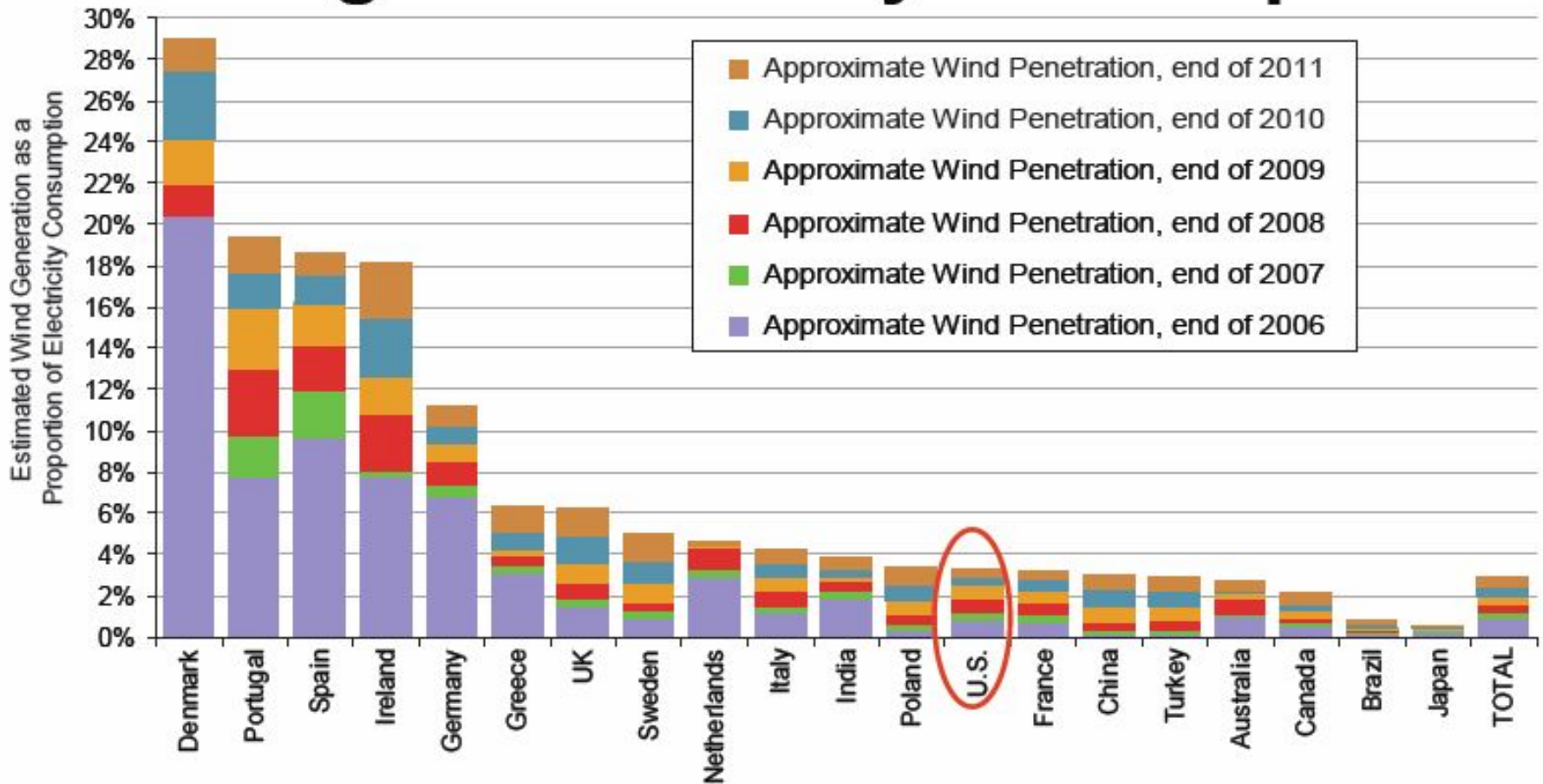




BEING ABOVE AVERAGE IN AN ALL OF THE ABOVE ENERGY WORLD

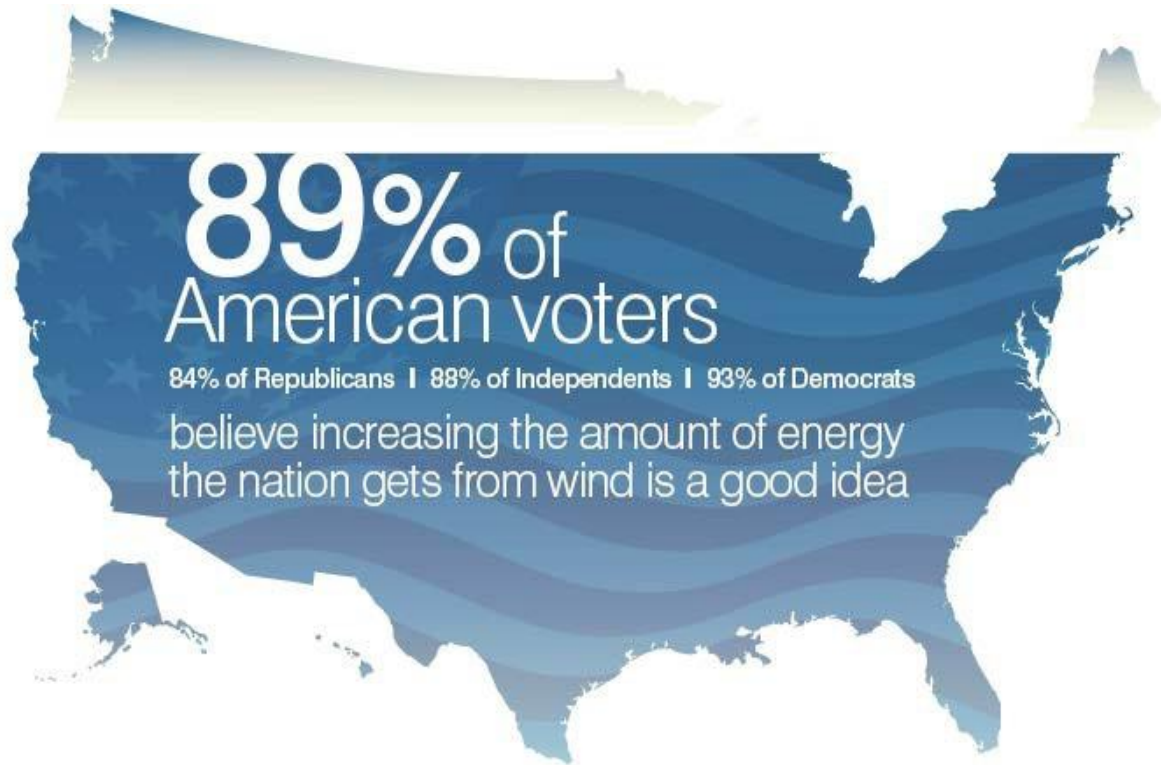
Jim Walker
EDF Renewable Energy
October 2012

U.S. Lagging Other Countries in Wind As a Percentage of Electricity Consumption

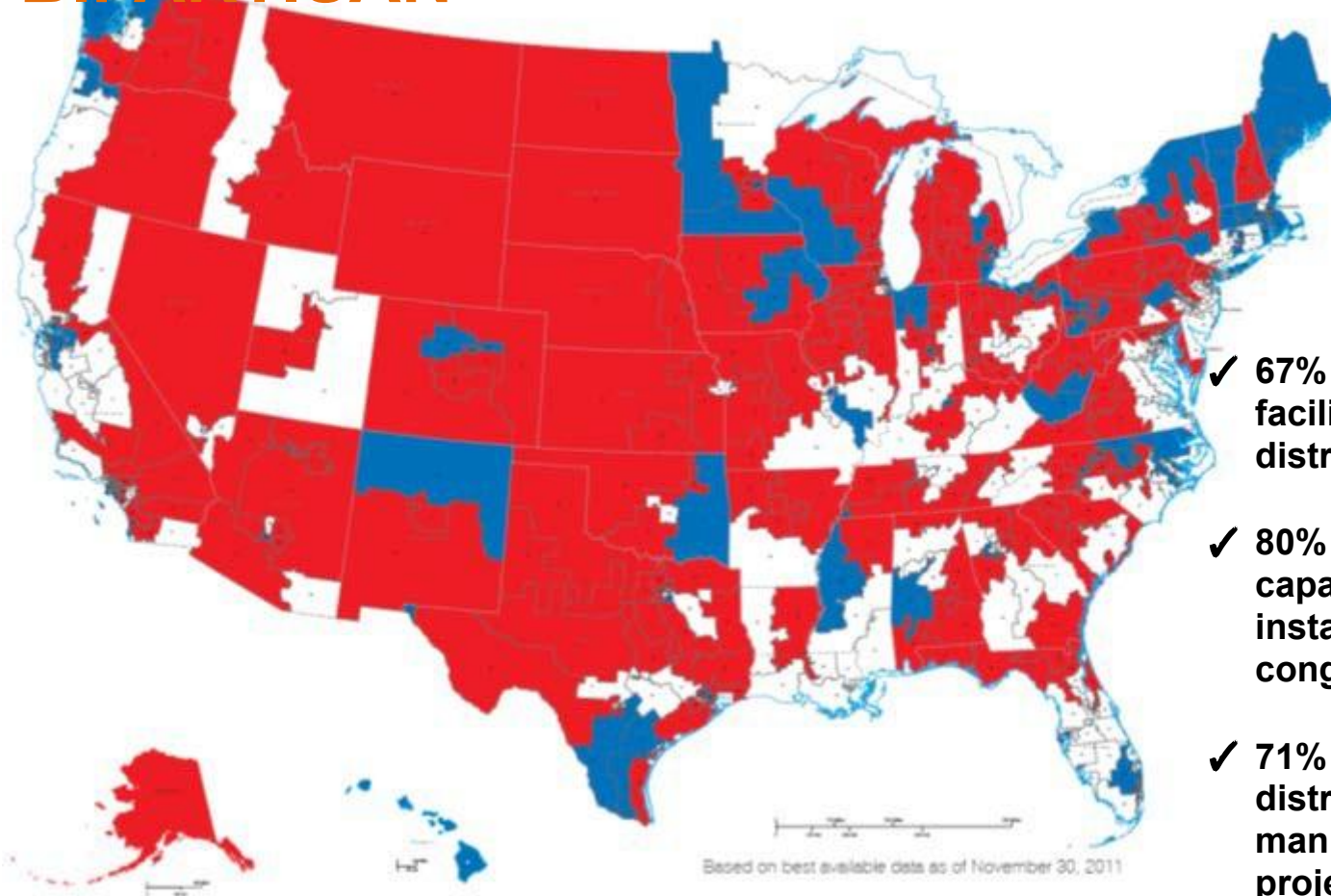


Wind Power in the U.S. Today

- The U.S. wind industry hit **50,000 MW** of cumulative wind capacity during August 2012
- Wind energy costs continues to decline making wind energy cheaper than new nuclear or coal plants and close to competitive with natural gas in the United States



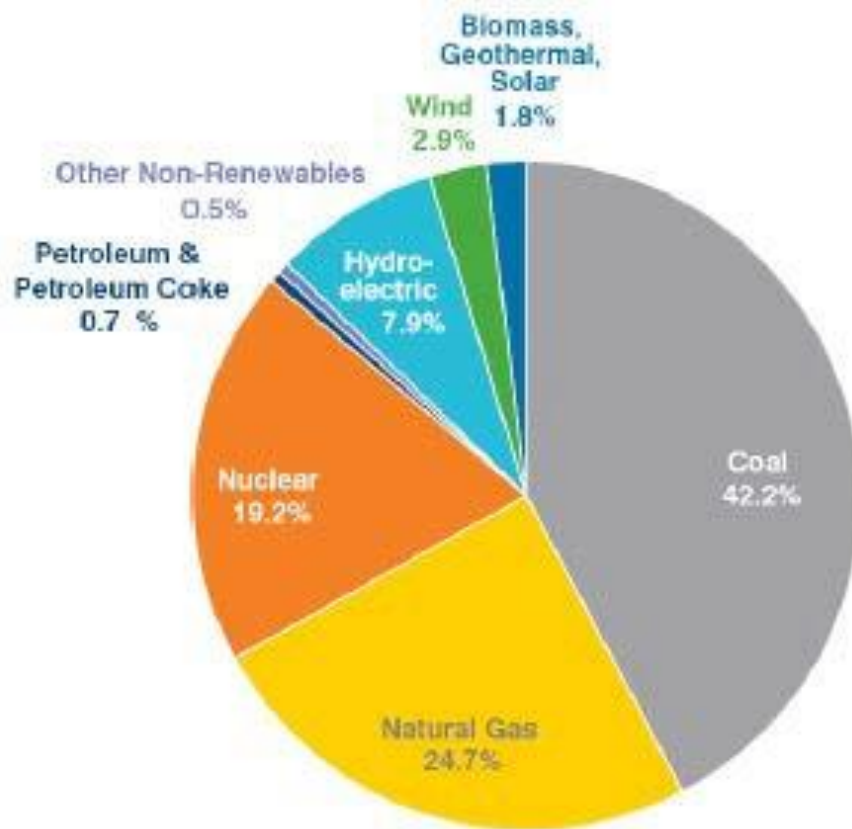
WIND IS TRULY BIPARTISAN



- ✓ 67% of wind manufacturing facilities are in GOP districts.
- ✓ 80% of the wind turbine capacity in the U.S. is installed in GOP congressional districts.
- ✓ 71% of all Republican districts have wind manufacturing or a wind project

Wind Projects & Wind-Related Manufacturing Locations, by Congressional District

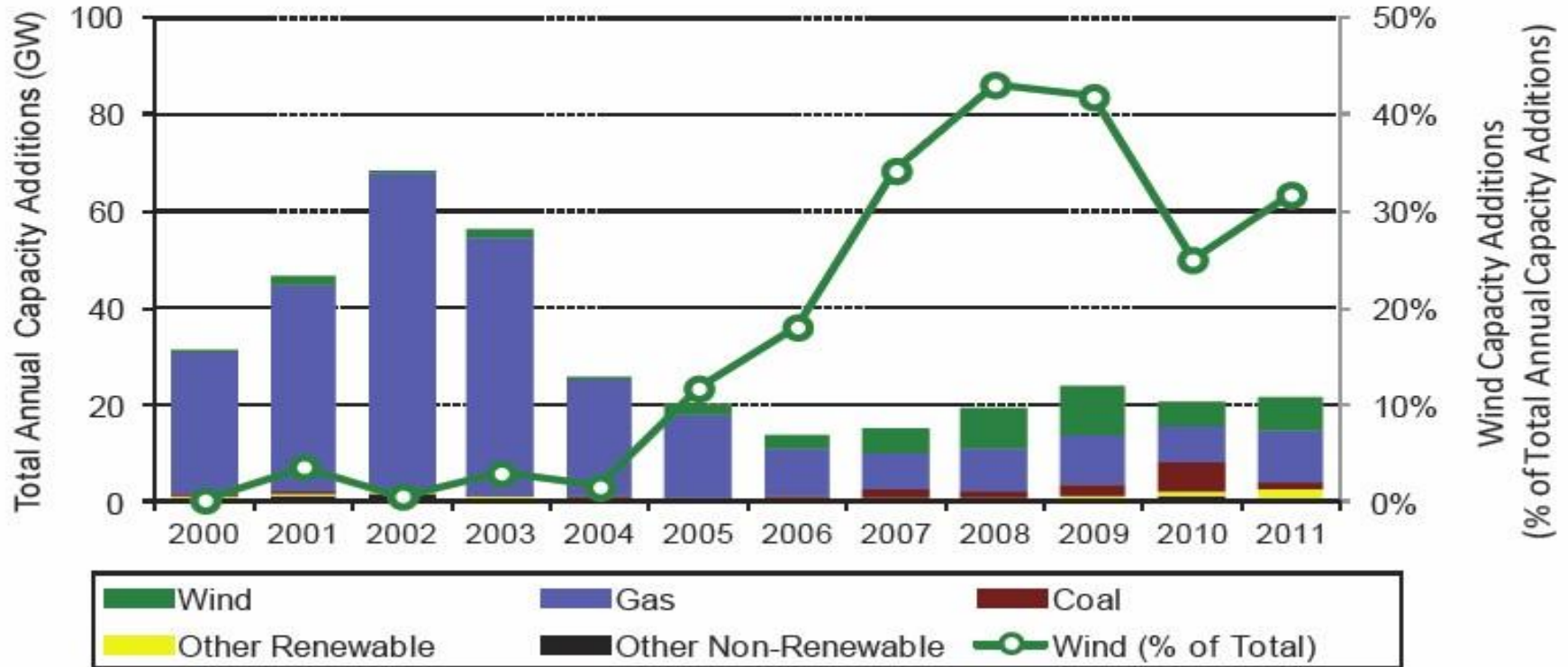
U.S. Electricity Generation Mix in 2011



In first 6 months of 2012 gas and coal had equal shares of production

- Wind provided 2.9% of U.S. electricity in 2011
- Electricity from wind power capacity in the U.S. will supply the equivalent of: **12.2 million** American homes. Also equivalent to output of **11 nuclear power plants** and **44 coal-fired power plants**

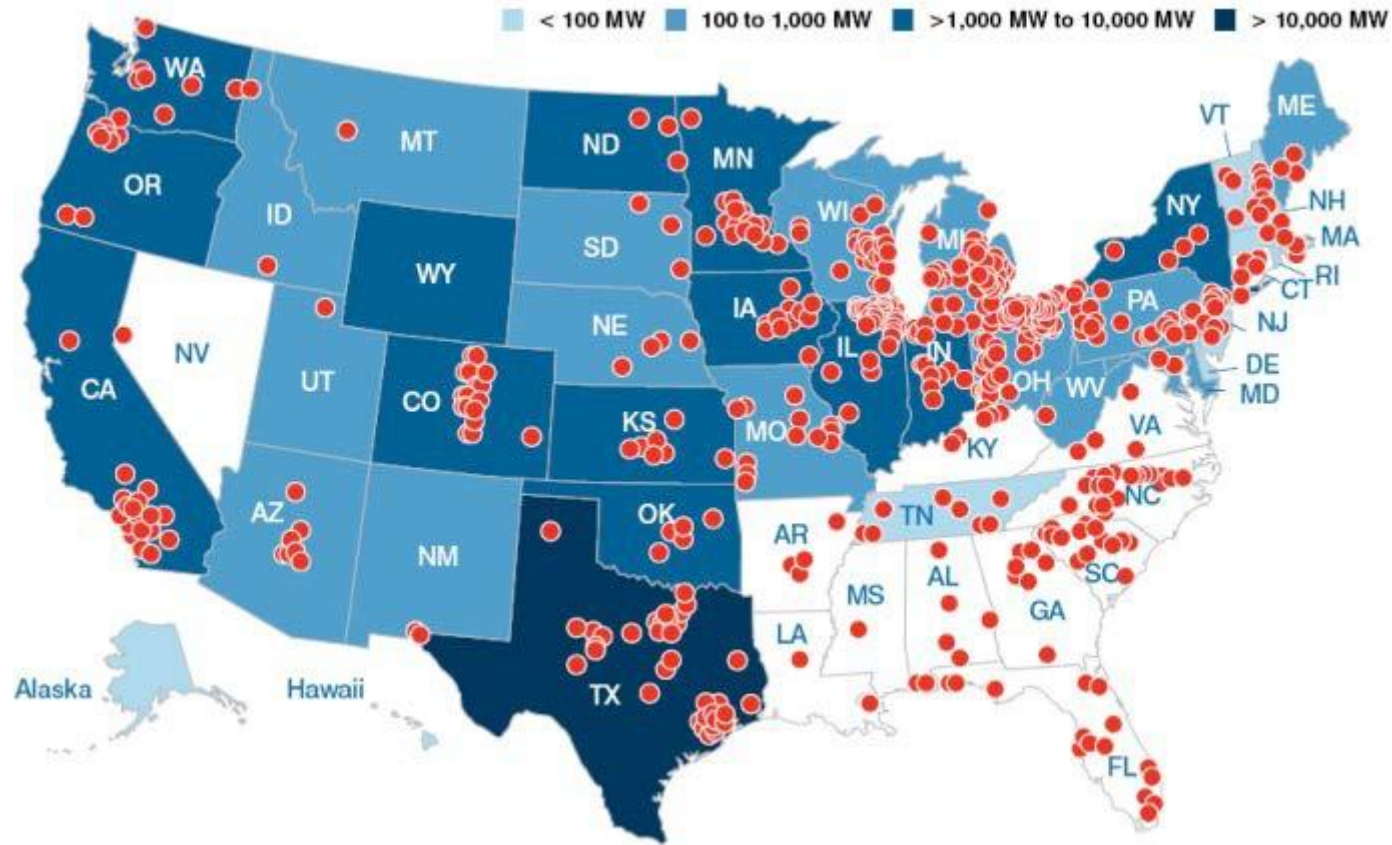
Wind Power Comprised 32% of Electric Generating Capacity Additions in 2011



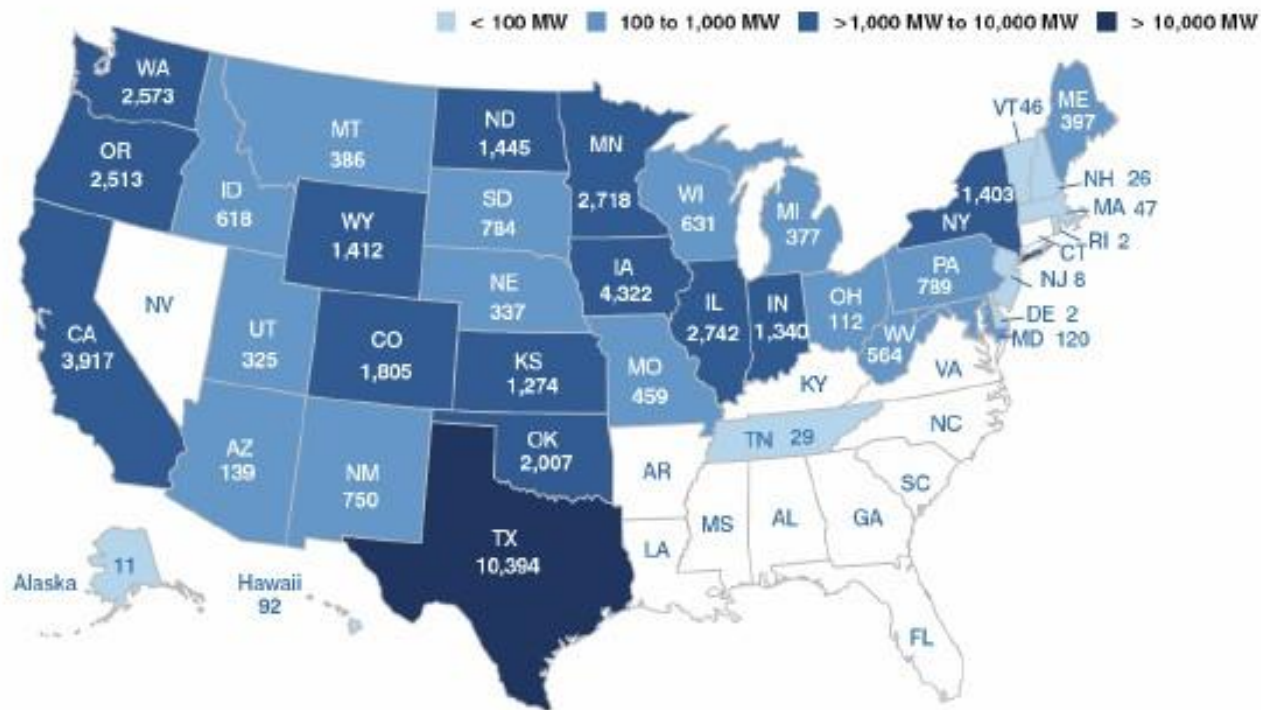
- Wind power in 2011 was again the 2nd-largest resource added (after gas, and for the 6th time in the past seven years)

Wind Manufacturing Growth

- 472 facilities in 44 states
- 12 fold growth over four years
- Domestic content up to 67% from 25%

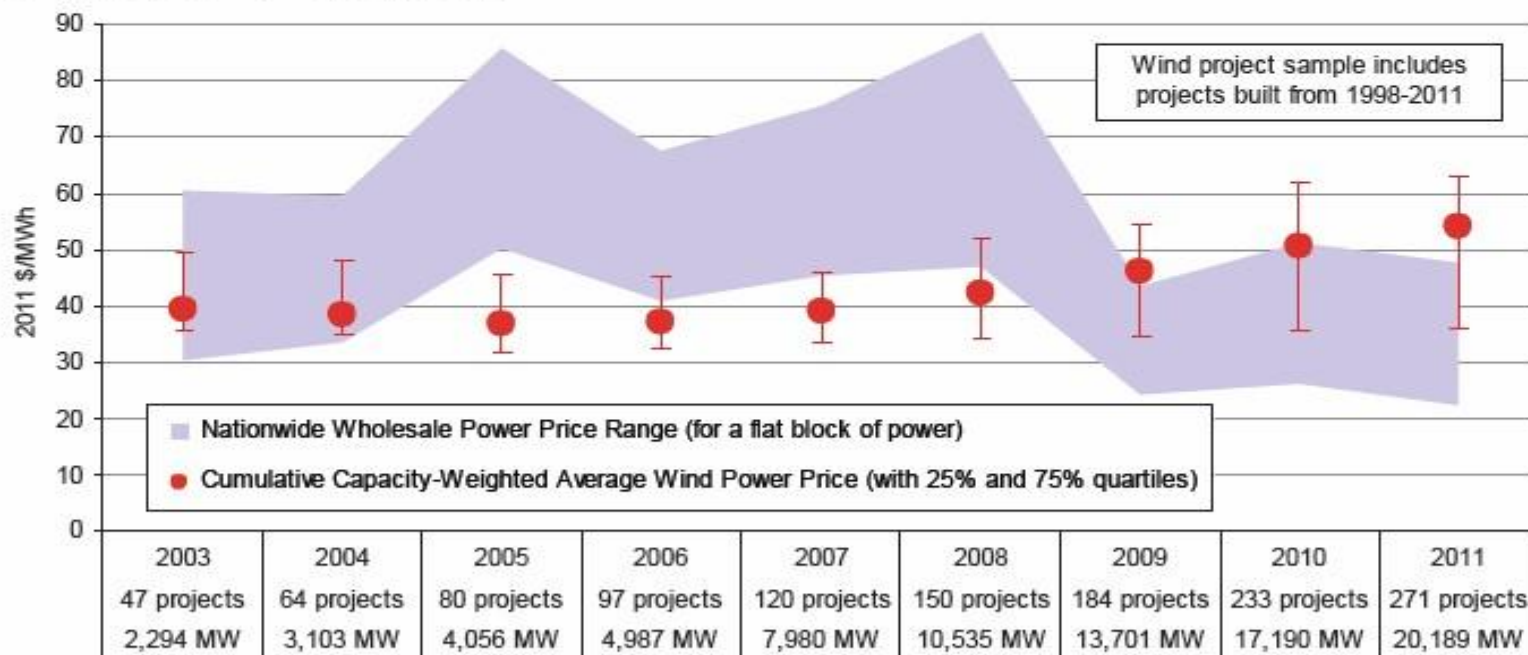


U.S. Wind Power Capacity Installations by State in 2011



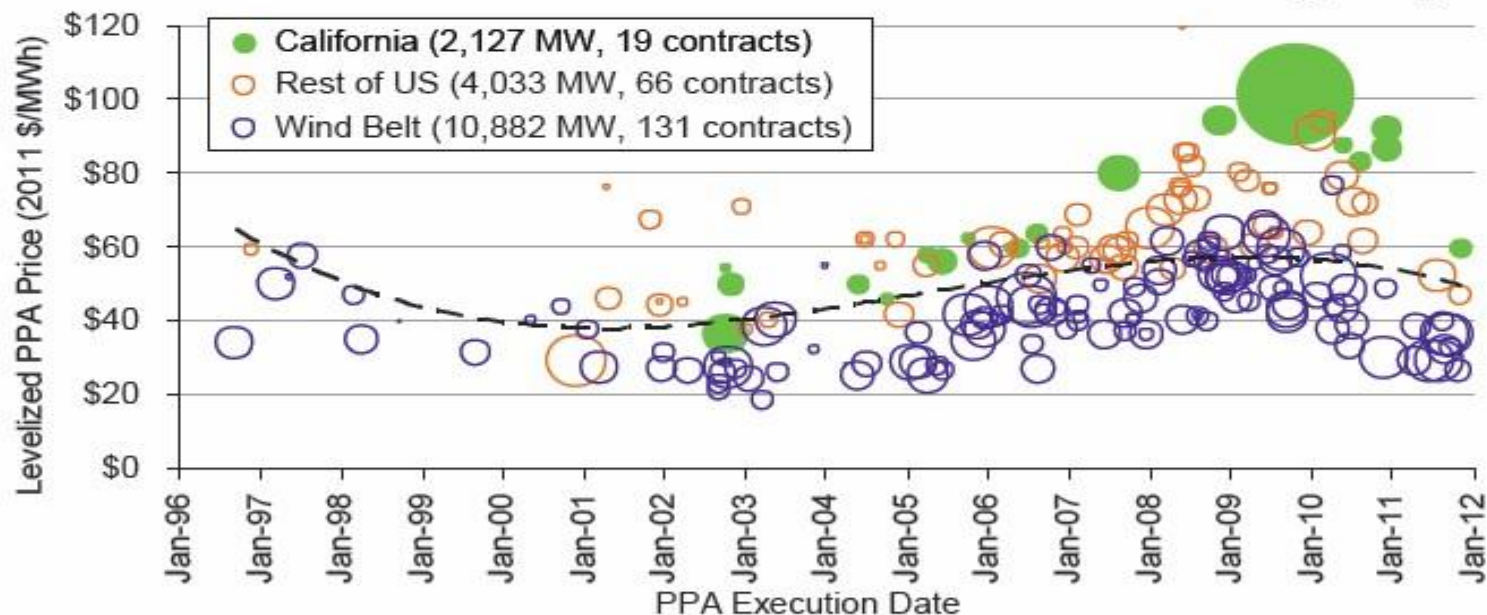
- » 38 states have utility-scale wind installations.
- » 14 states have more than 1,000 MW installed.

Low Wholesale Electricity Prices Continued to Challenge the Relative Economics of Wind Power



- Wholesale price range reflects flat block of power across 23 pricing nodes across the U.S.
- Recent wholesale prices reflect low natural gas prices, driven by weak economy and shale gas
- Price comparison shown here is far from perfect – *see full report for caveats*

Focusing on a Smaller Sample of Full-Term PPAs Demonstrates that Levelized Wind Prices Declined in 2011 and Vary by Region

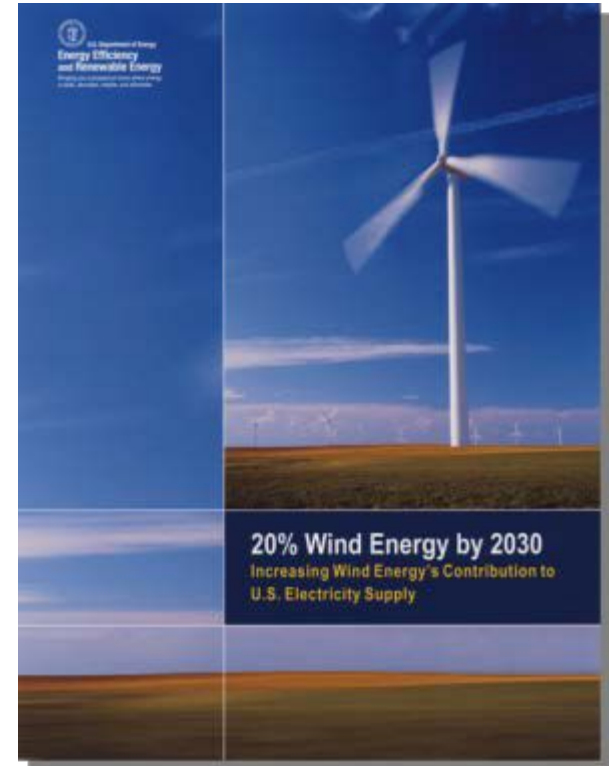


Full-term (rather than historical) data allow for a calculation of levelized prices over the entire PPA duration

Among the sample of PPAs signed in 2011, the capacity-weighted average levelized price is \$35/MWh, down from \$59/MWh for PPAs signed in 2010 and \$72/MWh for PPAs signed in 2009

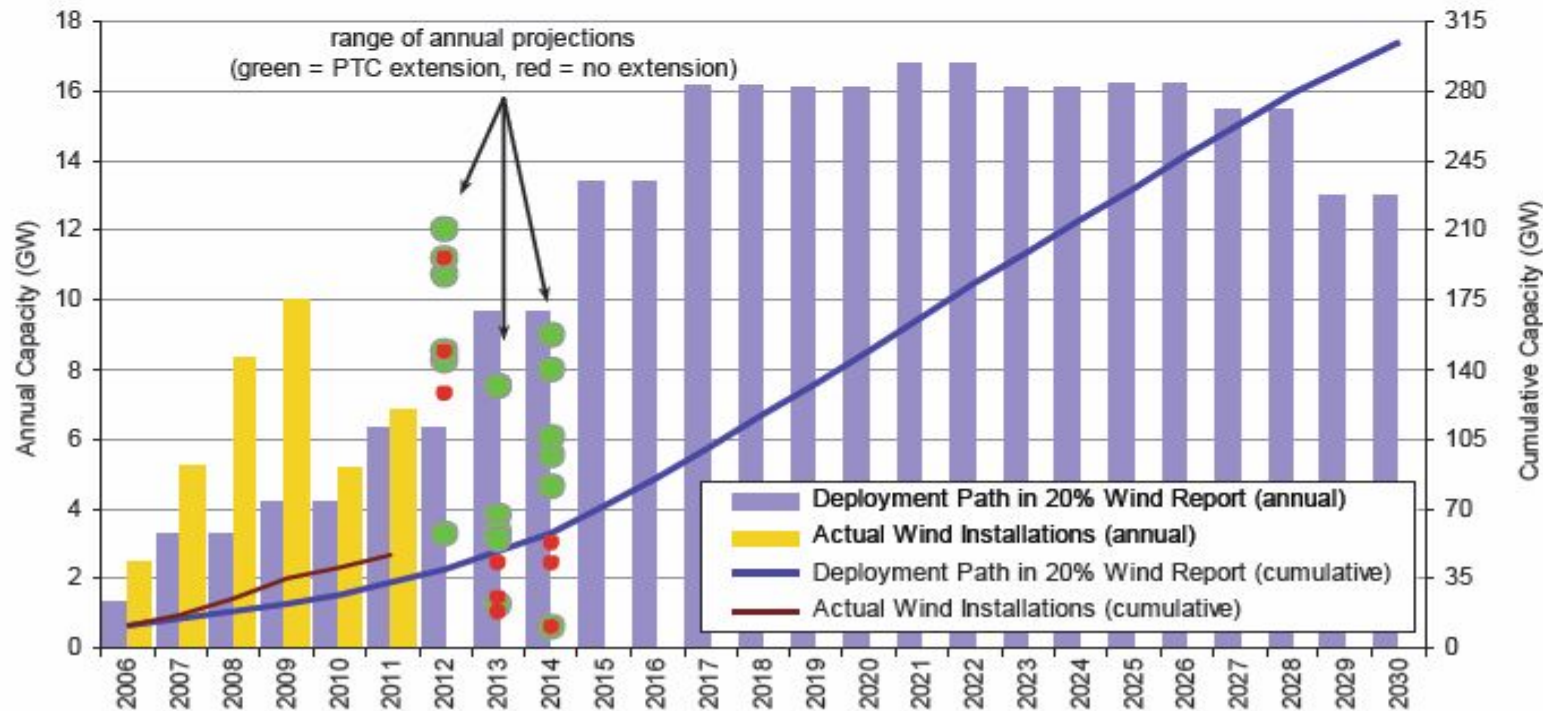
Future Potential of Wind Energy in the U.S.

- 20% Wind Energy by 2030 - Bush Administration Report Identifies the Path
- U.S. Department of Energy: “The U.S. possesses sufficient and affordable wind resources to obtain at least 20% of its electricity from wind by the year 2030.”
- Over 500,000 total jobs would be supported by the wind industry
- 46 states would have wind development by 2030 under the 20% Vision
- Avoids construction of 80 GW of new coal power plants



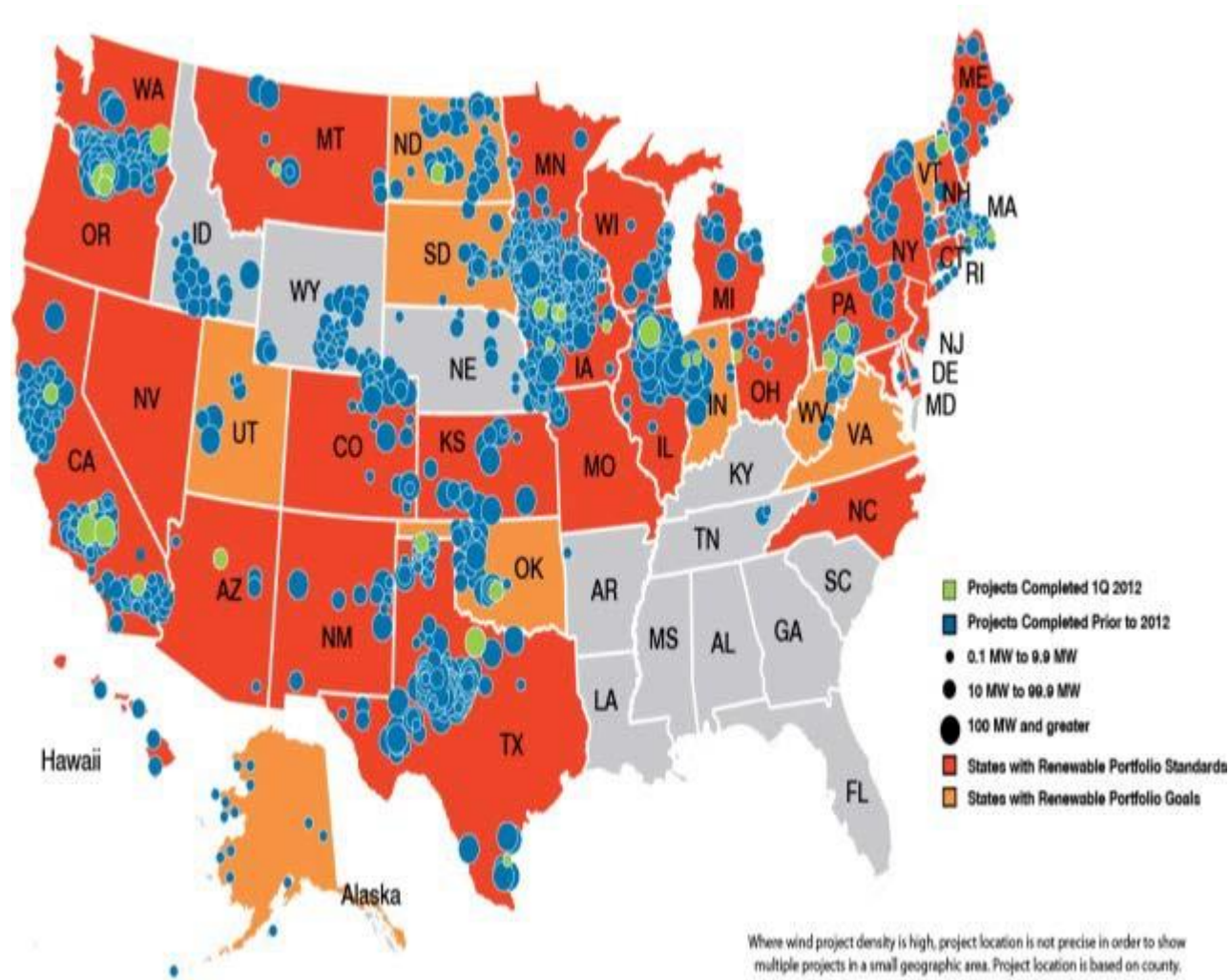
U.S. Is on a Trajectory that May Lead to 20% of Electricity Coming from Wind

But ramping up further to ~16 GW/year and maintaining that pace for a decade is an enormous challenge, and is far from pre-determined; forecasts for growth in 2013 and 2014 are below the 20% trajectory



Key Policy Drivers in the U.S. - RPS

- State RPS: State Renewable Portfolio Standards have created a market for wind with over 90% of the renewable energy build in states with RPS programs or goals.



Uncertainty Reigns in Federal Incentives for Wind Energy Beyond 2012

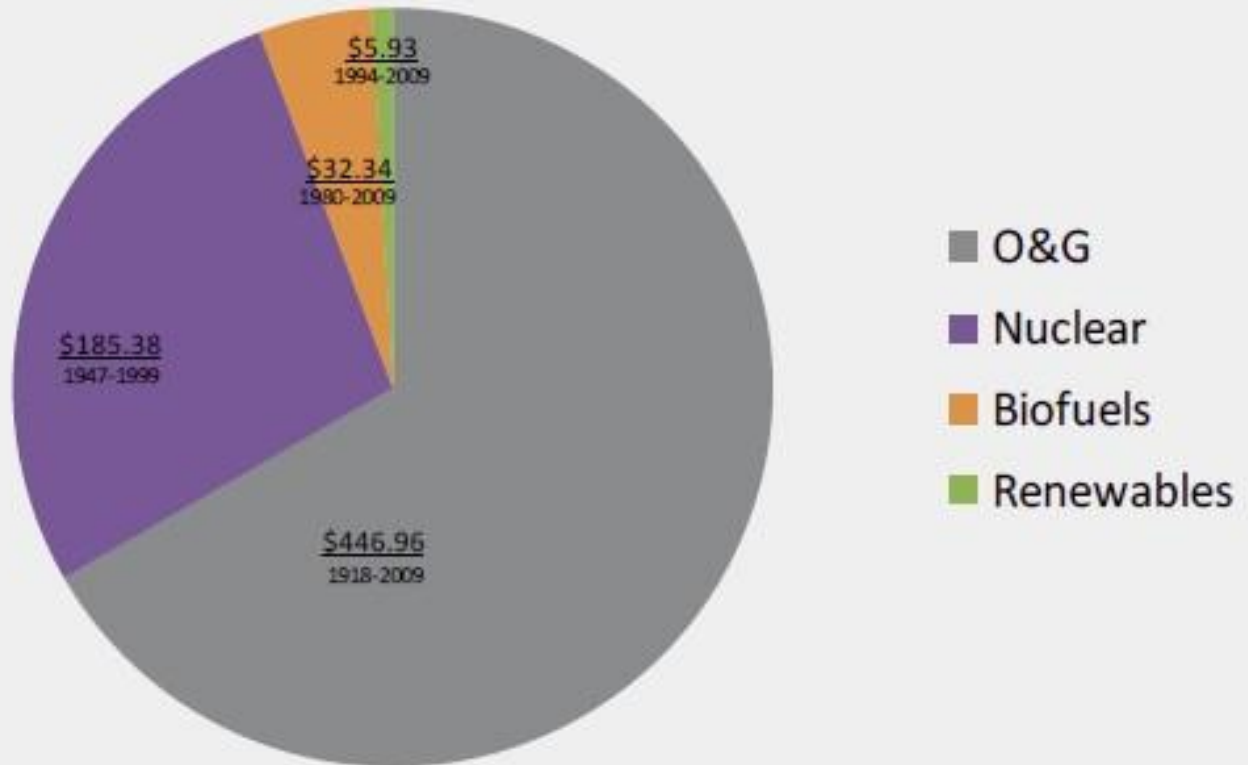
- Commercial wind projects placed in service before the end of 2012 have access to either the PTC or ITC
- Treasury cash grant program available for projects that were under construction by the end of 2011 and placed in service by the end of 2012
 - > 60% of the new wind capacity installed in 2011 elected the cash grant
- First-year “bonus depreciation” at 100% through 2011; reverted back to 50% for 2012 (and slated to disappear altogether in 2013)
- The Section 1705 loan guarantee program has wound down: program closed on four loan guarantees to wind projects totaling 1,024 MW, 285 MW of which were online by the end of 2011
- **With PTC, 30% ITC, 30% cash grant, and bonus depreciation all currently scheduled to expire at the end of 2012, the wind sector is currently experiencing serious federal policy uncertainty, and therefore rushing to complete projects by the end of the year**

PRODUCTION TAX CREDIT (PTC)

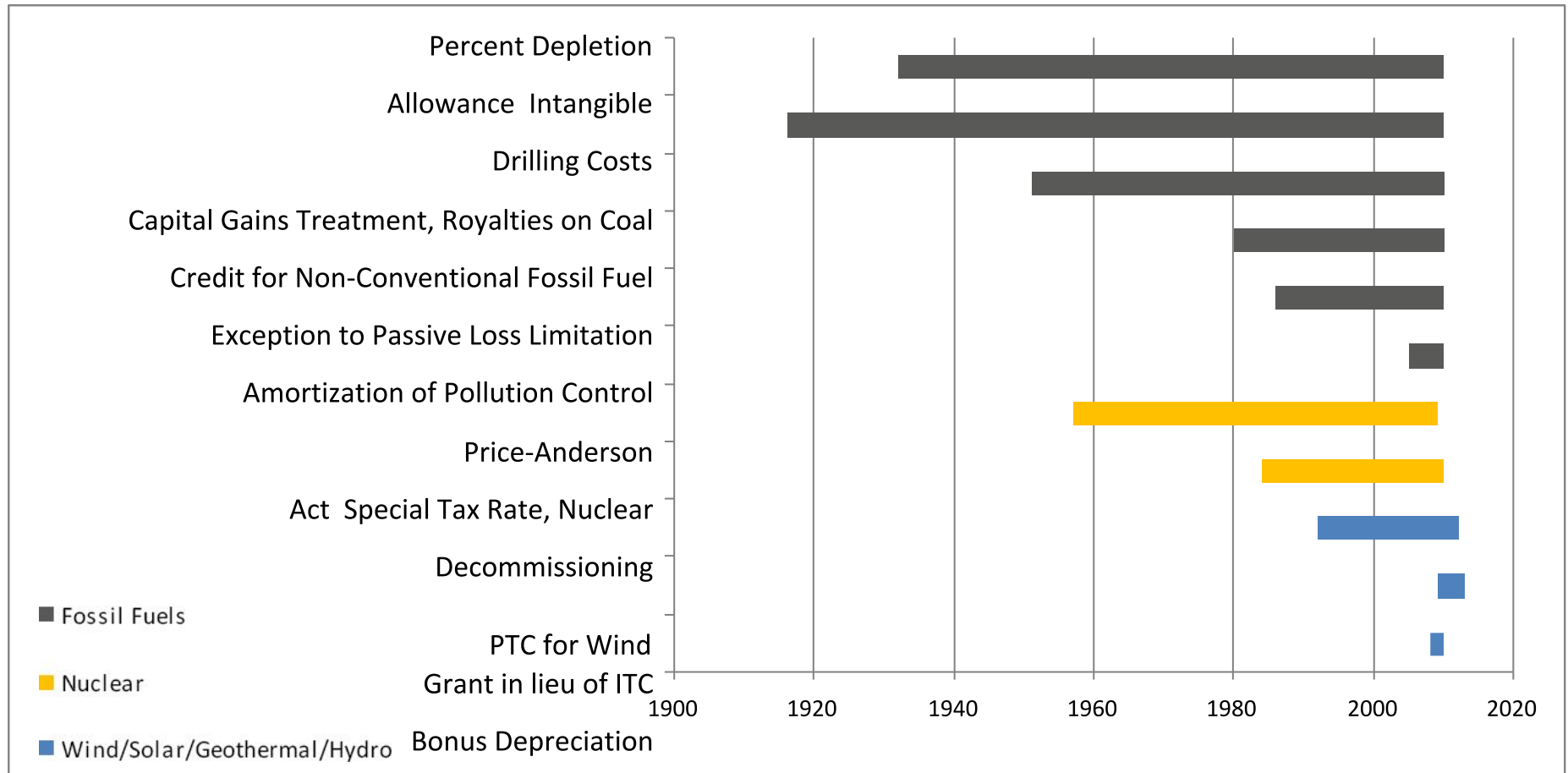
- ❖ 2.2 cents/kWh federal tax credit for 10 years
- ❖ Extended 7 times since 1992
- ❖ Expires at the end of 2012 but it is urgent that it is extended this year as manufacturing jobs are already disappearing
- ❖ PTC extension will create and save 54,000 jobs; expiration will kill 37,000

Cumulative Historical Federal Subsidies

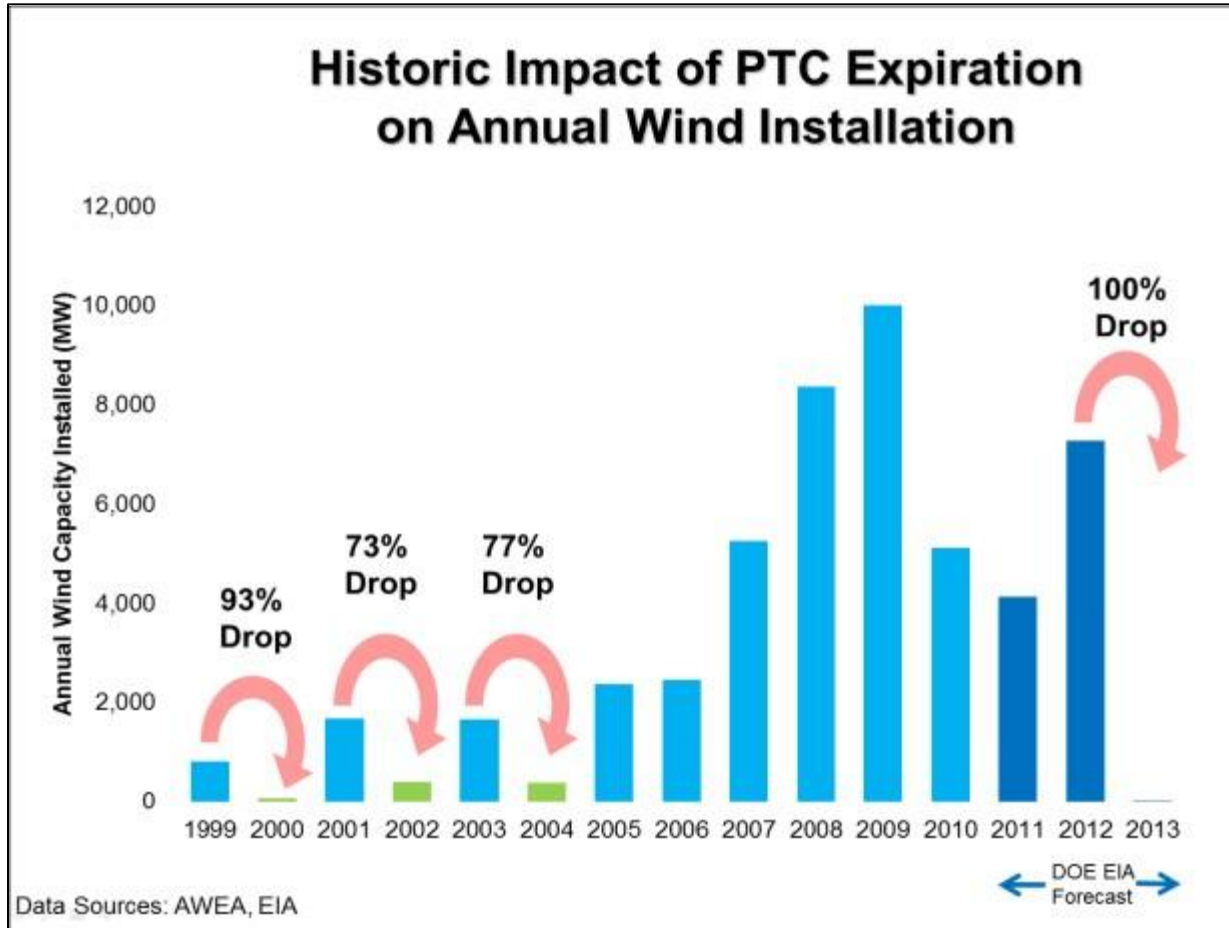
2010\$, BILLIONS



All Domestic Energy Has Had Long-Term Support, Except Renewables



The PTC Past and Future (?)



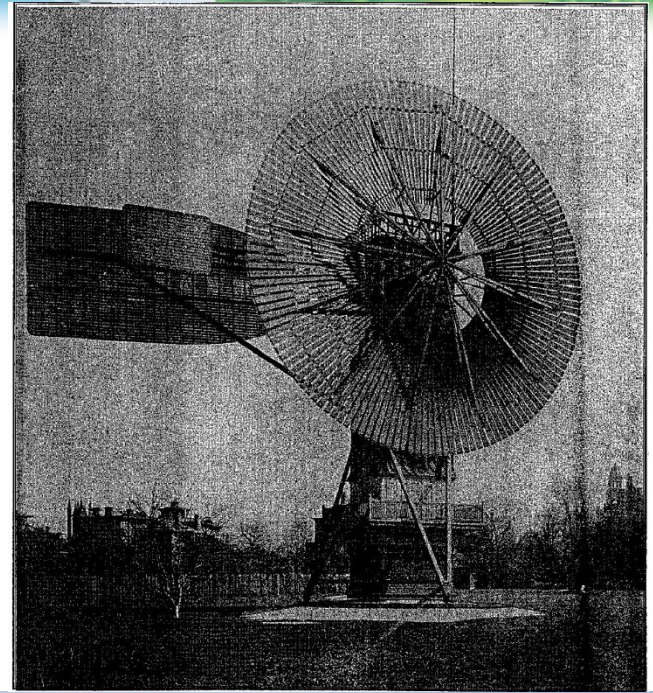
- Renewing the Production Tax Credit (PTC), which expires at the end of 2012 is the priority policy goal of AWEA.
- Without PTC extension, wind additions could shrink to 2 GW/yr

Some Wind Turbine Technology History

BENDIX 1981



GE 1888



GE 2003



NEW TURBINE TECHNOLOGY A GAME CHANGER

2012 turbines have 60-80% more output from same bill of materials as 2002

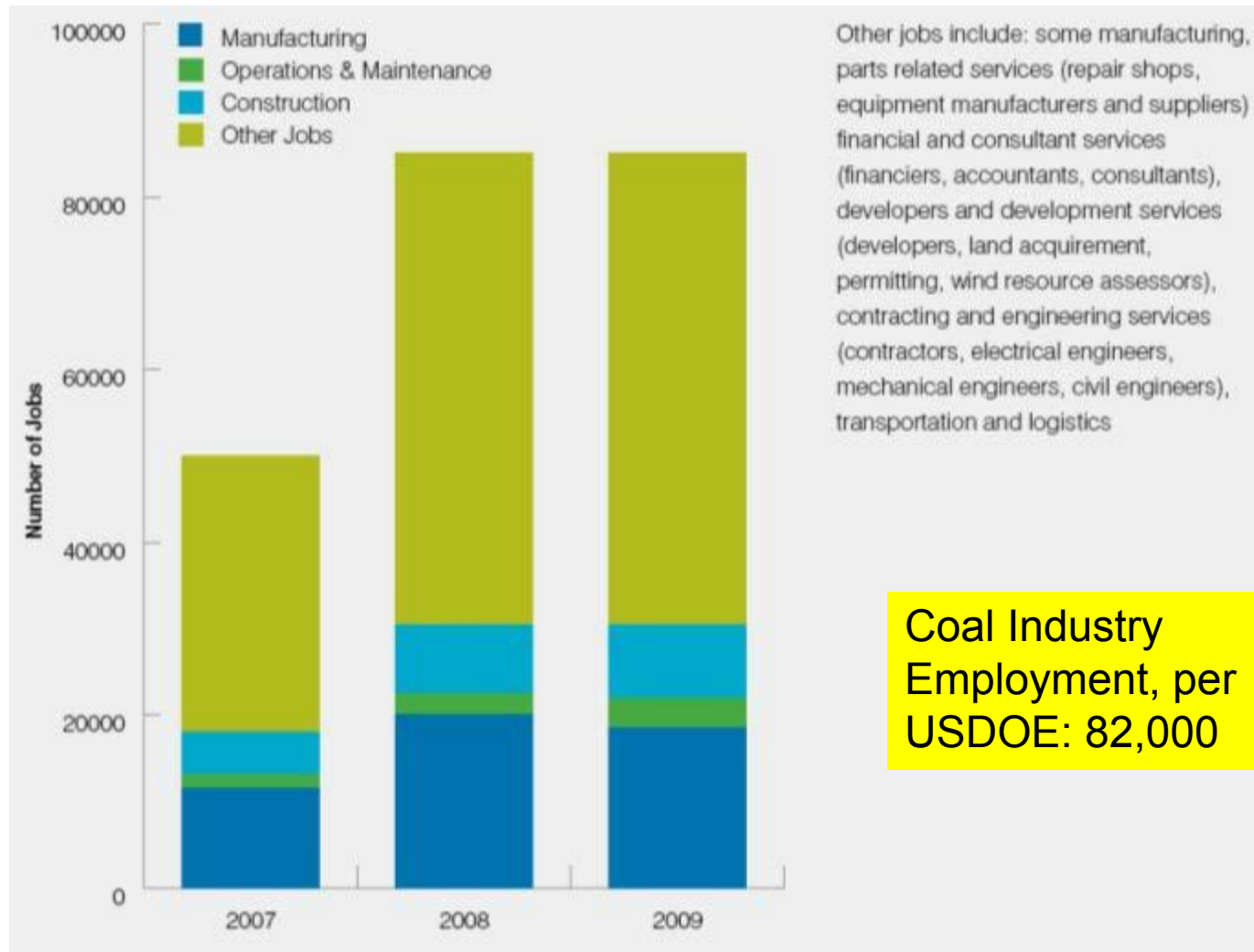
ecomagination

1.6 - 100 Wind turbine

GE continues to advance its 1.5 MW wind turbine series product line with the introduction of GE's 1.6-100 meter wind turbine. This latest development in turbine technology increases the rotor diameter on the 1.6 from 82.5 meters to 100 meters, increasing the capacity factor. Focusing on performance, reliability, efficiency, and multi-generational product evolution, GE's 1.6-100 meter wind turbine creates more value for our customers.



U.S. WIND INDUSTRY EMPLOYS ~~85,000~~ [?]



Coal Industry
Employment, per
USDOE: 82,000

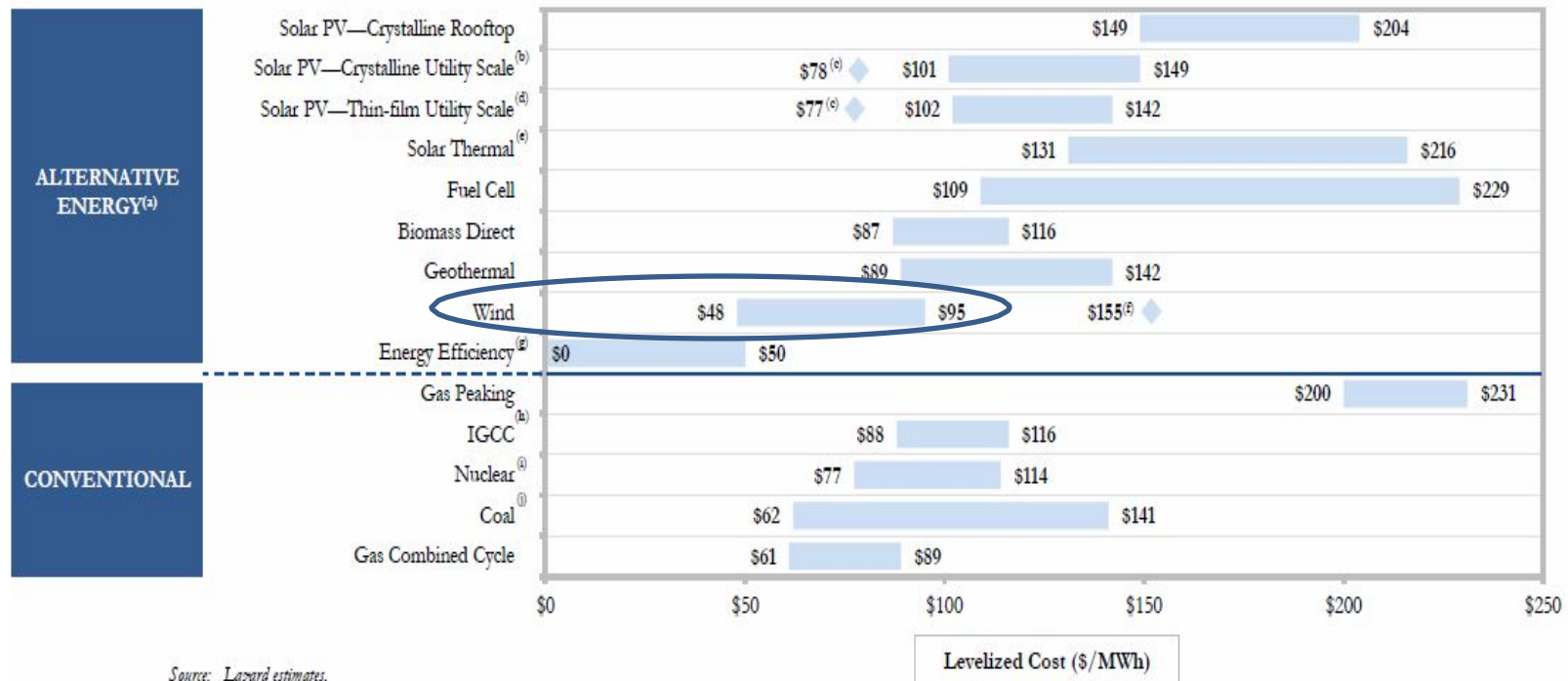
Wind Power Remains Cost-Competitive

LAZARD

LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 6.0

Unsubsidized Levelized Cost of Energy Comparison

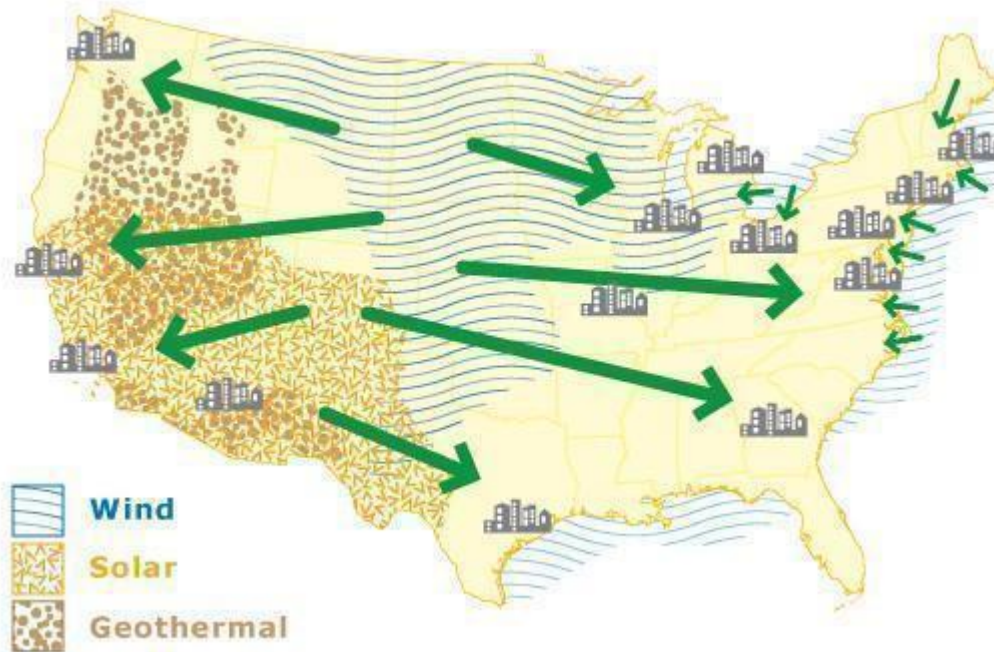
Certain Alternative Energy generation technologies are cost-competitive with conventional generation technologies under some scenarios, before factoring in environmental and other externalities (e.g., RECs, transmission and back-up generation/system reliability costs) as well as construction and fuel cost dynamics affecting conventional generation technologies



Source: Lazard estimates.

TRANSMISSION ACCESS KEY

- While prospects for a “Green Power Superhighway System” on the scale of the Interstate Highway system have faded, additions to grid are underway.
- Nebraska uniquely situated.





POLICY STATUS & PATH FORWARD FORWARD

ALL OF THE ABOVE ENERGY OPTIONS

❖ Gases

- Shale gas revolution changes energy landscape
- But long term markets and pricing still highly uncertain
- Wind now a mature technology with fixed pricing and declining costs

❖ Liquids

- Big energy story in North America for next decade is liquids not gases

❖ Solids

- Nuclear renaissance on hold since Fukushima but existing fleet highly efficient
- Coal – CCS still in R&D phase; EPA regulations likely to impact all but cleanest part of existing fleet.

❖ Negawatts

- Efficiency still among the most cost effective options

❖ Photons

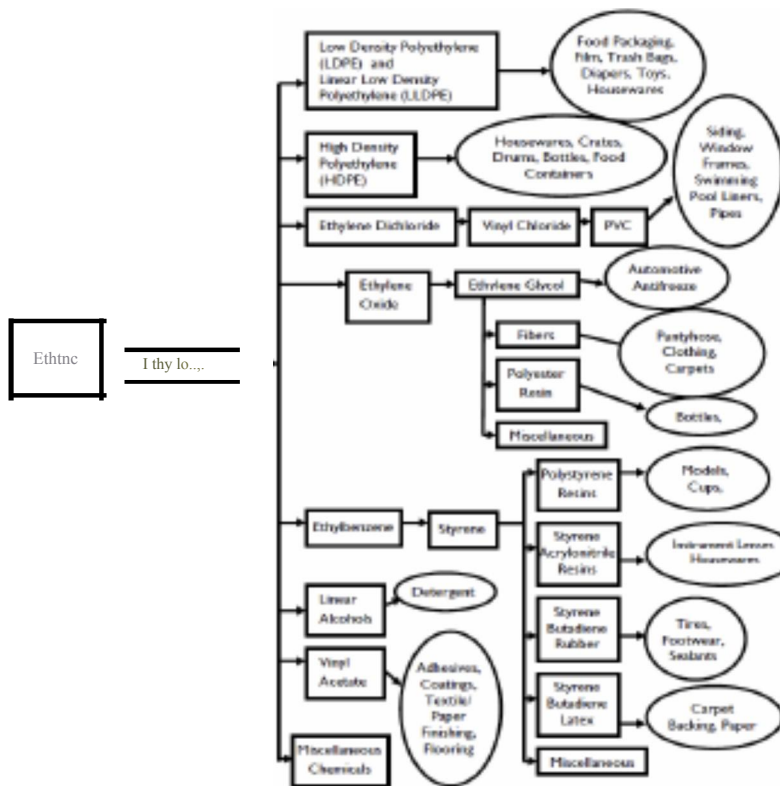
- Solar PV costs coming down rapidly and now attractive in SW RPS markets

A shale gas-fueled industrial revolution in, North America...

Natural gas looks likely by the end of the decade to be able to support globally competitive energy-intensive industries, with energy input costs among the lowest in the world

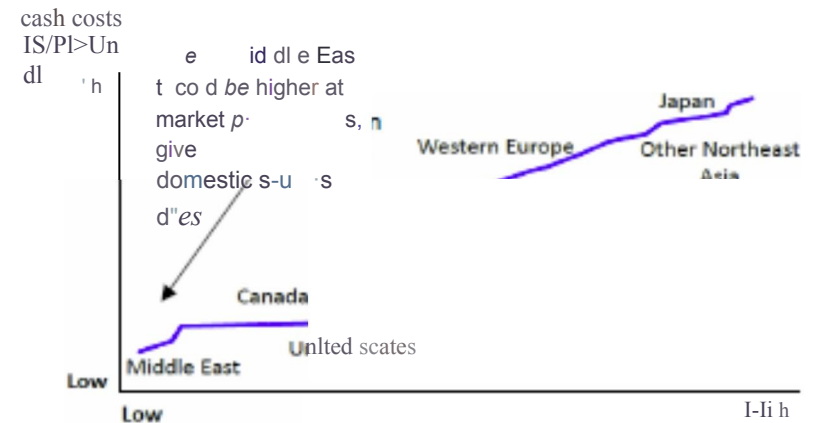
- The impact of liquids drilling extends far and wide :

Simplified ethylene flow chart



- ...and could take advantage of low costs of production

Typical petrochemical cost curve by country, 2010

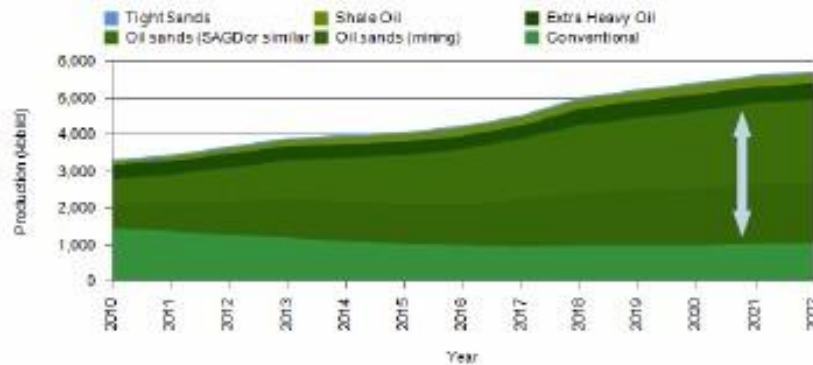


- Industrial demand could accelerate through the end of the decade, M1h direct results in petrochemicals, fertilizers, steel, and other energy intensive industries
- This would not be a boom-and-bust three-year cycle, and could last for a good number of generations

Oil supply growth: no end in sight?

Four incremental sources of liquids growth could make North America the largest source of new supply in the next decade...

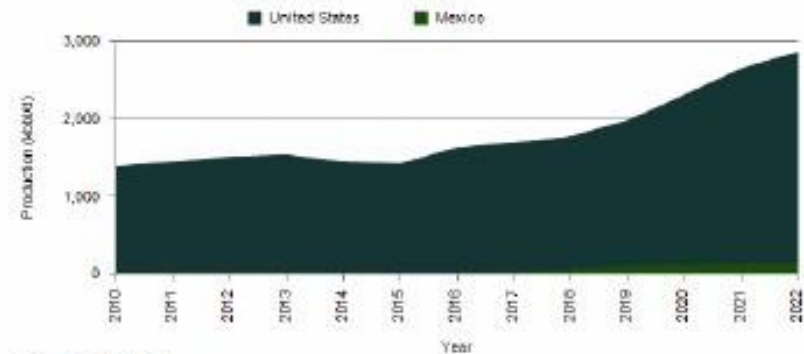
- Oil sands production in Canada



Source: Rystad UCube

Source: UConn

- Deepwater in the US and Mexico, focused on Gulf of Mexico



Source: Rystad UCube

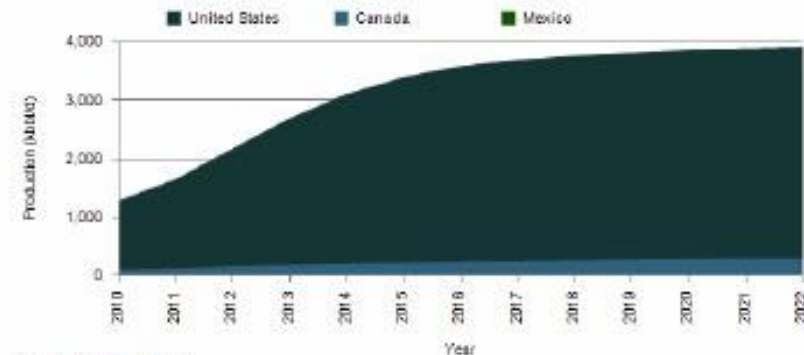
Source: UConn

- NGLs associated with the production of natural gas



Source: CIRA

- Oil from shales and tight sands



Source: Rystad UCube

Source: UConn



REASONS FOR WIND DEVELOPMENT IN THE U.S. REMAIN UNCHANGED

- Inexhaustible resource with over 10,000 GW of developable potential, enough to power the U.S. many times over
- Known long-term pricing of wind offers utilities a hedge against fuel price volatility risk
- Zero air impacts provides utilities a hedge against oncoming environmental regulations
- Zero water use avoids competition with fuel extraction and thermal generation in arid regions of the U.S.
- Cost of wind declining and in competitive zone for portfolio additions



ACTIVITY AT FEDERAL LEVEL ON LONG TERM ENERGY POLICY

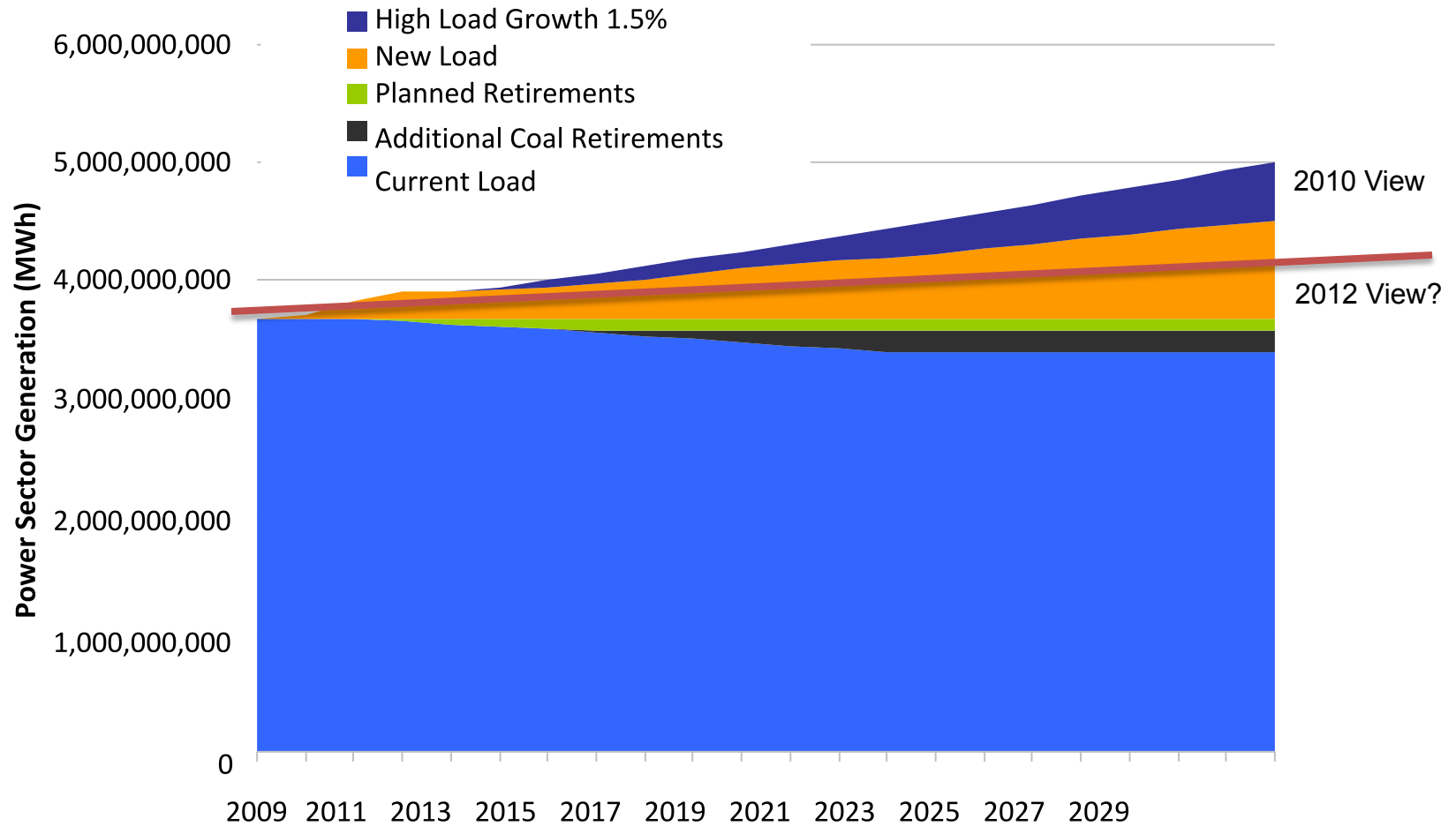
**“This page left deservedly blank”
(same as in 2010)**



ACTIVITY AT FEDERAL LEVEL ON LONG TERM ENERGY POLICY

- Production Tax Credit – Not Extended
- National Clean Energy Standard – Not Passed
- Transmission Reform Legislation – Not Passed

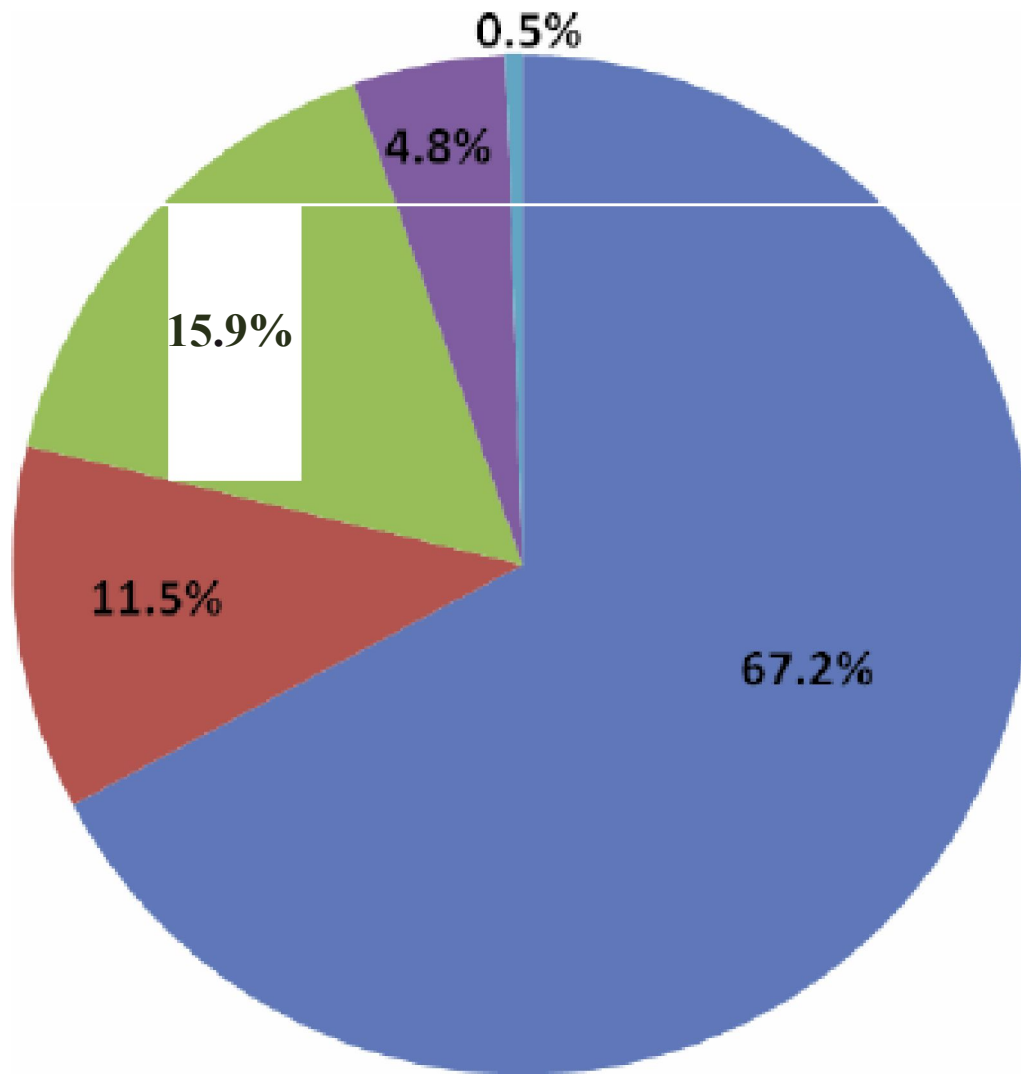
LOOKING AHEAD: MARKET FOR NEW GENERATION CHALLENGING





WHAT ABOUT NEBRASKA?

Figure 1. Nebraska Electricity Generation by Fuel Source, July 2012



■ Coal ■ Natural Gas ■ Nuclear ■ Hydropower ■ Other Renewables

FEDERAL POLICY IN '70S AND '80S SUPPORTED COAL AND NUCLEAR

- ❖ 1978 “Powerplant and Industrial Fuel Use Act” (PIFUA)
 - Reduced tariffs on buying East German bobsleds and luges so our Winter Olympic teams could be competitive (one paragraph)
 - Required all baseload fossil power plants to either use coal or be coal capable (30+ pages)
 - Restricted natural gas power plants to no more than 15% of peak demand
 - Not repealed until 1987
- ❖ Nuclear supported even after 1979 Three Mile Island incident
 - Nebraska nuclear plants built in early 1970s
- ❖ Public Power financing facilitated construction of capital intensive facilities

2009 NATIONAL ACADEMY OF SCIENCES STUDY QUANTIFIED DAMAGES FROM COAL PLANTS IN CENTS/KWH (NEBRASKA LOOKS PRETTY GOOD)

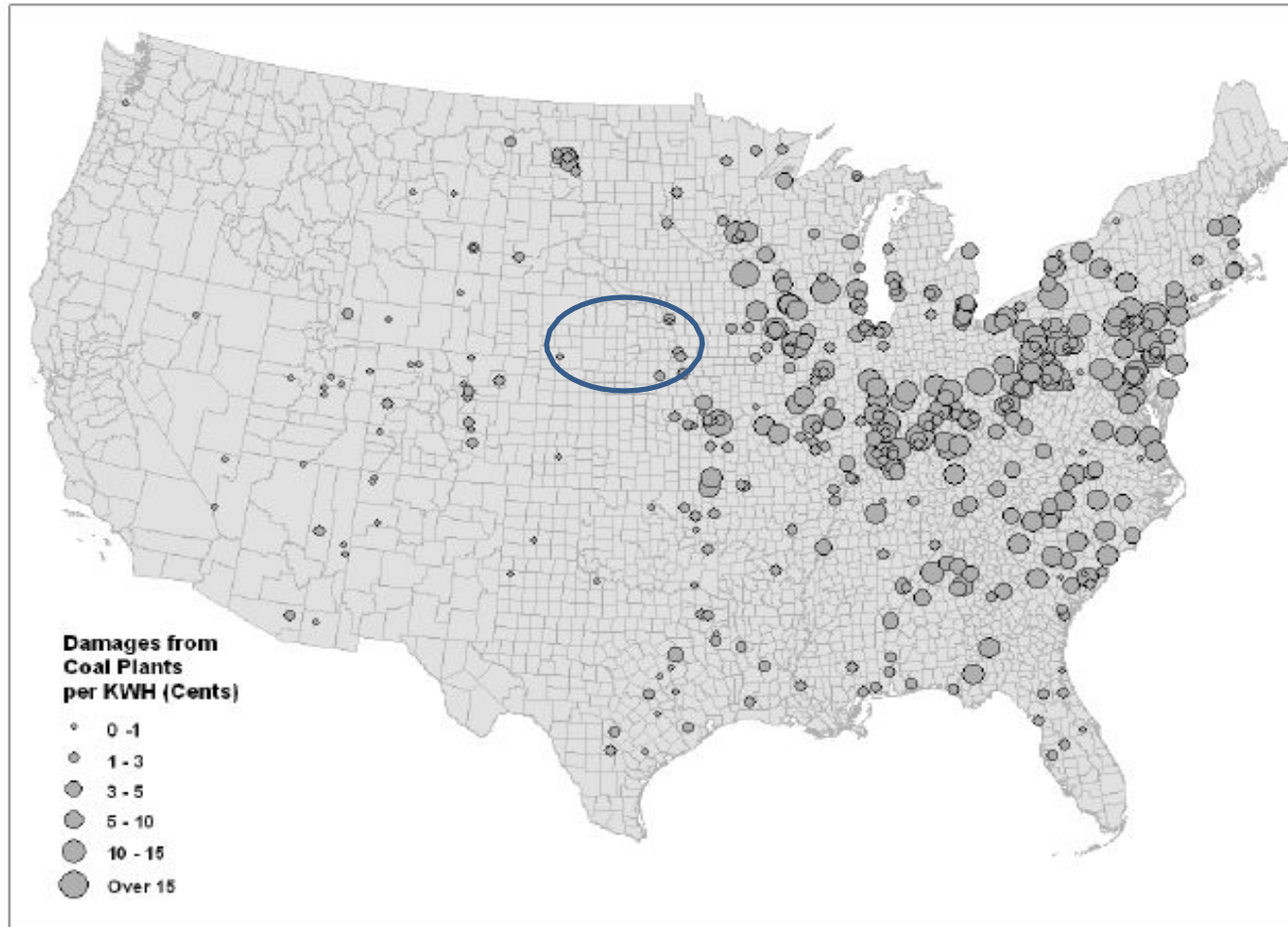
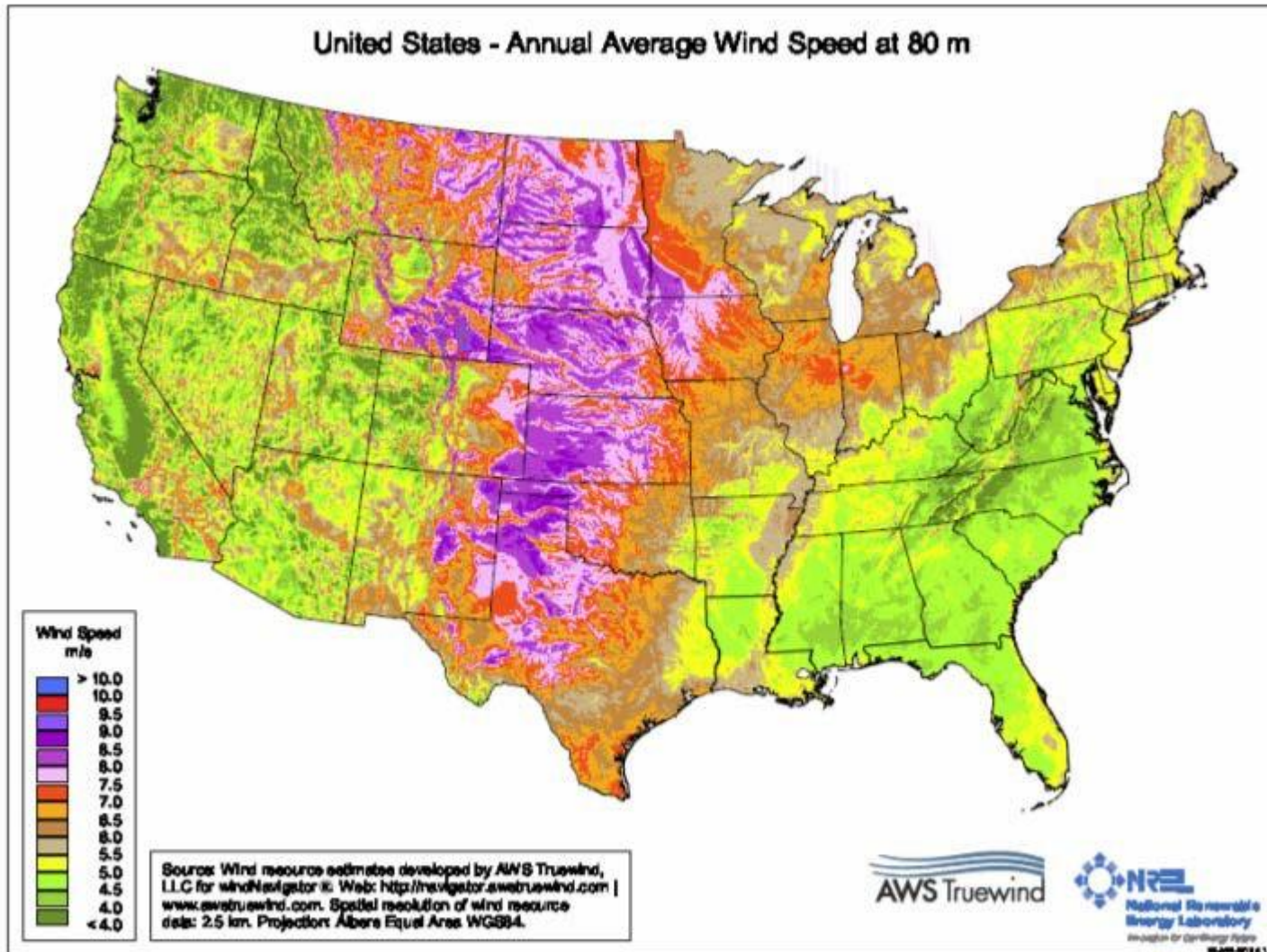
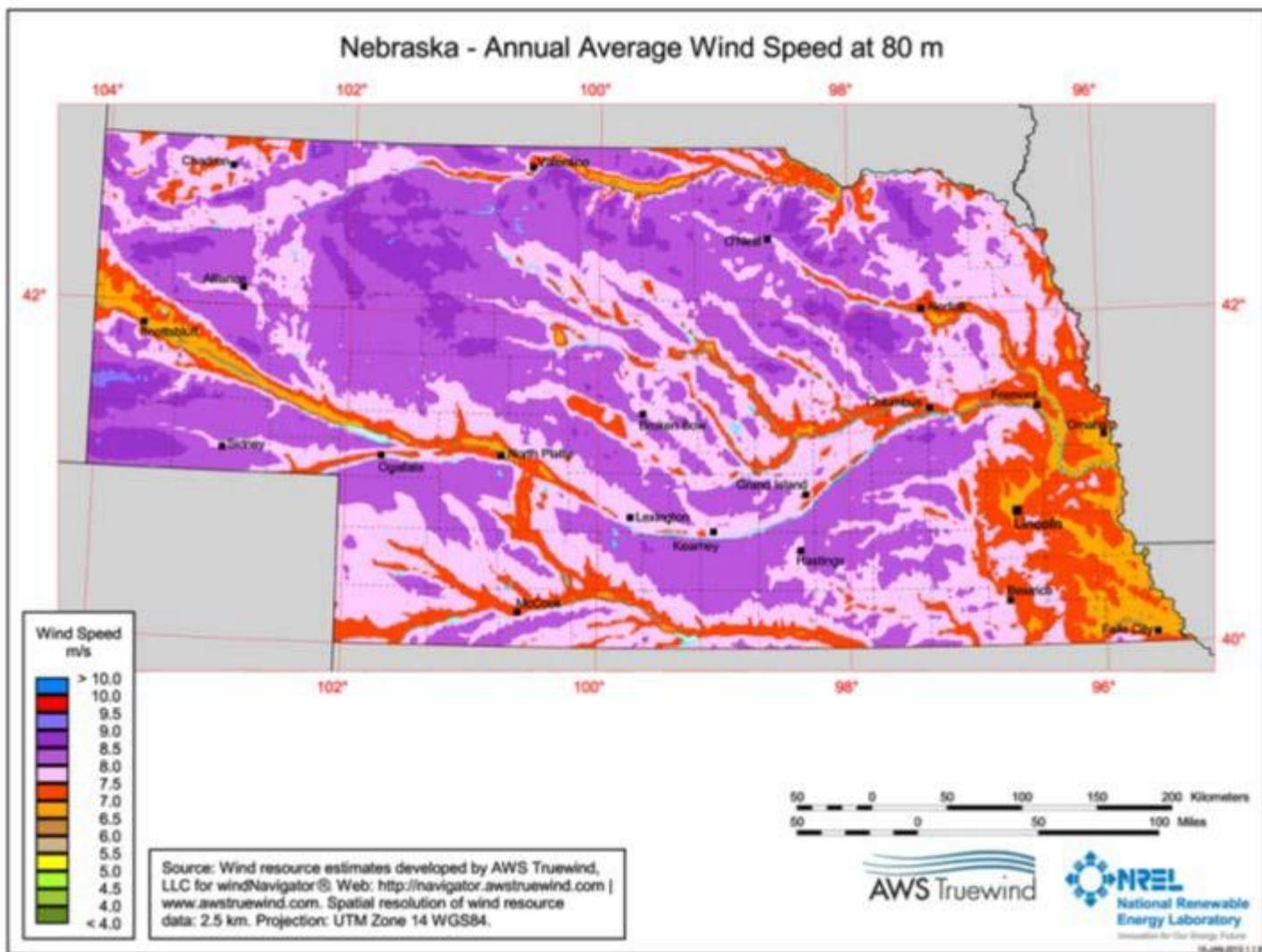


FIGURE 2-8 Regional distribution of air pollution damages from coal generation per kWh in 2005 (USD 2007). Damages related to climate change are not included.

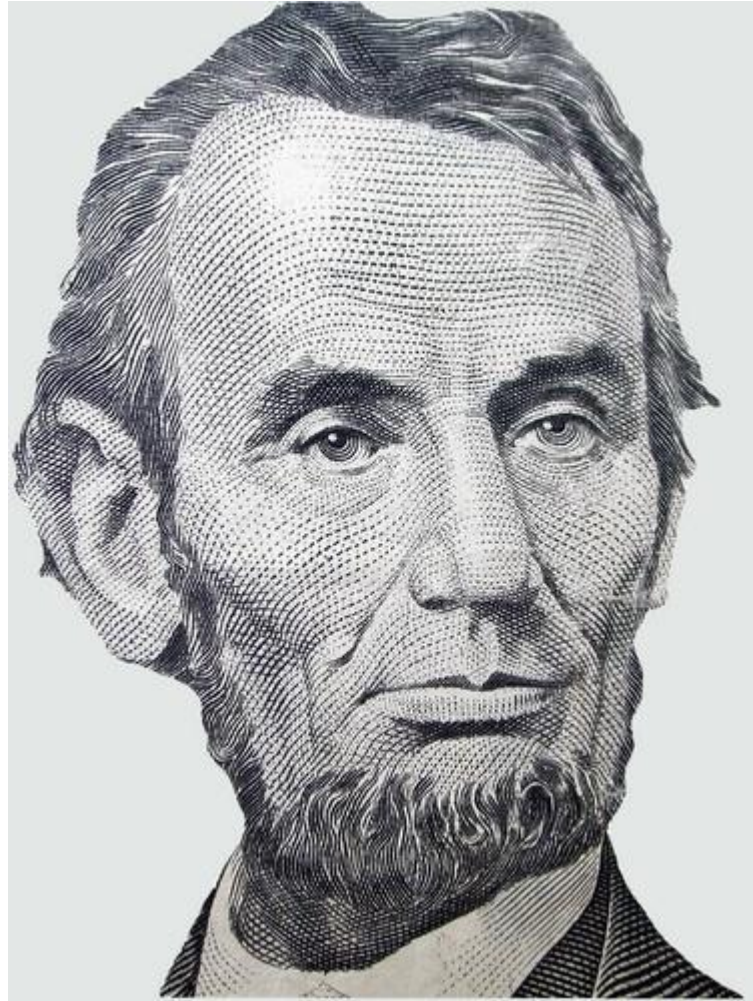
WHO KNEW NEBRASKA WAS SO WINDY?



NEBRASKA HAS HUGE WIND POTENTIAL



“Of all the forces of nature, I should think the wind contains the largest amount of motive power—that is, power to move things. Take any given space of the earth’s surface—for instance, Nebraska; and all the power exerted by all the men, and beasts, and running-water, and steam, over and upon it, shall not equal the one hundredth part of what is exerted by the blowing of the wind over and upon the same space. And yet it has not, so far in the world’s history, become proportionably valuable as a motive power. It is applied extensively, and advantageously, to sail-vessels in navigation. Add to this a few windmills, and pumps, and you have about all. ... As yet, the wind is an untamed, and unharnessed force; and quite possibly one of the greatest discoveries hereafter to be made, will be the taming, and harnessing of it.



NREL DATA SAYS NEBRASKA IS THE 3RD WINDIEST STATE

Rank	Windy Land Area >= 30% Gross Capacity Factor at 80m		Wind Energy Potential			Wind Energy Actual	
	State	Total Area of State (km ²)	Available Wind Land as % of State	Potential Installed Capacity ³ (MW)	Potential Annual Generation (GWh)	Actual 2009 Installed Wind Capacity (MW)	Percent of Potential MW installed
1	Texas	435,639	56%	1,901,530	6,527,850	9,506	0.50%
2	Kansas	211,861	89%	952,371	3,646,590	1,026	0.11%
3	Nebraska	199,628	92%	917,999	3,540,370	153	0.02%
4	South Dakota	193,828	88%	882,412	3,411,690	313	0.04%
5	Montana	232,769	50%	944,004	3,228,620	375	0.04%
6	North Dakota	182,375	84%	770,196	2,983,750	1,203	0.16%
7	Iowa	134,900	78%	570,714	2,026,340	3,670	0.64%
8	Wyoming	146,166	44%	552,073	1,944,340	1,101	0.20%
9	Oklahoma	123,244	57%	516,822	1,788,910	1,130	0.22%
10	Minnesota	121,885	45%	489,271	1,679,480	1,796	0.37%

U.S. Per Capita Electricity Use By State In 2010

Ranking	State	Population (thousands)	kWh (millions)	kWh per capita
1	Wyoming	564	15,475	27,457
2	Kentucky	4,339	93,686	21,590
3	District of Columbia	602	11,972	19,896
4	North Dakota	673	13,100	19,477
5	Louisiana	4,533	85,461	18,852
6	South Carolina	4,625	82,809	17,903
7	Alabama	4,780	82,654	17,293
8	West Virginia	1,853	32,039	17,290
9	Mississippi	2,967	49,829	16,793
10	Arkansas	2,916	48,167	16,519
11	Indiana	6,484	105,782	16,315
12	Nebraska	1,826	29,757	16,293
	United States	308,746	3,749,985	12,146
46	New Hampshire	1,316	10,909	8,286
47	Alaska	710	5,648	7,952
48	New York	19,378	144,693	7,467
49	Rhode Island	1,053	7,825	7,434
50	Hawaii	1,360	10,016	7,363
51	California	37,254	250,384	6,721

Sources: http://factfinder.census.gov/home/saff/aff_transition.html
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?_afpt=table
 Kilowatt-hour: <http://www.eia.doe.gov/Ftproot/pub/electricity/#8262010.xls>



© UFS, Inc.

THERE'S NO HEAVIER BURDEN
THAN A GREAT POTENTIAL!

LINUS

MANY POTENTIAL BENEFITS

- ❖ Good jobs in rural areas
- ❖ A second crop – land lease payments \$2,667/MW/year
- ❖ Export power sales to keep rates low now and in future
- ❖ Property taxes \$3,940/MW/year
- ❖ Water savings – 1,840 million gallons for every 1,000 MW built
- ❖ CO2 reductions – like taking 70,000 cars off the road for every 1,000 MW operating

CHALLENGES

- ❖ No investor owned utilities to make direct use of federal tax incentives or earn rate based returns
- ❖ But access to public power bond financing an advantage
- ❖ Among the lowest electric rates in the country
- ❖ Significant investment in coal generation
- ❖ No State RPS; utilities likely exempt from any federal CES due to size
- ❖ Low local demand
- ❖ Lack of transmission for large exports of wind

A REALISTIC PLAN – WHAT CAN NEBRASKA DO NOW TO GET READY FOR THE FUTURE?

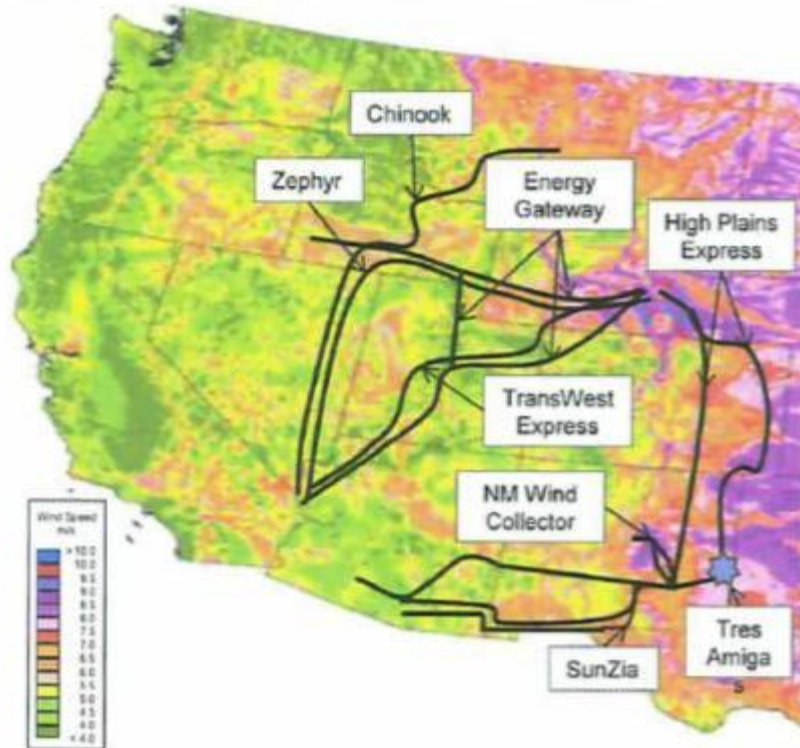
- ❖ Keep track of the economics – you should have been pleasantly surprised (Xcel NextEra PPA at \$27.5/MWH)
- ❖ Keep going after those green jobs
 - But manufacturers need some local markets
- ❖ Don't get left out of transmission opportunities
- ❖ Go for end use efficiency – “no transmission required”
- ❖ Build on strengths
 - Rail network, central location, insurance and financial services
- ❖ Remove barriers
 - Sales tax exemption

PLAN PART 2

- ❖ Do your siting homework ahead of time
 - Map wildlife and habitat on state and regional basis
 - Anticipate radar and other National Airspace issues
 - Plan Transmission corridors to avoid sensitive areas
- ❖ Use the educational system
 - Training – engineers, wildlife biologists, technicians, developers
 - Research – wind/wildlife interactions, grid integration, small wind, etc., etc.
- ❖ Educate & involve the public
 - Community wind, small wind in addition to big wind
- ❖ Combine with state's leading role in Bio-energy

WECC Transmission Initiatives Link Resource to Load

Select WECC Renewables-Based Transmission Initiatives



Note: Locations are approximate; map is not comprehensive of all transmission upgrades proposed in the region; not all transmission lines are focused on just wind, and could carry other renewables and conventional power; wind speeds based on 80 meter hub height
Source: NREL, IHS Emerging Energy Research

Analysis

PacifiCorp's Energy Gateway project is a three-part, 6 GW line designed to supply the growing demand of the US Pacific Northwest and Southwest

- The project has a South, West, and Central portion, with segments of the Gateway Central under construction for completion in 2010
- Remaining 500 kV segments are scheduled to come online between 2013 and 2019

TransCanada had mixed success in its transmission open season for the 3 GW, 500 kV Chinook and Zephyr HVDC lines

- TransCanada filled the entire capacity of its Wyoming-originating Zephyr line, awarding 2.1 GW to Pathfinder Renewable Energy and the remainder to EDP-Horizon and BP. TransCanada anticipates the line to be in operation in 2015 or 2016
- TransCanada was unable to auction the capacity of the Montana-based Chinook line due to lack of interest, and has extended its open season to developers until the end of 2010

The High Plains Express (HPX) is a 3.5 GW to 4 GW AC line that will connect to the Tres Amigas Superstation and coordinate with other lines

- The Tres Amigas Superstation will be a 5 GW superconducting hub in Clovis, New Mexico that will interconnect the Western, Eastern, and Texas Interconnections
- The route of the HPX overlaps with the New Mexico Wind Collector, SunZia, and the Wyoming-Colorado Intertie and HPX are working on coordinating development with these lines
- The SunZia will be capable of handling up to 4.5 GW of capacity and is currently undergoing WECC's Three Phase Rating Process to determine total capacity

Multi-state, multi-billion-dollar transmission proposals seek to link the best wind resource to demand regions in the US Southwest

WILL NEBRASKA HAVE THE RIGHT CONNECTIONS? COMPARED TO THE TRANSCONTINENTAL RAILROAD THIS SHOULD E

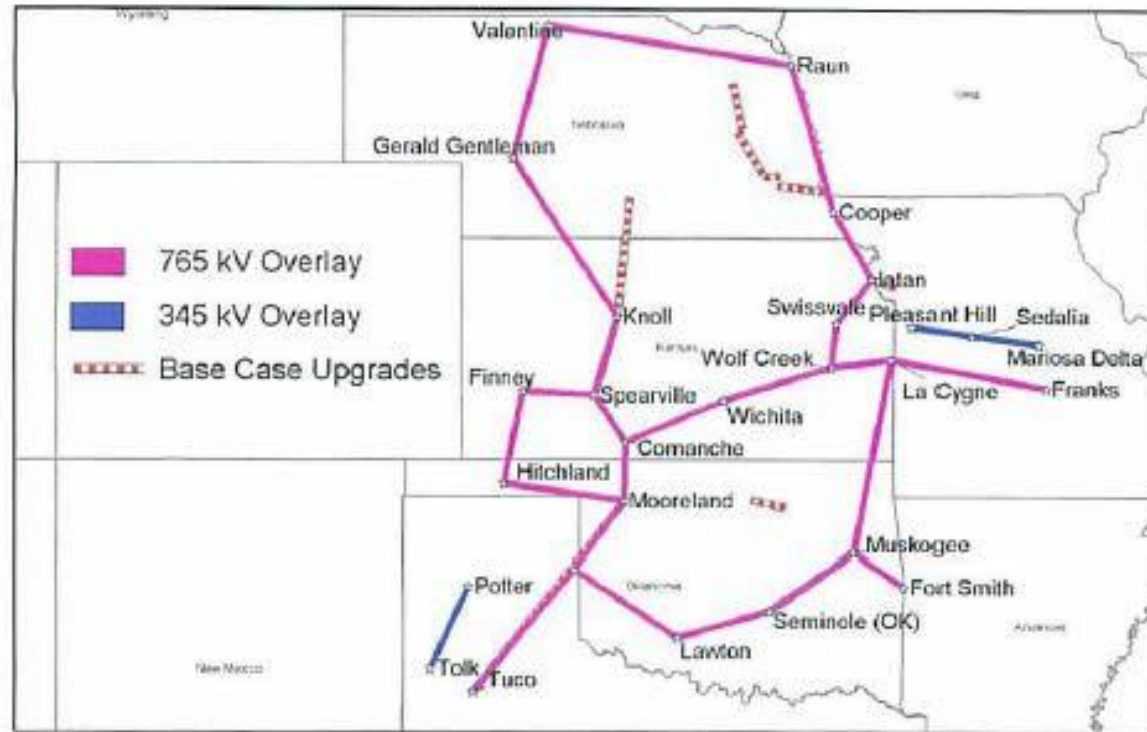
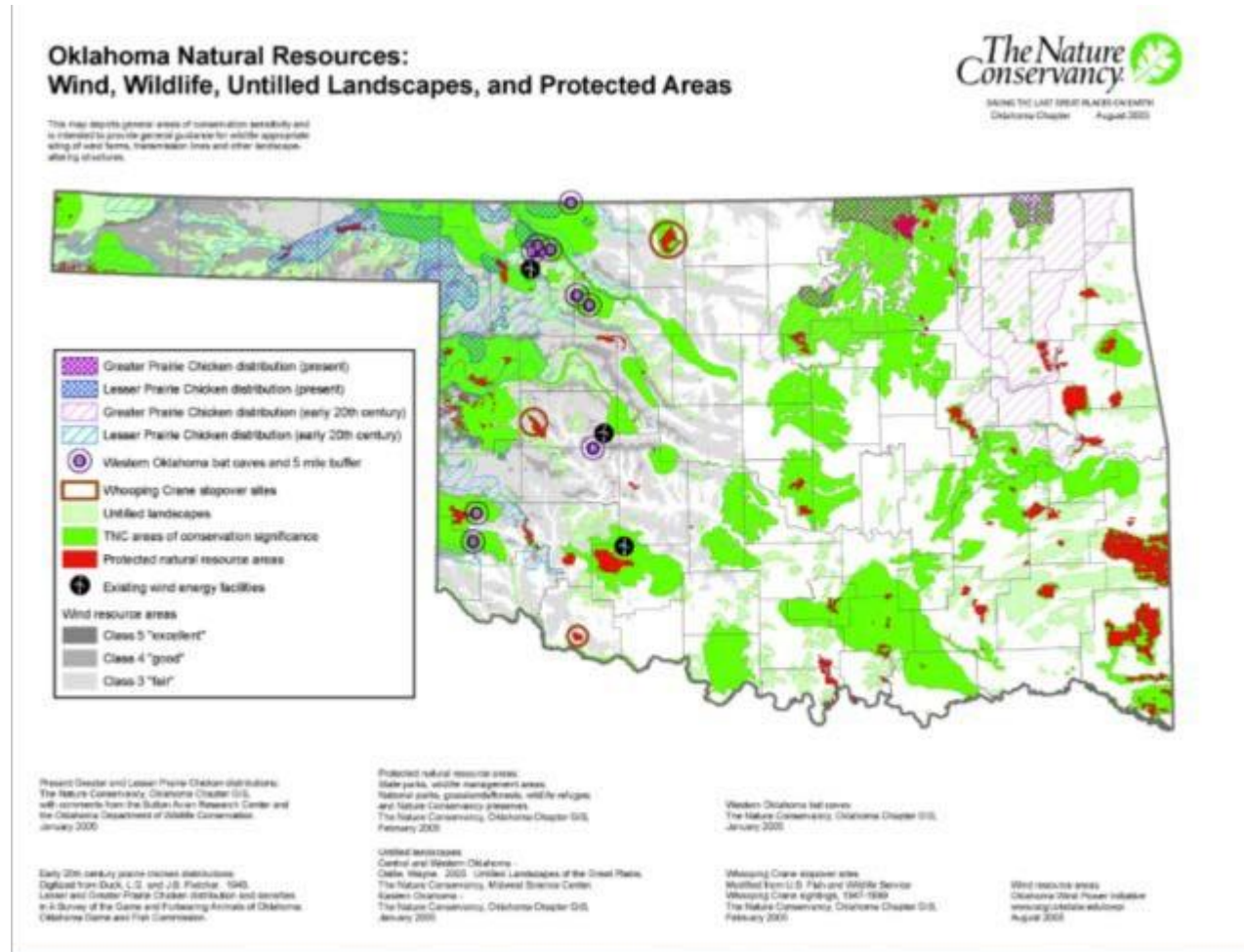


Figure 4: Base Case Conceptual EHV Overlay

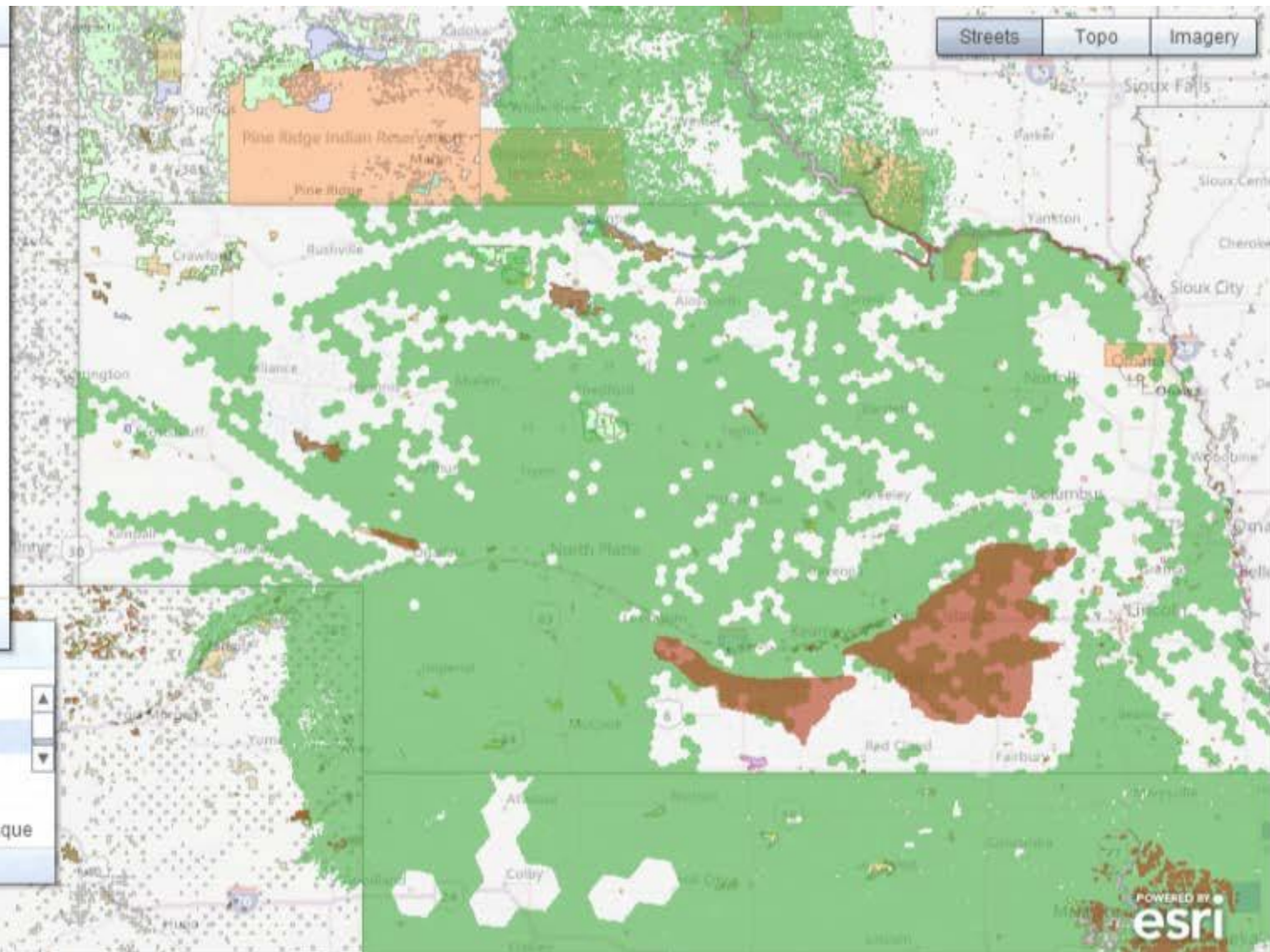
TAKE SITING CONCERNS SERIOUSLY NE HAS TIME TO PREPARE AND TAKE CARE – MINIMIZING IMPACTS MINIMIZES RISK AND DELAY (WHERE IS NEBRASKA'S MAP?)



Land Ownership

- U.S. Protected Areas - PAD-US 1.1 (CBI Edition)
- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense and Department of Energy
- Fish and Wildlife Service
- Forest Service
- National Park Service
- Bureau of Indian Affairs
- Other Federal Land
- Native American Land
- Private Conservation Lands
- Private Land, Unprotected Land
- Local Government Land
- State Land

[View Metadata](#) [Download Data](#)



Important Bird Areas ■
Greater Prairie Chicken ■

THE POTENTIAL

According to the National Renewable Energy Lab if Nebraska met their national target of the developing 7800 MW of wind (US Department of Energy 20% Wind by 2030) the twenty year pay back to Nebraska would be \$570 million in increased property tax payments, \$547 million in lease payments to Nebraska ranchers and farmers, upwards of \$14 billion dollars in private investment, 64,000 FTE in construction and operation jobs.

A LONG TERM VISION

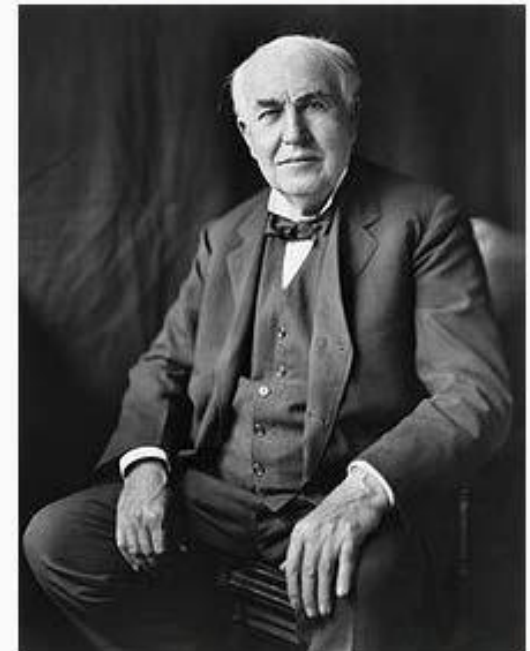
- ❖ State nameplate capacity about 8,500 MW
- ❖ Per NREL NE has at least 7,800 MW developable wind resource.
- ❖ Power agencies jointly plan for portfolio of the future – efficiency, gas, clean coal, nuclear, wind
- ❖ Define Competitive Renewable Energy Zones (CREZ) within the state considering wind resource, environmental and transmission issues for up to 7,800 MW of wind
 - Two year process – ready when market should pick up
- ❖ Develop joint procurement and financing mechanisms to protect ratepayers
 - Bond financing and cooperative bargaining for turbines and balance of plant and transmission for export development over 10-15 years
 - Pace procurement to limit rate impacts, but give credit to efficiency, gas, coal costs avoided.
- ❖ Just do it

“IT’S TOUGH TO MAKE PREDICTIONS, ESPECIALLY ABOUT THE FUTURE”

(YOGI BERRA, OR NEILS BOHR, MARK TWAIN, WINSTON CHURCHILL, GROUCHO MARX, ETC.)

- ❖ Nebraska has huge renewable energy potential
- ❖ *With preparation*, it can create its own luck
- ❖ Wind is now an “overnight success,” and it only took 30 years to get here.
- ❖ Nebraska has all the tools to be another “overnight success” in renewables
- ❖ But the time has come to live up to its championship potential

Thomas Edison



"Genius is one percent inspiration, ninety-nine percent perspiration."

– Thomas Alva Edison, *Harper's Monthly*
(September 1932)