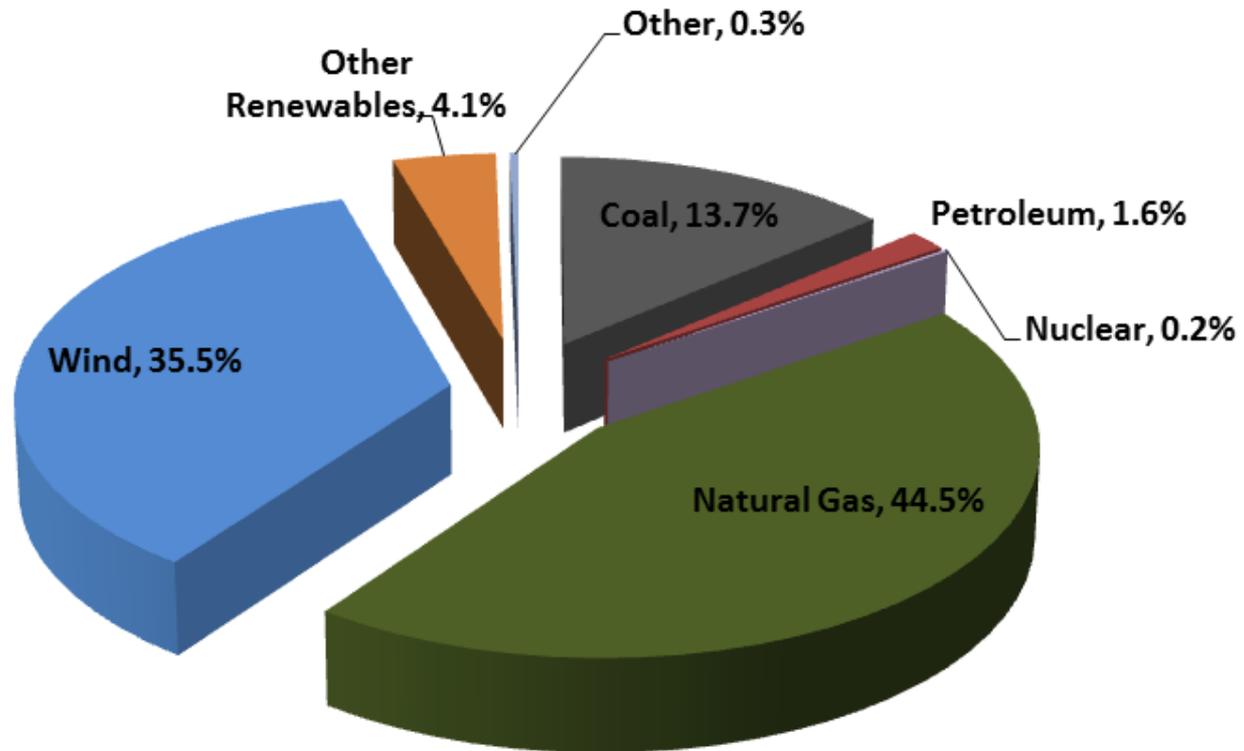


# Wind has contributed 35% of all new electric generating capacity in America since 2007

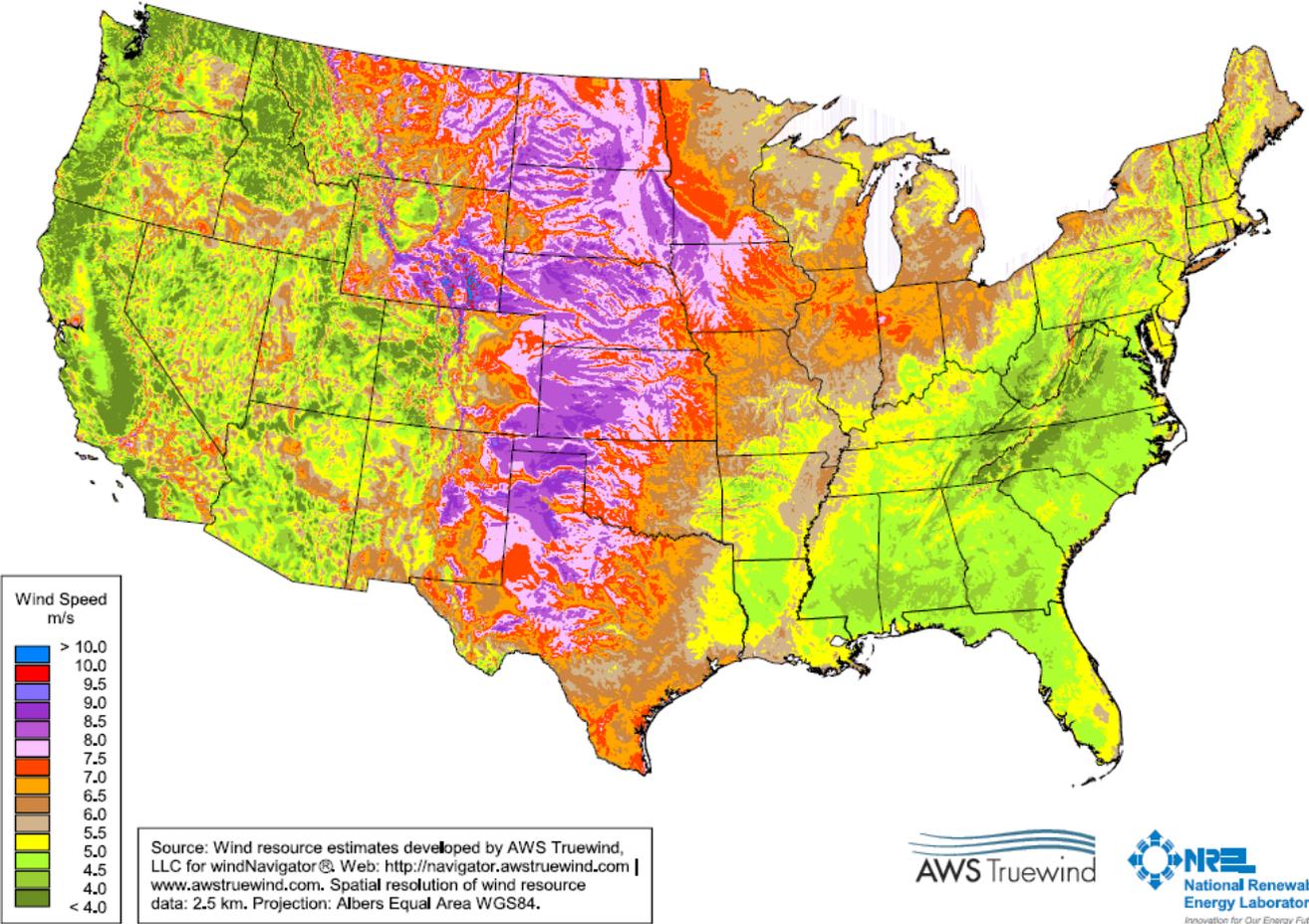
Percent of New Installed Capacity, 2007-2010

Nearly 81,000 MW of new generating capacity installed between 2007 and 2010

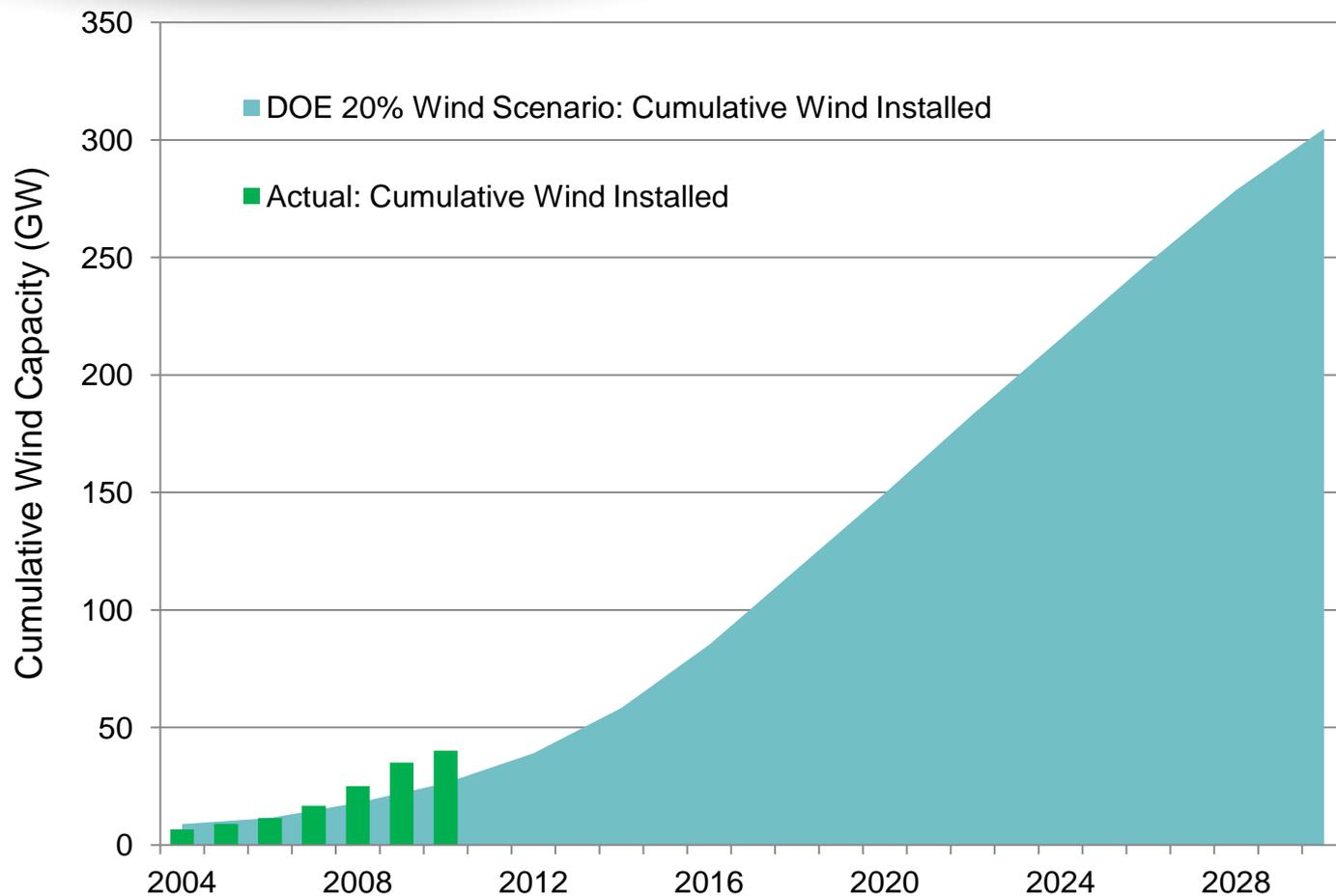
Wind installed over 35% of all new generating capacity between 2007 and 2010, or 28,740 MW.



# Onshore & Offshore Wind Could Electrify U.S. 13 Times Over



# U.S. Wind Power Installations are Ahead of Projected Path for 20% by 2030

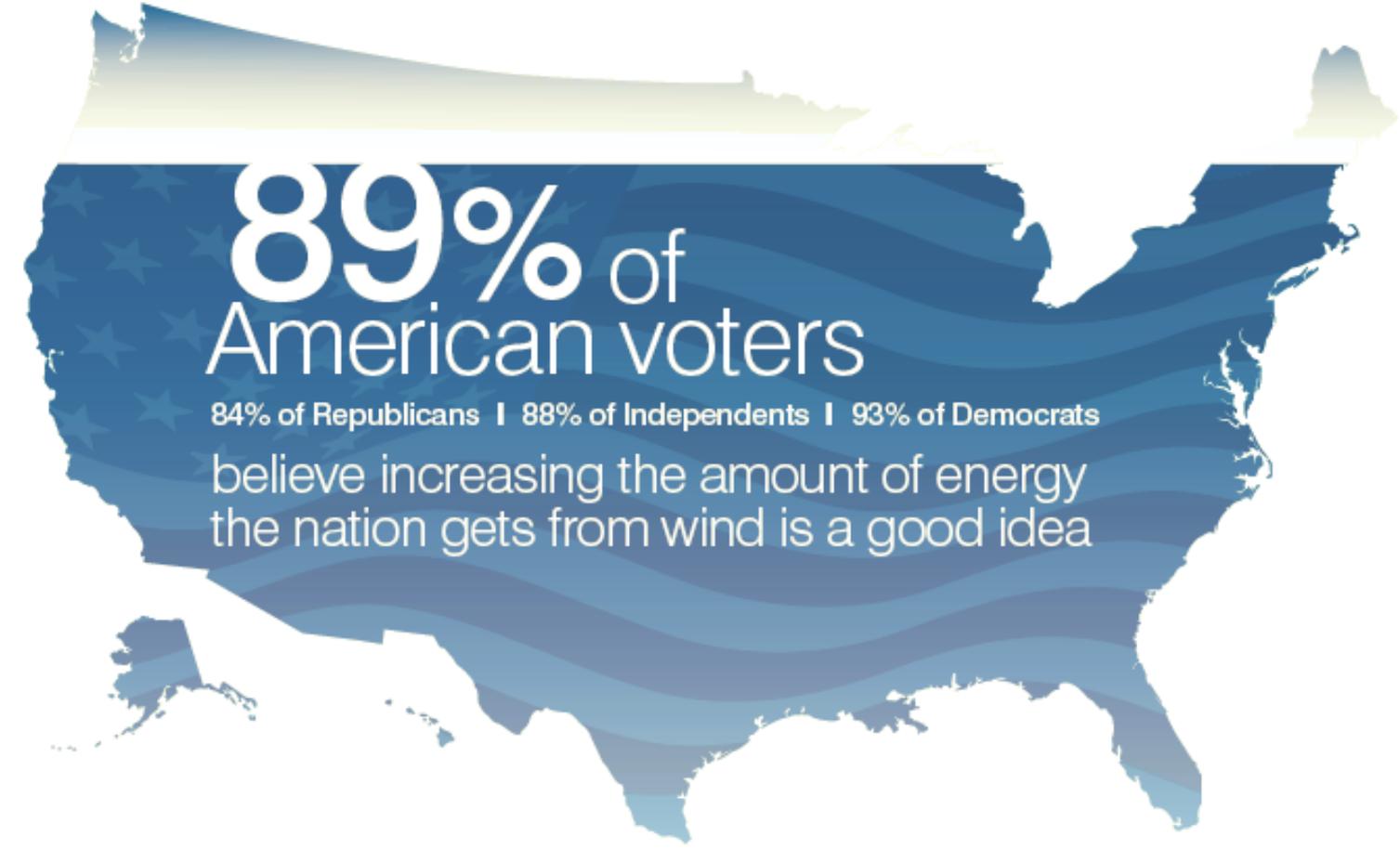




# Wind Energy and Electricity Prices

Wind Power Ranking	Electric Price Increase, 2005-2010
Bottom 30 states	<b>26.74%</b>
Top 20 states	<b>15.72%</b>
Top 10 states	<b>10.94%</b>

# Wind Power: America's Choice

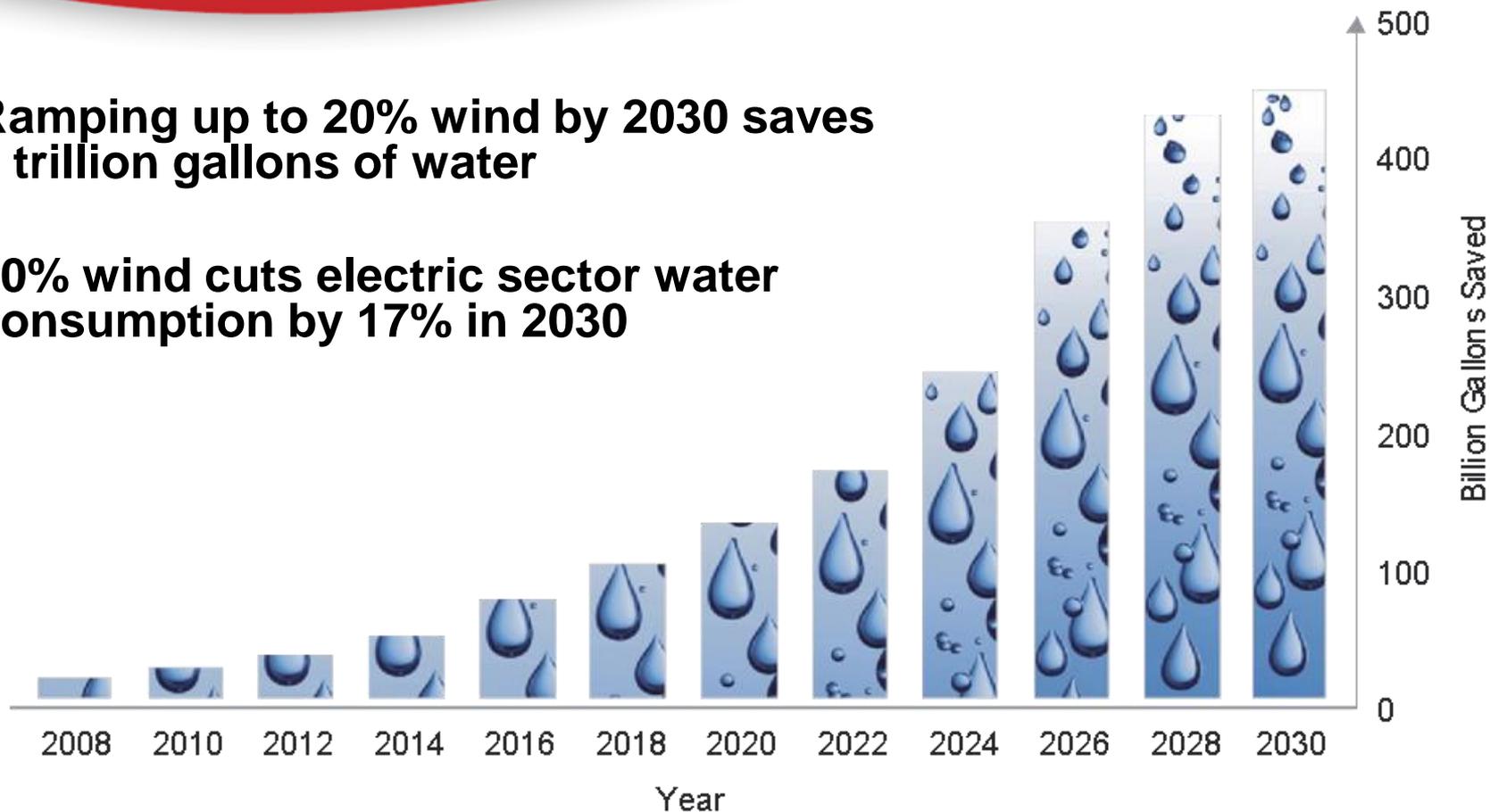


**89%** of  
American voters

84% of Republicans | 88% of Independents | 93% of Democrats  
believe increasing the amount of energy  
the nation gets from wind is a good idea

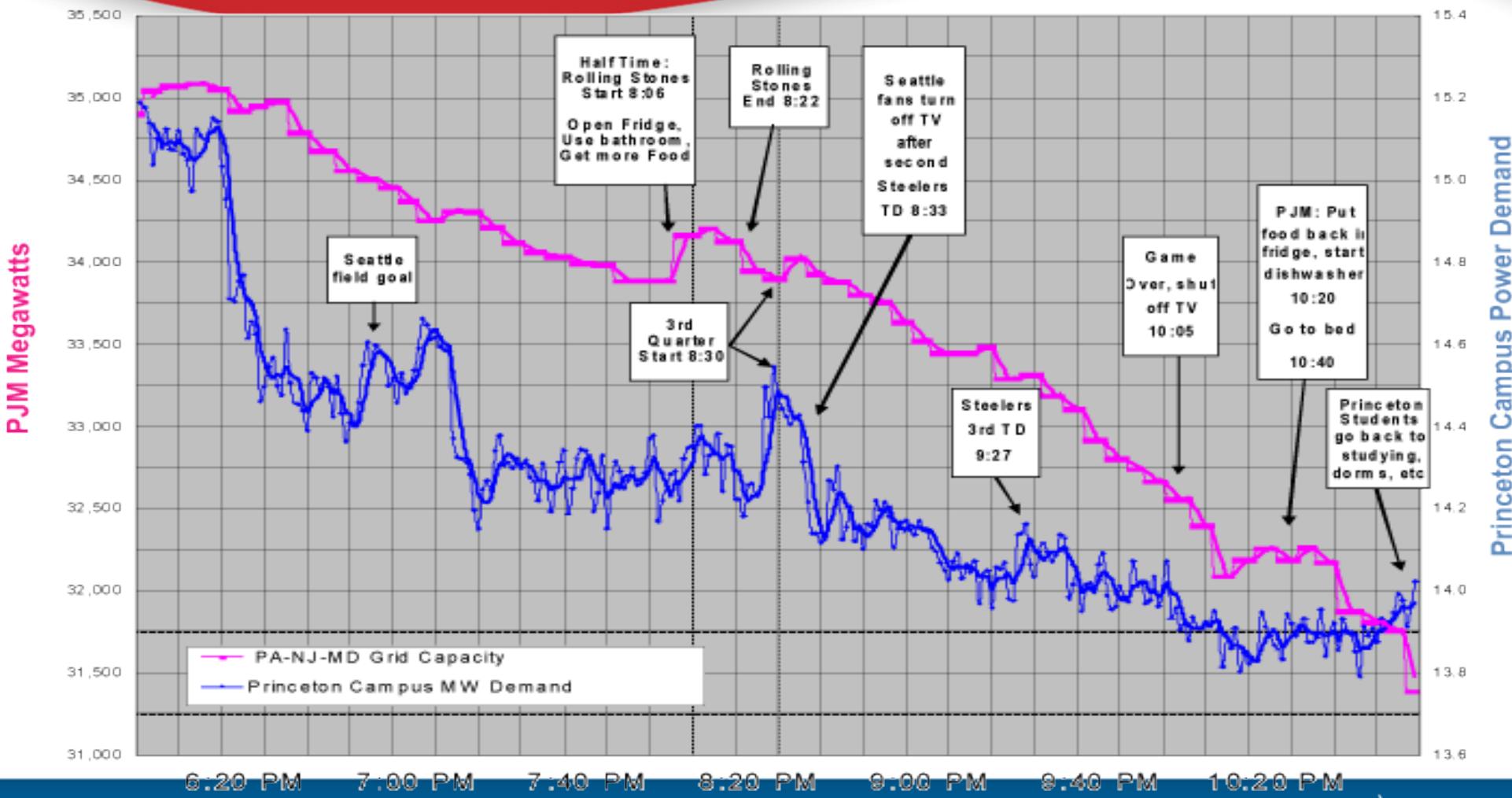
# Wind Power Uses Virtually No Water

- Ramping up to 20% wind by 2030 saves 4 trillion gallons of water
- 20% wind cuts electric sector water consumption by 17% in 2030



# Electricity Demand is Variable and Uncertain

## Feb. 5, 2006 Power Use During Super Bowl



# Wind's Variability is Slow

<b>Study</b>	<b>Wind Penetration</b>	<b>1 minute</b>	<b>5 minute</b>	<b>1 hour</b>
Texas 2008	15,000 MW	6.5 MW	30 MW	328 MW
California Energy Commission 2007	2,100 MW, +330MW solar	0.1 MW	0.3 MW	15 MW
	7,500 MW, +1,900 MW solar	1.6 MW	7 MW	48 MW
	12,500 MW, +2,600 MW solar	3.3 MW	14.2 MW	129 MW
New York 2005	3,300 MW	--	1.8 MW	52 MW

# Westar Data Confirms Wind is Small Share of Total Power System Variability

Data submitted to Federal Energy Regulatory Commission on February 29, 2012. For the ~5,400 MW Westar power system:

<b>Regulation reserve need without wind</b>	<b>120.2 MW</b>
<b>Regulation need with 400 MW of wind</b>	<b>123.0 MW</b>

# Minnesota PUC Study Finds Same Result

## Minnesota Wind Integration Study

	Base	15% Wind	20% Wind	25% Wind
Wind MW	0 MW	3,441 MW	4,582 MW	5,688 MW
Total MW Regulation	137 MW	149 MW	153 MW	157 MW
Incremental regulation need for wind	-	12 MW	16 MW	20 MW
Incremental regulation as % of wind capacity	-	0.35%	0.35%	0.35%

# ERCOT Study Finds Same Result

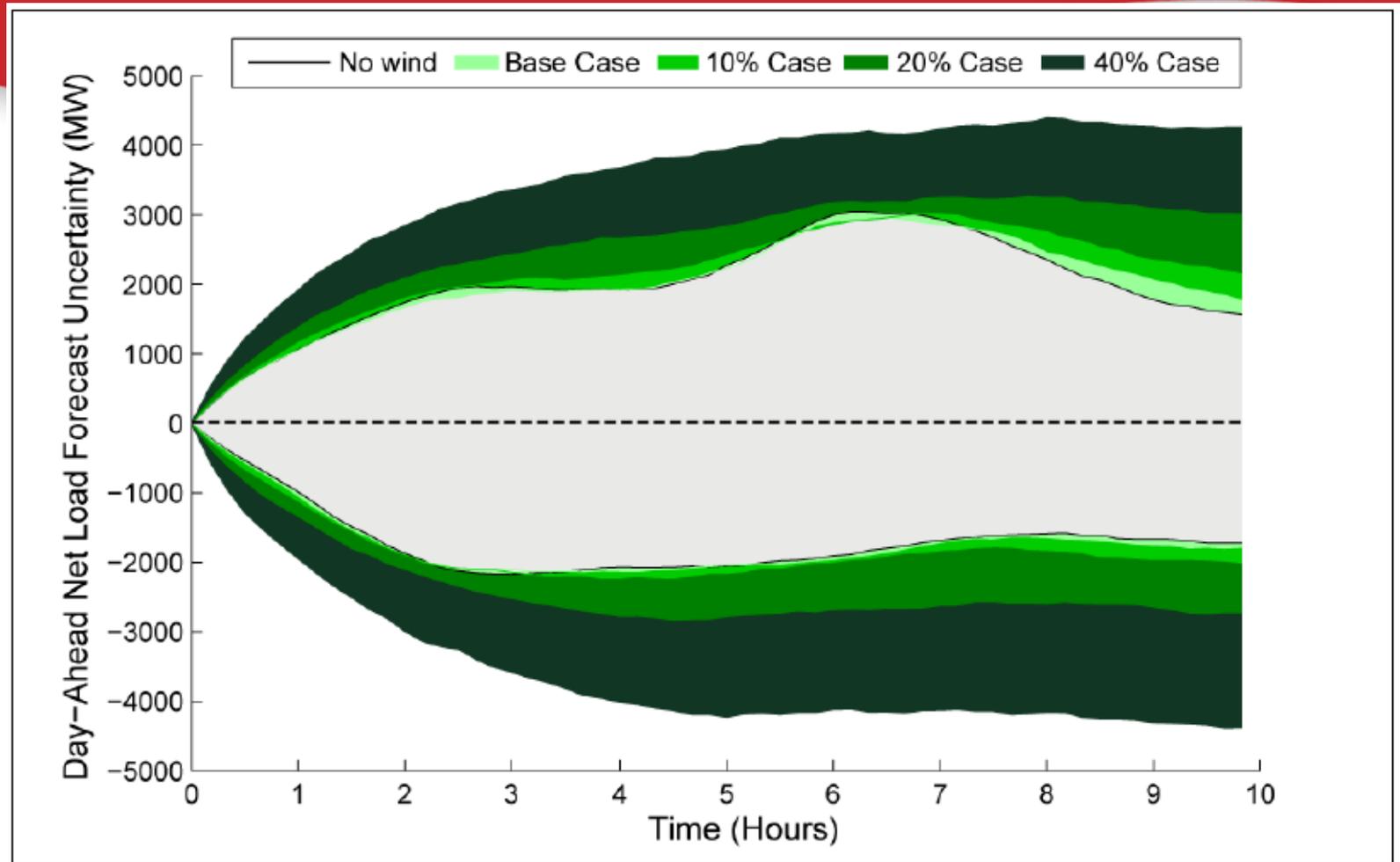
## Up-Regulation

Wind (MW)	Average Max of 5-min Periods	% Change	98 <sup>th</sup> Percentile of 5-min Periods	% Change	Maximum	% Change
0	73.8 MW		232.1 MW		1072.5 MW	
5,000	78.1 MW	5.8%	247.0 MW	6.4%	1075.9 MW	0.3%
10,000 (1)	82.5 MW	11.7%	265.2 MW	14.2%	1105.6 MW	3.1%
10,000 (2)	81.4 MW	10.2%	261.5 MW	12.7%	1112.7 MW	3.7%
15,000	86.1 MW	16.5%	285.8 MW	23.1%	1124.9 MW	4.9%

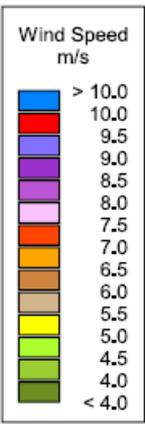
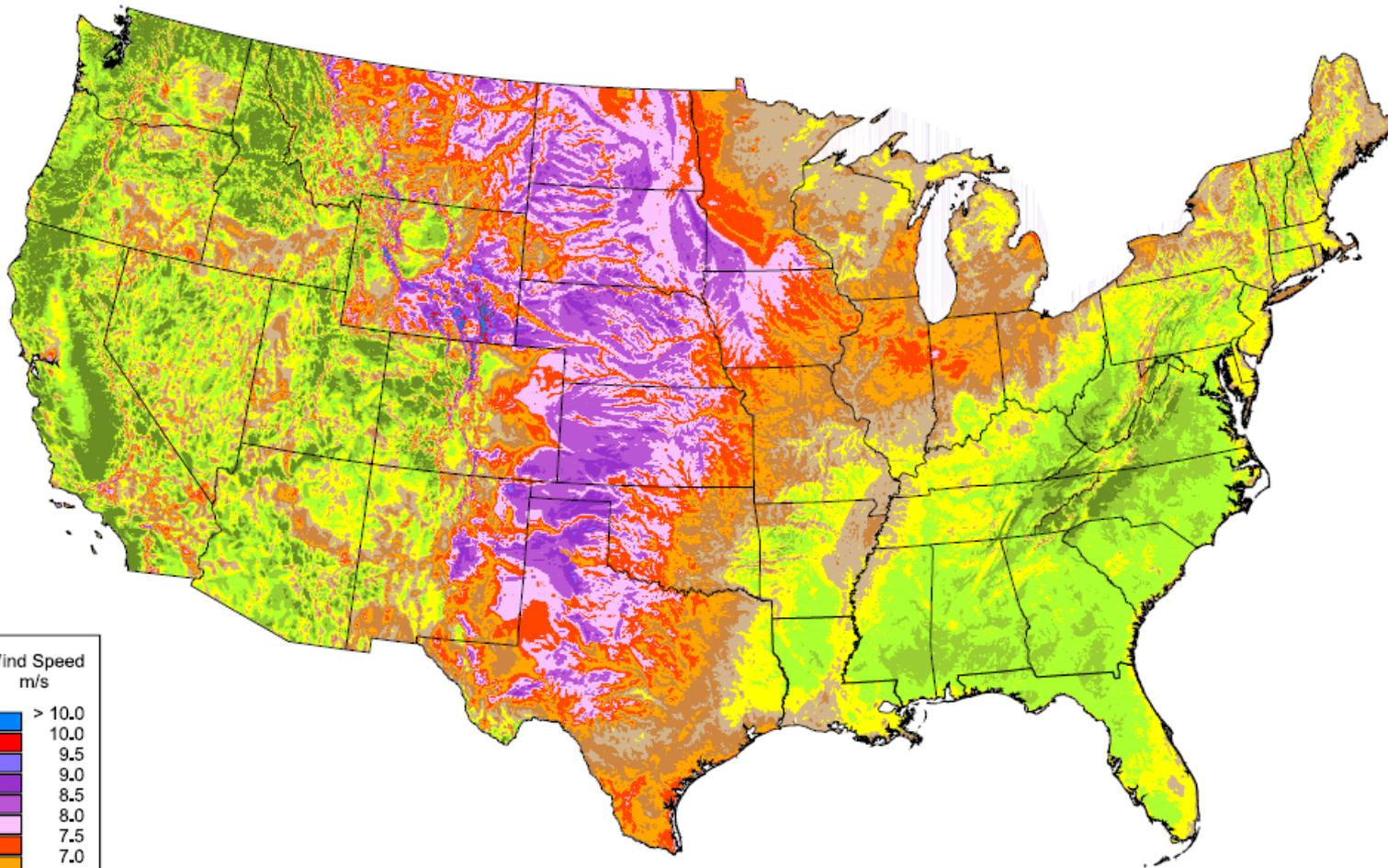
## Down-Regulation

Wind (MW)	Average Min of 5-min Periods	% Change	98 <sup>th</sup> Percentile of 5-min Periods	% Change	Minimum	% Change
0	-74.3 MW		-233.0 MW		-522.2	
5,000	-78.6 MW	5.8%	-246.7 MW	5.9%	-538.9	3.2%
10,000 (1)	-83.0 MW	11.7%	-262.7 MW	12.8%	-554.9	6.3%
10,000 (2)	-81.5 MW	9.7%	-260.4 MW	11.8%	-565.9	8.4%
15,000	-86.6 MW	16.5%	-281.2 MW	20.7%	-566.4	8.5%

# Uncertainty Increases Modestly at High Wind Levels



Day-ahead net load forecast uncertainty: evolution with time



Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: <http://navigator.awstruewind.com> | [www.awstruewind.com](http://www.awstruewind.com). Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.

