

Distributed Wind Market Report: 2021 Edition Summary

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Distributed Wind Market Report: 2021 Edition

Purpose, Scope, and Data:

- Summarizes publicly available U.S. distributed wind annual data.
- Analyzes distributed wind projects of all sizes.
- Provides data and analysis that are separate from land-based and offshore wind.
- Includes data from turbine manufacturers, project installers, state agencies, American Clean Power Association, U.S. Energy Information Administration, Federal Aviation Administration, U.S. Department of Agriculture, U.S. Treasury, U.S. Wind Turbine Database, and others.

Report Authors

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

Key Findings

- 11 states added 14.7 MW of new distributed wind capacity in 2020, representing 1,493 turbine units and \$41 million in investment.
- Cumulative U.S. distributed wind installed capacity now stands at 1,055 MW.
- Iowa and Minnesota led the United States in 2020 capacity additions as a result of two projects that combined represent 95% of the 2020 installed distributed wind capacity.
- Of the 14.7 MW installed in 2020, 12.9 MW came from distributed wind projects using large-scale turbines (greater than 1 MW in size), 0.16 MW came from projects using mid-size turbines (101 kilowatts [kW] to 1 MW in size), and 1.6 MW came from projects using small wind turbines (up through 100 kW in size).
- Small wind retrofits make up an increasing amount of the small wind capacity deployment. Retrofits are new turbines installed on existing towers and foundations to replace nonfunctioning turbines or to upgrade the technology. Small wind retrofits contributed 80% of total installed small wind capacity in 2020 and 36% in 2019. No small wind retrofits were reported in 2018.
- In 2020, utility customers accounted for the majority of the total documented distributed wind capacity (58%), while agricultural customers accounted for the greatest number of projects installed (36%).

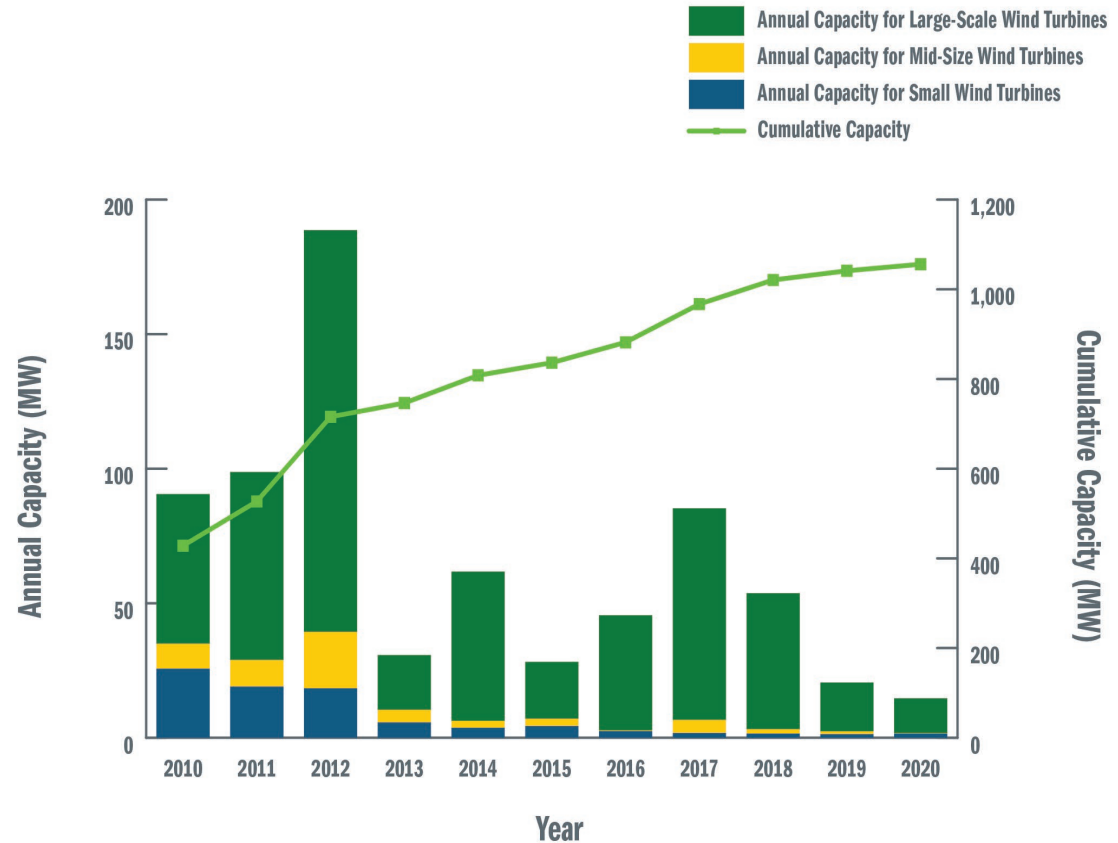
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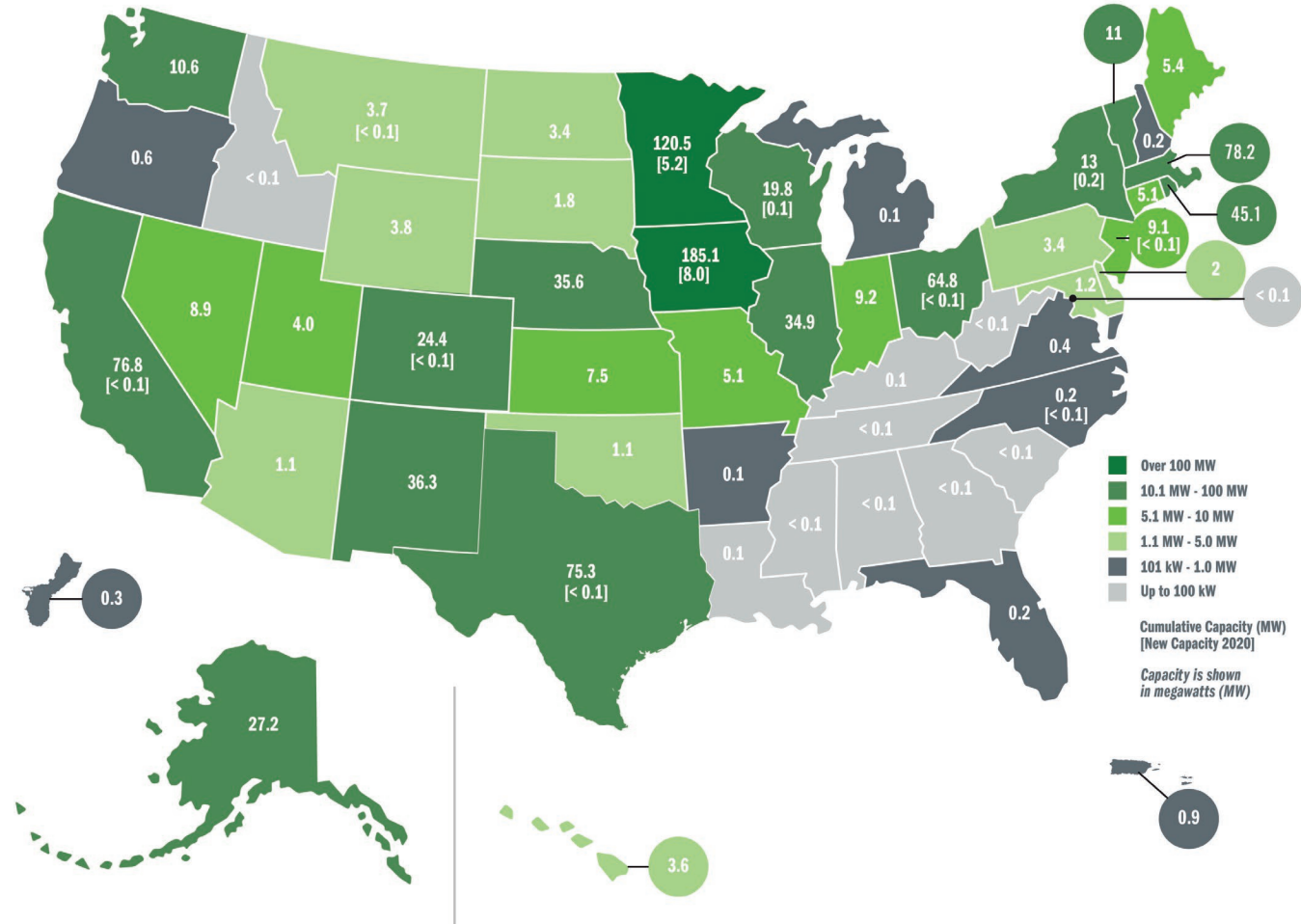
U.S. Distributed Wind Deployment

- In 2020, cumulative distributed wind capacity reached 1,055 MW from over 87,000 wind turbines across all 50 states, Puerto Rico, the U.S. Virgin Islands, and Guam.
- The 14.7 MW of distributed wind capacity deployed in 2020 represents \$41 million in investment.
 - 12.9 MW came from projects using large-scale turbines (greater than 1 MW in size)
 - 0.16 MW came from projects using mid-size turbines (101 kW to 1 MW in size)
 - 1.6 MW came from projects using small wind turbines (up through 100 kW in size).



U.S. Distributed Wind Deployment

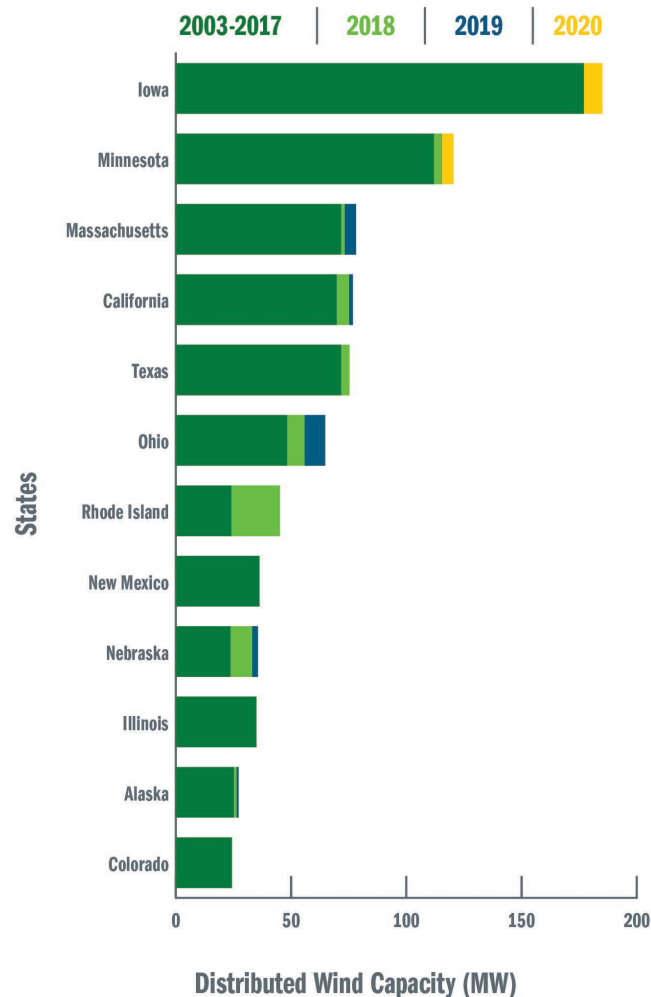
- In 2020, new distributed wind projects were documented in 11 states (CA, CO, IA, MN, MT, NJ, NY, NC, OH, TX, and WI).
- Iowa and Minnesota led the United States in new distributed wind power capacity in 2020 as a result of the 7.9-MW Mason City Wind project in Iowa and the 5-MW Rock County Wind Fuel project in Minnesota.



U.S. cumulative (2003–2020) capacity and 2020 capacity additions for distributed wind by state

U.S. Distributed Wind Deployment

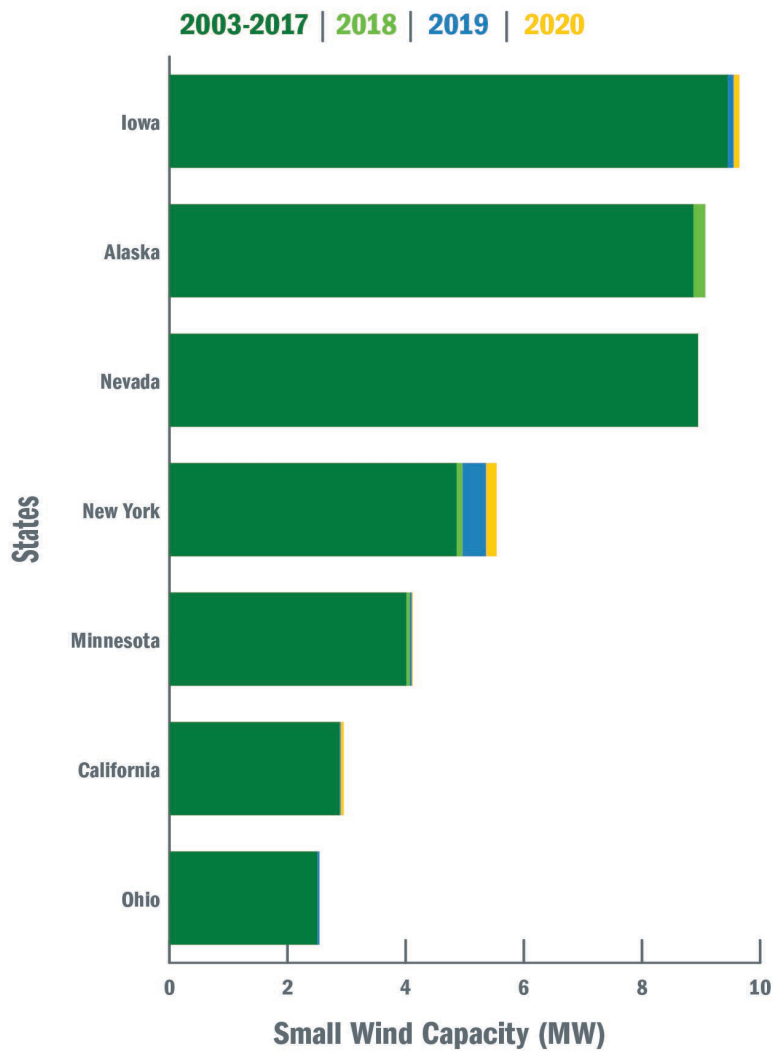
- Iowa, Minnesota, and Massachusetts are the top three states for distributed wind capacity, although Massachusetts had no new documented projects in 2020.



States with distributed wind capacity greater than 20 MW, 2003–2020

U.S. Distributed Wind Deployment

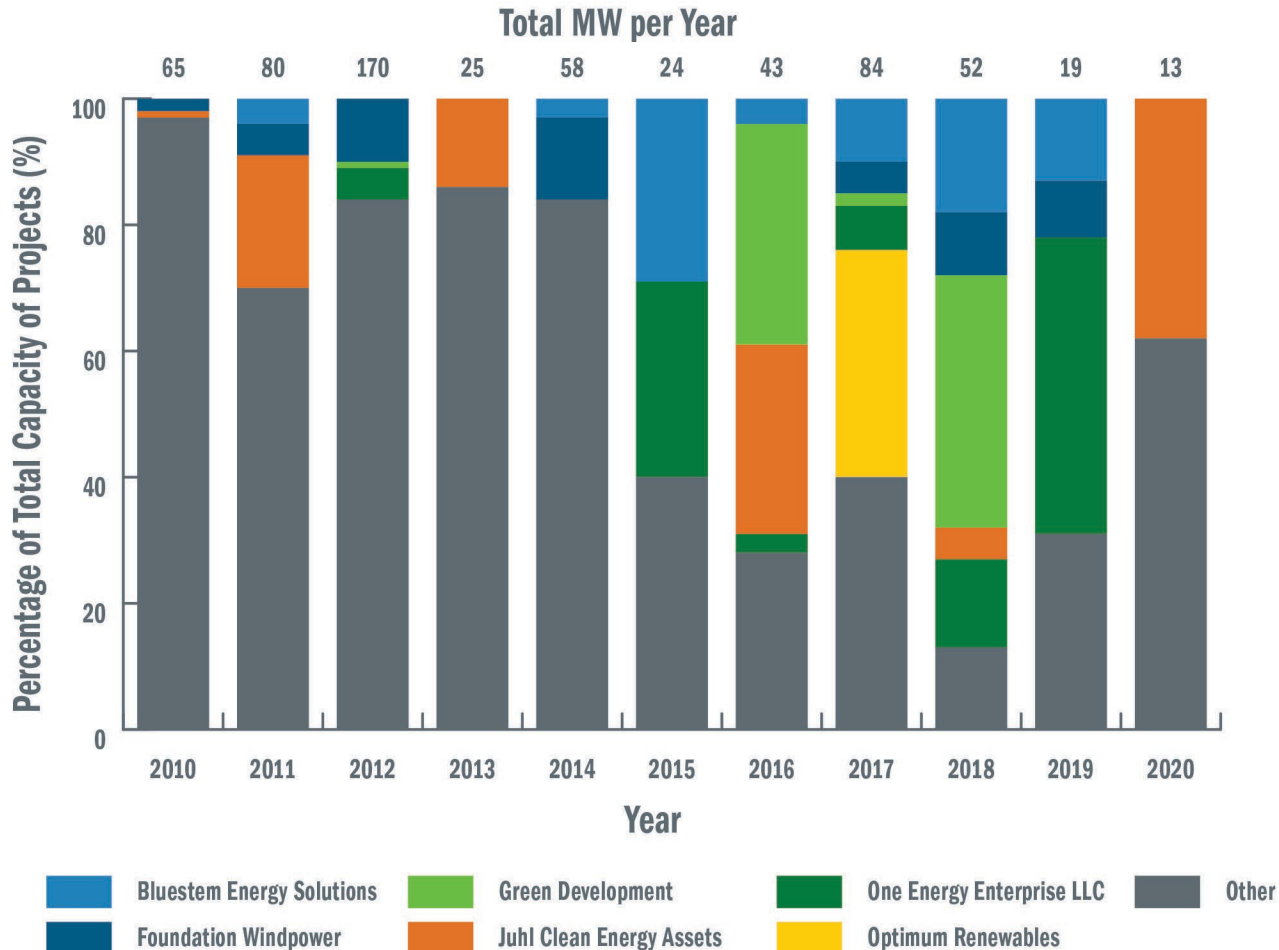
- Iowa, Alaska, and Nevada are the top three states for cumulative small wind capacity in the United States, although New York had the most reported small wind projects in 2020.



States with small wind capacity greater than 2 MW, 2003-2020

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

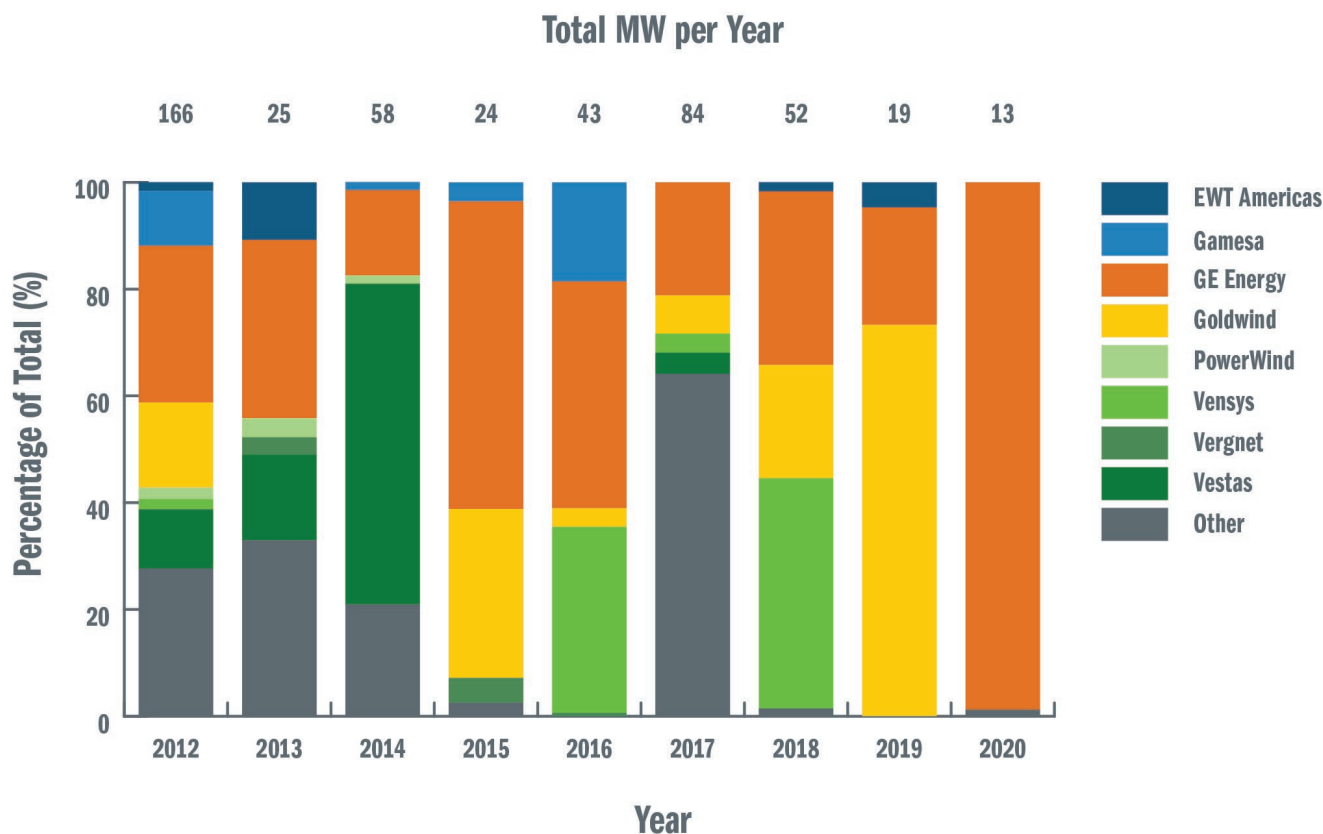
- Six developers have accounted for at least 40% of the distributed wind capacity from projects using turbines greater than 100 kW since 2015.



Project developers using turbines greater than 100 kW, 2010–2020

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

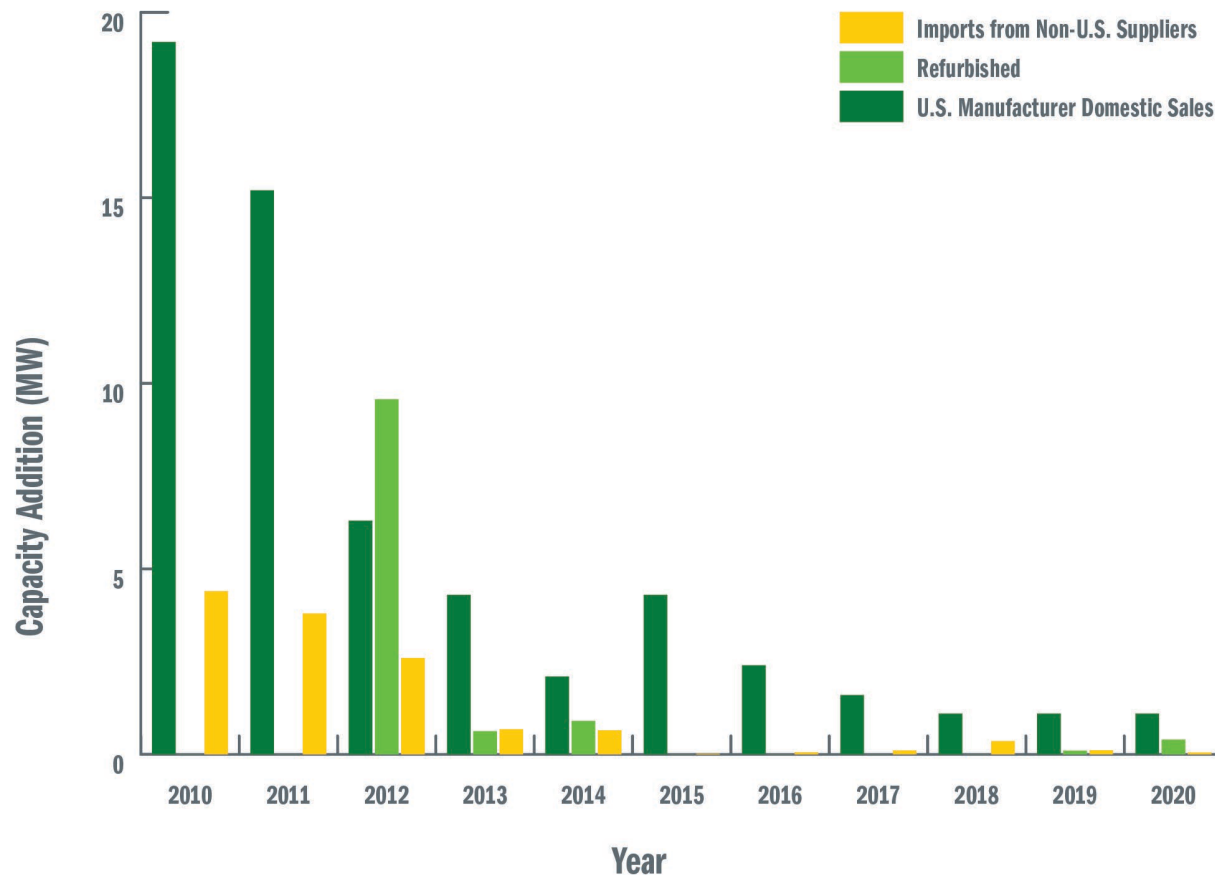
- The number of mid-size and large-scale turbine manufacturers and suppliers with installations in the United States has generally declined since 2012.
- GE Energy has had the most consistent sales presence in recent years.



Wind turbine manufacturers of turbines greater than 100 kW with a U.S. sales presence, 2012–2020

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

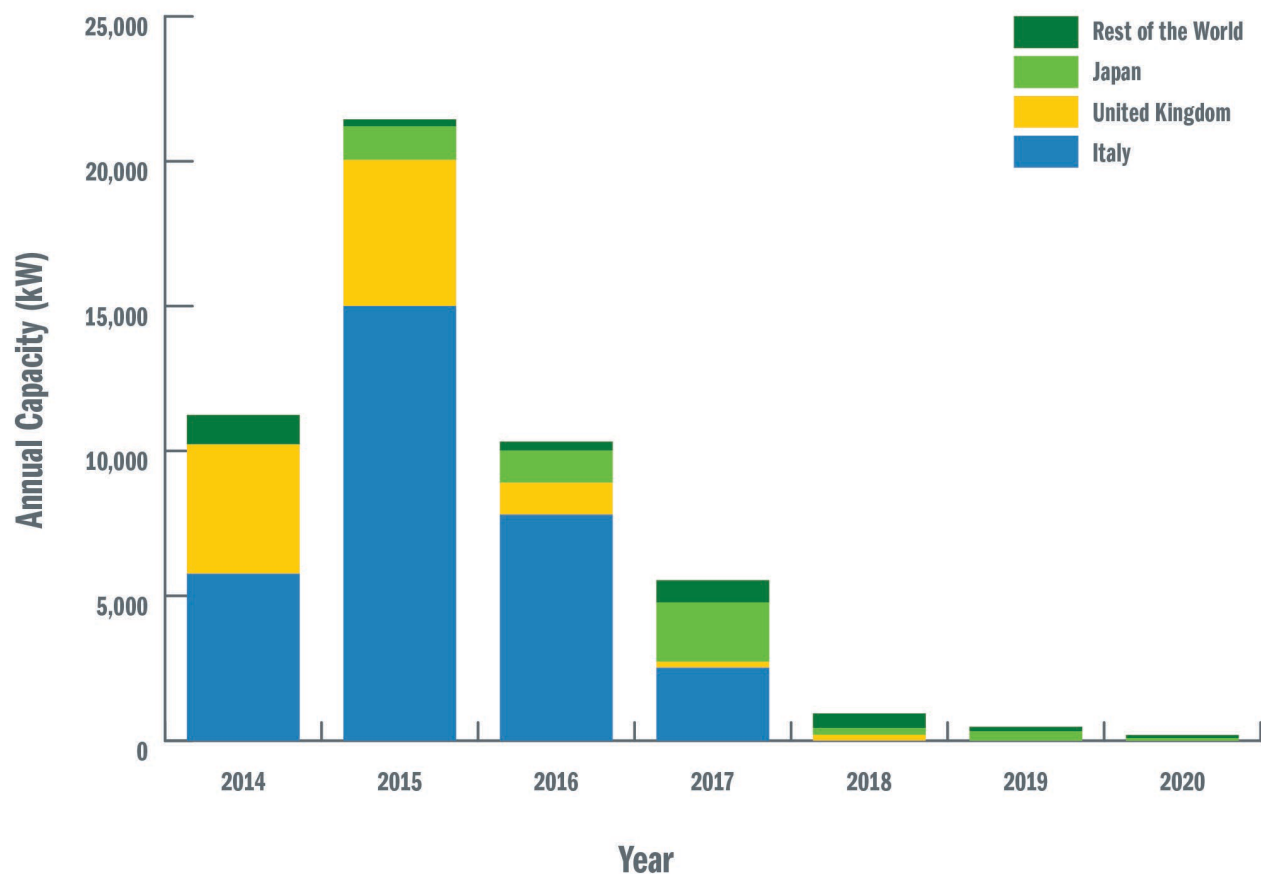
- U.S.-based manufacturers of new small wind turbines accounted for 71% of the domestic small wind sales capacity in 2020. Refurbished turbines accounted for 26% of the sales capacity.



U.S. small wind turbine sales, 2010–2020

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

- Small wind exports have declined as feed-in tariff programs in Italy, the United Kingdom, and Japan have been discontinued or reduced.



U.S. small wind turbine exports, 2014–2020

Small Wind Certification

- Eight small wind turbines are currently certified to American Wind Energy Association (AWEA) 9.1-2009 or IEC 61400-1, -2, and -11 standards.

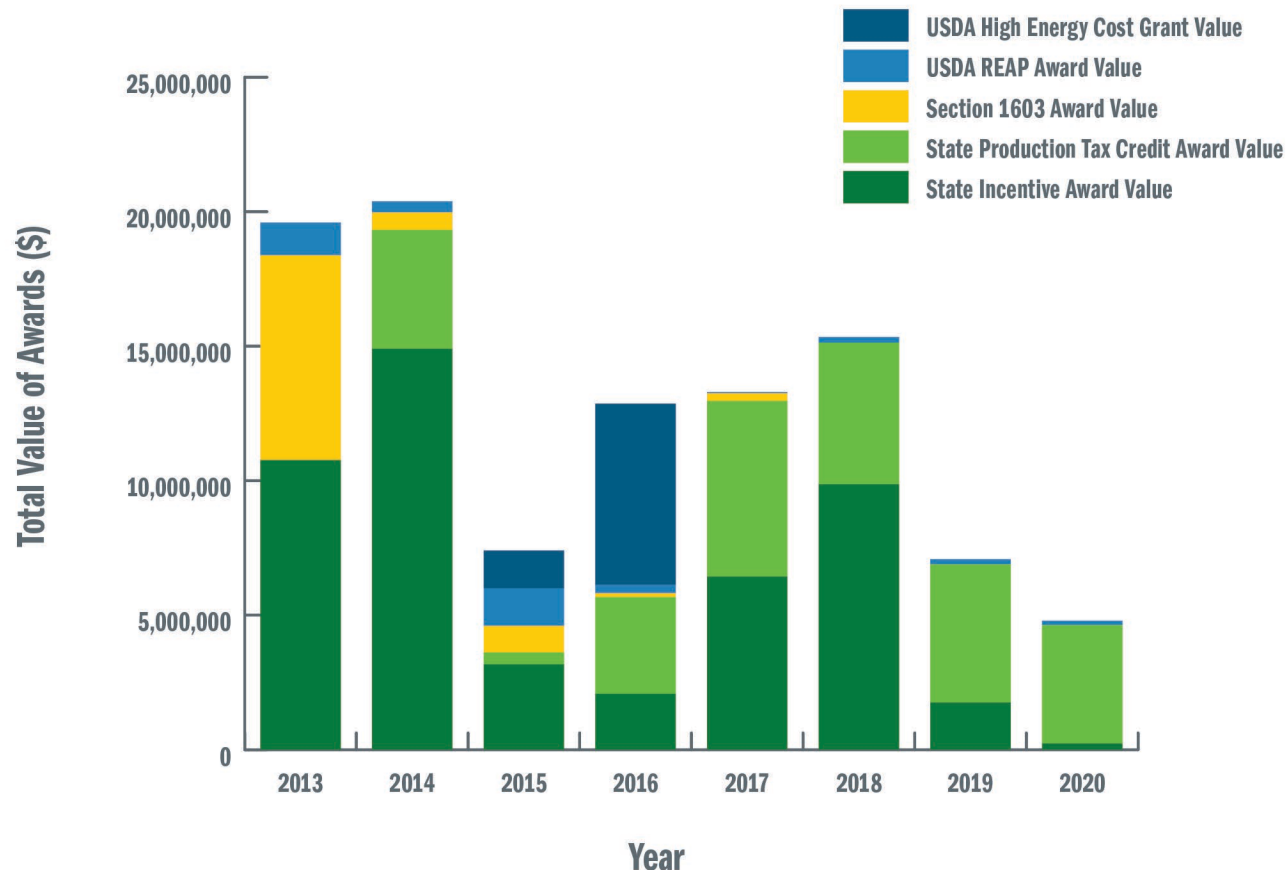
Certified Small Wind Turbines

Applicant	Turbine Model	Date of Initial Certification	Certified Power Rating ^a @ 11 m/s (kW)	Certification Standard
Bergey WindPower	Excel 10	11/16/2011	8.9	AWEA 9.1
Bergey WindPower	Excel 15	2/5/2021	15.6	AWEA 9.1
Eveready Diversified Products (Pty) Ltd.	Kestrel e400nb	2/14/2013 ^b	2.5	AWEA 9.1
Eocycle Technologies, Inc.	EO20/E025	3/21/2017	22.5/28.9	AWEA 9.1
HI-VAWT Technology Corporation/Colite Technologies	DS3000	5/10/2019	1.4	AWEA 9.1
Primus Wind Power	AIR 30/AIR X	1/25/2019	0.16	IEC 61400
Primus Wind Power	AIR 40/Air Breeze	2/20/2018	0.16	IEC 61400
SD Wind Energy, Ltd.	SD6	6/17/2019	5.2	AWEA 9.1

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	This model's certification was renewed in 2020.

Policies, Incentives, and Market Insights

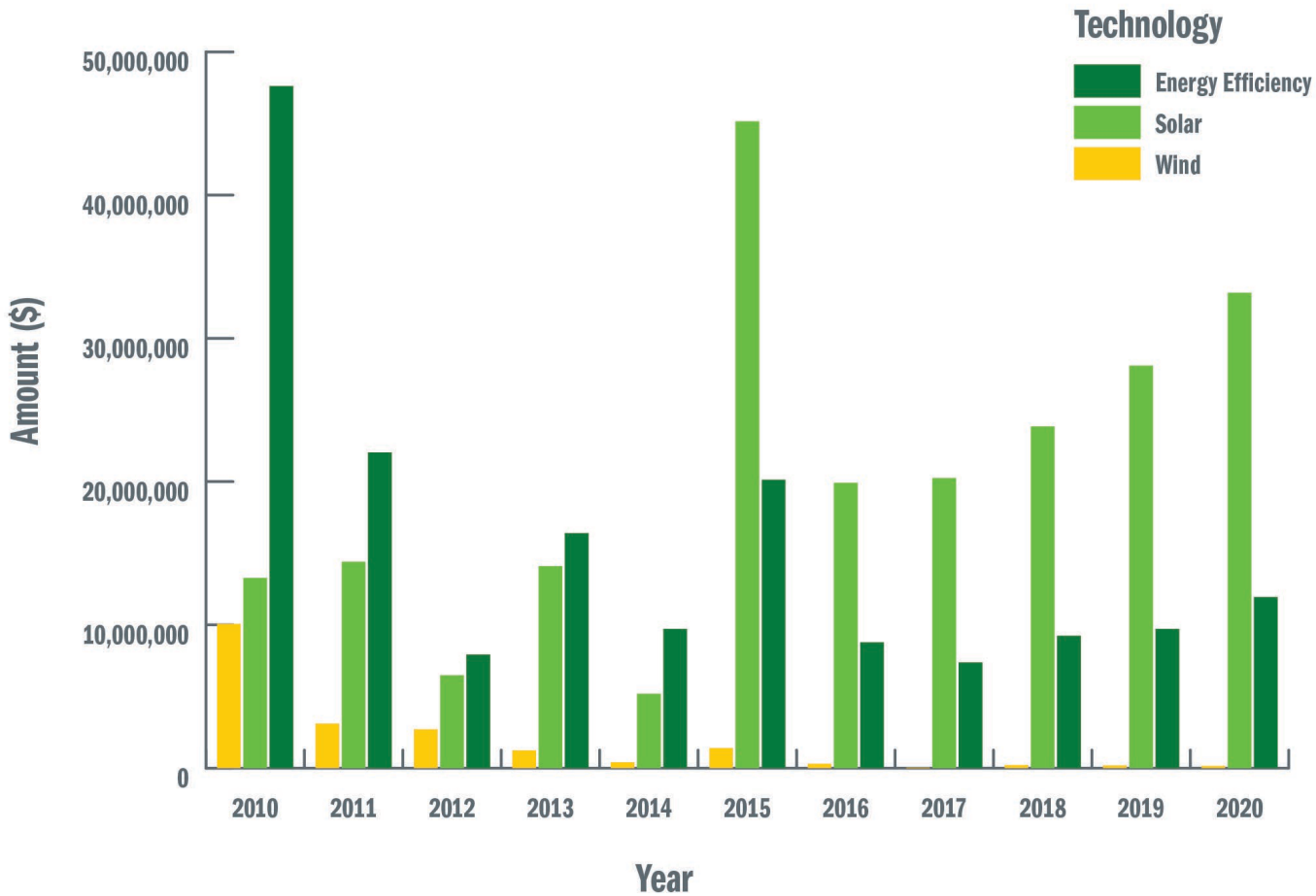
- The combined value of state rebates, production-based incentives, production tax credits, and U.S. Department of Agriculture (USDA) Rural Energy for America Program (REAP) grants given to distributed wind projects in 2020 was nearly \$4.8 million across six states.



U.S. distributed wind incentive awards, 2013–2020

Policies, Incentives, and Market Insights

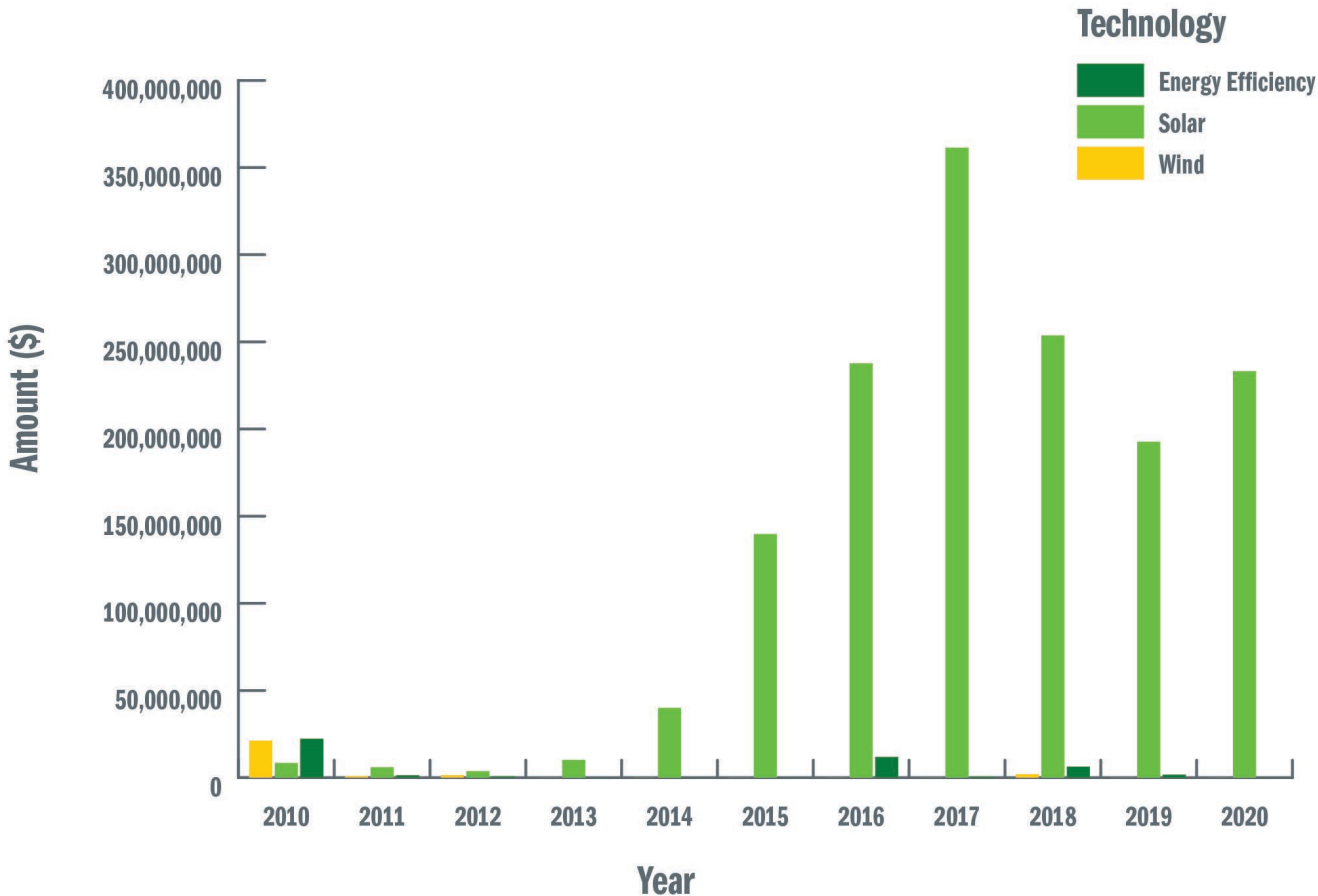
- Since 2003, USDA has awarded over \$72 million in REAP wind grants. These grants have decreased significantly since a peak in 2010 for wind, while awards to solar PV projects have increased. In 2020, a total of \$155,026 in REAP grants were awarded to three wind projects.



USDA REAP grants by technology, 2010–2020

Policies, Incentives, and Market Insights

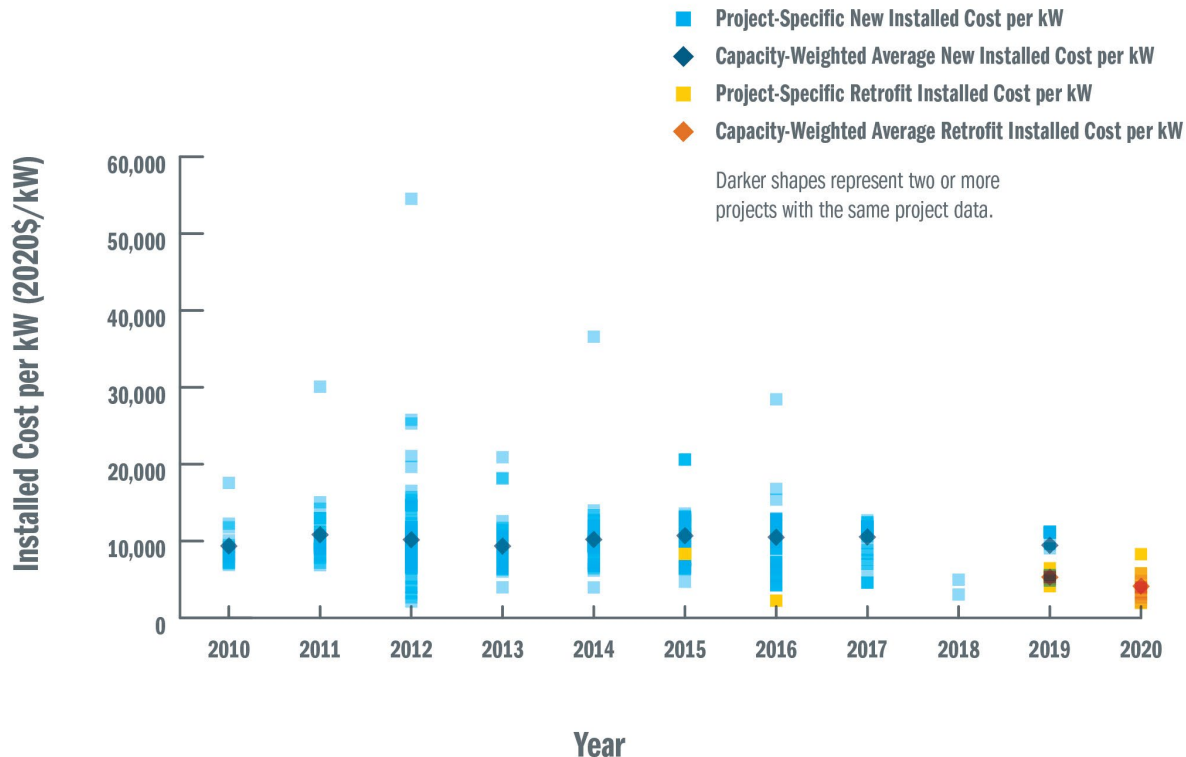
- USDA REAP wind loan guarantees decreased significantly after 2010, while loans to solar PV projects have increased. USDA REAP did not provide any loan guarantees to wind projects in 2020.



USDA REAP loans by technology, 2010–2020

Distributed Wind Cost Trends

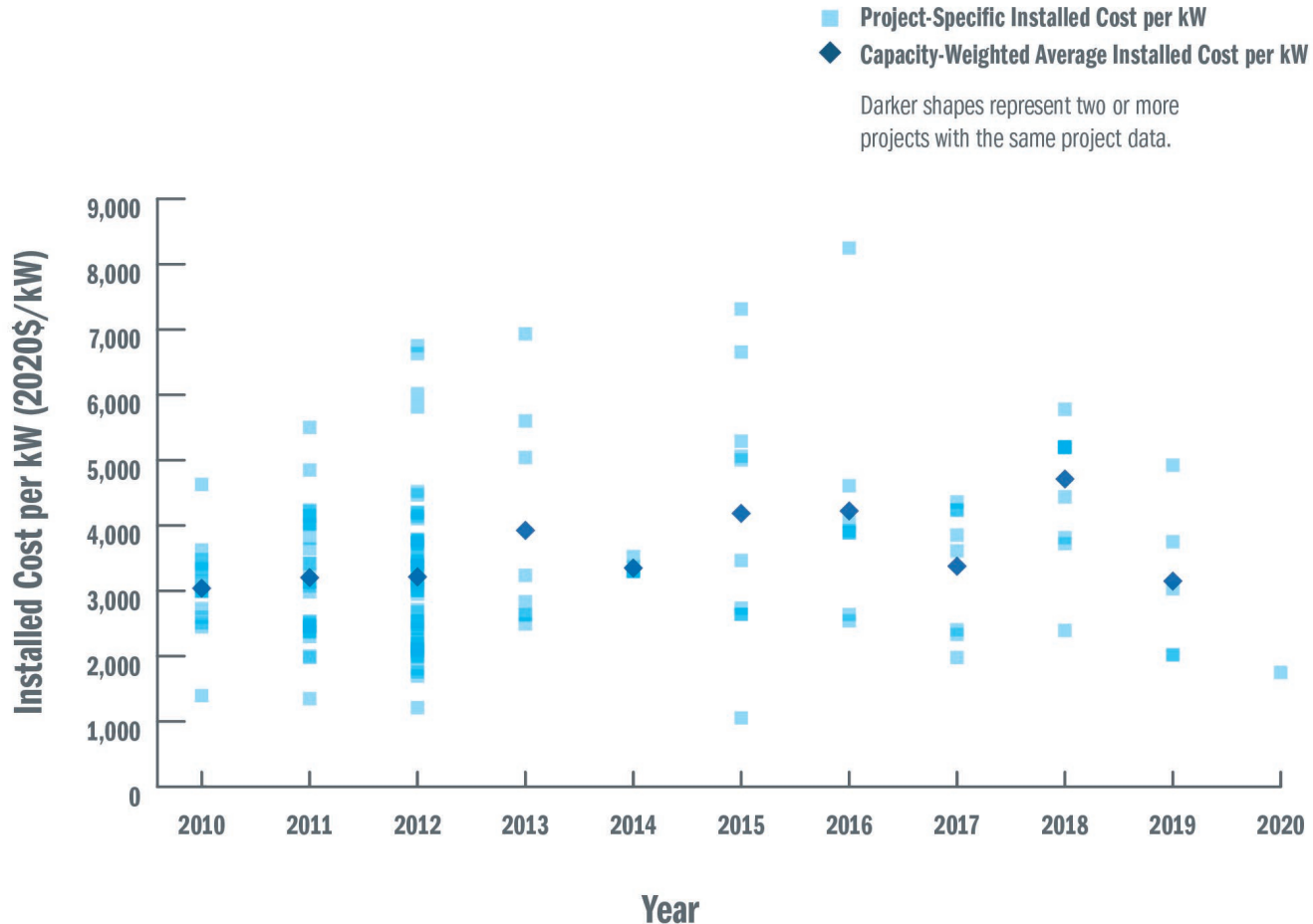
- Annual average capacity-weighted installed costs for new small wind projects range from \$4,000/kW to \$11,000/kW, with the overall average installed cost relatively flat at \$9,500/kW.
- The annual average capacity-weighted installed cost for small wind retrofit projects was approximately \$5,300/kW in 2019 and \$4,100/kW in 2020. Retrofits using refurbished turbines represent 1



Average and project-specific U.S. new and retrofit small wind installed project costs, 2010–2020

Distributed Wind Cost Trends

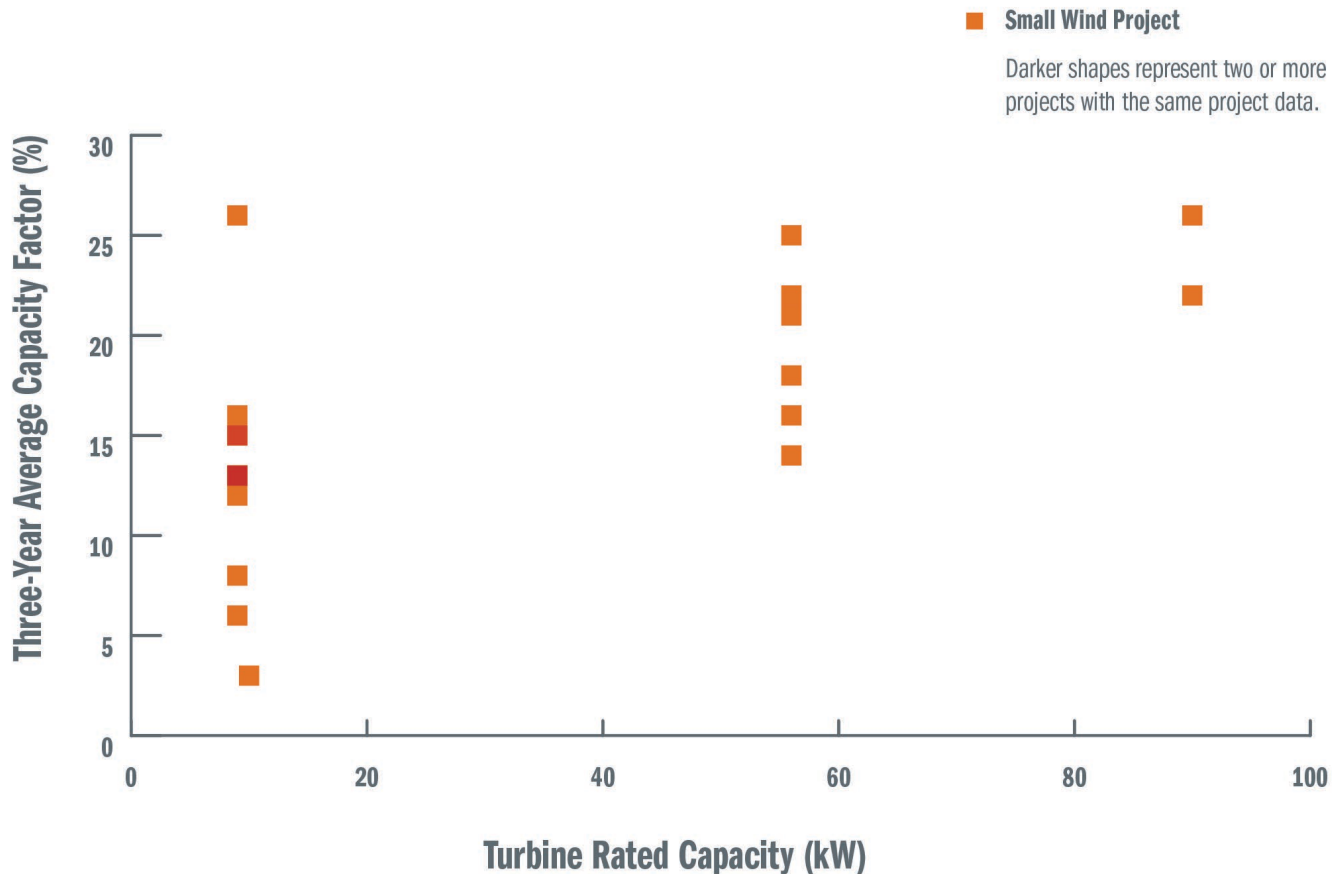
- The overall annual average capacity-weighted installed cost of projects using turbines greater than 100 kW from 2010 through 2019 is \$3,640/kW.



Average annual and project-specific installed costs for projects using turbines greater than 100 kW, 2010–2020

Distributed Wind Performance

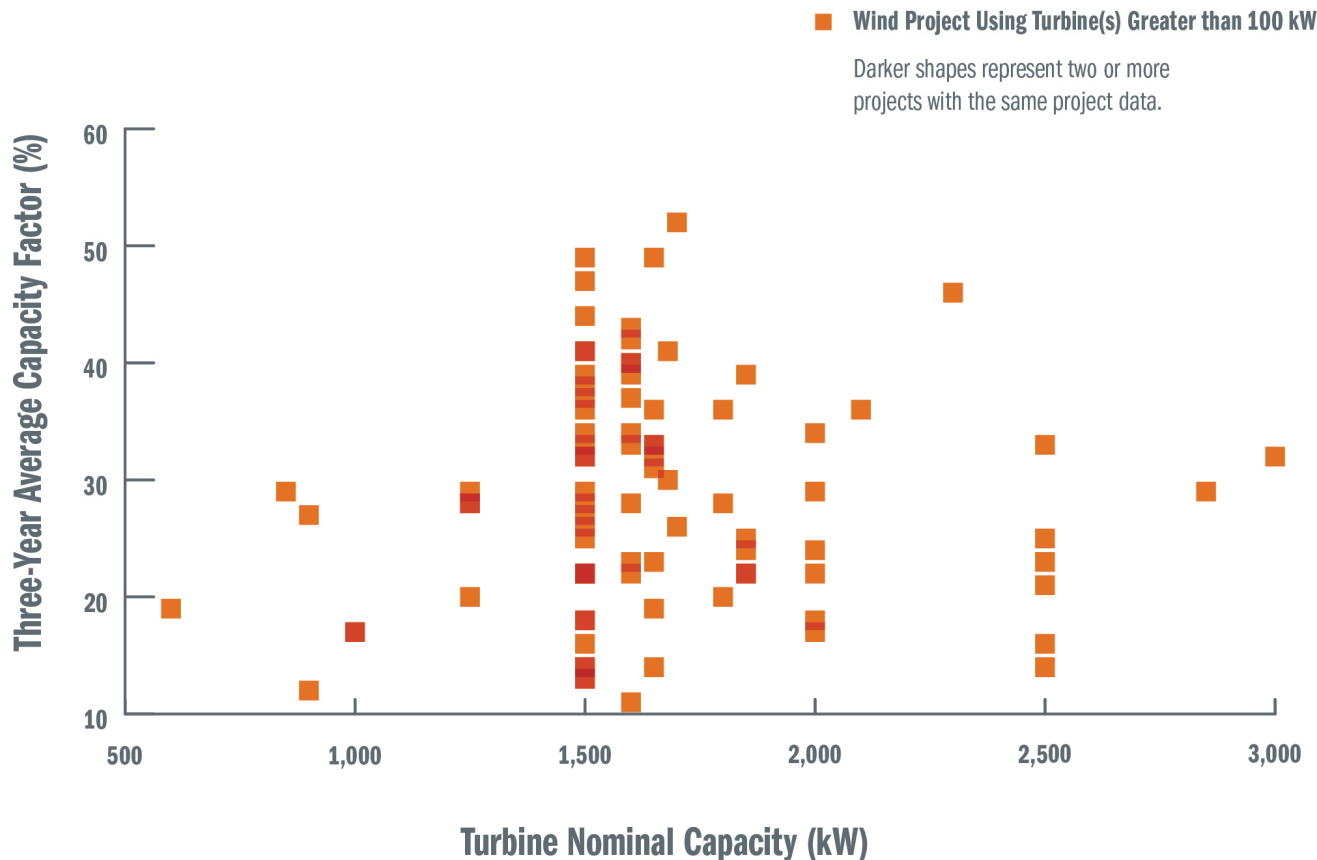
- The small wind three-year average capacity factor from a sample of projects (19 turbines totaling 615 kW in rated capacity) is 16%.



Small wind capacity factors

Distributed Wind Performance

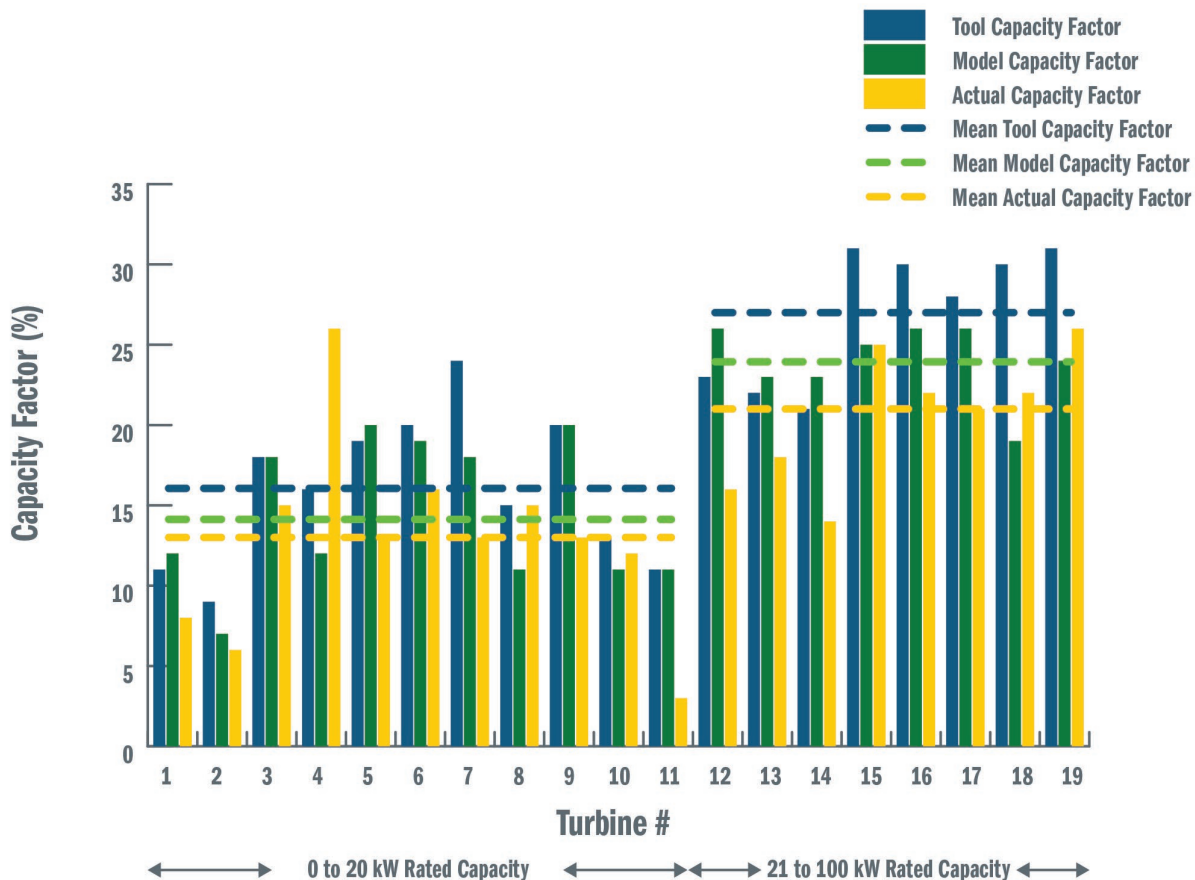
- Based on the available dataset, the three-year average capacity factor for distributed wind projects using mid-size turbines is 20% and 29% for large-scale wind turbines.



Capacity factors for projects using turbines greater than 100 kW

Distributed Wind Performance

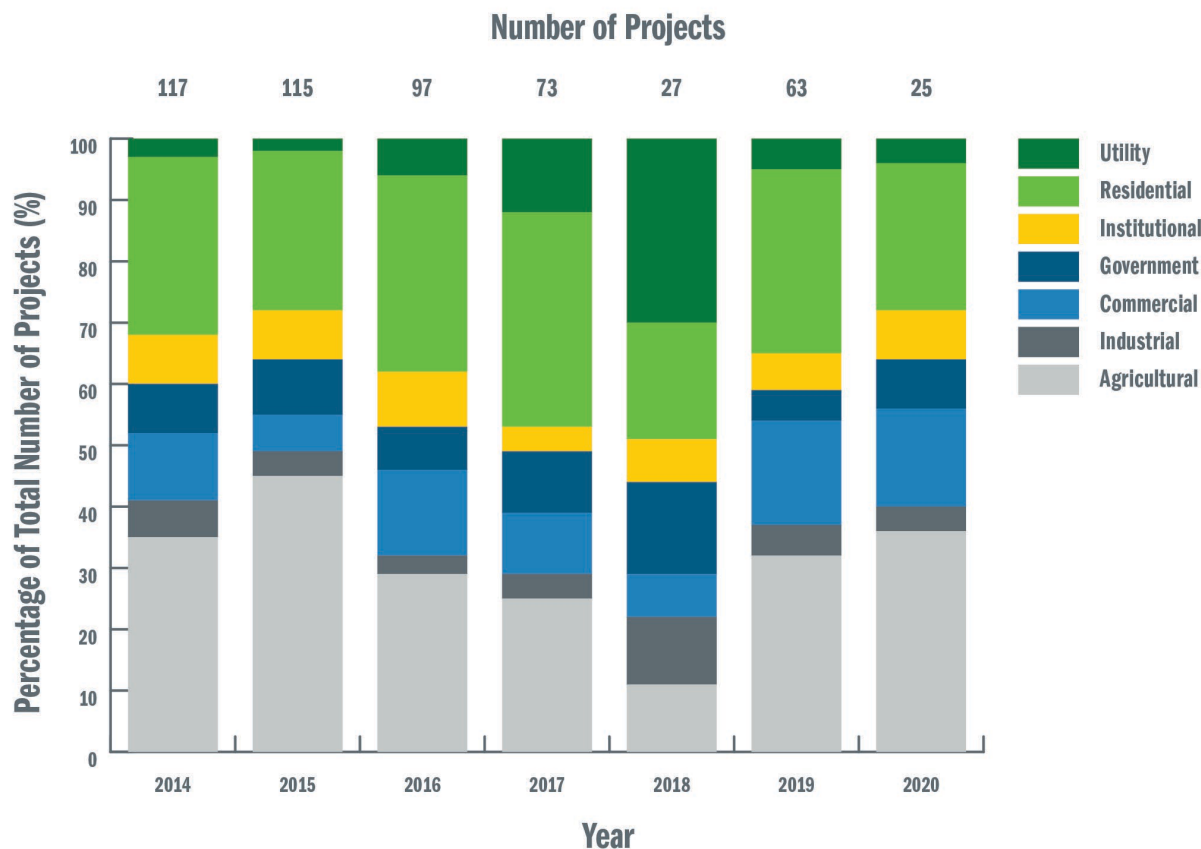
- Energy generation estimates produced from a modeled data source and the Small Wind Explorer tool generally overpredict small wind performance when compared to actual reported performance amounts.



Actual and estimated performance for small wind projects

Distributed Wind Markets

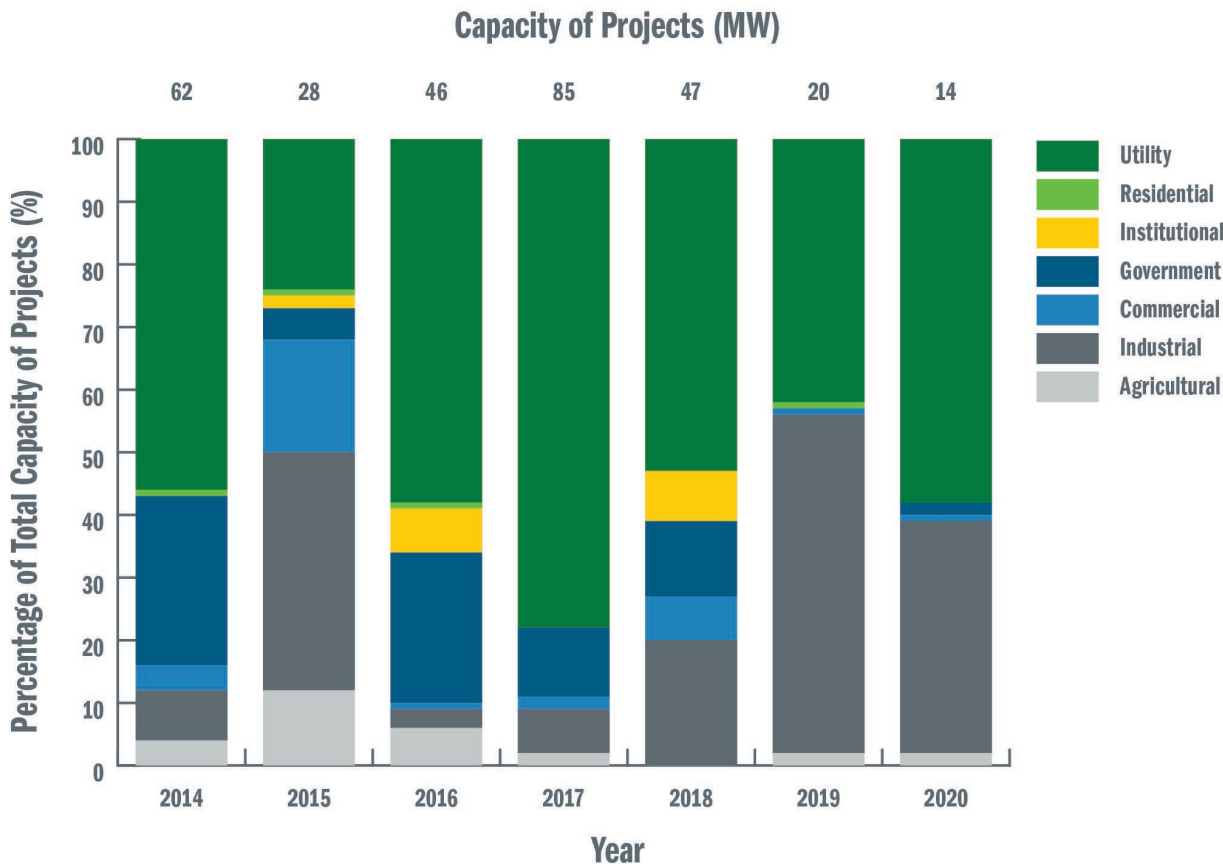
- Agricultural and residential end-use customers have consistently represented most of the distributed wind installations by number of projects.
- In 2020, agricultural customers accounted for 36% of the number of projects installed, followed by residential customers at 24%.



Distributed wind end-use customer types by number of projects, 2014–2020

Distributed Wind Markets

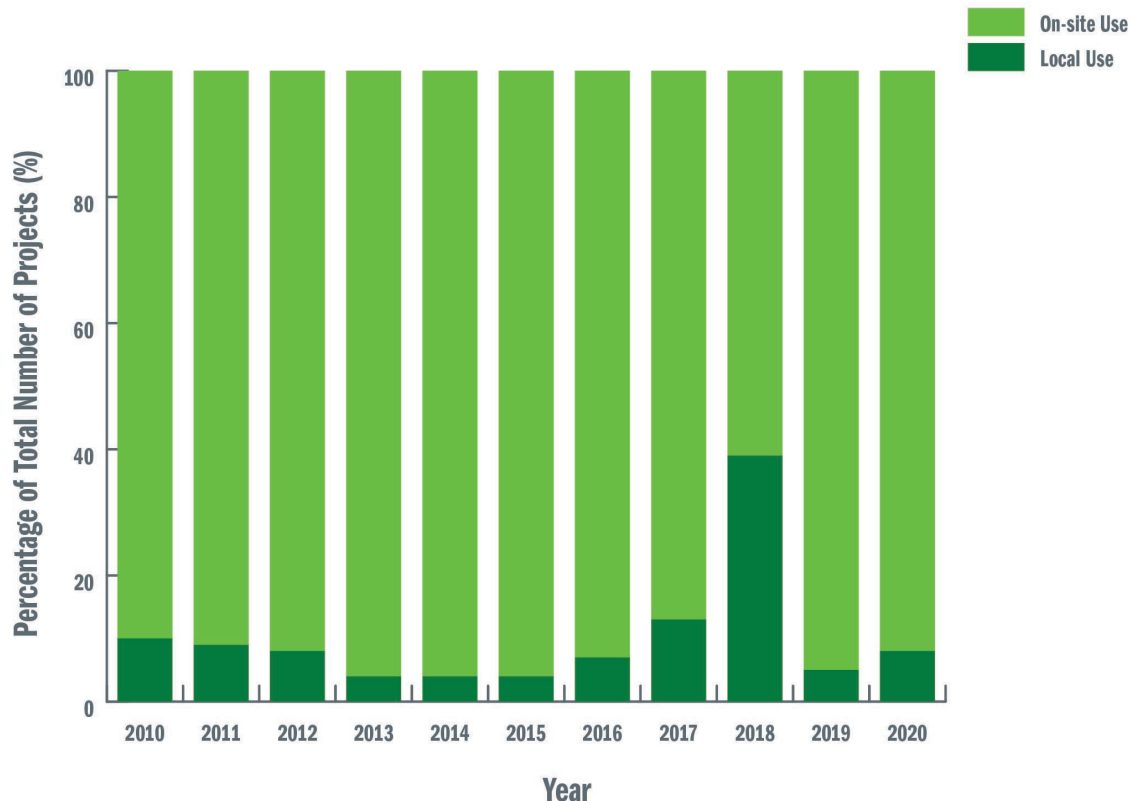
- Projects using large-scale turbines that serve utility customers have consistently accounted for most of the distributed wind capacity.
- In 2020, utility customers accounted for 58% of the total documented distributed wind capacity.



Distributed wind end-use customer types by capacity of projects, 2014–2020

Distributed Wind Markets

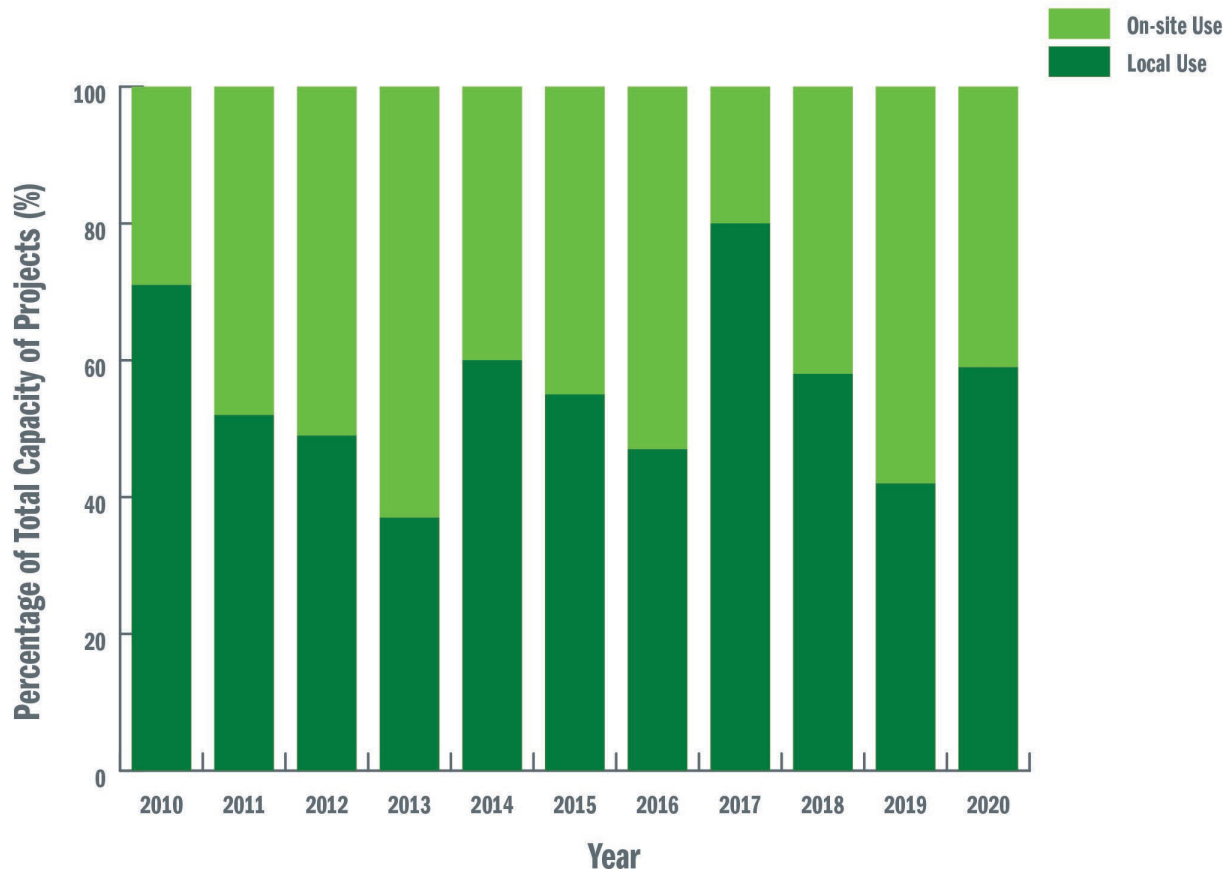
- Most distributed wind projects are interconnected for on-site use, but projects for local use represent more of the installed distributed wind capacity.
- From 2010 through 2020, 90% of all documented distributed wind projects were interconnected for on-site use, while the remaining 10% were deployed for local use.



Distributed wind for on-site use and local loads by number of projects, 2010–2020

Distributed Wind Markets

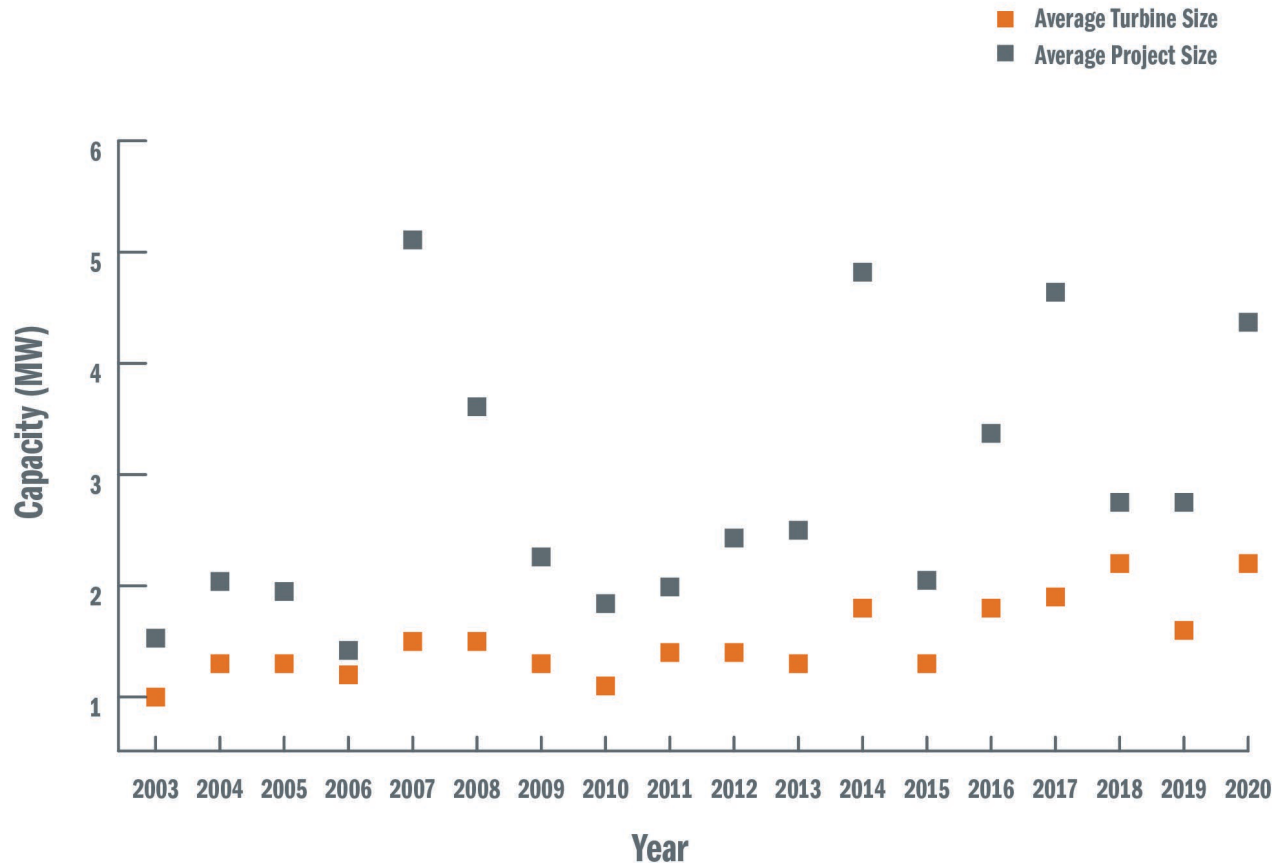
- Most installed distributed wind capacity is for local use.
- From 2010 through 2020, 45% of total installed project capacity was documented for on-site use, while 55% was reported to serve local loads.



Distributed wind for on-site use and local loads by capacity of projects, 2010–2020

Distributed Wind Markets

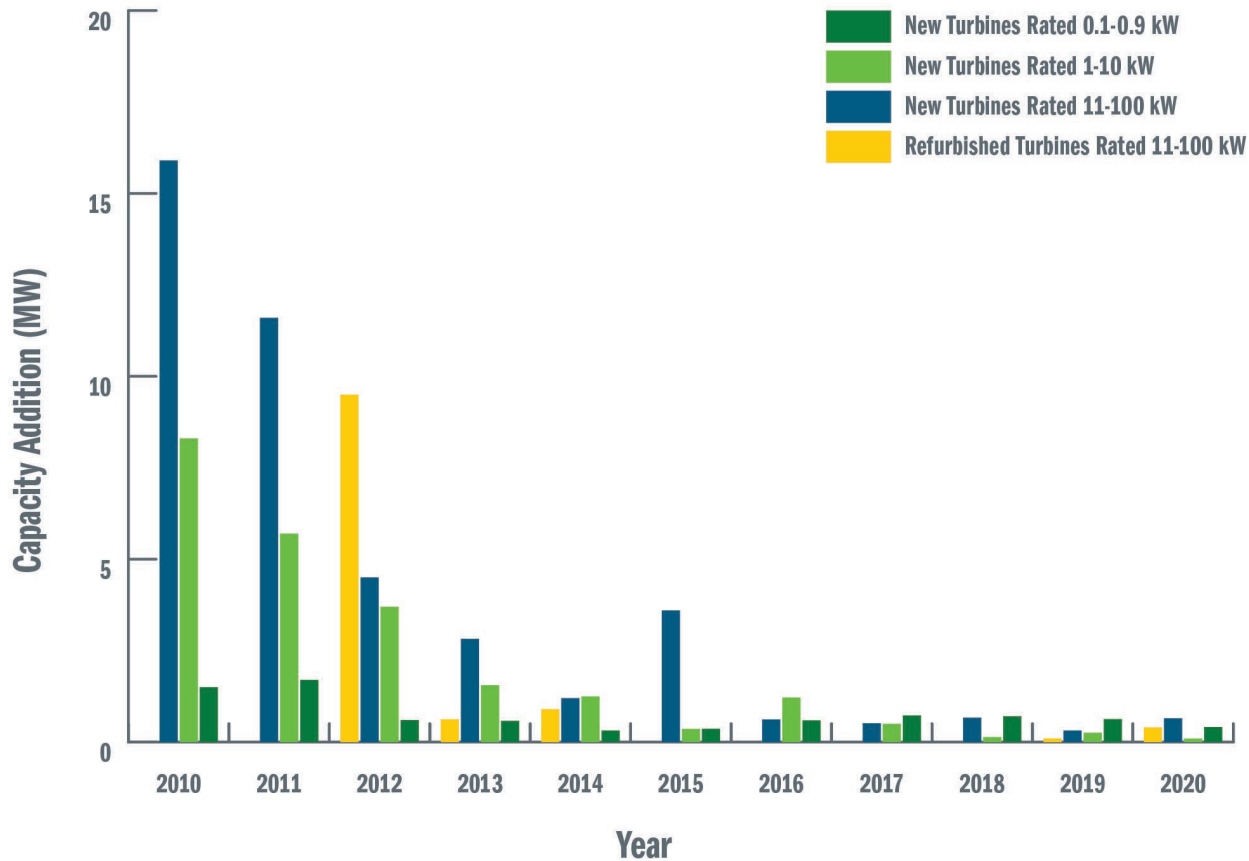
- In 2020, the average capacity of turbines greater than 100 kW in distributed wind projects was 2.2 MW and project size was 4.4 MW.



Average size of turbines greater than 100 kW in distributed wind projects and average size of those projects, 2003–2020

Distributed Wind Markets

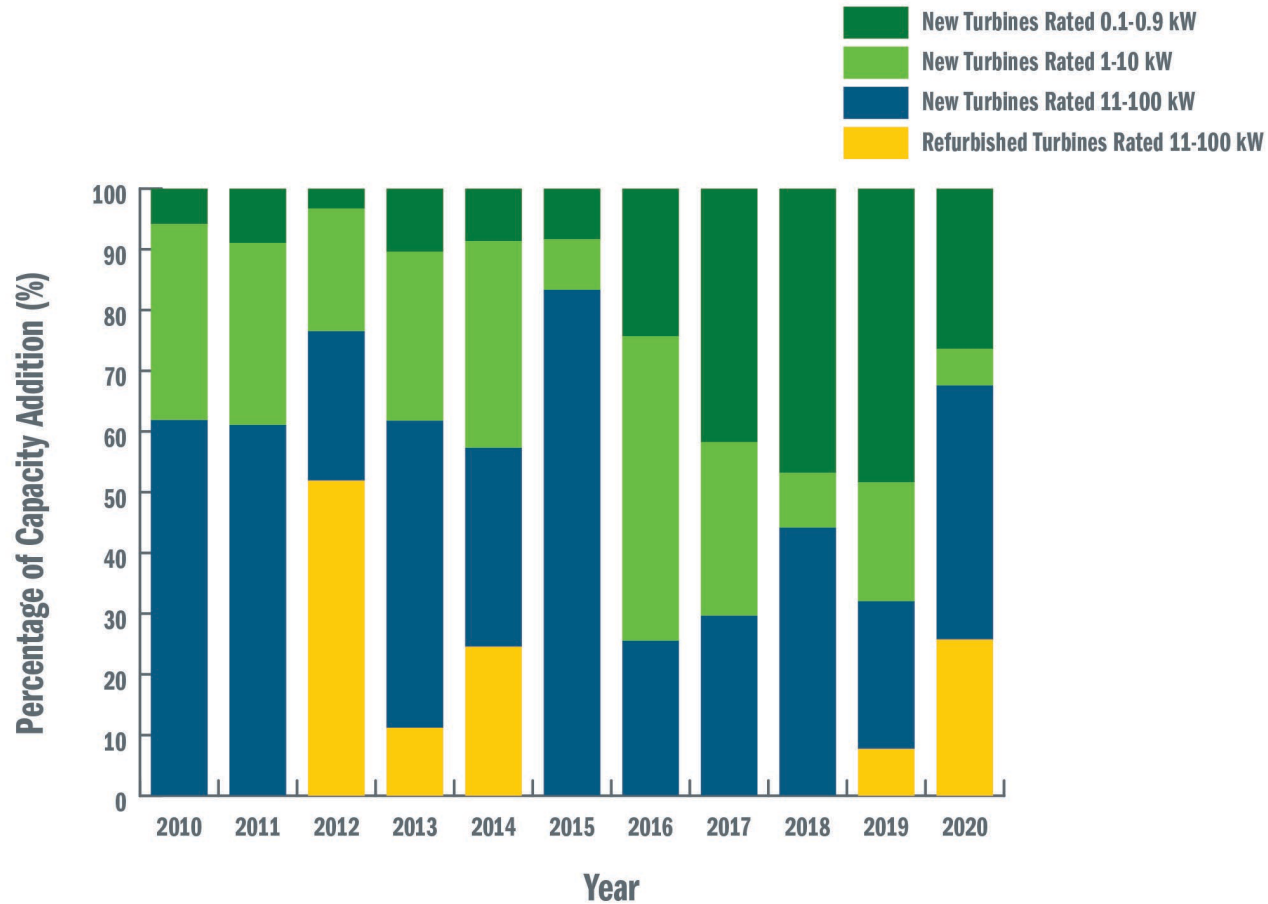
- New turbines rated 11–100 kW account for 0.65 MW of sales capacity in 2020, turbines less than 1 kW in size represented 0.41 MW, refurbished turbines rated 11–100 kW represented 0.4 MW, and new turbines rated 1–10 kW represented 0.1 MW



U.S. small wind sales capacity by turbine size, 2010–2020

Distributed Wind Markets

- New turbines rated 11–100 kW represented 42% of sales capacity in 2020, turbines less than 1 kW in size represented 26%, refurbished turbines rated 11–100 kW represented 26%, and new turbines rated 1–10 kW represented 6%.



U.S. small wind sales percentage of capacity by turbine size, 2010–2020

Summary

- Large-scale wind turbines continue to account for most of the distributed wind capacity additions, but market conditions and project development cycles contribute to varying capacity additions from year to year.
- The U.S. small wind market has been steadily declining since a peak in 2012 and the use of mid-size turbines (101 kW to 1 MW) remains limited.
- As existing small wind turbines age and customers remain committed to wind as a distributed energy resource, retrofit reports are likely to increase.
- Small wind manufacturers and installers have reported a brighter outlook for 2021, given the role distributed energy resources can play in addressing energy security, grid resilience, and climate change challenges.



Photo credit: Jordan Nelson / Nelson Aerial Productions

For More Information

See full report for additional findings and details:

<https://energy.gov/windreport>

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https://epe.pnnl.gov/research_areas/distributed_wind/photos2.stm

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