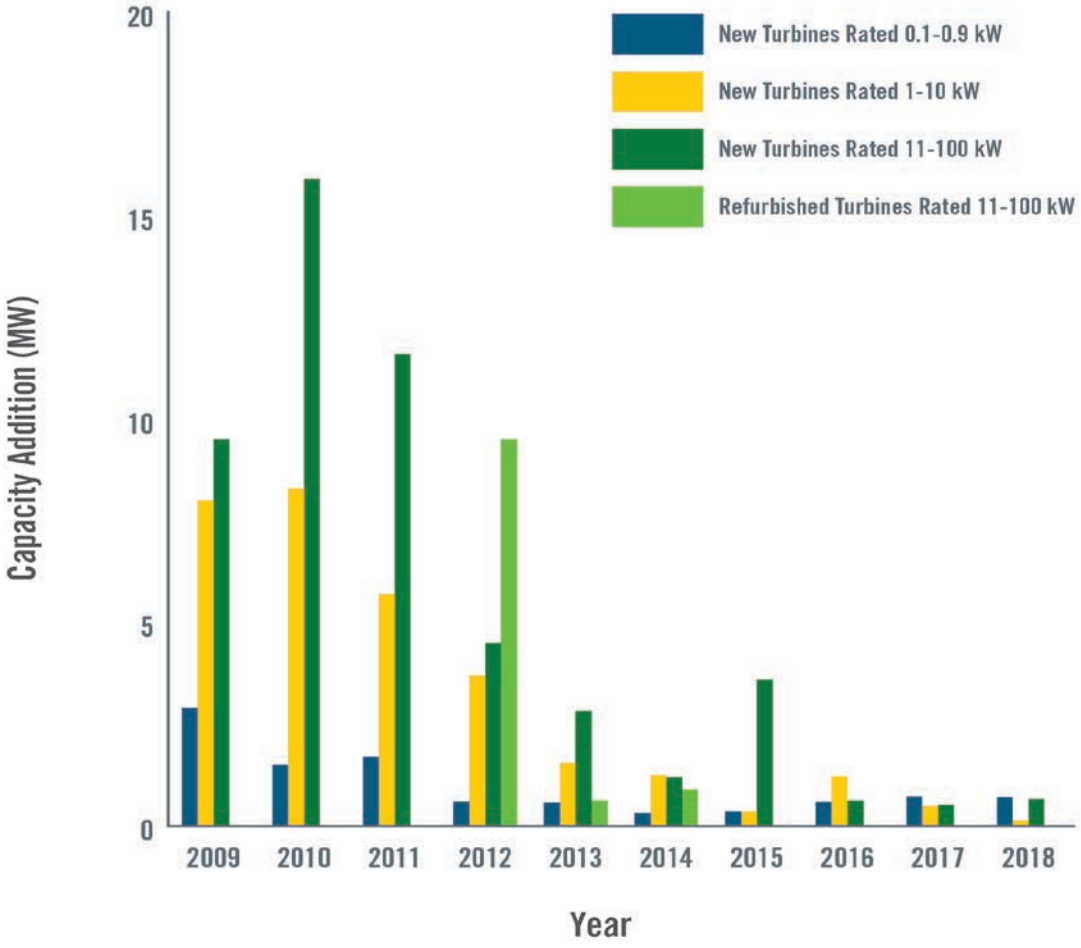
In 2018, the average turbine capacity size for turbines greater than 100 kW in distributed wind projects was 2.1 MW – almost double the capacity of turbines used in 2003. This trend mirrors the increase in turbine capacity size used for all land-based wind projects.



Average size of turbines greater than 100 kW in distributed wind projects, 2003–2018

Distributed Wind Markets

- As overall annual small wind capacity deployment has decreased, the less than 1-kW turbine size segment is contributing an increasingly larger percentage of both the total number of turbines and capacity of small wind projects (99% and 47% in 2018, respectively).
- The less than 1-kW turbines are used primarily for battery charging and remote power, often integrated with solar PV panels.



U.S. small wind sales capacity by turbine size

Summary

- Distributed wind deployment significantly varies from year to year, both by turbine size and customer type.
- Market conditions, policies, and customer demands do not impact the different sectors of the distributed wind market uniformly.
- The U.S. small wind market has been steadily declining since a peak in 2012. To reverse this trend, the industry is focusing on innovative technology development and certification and rural markets that have quality wind resources and high electric retail rates.
- Large-scale turbine projects, particularly for government, commercial and industrial, and utility customers, are likely to continue to dominate distributed wind capacity deployment.

Photo Credit: Eocycle Technologies Inc.

For More Information

See full report for additional findings and details:

https://www.energy.gov/eere/wind/downloads/2018-distributed-wind-market-report

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