

GROWING SOUTH CAROLINA WIND: Expanding Supply Chain in the Palmetto State

Public Forum
April 25, 2012



Agenda:

5:00 – 5:30 – Meet and Greet with the Experts

5:30 – 5:35 – Chris Carnevale, Welcome Message

5:35 – 5:45 – Merle Johnson, Opening Remarks

5:45 – 6:05 – Jeff Anthony, “Wind Power Manufacturing Opportunities in South Carolina”

6:05 – 6:25 – Dr. Nicholas Rigas, “Clemson University Restoration Institute Innovation and Testing Campus”

6:25 – 7:00 – Questions & Answers



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Wind Power Manufacturing Opportunities in South Carolina

April 25, 2012

Jeff Anthony

American Wind Energy Association





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American Wind Energy Association

AWEA is the non-profit, national trade association for the U.S. wind energy industry

- » AWEA was established in 1974
- » Over **2,000 companies** are business members
 - » AWEA represents the entire industry from small component manufacturers to developers to transportation companies to service firms to electric utilities
 - » Industry employees **75,000**
- » Convenes conferences and workshops to educate the public and bring industry members together, including one of the **fastest growing Conference & Exhibitions** in the U.S., **WINDPOWER**



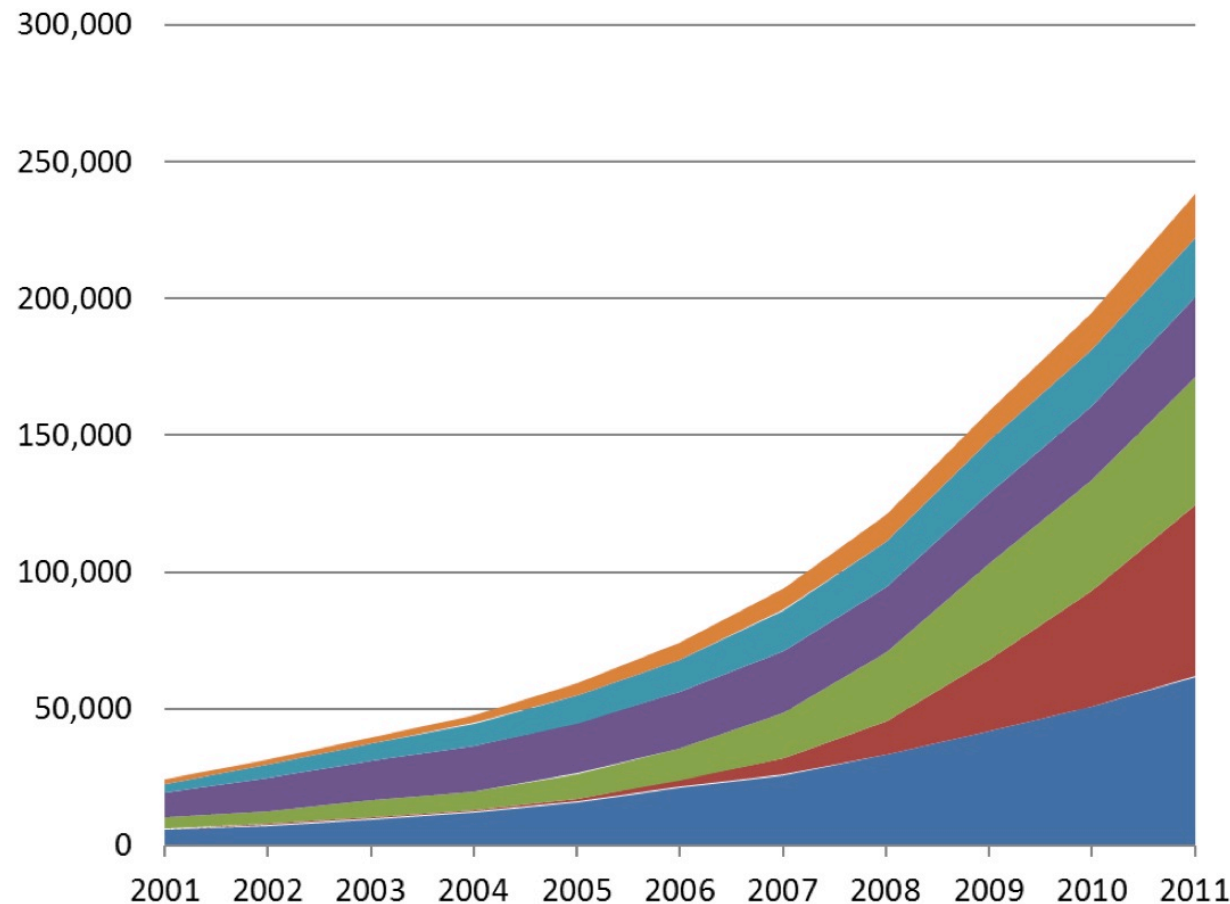
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Market Overview



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Global Growth In Wind Power

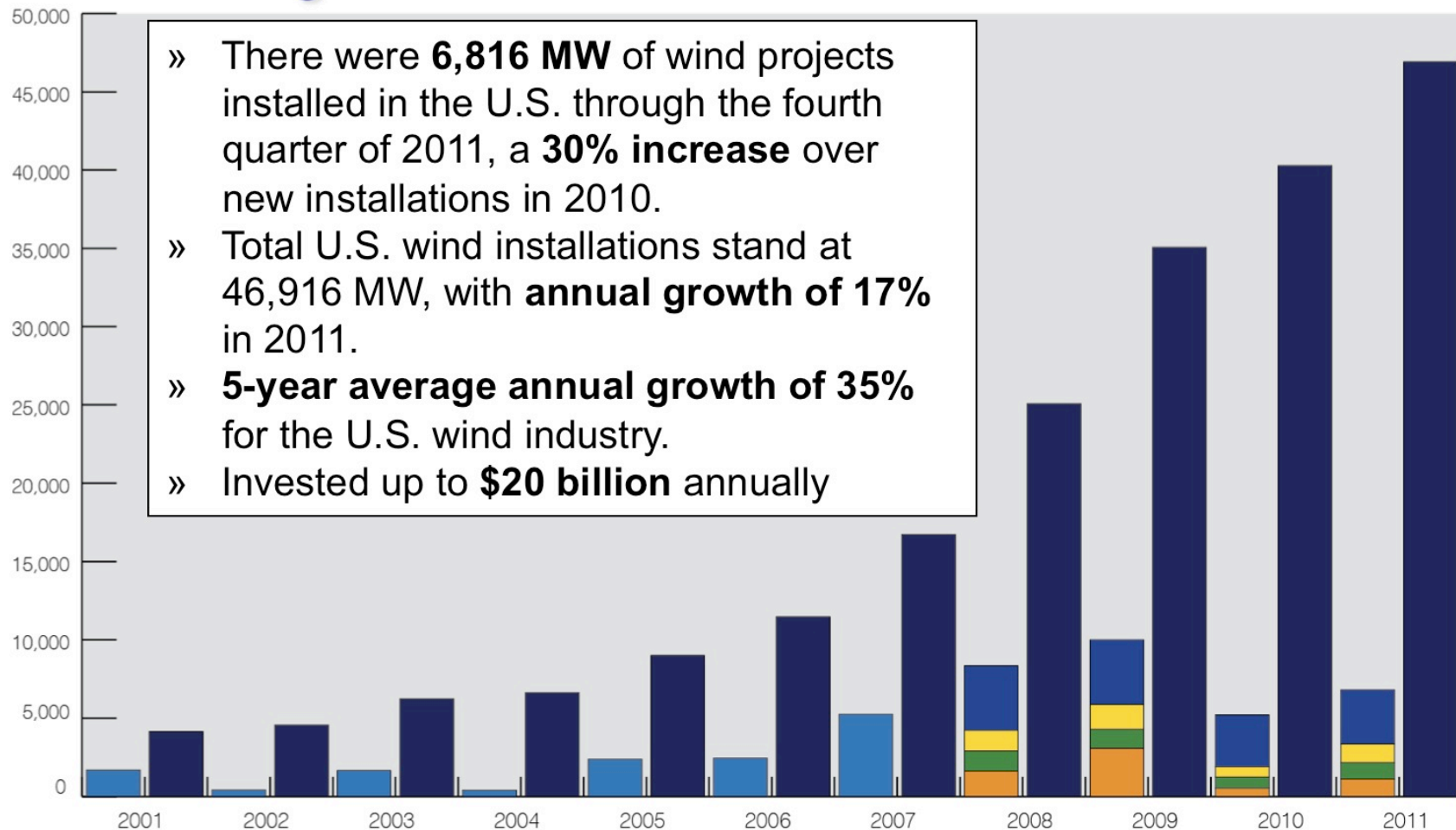


» **238,351 MW of wind installed globally**

» **The global industry grew 21% in 2011**

» **The U.S. represented 15.5% of the total 2011 market for new wind.**

Wind Projects Installations

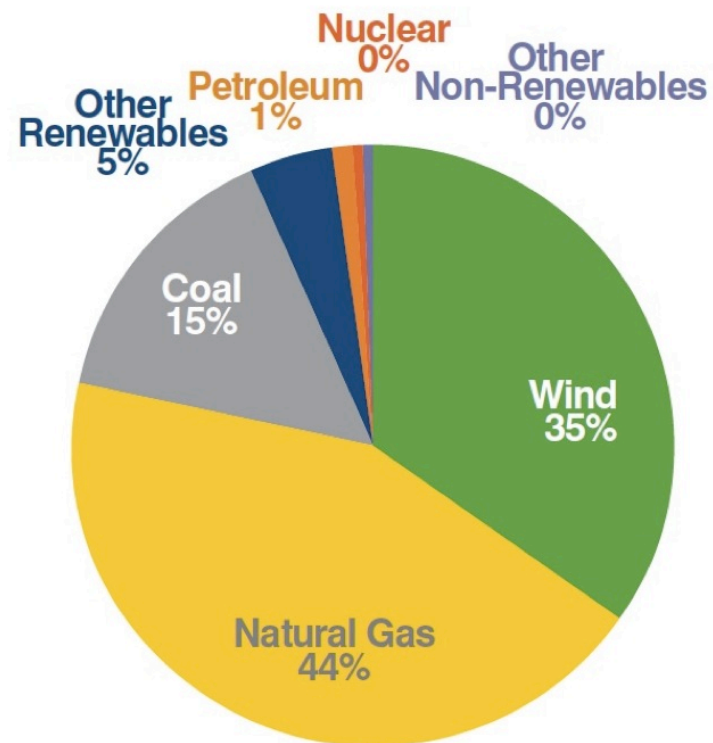


Source: AWEA U.S. Wind Industry Annual Market Report Year Ending 2011

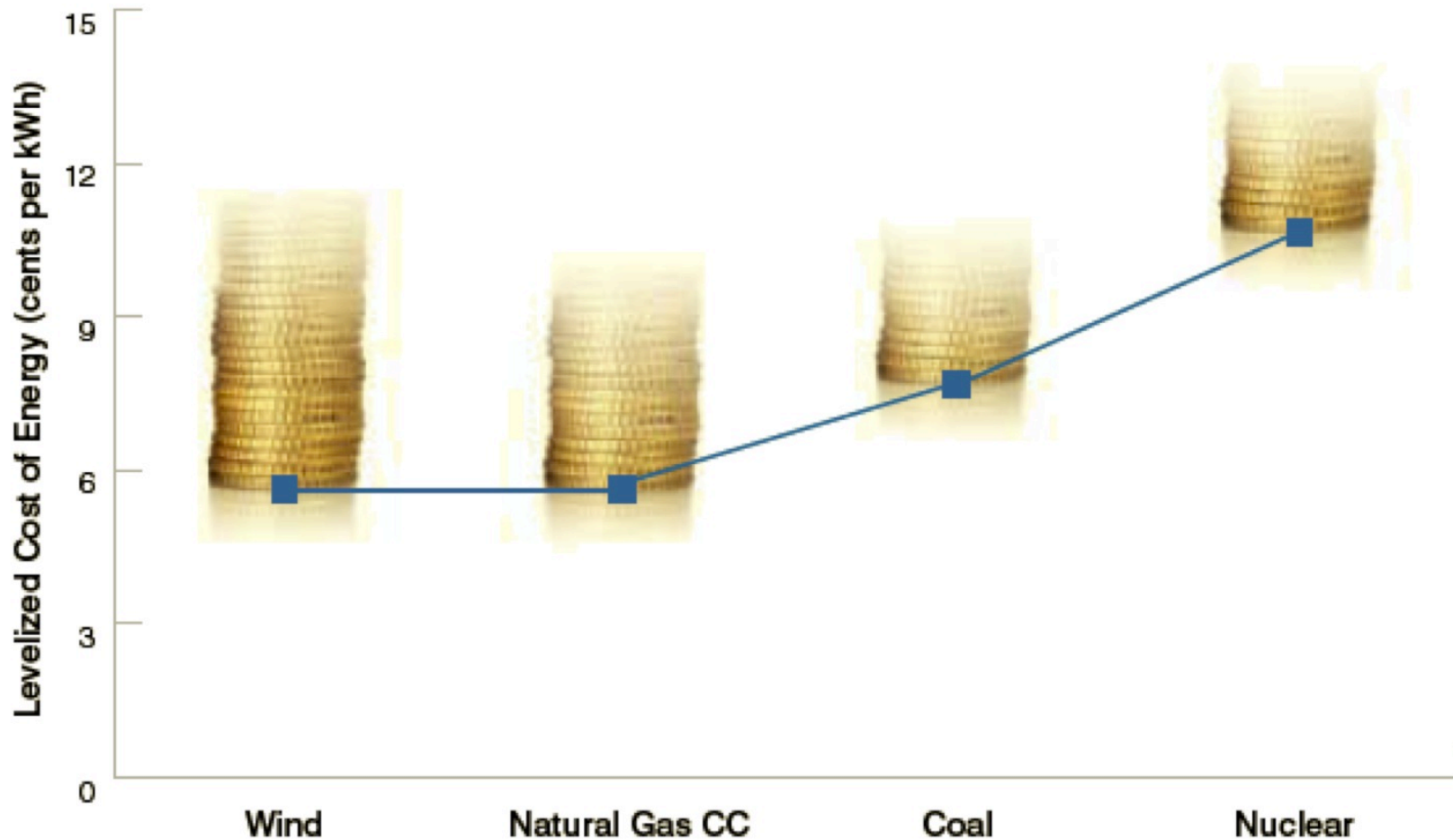
Wind Power has captured 35% of all new generating capacity in America since 2007

- New wind capacity represented 31% of all new capacity installed in 2011.
- Wind remained the second largest source of new installed capacity, second to natural gas at 42%.
- **Over the past 4 years combined, wind represented 35% of all new generating capacity installed.**

Percent of New Installed Capacity (in MW),
2007-2011



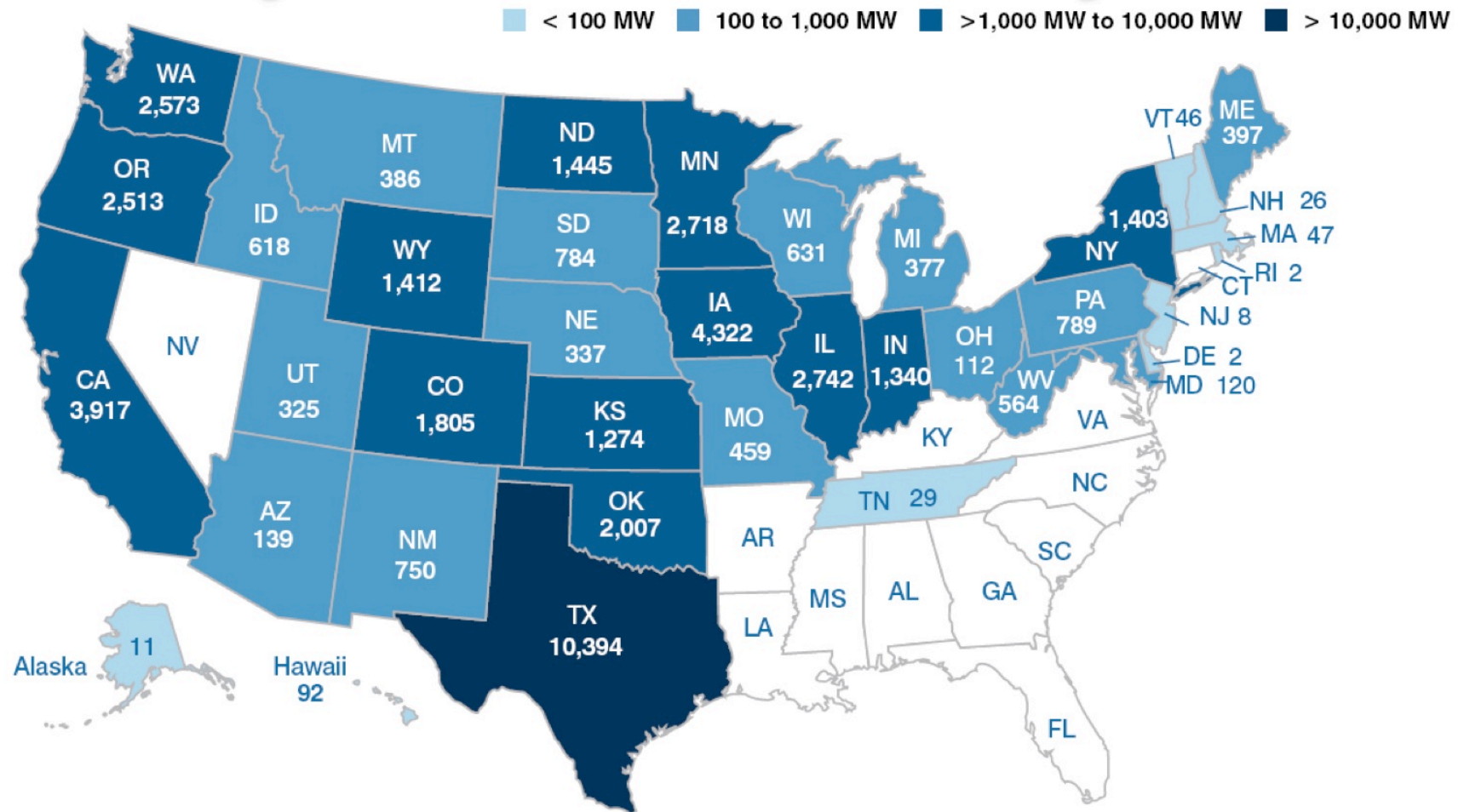
Wind Energy Costs: All-Time Low



Data Source: Lazard, Levelized Cost of Energy, June 2009

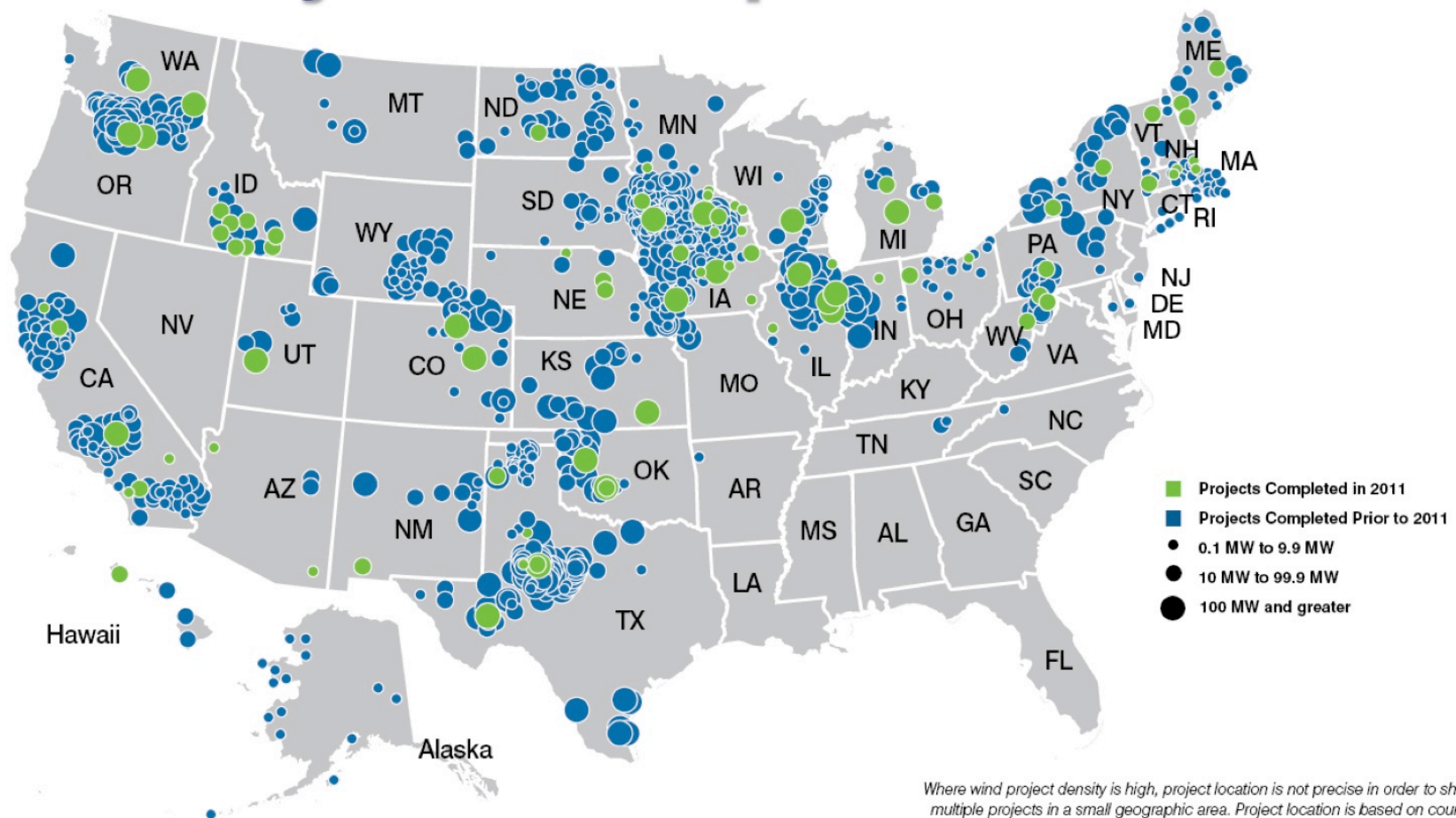
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Wind Projects Installations by State



Source: AWEA U.S. Wind Industry Annual Market Report Year Ending 2011

Wind Projects Completed in 2011

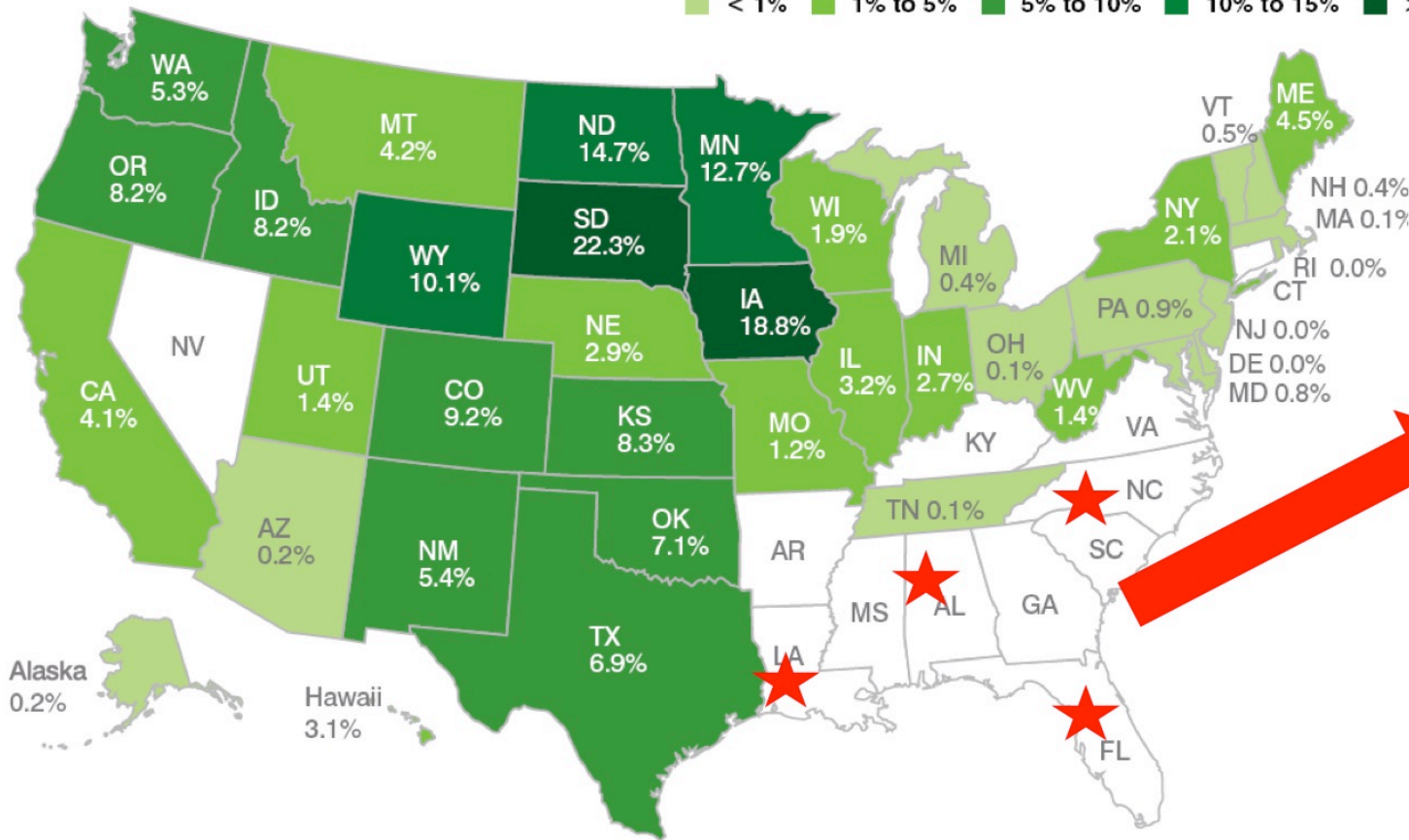


Where wind project density is high, project location is not precise in order to show multiple projects in a small geographic area. Project location is based on county.

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Wind Development in the Southeast

■ < 1% ■ 1% to 5% ■ 5% to 10% ■ 10% to 15% ■ > 15%



Southeast is now receiving low-cost wind power through power contracts in **Louisiana & Alabama**

With improved wind technology (taller towers, longer blades) there is project development activity now occurring in **North Carolina & Florida**



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Policy / PTC Update



The Voting Public “Gets It”



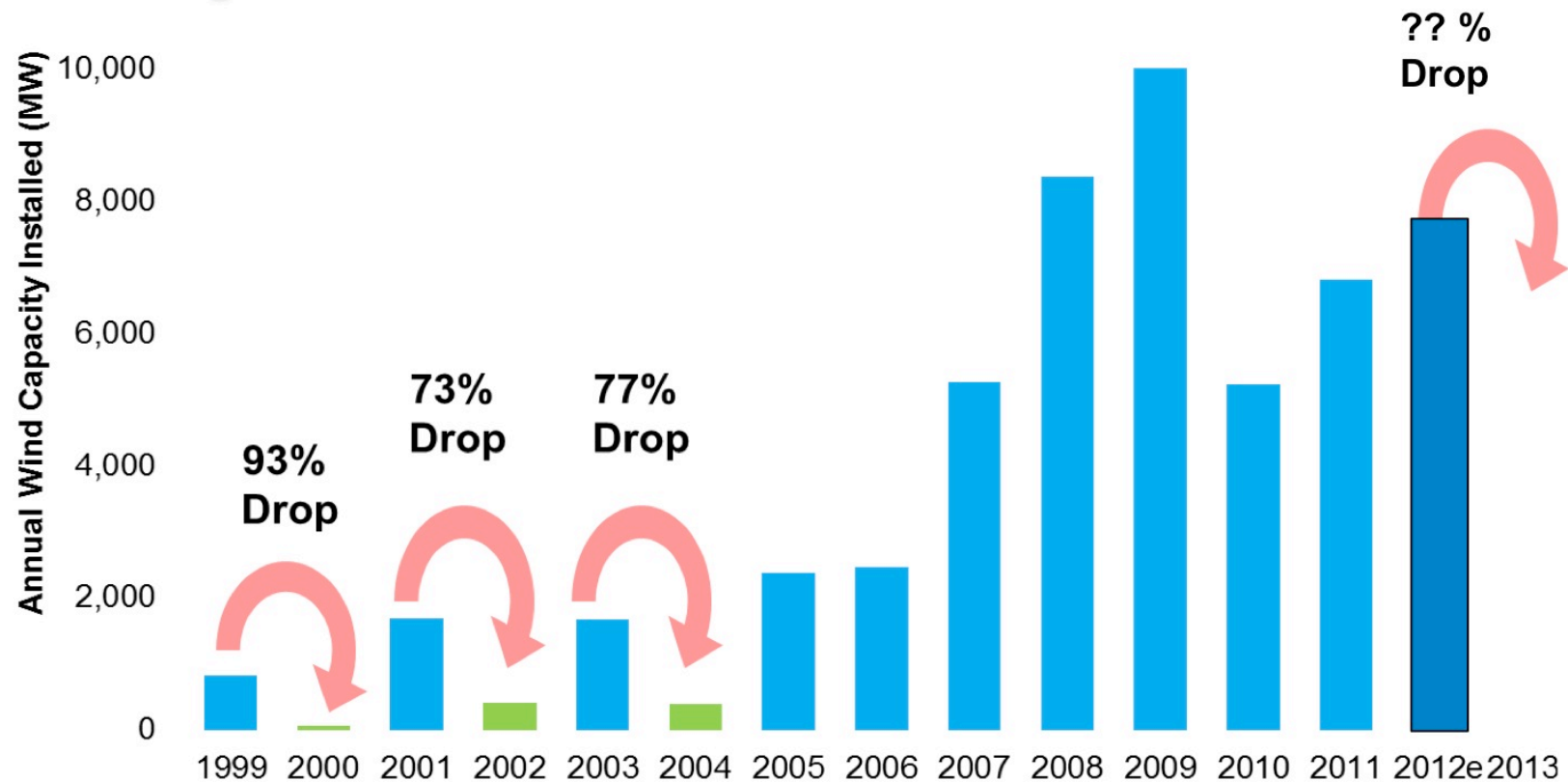
89% of
American voters

84% of Republicans | 88% of Independents | 93% of Democrats

believe increasing the amount of energy
the nation gets from wind is a good idea

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Lack of Federal Energy Policy— a history of boom & bust environment





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PTC extension: what we have to gain

- With a 4-year PTC extension, the US wind market will grow through 2016
 - » Annual installations will be 8-10 GW through 2016
 - » Total wind-supported jobs, with many of them long-term manufacturing jobs, will grow to nearly 100,000 by 2016
 - » Total wind investment will continue attracting an average of \$17 billion in private investment in the U.S.
 - » Extension supported by the U.S. Chamber, the National Association of Manufacturers and the Farm Bureau among others.

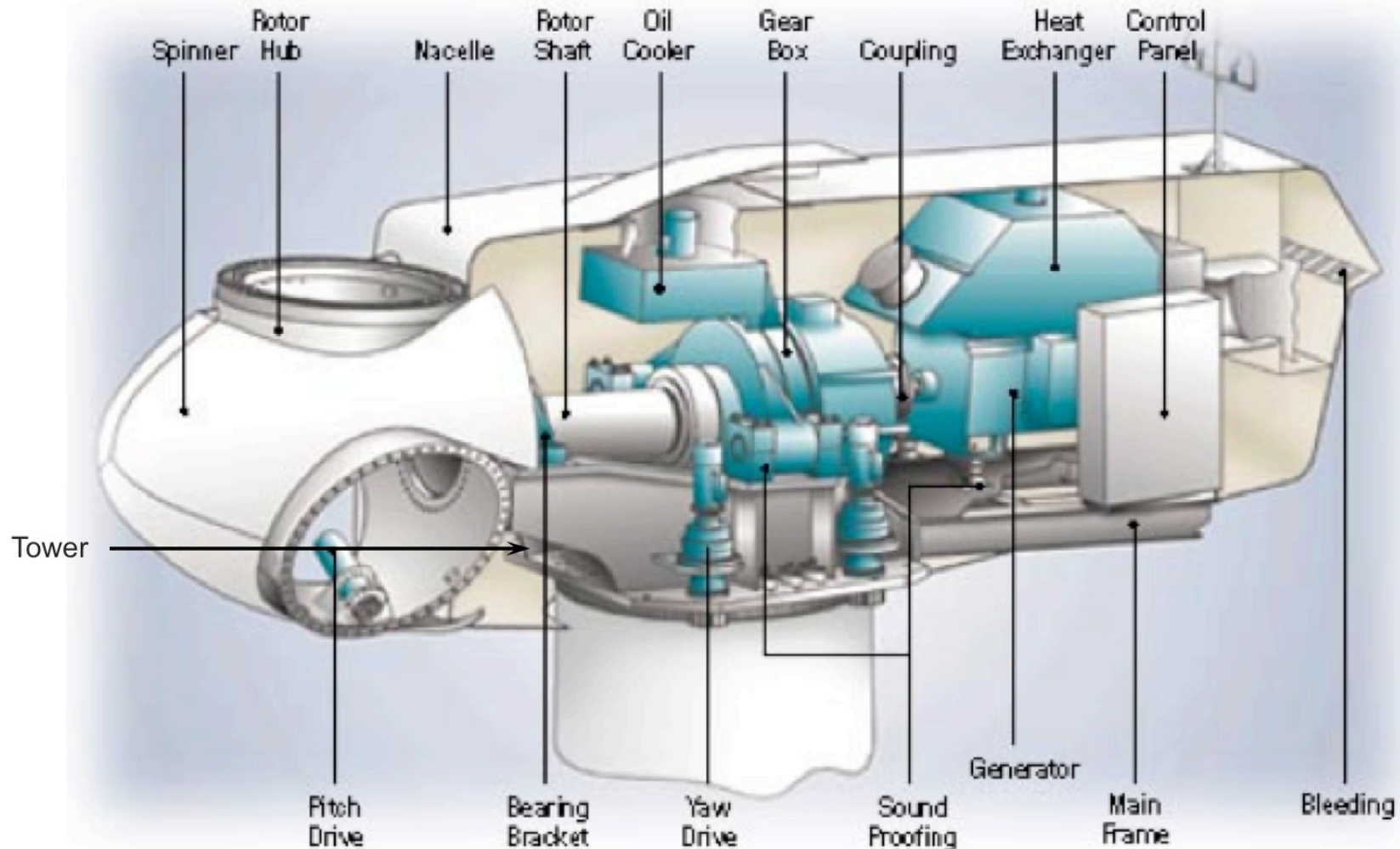


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Manufacturing & Supply Chain



Inside a Wind Turbine



Turbine Components

Towers:

- Towers
- Ladders
- Lifts

Rotor:

- Hub
- Nose Cone
- Blades
- - Composites
- - Blade Core
- Pitch Mechanisms
- Drives
- Brakes
- Rotary Union

Nacelle:

- Nacelle Cover
- Nacelle Base
- Heat exchanger
- Controllers
- Generator
- Power Electronics
- Lubricants
- Filtration
- Insulation
- Gearbox
- Pump
- Drivetrain
- Ceramics
- Shaft

Foundation:

- Rebar
- Concrete
- Casings

Other:

- Transformers
- Bolts/Fasteners
- Wire
- Paints and Coatings
- Lighting
- Lightning Protection
- Steel Working/Machining
- Communication Devices
- Control & Condition Monitoring Equipment
- Electrical Interface & Electrical Connection
- Batteries
- Bearings
- Brakes

**There are
over 8000
components
in a turbine.**



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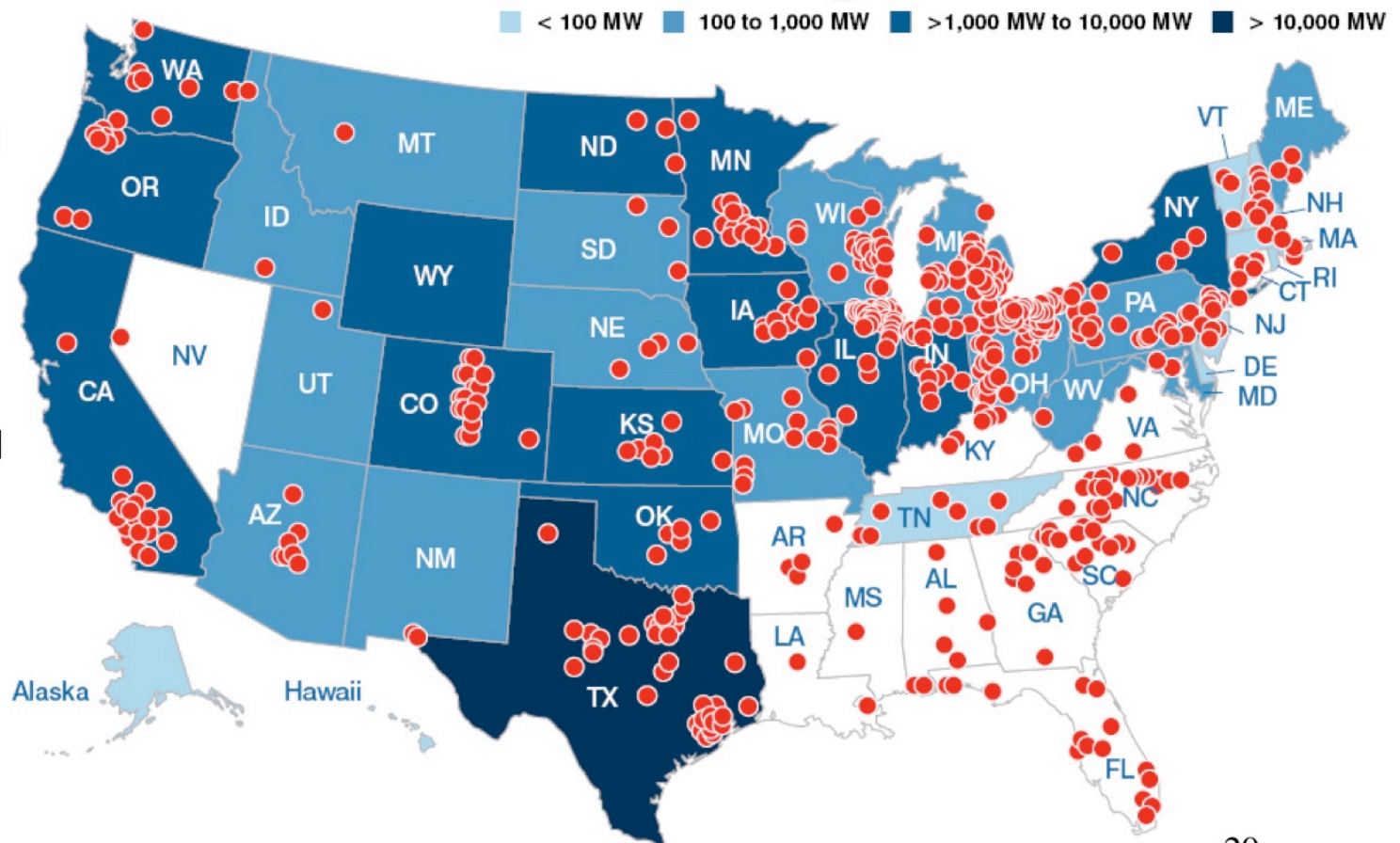
Turbine Manufacturers Active, by year

2005	2006	2007	2008	2009	2010	2011
GE Energy	GE Energy	GE Energy	GE Energy	GE Energy	GE Energy	GE Energy
Vestas	Siemens	Vestas	Vestas	Vestas	Siemens	Vestas
Mitsubishi	Vestas	Siemens	Siemens	Siemens	Gamesa	Siemens
Gamesa	Mitsubishi	Gamesa	Suzlon	Mitsubishi	Suzlon	Suzlon
Suzlon	Suzlon	Mitsubishi	Gamesa	Suzlon	Mitsubishi	Mitsubishi
	Gamesa	Suzlon	Mitsubishi	Clipper	Vestas	Nordex
		Clipper	Clipper	Gamesa	Acciona WP	Clipper
		Nordex	Acciona WP	REpower	Clipper	REpower
			REpower	Acciona WP	REpower	Gamesa
			Fuhrlander	Nordex	DeWind	Alstom
			DeWind	DeWind	Nordex	Sany
			AWE	AAER/Pioneer	Samsung	VENSYS
			DES	Goldwind	Northern Power	Samsung
			Northern Power	Northern Power	Nordic	Goldwind
			VENSYS	Fuhrlander	AAER/Pioneer	Hyundai
				VENSYS	EWT Americas	Nordtank (refurbished)
				EWT Americas	Turbowinds	Kenersys
					PowerWind	Northern Power
					Elecon	Unison
						Sinovel
						Nordic
						PowerWind
						Aeronautica

Source: AWEA U.S. Wind Industry Annual Market Report Year Ending 2011

Wind-Related Manufacturing Facilities

- At the end of 2011, there were over 470 manufacturing facilities online making wind-related products.
- These online facilities span **42** states
- Over **100 different projects** were installed in 2011 ranging from a single turbine to over 400 MW in size.
- **Over 60** different companies developed wind projects in 2011

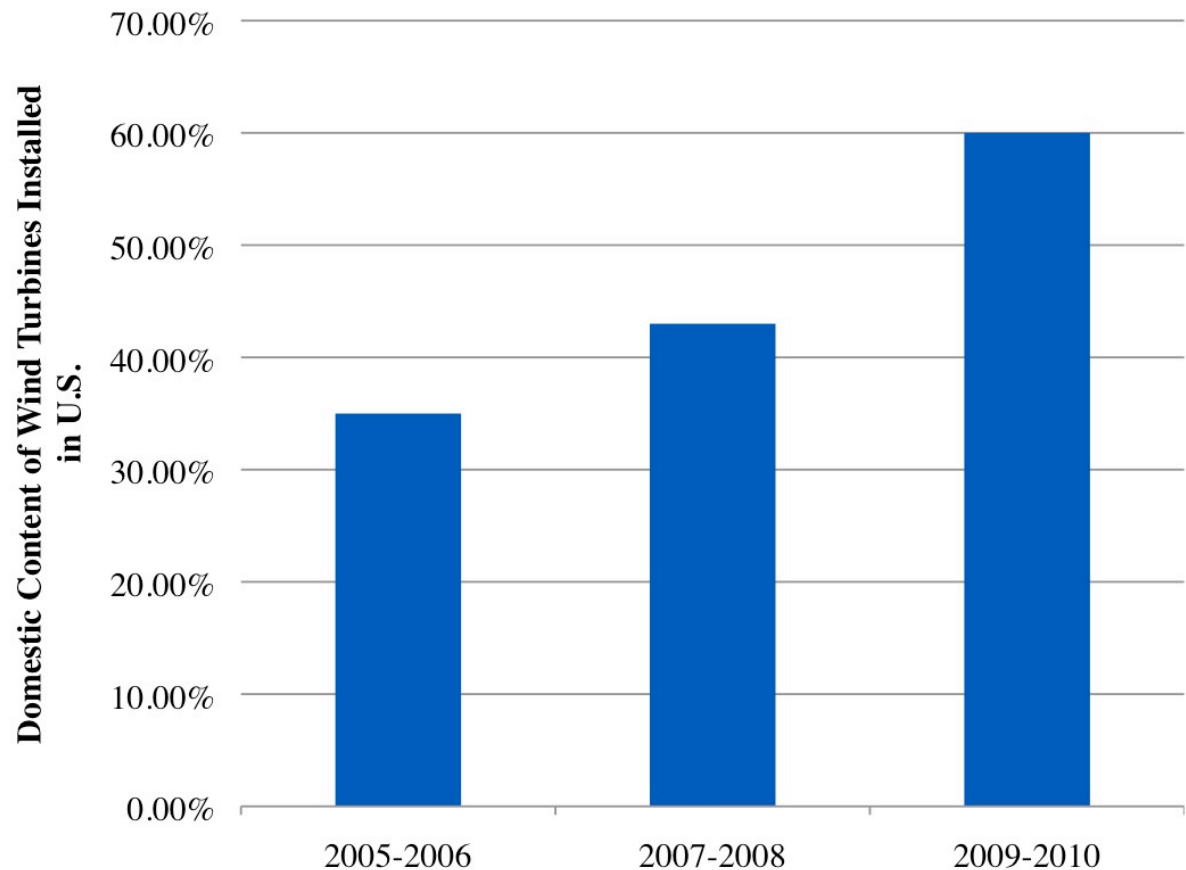


Domestic Content

Prior to 2005, wind turbines installed in U.S. had **25% of their components made in the U.S.**

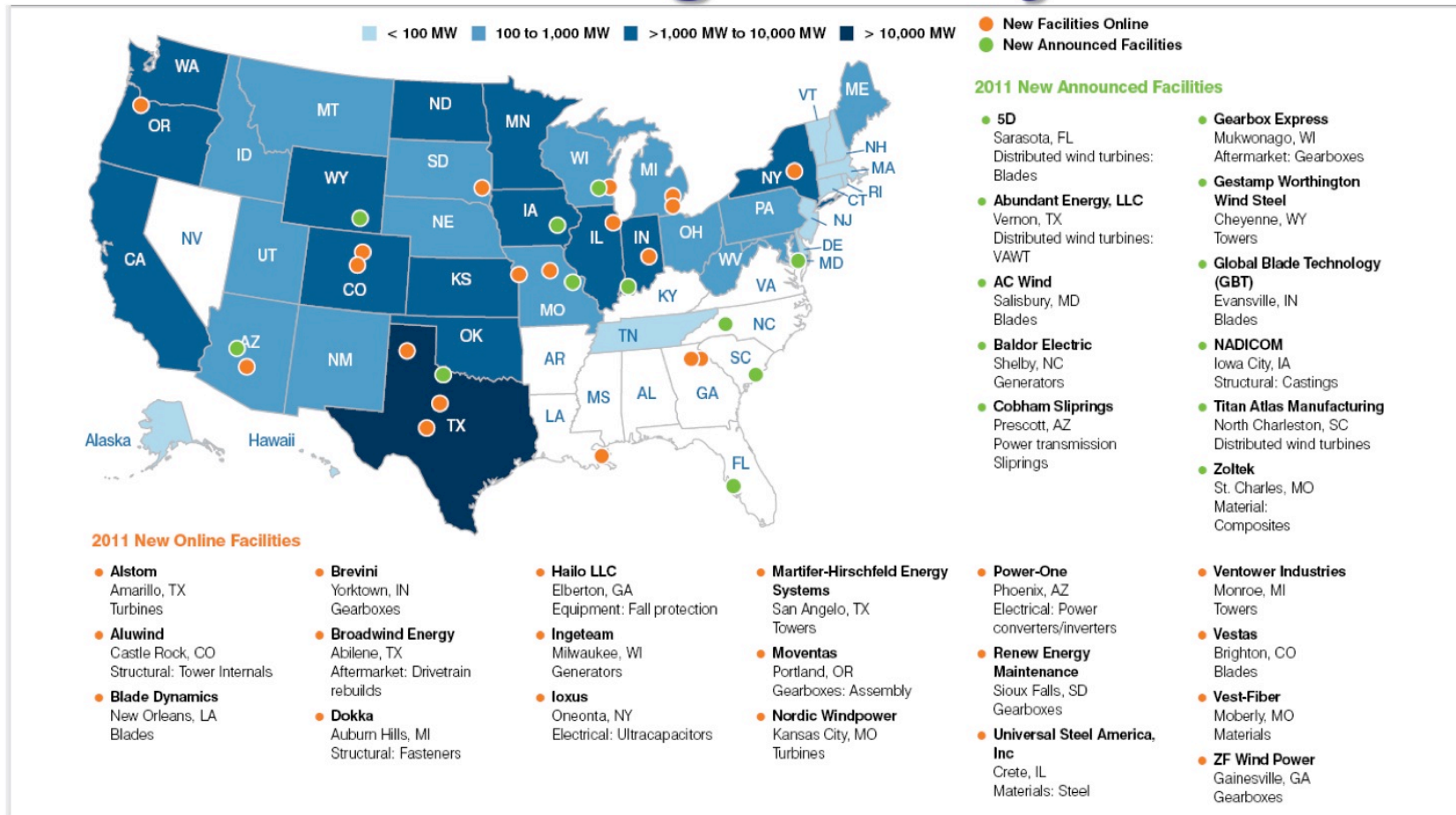
Over the next five years, U.S. manufacturing expanded rapidly so that now over **60% of the components installed in wind turbines are made in the U.S.**

This is a **ten-fold increase overall**, because of the larger number of turbines installed in subsequent years.



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Wind Manufacturing Activity in 2011



Southeast: Hub for Wind Manufacturing

State	Number of Jobs	Number of Facilities
Alabama	501-1,000	7
Arkansas	1,001-2,000	4
Florida	2,001-3,000	14
Georgia	501-1,000	7
Kentucky	101-500	7
Louisiana	101-500	2
Mississippi	1-100	1
North Carolina	1,001-2,000	19
South Carolina	1,001-2,000	15
Tennessee	1,001-2,000	9
Virginia	501-1,000	4
West Virginia	101-500	1
Total in the Southeast	8,300-14,500	> 90

Wind Manufacturing in South Carolina



At the end of 2011, there were more than 90 wind-related manufacturing facilities in the Southeast. In South Carolina, these include:

ABB Inc.	Florence, SC
AGY	Aiken, SC
Ahlstrom Specialty Reinforcements	Bishopville, SC
ESAB	Florence, SC
GE Energy	Greenville, SC
Iljin	Greer, SC
IMO Group	Summerville, SC
Kaydon Bearings	Sumter, SC
Kemet	Simpsonville, SC
PPG Industries	Chester, SC
Prysmian Power Cables and Systems	Lexington, SC
Sandvik	Westminster, SC
Staubli	Duncan, SC
Synteen Technical Fabrics	Lancaster, SC
Timken	Union, SC



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WINDPOWER 2012 Update



**Registration
is NOW OPEN!**

www.WINDPOWERexpo.org

Register by April 9th
and Save!



Manufacturing the **FUTURE** Today

**See and Be Seen
at the World's Largest
Annual Wind Energy
Conference & Exhibition**

www.windpowerexpo.org





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WINDPOWER 2012

– Coming to Atlanta, GA

- June 3-6, 2012 – Atlanta, GA
- The premier wind power event in the U.S.; largest annual wind power event in the world
- Strong focus on manufacturing & supply chain
 - » Expecting ~13,000 attendees and over 900 exhibitors



www.windpowerexpo.org



Manufacturing the FUTURE Today

WINDPOWER 2012

– Coming to Atlanta, GA

- June 3-6, 2012 – Atlanta, GA
- Special “Supply Chain” introductory session offered to manufacturers and others interested in the wind energy supply chain
- **SPECIAL REGISTRATION DISCOUNT** – for attendees at this event today



www.windpowerexpo.org



Manufacturing & Supply Chain Activities at WINDPOWER 2012

- Sunday, June 3rd – Industry Essentials session on Manufacturing & Supply Chain issues
- Program Sessions:
 - Transportation & Logistics session – June 5th
 - Wind Turbine Supply Chain Opportunities– June 5th
 - Large Wind Turbine Vendor Forums – June 6th
- Exhibit Floor with over 900 exhibitors, half in the manufacturing and supply chain sector
- More info ? manufacturing@awea.org



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Thanks to our Event Partners for WINDPOWER 2012:





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Your Questions ?

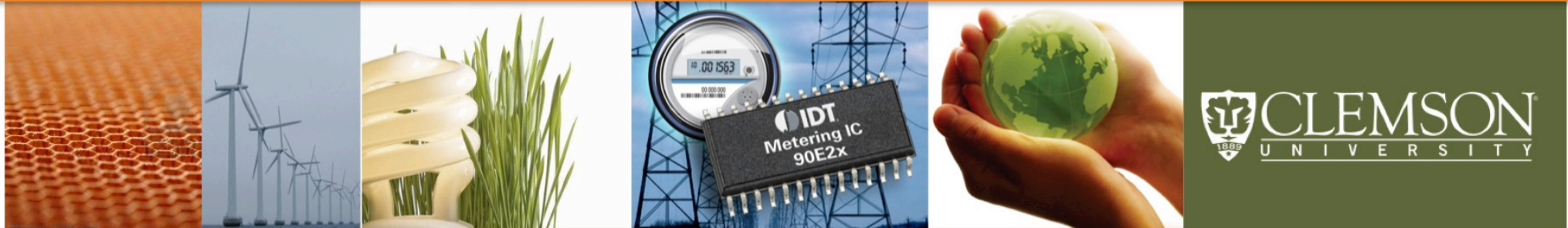
Jeff Anthony, AWEA

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www.windpowerexpo.org

Clemson University Restoration Institute Innovation and Testing Campus

‘Accelerating New Technologies to Market and Educating a
workforce for a sustainable future’



Dr. Nikolaos Rigas
Senior Scientist
April 25, 2012



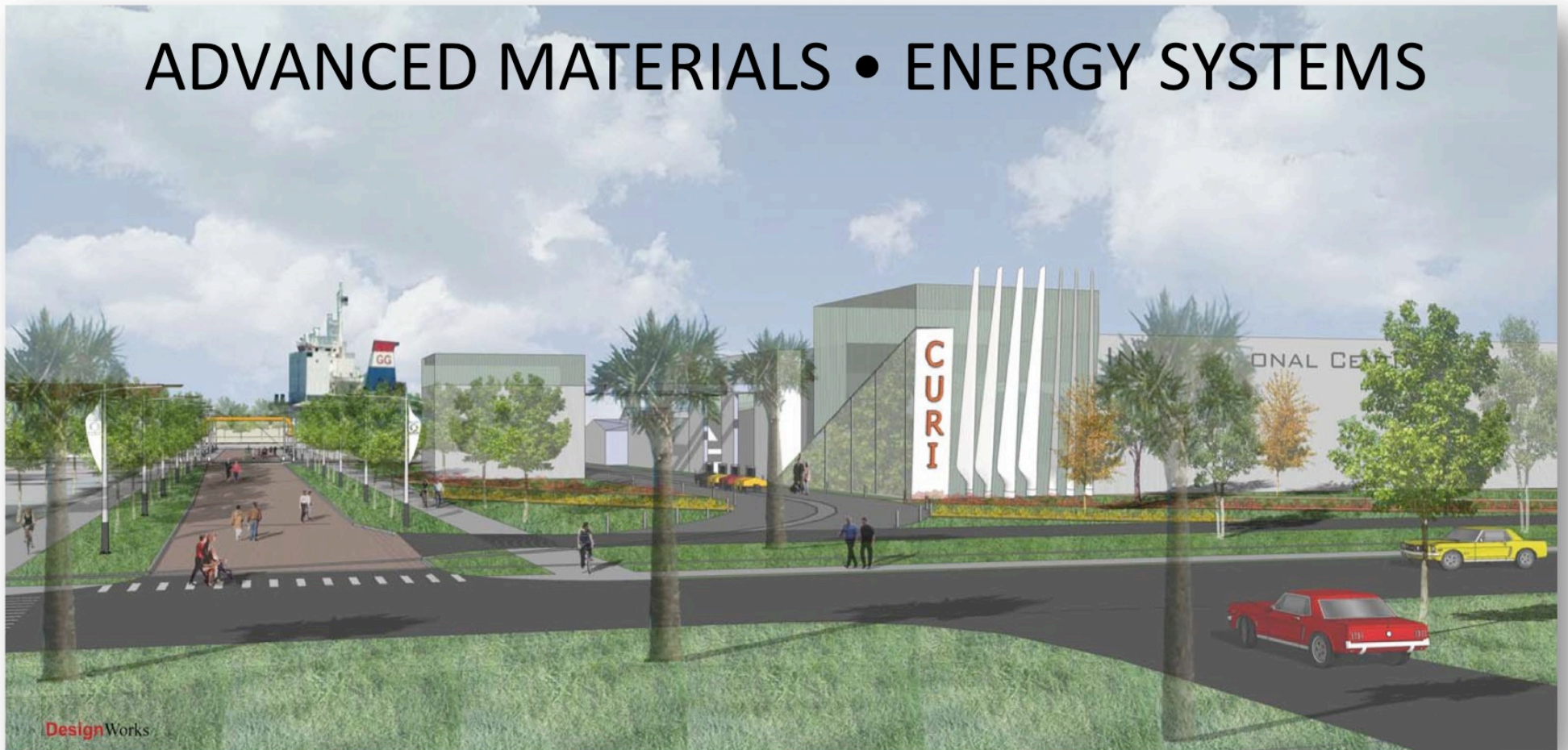


The Clemson University Restoration Institute

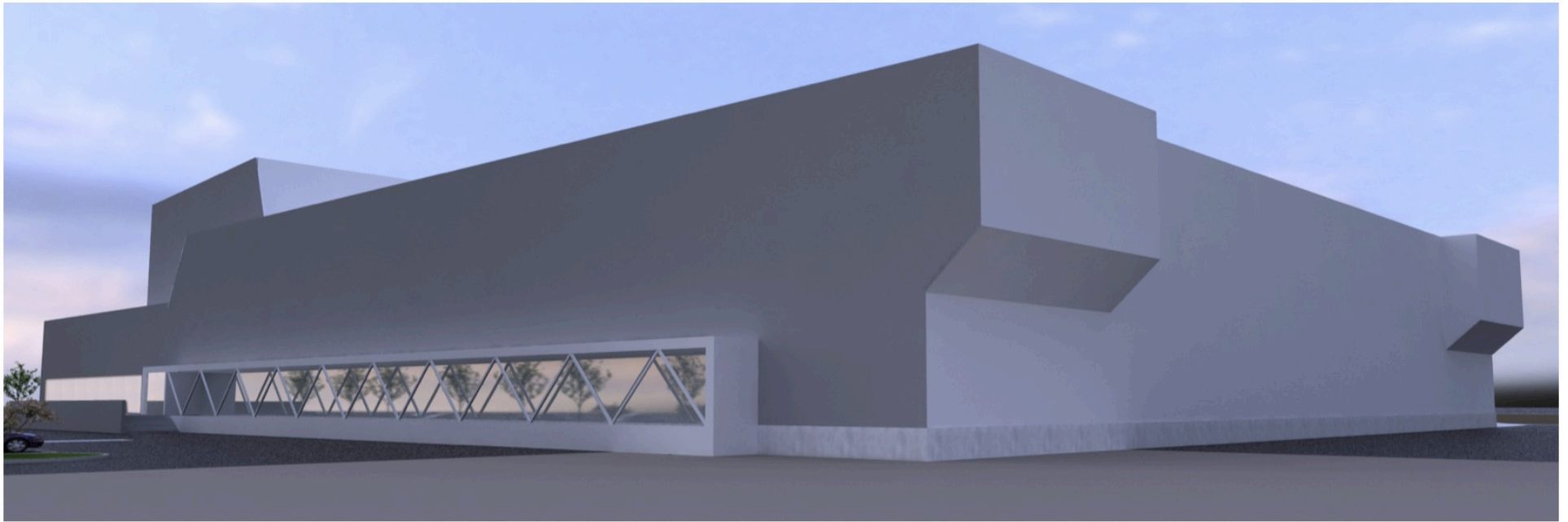


North Charleston, SC

ADVANCED MATERIALS • ENERGY SYSTEMS



Wind Turbine Drivetrain Testing Facility



Objective: Accelerate the development of new technology to reduce the cost of energy delivered.

Mission:

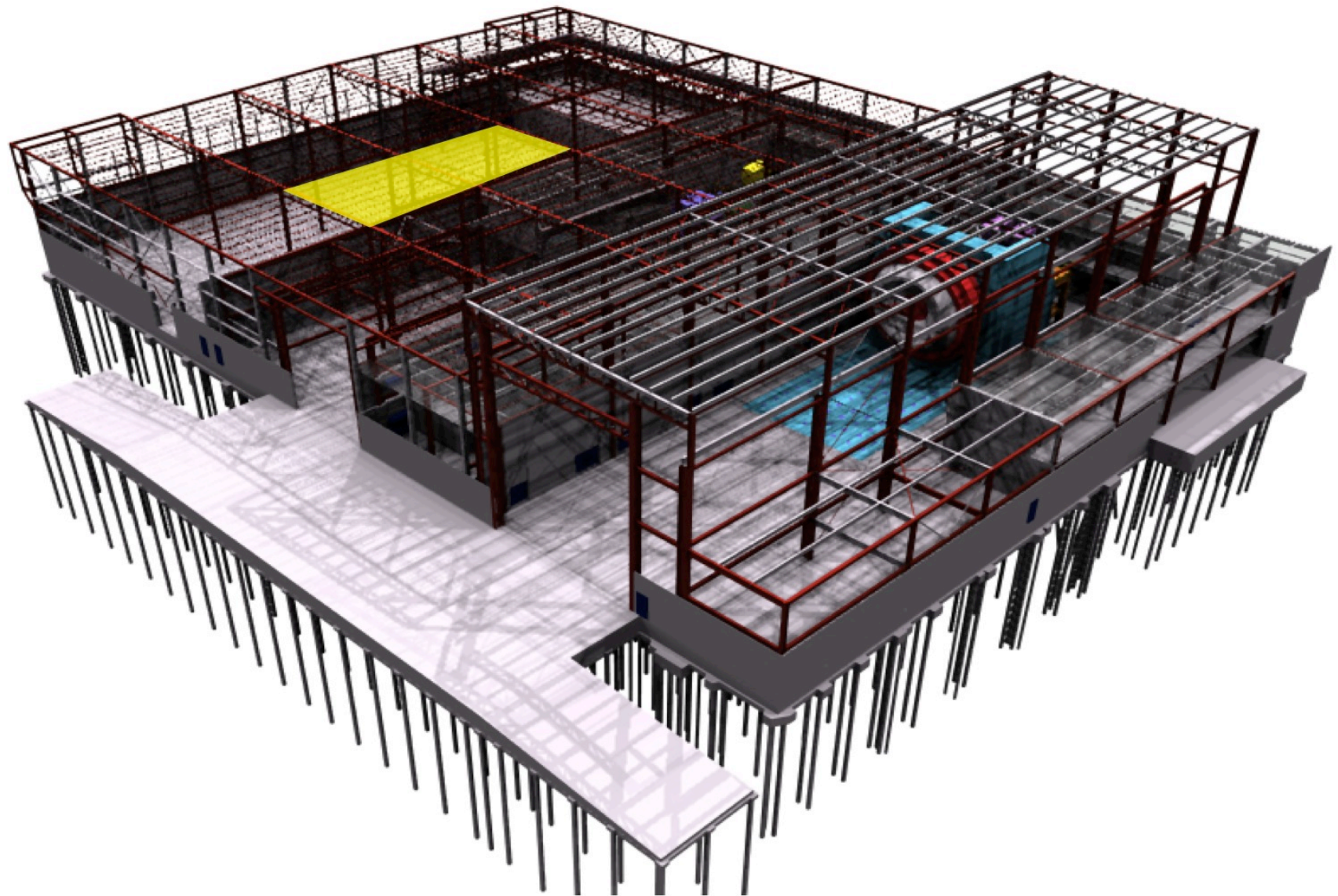
Provide (1) **High Value**, (2) **High Quality** and (3) **Cost Competitive** testing services to industry.

Establish long term partnerships with industry for work force development, research and education.

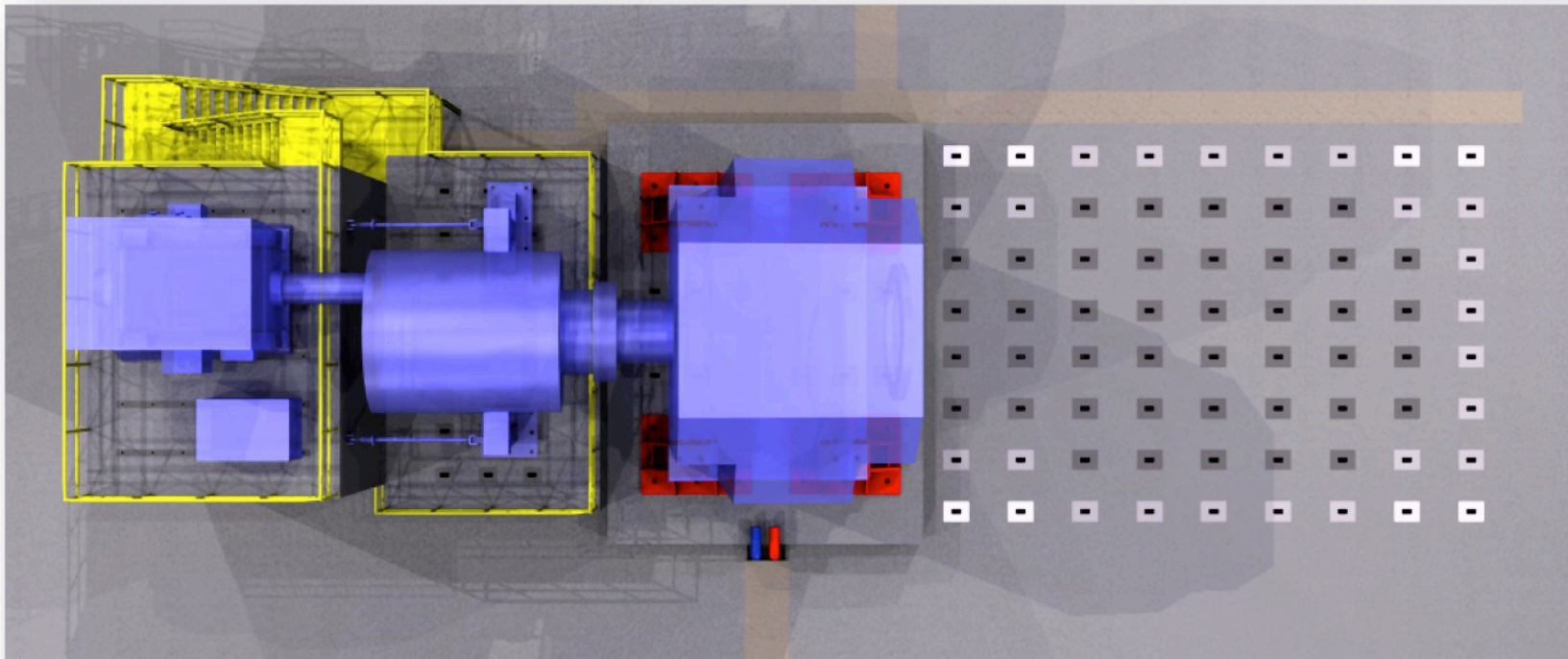
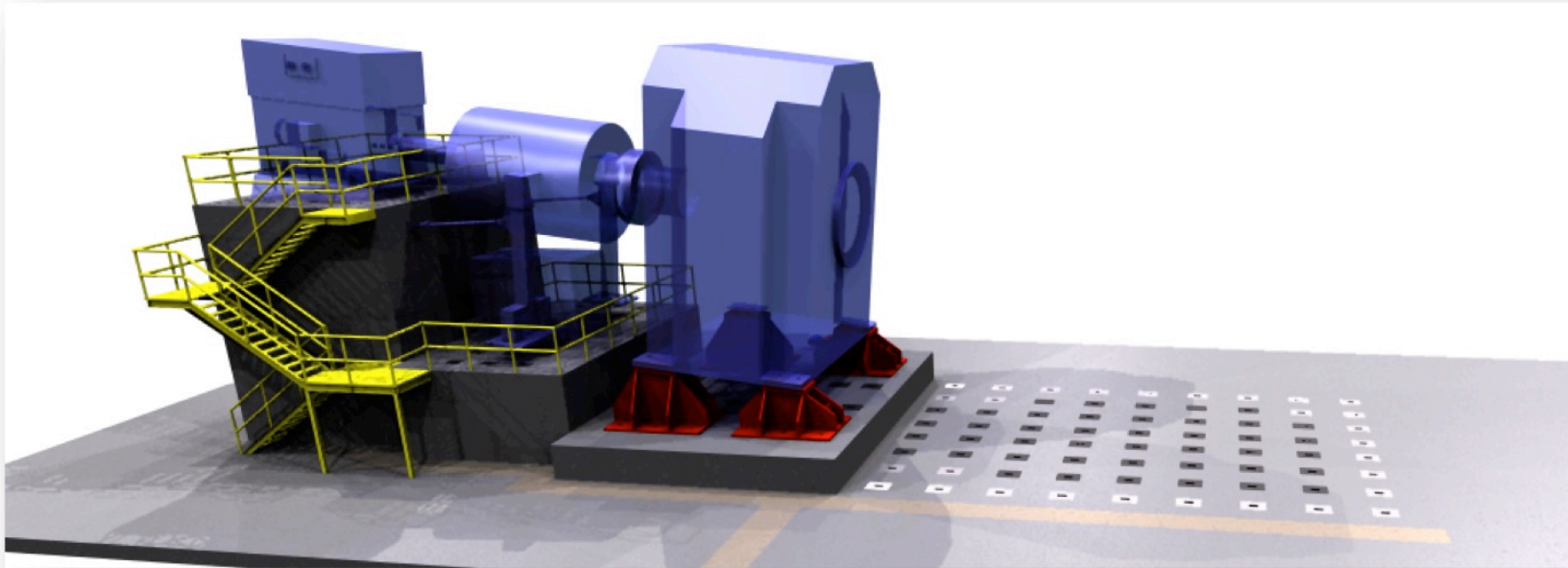
Industrial Advisory Board

- GE Energy
- Siemens
- Clipper Wind
- Timken Bearings
- Bosch-Rexroth
- Winergy
- Nordex
- ZF
- Vestas
- Gamesa
- RePower
- GE Transportation
- Broad Wind
- Northern Power Sys
- Samsung
- Areva
- Mitsubishi
- Suzlon
- *Duke Energy*
- *SCANA*
- *Santee Cooper*
- *Underwriters Lab*
- *Teco-Westinghouse*
- *SRNL*






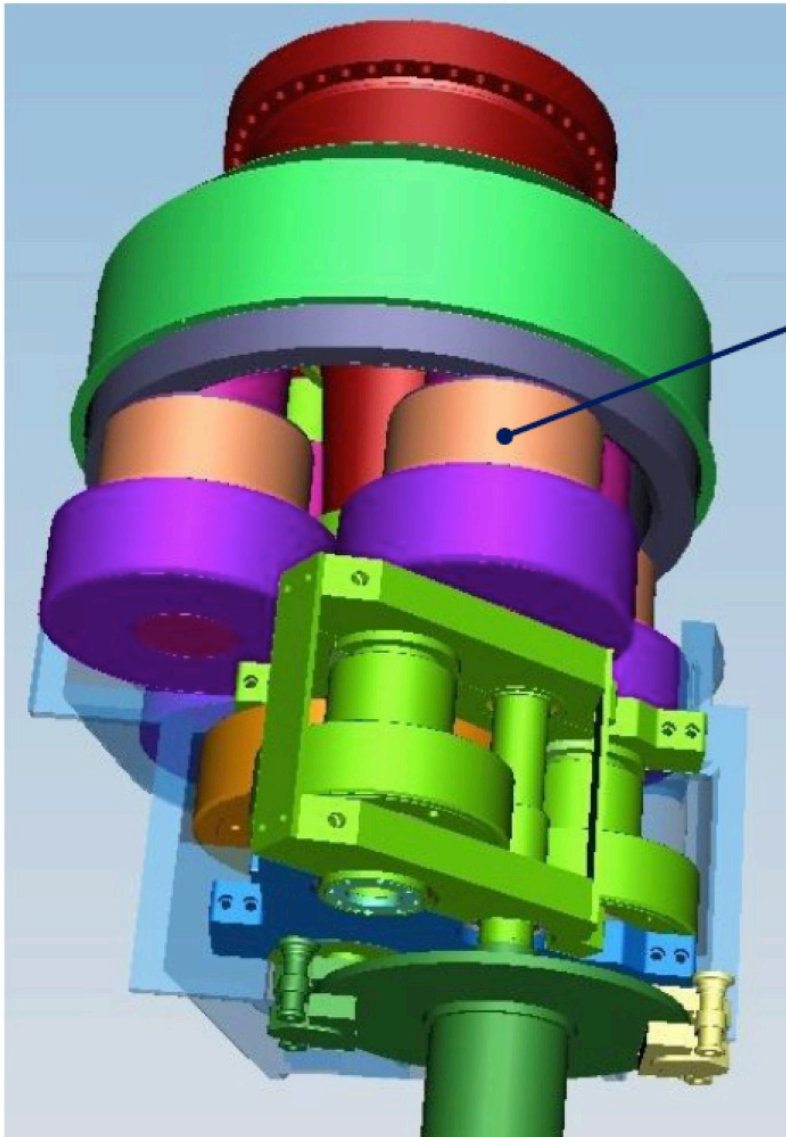
7.5 MW with Static NTL





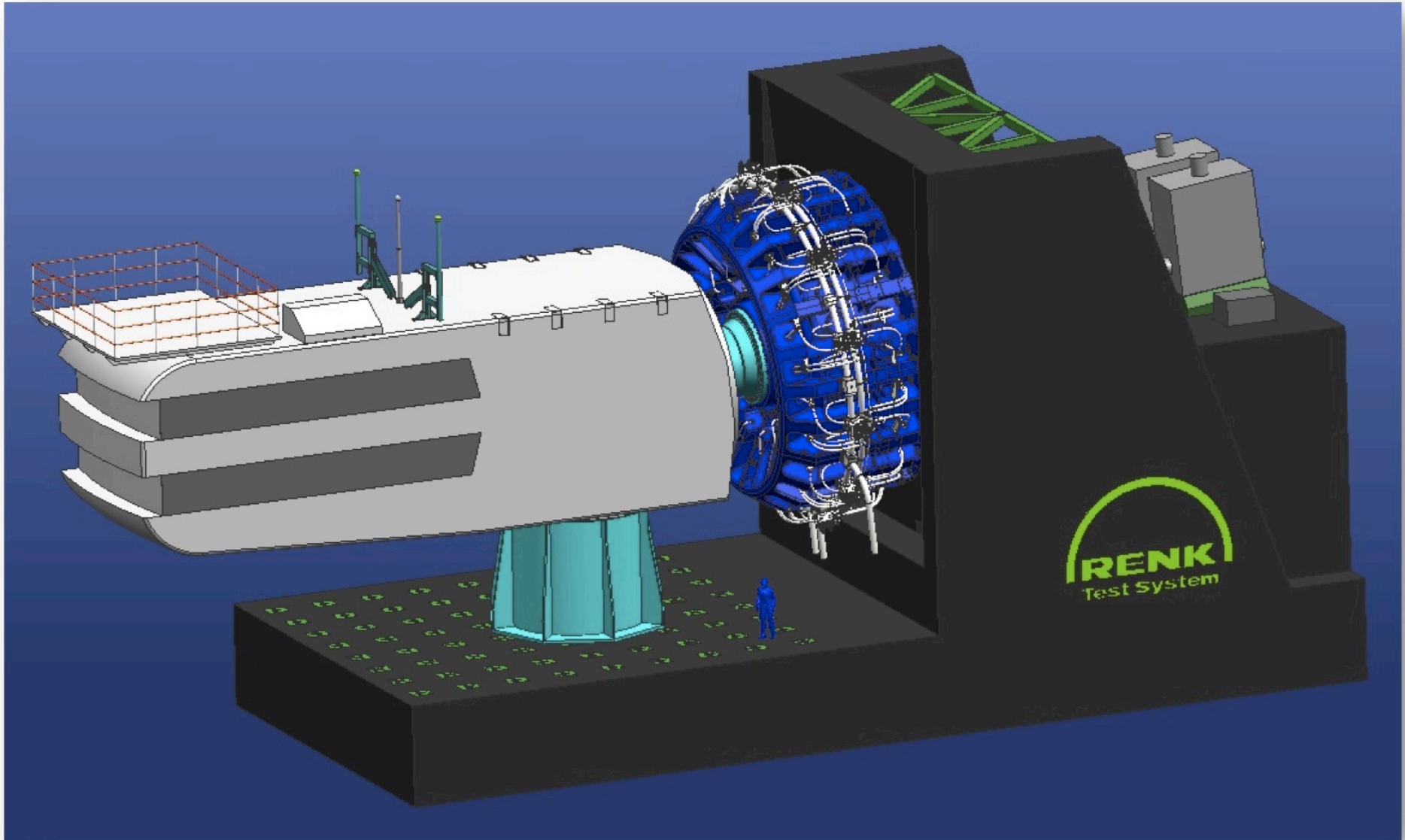
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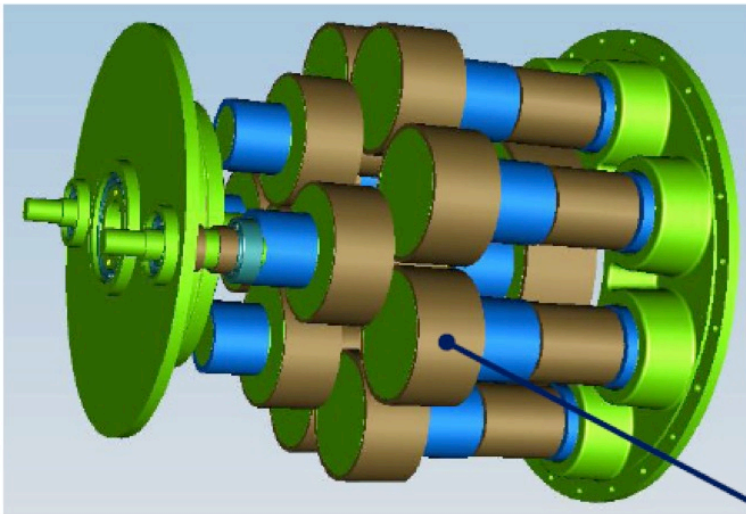
RENK Test System GmbH 



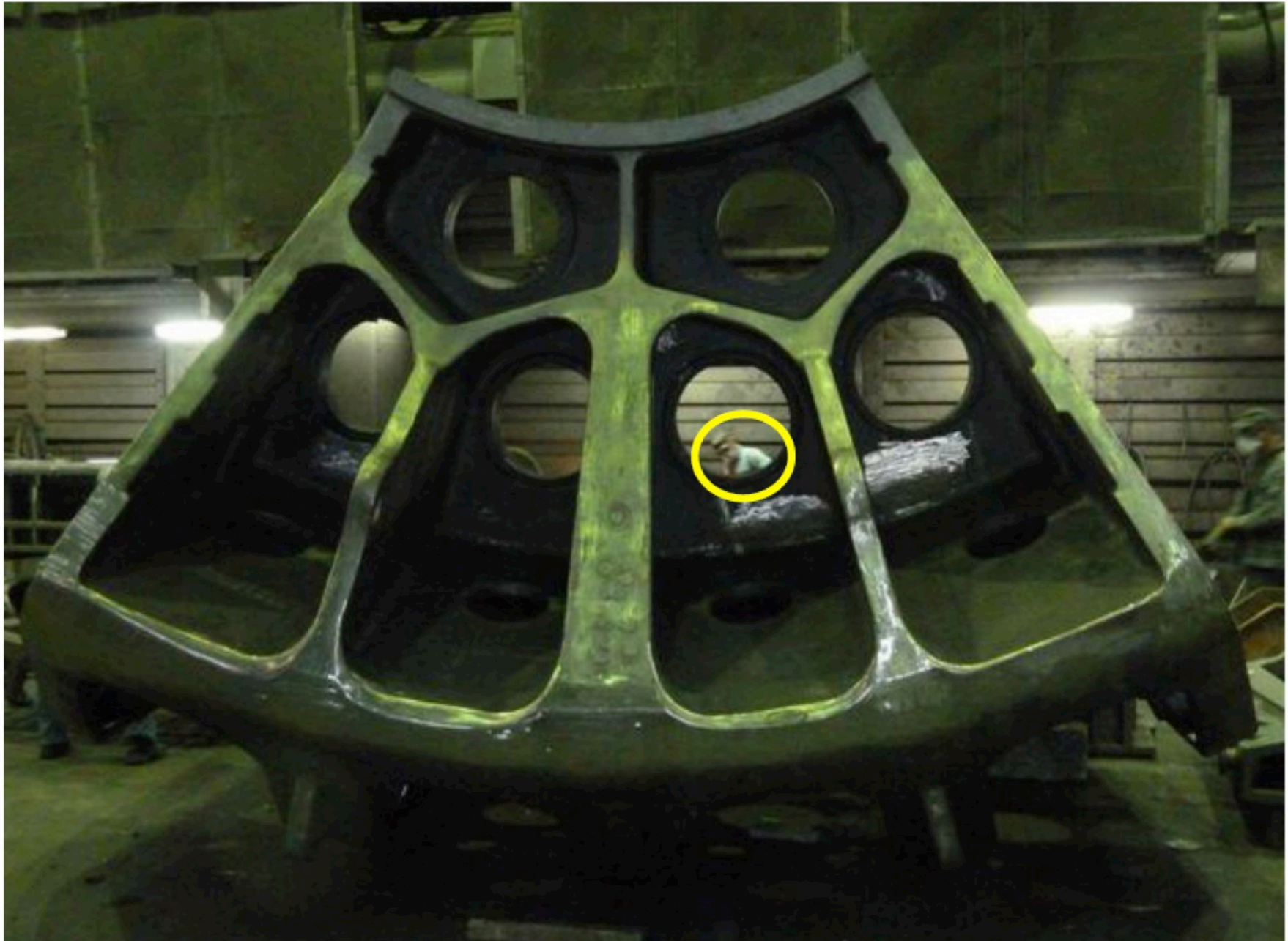
4 offset planet shaft after hardening

15 MW with Dynamic NTL System





4 of 8 offset planets











15 MW Grid Simulator with Hardware-In-the-Loop (HIL)

Vision:

An international center of excellence in grid compatibility and grid security.

Mission:

Accelerate the introduction of new technologies through research, advanced testing, certification and modeling.

Objectives:

1. Provide (1) **High Value**, (2) **High Quality** and (3) **Cost Competitive** research, development, testing and certification services.
2. Establish long term partnerships with public and private partners to promote research, work force development and education in power systems engineering.

15 MW Hardware-in-the-Loop Grid Simulator

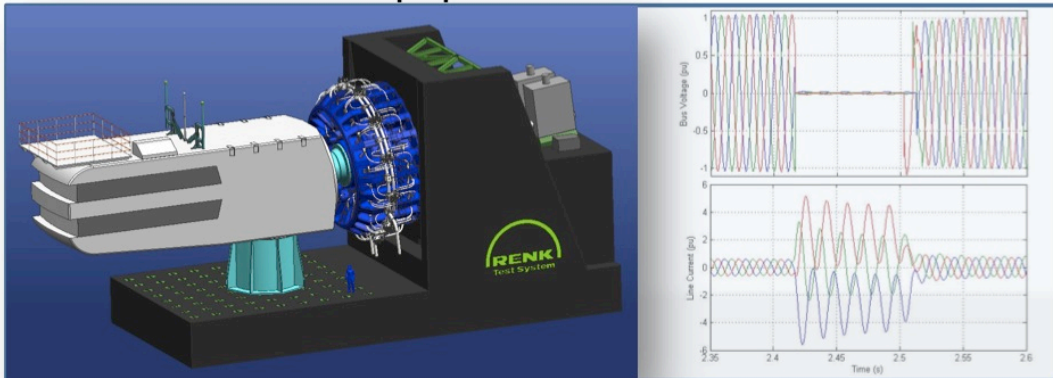


Dedicated Power System Substation

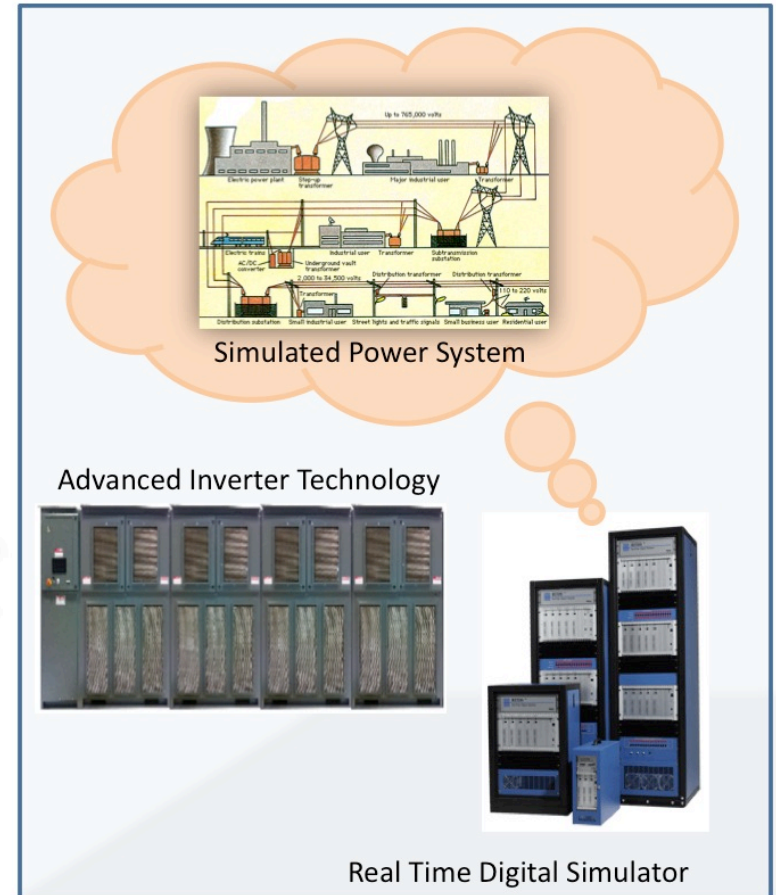


Experimental, prototype, and commercialized electrical equipment can be rigorously tested without exposing the power system to the risks involved with testing.

Electrical Equipment Under Test



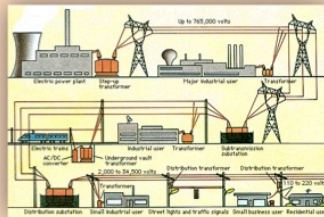
Hardware-in-the-Loop Grid Simulator



A power system is simulated and reproduced in real-time in order to ensure grid compatibility of the device.

Other Applications

Hardware-in-the-Loop Grid Simulator



Simulated Power System

Advanced Inverter Technology



Real Time Digital Simulator

Power system is simulated in real-time in order to ensure proper interaction of the device under test.

Electric Vehicle (EV) Charging Stations



Utility Scale Energy Storage



Large Solar PV Converter



Micro-Grid Applications



Traditional Distributed Generation (Diesel, NG. etc.)





Thank You





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Thank You!

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