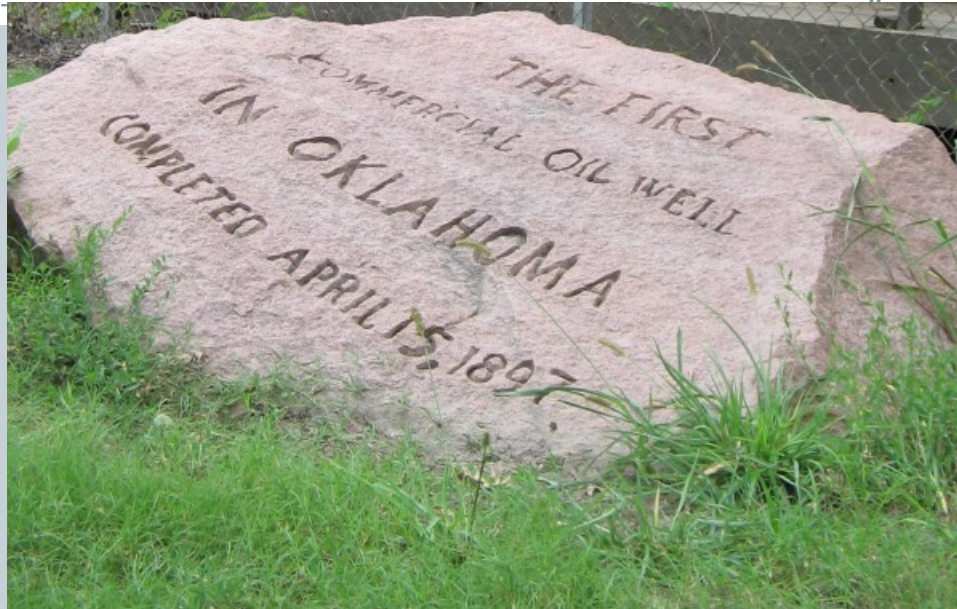


The Changing Nature of Energy in Oklahoma



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Oklahoma and Energy



- As the U.S. energy landscape evolves, Oklahoma's contribution is transforming as well.
- From oil and natural gas to wind resources, Oklahoma is an important producer of both traditional and renewable fuels.

Oil Production Begins in OK



- **Nellie Johnstone No.1**

- Drilled in April 1897
- Discovery well for the Bartlesville-Dewy Field
- Became commercially profitable in May 1900
 - ✦ Due to the construction of the railroad to Bartlesville in 1899
- Field produced more than 100,000 barrels

- “ In the 10 years between the Nellie Johnstone and Statehood, Oklahoma became the largest oil-producing entity in the world.”
 - American Oil & Gas Historical Society
 - ✦ Statehood, 1907

- State oil production peaked in 1927 at 762,000 barrels per day
 - <http://www.ogs.ou.edu/oilgasmilestones.php>

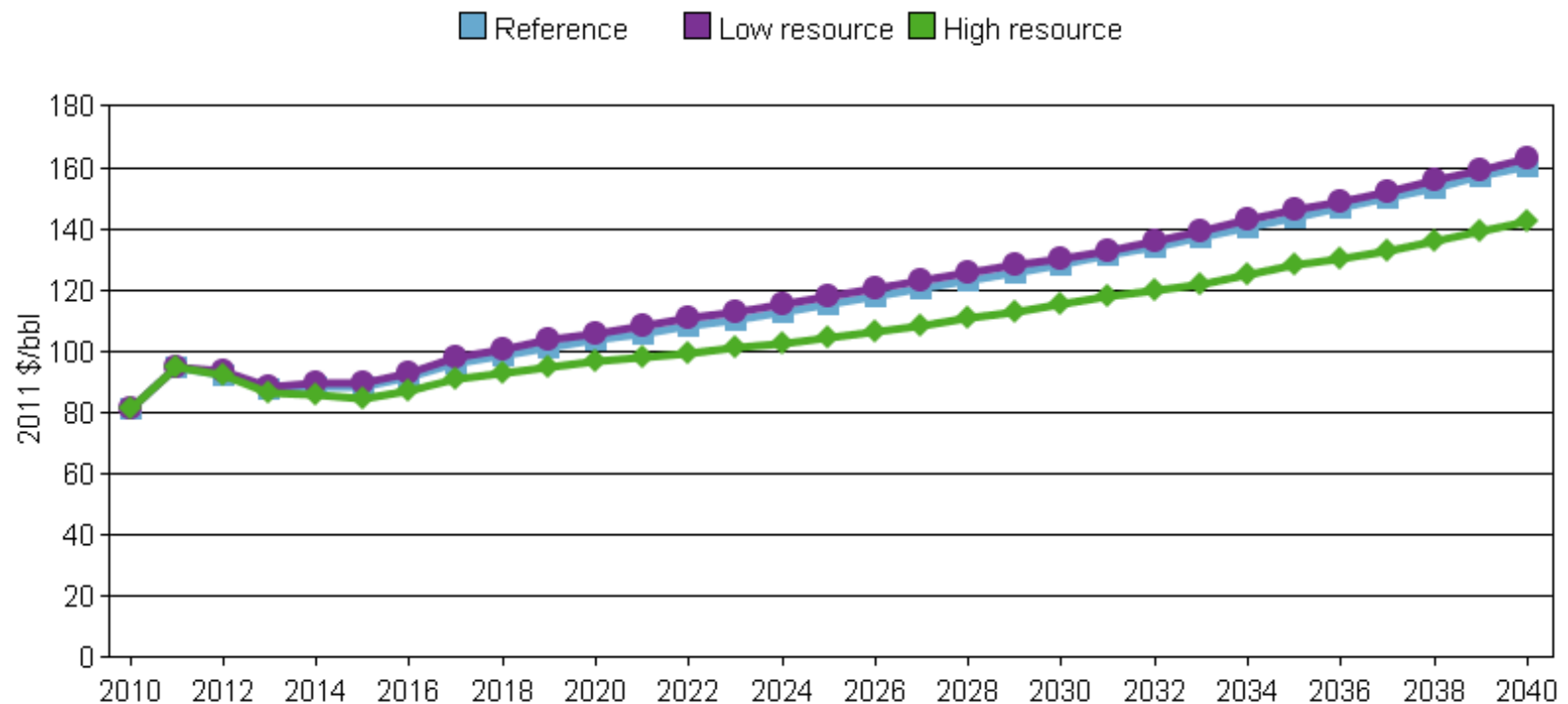
Oil Today



- Annual production typically accounts for more than 3% of total U.S. production
- 2 of the 100 largest U.S. oil fields
 - Approximately 3% of U.S. reserves as of 2011
 - As of July 2013, Oklahoma was ranked 5th in onshore state crude oil production
- Cushing is a major crude oil trading hub
- Crude oil production has been increasing in OK between 2005 and 2012 (from 61,262 to 89,300 thousand barrels)

Projected Oil Prices

Real Petroleum Prices : Crude Oil : West Texas Intermediate Spot



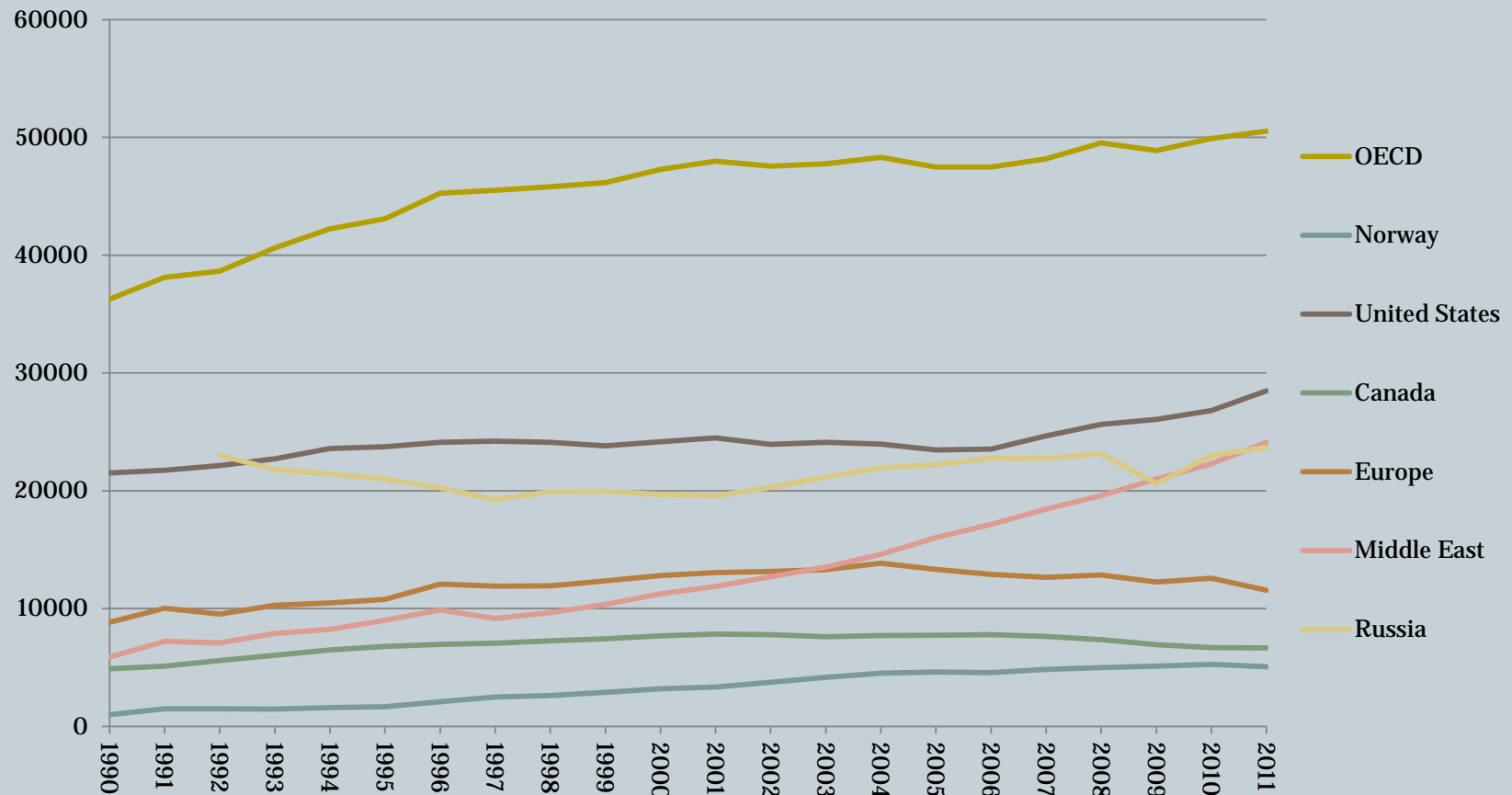
Independent Statistics & Analysis
U.S. Energy Information
Administration

Natural Gas Production Begins in OK



- **First commercial use of natural gas**
 - 1903
- **Natural gas production exceeds oil production (energy equivalent)**
 - 1963
- **Oil and gas production peaks (combined production equivalent to 1.4 million barrels of oil)**
 - 1970
- **Natural gas production peaks (1.8 trillion cubic feet)**
 - 1990
- **Proved reserves doubled between 2000 and 2011 (13, 490 Bcf to 29, 937 Bcf)**

Table: Gross Natural Gas Production (Billion Cubic Feet)



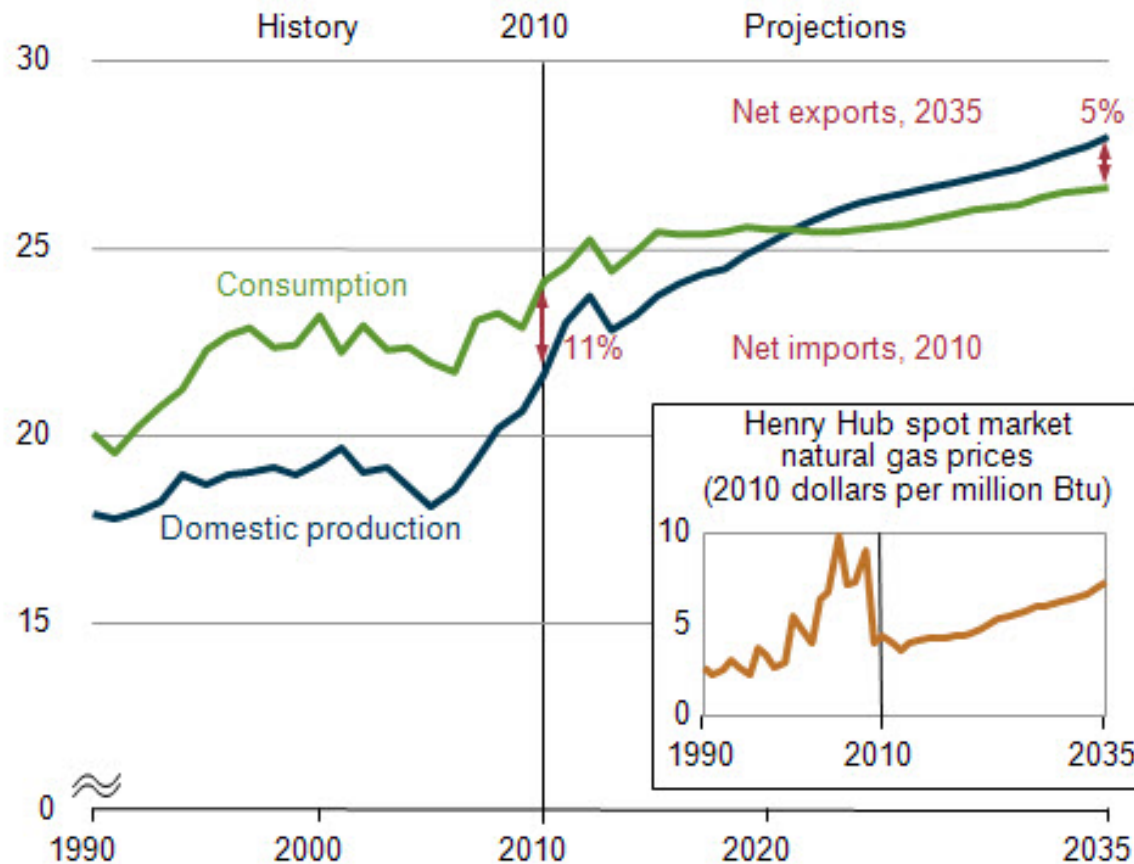
Oklahoma and Natural Gas Today



- One of the top natural gas producers in the U.S.
- Nearly 1/10th of U.S. production
- More than a 12 of the 100 largest natural gas fields in the country are in OK
- Proved Reserves are increasing
 - As of 2011, OK had approximately 10% of U.S. reserves
 - ✦ 8% of natural gas producing wells
 - ✦ Ranked 4th in Natural Gas Production

Future of Natural Gas in the U.S.

Figure 4. Total U.S. natural gas production, consumption, and net imports, 1990-2035
(trillion cubic feet)



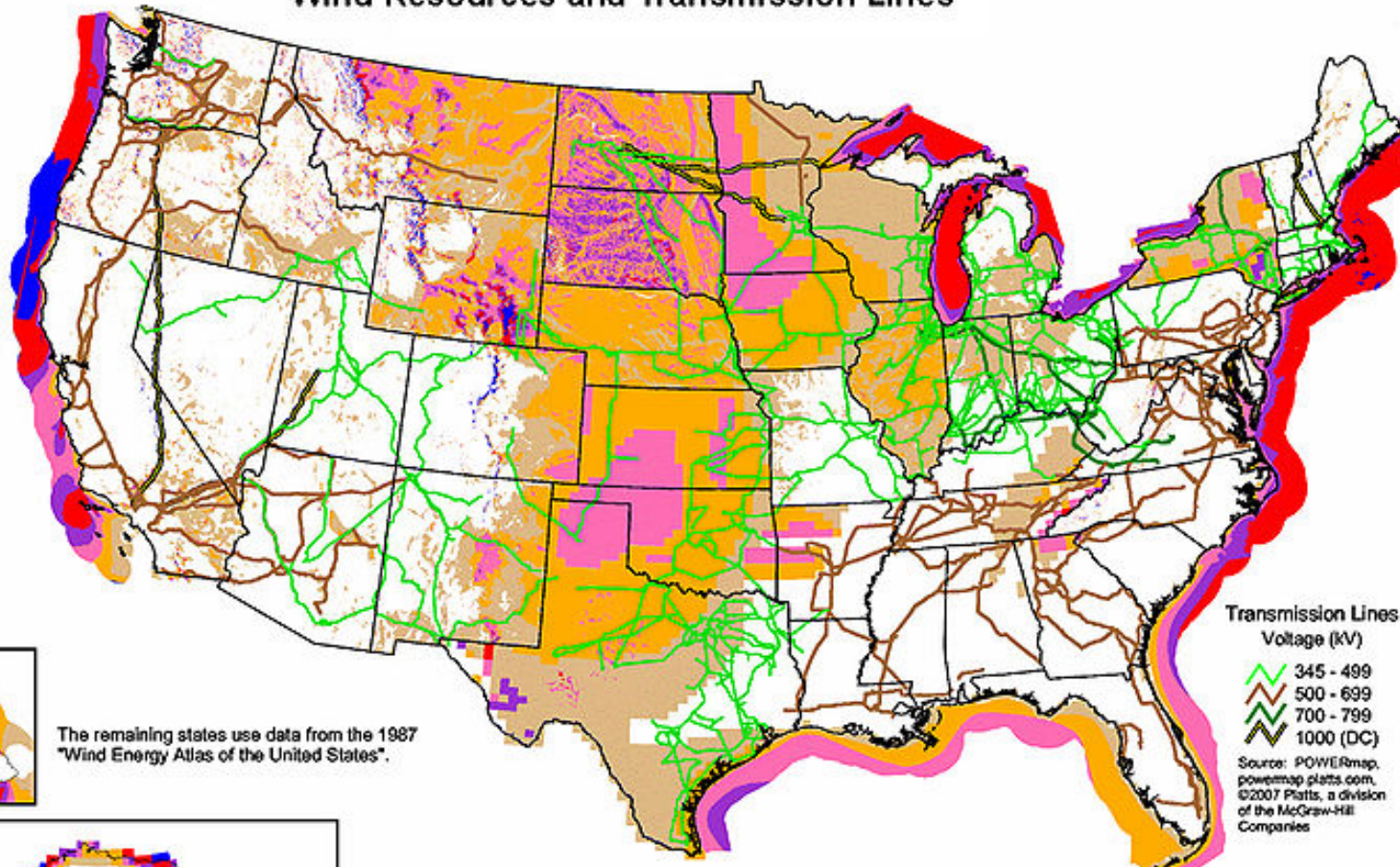
Wind



NREL Updated Maps:

Arizona (2003)
 California (2002)
 Colorado (2004)
 Connecticut (2001)
 Delaware (2002)
 Hawaii (2004)
 Idaho (2002)
 Illinois (2001)
 Indiana (2004)
 Maine (2001)
 Maryland (2002)
 Massachusetts (2001)
 Michigan (2004)
 Missouri (2005)
 Montana (2002)
 Nebraska (2005)
 Nevada (2003)
 New Jersey (2002)
 New Hampshire (2001)
 New Mexico (2003)
 North Carolina (2002)
 North Dakota (2000)
 Ohio (2004)
 Oregon (2002)
 Pennsylvania (2002)
 Rhode Island (2001)
 South Dakota (2001)
 Texas (2003)
 Utah (2003)
 Vermont (2001)
 Virginia (2002)
 Washington (2002)
 West Virginia (2002)
 Wyoming (2002)

Wind Resources and Transmission Lines



The remaining states use data from the 1987 "Wind Energy Atlas of the United States".

Transmission Lines Voltage (KV)

345 - 499
 500 - 699
 700 - 799
 1000 (DC)

Source: POWERmap,
 powermap.platts.com,
 ©2007 Platts, a division
 of the McGraw-Hill
 Companies

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m ²	Wind Speed ^a at 50 m m/s	Wind Speed ^a at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

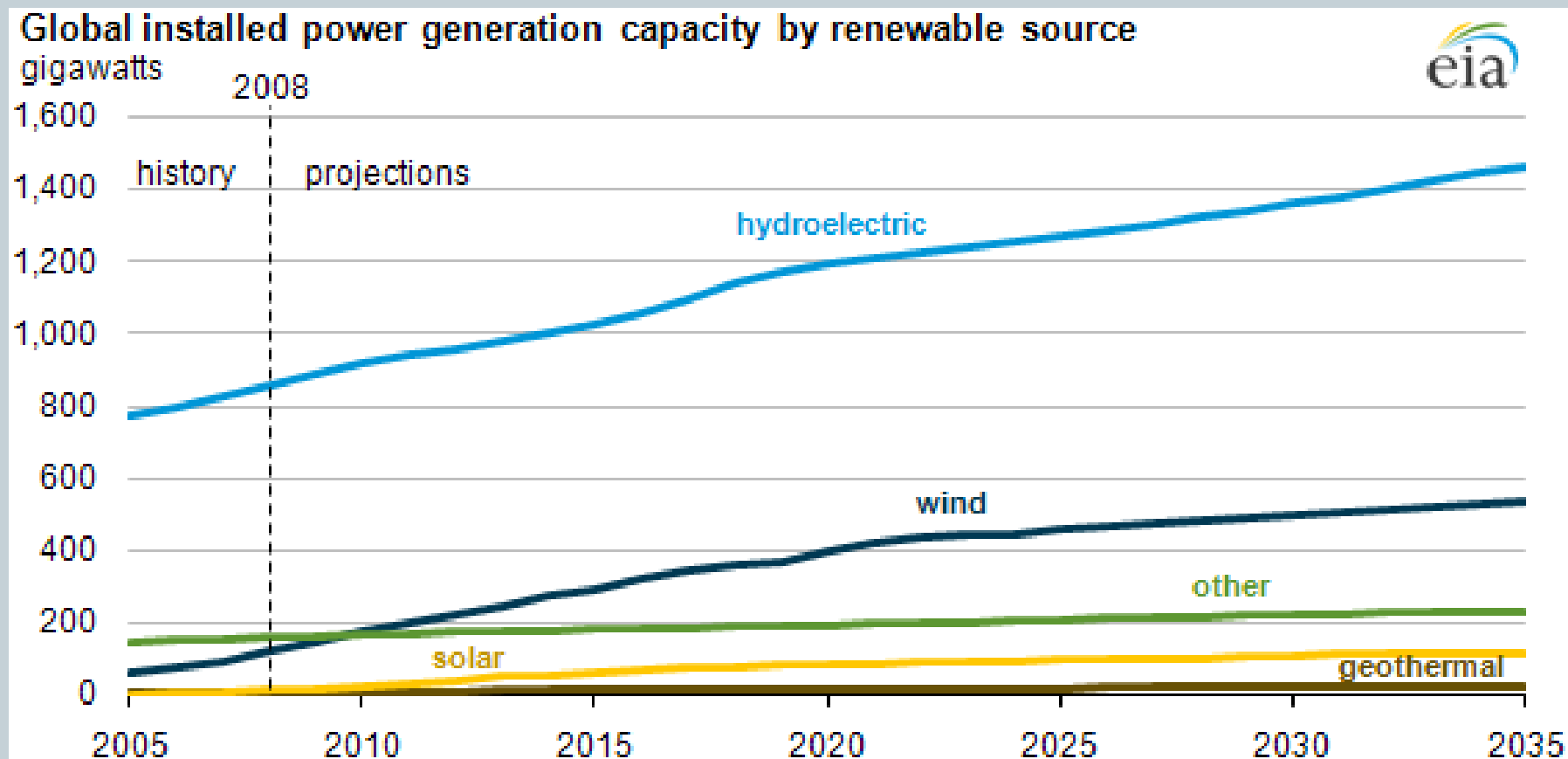
^a Wind speeds are based on a Weibull k value of 2.0

U.S. Department of Energy
 National Renewable Energy Laboratory



19-APR-2007 1.5.9

Global - Future of Renewable Energy Use for Electricity

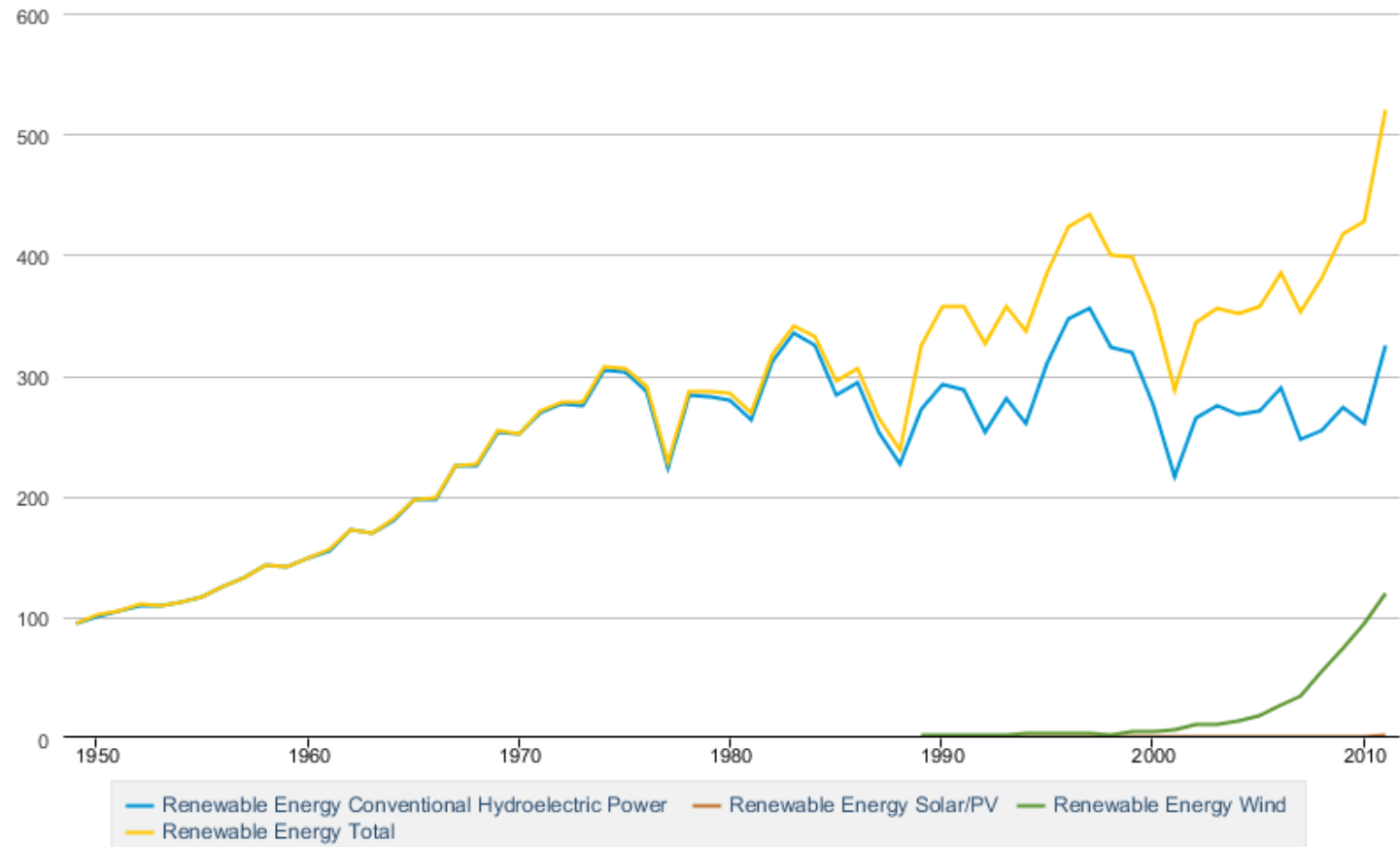


U.S. Net Generation from Renewables



Table 8.2a Electricity Net Generation: Total (All Sectors), 1949-2011

Billion Kilowatthours

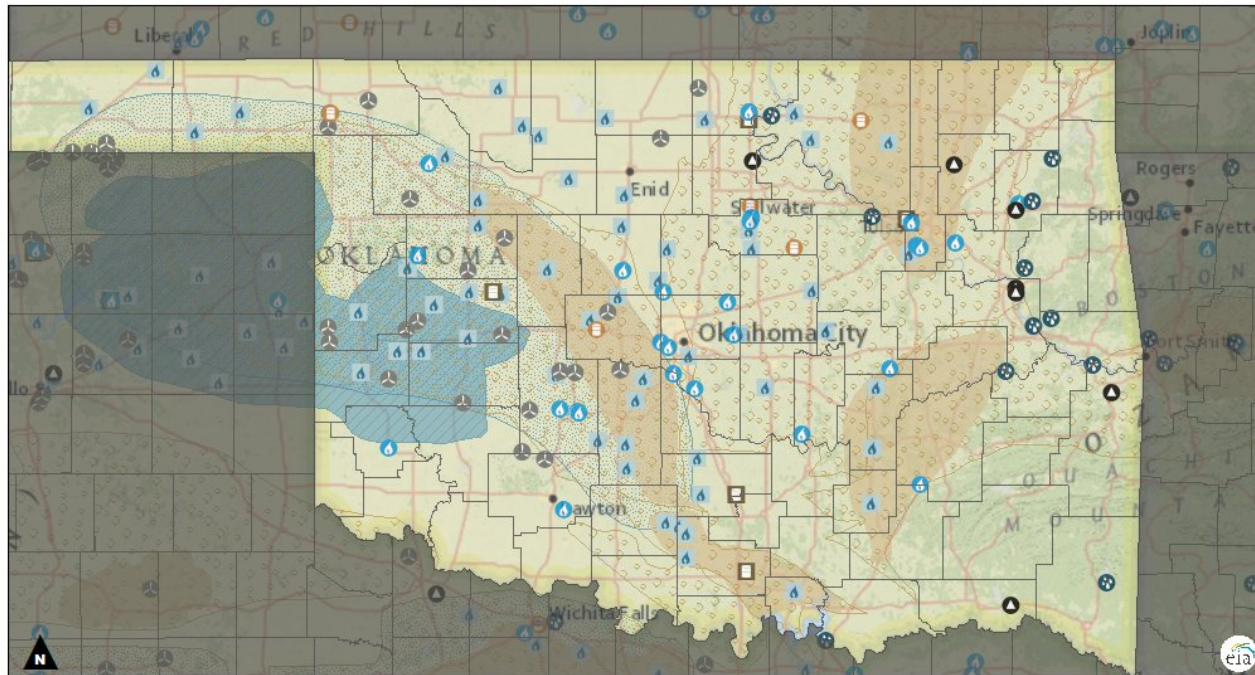


Wind Today



- OK ranked 7th in wind generated electricity in 2011
- Approximately 7% of total net electricity generation was from wind
- From September 2012 to September 2013, wind generation in OK increased 51.3% (from 516 to 781 MW)

Oklahoma and Energy Generation



National Geographic: National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN,

- | | | |
|------------------------------|-------------------------------------|---------------------------------------|
| ■ Mask | ⚙️ Petroleum Power Plant | ■ Oil and Gas Field (Selected Basins) |
| □ County Boundary | ⚙️ Wind Power Plant | ■ Shale Basin |
| ⬆️ Coal Power Plant | ⚙️ Petroleum Refinery | ■ Shale Play |
| ⚙️ Hydroelectric Power Plant | ⚙️ Natural Gas Processing Plant (z) | ■ Tight Gas Basin |
| ⚙️ Natural Gas Power Plant | ⚙️ Natural Gas Market Hub (z) | ■ Tight Gas Play |

<http://www.eia.gov/state/>

References



- **American Oil & Gas Historical Society**
 - <http://aoghs.org/petroleum-industry-pioneers/first-oklahoma-oil-well>
- **Energy Information Association**
 - www.eia.gov
- **National Renewable Energy Laboratory**
 - www.nrel.gov
- **Oklahoma Geologic Survey – Energy**
 - <http://www.ogs.ou.edu/oilgasmilestones.php>