

Wind Energy Manufacturing in the U.S.

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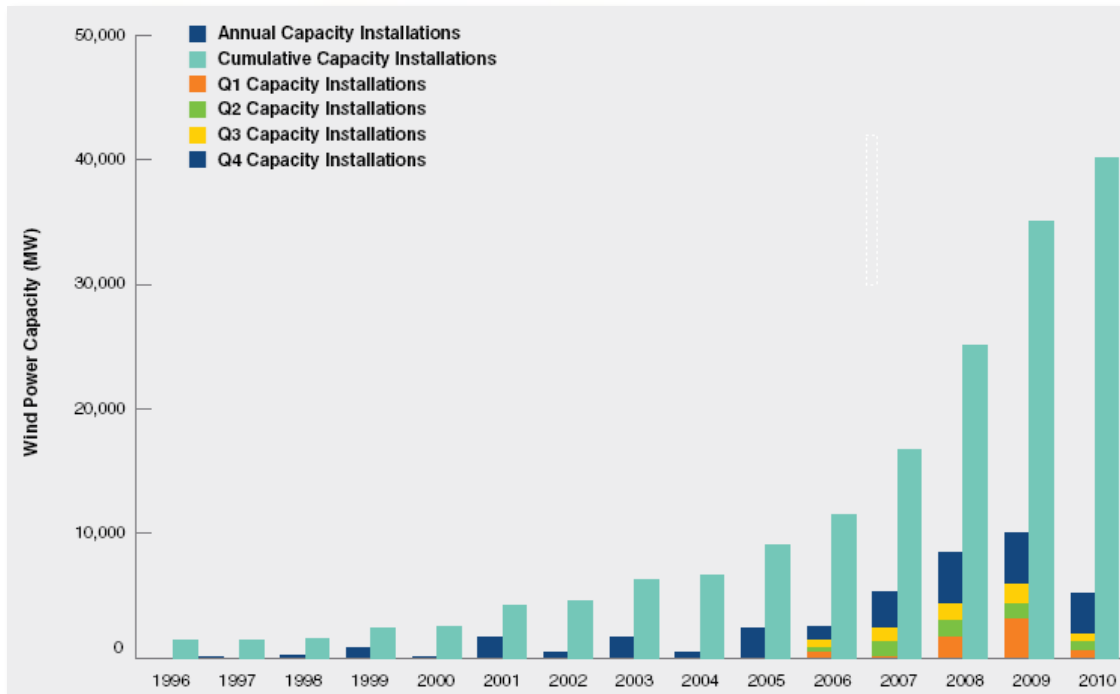
American Wind Energy Association

American Wind Energy Association (AWEA)

- **Founded in 1974**
- **More than 2,500 business members**
 - Wind project developers, O&M companies
 - Transportation and construction companies
 - Manufacturers from bolts to turbines
 - Financiers, consultants
- **www.AWEA.org provides extensive info on wind**

Wind Energy Market: Driver for Turbine Manufacturing

U.S. Annual and Cumulative Wind Power Capacity Growth

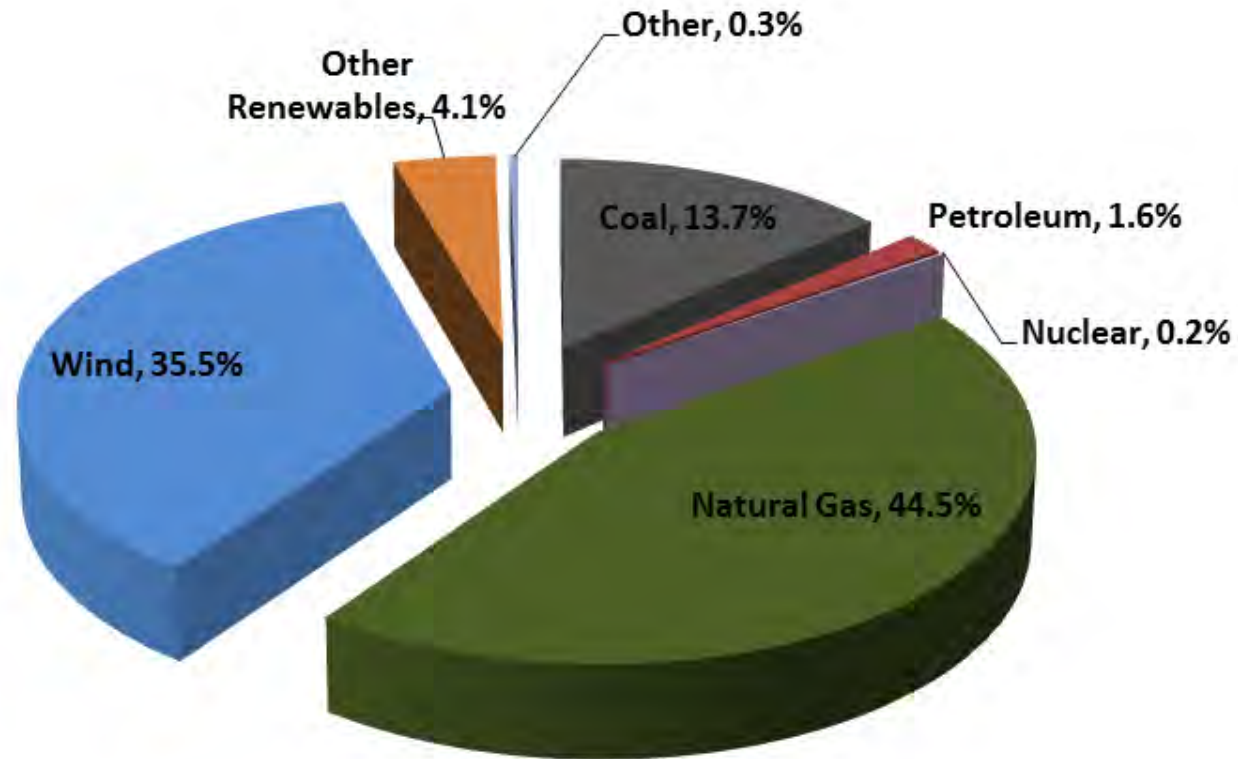


- » Installed in 2010: 5,116 MW
- » Installed in 1Q 11: 1,100 MW
- » Under construction as of 1Q 11: 5,600 MW
- » Total U.S. wind installations as of 1Q 11: 41,400 MW
- » U.S. wind installations represent over 21% of global wind capacity

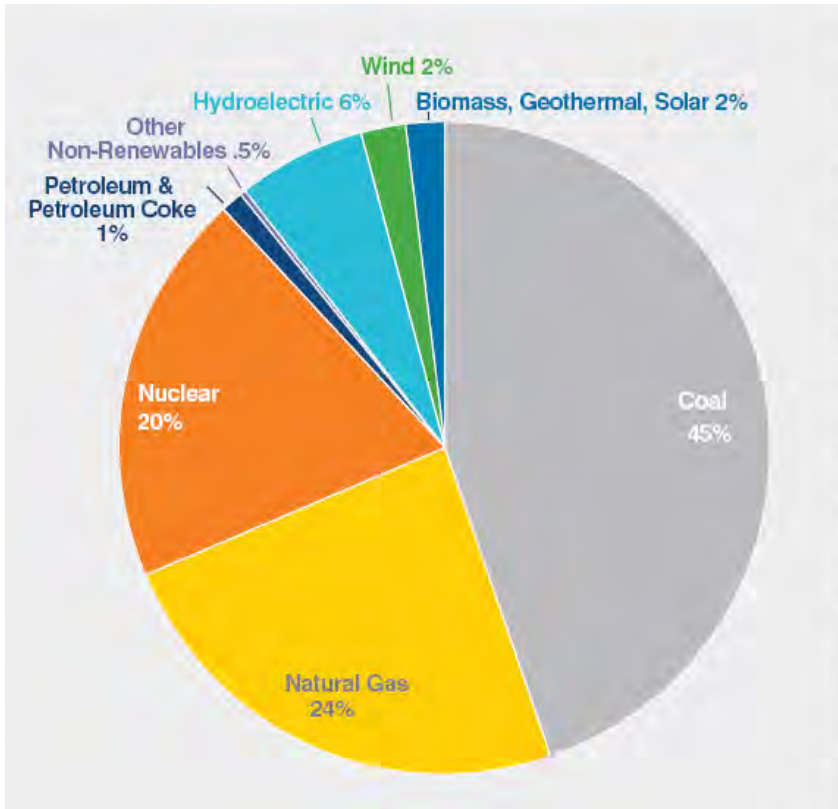
U.S. New Installed Capacity Mix 2007-2010

Wind installed over 35% of all new generating capacity between 2007 and 2010 with 28,740 MW

Percent of New Installed Capacity, 2007-2010



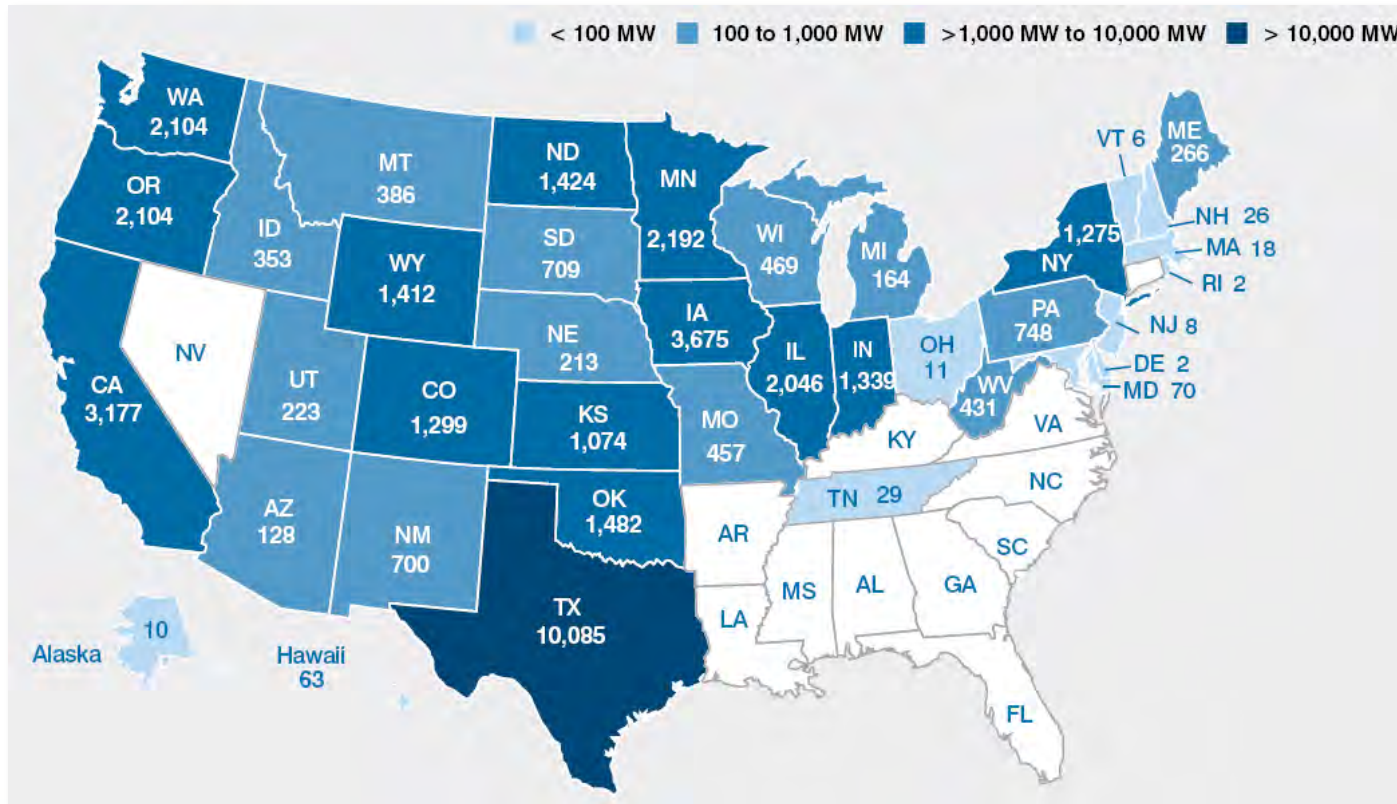
U.S. Electricity Generation Mix in 2010



Source: Energy Information Administration Electric Power Monthly

- » Wind provided 2.3% of U.S. electricity in 2010
- » Electricity from wind power capacity in the U.S. will supply the equivalent of:
 - Over 10 million American homes
 - Nearly 10 nuclear power plants

U.S. Wind Power Capacity Installations by State in 2010 (MW)



» 38 states have utility-scale wind installations

» 14 states have more than 1,000 MW installed and Texas has more than 10,000

Wind Manufacturing in the U.S.

Basic Turbine Anatomy

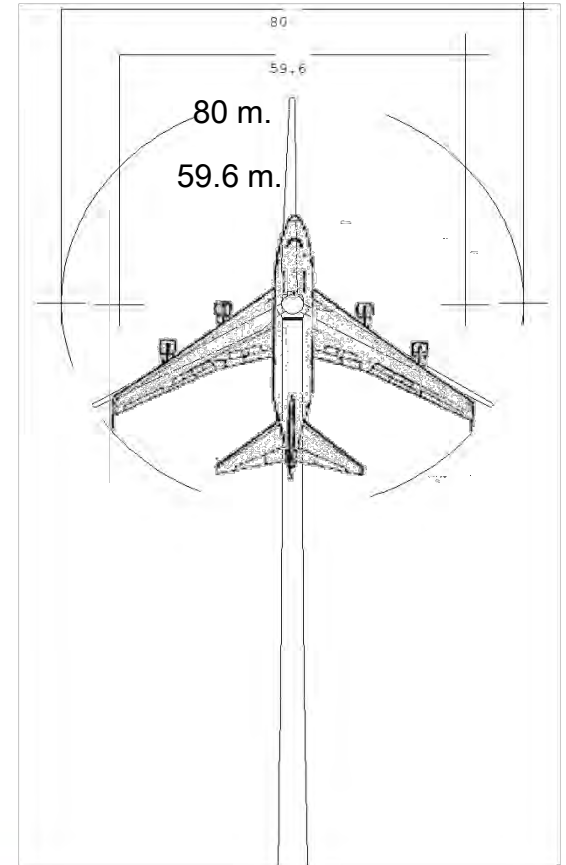


What's the average turbine or wind project?

In 2010, average turbine size was rated **1.77 MW** - enough to power over **500 homes**.

An average wind project in 2010 was **76 MW (~43 turbines)** The average project would supply electricity for over **20,000 homes**.

This picture shows a Vestas 80-meter diameter 2-MW wind turbine superimposed on a Boeing 747 jumbo jet



Sizes and Material Use for Utility-Scale Wind Turbines Installed in 2010

- » A typical turbine is roughly 90% steel and can weigh anywhere from 200 to 400 tons.
- » Higher tower heights and larger rotor diameters have increased output of turbines.

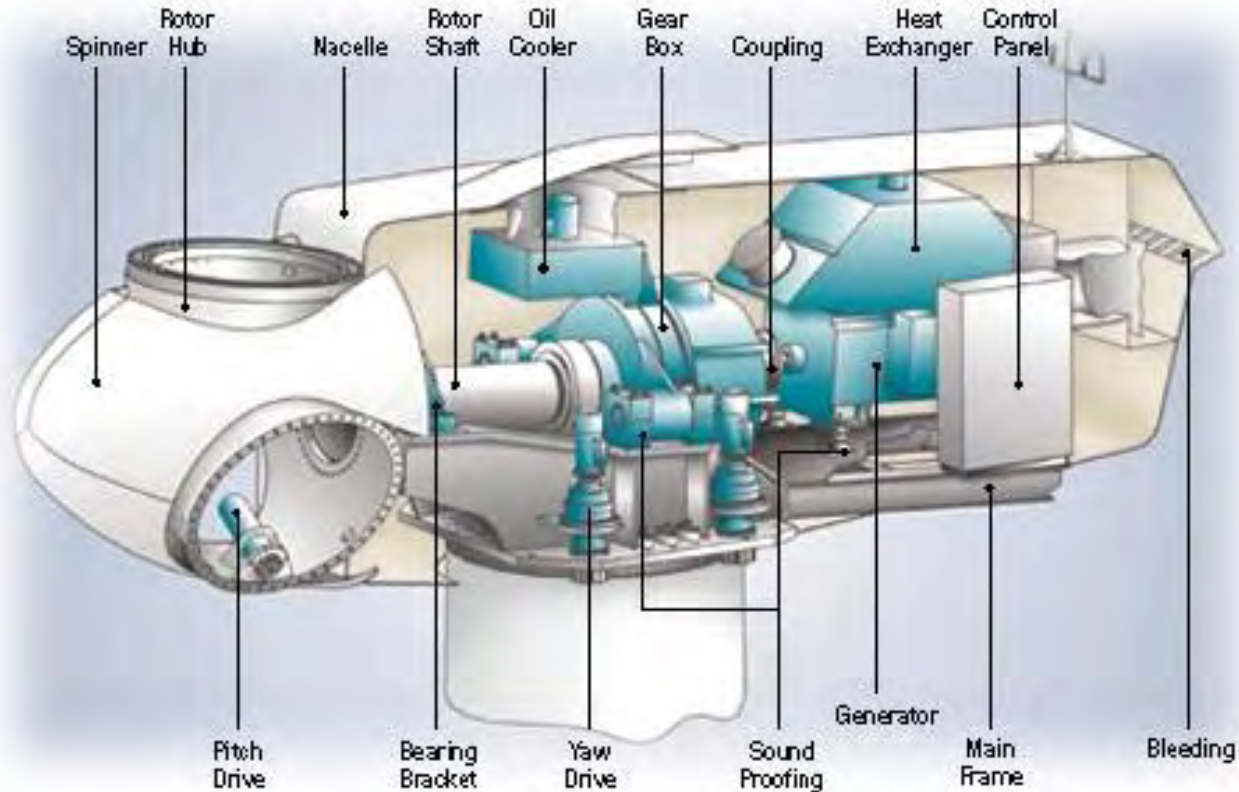
Material Use for Typical Utility-Scale Wind Turbines Installed in 2010

Component	% Weight	% Steel
Rotor		
Hub	6.0%	100%
Blades	7.2%	2%
Nacelle		
Gearbox	10.1%	96%
Generator	3.4%	65%
Frame	6.6%	85%
Tower	66.7%	98%

Sizes for Typical Utility-Scale Wind Turbines Installed in 2010

Capacity Range	1-3 MW
Tower height range	45 – 105 meters
Rotor diameter range	57 – 101 meters
Blade length range	26.8 – 49 meters

Inside the Nacelle



There are over 8,000 components in a typical wind turbine

Fundamentals of the Wind Industry

What is a wind turbine OEM?

Wind turbine OEMs (i.e. wind turbine manufacturers) design the full turbine, and typically assemble the nacelle. OEMs produce or procure all components.

Towers: typically not considered a strategic component – OEMs may be vertically integrated or purchase from a supplier.

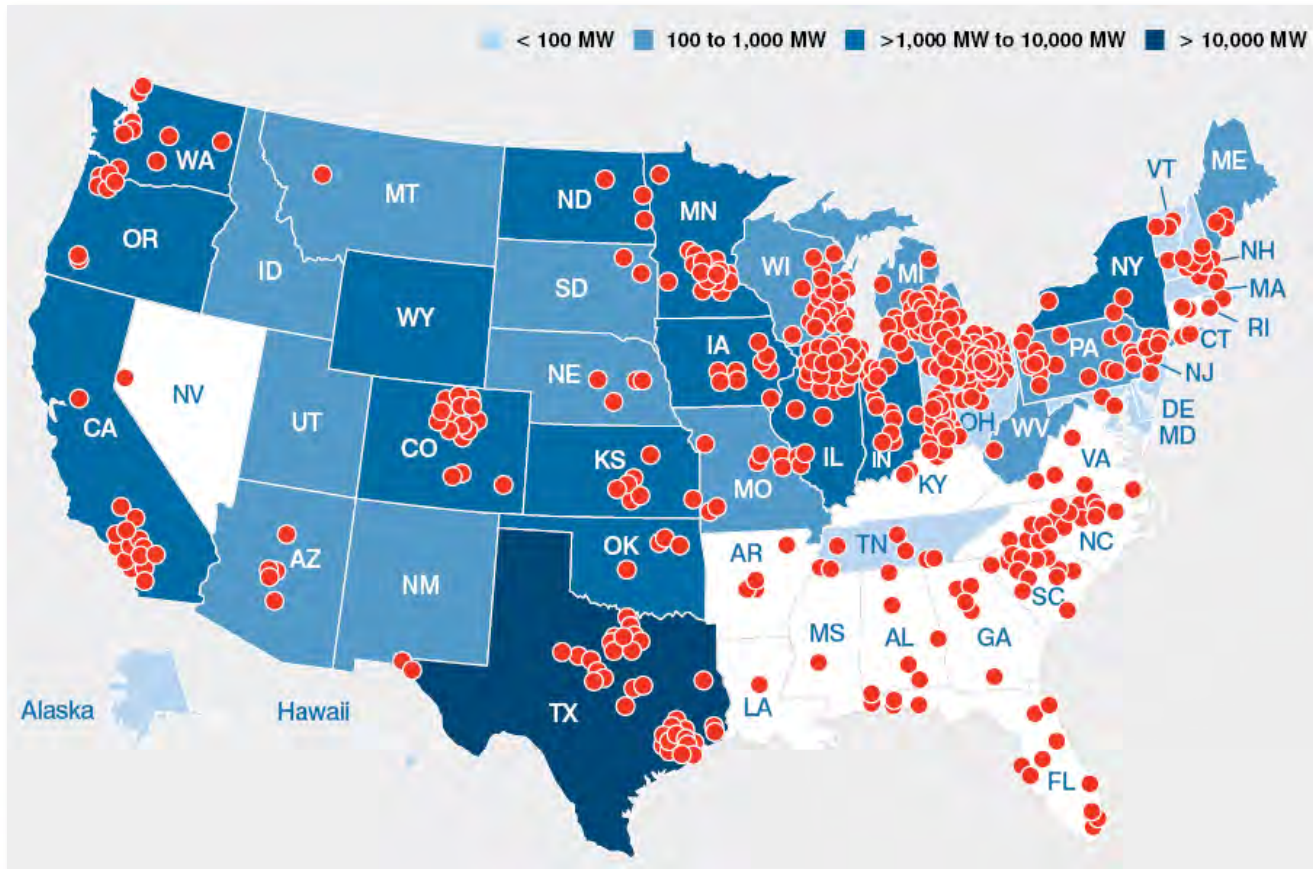
Blades: strategic components – OEMs may be vertically integrated or purchase from a dedicated supplier.

Nacelle assembly: typically done by the OEM.

Nacelle components: strategic components - typically procured by the OEM from dedicated suppliers.

Manufacturing Across the U.S.

Over 400 facilities manufacture for the wind industry



Major Wind Manufacturing Facility Locations – Towers

» At the end of 2010, there were 22 online tower manufacturing facilities and an additional 8 announced facilities.



Major Wind Manufacturing Facility Locations – Blades

» At the end of 2010, there were 11 online blade manufacturing facilities and an additional 5 announced facilities.



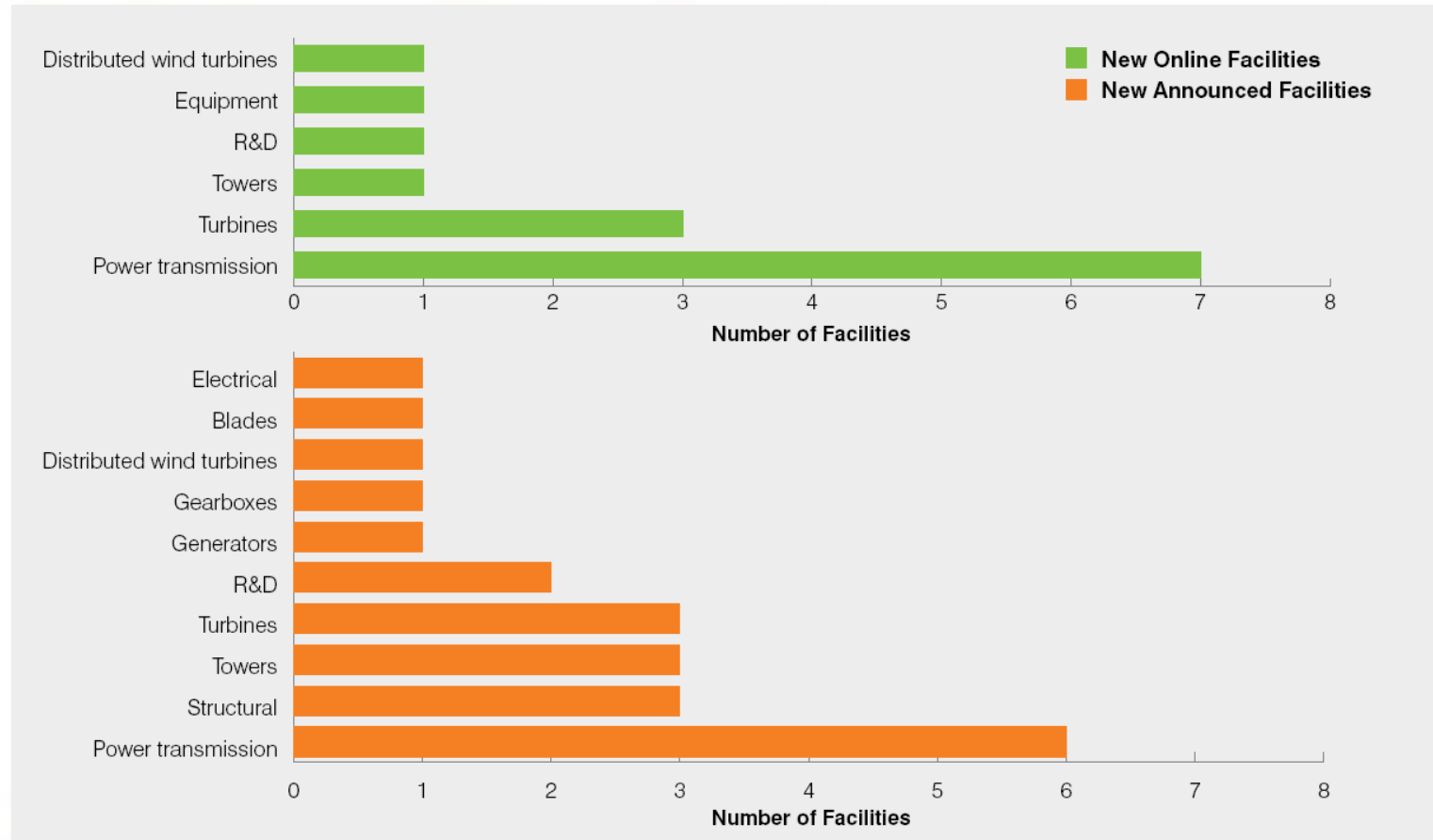
Major Wind Manufacturing Facility Locations – Turbine & Turbine Assembly

» At the end of 2010, there were 12 online turbine manufacturing facilities and an additional 8 announced facilities.



Type of Online and Announced Wind-Related Manufacturing Facilities in 2010

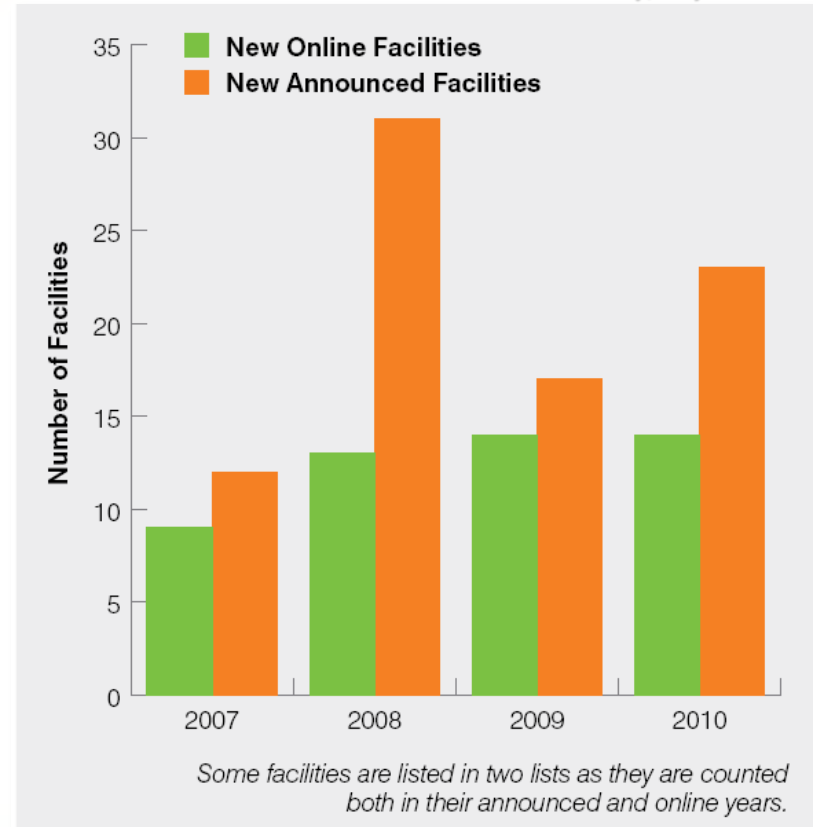
Type of Online and Announced Wind-Related Manufacturing Facilities in 2010



Wind-Related Manufacturing Facility Activity, by Year

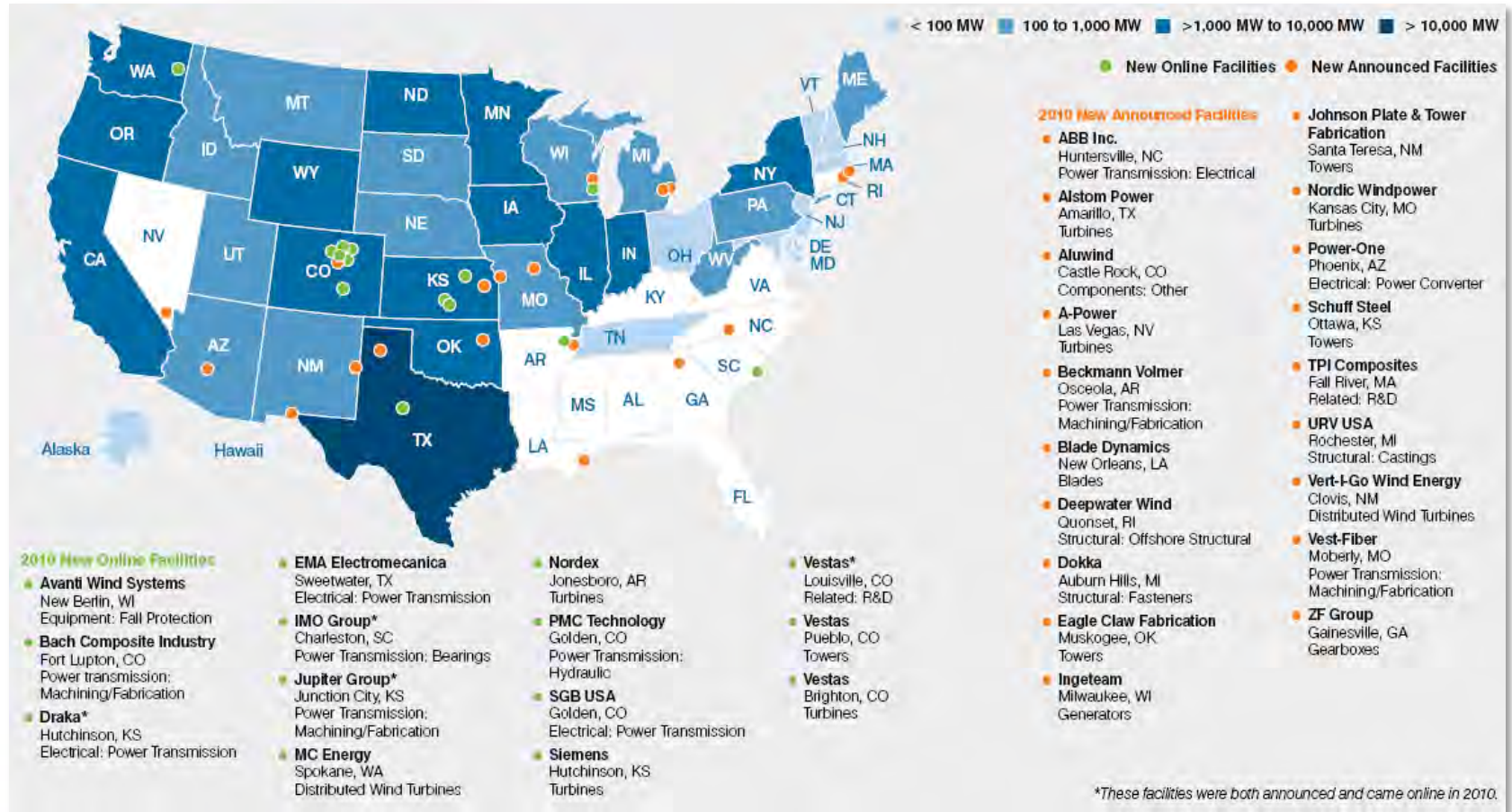
- » In 2010, 14 new manufacturing facilities came online, consistent with new online facilities in 2009.
- » 23 manufacturing facilities were announced, a slight increase over announcements in 2009.

Wind-Related Manufacturing Facility Activity, By Year

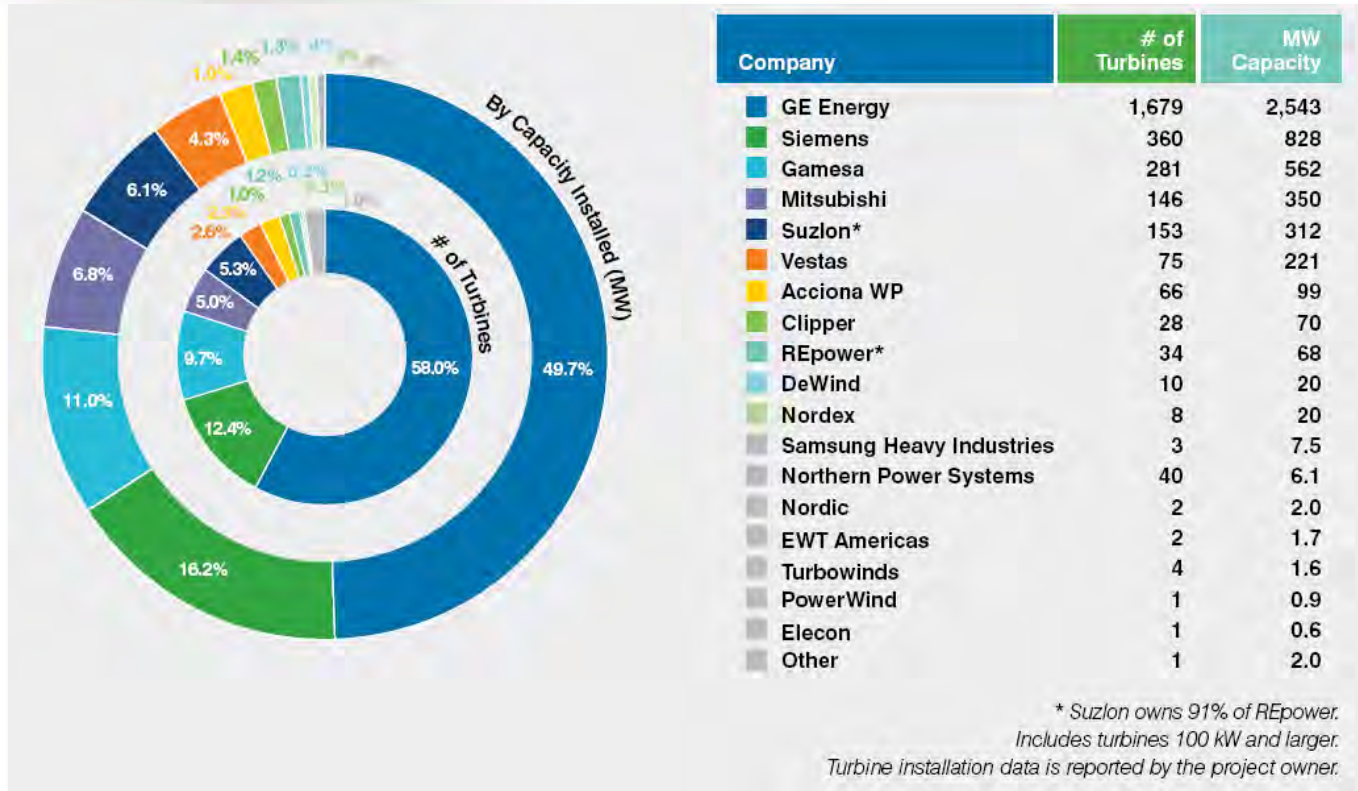


Online & Announced Wind-Related Manufacturing Facilities in 2010

Online & Announced Wind-Related Manufacturing Facilities in 2010



Wind Turbine Manufacturers' Share of 2010 U.S. Wind Power Installations



Over 92% of the 2010 market was captured by OEMs with online or announced nacelle assembly facilities.

Utility-Scale Wind Turbines Installed in 2010

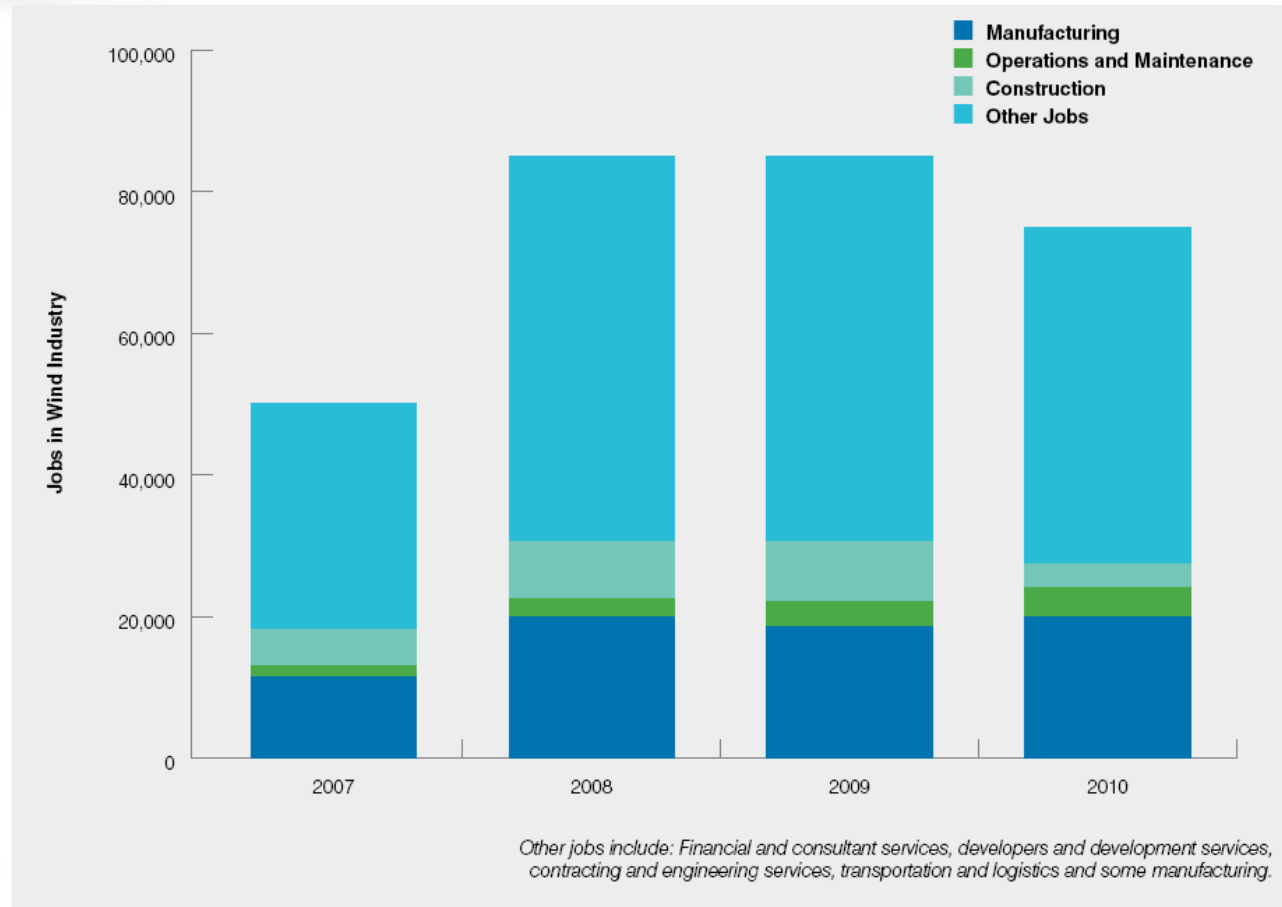
- » 100-kW to 3.0-MW:
 - 18 different OEMs installed
26 different turbine platforms
in 2010

- » 1.0-MW and Larger:
 - There were 14 OEMs which
installed 20 different turbine
platforms in 2010.

Manufacturer	Turbine Rating, MW
Acciona WP	1.50
Clipper	2.50
DeWind	2.00
Elecon	0.60
EWT Americas	0.75
EWT Americas	0.90
Gamesa	2.00
GE Energy	1.50
GE Energy	1.60
Mitsubishi	2.40
Nordex	2.50
Nordic	1.00
Northern Power Systems	2.20
Northern Power Systems	0.10
PowerWind	0.90
REpower	2.00
REpower	2.05
Samsung Heavy Industries	2.50
Siemens	2.30
Suzlon	1.25
Suzlon	2.00
Suzlon	2.10
Turbowinds	0.40
Vestas	1.65
Vestas	1.80
Vestas	3.00

U.S. Wind Industry Total Employment Over Time

Overall, the U.S. wind industry supported 75,000 direct and indirect jobs in 2010.



Questions ?

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