



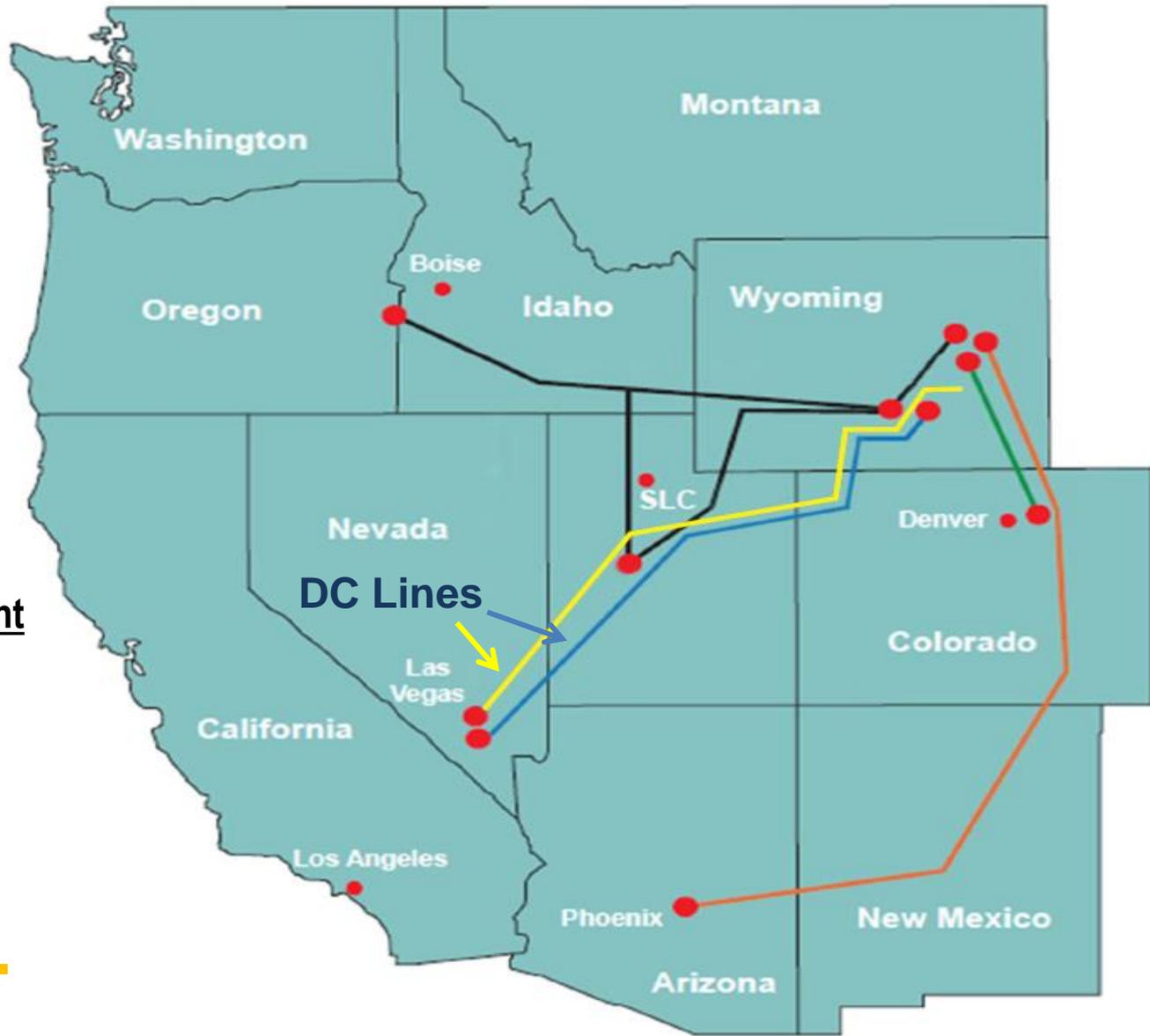
**Nebraska Wind & Solar Conference**  
**Omaha, NE**  
**Oct 29, 2014**

# Wyoming Infrastructure Authority

- An instrumentality created in 2004 by the Wyoming Legislature
- **Mission:** *The WIA will diversify and expand the state's economy by adding value to Wyoming's energy resources and infrastructure for the benefit of Wyoming and the region*
- **Vision:** *The WIA will advance Wyoming's Energy Strategy by promoting the value of Wyoming's energy resources; supporting expanded infrastructure; enhancing resource development and operation; and ensuring a credible and objective voice for Wyoming*
- **Tools:** Can plan, finance, site, own, operate and otherwise promote transmission projects; \$1 billion in bonding authority
- Governed by a 5-member Board of Directors appointed by the Governor with the advice and consent of the Senate



# **Transmission Projects under development in Wyoming**



6 projects under development

Energy Gateway —

WY-CO Intertie —

TransWest Express —

Zephyr —

High Plains Express —

DC Lines



*Routes shown are for illustrative purposes only and will be finalized as part of the permitting and siting process*

# **Transmission Projects to California under development in Wyoming**

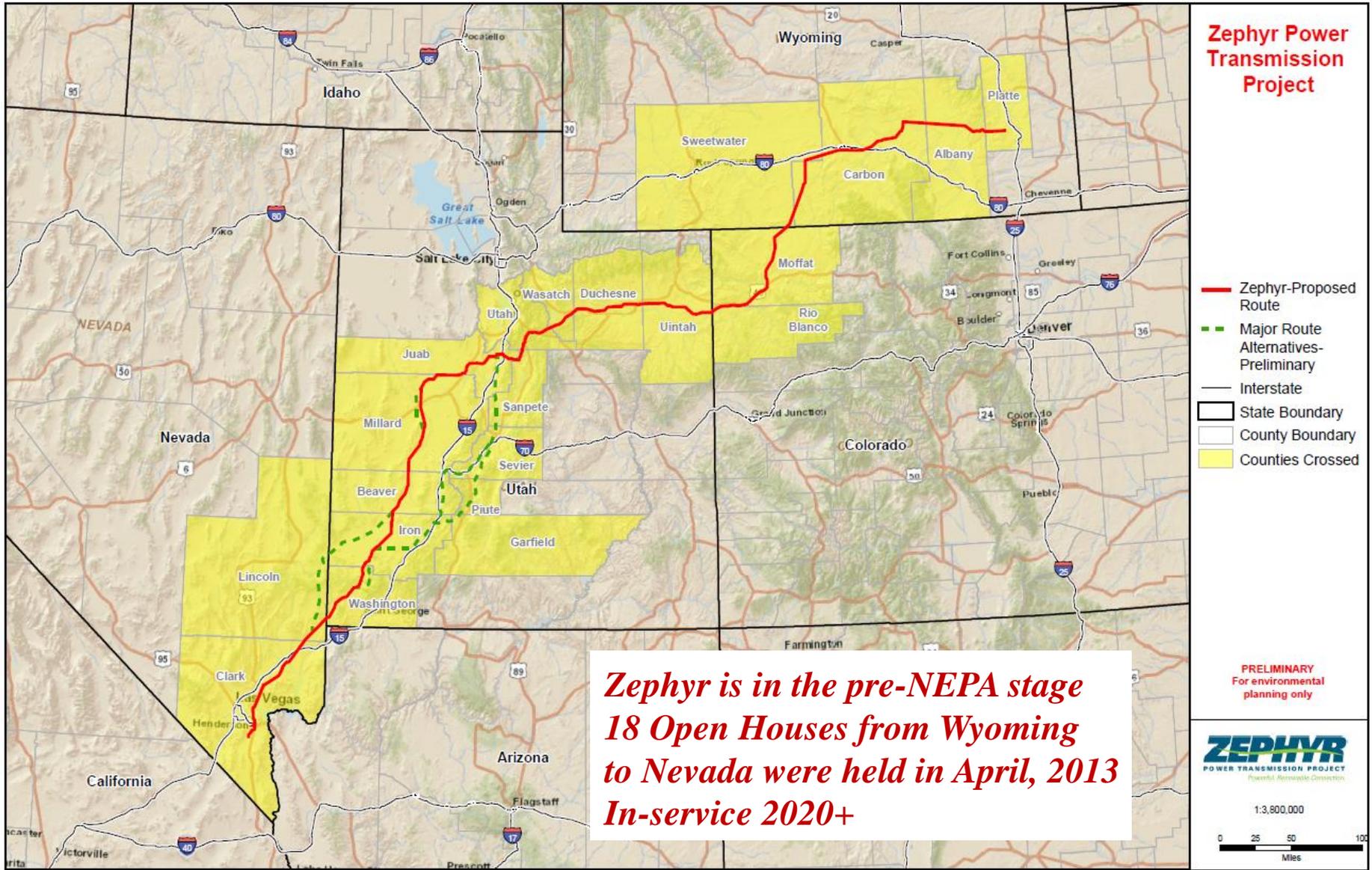
# One way for California to access Wyoming's complementary renewables

- Direct current **TransWest Express Transmission Project**
- 3,000 MW capacity, 600 kV HVDC
- 725-mile proposed route, connecting into California ISO at Marketplace
- Jointly developed by Western Area Power Administration, part of DOE
- Selected for special focus by federal interagency "Rapid Response Team for Transmission"
- NEPA process well advanced: Public scoping completed 2011; **Draft EIS released July 2013; Final EIS & ROD scheduled for 2014; In-Service 2017**



# Zephyr Transmission Project

An 850 mile, 500kV HVDC line with a capacity of 3,000 MW



*Zephyr is in the pre-NEPA stage  
18 Open Houses from Wyoming  
to Nevada were held in April, 2013  
In-service 2020+*

# **Building a Value Proposition for delivering Wyoming Wind to California**

# Potentially \$600 million in savings annually

WECC 10yr plan published in 2011

Data from WECC 10 year plan



Annual Cost Estimates for Delivering Approximately 3,000 MW of Renewable Energy to California by 2019

Source: WECC DRAFT 10-Year Regional Transmission Plan Summary, August 2011



# University of Wyoming Phase I and II Geographic Diversity Studies

- Study compares the geographic diversity of Wyoming wind to wind and solar in California
- Commissioned by WIA and released January 25, 2013
- Results were compelling:
  - *Wyoming wind will **smooth the variability of wind and solar** on the California ISO System, mitigating ramping events*
  - *Wyoming wind **improved the correlation** of available wind supplies and the CAISO demand curve*
  - By reducing the need for dispatchable gas-fired generation:

# **NREL WY/CA Grid Integration Study**

**NREL economic analysis identifies significant benefits of Wyoming wind power for California ratepayers**

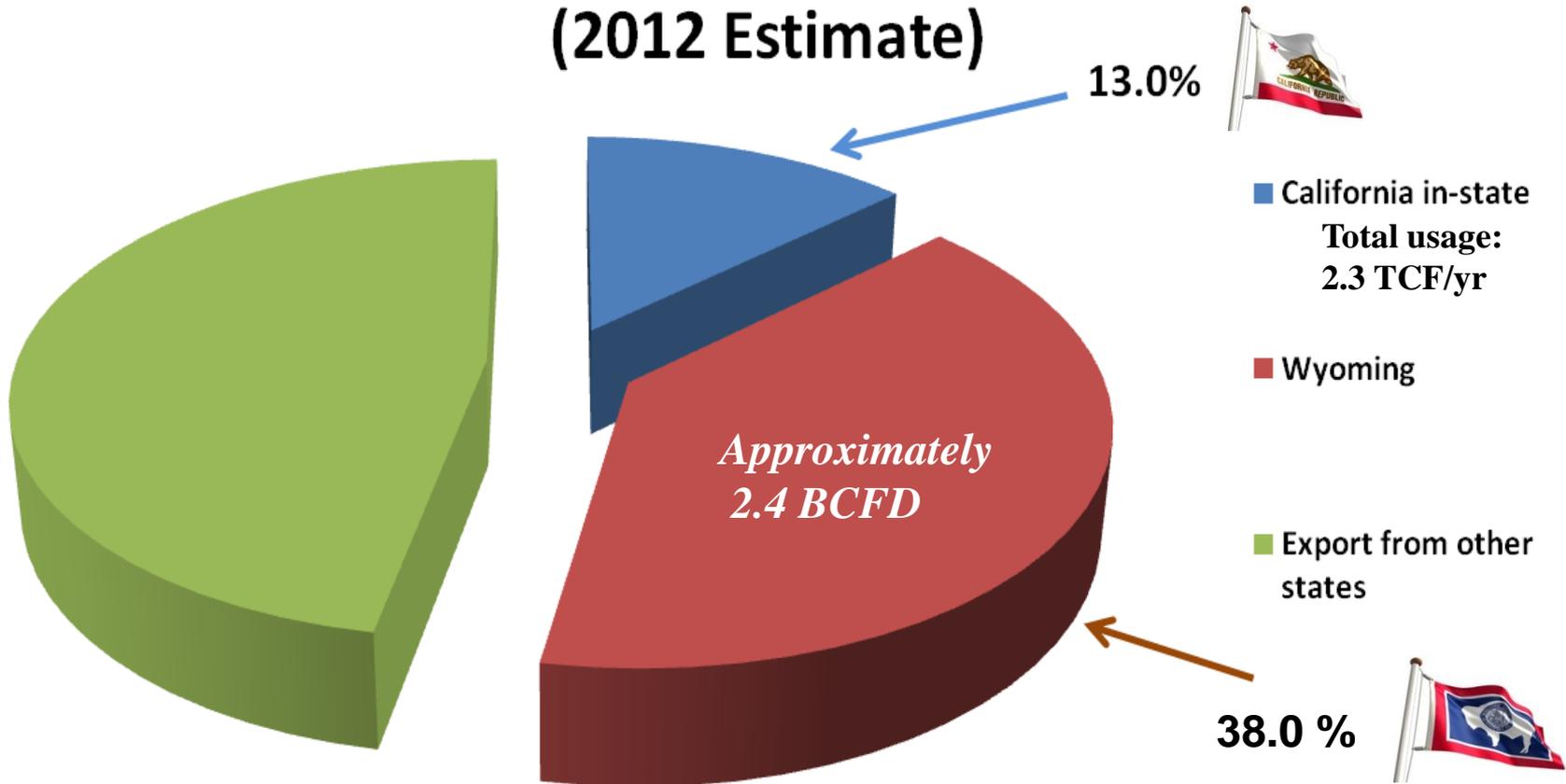
***“Consumers win when their utilities can access cost-effective energy”***

**CHEYENNE, Wyo., March 24, 2014** – A new economic analysis produced by the U.S. Department of Energy’s National Renewable Energy Laboratory shows Californians will benefit and save money – up to \$1 billion in annual generation costs – if a new direct current transmission line connects the California grid to Wyoming’s high-capacity wind energy resources.

*“The 2014 NREL California/Wyoming Grid Integration Analysis shows that deploying a regional renewable resource strategy can help California better contain and manage its escalating electricity costs,” said Danny Curtin, Director, California Conference of Carpenters. “If we unnecessarily drive up the cost of electricity in California by not considering diverse resources, we risk losing jobs because manufacturers and other companies will consider relocating or expanding to states where their electricity bills will be lower.”*

# A great example of how Wyoming is already complementing California

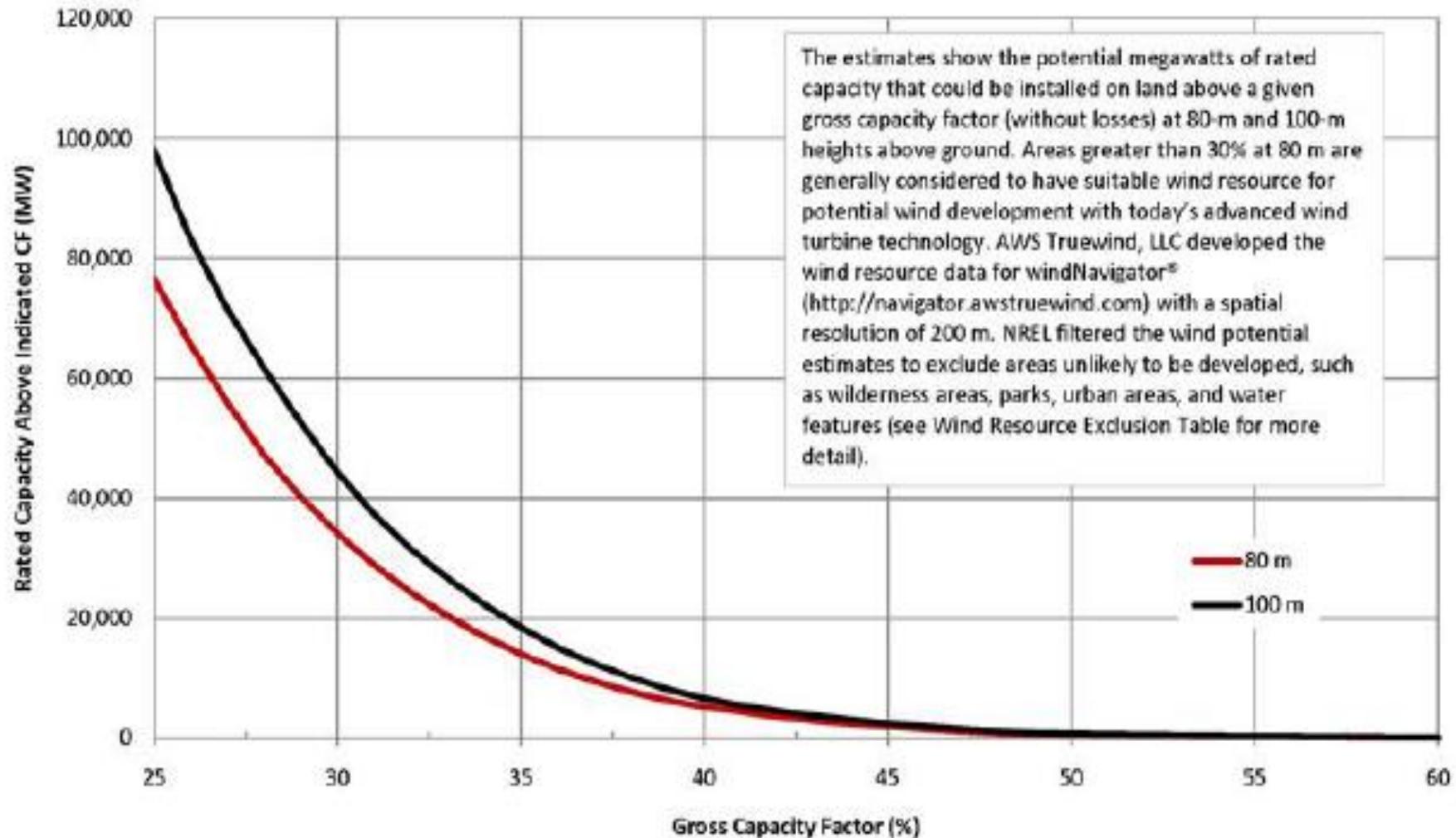
## Where Does California Get its Natural Gas? (2012 Estimate)



Estimate is based on the addition of natural gas from Wyoming via the El Paso Ruby Pipeline completed in 2011

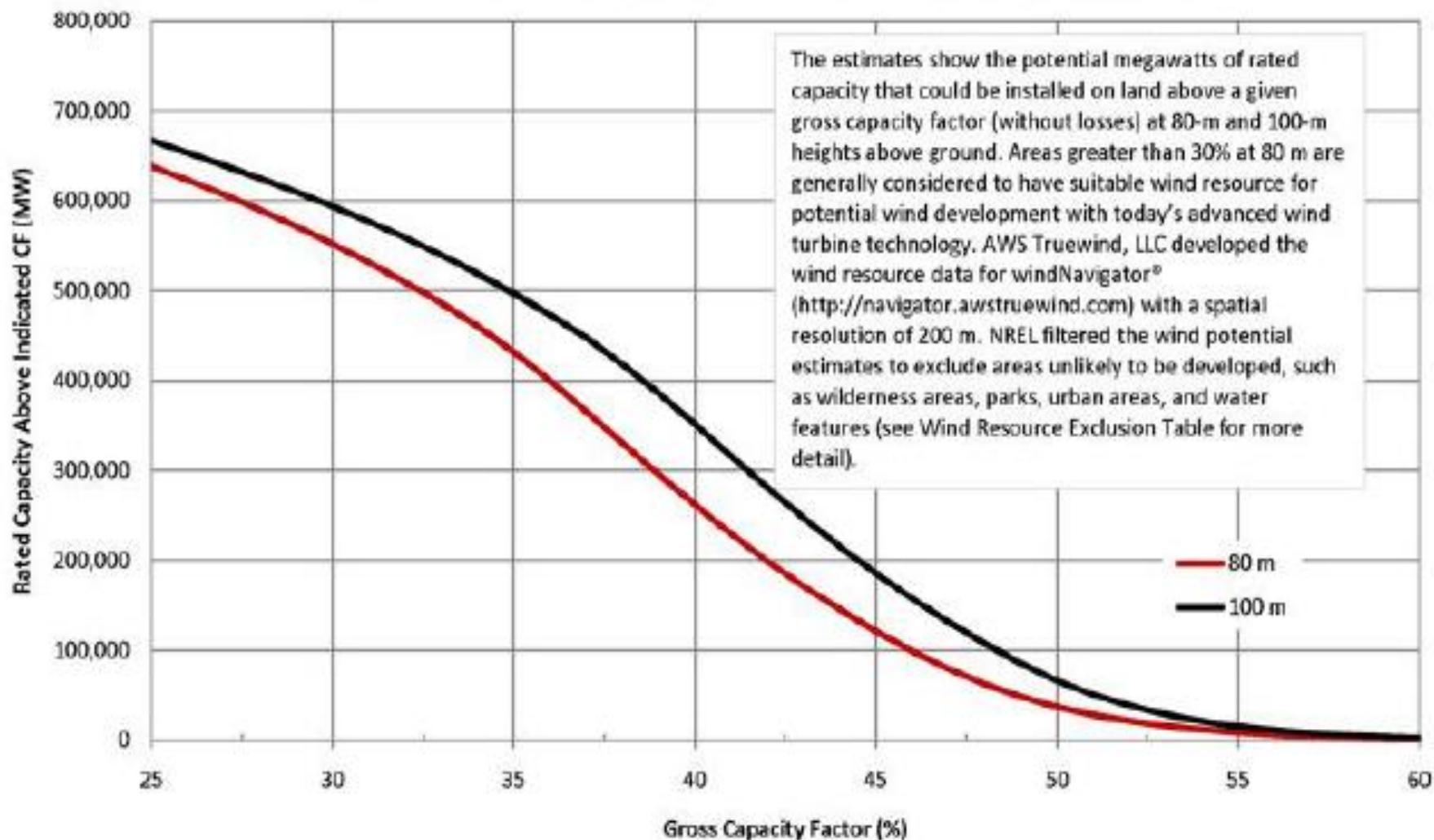
# California - Wind Resource Potential

## Cumulative Rated Capacity vs. Gross Capacity Factor (CF)



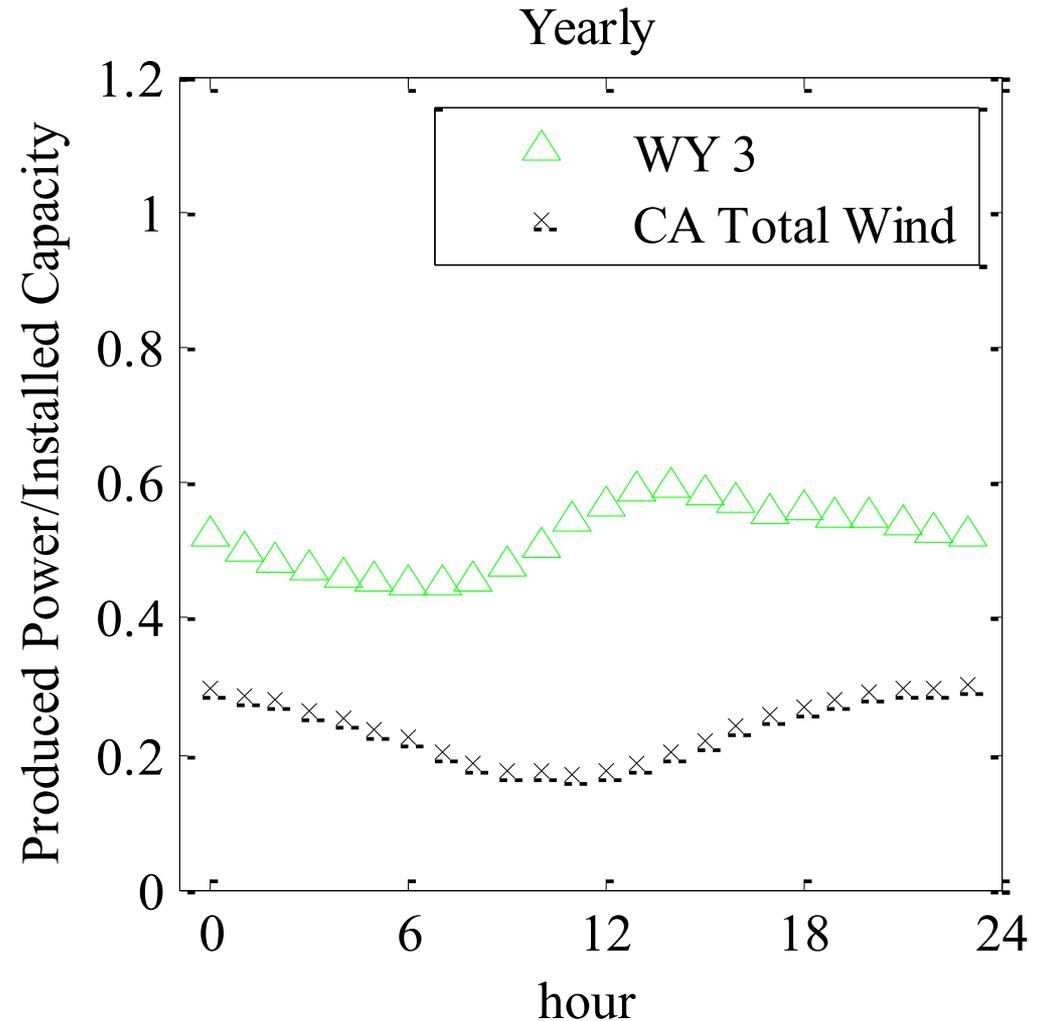
# Wyoming - Wind Resource Potential

## Cumulative Rated Capacity vs. Gross Capacity Factor (CF)



# Diversity of Wind Resources –The Impact on Hourly Basis

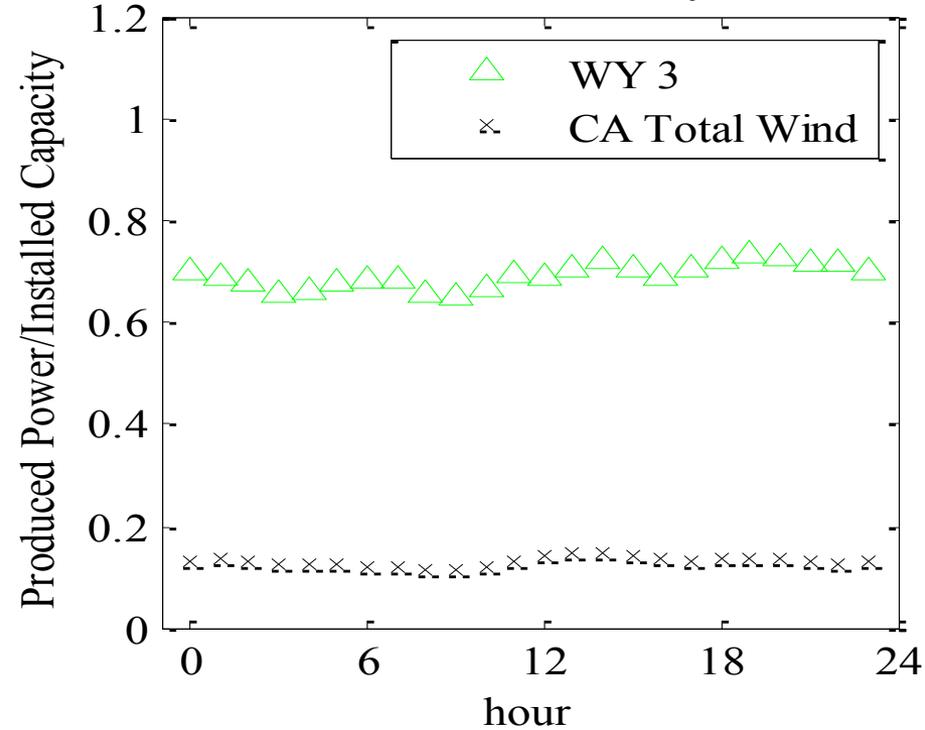
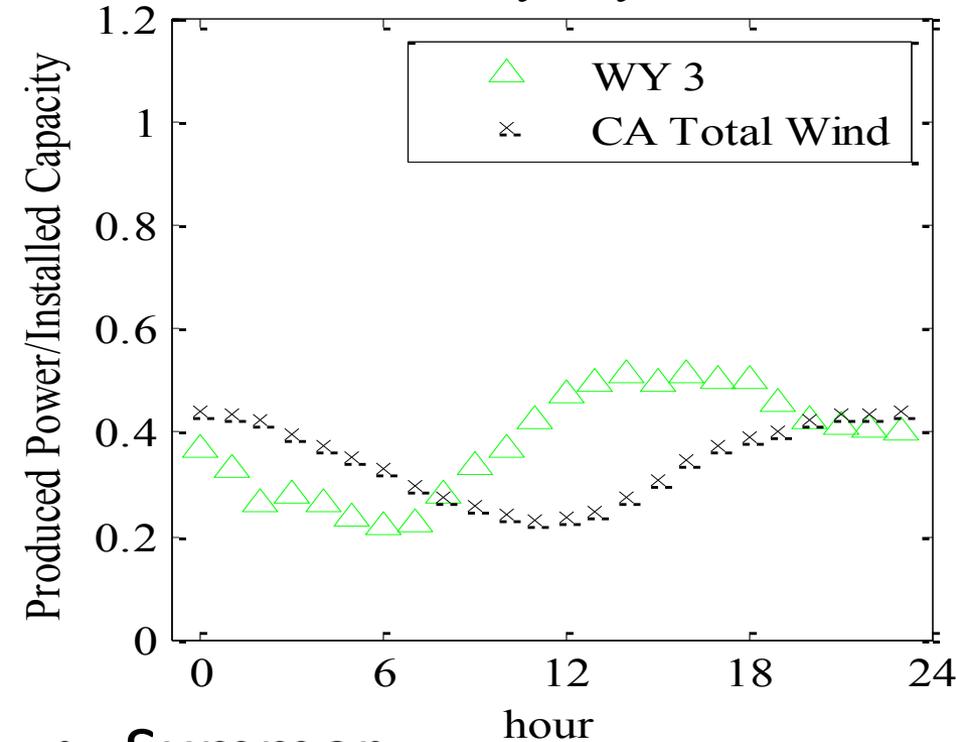
- Based on yearly average
  - CA tends to peak at night
  - WY tends to peak in day
- Results change a little if we break into seasons



# Diversity of Wind Resources -The Impact on Hourly Basis

May-July

November-January

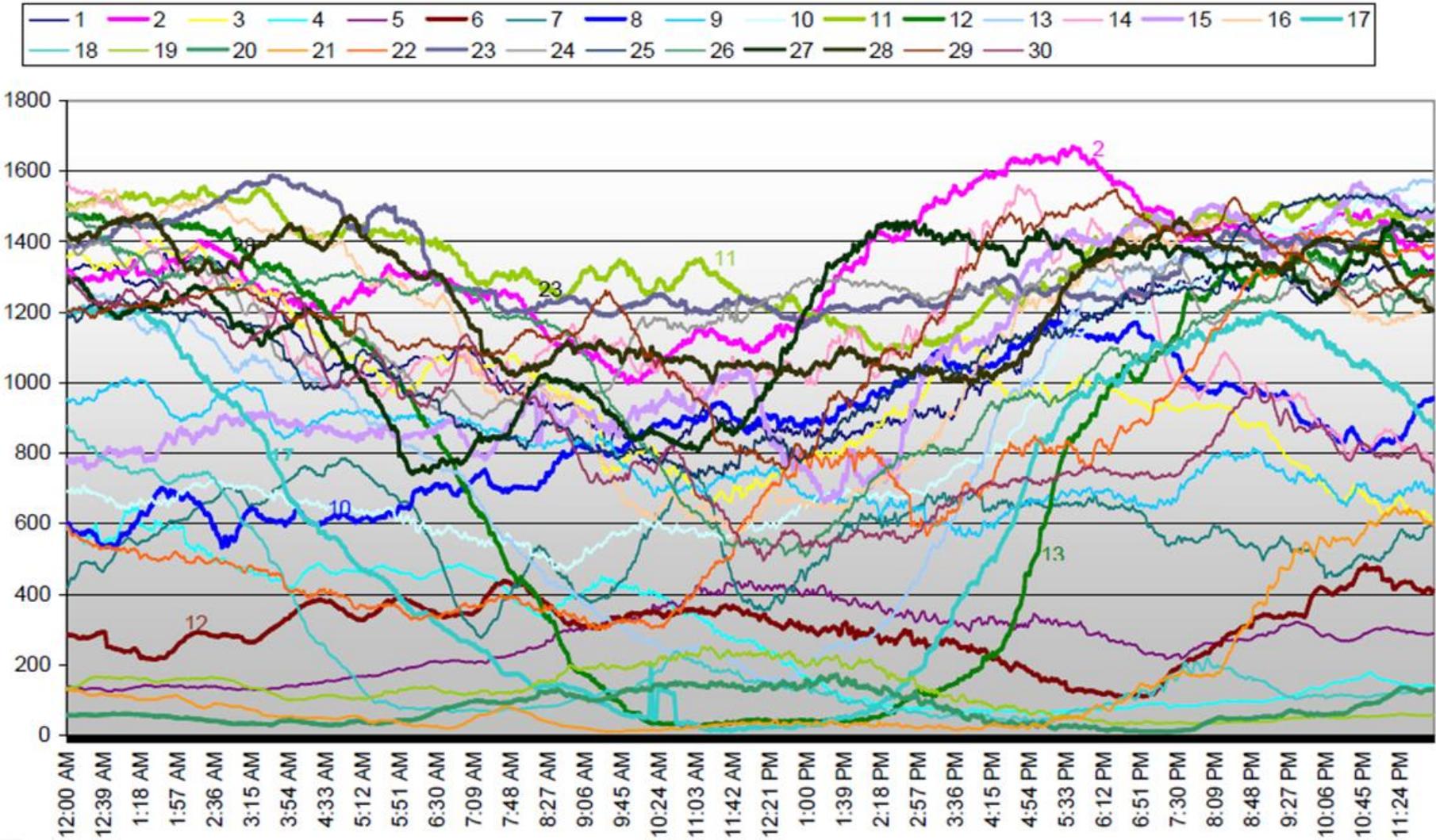


- Summer
  - WY winds is lower than other times but peaks in afternoon
  - CA wind at its strongest, at night

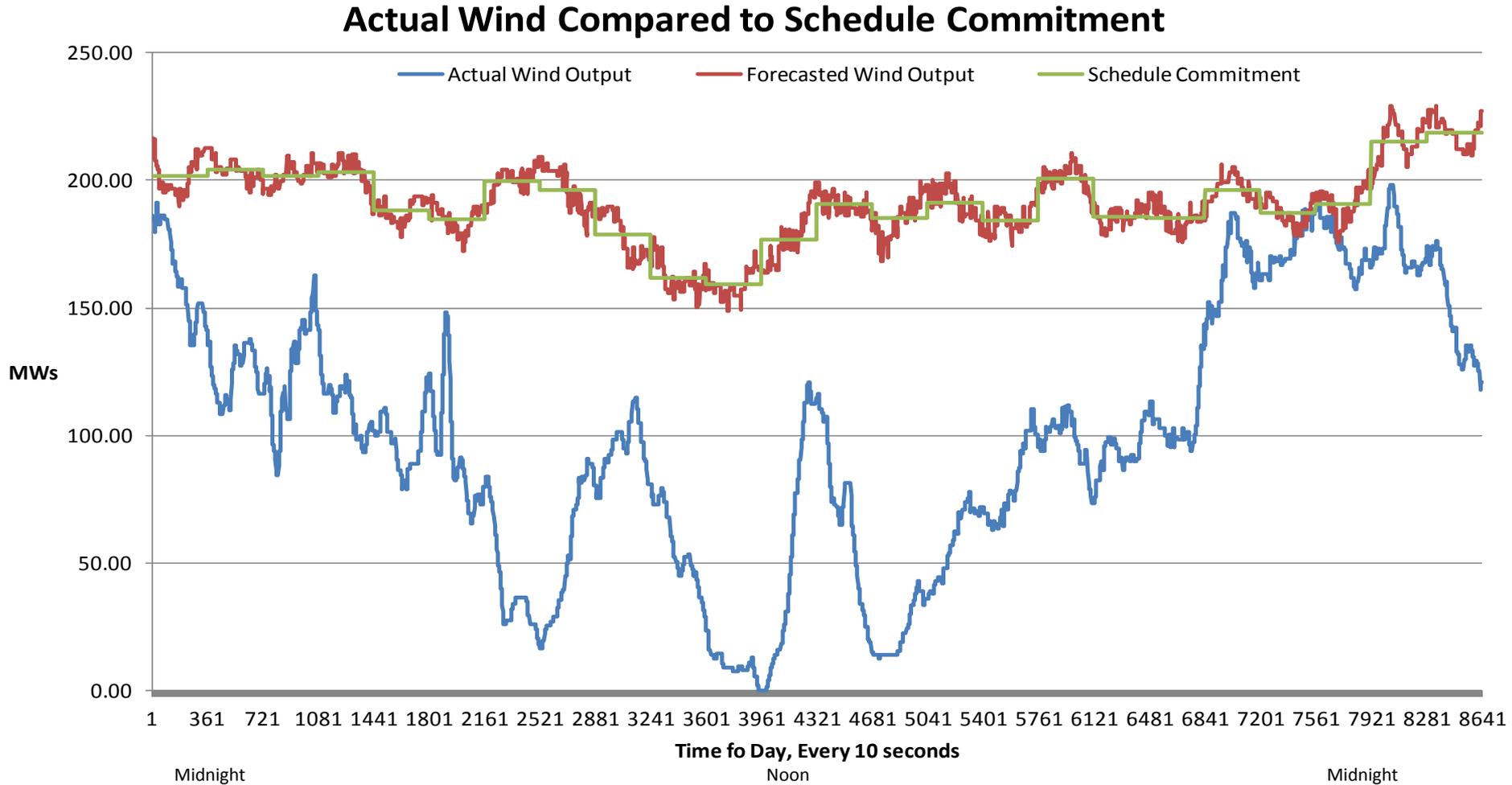
- Winter
  - WY winds consistent and strong throughout the day
  - CA wind consistent, but at lowest production

# Daily Wind Deviation and Variability - CA

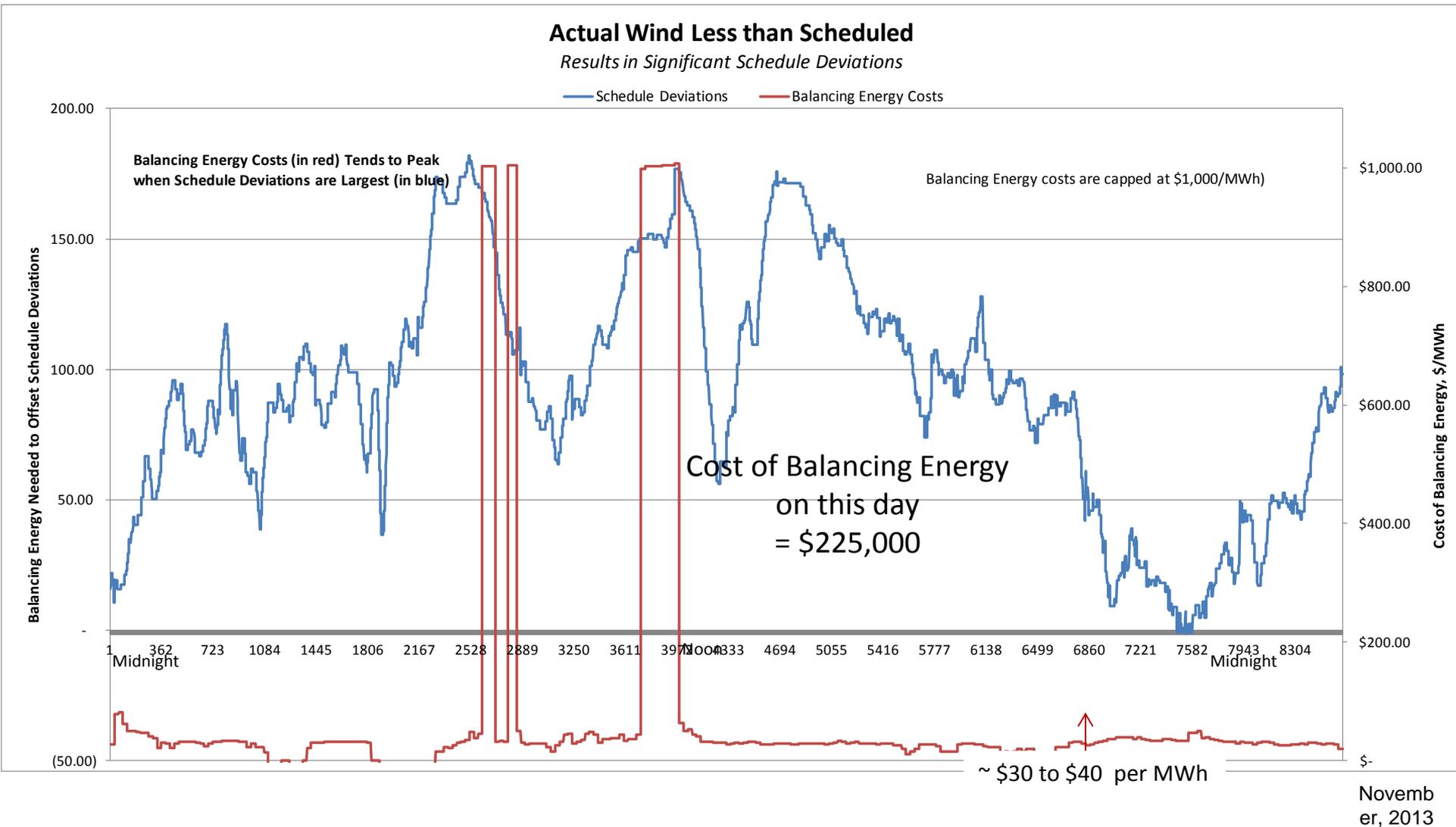
April 2009 Wind Generation - TEHACHAPI



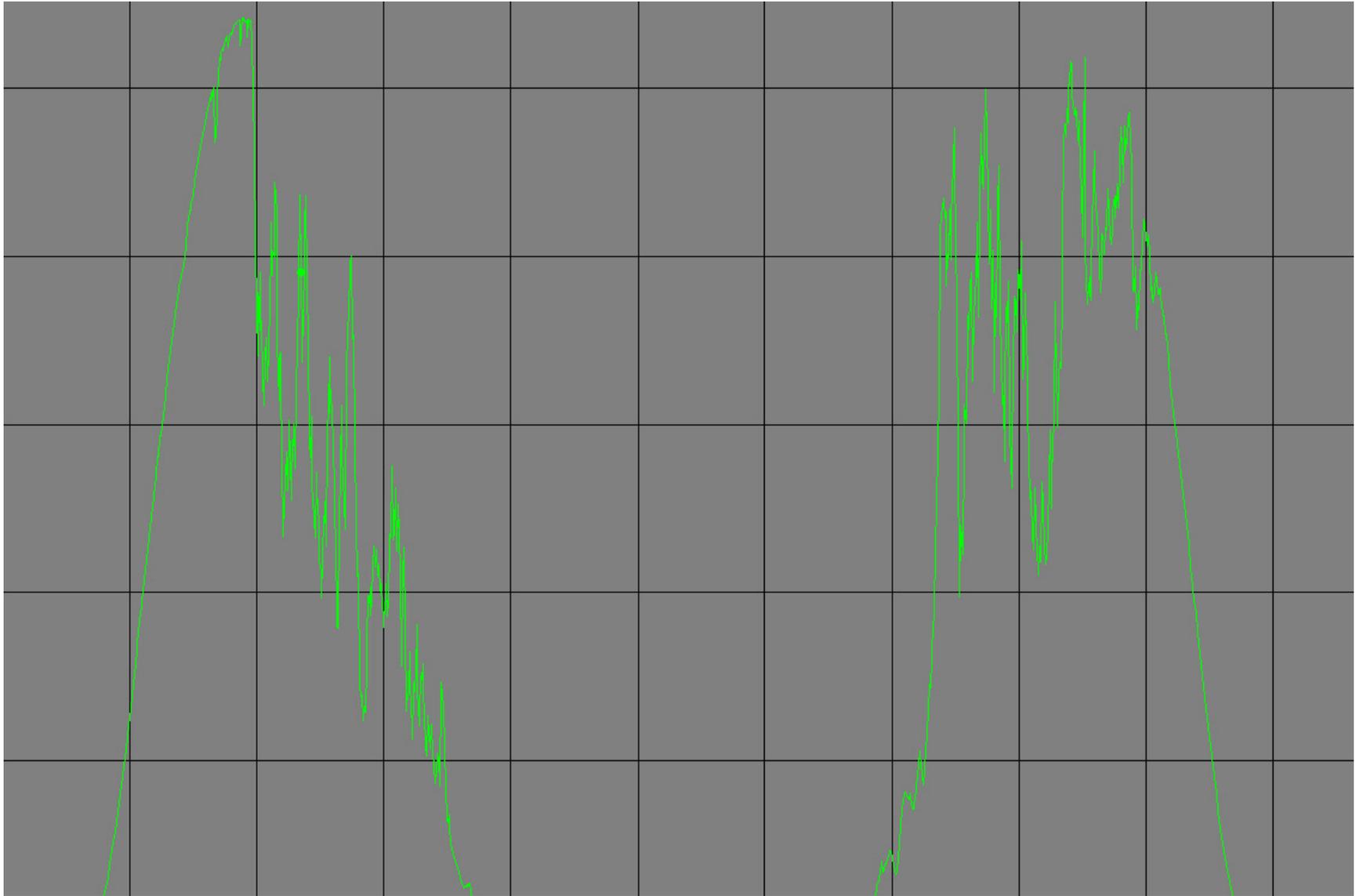
# Actual Wind Power vs. Schedule



# Cost of Balancing Energy vs. Schedule Deviations



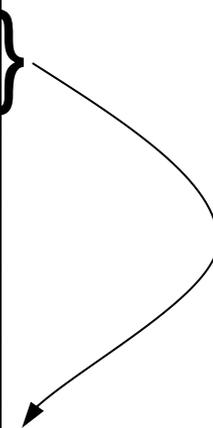
# Solar Production Deviation



# Renewable Resource Quality Parameters

## Wyoming and California Wind

% Installed Capacity				Capacity Factor	Relative Variability	P>5%	P>25%
CA 3	CA 5	WY 1	WY 3				
100%				0.240	1.03	0.67	0.39
	100%			0.266	1.08	0.62	0.41
		100%		0.440	0.81	0.80	0.59
			100%	0.482	0.77	0.79	0.64
50%	50%			0.242	0.97	0.71	0.40
50%		50%		0.333	0.61	0.91	0.64
50%			50%	0.359	0.61	0.90	0.67
	50%	50%		0.342	0.65	0.89	0.64
	50%		50%	0.371	0.64	0.89	0.68
		50%	50%	0.462	0.65	0.90	0.71
25%	25%	25%	25%	0.340	0.54	0.95	0.69



# **WIA's Outreach Initiative to California**

*Providing benefits to California beyond electricity*

**Since November 2012, the WIA has held meetings with over eighty-five (85) people to-date from the following entities in California:**

- *Governor Brown's Office*
- *California PUC*
- *California Energy Commission (CEC)*
- *California Independent System Operator (CAISO)*
- *California Air Resources Board (CARB)*
- *California Senate Energy Committee Staff*
- *California Assembly Energy Committee Staff*
- *Southern California Edison*
- *San Diego Gas and Electric*
- *Pacific Gas and Electric*
- *Los Angeles Department of Water & Power*
- *California PUC Division of Rate Payer Advocates*
- *Northern California Power Agency (NCPA)*
- *Natural Resources Defense Council (NRDC)*
- *Stanford University*
- *University of California, Davis*
- *University of California, Berkeley*
- *California Wind Energy Association*
- *Greensparc Energy Advisors*
- *E3 Consulting*
- *Energy Foundation*

**We've heard it said:**

***California will develop all of its renewable requirements in-state***

# Renewable Energy on the CAISO System

- **Over 25% of the wind energy currently on the California ISO system is from out of state**
- There are massive amounts of hydroelectric power that flow into California annually from the Pacific Northwest
- Solar energy from outside California is being contracted on a regular basis.
- The direct current transmission projects being developed to deliver Wyoming wind to California and the corresponding wind energy ***qualifies as “Bucket 1; in-state equivalent” pursuant to SB21X (according to the California Energy Commission)***

**We've heard it said:**

***Organized Labor in California does not support  
imports of renewable energy***

# Union Support for Transmission from Wyoming

*In 2012, letters of support for the TransWest Express Project were written to Governor Brown, Energy Secretary Chu and Interior Secretary Salazar were written by:*

- The International Brotherhood of Electric Workers (IBEW);*
- The California Conference of Carpenters;*
- The National Construction Alliance;*
- The International Union of Operating Engineers; and*
- The AFLCIO*

**We've heard it said:**

***Long-line transmission cannot be built given the  
permitting & siting regulations***

**The permitting & siting process for long-line transmission can be achieved:**

***---Gateway West has it's ROD***

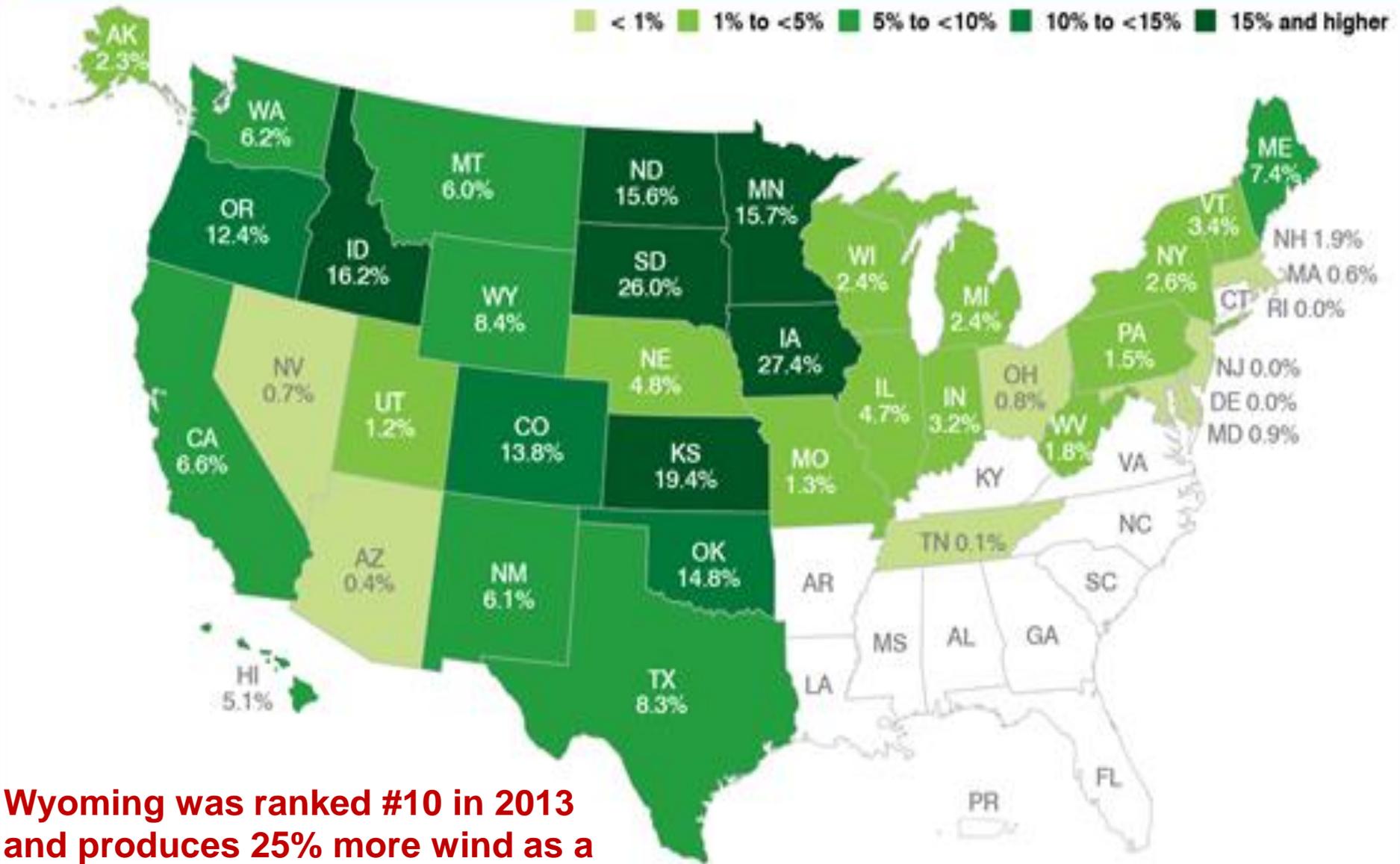
***--- TransWest Express' ROD is scheduled for late 2014***

**We've heard it said:**

***Wyoming has no Renewable Portfolio Standard (RPS) and has no interest in renewables***

# U.S. Wind Energy Share of Electricity Generation during 2013, by State

EIA



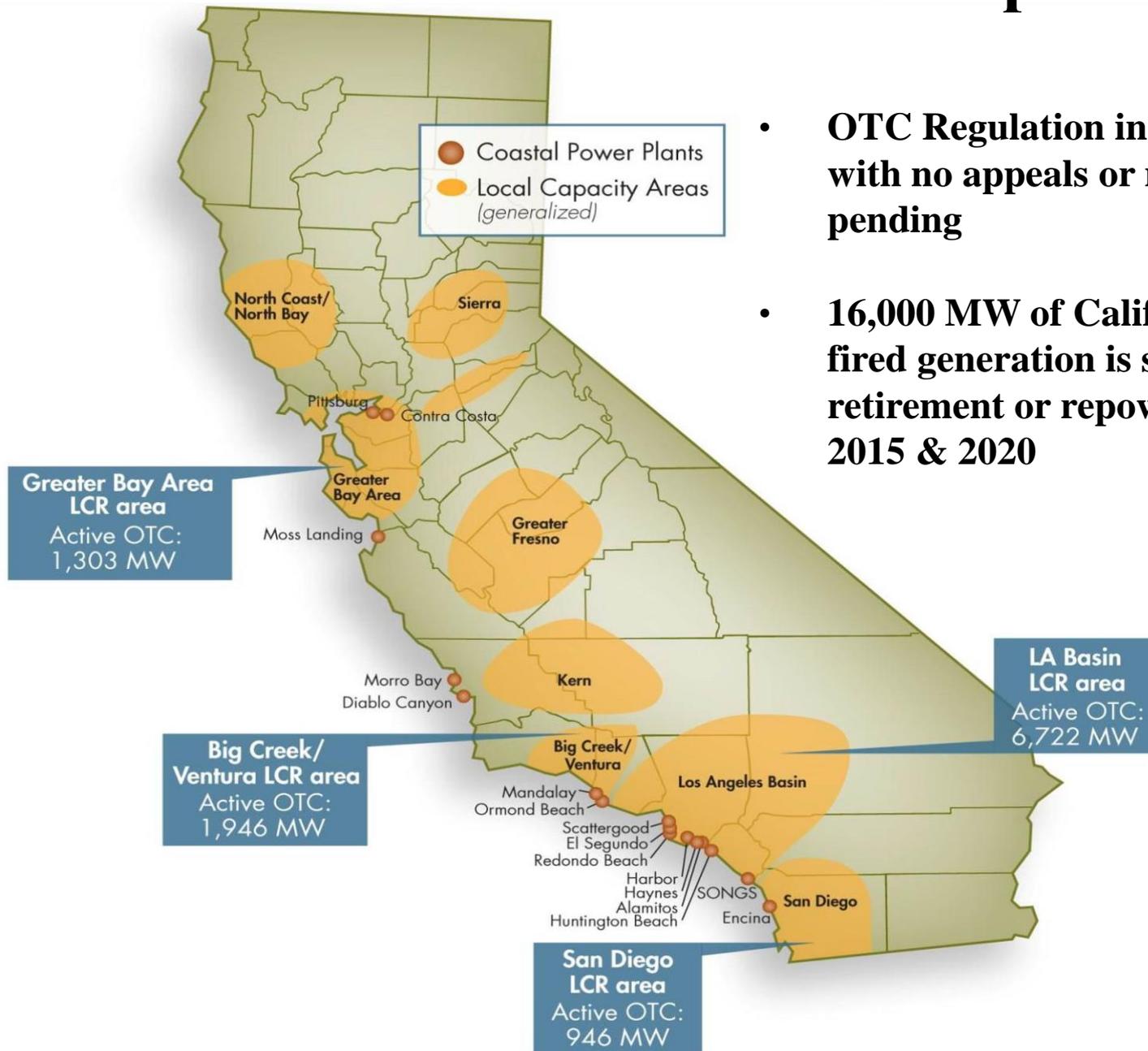
**Wyoming was ranked #10 in 2013 and produces 25% more wind as a function of total power produced than California**

# **Once Through Cooling Policy Challenge in California & Nuclear Issues**

# The OTC Problem in CA

- On May 4, 2010, the State Water Board adopted a Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Policy) and became effective on October 1, 2010.
  - *2015 deadline for most natural gas-fired facilities*
  - *2020 for gas-fired facilities in the LA area*
  - *2024 for Diablo Canyon*
- The Policy applied initially to the 19 existing power plants that currently have the ability to *withdraw over 15 billion gallons per day* from the State's coastal and estuarine waters using once-through cooling (OTC).

# California's OTC Impacts



- **OTC Regulation in California is fact with no appeals or modifications pending**
- **16,000 MW of California natural gas-fired generation is scheduled for retirement or repowering by 2015 & 2020**

**California has only one (1) Remaining Nuclear Generation Facility,  
Diablo Canyon-**

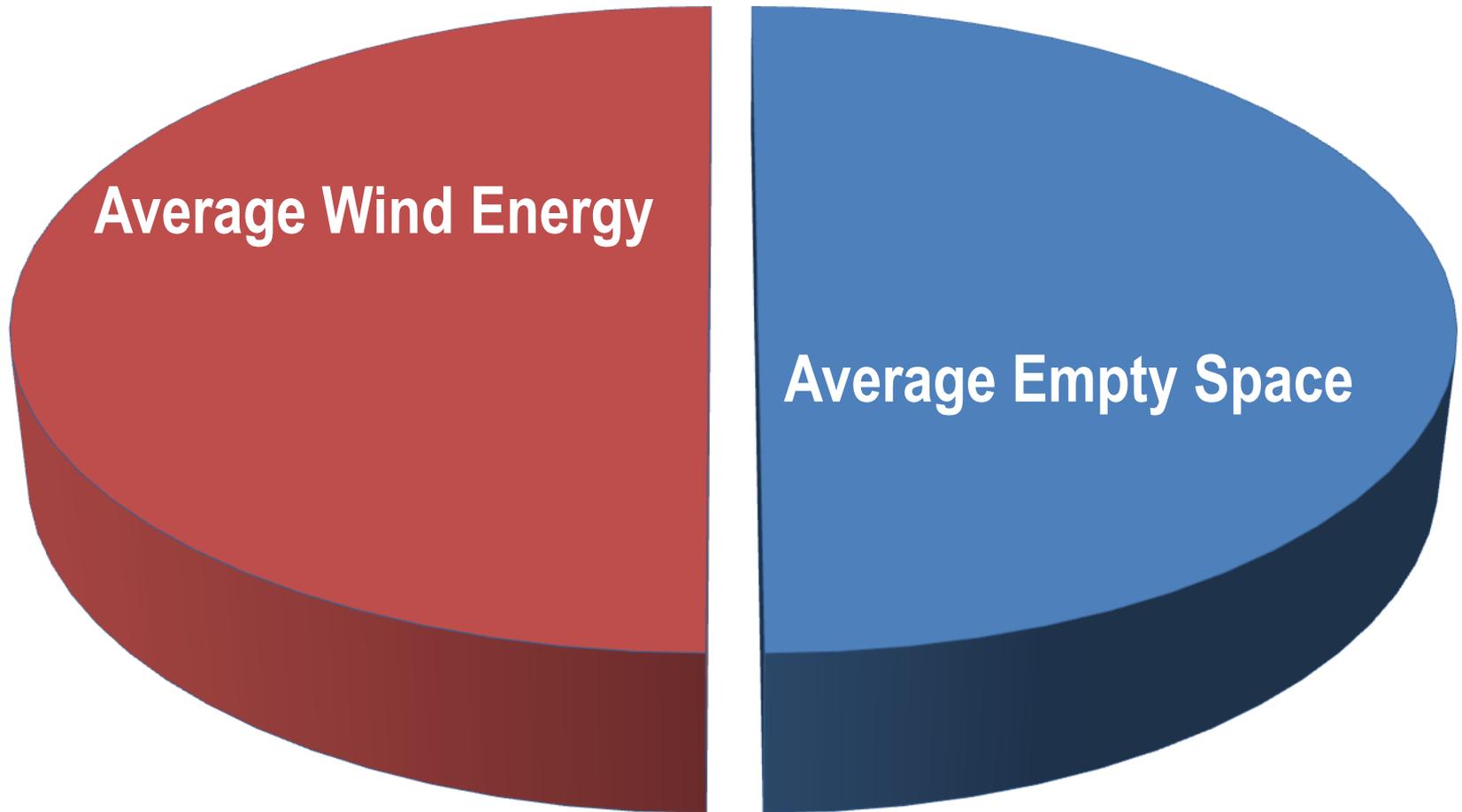
***With increasing discussions about its possible closure***

**Two units sized at 1,100 MW---total---2,200 MW**



**Opportunity to build natural gas-fired  
generation as new transmission is placed  
into service**

# Transmission Capacity relative to Transmission from Wyoming to California



**Analysis of natural gas-fired generation at elevation---will be presented at the WIA's Winter Energy Conference in Cheyenne on Feb 3-4, 2015**

- *University of Wyoming*
- *University of Colorado*
- *General Electric—study lead*
- *Wyoming wind developer*
- *Wyoming Infrastructure Authority*

# With Transmission Cost Sunk, the variables to consider are as follows:

- *Where to build the gas-fired generation?---near the load or near the wind source?*
- *What is the loss of performance due to elevation?*
- *What is the line loss?*
- *Construction cost differential*
- *Available Air Shed for new generation*
- *What gain do we get from lower ambient temperatures in Wyoming?*
- *What gain is realized relative to the basis differentials to Henry Hub for natural gas prices?*
- *What is the relative cost for firm transmission service and natural gas storage for the different locations?*

# Other Activities in which the WIA is Engaged:

- *EPA's Section 111(d) Analysis*
- *Coal Exports*
- *Carbon Capture & Utilization*
- *Advanced Fuel Technologies*
  - *Natural Gas to Motor Fuels*
  - *Coal to Motor Fuels & numerous other products*
  - *Used Tires to Fuel*

# Questions?

*For more information, please visit [www.wyia.org](http://www.wyia.org)*



**Wyoming Infrastructure Authority**  
**200 East 17<sup>th</sup> Street**  
**Cheyenne, WY**  
**307-635-3573**

**Loyd Drain**  
**Executive Director**  
**[loyd.drain@wyo.gov](mailto:loyd.drain@wyo.gov)**

***Register on the home page of our website to receive  
announcements and updates on activities in Wyoming at  
[www.wyia.org](http://www.wyia.org)***