



2012 Market Report on Wind Technologies in Distributed Applications

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What is “Distributed Wind”?

Distributed wind is used on or near where it is generated and is...

Not just small scale; could be any size turbine or array

Employed by households, schools, farms, industrial facilities, municipalities

Found in all 50 states and Puerto Rico and the U.S. Virgin Islands

A large portion of turbines installed in U.S. on a per unit basis

And has been used for more than 2,000 years to pump water and grind grain



Photo Credit: Tom Rivers/The (Batavia, N.Y.) Daily News



Photo Credit: Gamesa

Benefits of Distributed Wind

- Helps owners reduce utility bills and hedge against rising electricity rates
- Coupled with energy storage, can improve grid resilience and emergency preparedness
- Is a home grown industry and its growth over recent years has contributed to domestic economy



Photo Credit: Luther College Photo Bureau

Distributed Wind Market Report

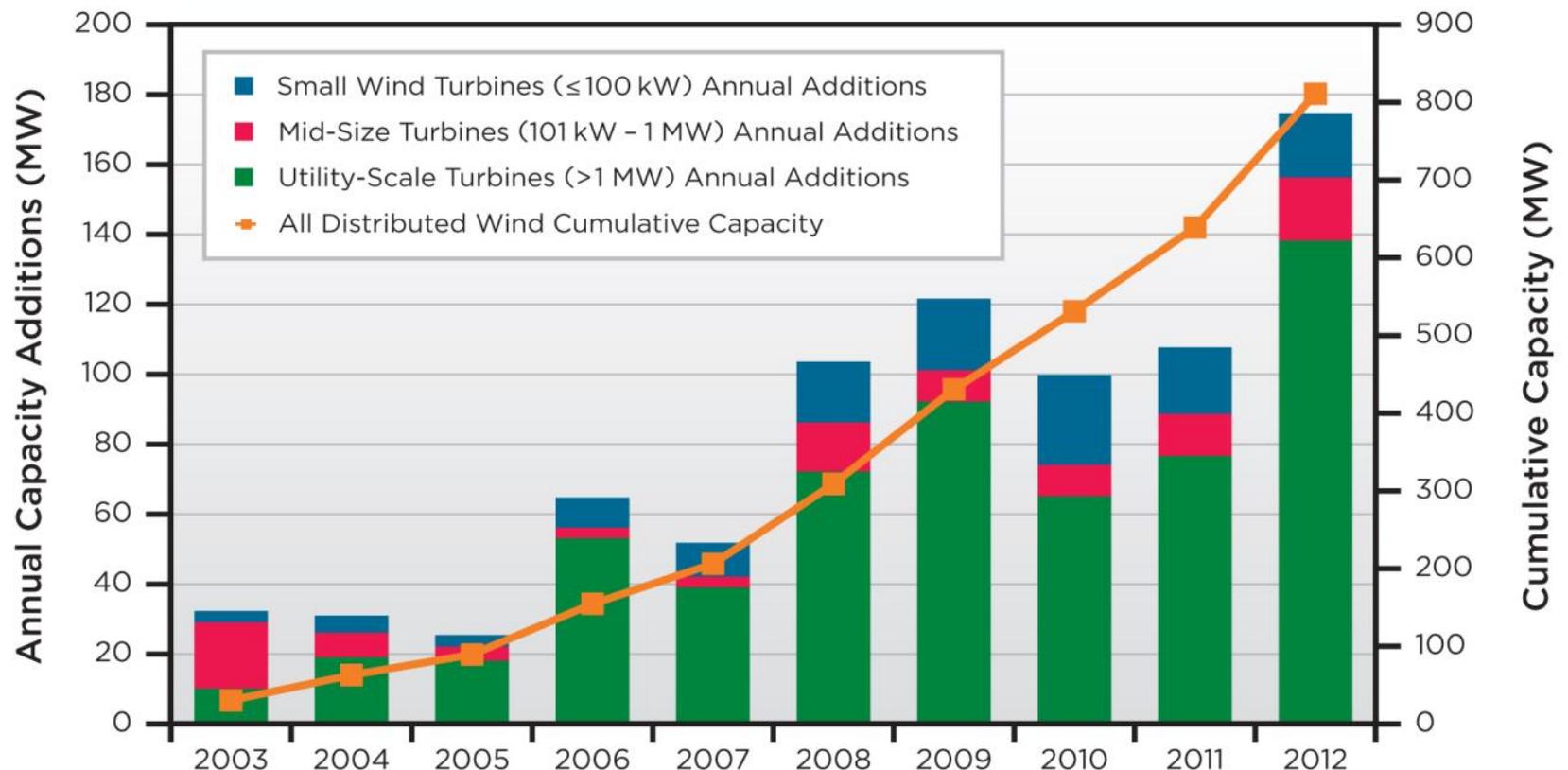
- First year with expanded scope
 - 2012 report covers small (≤ 100 kW), mid-size (> 100 kW – 1 MW), and utility-scale turbines (> 1 MW) used in distributed applications
 - Previous reports only covered small wind
 - Expanded scope matches DOE's expanded definition of distributed wind
- Prepared for U.S. DOE's Energy Efficiency & Renewable Energy Office's Wind and Water Power Technologies Office
 - By PNNL and eFormative Options with contributions from American Wind Energy Association and Distributed Wind Energy Association
- Report data comes from
 - AWEA database, eFormative database, U.S. Treasury Section 1603 payments, U.S. Department of Agriculture (USDA) Rural Energy for America Program (REAP) grants, news publications and press releases about projects, state agency reports, and manufacturer and supplier sales reports



Photo Credit: Foundation Windpower

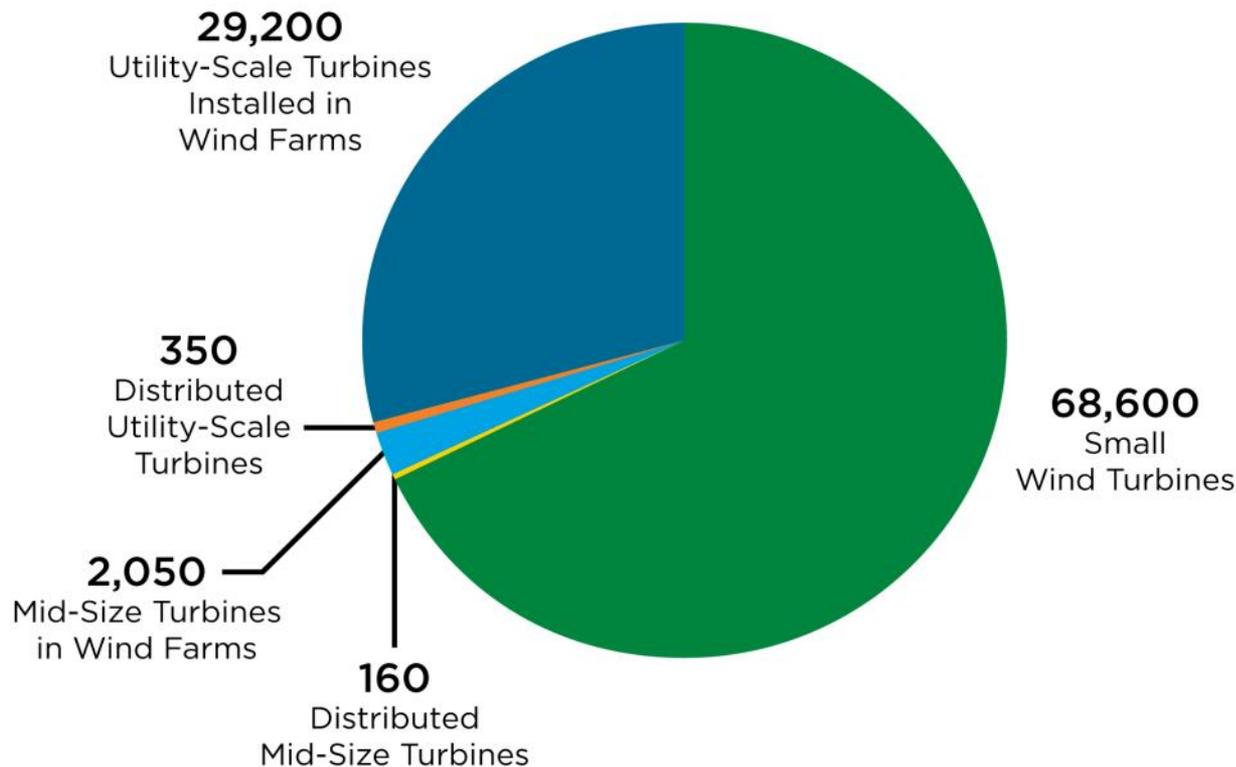
2012 Findings – Overview

At the end of 2012, U.S. wind turbines in distributed applications reached a 10-year cumulative installed capacity of more than 812 MW from more than 69,000 units across all 50 states, Puerto Rico, and USVI



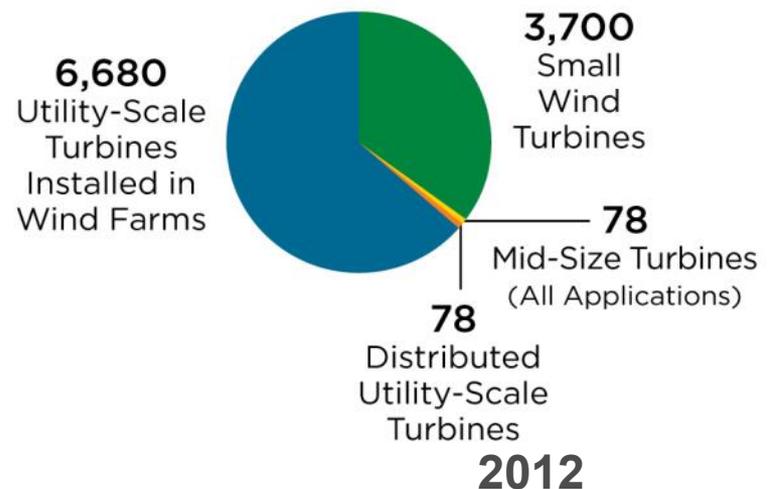
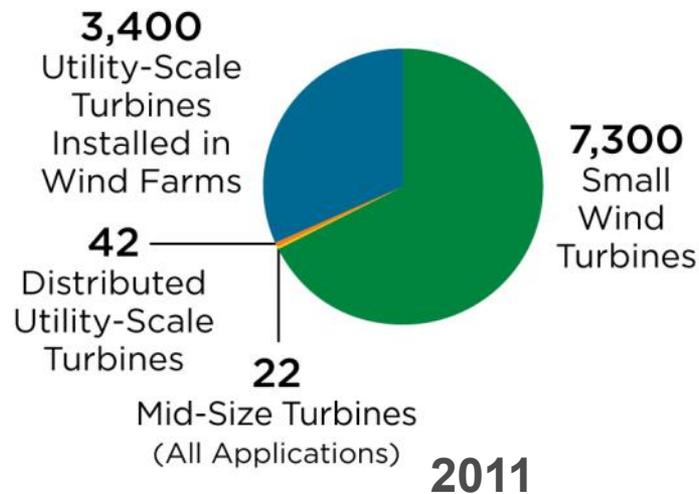
2012 Findings – *Cumulative Number of Installations*

- Distributed wind installations comprise >68% of all wind turbines installed in U.S. on a unit basis over past decade (2003 – 2012)



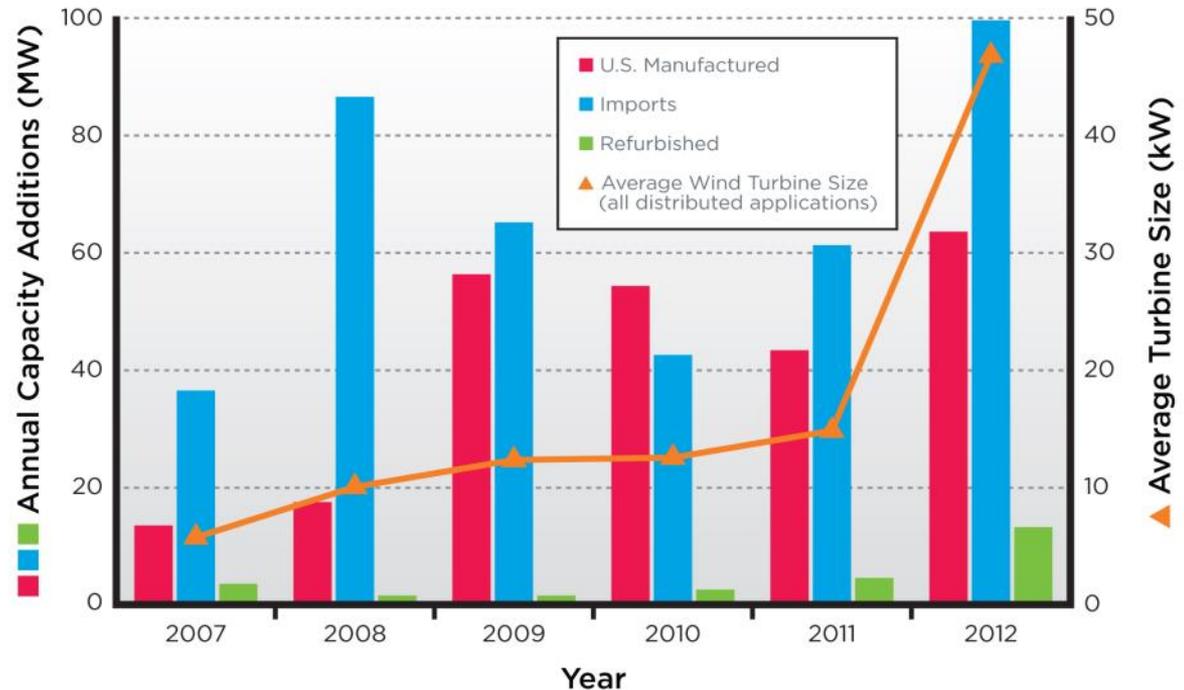
2012 Findings – 2011 vs. 2012

- Overall installed capacity increased by 62% in 2012 from 2011, but overall number of units installed in distributed applications decreased
 - Number of small scale units decreased by 50%, but number of mid-size and utility-scale units increased from 2011 to 2012
 - In 2012, 175 MW deployed with about 3,800 turbines, representing more than \$410 million in investment



2012 Findings – Turbine Type and Size Trends

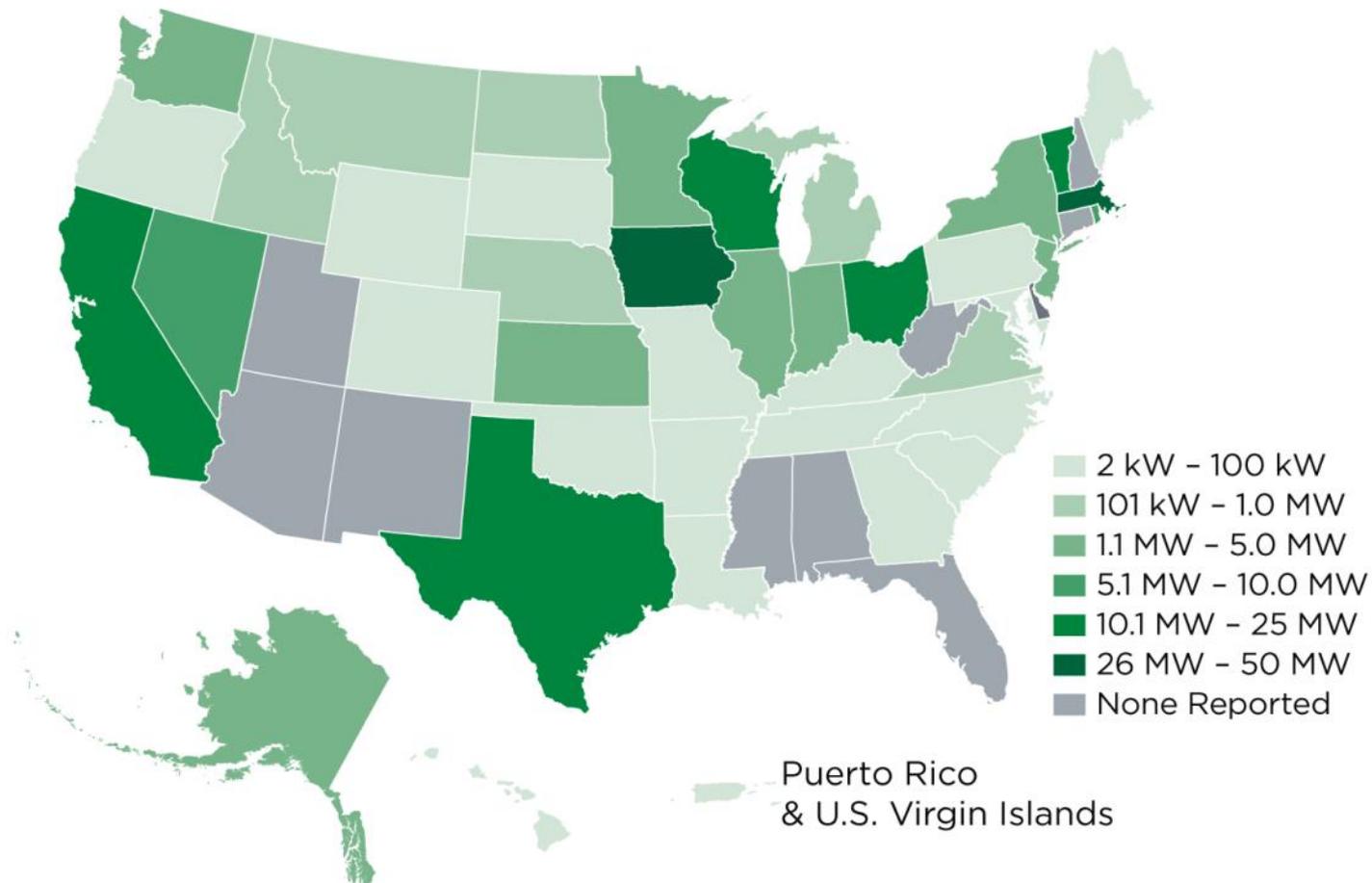
- Average turbine size has increased
- Use of refurbished turbines has increased
- Imports represent almost half 2012 sales (in terms of capacity)



		2007	2008	2009	2010	2011	2012
Imports (MW)	Small	1.1	4.4	3.6	4.4	3.8	2.6
	Mid-Size	0.0	13.0	8.3	4.8	7.2	11.7
	Utility	35	69	53	33	50	85.2
U.S. Manufactured (MW)	Small	9	13	17	21	15	6.3
	Mid-Size	0	0	0	2	2	4.3
	Utility	4	4	39	31	26	52.7
Refurbished (MW)	Small	0	0	0	0	0	9.6
	Mid-Size	3	1	1	2	4	3.1
Units (Number of Turbines)	Small	9,100	10,400	9,800	7,800	7,300	3,700
	Mid-Size	9	17	15	22	22	31
	Utility	22	43	63	34	42	78

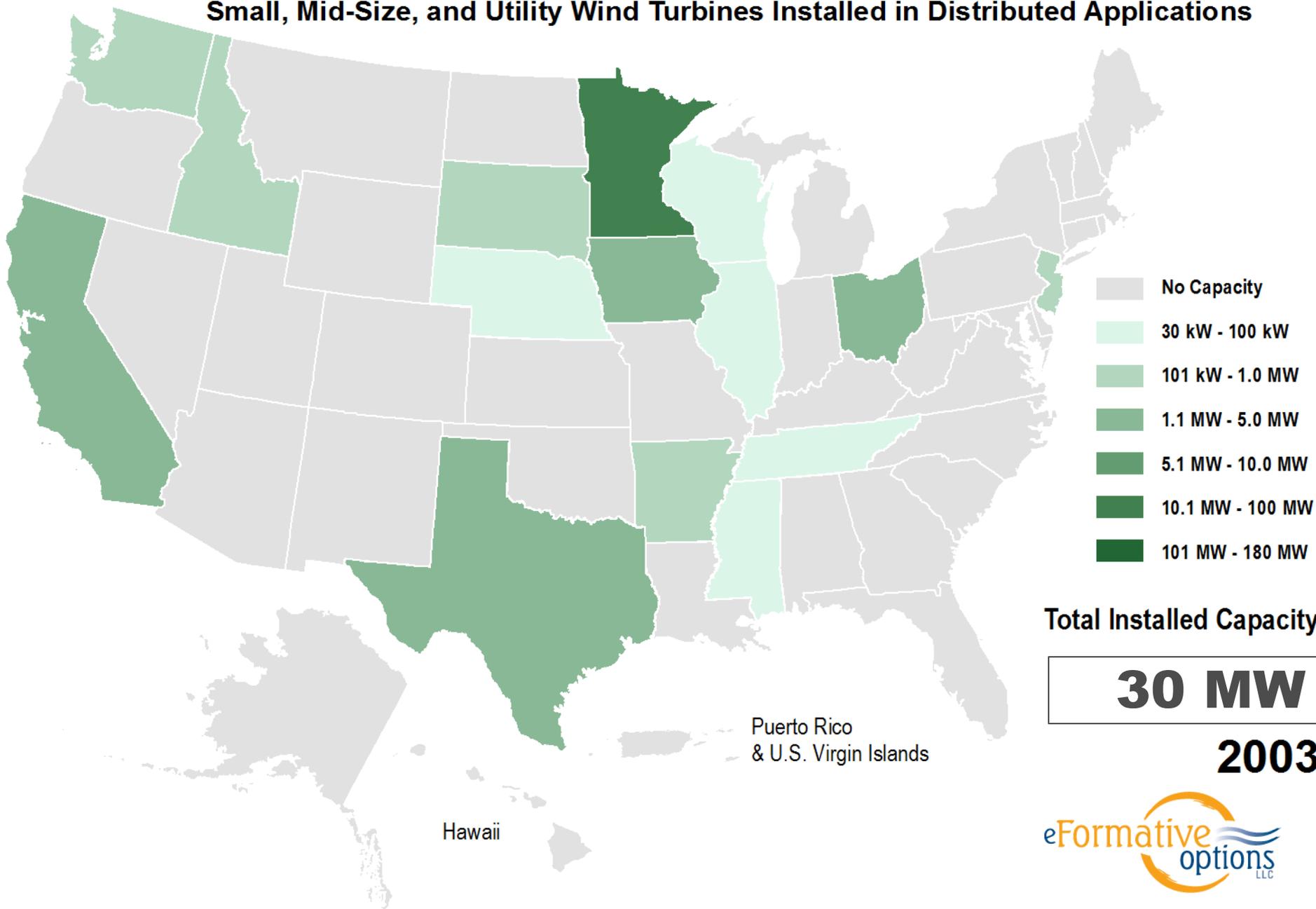
2012 Findings – *Top States in 2012*

- Distributed wind installations were documented in 40 states, Puerto Rico, and U.S. Virgin Islands in 2012



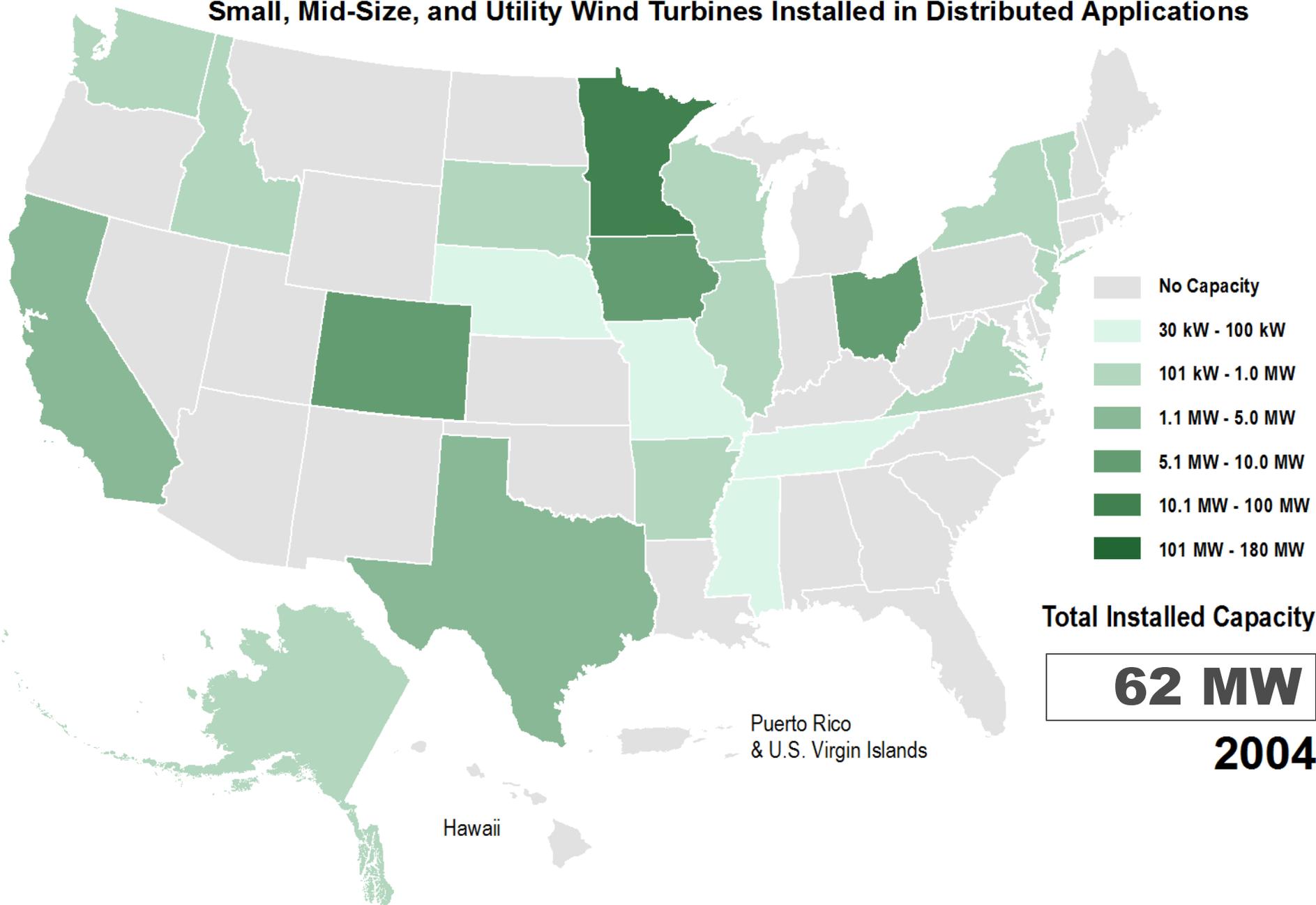
U.S. Distributed Wind Cumulative Capacity 2003-2012

Small, Mid-Size, and Utility Wind Turbines Installed in Distributed Applications



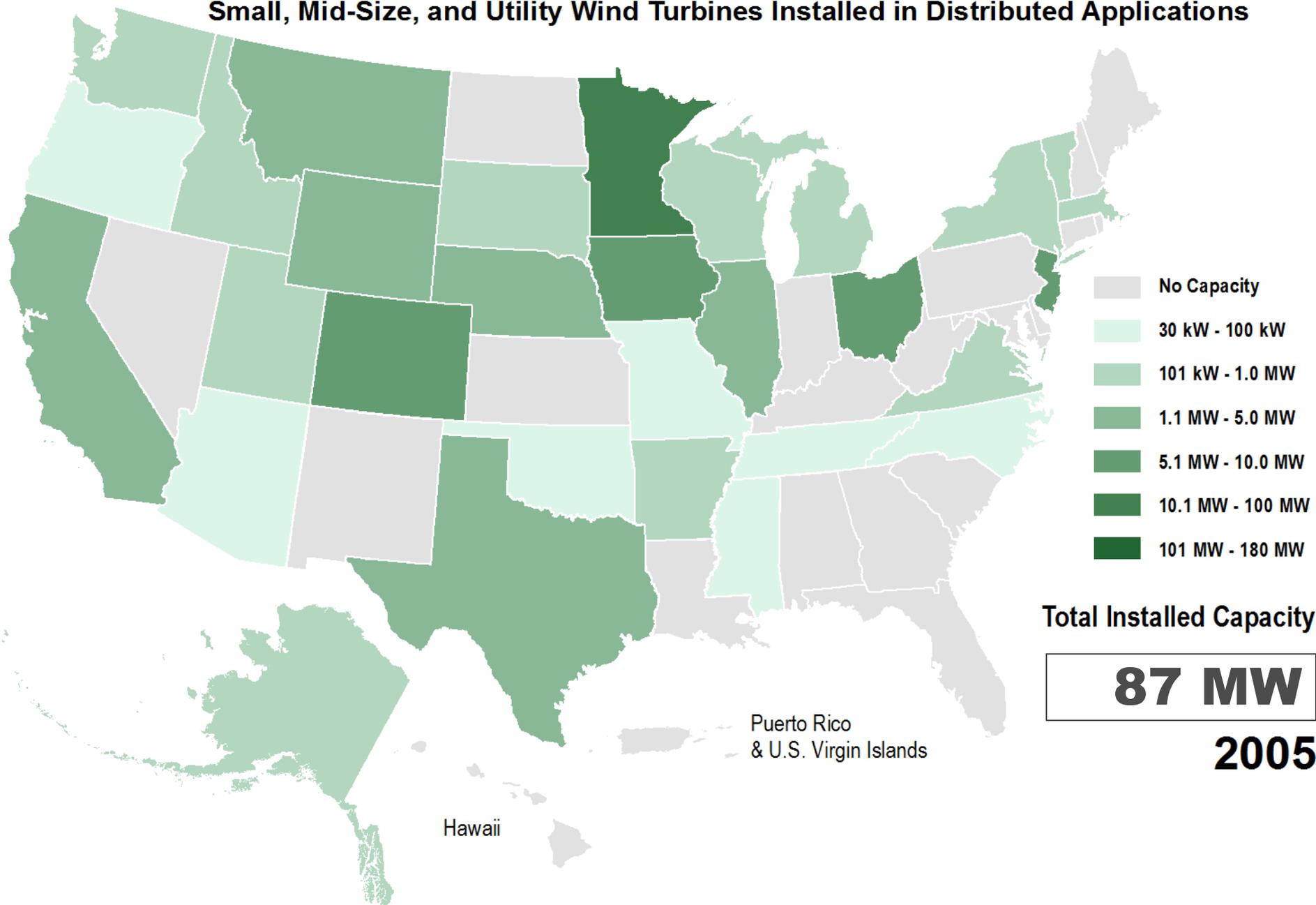
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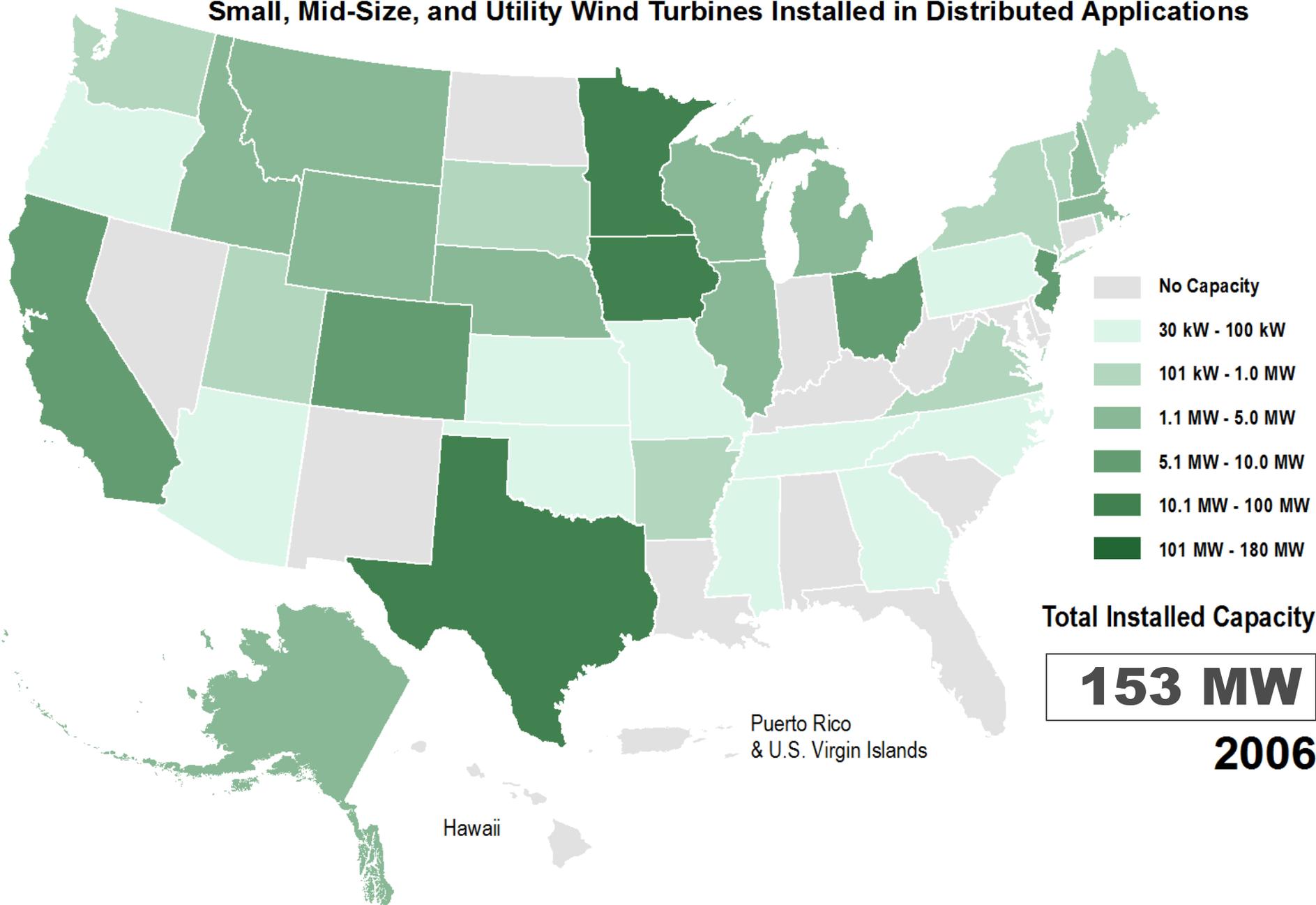
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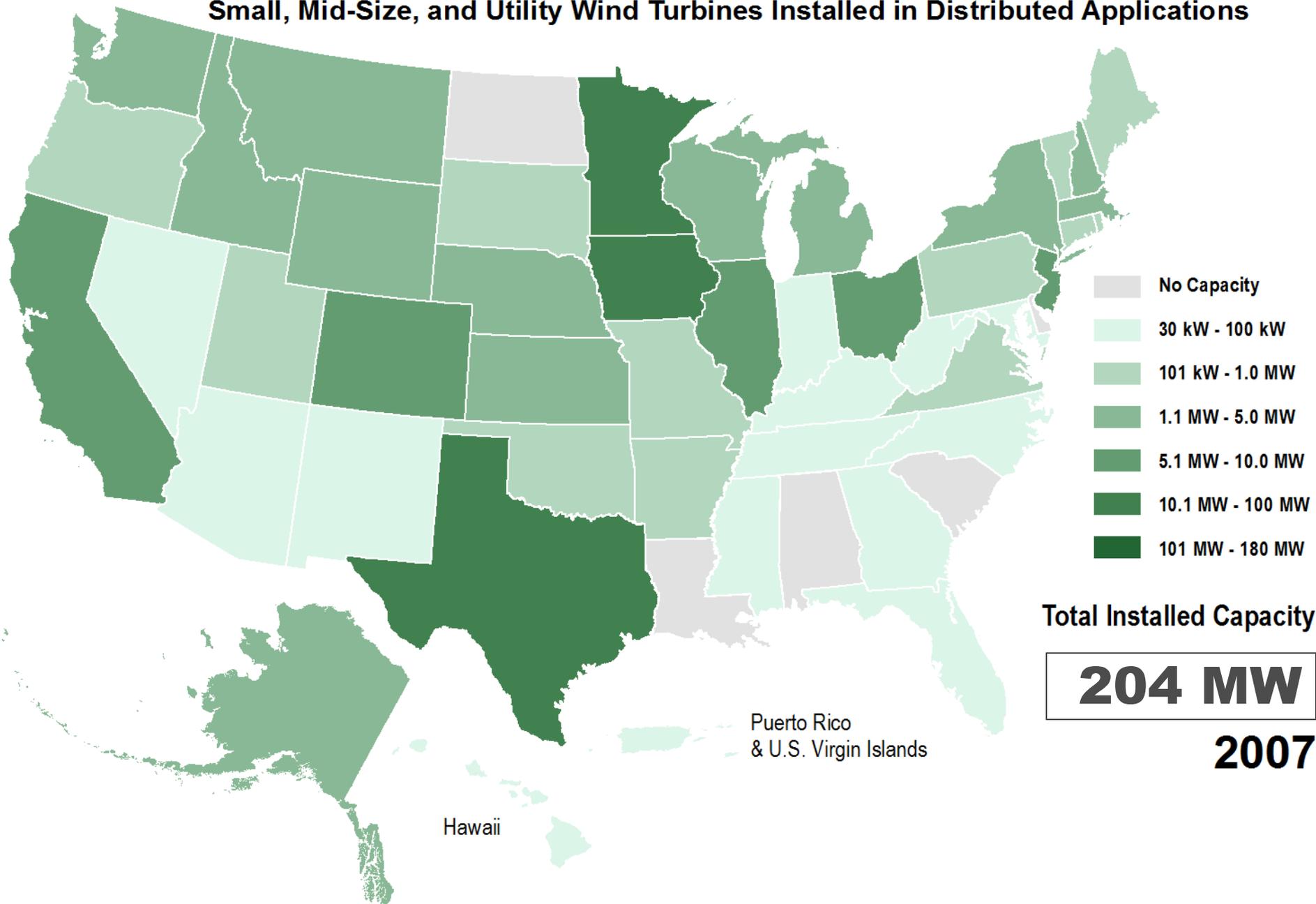
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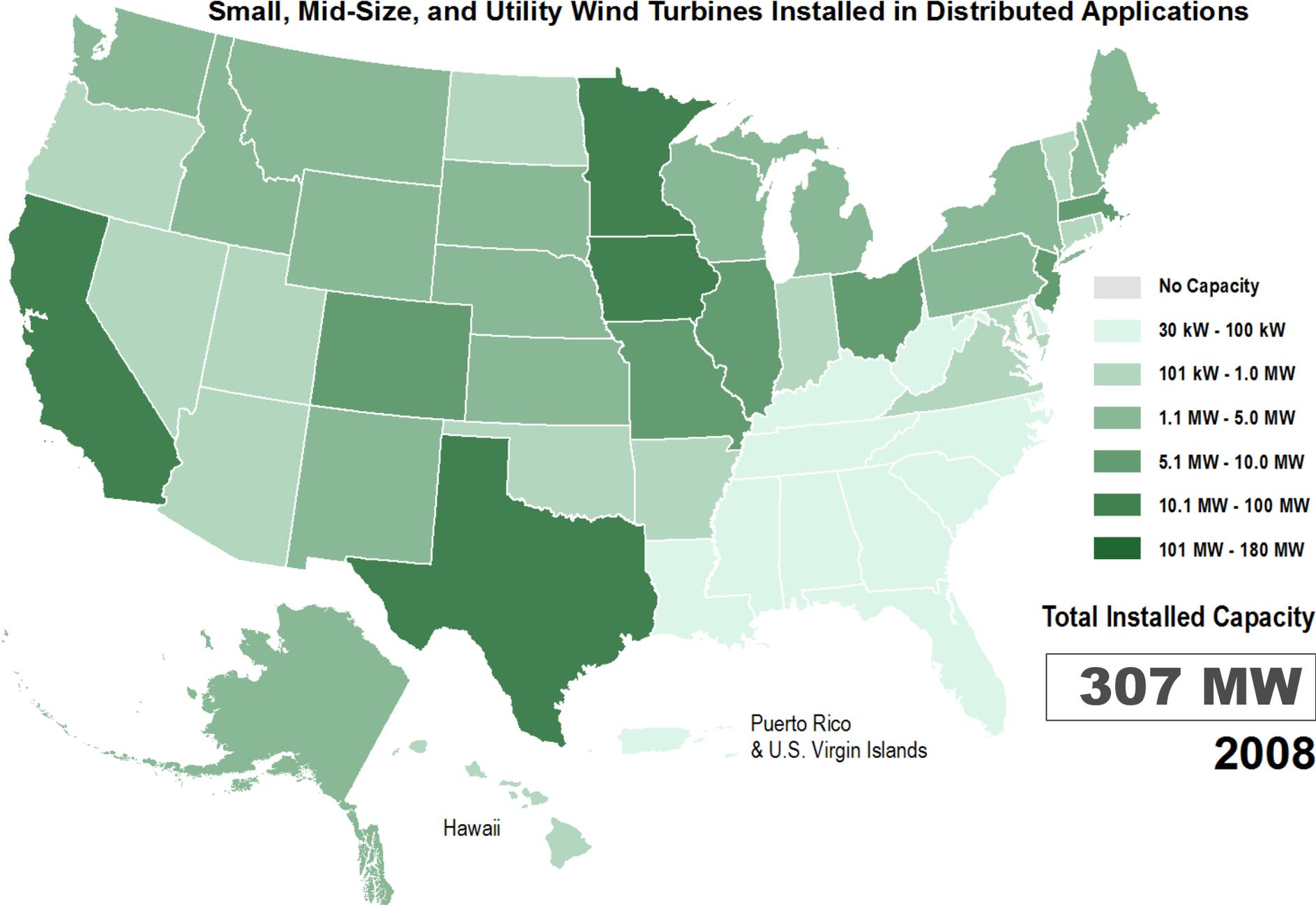
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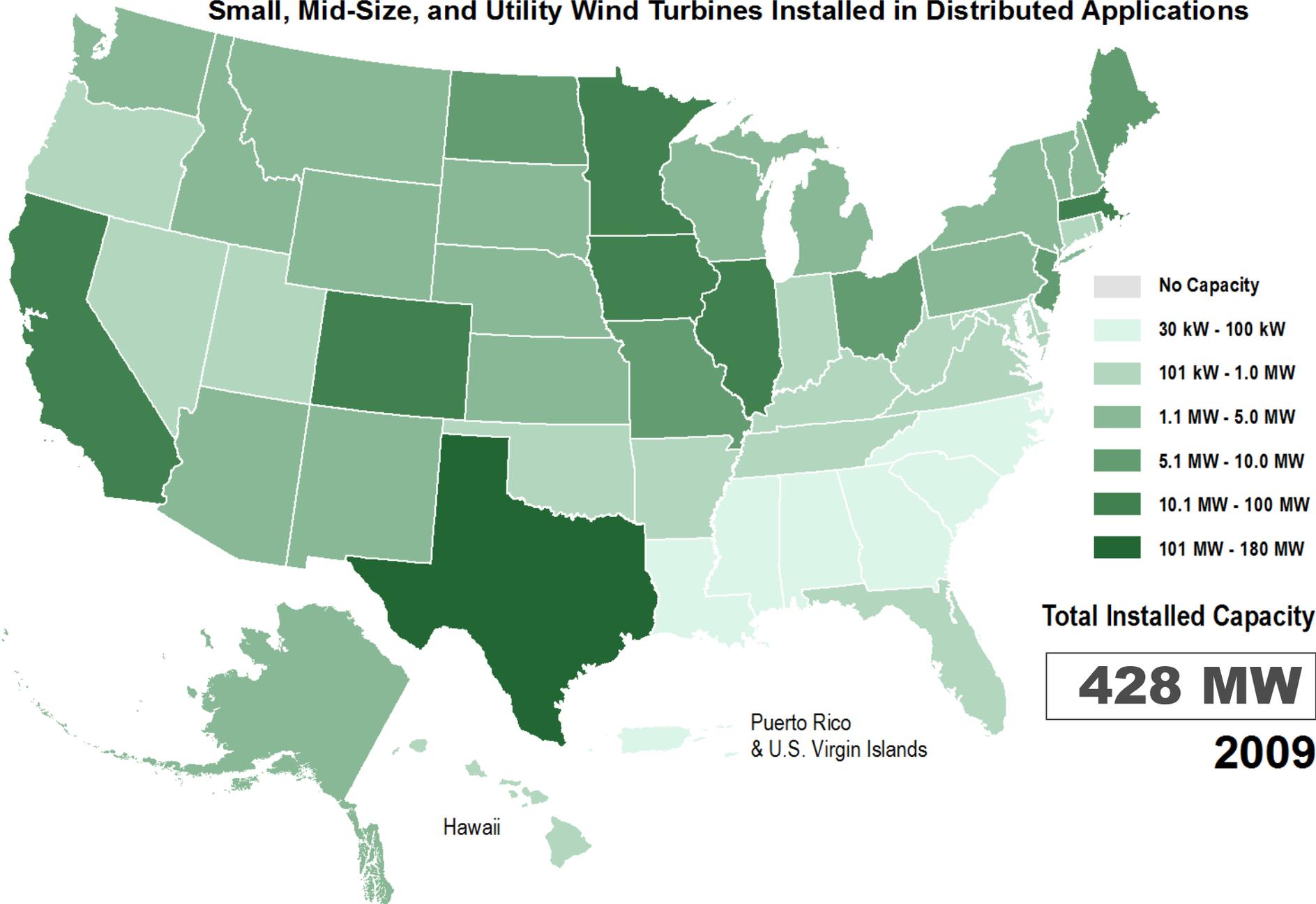
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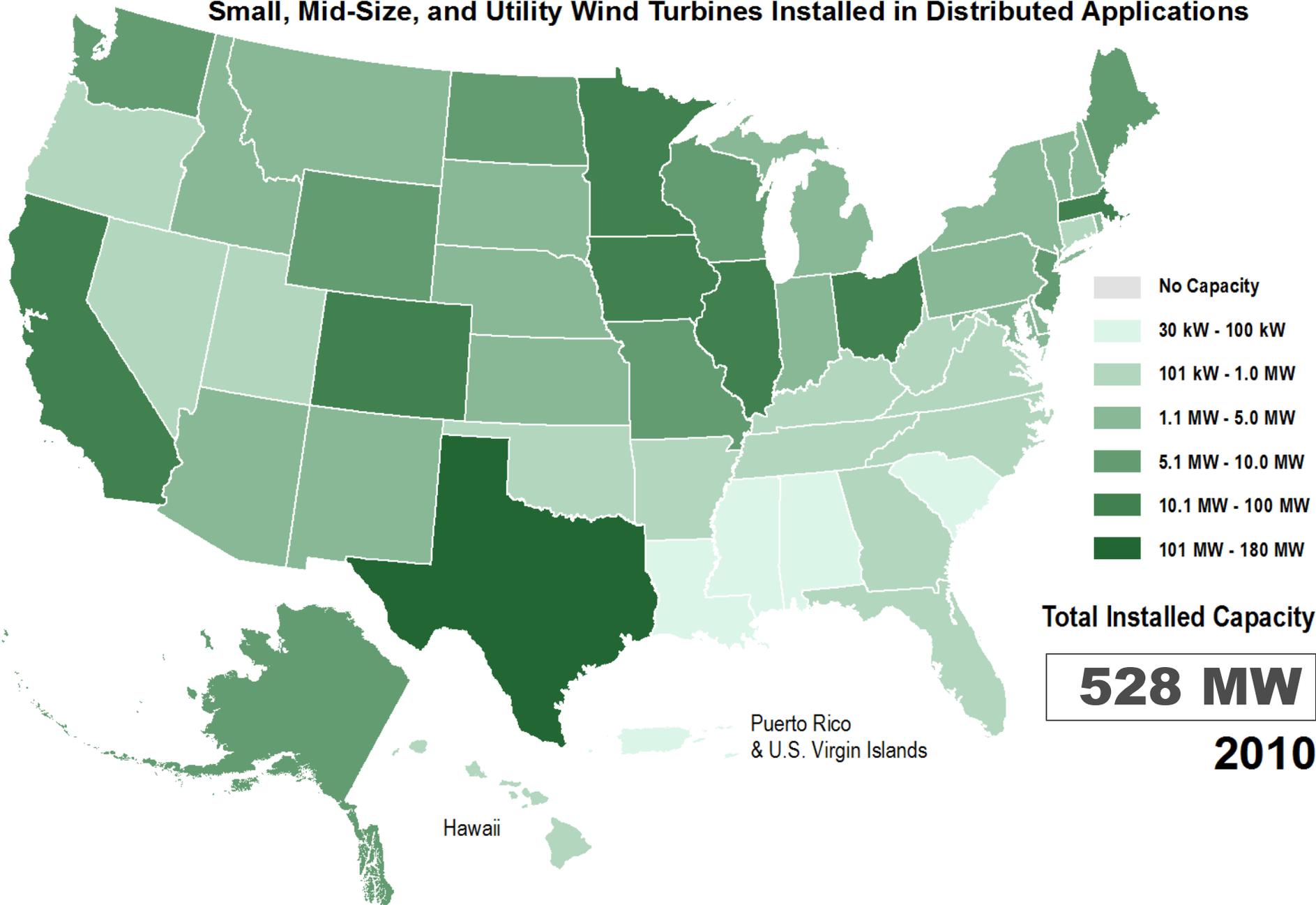
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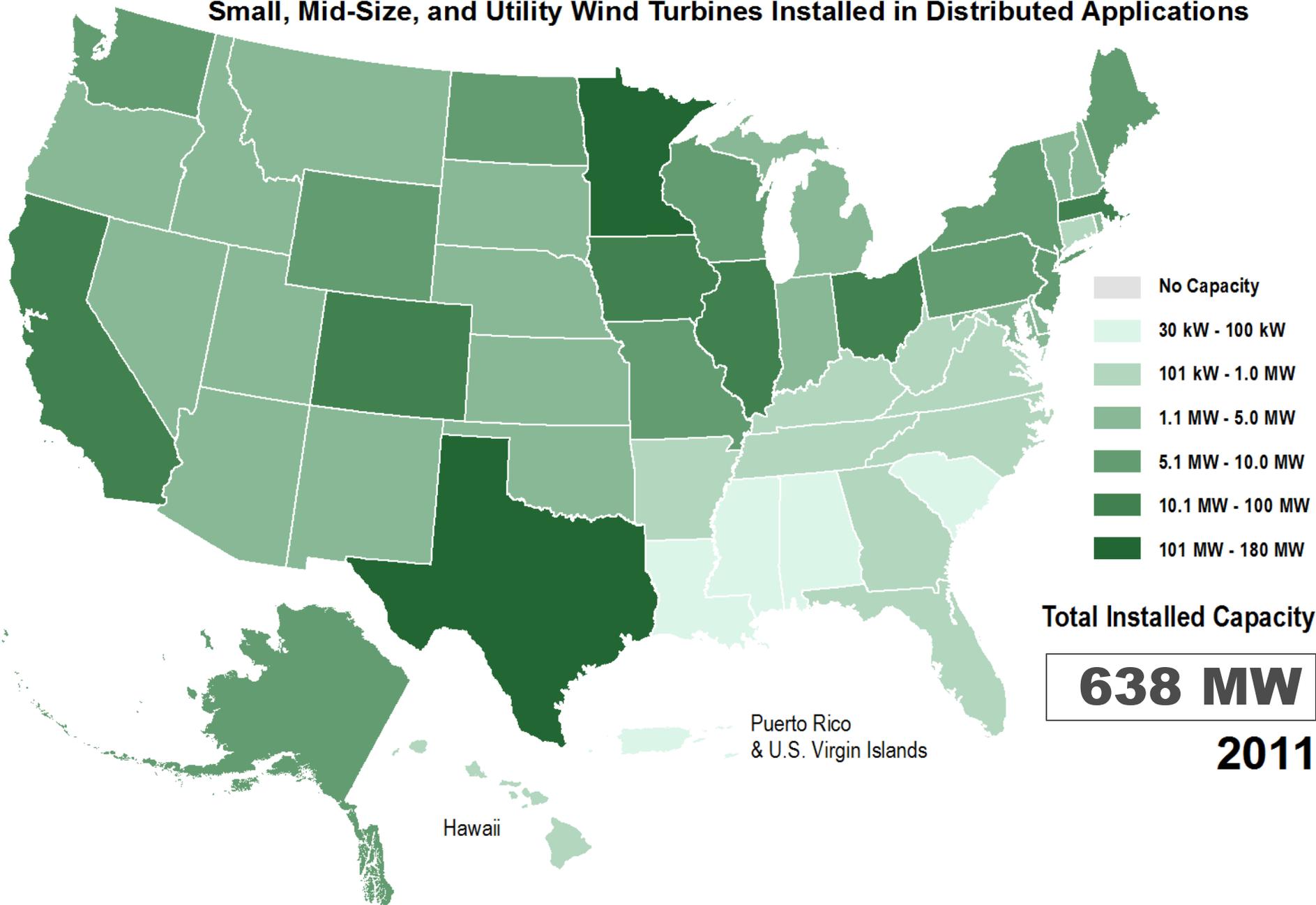
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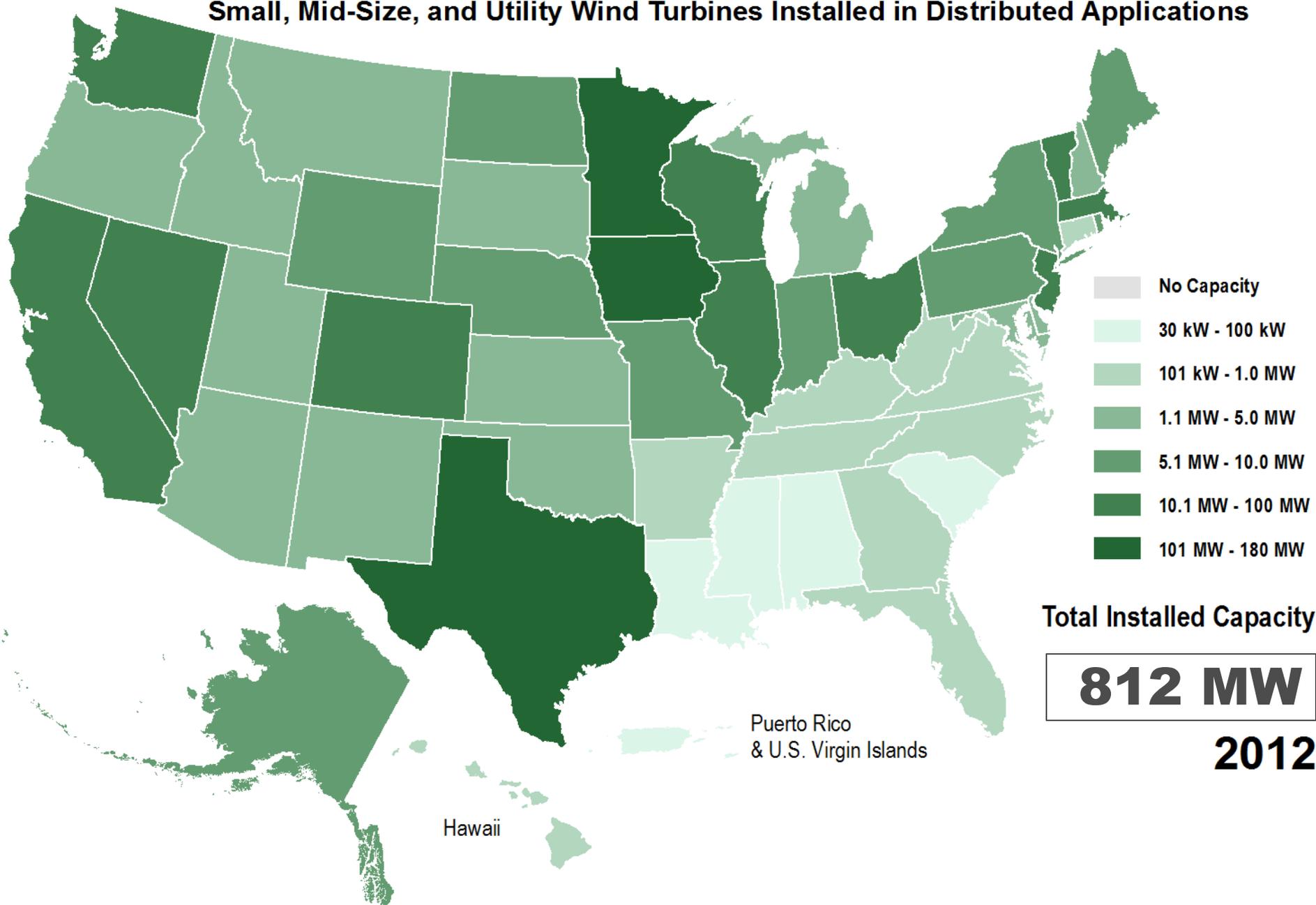
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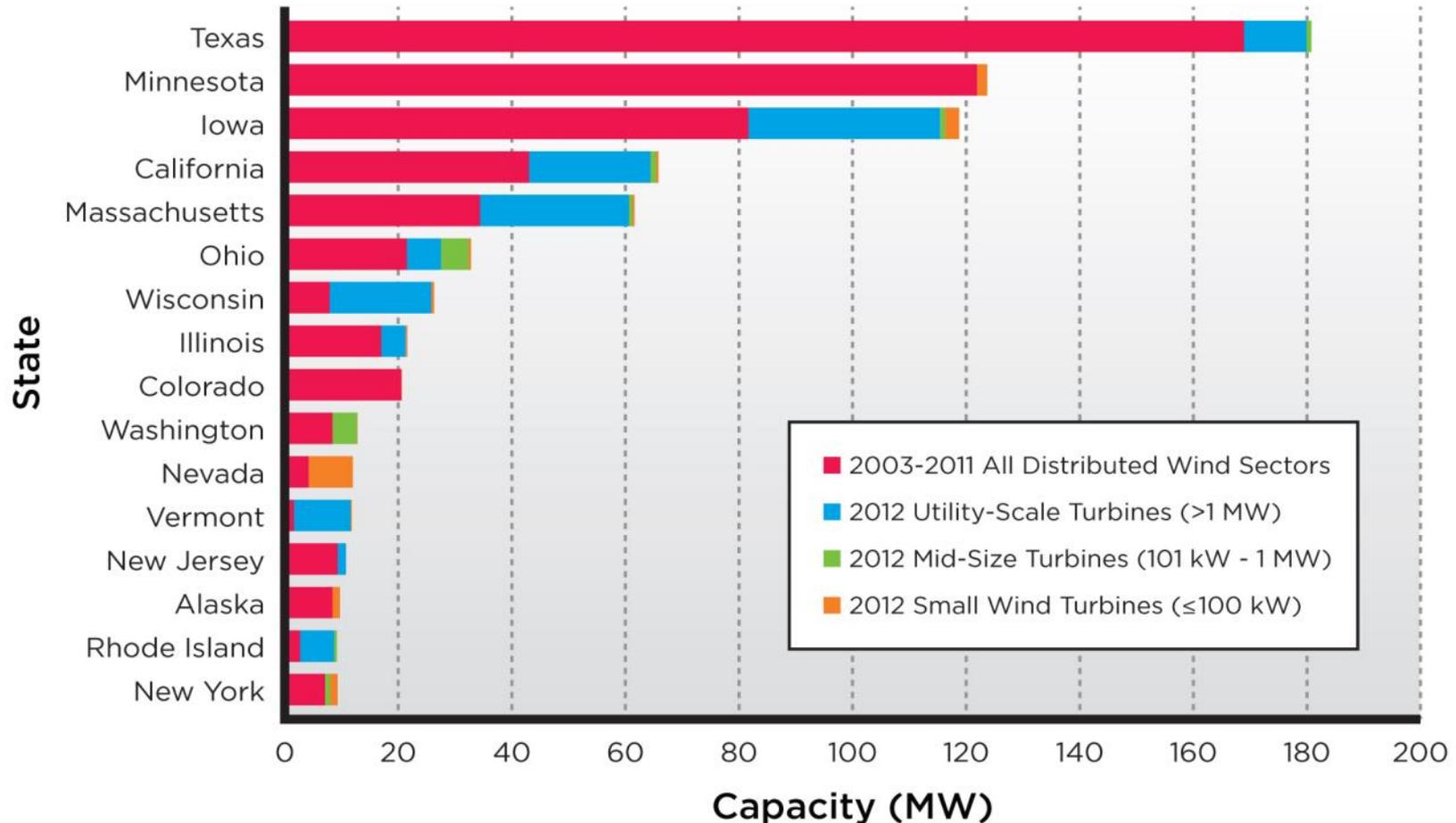
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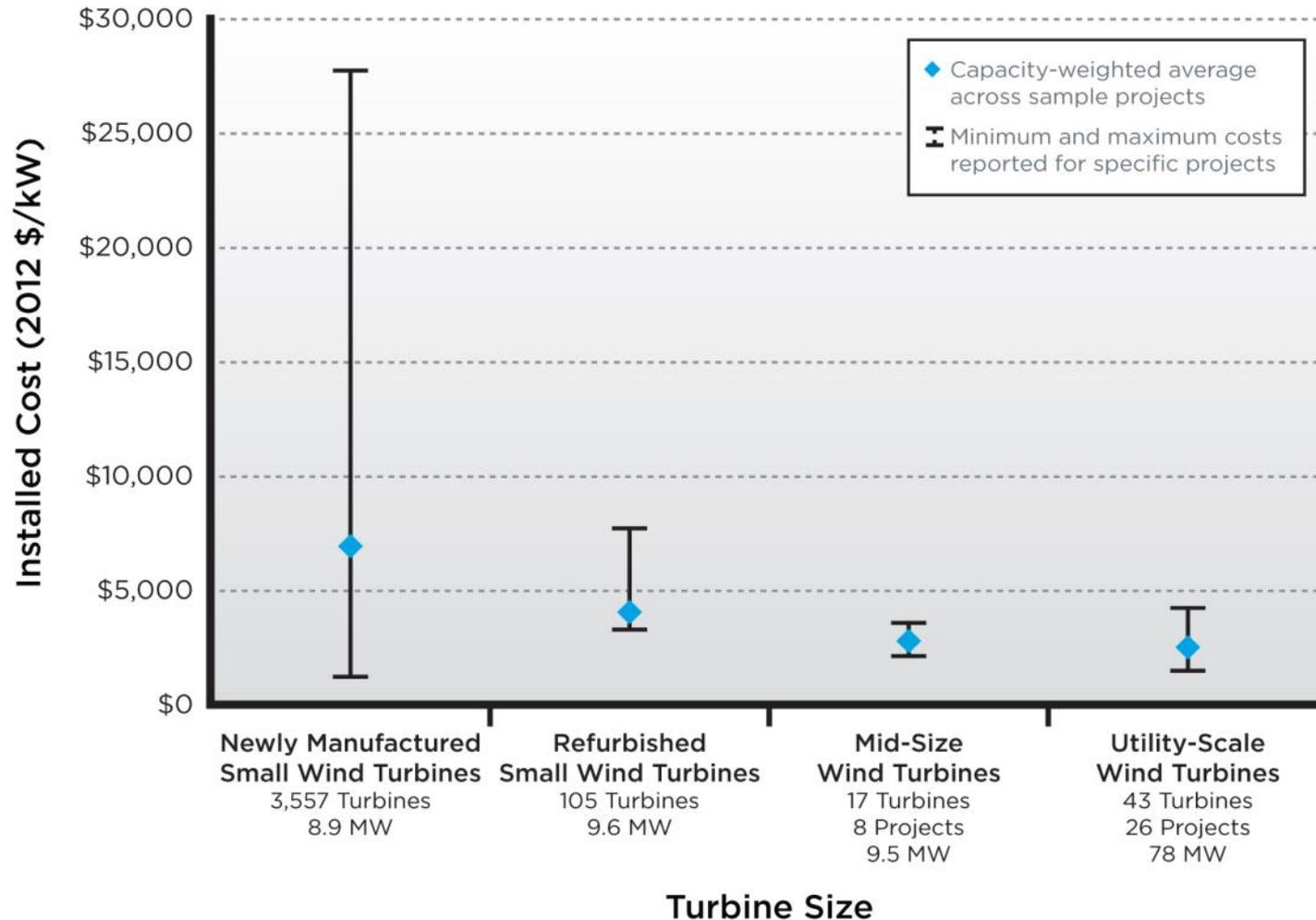
2012 Findings – Top States Over Past Decade

- TX and MN still lead in installed MWs, even with lower capacity additions in 2012



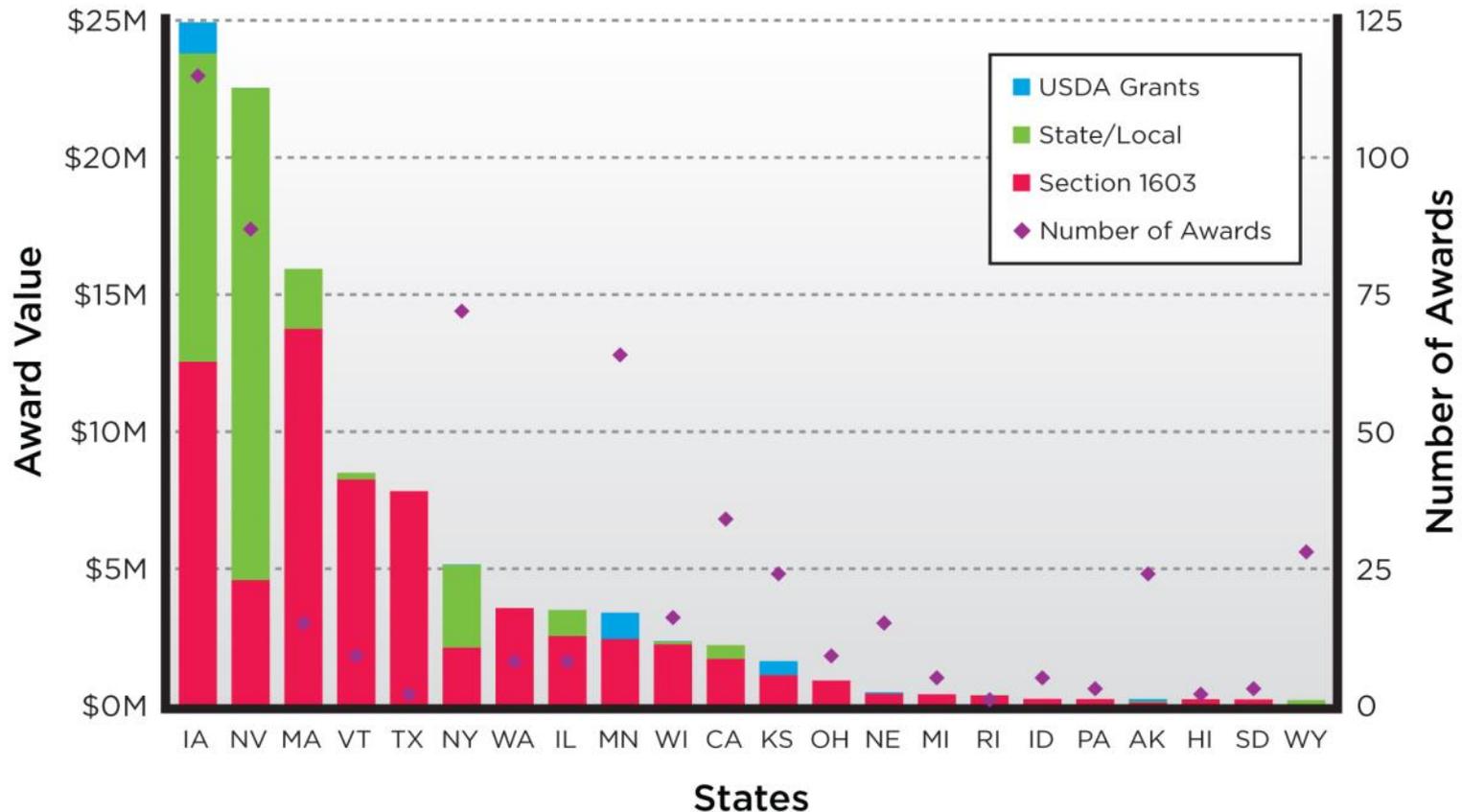
2012 Findings – Installed Costs

- In general, larger turbines have a lower per kW average cost



2012 Findings – Incentives

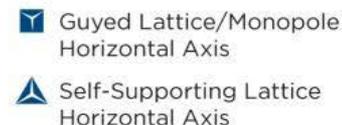
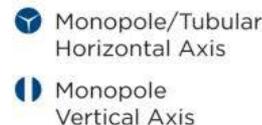
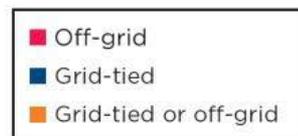
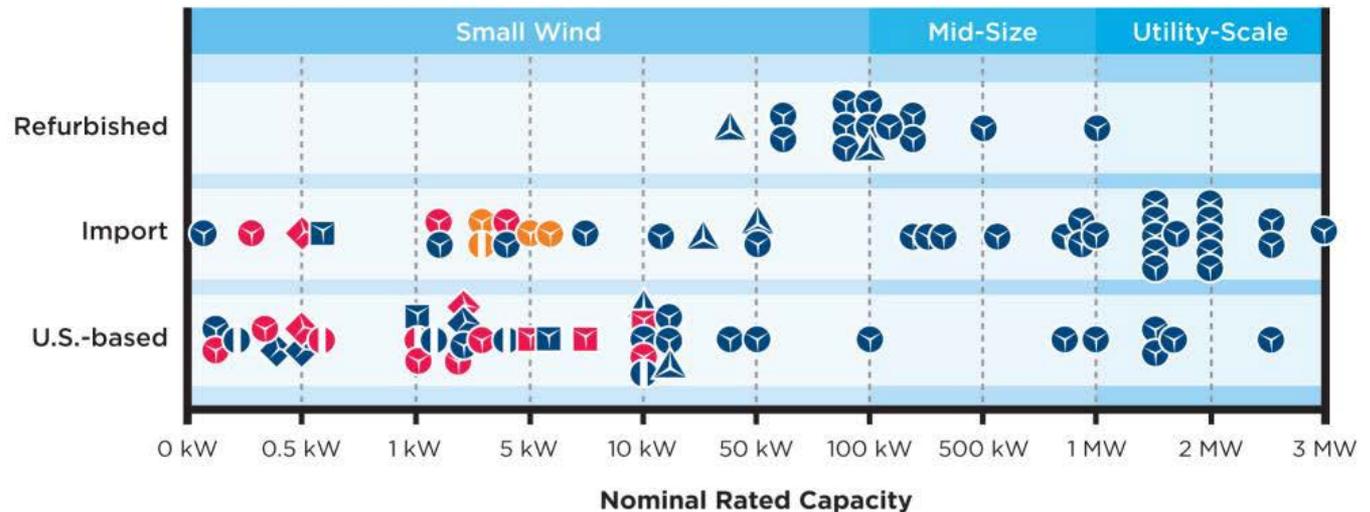
- Distributed wind projects used a variety of federal, state, and utility incentives in 2012



More information about policies and incentives can be found at windpolicytool.org

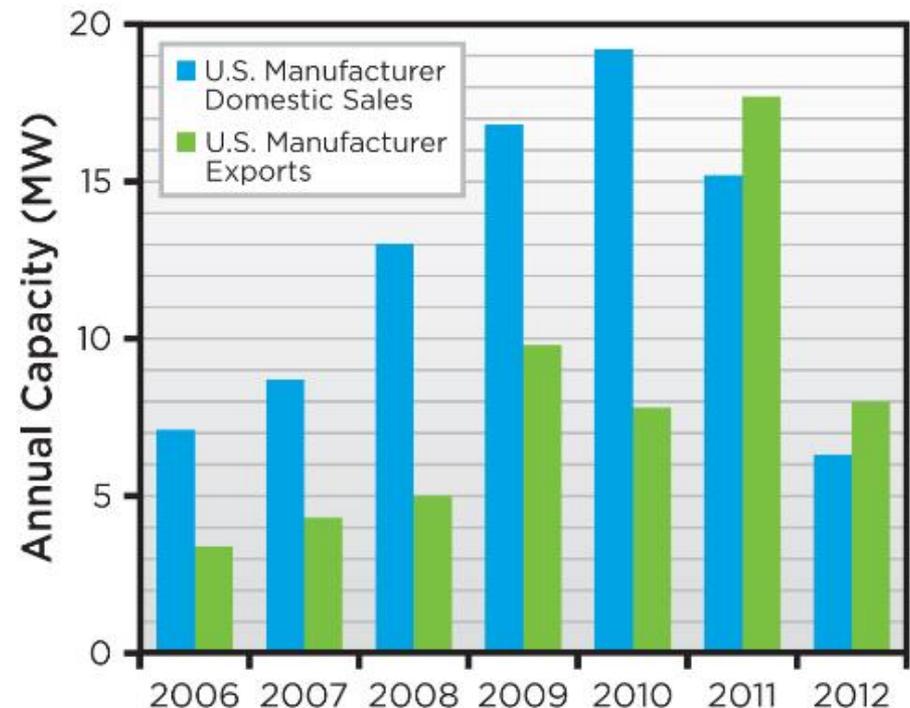
2012 Findings - *Manufacturers, Suppliers, and Imports*

- U.S. installations used 84 different turbine models ranging from 100 W to 3 MW in size from 55 global and U.S. suppliers
- U.S. manufacturers based in 14 states sold 38 different models
- Nine of top 10 models of all 2012 wind turbines installed in U.S. distributed applications (on a unit basis) were manufactured in U.S.
- Most 2012 grid-tied distributed wind installations featured hub heights of 30-80 m



2012 Findings – U.S. Manufacturers and the Supply Chain

- In 2012, U.S.-based manufacturers claimed nearly 86% of domestic small wind capacity sales
- Leading U.S.-based small wind turbine manufacturers continued favoring U.S. supply chain vendors for most of their turbine components, maintaining domestic content levels of 80 to 85%
- U.S. distributed wind energy supply chain contains > 3 dozen facilities spread across 17 states supporting manufacturing, retail, construction, and maintenance jobs



Note: refurbished sales and Imports are not shown

2012 Findings – *Top Suppliers to the U.S.*

- Top small wind suppliers
 - Southwest Windpower (Arizona)
 - Bergey Windpower (Oklahoma)
 - Northern Power Systems (Vermont)
 - Leading importers
 - Endurance Wind Power (Canada)
 - Sonkyo Energy (Spain)
- Top mid-size suppliers
 - Gamesa (Spain)
 - PowerWind (Germany)
 - Aeronautica (Massachusetts)
- Top utility-scale suppliers
 - General Electric (US)
 - Goldwind (China)
 - Vestas (Denmark)



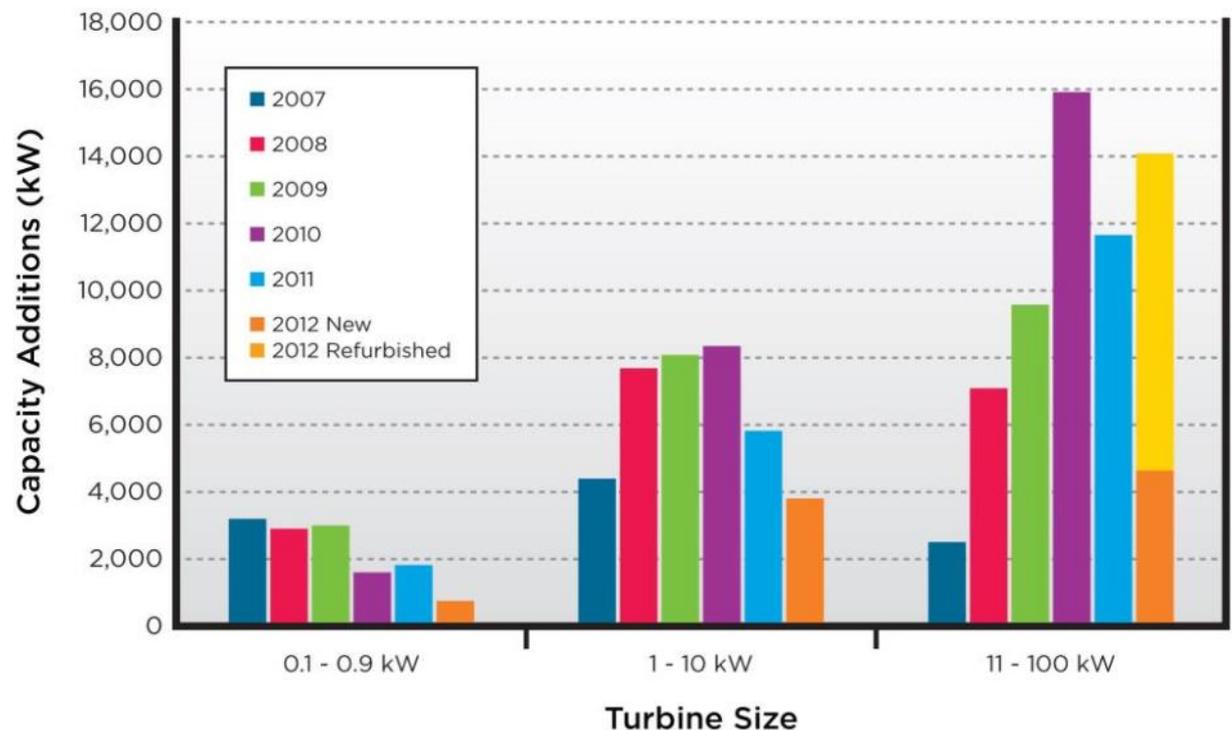
Photo Credit: Endurance



Photo Credit: Northern Power Systems

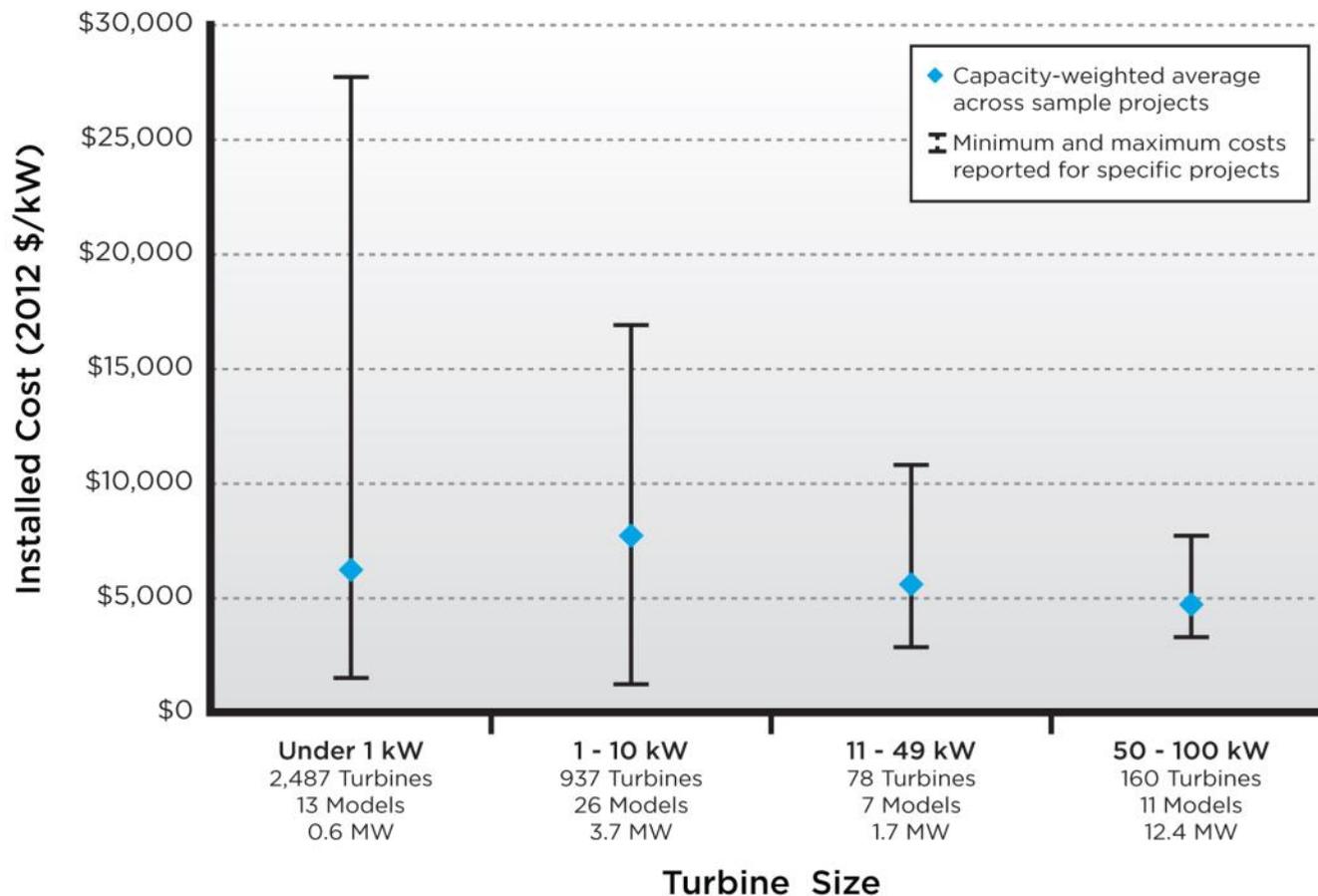
2012 Findings – *Small Wind (up through 100 kW)*

- Small wind turbine installations accounted for 18.4 MW of 2012 U.S. capacity, representing 3,700 turbines and \$101 million in investment
- U.S. small wind turbine manufacturers exported 8 MW to foreign markets in 2012—primarily serving European feed-in tariffs (FITs), and to a lesser role, telecom, and wind-diesel applications
- Majority of small wind turbines continue to be installed for homes, farms, and other individuals



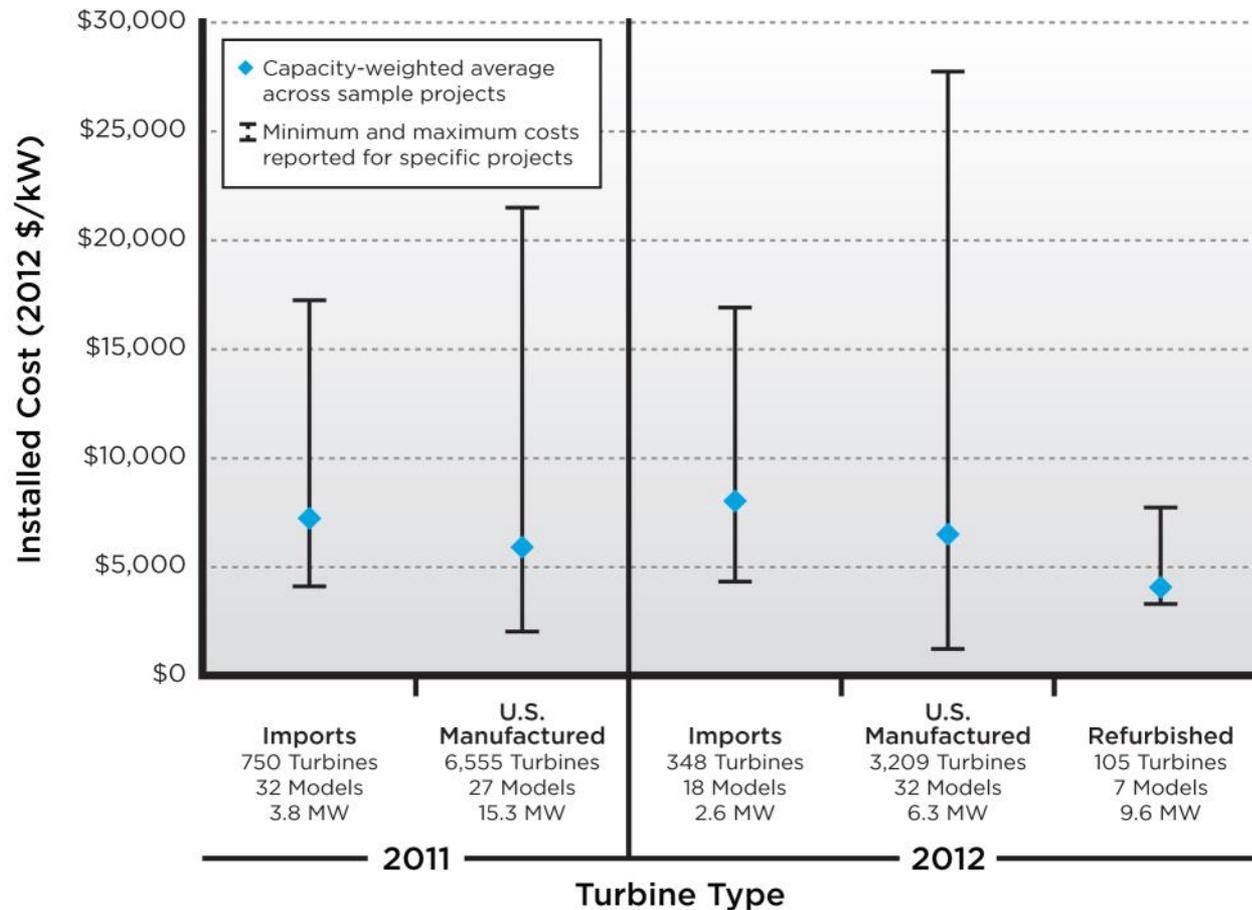
2012 Findings – *Small Wind Installed Costs by Size*

- Installed cost reports for small wind turbines range widely, due to a considerable variety of suppliers, tower designs and heights, and methodologies for estimating expenses



2012 Finds – *Small Wind Installed Costs by Type*

- U.S. manufacturers report a wider range of costs than imported models, but have a lower average cost



2012 Findings – *Mid-Size Wind (101 kW to 1 MW)*



Photo Credit: John Yingling

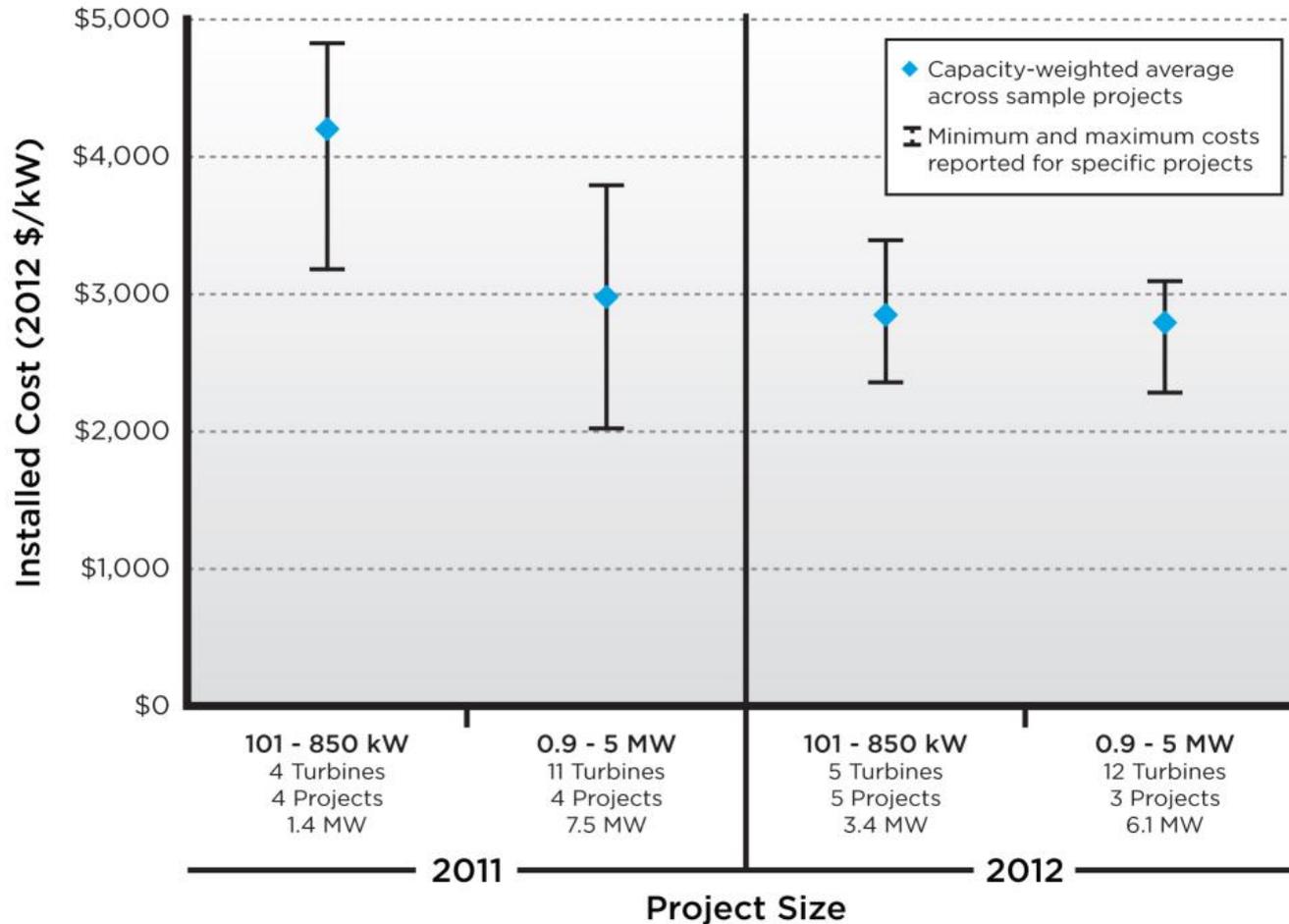


Photo credit: Vergnet

- Mid-size distributed wind projects installed in 2012 totaled 19 MW, a >50% increase from mid-size distributed wind capacity installed in 2011
- Of the 22 mid-size distributed wind projects installed in 2012, 20 provide power directly for onsite use
 - Majority of such projects are owned by schools, government, and non-profits

2012 Findings – Mid-Size Installed Costs

- Mid-size project costs decreased in 2012 (based on small sample size)



2012 Findings – *Utility-Scale Wind (greater than 1 MW)*



Photo Credit: Harvest the Wind Network

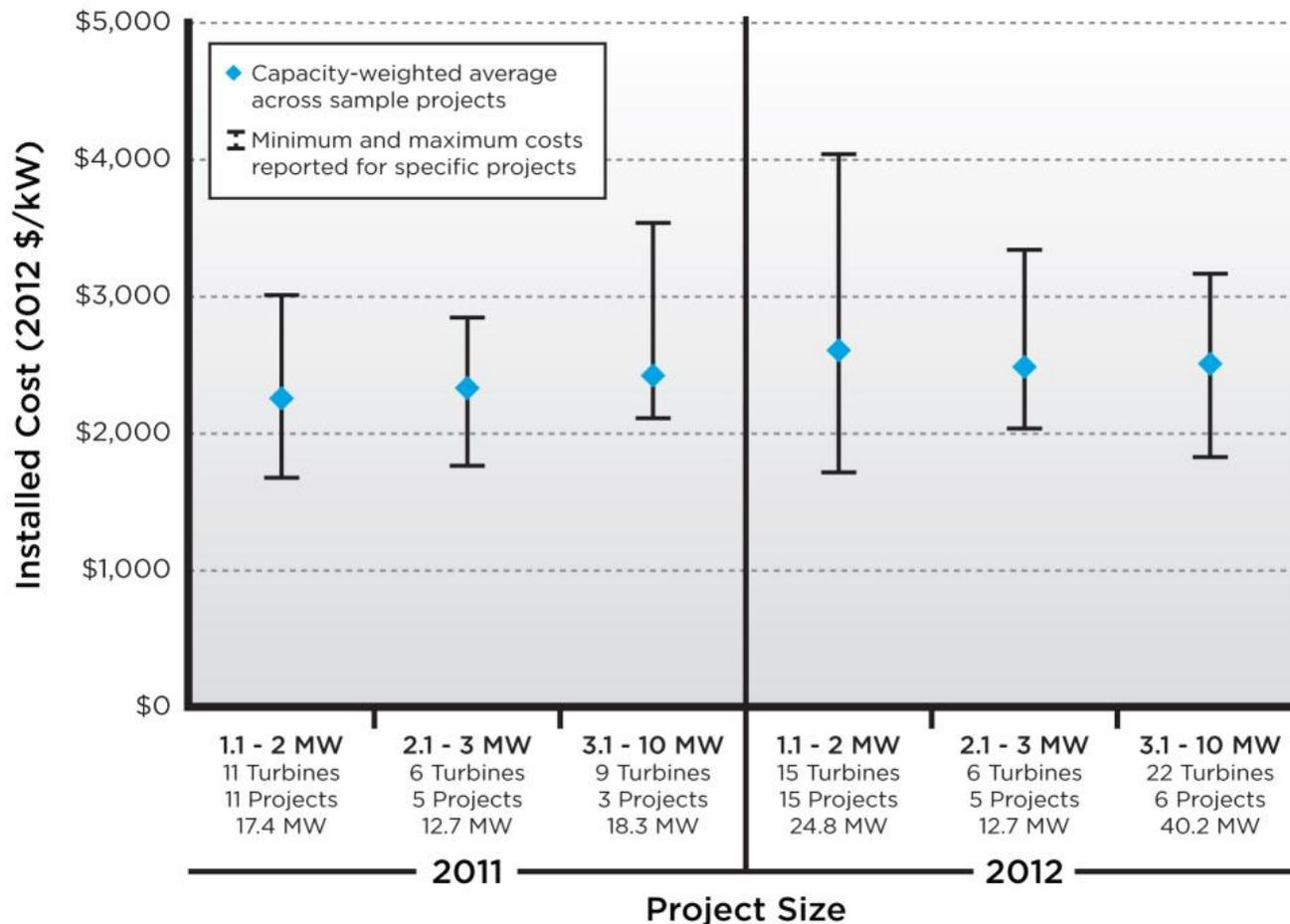


Photo Credit: Juhl Energy

- 47 projects consisted of 78 utility-scale turbines resulting in 138 MW of installed capacity
- Sector grew the most in 2012, up 80% from 2011
- Iowa led the states with 33.8 MW installed in 2012
- Applications include farms, commercial, industrial, schools, wastewater treatment, utility supply and private- and community-owned generation sited near large loads
 - 2/3ds of 2012 installations provide power directly for on-site use

2012 Findings – Utility-Scale Installed Costs

- Costs are in line with expected economies of scale cost trends for smaller projects



2012 Findings – *Trends & Outlook for 2013*

- Certification of small and mid-size turbines progressing, signaling a maturing industry
- Increased use of refurbished turbines is an emerging trend
- Incentives and policies will continue to play a key role in distributed wind market
- Alternative financing models, such as third-party power purchase agreements and lease-to-own agreements that have led to large growth in solar, is anticipated to boost the residential and mid-size wind markets
- 2013 report will build on 2012 report with some changes likely



Photo credit: SED

For More Information

- 2012 Distributed Wind Market Report:
 - energy.gov/wind-report
 - www1.eere.energy.gov/wind/pdfs/2012_distributed_wind_technologies_market_report.pdf
- Data Spreadsheet:
 - eere.energy.gov/wind/resources.html
 - www1.eere.energy.gov/wind/docs/2012_distributed_wind_technologies_data.xls
- Photo Library:
www.eformativeoptions.com/distributed_featured

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Photo credit: Arrowhead Spring Vineyards



Photo credit: Windsine, Inc.