Tracking the US Wind Industry

Annual Report on U.S. Wind Energy Markets: 2008

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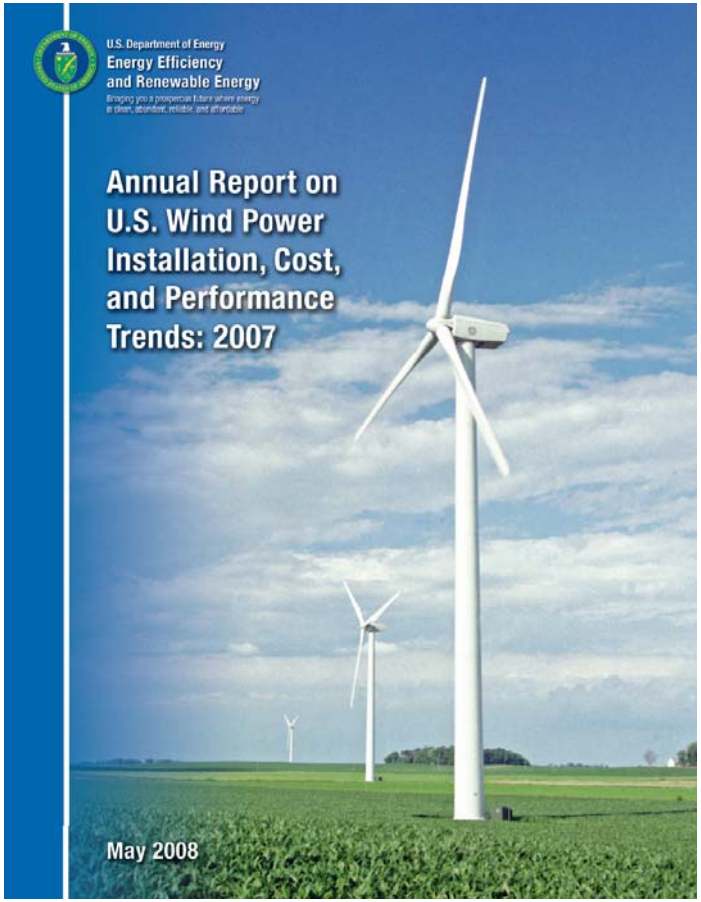
Annual Report on US Wind Energy Markets: To Be Published in June 2009

- Goal is to publish annual, publicly available report summarizing key trends in the U.S. wind market, building from AWEA's data collection efforts
- Current report focuses on 2008; scope primarily includes utility-scale wind applications; data sources are numerous and diverse
- Contributions from LBNL, NREL, DOE, AWEA, and Exeter Associates; funding from the U.S. DOE's Wind & Hydropower Technologies Program

Report Contents

- Wind installation trends
- Wind industry trends
- Price, cost, and performance trends
  - Power sales prices
  - Installed wind project costs
  - Wind turbine transaction prices
  - Wind project performance
  - O&M cost trends
- Policy and market drivers
- Future outlook

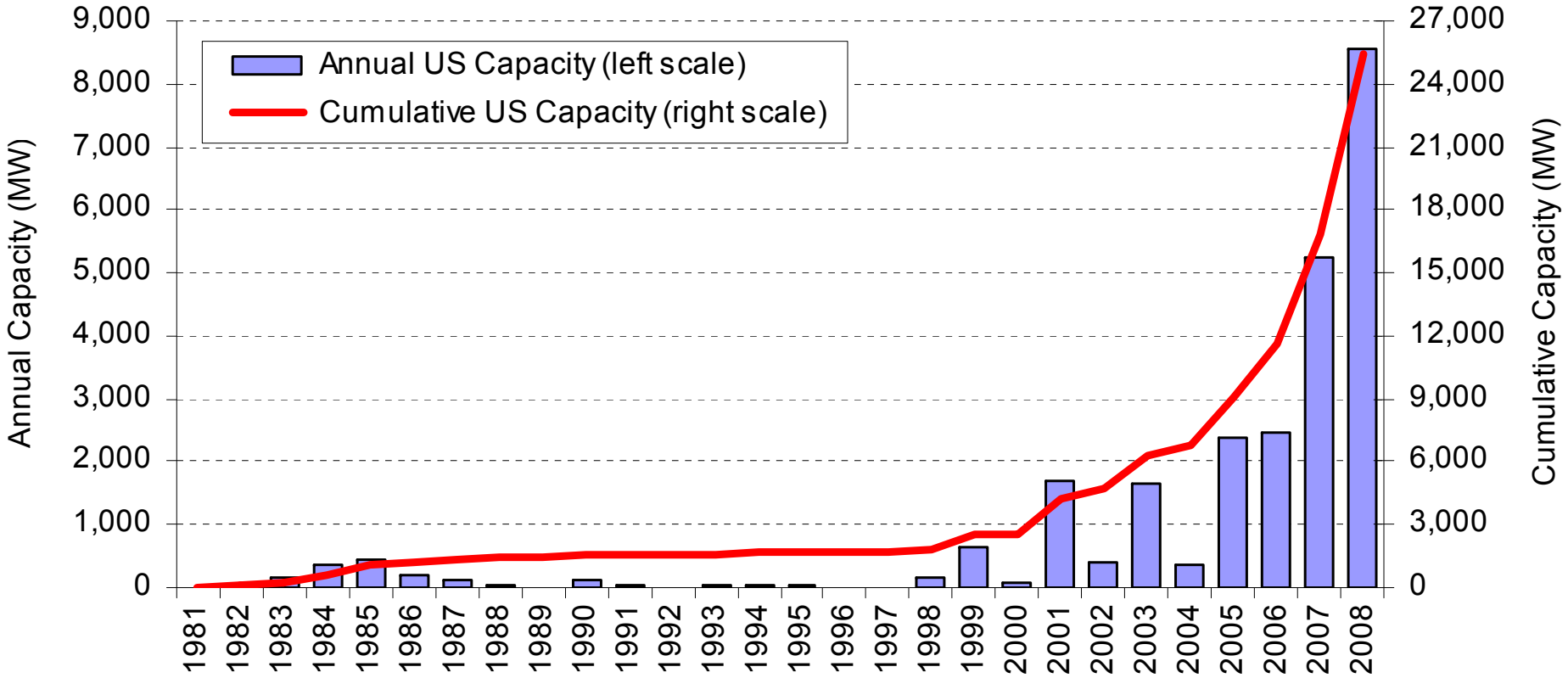


This presentation covers all topics, except O&M costs and policy and market drivers

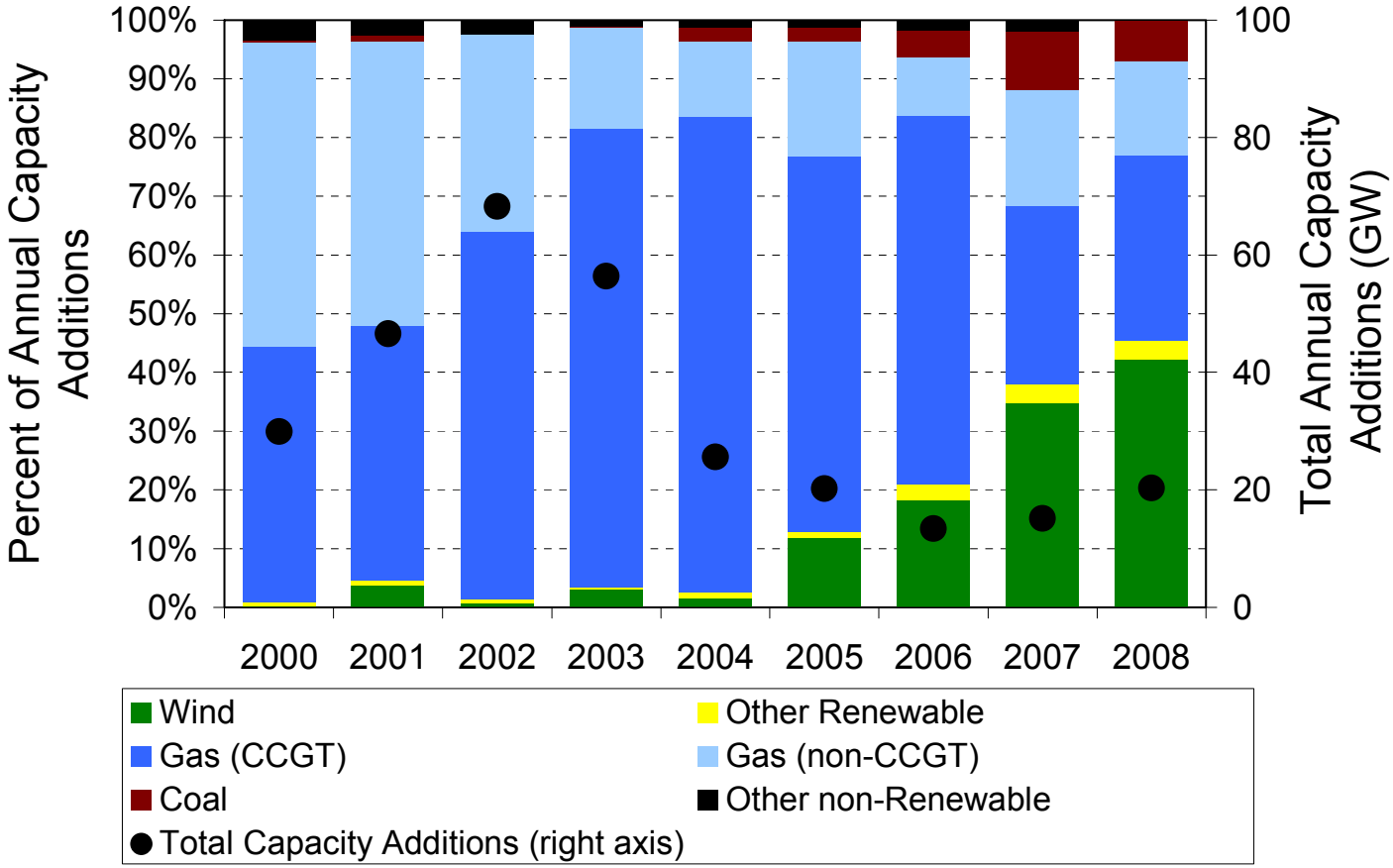
Basic Themes of This Presentation, and the 2008 Report

- U.S. wind industry is growing and maturing at a rapid pace, effectively preparing itself for further growth
- Wind has been competitive in wholesale power markets in recent years, due to:
  - installed cost reductions (historically)
  - performance improvements
  - rising wholesale power prices
- Recent escalation in wind project costs and wind prices, and corresponding drop in wholesale market prices, puts more dramatic increases in sector growth at some risk

Four Years of Strong Growth:
2008: 8,558 MW Added; $16 billion Investment



Wind Is a Major Source of New Generation Capacity Additions



2008: 42%
2007: 35%
2006: 18%
2005: 12%
2000-04: <5%

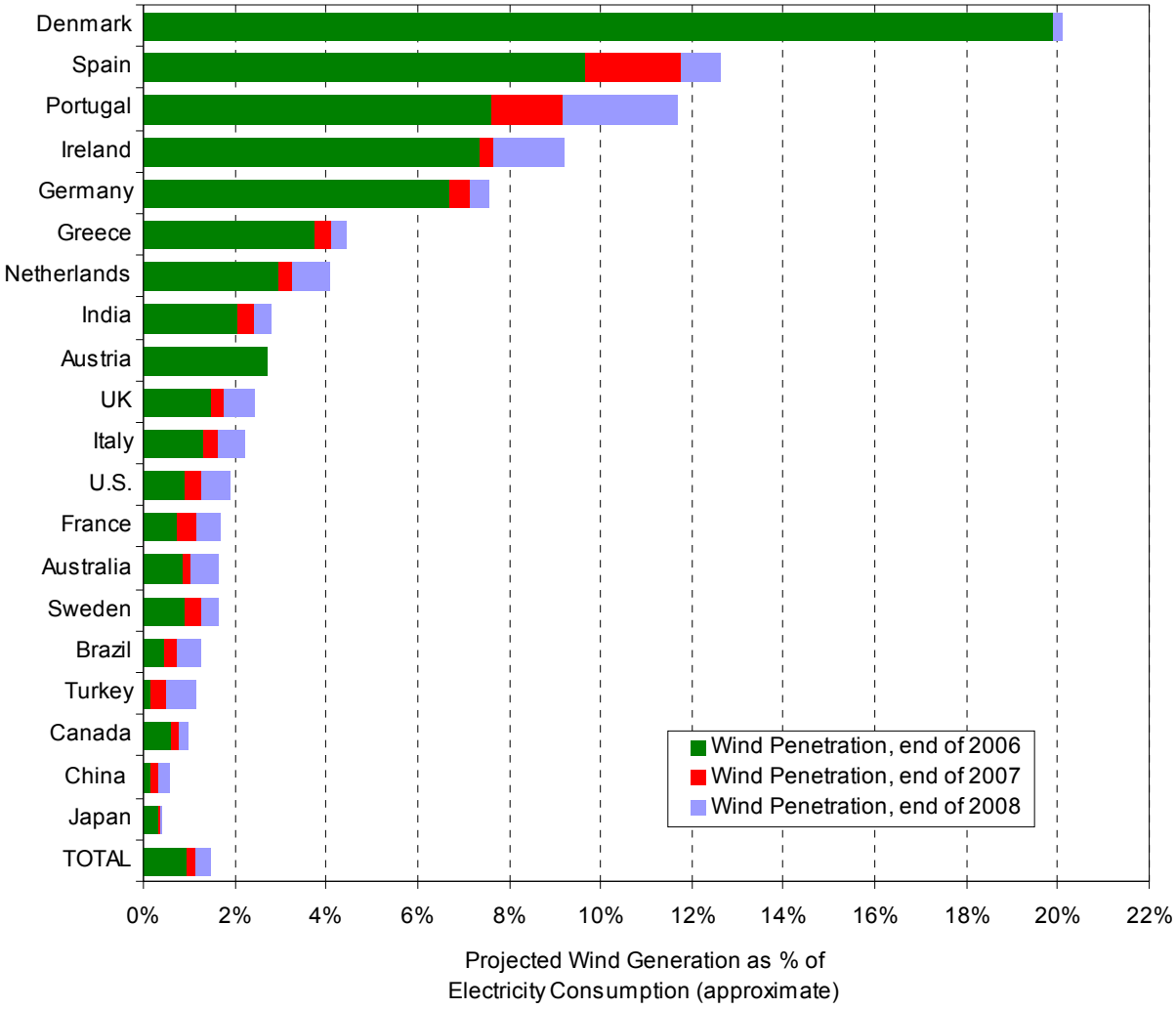
Source: EIA, Ventyx, AWEA, IREC, Berkeley Lab

U.S. Led the World in 2008 Wind Capacity Additions, and in Cumulative Capacity

Annual Capacity (2008, MW)		Cumulative Capacity (end of 2008, MW)	
U.S.	**8,558**	**U.S.**	**25,369**
China	6,246	Germany	23,933
India	1,810	Spain	16,453
Spain	1,739	China	12,121
Germany	1,665	India	9,655
France	1,200	Italy	3,731
Italy	1,010	France	3,671
U.K.	869	U.K.	3,263
Portugal	679	Denmark	3,159
Australia	615	Portugal	2,829
Rest of World	3,999	*Rest of World*	18,106
TOTAL	**28,390**	**TOTAL**	**122,290**

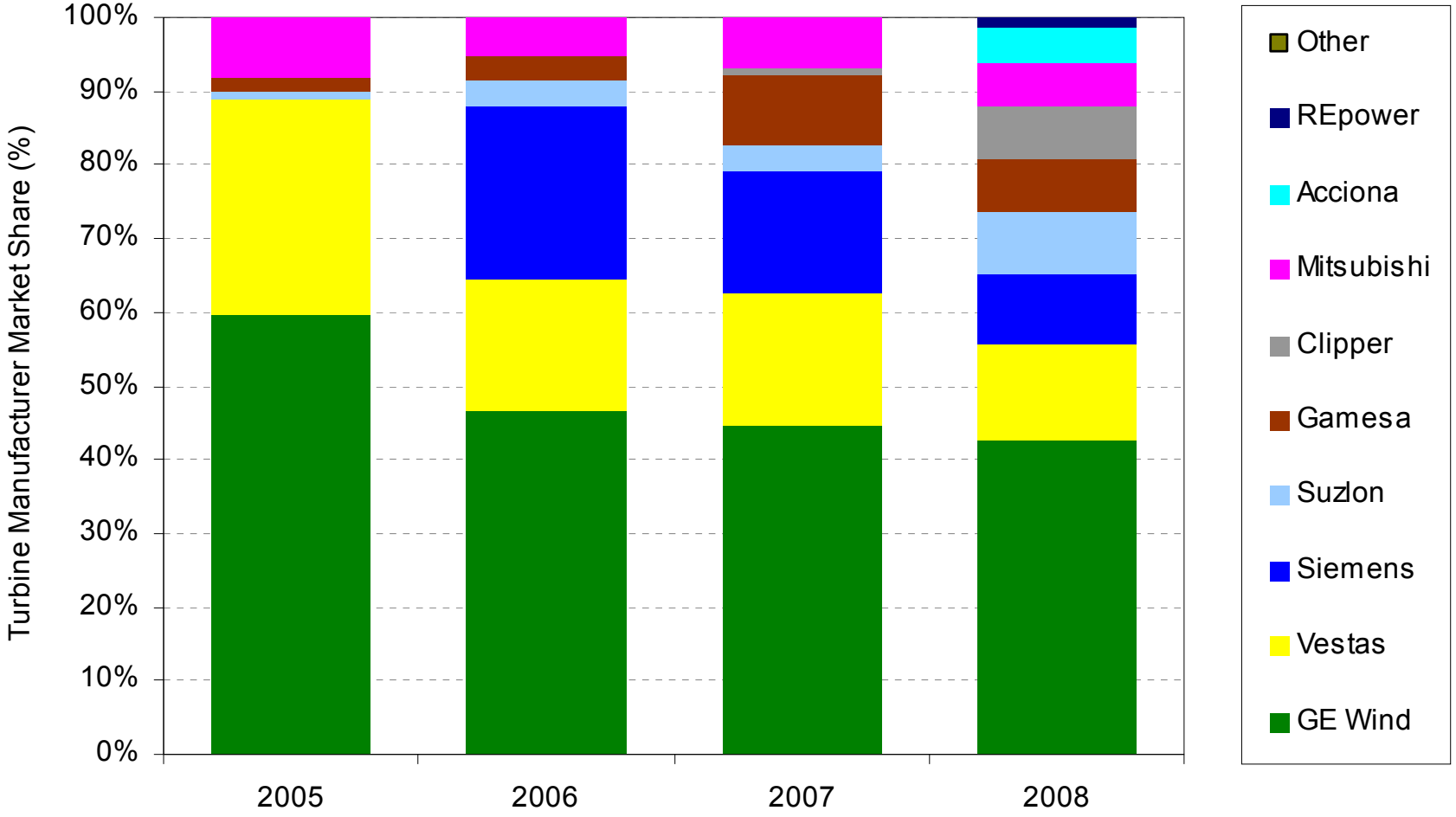
Source: BTM Consult; AWEA for U.S. capacity

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

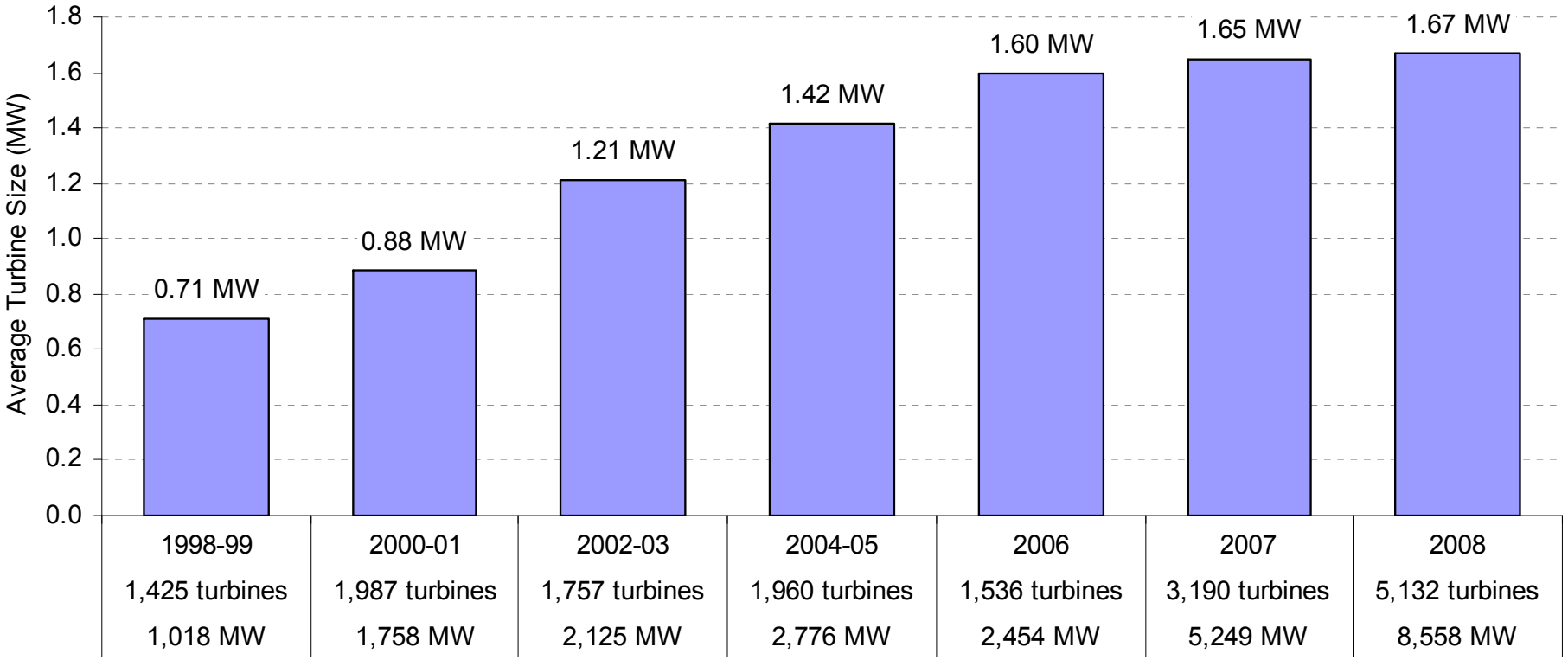


Note: Figure only includes the 20 countries with the most installed wind capacity at the end of 2008

Growing Competition Among Wind Turbine Manufacturers

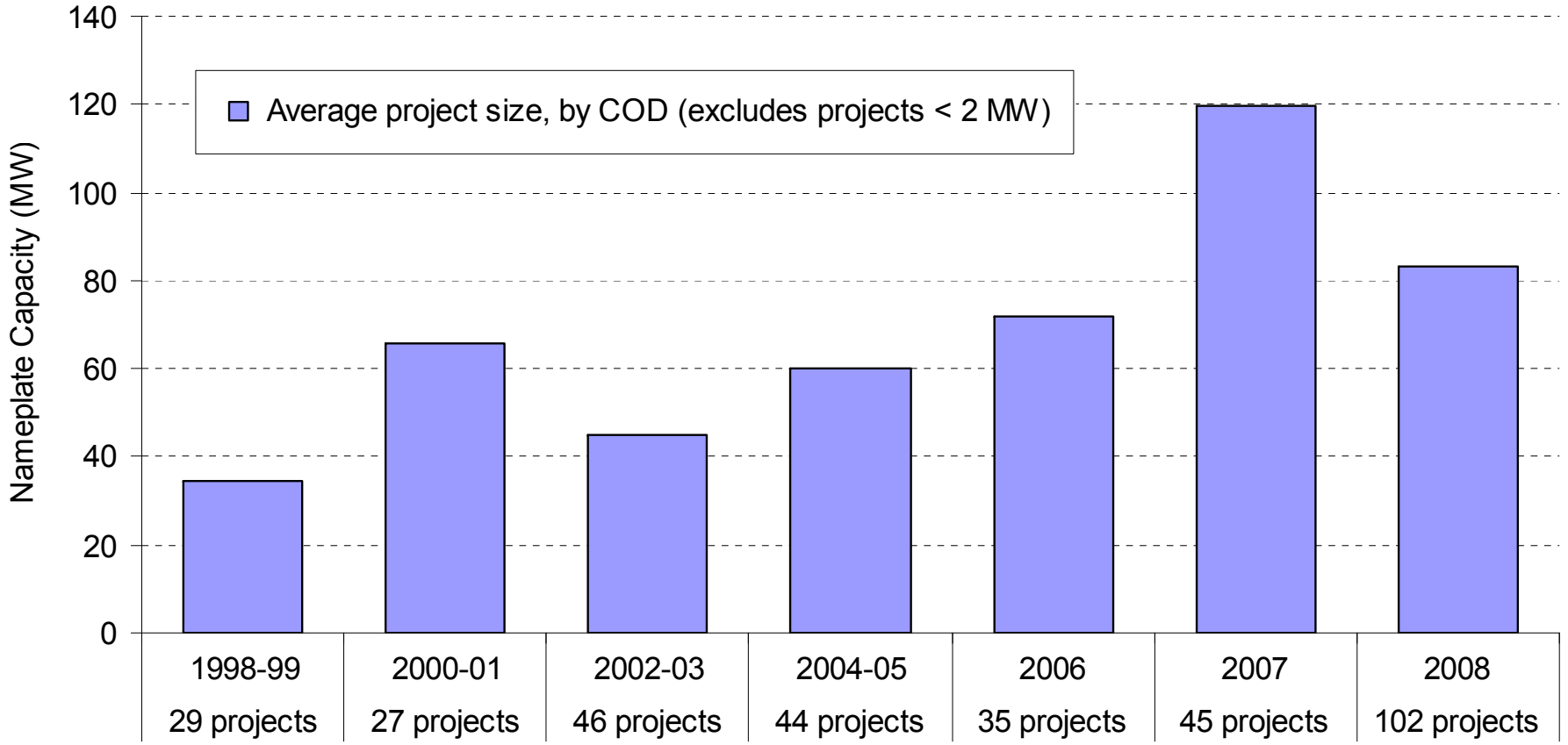


Average Turbine Size Inched Higher in 2008



Source: AWEA project database

Average Project Size Has Increased Since the Late 1990s



Source: Berkeley Lab analysis of AWEA project database

Wind Developer Consolidation Slowed in 2008

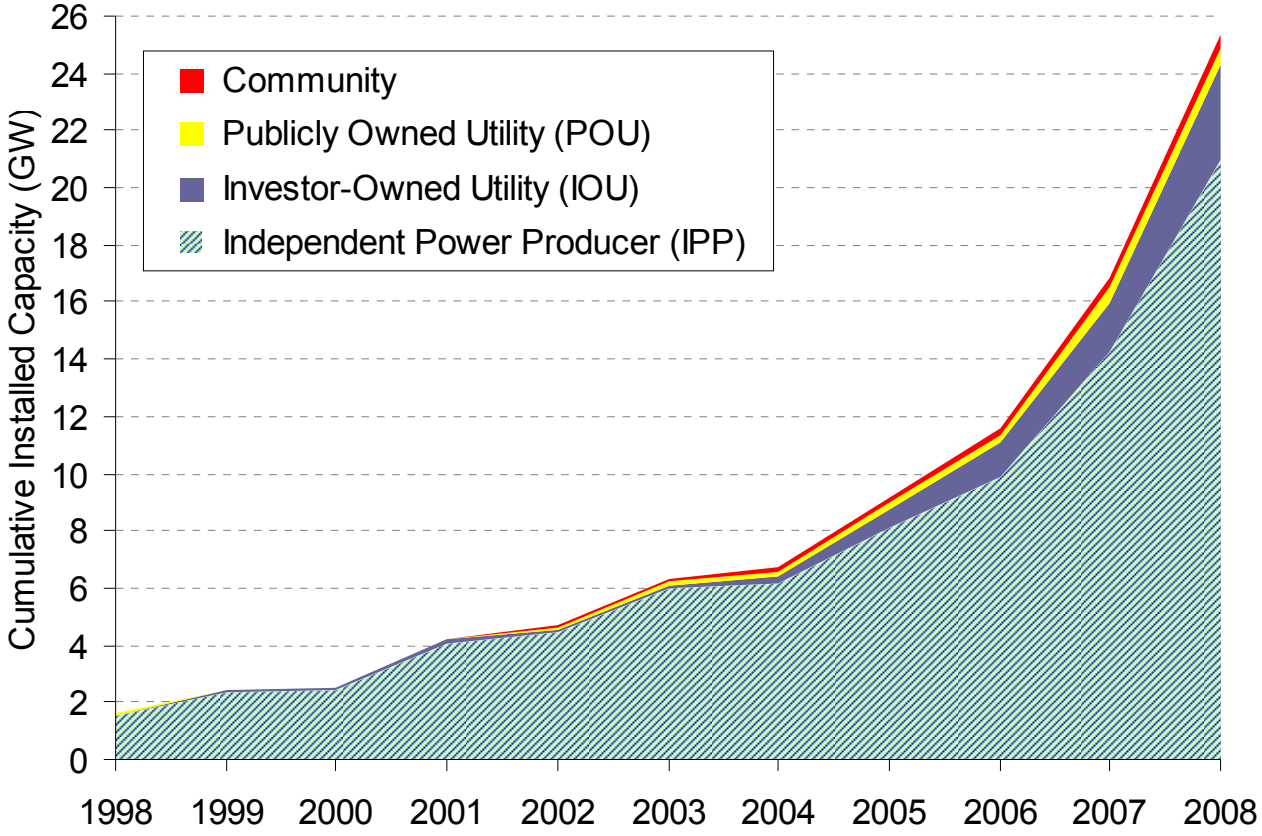
- Acquisition/investment continued strong trend that began in 2005
  - **2008:** 5 deals = 19 GW of wind development pipeline
  - **2007:** 11 deals = 37 GW
  - **2006:** 12 deals = 34 GW
  - **2005:** 8 deals = 12 GW
  - **2002-04:** 4 deals = 4 GW
- A number of large companies, including European energy firms, have recently entered the U.S. wind development business

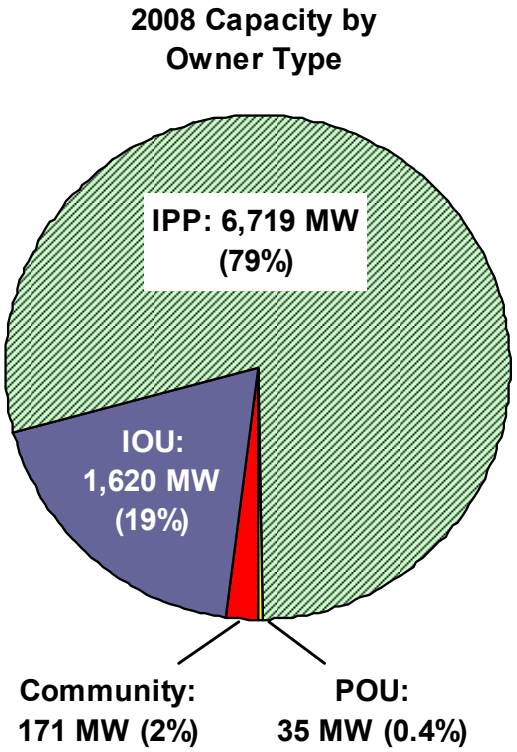
Investor	Transaction Type	Developer	Announcement Date
EDF (SIIF Energies)	Acquisition	enXco	May-02
Gamesa	Investment	Navitas	Oct-02
AES	Investment	US Wind Force	Sep-04
PPM (Scottish Power)	Acquisition	Atlantic Renewable Energy Corp.	Dec-04
AES	Acquisition	SeaWest	Jan-05
Goldman Sachs	Acquisition	Zilkha (Horizon)	Mar-05
JP Morgan Partners	Investment	Noble Power	Mar-05
Arclight Capital	Investment	CPV Wind	Jul-05
Diamond Castle	Acquisition	Catamount	Oct-05
Pacific Hydro	Investment	Western Wind Energy	Oct-05
EIF U.S. Power Fund II	Investment	Tierra Energy, LLC	Dec-05
Airtricity	Acquisition	Renewable Generation Inc.	Dec-05
Babcock & Brown	Acquisition	G3 Energy LLC	Jan-06
Iberdrola	Acquisition	Community Energy Inc.	Apr-06
Shaw/Madison Dearborn	Investment	UPC Wind	May-06
NRG	Acquisition	Padoma	Jun-06
CPV Wind	Acquisition	Disgen	Jul-06
BP	Investment	Clipper	Jul-06
BP	Acquisition	Greenlight	Aug-06
Babcock & Brown	Acquisition	Superior	Aug-06
Enel	Investment	TradeWind	Sep-06
Iberdrola	Acquisition	Midwest Renewable Energy Corp.	Oct-06
Iberdrola	Acquisition	PPM (Scottish Power)	Dec-06
BP	Acquisition	Orion Energy	Dec-06
Naturener	Acquisition	Great Plains Wind & Energy, LLC	Feb-07
HSH Nordbank	Investment	Ridgeline Energy	Feb-07
Energias de Portugal	Acquisition	Horizon	Mar-07
Iberdrola	Acquisition	CPV Wind	Apr-07
Duke Energy	Acquisition	Tierra Energy, LLC	May-07
Acciona	Acquisition	EcoEnergy, LLC	Jun-07
Babcock & Brown	Acquisition	Bluewater Wind	Sep-07
Good Energies	Investment	EverPower	Sep-07
E.ON AG	Acquisition	Airtricity North America	Oct-07
Wind Energy America	Acquisition	Boreal	Oct-07
Marubeni	Investment	Oak Creek Energy Systems	Dec-07
NTR	Investment	Wind Capital Group	Apr-08
Canadian Pension Plan	Investment	Noble Power	Apr-08
ArcLight and Terra-Gen	Acquisition	Allco Wind Energy	Jun-08
Duke Energy	Acquisition	Catamount	Jun-08
Veolia	Acquisition	Ridgeline Energy	Oct-08

* Select list of announced transactions; excludes joint development activity

Source: Berkeley Lab

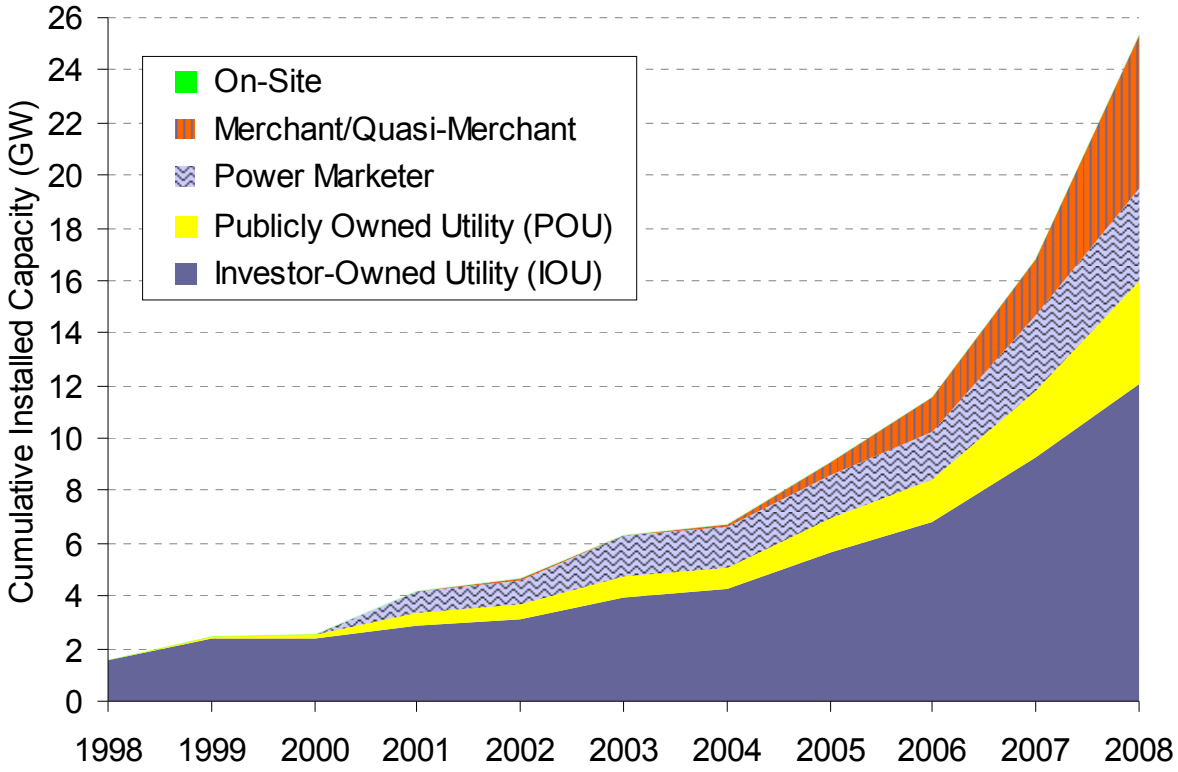
IPP Ownership Remained Dominant, But Utility Ownership Gains Ground

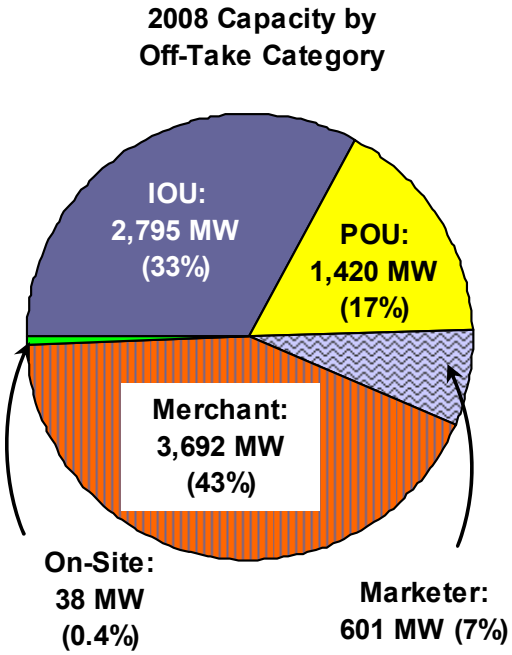




Source: Berkeley Lab estimates based on AWEA project database

Increased Diversity In Off-take Deals:
Merchant Plants and Sales to Power Marketers





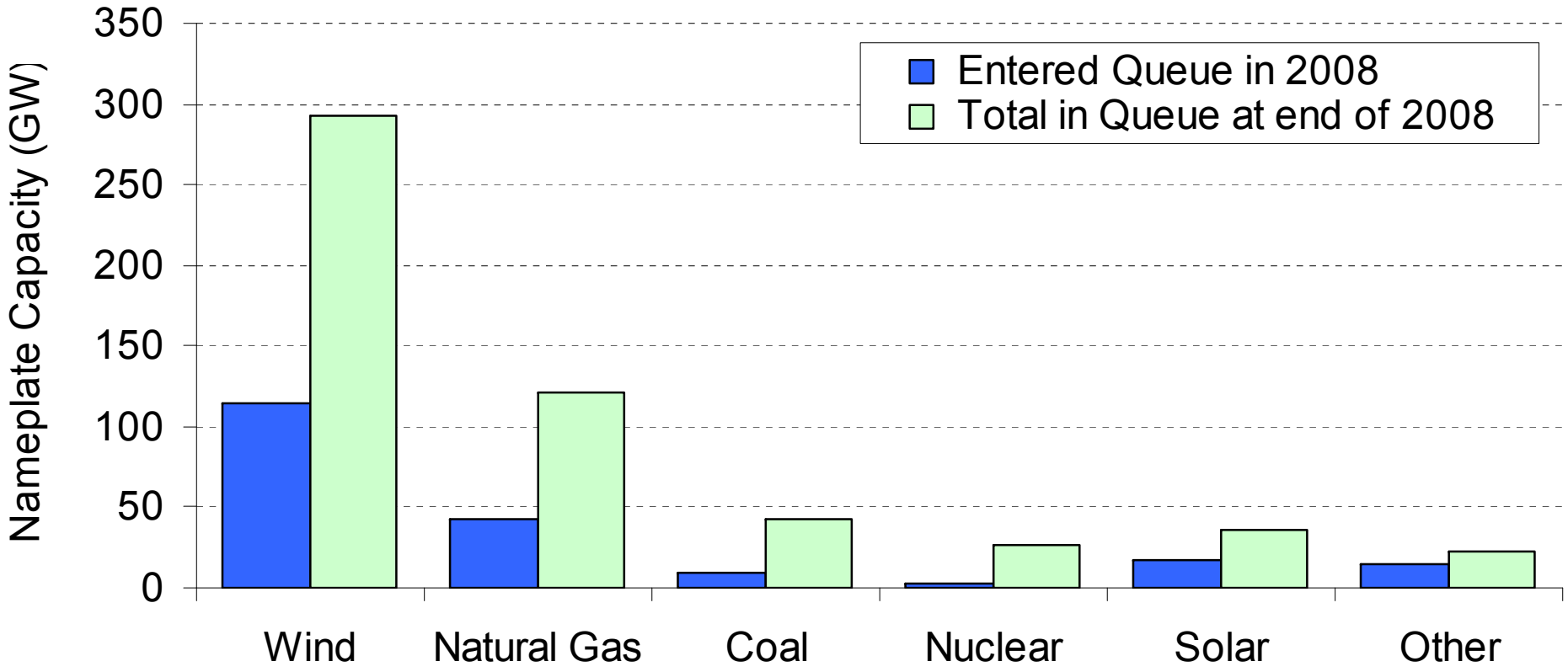
Source: Berkeley Lab estimates based on AWEA project database

Utilities continue to be the dominant purchasers of wind power, but power marketers and, more recently, merchant activity has increased dramatically

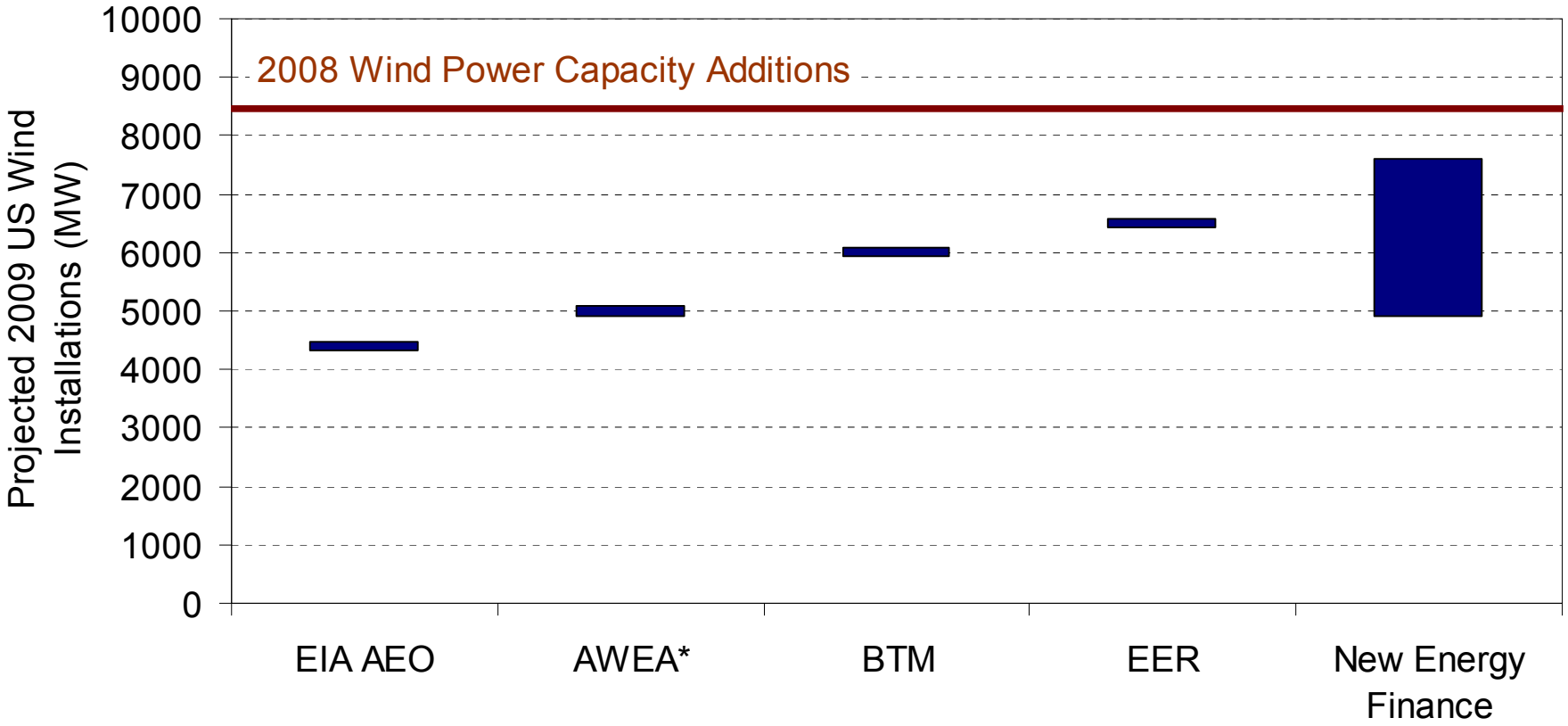
State and Federal Policy Support for Wind Has Been Strong

- State Policies
  - 28 states and DC with renewables portfolio standards
  - Growing interest in carbon reduction policies
  - Increased state/regional efforts to address transmission barriers
- Federal Policies
  - Production Tax Credit: now extended through 2012
  - MACRS: 5-year accelerated depreciation
  - More-proactive transmission build-out supported by FERC
  - More-proactive efforts on siting by Federal authorities
- American Recovery and Reinvestment Act (ARRA) of 2009
  - PTC extension through 2012
  - 30% ITC election option and temporary Treasury grants program
  - Expansion and extension of loan guarantee program
  - New CREB funding, manufacturing tax incentives, transmission funds, bonus depreciation extension, etc.

Interconnection Queues Are Clogged with Wind Projects: Nearly 300 GW!



But 2009 Is Expected To Be a Slow(er) Year for the US Wind Sector



* AWEA projects "more than" 5,000 MW

Expansion…

Investment climate → **EESA 2008; ARRA 2009**

Transmission investment → **New federal policies under consideration; state efforts underway**

Comparative economics → **Federal RPS? Federal climate legislation? State policies?**

Wind Power Price, Cost, and Performance Trends

Project-Level Power Sales Prices

– Sample of 159 projects built from 1998-2008, 11.1 GW; prices reflect price of electricity as sold by project owner

Project-Level Performance/Capacity Factor

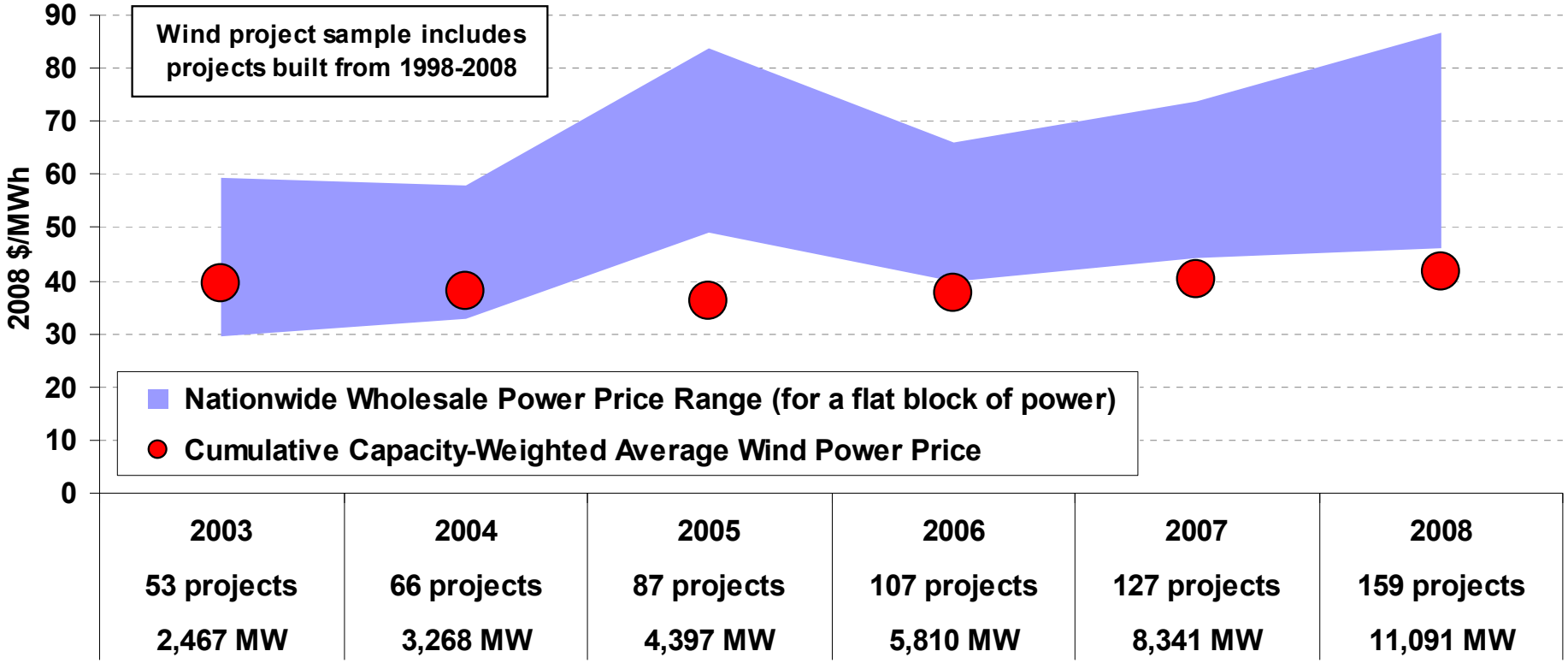
– Sample of 180 projects built from 1983-2007, 14.2 GW

Project-Level and Turbine-Level Capital Costs

– Project sample: 283 projects built from 1983-2008, 18.6 GW

– Turbine sample: 58 transactions from 1997-2009, 21.1 GW

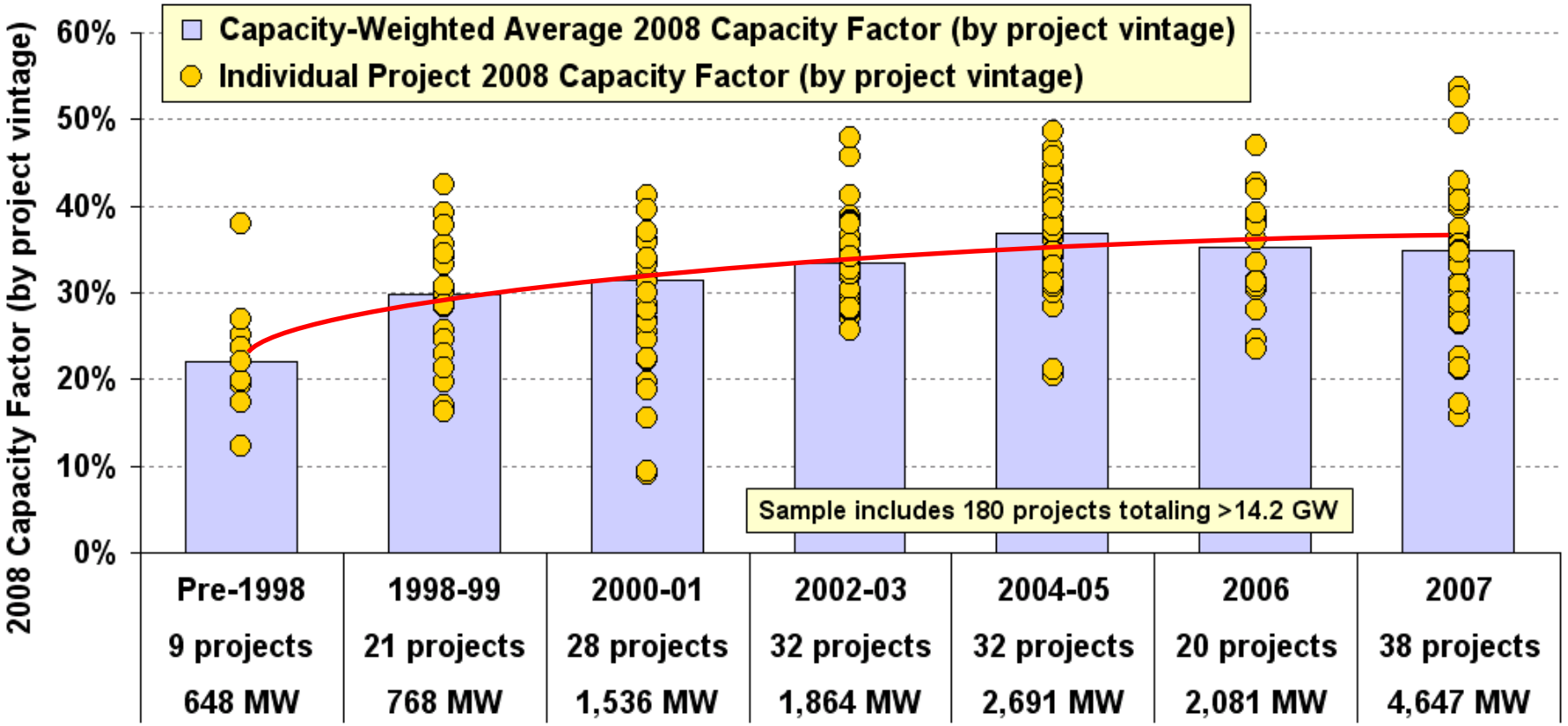
Wind Power Has Been Competitive with Wholesale Power Prices in Recent Years



Source: FERC 2006 and 2004 "State of the Market" reports, Berkeley Lab database, Ventyx, ICE

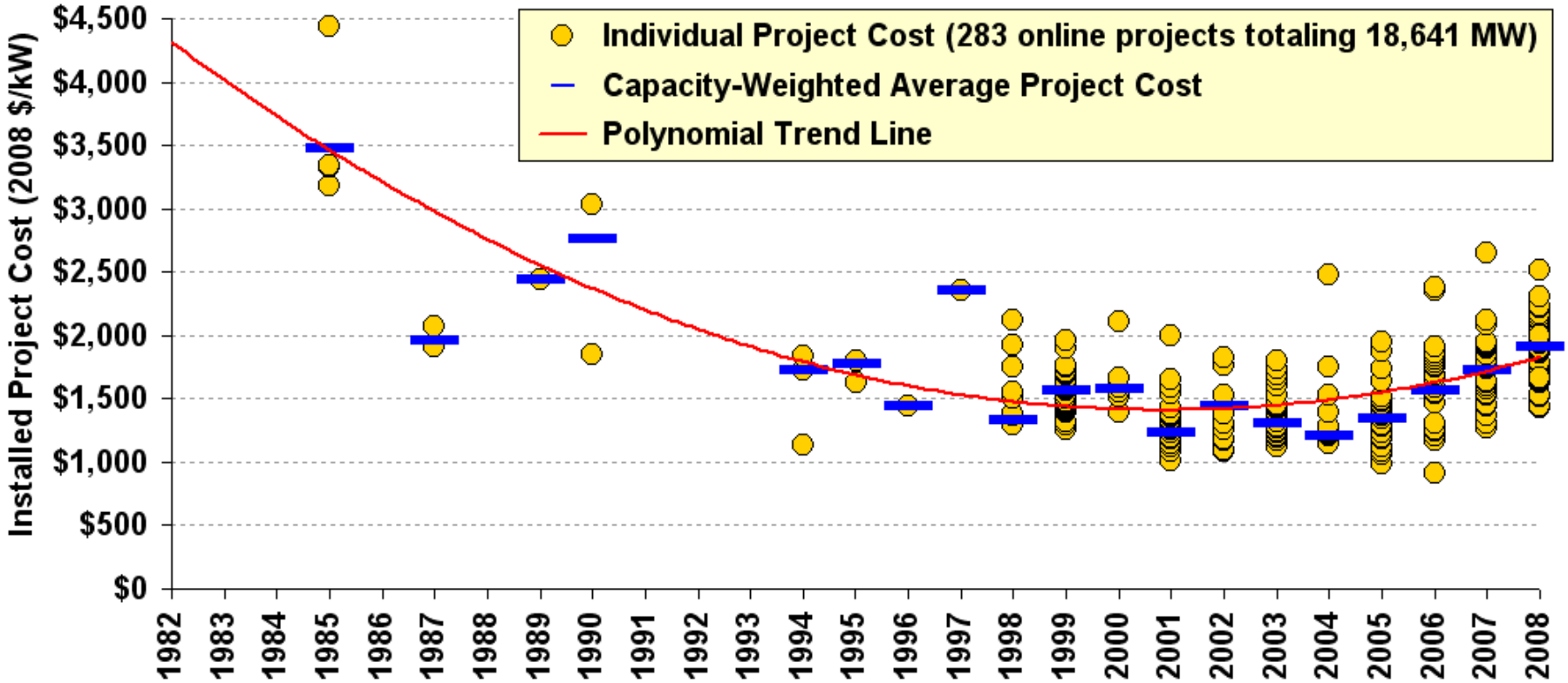
Note: Wholesale price range reflects flat block of power across 23 pricing locations; wind costs represent capacity-weighted average price for wind power for entire sample of projects built from 1998-2008

Wind Project Performance Has Improved, But Has Been Largely Flat Since 2004-05



- 6% of projects installed prior to 2004 had CFs > 40% in 2008
- 27% of projects installed from 2004-07 had CFs > 40% in 2008

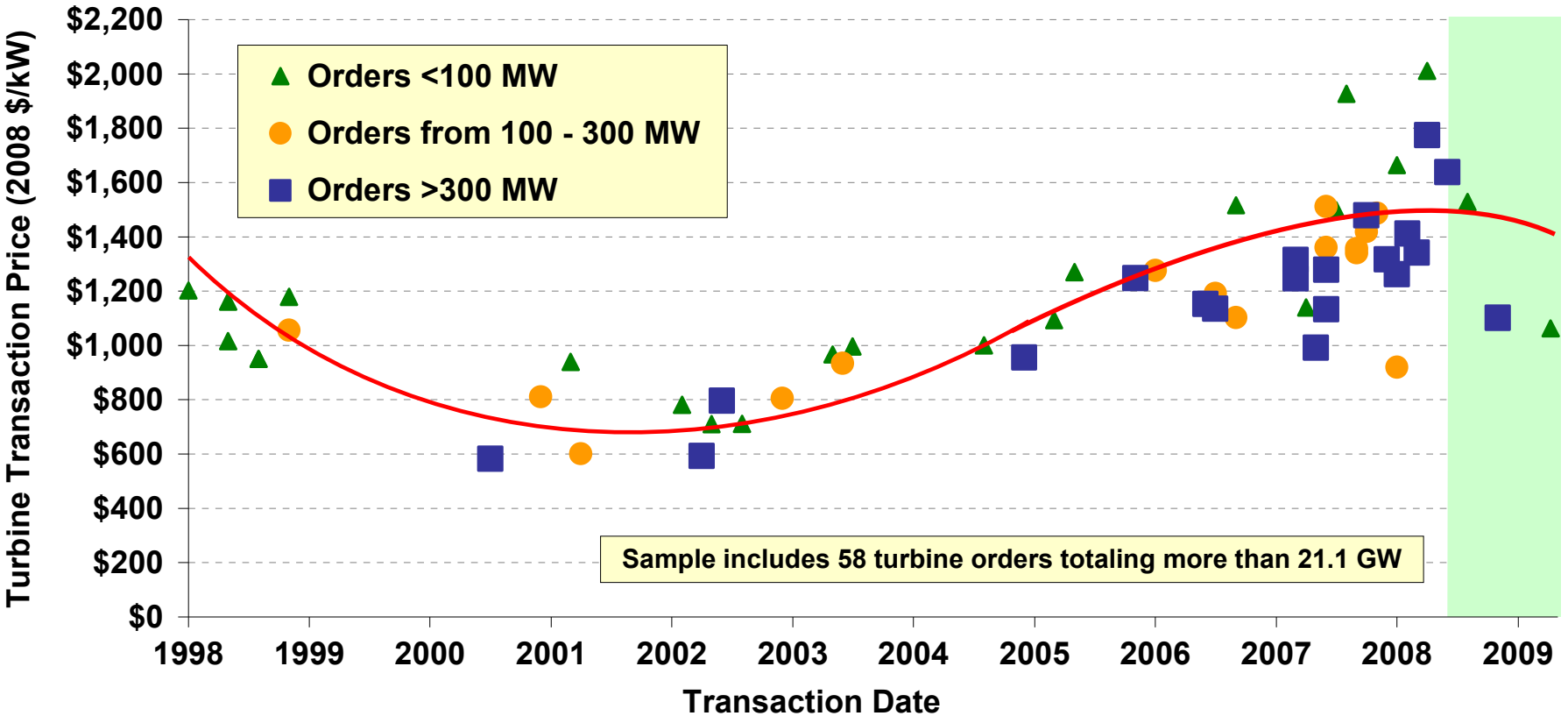
After a Long Period of Decline, Installed Project Costs Have Risen



Source: Berkeley Lab database (some data points suppressed to protect confidentiality)

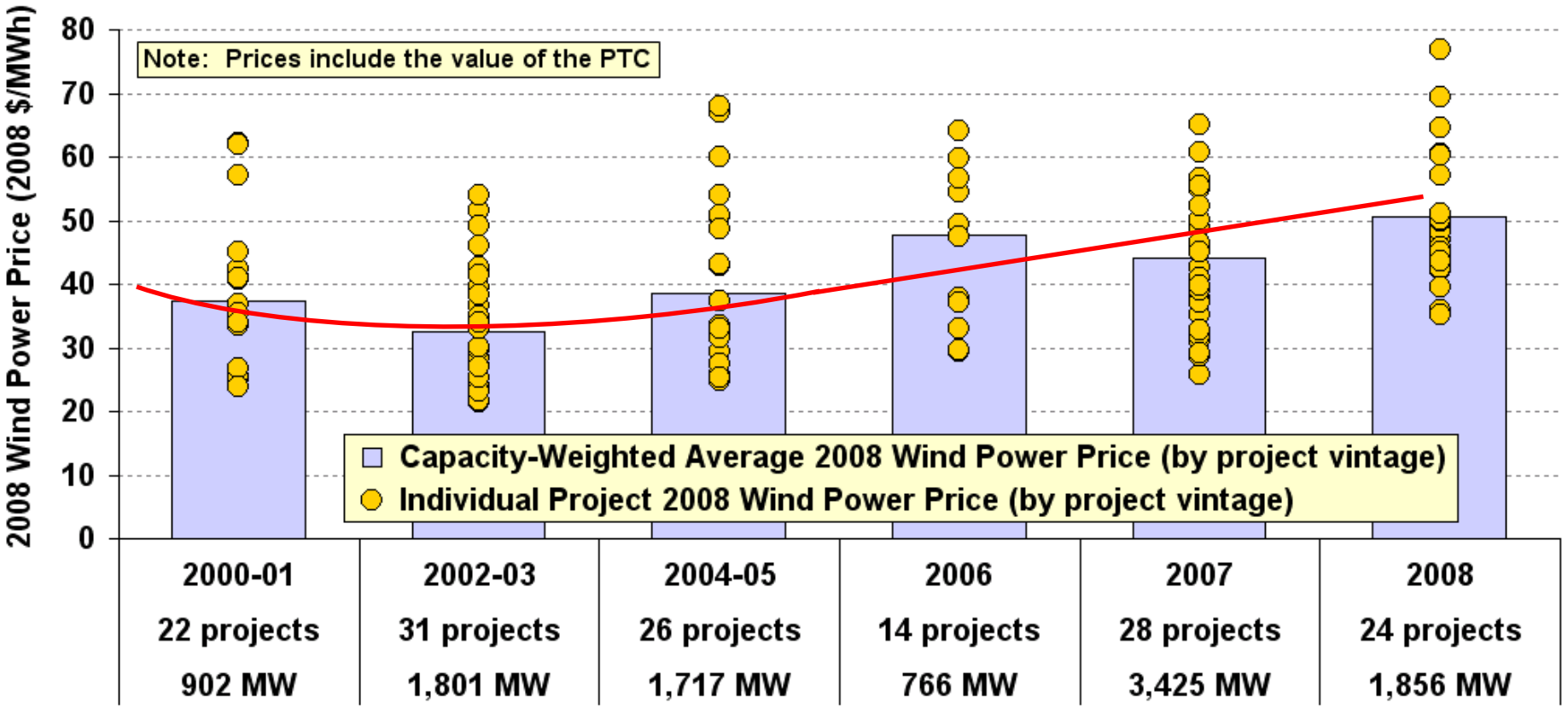
Project costs bottomed out in 2001-2004, and have risen by roughly $650/kW, on average, through 2008

Wind Turbine Prices Are Softening, But Remain High By Historical Standards



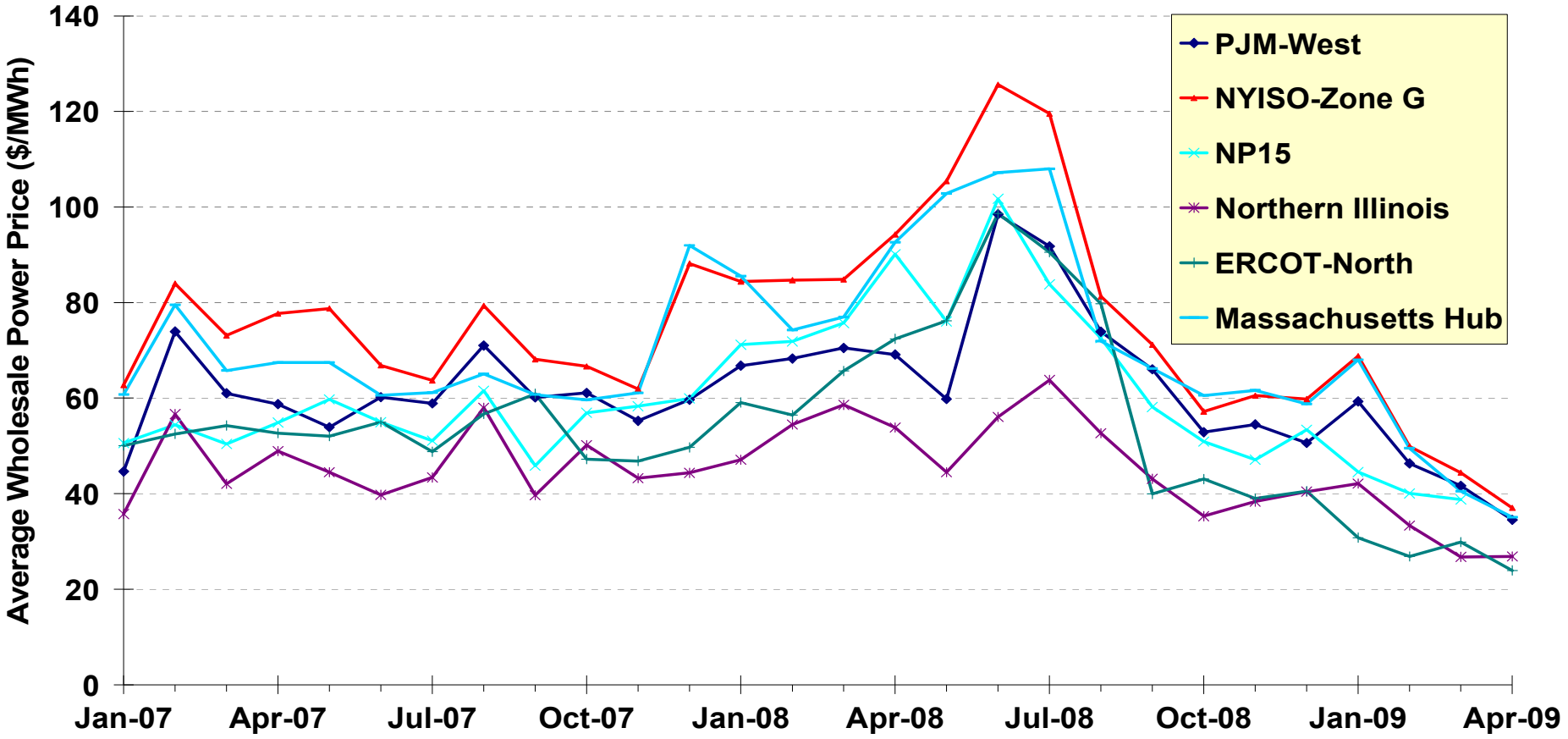
Turbine prices up by ~$800/kW from 2002 through mid-2008, but are now softening (though recent sample is small)

As a Result of Foregoing Trends, Wind Prices Have Been Rising Since 2002-03…

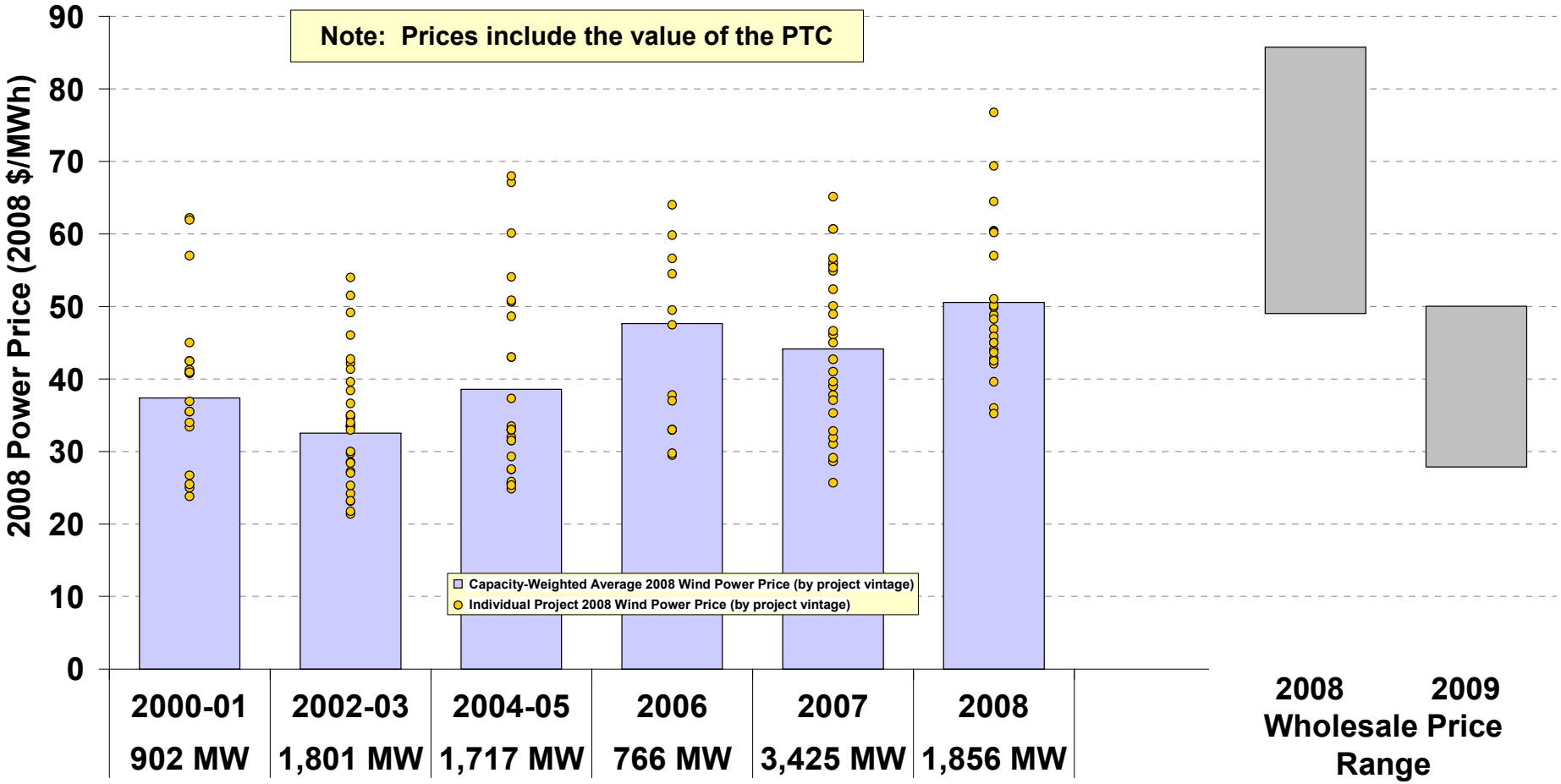


- Wind power prices bottomed out with projects built in 2002-03
- Projects built in 2008 are ~$15-20/MWh higher on average

…While Wholesale Prices Have Recently Plummeted (with Natural Gas Prices)



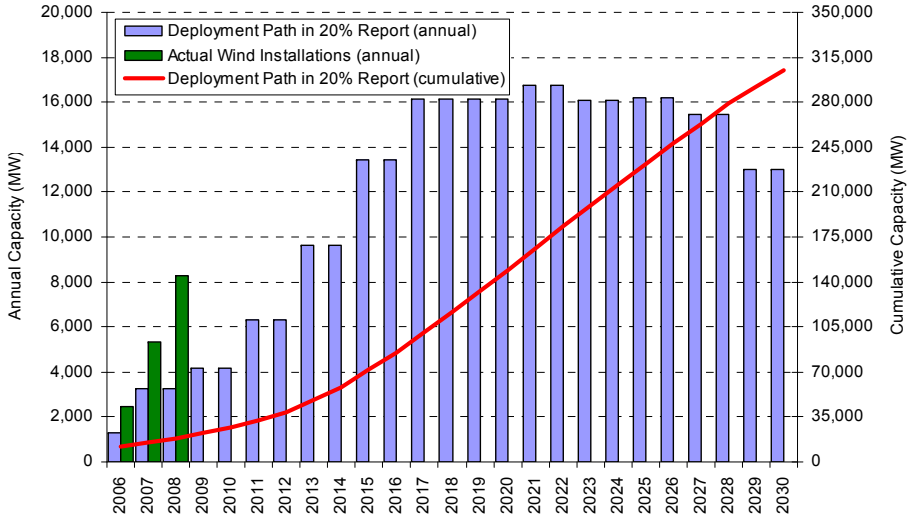
The Near-Term Economics of Wind Has Become Somewhat Less Attractive



Wind prices are likely to increase further in 2009 as installed costs will remain high as developers work through turbines ordered at peak prices, and given higher equity yields

Future Outlook

- Wind industry has matured, giving it the standing to be a major contributor to the U.S. supply mix
- Wind has been competitive in wholesale power markets in many regions in recent years, and expansion has allowed wind additions to exceed DOE's 20% scenario
- Recent escalation in wind prices, and reduction in natural gas/wholesale market prices, puts more dramatic wind growth at some risk; other factors will also yield a slow(er) 2009
- Growth in future years will be impacted by state/federal policy efforts (RPS, carbon, transmission)



For More Information...

See upcoming full report for additional findings, a discussion of the sources of data used, etc.

- http://eetd.lbl.gov/ea/ems/re-pubs.html
- Available in June 2009

To contact the primary authors

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