



The Small Wind Industry: Applicability for Florida

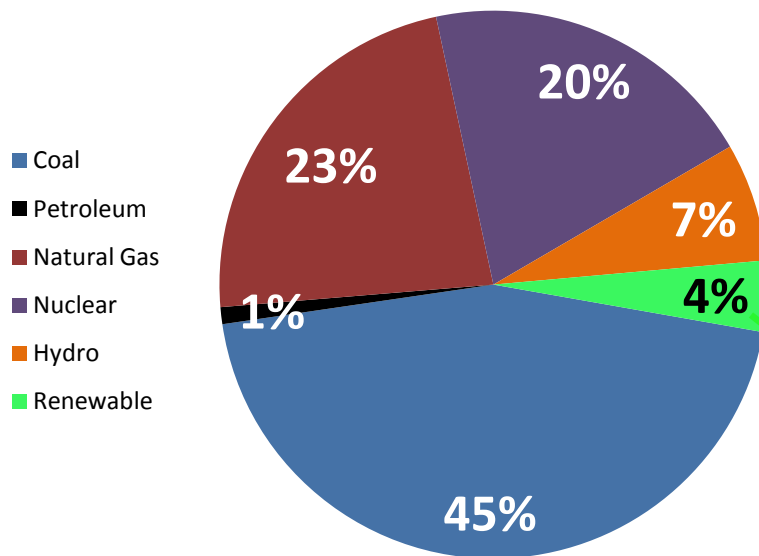
2nd Annual FESC Summit
September 2010

What's So Compelling About Wind?

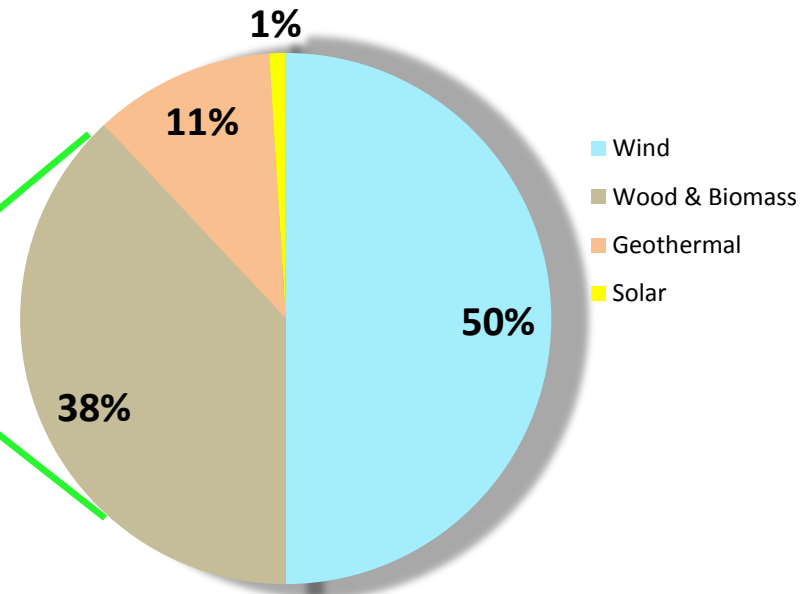
Wind dominates the renewable energy market. Economics is the reason: *Wind energy is the least expensive green power that has already been competing with traditional sources. At current average wholesale prices, wind costs 4.2 cents per kilowatt hour, compared with 4 cents for coal, 6.8 cents for natural gas, 9.1 cents for oil and 10 cents for nuclear power.**

** source: Rocky Mountain Institute*

US Electricity Sources, 2009



Renewable Sources - Detail



Industry size in \$: \$115.9bb (globally) for renewables, \$51.4bb for wind

WIND INDUSTRY ON A MACRO SCALE

ADVANTAGES

RENEWABLE

AVAILABLE GLOBALLY

LARGELY INSULATED FROM **INFLATION**

CLEAN AND CARBON-EMISSION FREE

DOMESTICALLY, THE US HAS THE BEST WIND RESOURCES EASILY ACCESSIBLE – ENERGY INDEPENDENCE AND SECURITY

CHALLENGES

VARIABLE BOTH IN GEOGRAPHY (CLASS) AND TIMING (SEASONAL AND DAY/NIGHT)

OFF-GRID SYSTEMS – STORAGE ISSUES

NOISE / ENVIRONMENTAL / PERMITTING

TRANSPORT / INSTALLATION / MAINTENANCE ON A NATIONWIDE SCALE

UTILITY SCALE PROJECTS REQUIRE LARGE CAPITAL NEEDS, CONNECTIVITY & GRID TRANSMISSION ISSUES

TWO DISTINCT MARKETS WITHIN WIND:

UTILITY SCALE SYSTEMS

100KW AND UP - **99.93%** of capacity face the green and blue obstacles above

SMALL WIND MARKET

BELOW 100KW - **.07%** of installed US capacity face the blue obstacles above

WIND INDUSTRY – WHAT IS POSSIBLE?

The US is the greatest easily-accessible wind resource in the world

Stated policy goal of 20% of US electricity by 2030 (US Department of Energy)

Is it possible?

2008: 25,369 installed MW – 1.26% of electricity demand, a **51%** increase from 2007

Highest Installed capacity: TX, IA, CA, MN, WA

Highest % of Load: MN 7.5%, IA 7.1%, CO 6.0%, ND 4.9%, NM 4.4%

Highest Growth Rates: MI (4,800%), UT (2,100%), NH (1,700%) WI (600%)

Wind Map of US available at: http://www.windpoweringamerica.gov/wind_maps.asp

What is “off the map?”

DOE estimates that offshore wind could supply 100% of US electric needs.

Local 2005 study: Florida has good wind east of I95 (which where the load is)

Small wind market:

17.3MW of installed capacity - Growth rate of **78%** in 2008

30-fold growth expected within 5 years, driven by

consumer and CORPORATE awareness

grid-tie capability nationwide

30% federal ITC

BIG AND SMALL GROWTH

- The US is the greatest easily-accessible wind resource in the world
- Stated policy goal of 20% of US electricity by 2030 (US Department of Energy)
- Highest % of Load: MN 7.5%, IA 7.1%, CO 6.0%, ND 4.9%, NM 4.4%
- Consistent double digit growth rates – even through the **Great Recession**

US ANNUAL WIND CAPACITY

SOURCE: AWEA 2009 Wind Industry Annual Market Report

Year	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
MW Installed	4,151	4,563	6,233	6,629	9,014	11,476	16,725	25,076	35,086
Growth Rates	68.7%	9.9%	36.6%	6.4%	36.0%	27.3%	45.7%	49.9%	39.9%

SMALL WIND INDUSTRY – EVEN GREATER POTENTIAL

US ANNUAL SMALL WIND CAPACITY

SOURCE: AWEA 2009 Wind Industry Small Wind Outlook

Year	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
MW Installed	2,100	5,200	8,400	13,278	16,563	25,128	34,865	52,239	72,539
Growth Rates		147.6%	61.5%	58.1%	24.7%	51.7%	38.7%	49.8%	38.9%

30-fold growth expected within 5 years, driven by consumer and corporate awareness;
grid-tie capability nationwide ; 30% federal ITC

Does the Sunshine State have Wind?

	Wind Strength	Meters / Second	MPH	
	Class 1	< 5.6	< 12.5	
	Class 2	5.6 - 6.4	12.5 - 14.3	Small Scale Windpower Feasible
	Class 3	6.4 - 7.0	14.3 - 15.7	
Utility Scale Windpower Feasible	Class 4	7.0 - 7.5	15.7 - 16.8	
	Class 5	7.5 - 8.0	16.8 - 17.9	
	Class 6	8.0 - 8.8	17.9 - 19.7	

NOAA National Buoy Center Data & Coastal Weather Stations – Class 2 winds or better along approximately **85%** of Florida's Coast.

Inland Climatological Data shows inland class two winds in Apoka / Pensacola and higher class 1 winds in **most major metropolitan markets** – specifics of site selection and height can push many sites into class 2 status.

Source: November 2005 Florida Wind Initiative Study, DOE Wind Powering America Program performed by Advantek Consulting.

Why Are People Buying?

Environmentally Conscious

Economics

Emergency Preparedness

Electric Grid unreliable / non-existent

Leading Edge Adaptors

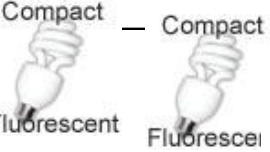
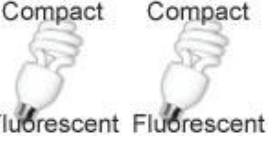




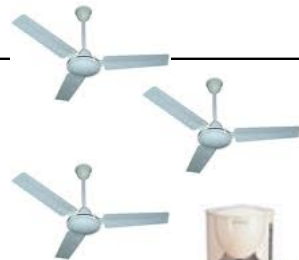






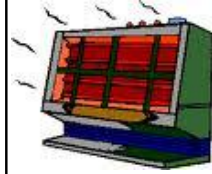
THE ECONOMICS OF SMALL WIND

<u>Metric</u>	<u>Scope</u>	<u>Driving Dynamic</u>	<u>wind m/s</u>	<u>kw /day</u>
Rated Power (k/w)	1.5	<i>Machine Efficiency about 13 mph - light wind</i> →	5.0	7.9
Wind Speed (m/s)	6.0		6.0	11.9
Kilowatts per Day	11.9		7.0	15.6
Days per Year	365		8.0	18.4
Kilowatts per year	4327			
Cost per kilowatt	\$ 0.14	<i>varies in cont. US to 24 cents</i>		
Annual Electric Savings	\$606			
			paybk	
			in years	
Installed Cost	\$ 6,500		10.7	
- Federal Tax Credit @30%	\$ (1,950)	<i>nationwide and stable</i>	(3.2)	
- State / Local Tax Credit @5%	\$ (325)	<i>varies from 0-50%, also local</i>	(0.5)	
Net Out of Pocket	\$ 4.225		7.0	
			<i>Each 1 cent rise in kwh cost will lower paybk by ½ year</i>	
Installed Cost	\$ 6,500			
- Tower	\$ (900)	<i>"Airstream costs" – getting up in the wind - can be 20% of total system cost</i>		
- Installation	\$ (500)			
Delivered Cost	\$ 5,400			

The "big levers" are in Green

EMERGENCY POWER FOR ESSENTIALS

- Power all of these items – depending upon wind and system capacity.
- May vary upon personal usage.

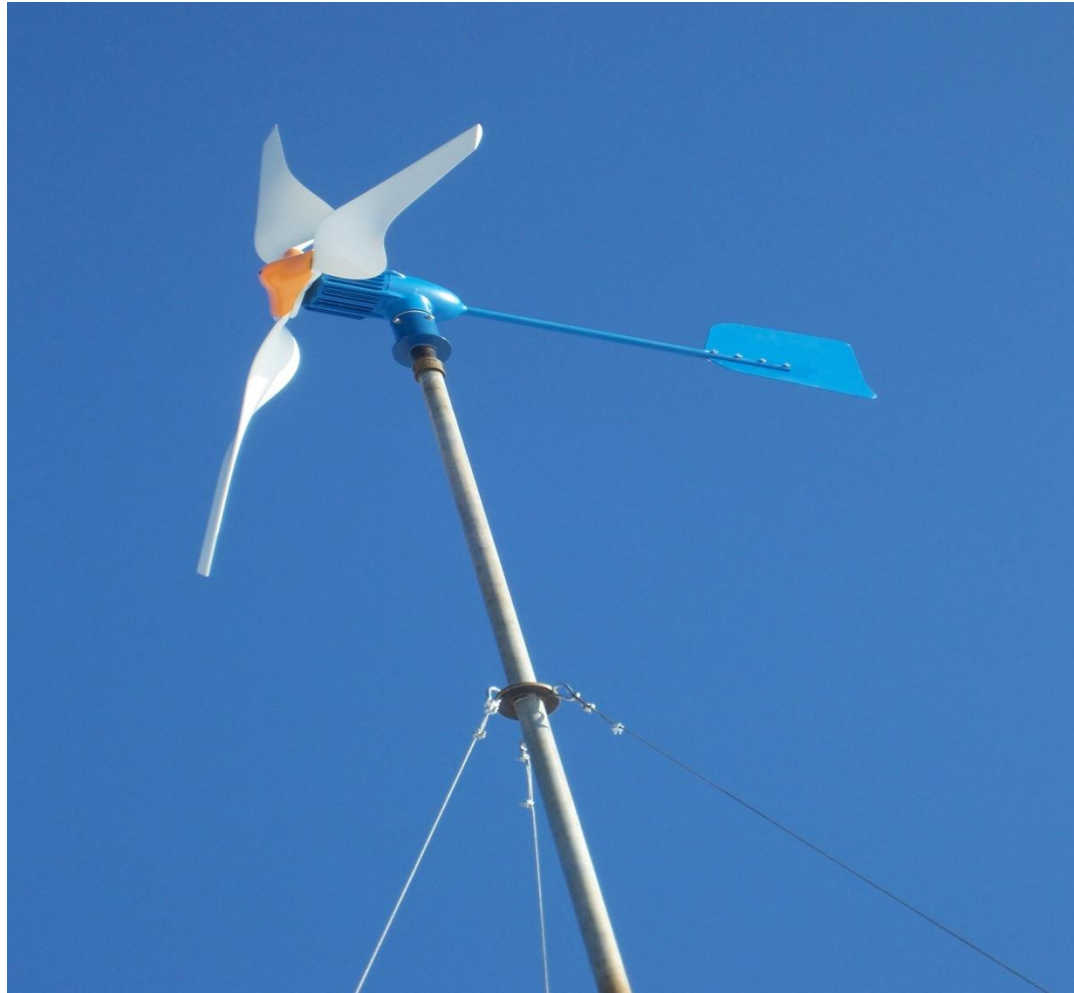
Watt Hours/Day	2800Wh	5800Wh	9300Wh	12,900Wh	16,200Wh
 Compact Fluorescent  Compact Fluorescent    	    Water Heater	 Water Pump 			
Average Annual Wind Speed	mph 7.6 m/s 3.5	mph 10 m/s (4.5)	mph 12 m/s (5.4)	mph 14 m/s (6.3)	mph 16 m/s (7.2)

OFF-THE-GRID SYSTEM (integrated w/ solar)



1 kw model in operation (hybrid system with solar panels)

GRID-TIED INSTALLATION



1kw model showing 1st generation “swept blade” design

HYBRID SYSTEM SUPPLEMENTING GRID

Canary Islands
Implementation –
hybrid system to
supplement
unreliable &
expensive electric
service



Recent Technology Advances

- ✓ Blade design-passive flow control to prolong point of separation
- ✓ Integrates with solar
- ✓ Permanent magnet generators – no maintenance
- ✓ Patented “Jet-tube” for greater efficiency and quietness
- ✓ Aerodynamic and electronic braking
- ✓ 12, 24 or 48V convertible configuration



BASIC SYSTEM UNDERSTANDING

An educated sales force needs to understand that a wind system contain multiple components that vary with the configuration. They should be *designed to work together* to provide maximum efficiency:

- ✓ **Turbine** – Produces the power. WindE combines patented ultra-quiet blade technology with permanent magnet, direct drive generators (no gearbox).
- ✓ **Tower** – Holds the turbine in the wind stream. WindE provides 30-foot lattice towers, and other options are available.
- ✓ **Solar Panels** – We provide US-made Solar panels (but our systems can work with multiple suppliers).
- ✓ **Hybrid Charge Controllers** – Plug-in capability for simultaneous use of wind power (AC current) and solar power (DC current), provides electronic braking mechanism, and can be configured to 12, 24 or 48 volt applications.
- ✓ **Batteries** – Provide the power reserve to store energy in off grid systems, or provide backup power capabilities for grid-tie systems. WindE strongly recommends, and can provide, batteries specifically tailored for renewable energy systems.
- ✓ **Inverters** – Convert DC battery power back to AC current for direct use by the homeowner (off-grid applications), and can step up the voltage to feed back into the grid (grid-tie).
- ✓ **Smart Switch** – Allows your system to react to changing power conditions between your renewable system and the grid.
- ✓ **Smart Meter** – Provided by your utility, it credits you for the power produced by your system.

CONFIGURATION DEPENDS ON NEED

If you want to:	Your System is:	Then you will need:	Estimated Consumer Results	To Consider:
Provide Power where there is none (a cabin, remote village)	Off-Grid Hybrid System	Turbine Tower Solar Panels,400W Hybrid Controller Batteries Off-Grid Inverter Installation	<u>Estimated Retail</u> MSRP: \$6,900** Net Retail w/Incentives: \$4,485* <u>Estimated Power Production:</u> Annual kWh: 5,276 kWh value: \$739 <u>Estimated Payback:</u> Payback years: 6.07	The battery bank is your power reservoir: more batteries = bigger power reserve
Have emergency power in case of power failure to run critical functions (refrigerator, lights) and reduce the electrical bill	Off-Grid Hybrid Smart System	Turbine Tower Solar Panels,1000W Hybrid Controller Batteries Off-Grid Inverter Smart SWITCH Installation	<u>Estimated Retail</u> MSRP: \$8,700 Net Retail w/Incentives: \$5,655* <u>Estimated Power Production:</u> Annual kWh: 6,267 kWh value: \$877 <u>Estimated Payback:</u> Payback years: 6.45	Tie into circuit panel for critical items (fridge) with renewable power. If reserve is low, smart switch pulls from the grid. If grid goes down, renewable reserve runs critical circuits.
Reduce your current electric bill as much as possible	Grid-Tie Hybrid System	Turbine Tower Solar Panels,1000W Hybrid Controller 2kw Grid-Tie Inverter Smart METER Installation	<u>Estimated Retail</u> MSRP: \$8,900 Net Retail w/Incentives: \$5,785* <u>Estimated Power Production:</u> Annual kWh: 6,700 kWh value: \$938 <u>Estimated Payback:</u> Payback years: 6.17	Utility supplies a smart meter for free or very little cost. Grid-Tie inverter "runs meter backwards" -every watt of renewable power, lowers your net electricity usage.
Reduce your current electric bill as much as possible AND have emergency power in case of electric failure	Grid-Tie Hybrid Smart System	Turbine Tower Solar Panels,1000W Hybrid Controller Batteries 3.5kw Grid-Tie Inverter Smart SWITCH Smart METER Installation	<u>Estimated Retail</u> MSRP: \$9,800 Net Retail w/Incentives: \$6,370* <u>Estimated Power Production:</u> Annual kWh: 6,700 kWh value: \$938 <u>Estimated Payback:</u> Payback years: 6.79	Any power produced from renewable system charges batteries to max reserve, then the Smart Switch feeds power back into the grid. If the grid goes down, you now have a fully functional off-grid system with battery reserves.

HOW YOU VIEW THE FUTURE MAY DETERMINE THE SHAPE OF THE FUTURE

Suppose we constructed a nationwide network of wind tunnels?

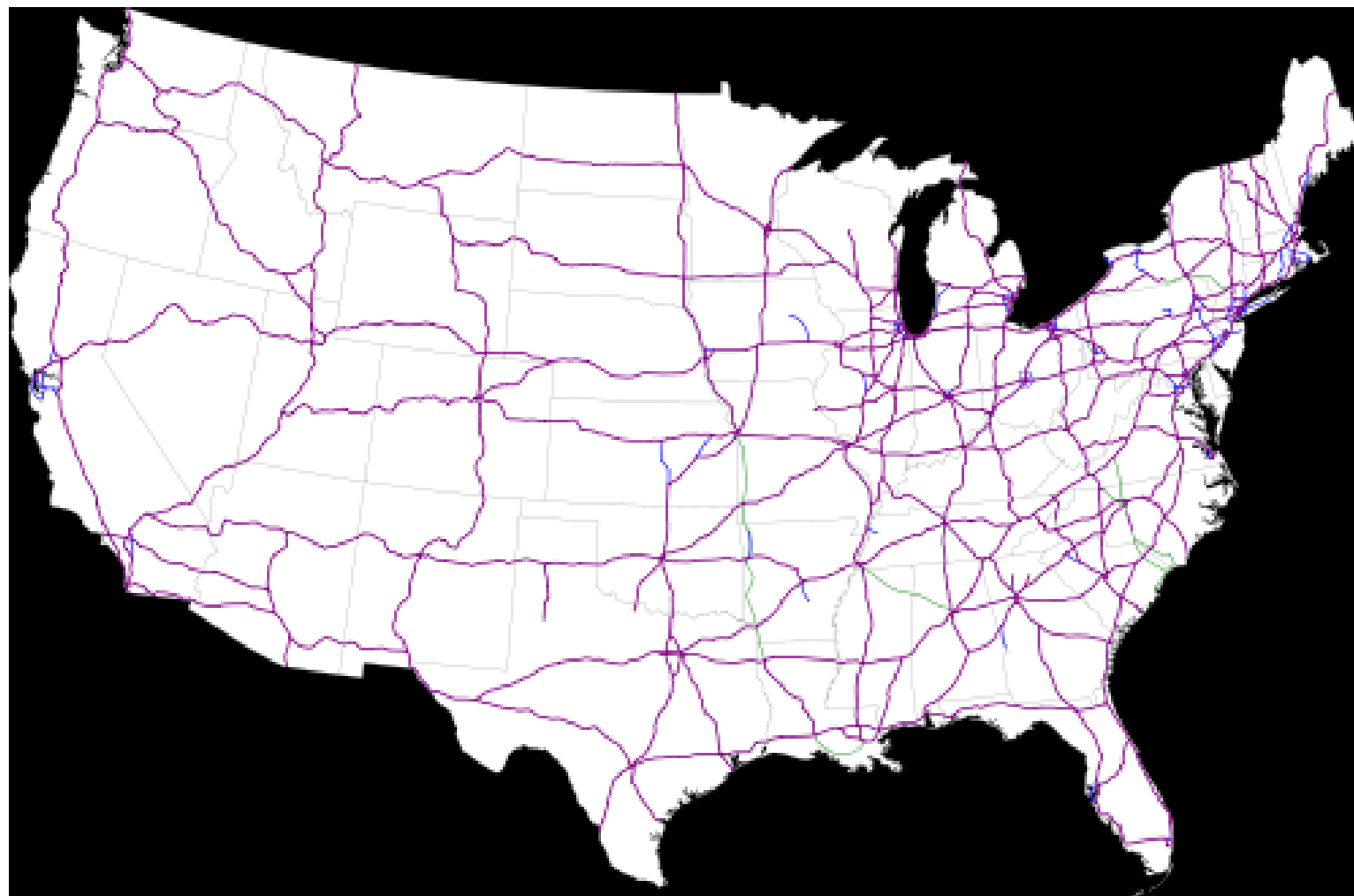
Suppose we build tunnels where the load (population) is?

Suppose we produced wind there for 16 hours+ every day?

Suppose we run the tunnels more during the day when the load is highest?

Supposed it crossed the existing grid at multiple points, so you could build in an infinite amount of “switching options” in case of failure in one part of either system?

Suppose we placed the tunnels on the ground to eliminate much of the “airstream costs”?



Tomorrow's wind tunnel map?

Thank you for your time and attention.



May the wind be always at your back...
(.....and blowing at 10 meters per second).

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