

RENEWING OUR FUTURE



SUMMER SEMINAR 2010

**EPRI**

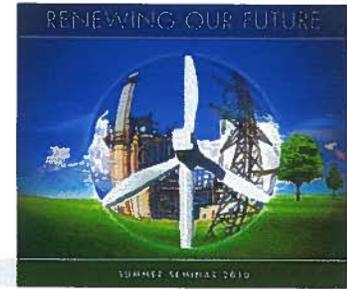
ELECTRIC POWER  
RESEARCH INSTITUTE

**Prism 2.0:**  
***Preliminary Insights from***  
**EPRI's Regional Model**

**Bryan Hannegan, Ph.D.**  
Vice President, Environment & Renewables  
Electric Power Research Institute

**2010 Summer Seminar**  
August 2, 2010

# Why Prism 2.0?



- **New Regional Economic Model**
- **Improved treatment of renewable energy**
  - *High-resolution wind and solar resource data*
  - *Full biomass model with resource competition*
- **Expanded demand-side detail**
  - *Energy efficiency potential by region and technology*
  - *Fully developed transportation module*
- **Full complement of environmental regulations**

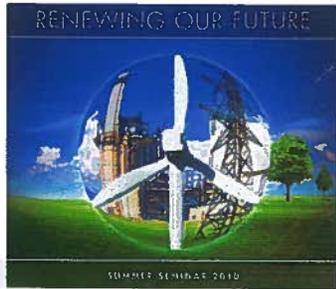
**The Next Generation of EPRI Analysis**

# Why Prism 2.0?

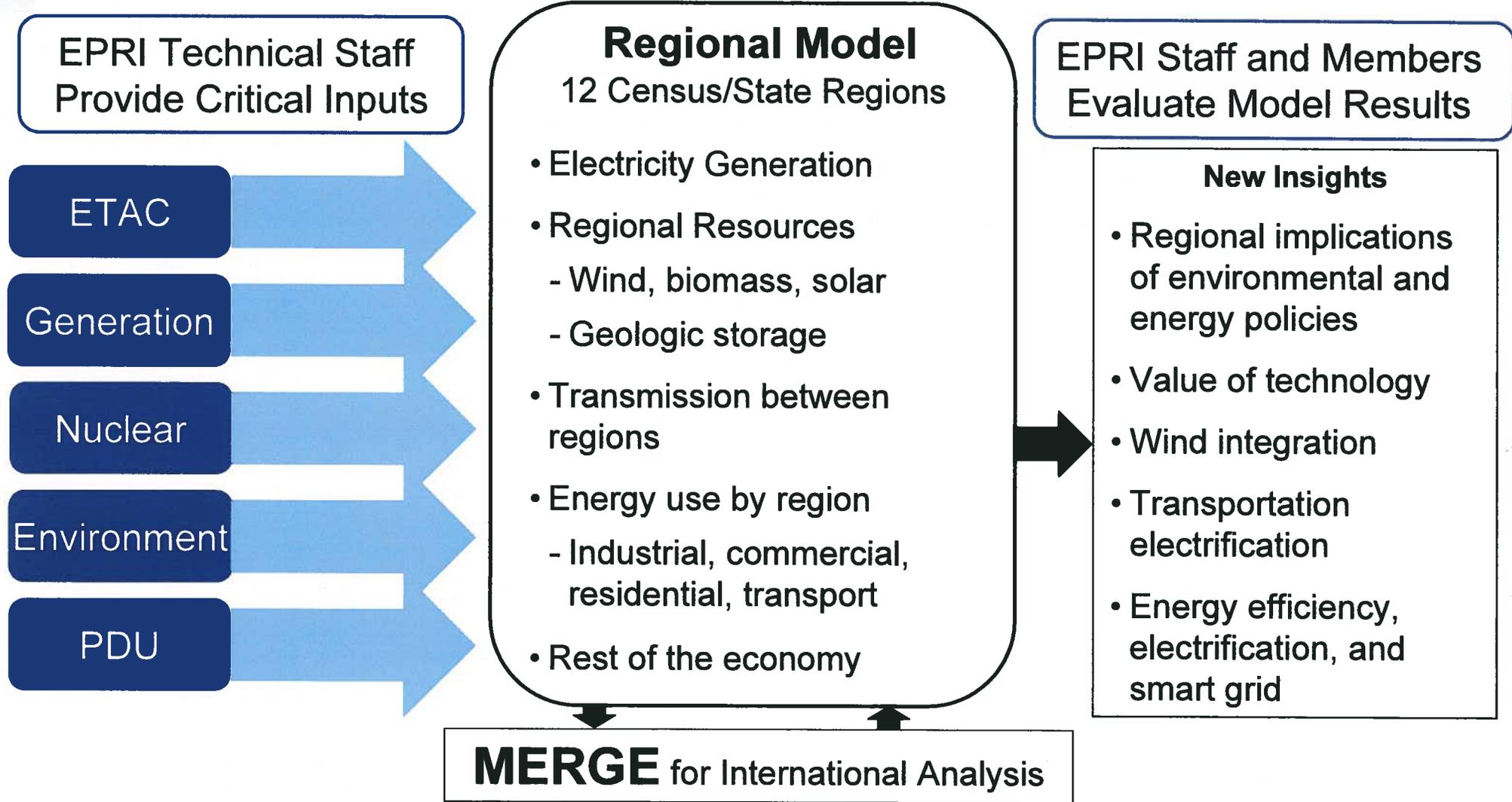


- **New Regional Economic Model**
- **Improved treatment of renewable energy**
  - *High-resolution wind and solar resource data*
  - *Full treatment of integration costs of variable generation*
  - *Integrated biomass model with resource competition*
- **Expanded demand-side detail by region and technology**
  - *Energy efficiency, demand response, and distributed resources*
  - *Electric transportation and electro-technologies*
- **Full complement of environmental regulations**

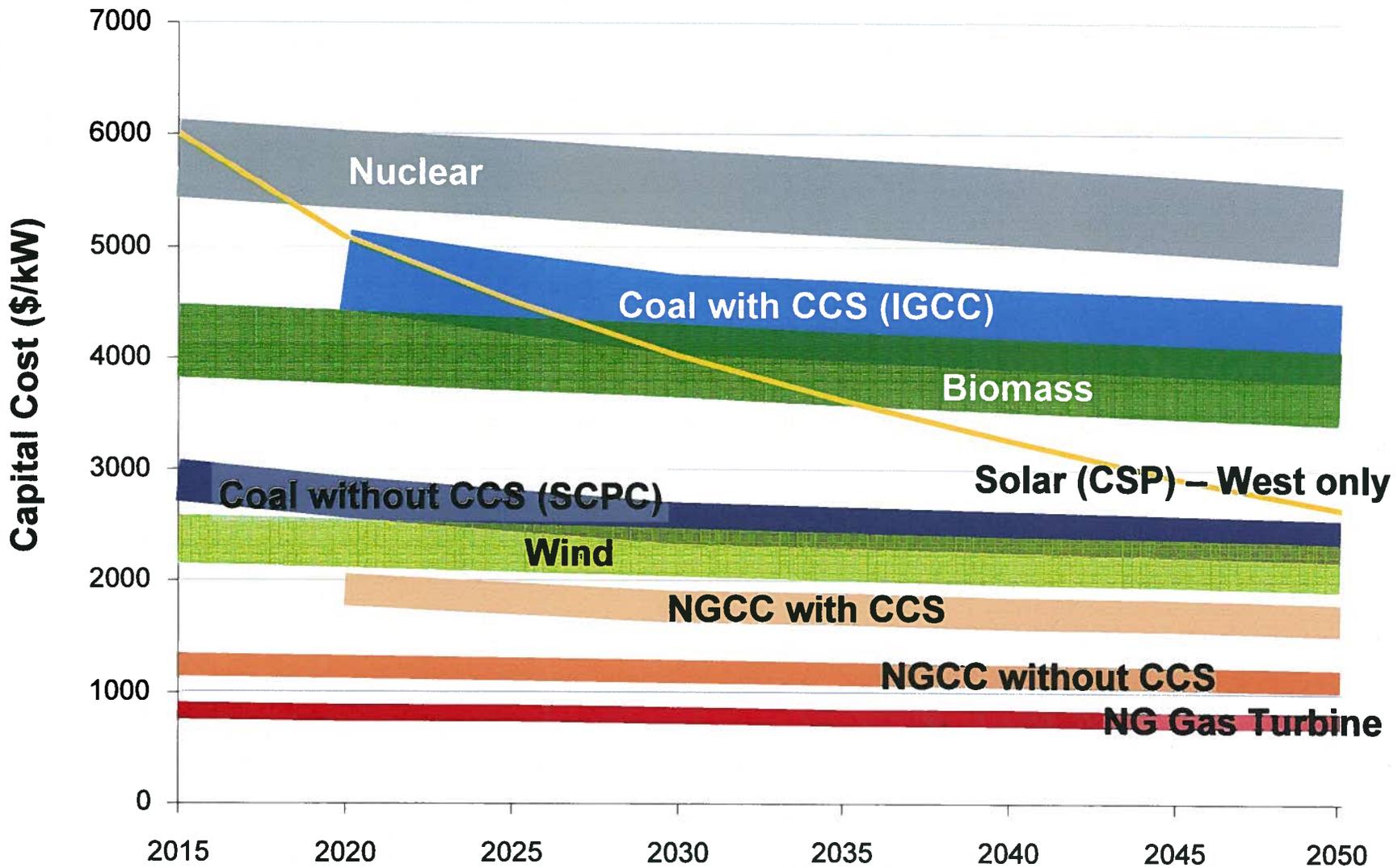
**The Next Generation of EPRI Analysis**



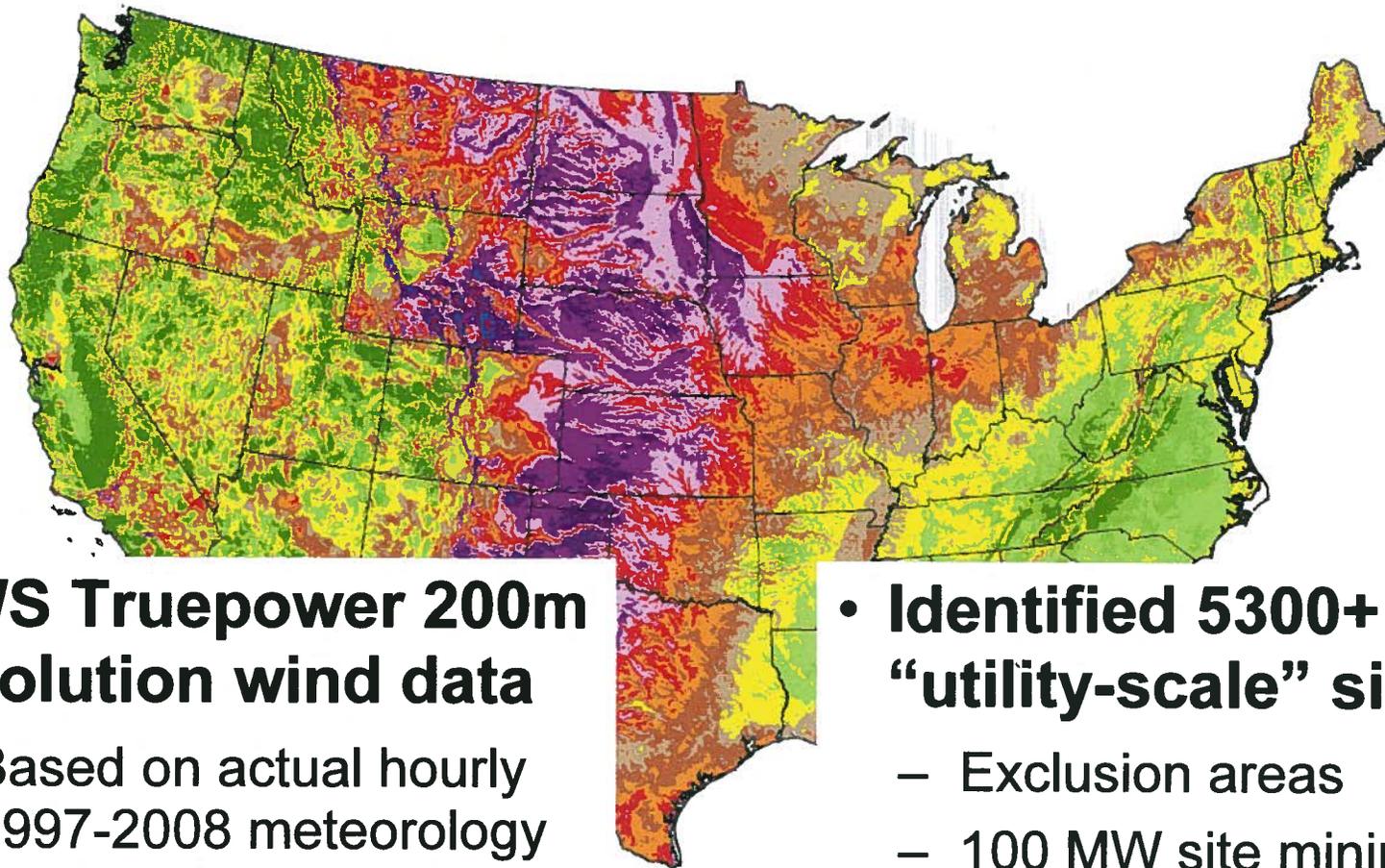
# Leveraging EPRI Technology Insights



# New Generation Technology Options: Capital costs vary across regions



# New Wind Resource Data: Capturing the Variability of Wind



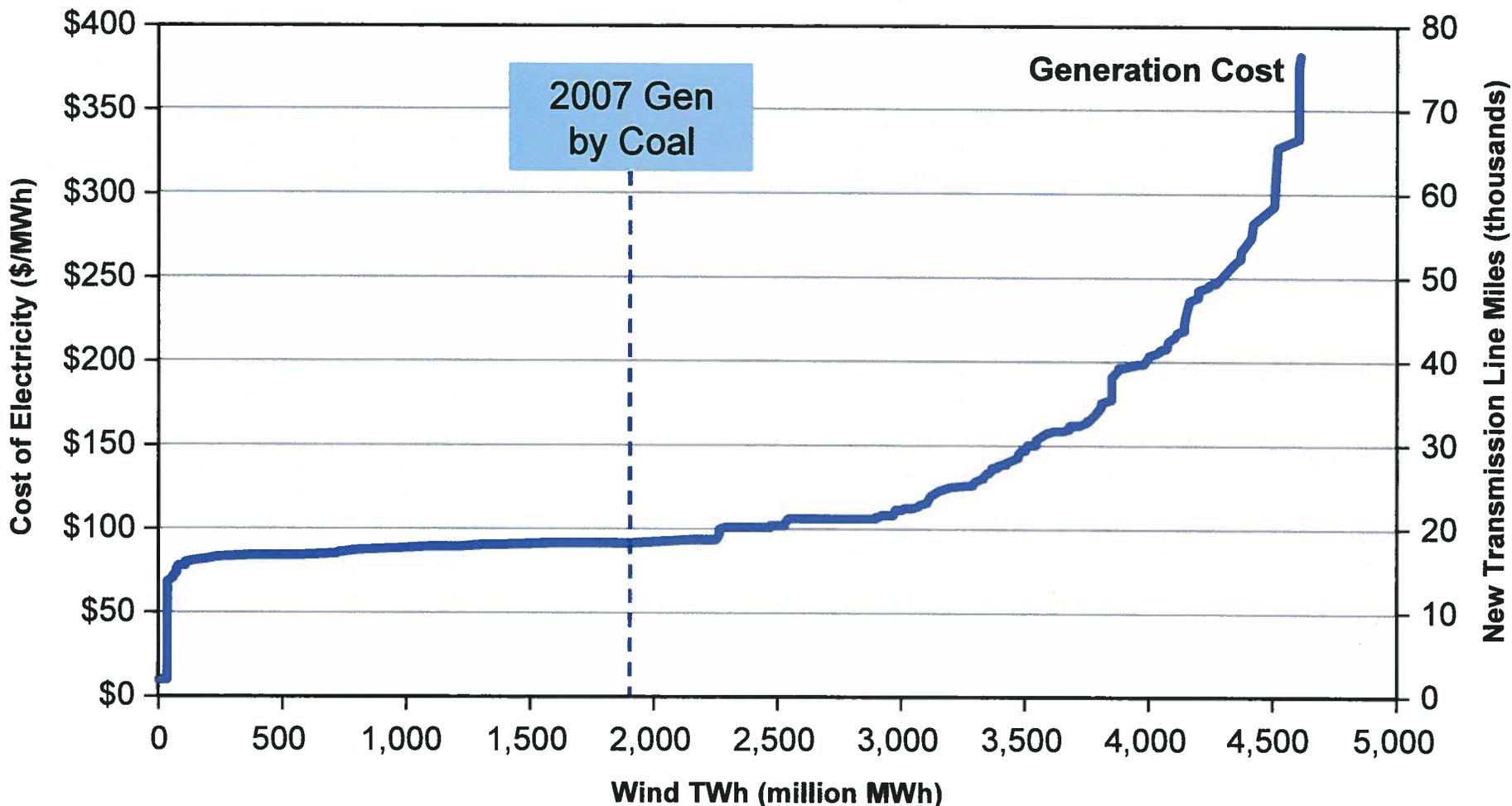
- **AWS Truepower 200m resolution wind data**

- Based on actual hourly 1997-2008 meteorology
- Provides simulated output for typical turbine (80m height, 1.5 MW)

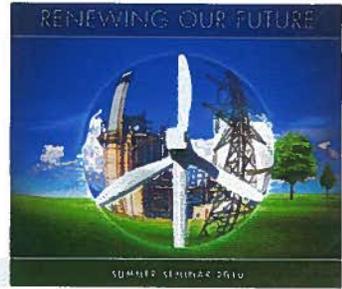
- **Identified 5300+ “utility-scale” sites**

- Exclusion areas
- 100 MW site minimum
- Distance to grid
- Terrain/wake effects

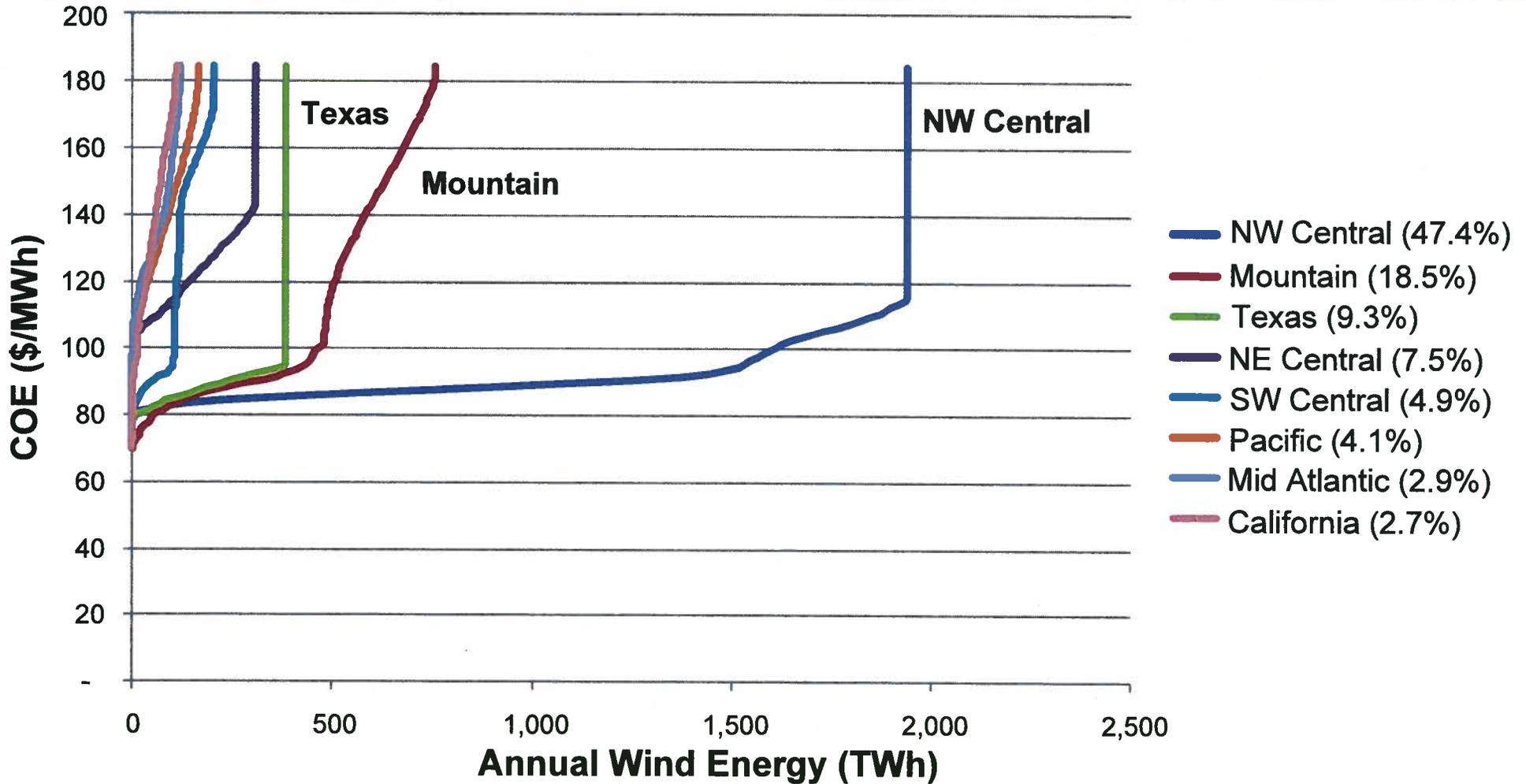
# National Wind Energy Potential Supply Curve\* (excluding delivery costs)



\*EPRI – AWS TruePower National Wind Energy Supply Curve



# Regional Wind Energy Potential Supply Curve



**Uneven Regional Distribution.... ~50% of Economic Resource in NW Central**

# Example Analysis for NW-Central Region

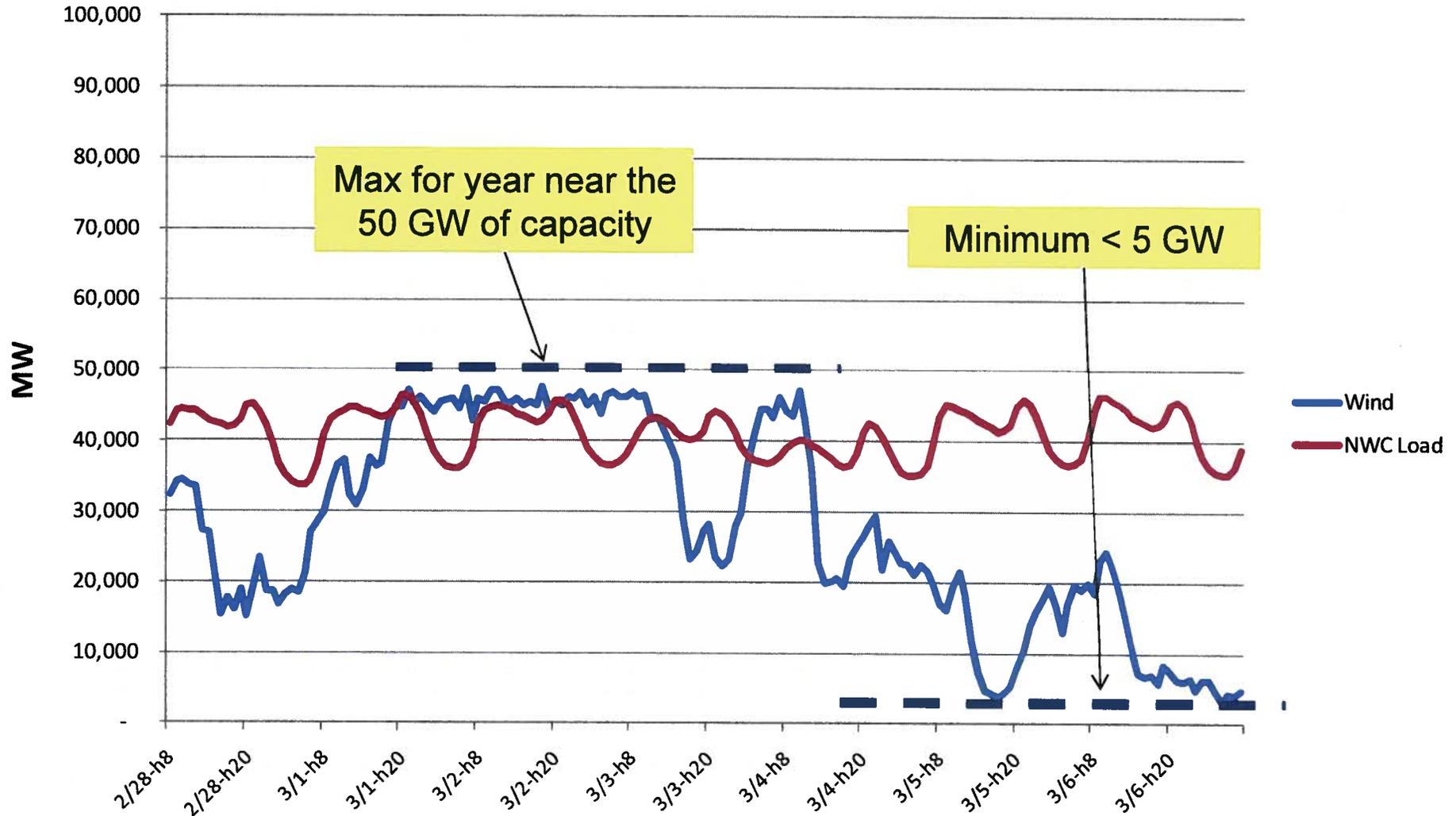


- State hourly load data for 2007 from Energy Velocity
- Hourly loads and wind output synchronized so driven by same 2007 meteorology
- Add 50 GW new installed wind capacity within region
- Rank sites by capacity factor, build best sites first

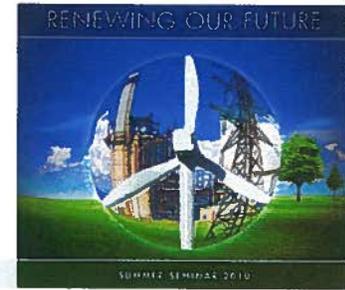


# New Wind Data Captures Variability

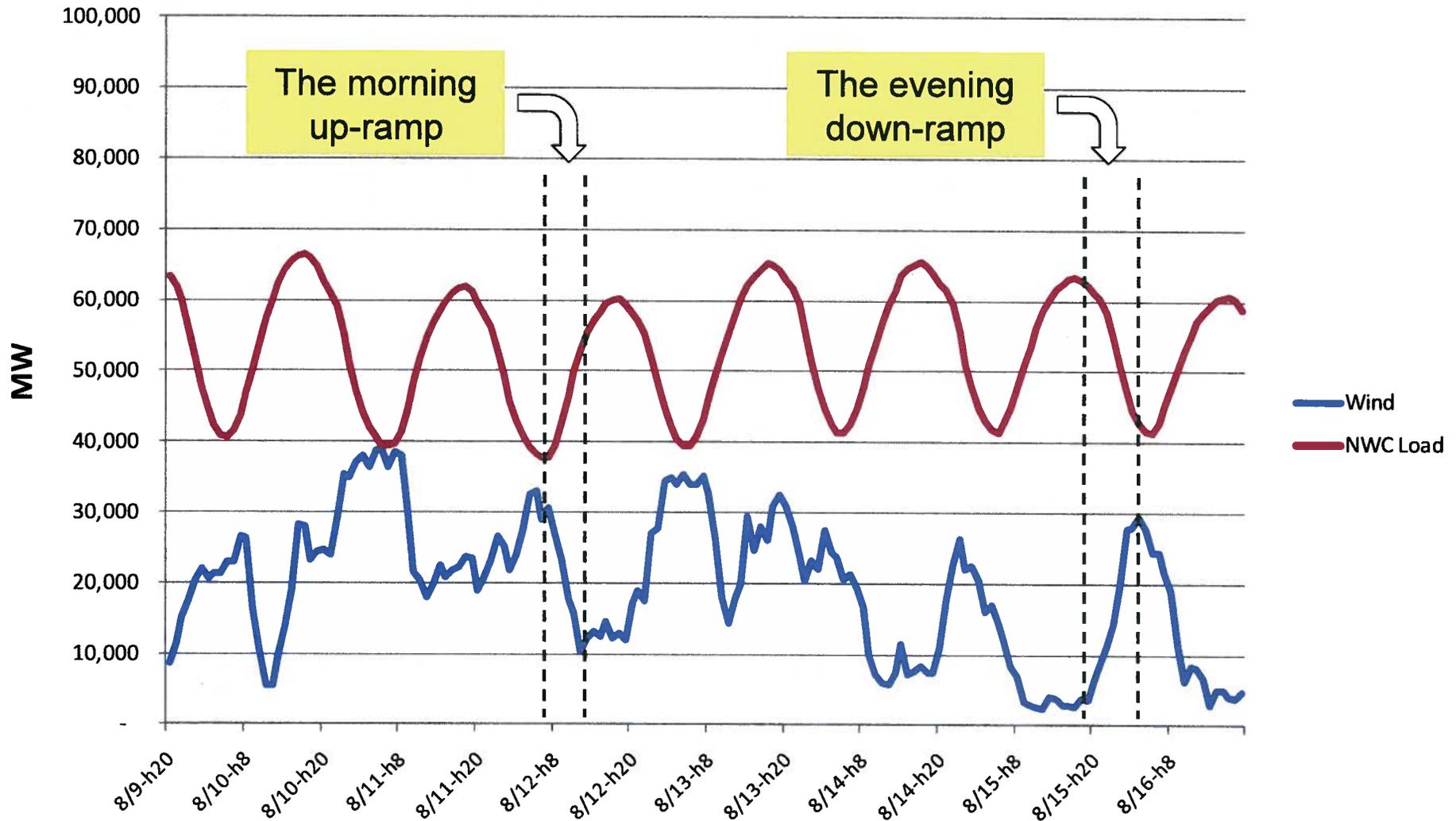
NWC Time Series from 2/28/07 to 3/7/07 w 50 GW Added

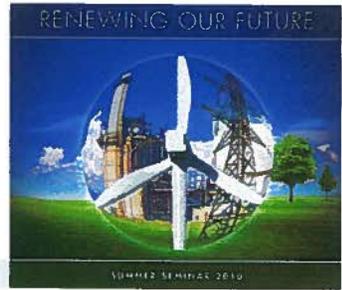


# Anti-correlation of Wind with Load Creates Ramping Issues

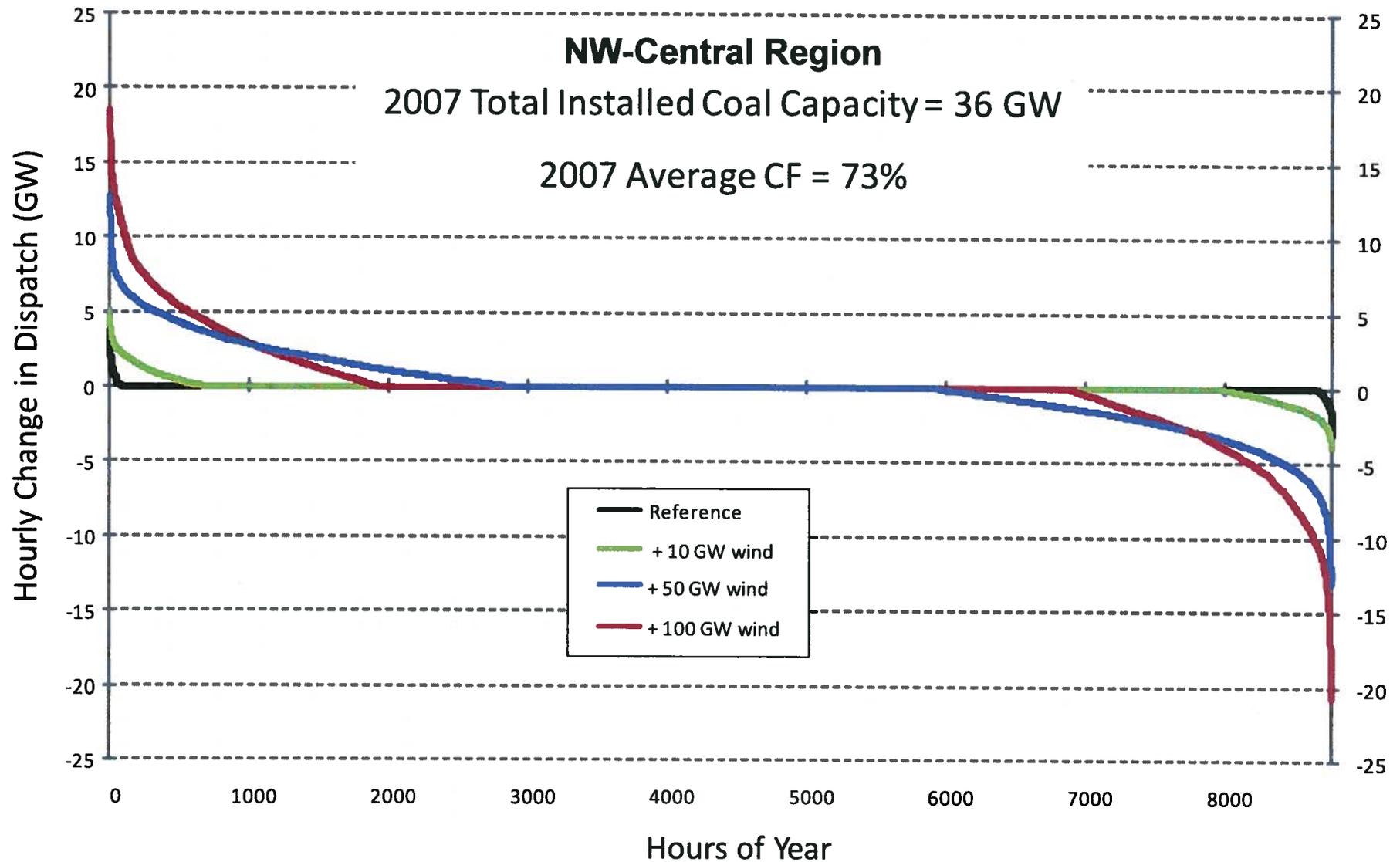


NWC Time Series from 8/9/07 to 8/16/07 w 50 GW Added





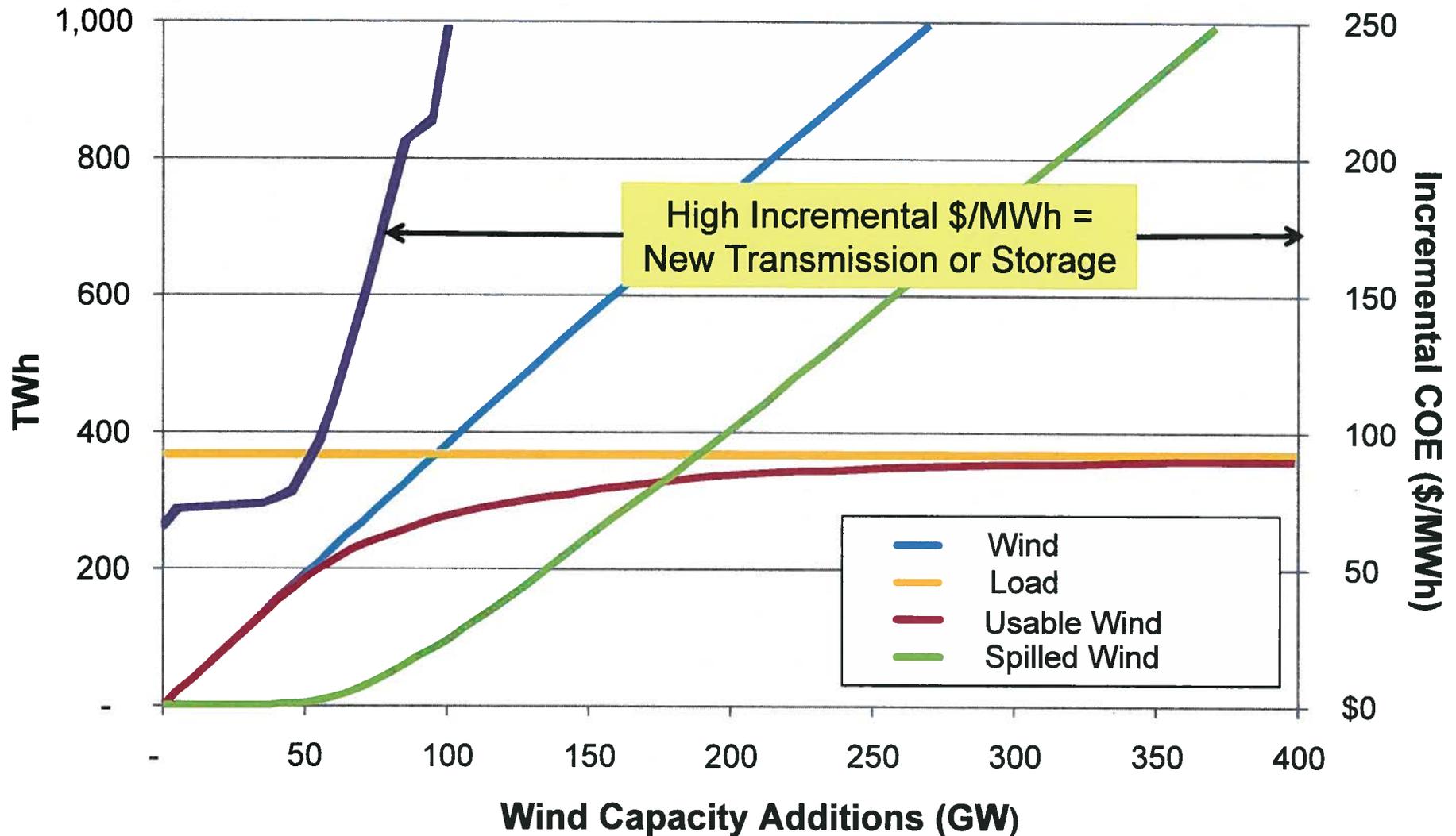
# Wind Variability Impacts Thermal Fleet



# What Happens When Wind Exceeds Available Load?

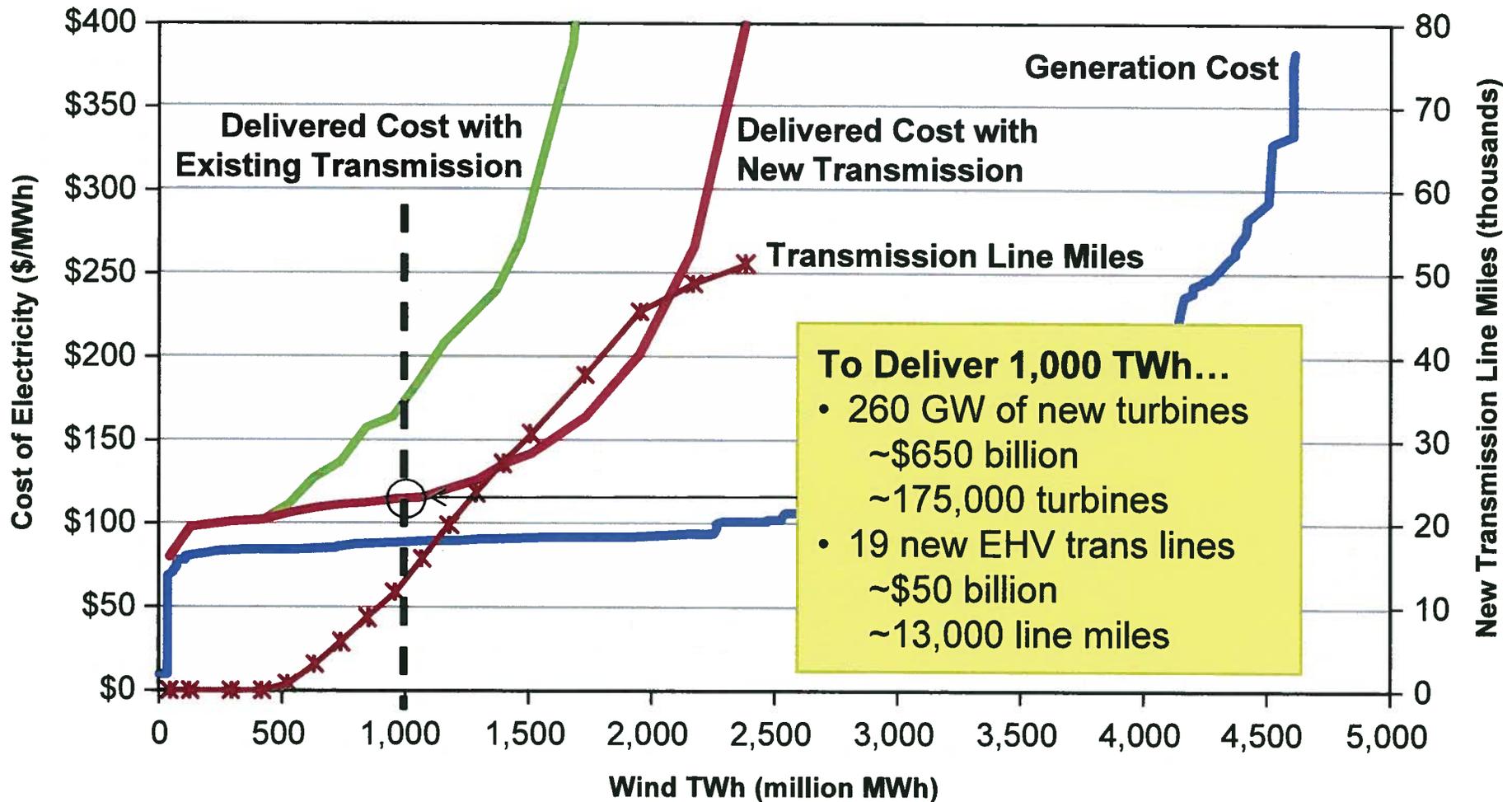


NW-Central Region

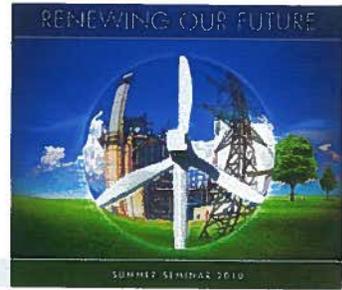




# National Wind Energy Potential Supply Curves\* (including delivery costs)

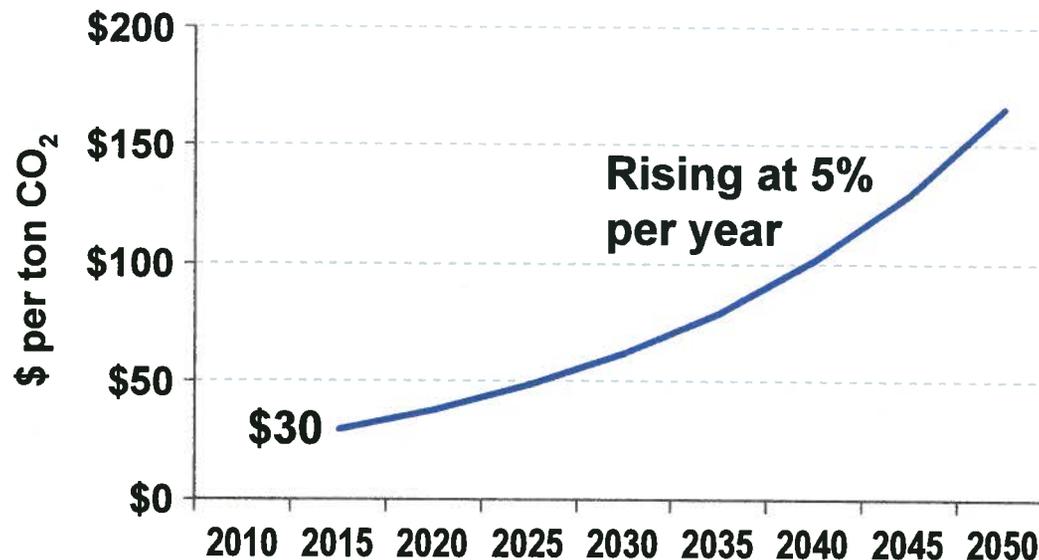


\*EPRI – AWS TruePower National Wind Energy Supply Curves



# Taking Prism 2.0 for a “Test Drive”

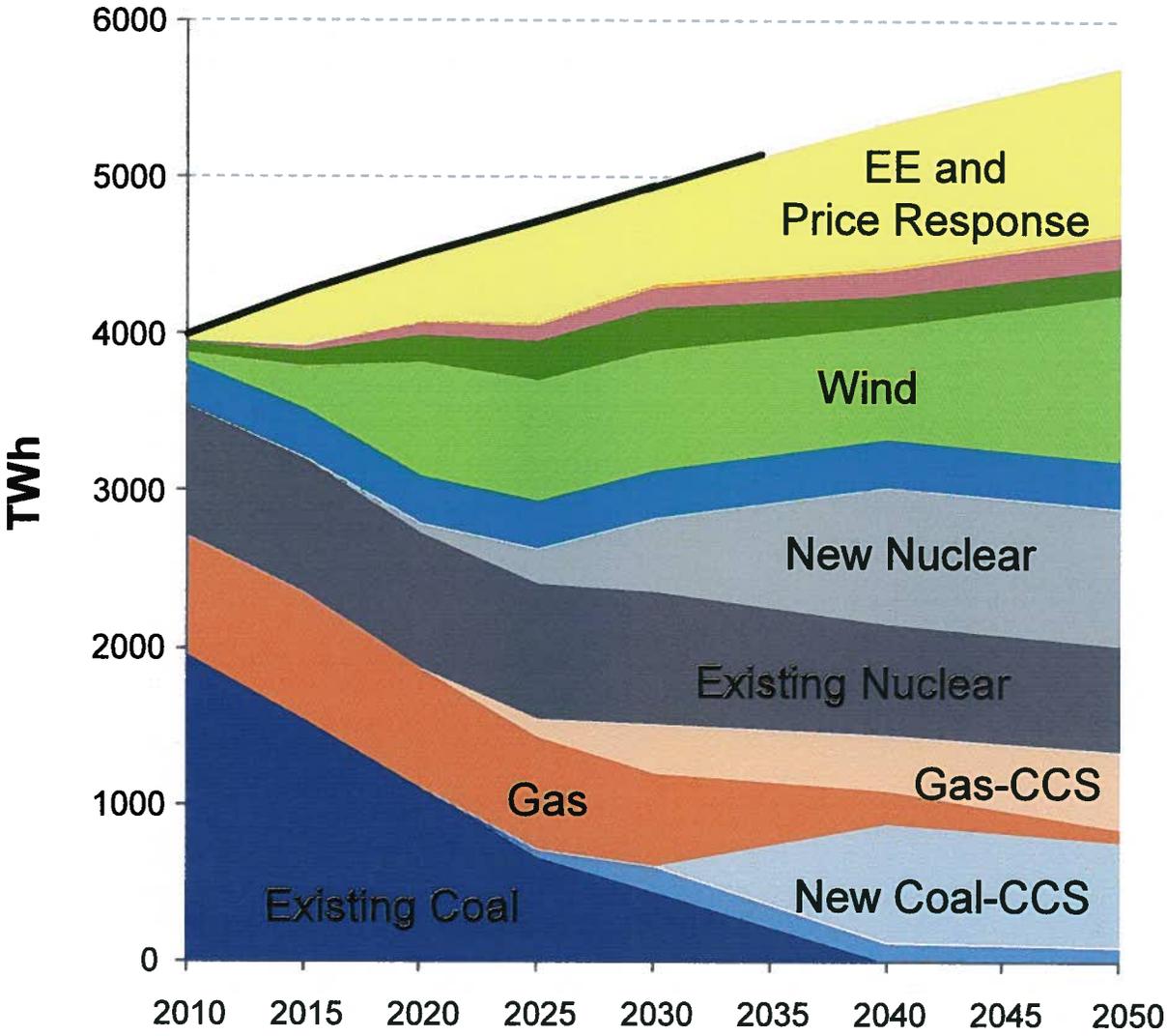
- Details and timing of potential federal limits on GHG emissions remain unclear
- Without specifying a particular proposal or cap, we can simulate an aggressive policy with a rising CO<sub>2</sub> price:



**Results are illustrative, not polished scenarios!!!**

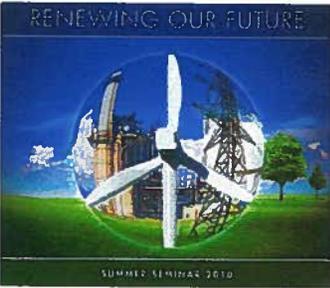


# Prism 2.0 "Test Drive" Generation Mix



- AEO 2010 Reference Case
- Energy Efficiency\*
- Solar
- Geothermal
- Biomass
- Wind
- Hydro+
- Nuclear (New)
- Nuclear (Existing)
- Gas-CCS
- Gas
- Coal-CCS (New)
- CCS Retrofit
- Coal

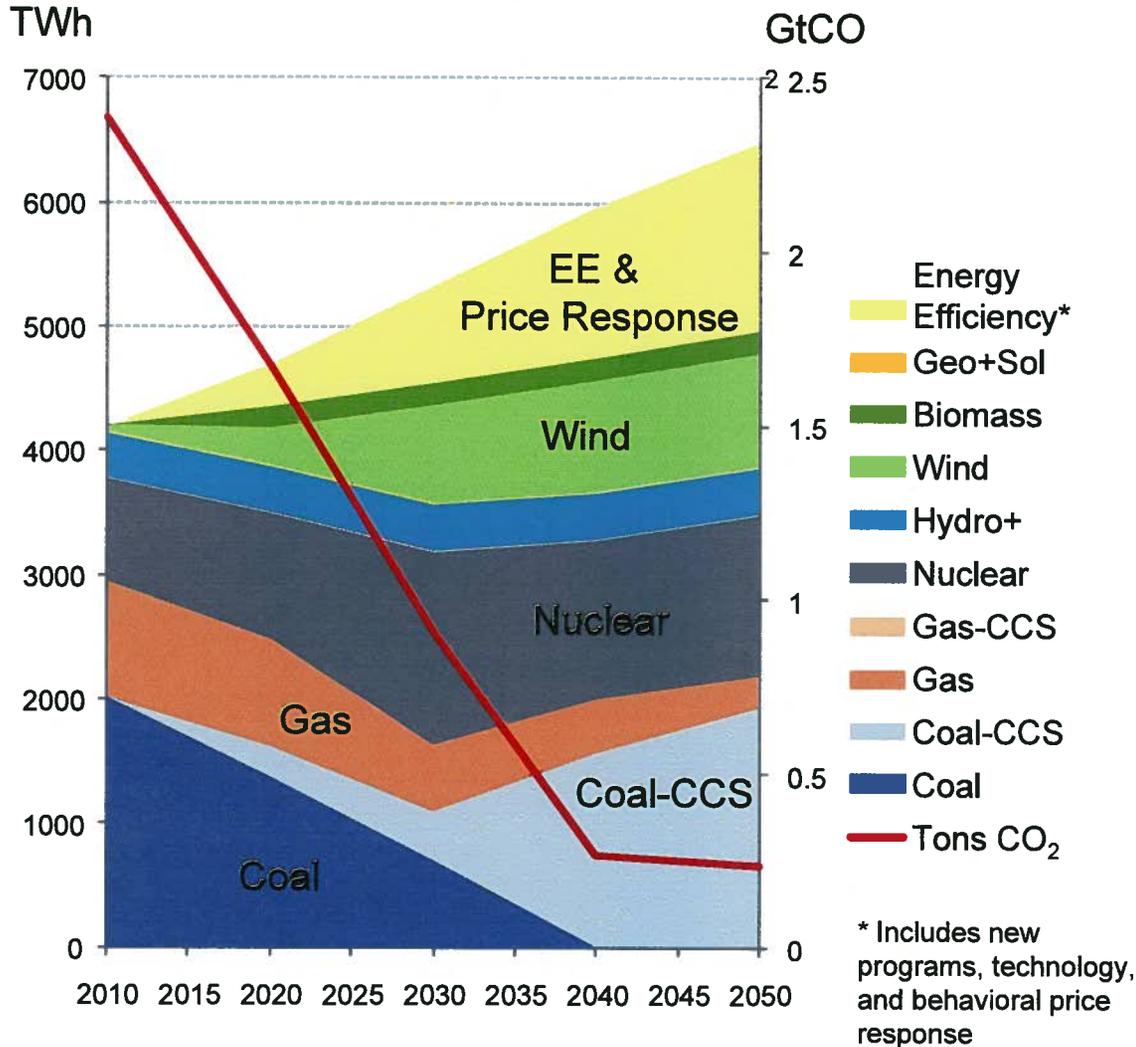
\* Includes new programs, technology, and behavioral price response



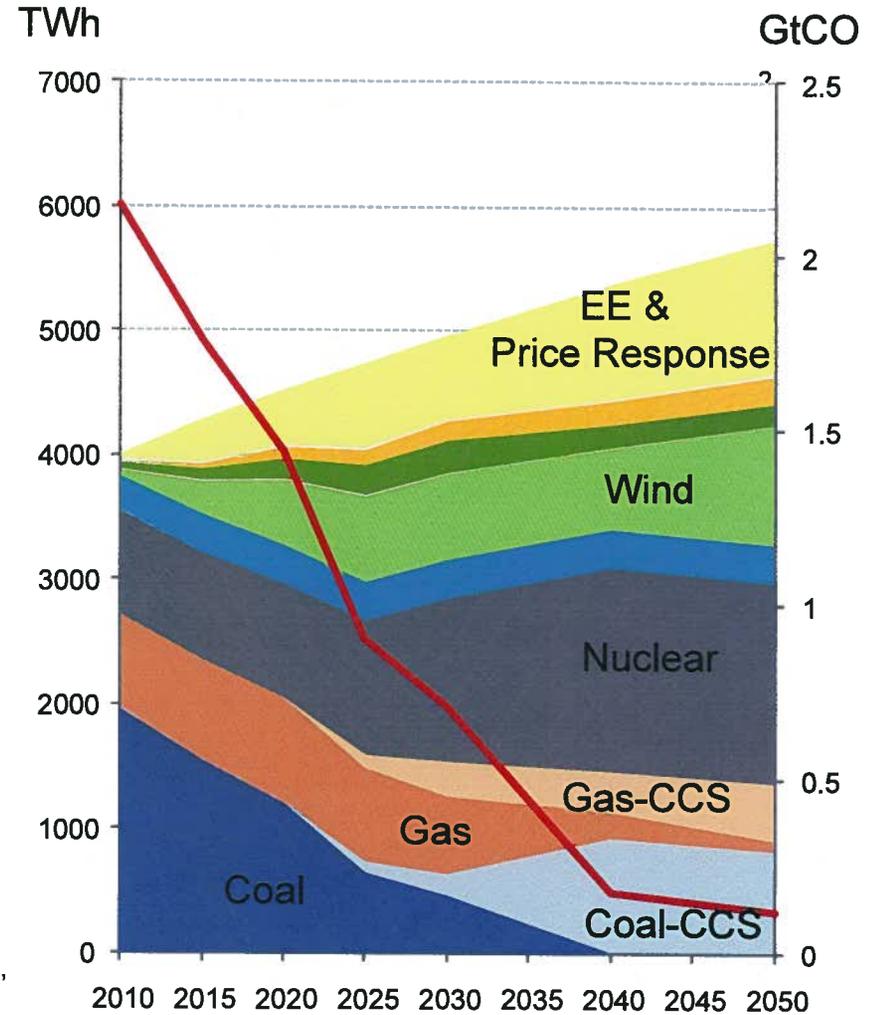
# MERGE vs. Prism 2.0 "Test Drive"

Electric sector module only

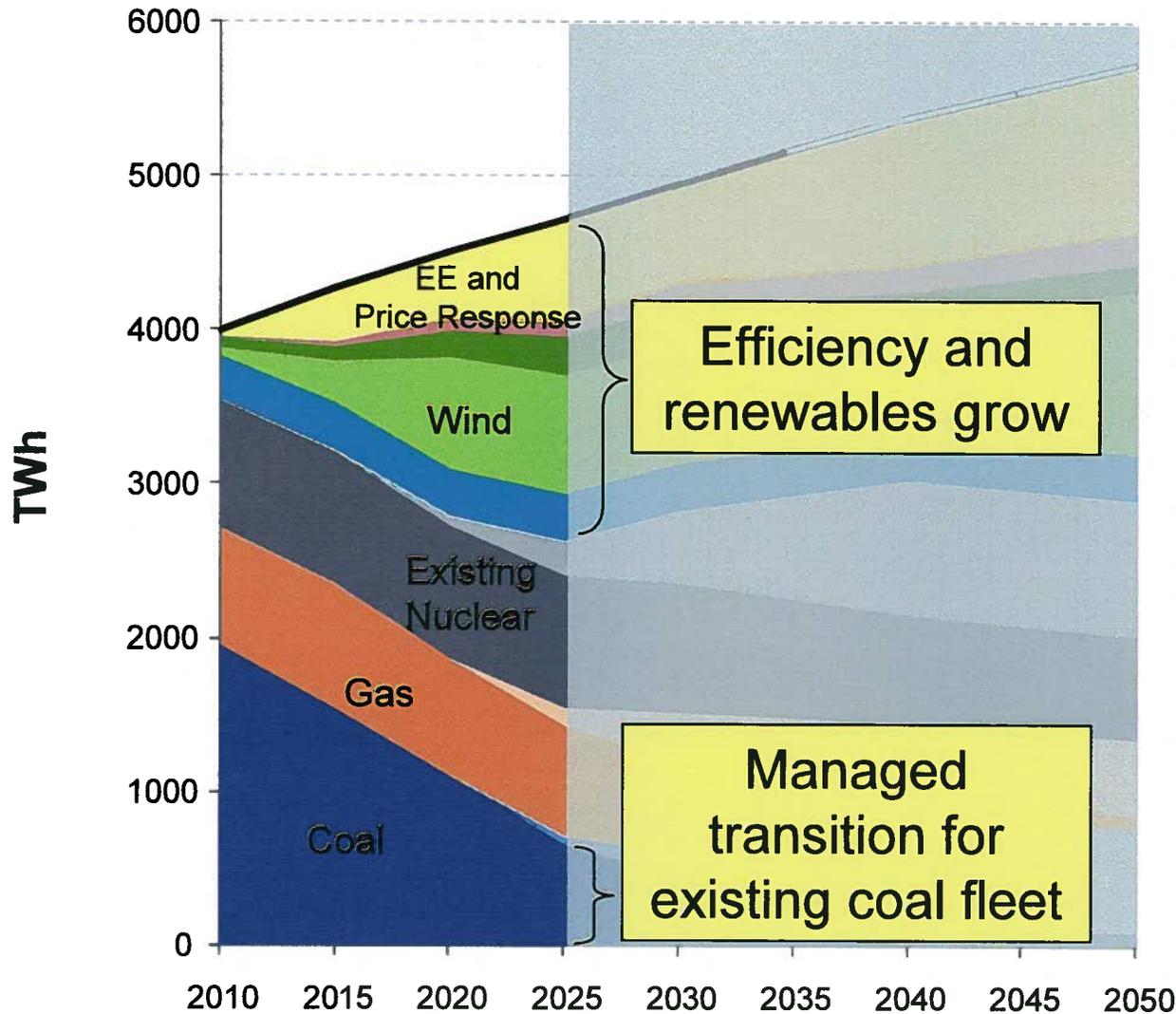
## MERGE with 80% by 2050 Cap



## Prism 2.0 "Test Drive"



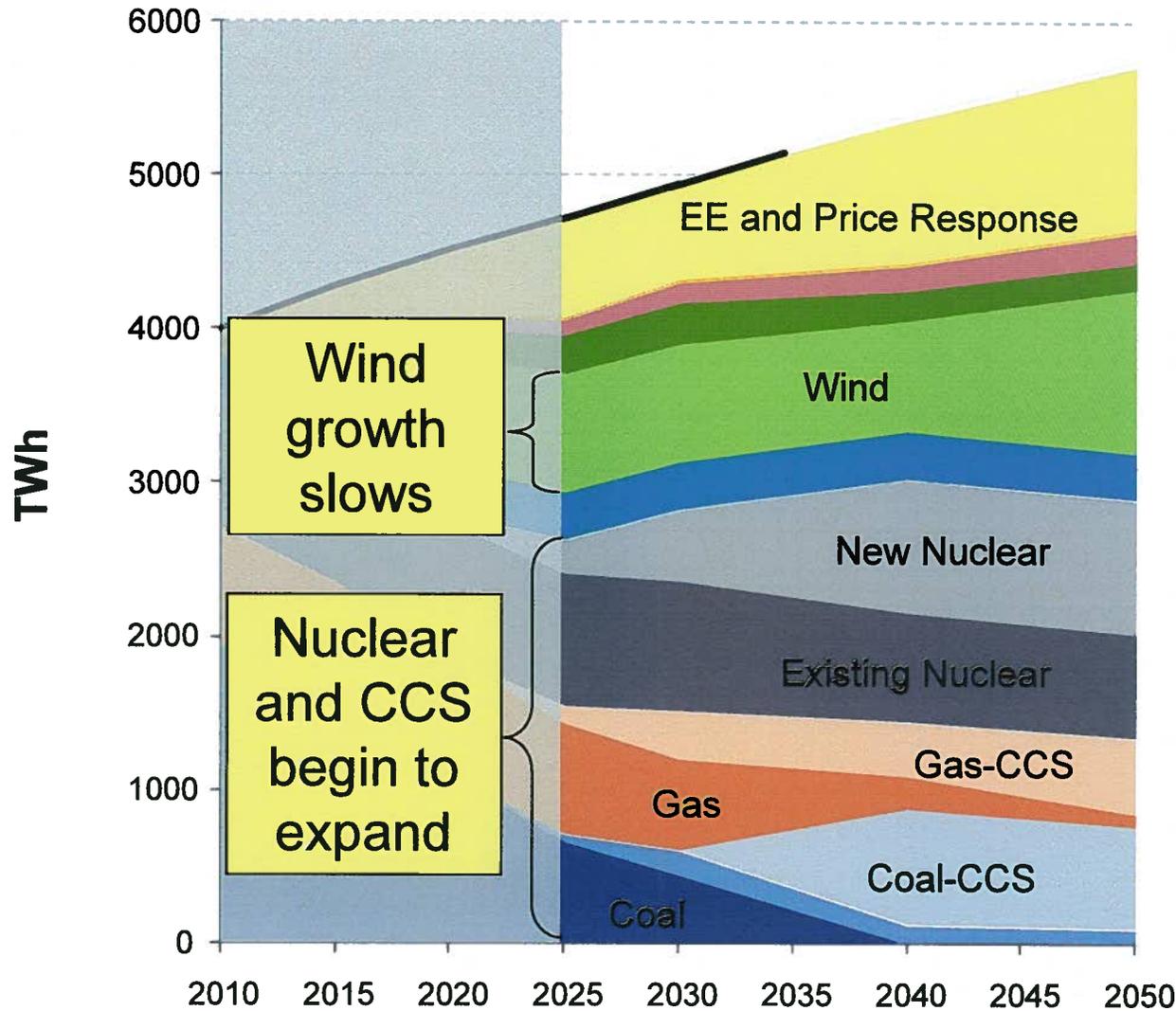
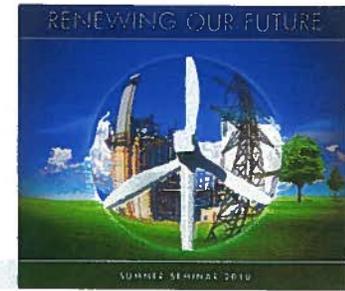
# Prism 2.0 “Test Drive” Insights... 2010-2025



- AEO 2010 Reference Case
- Energy Efficiency\*
- Solar
- Geothermal
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- Nuclear (New)
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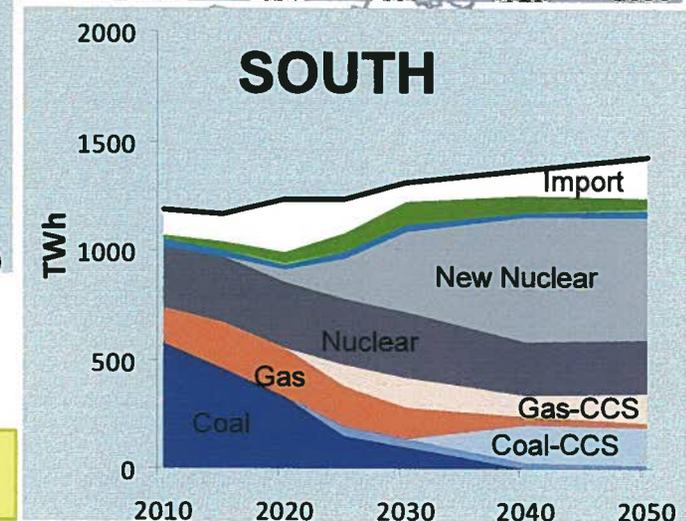
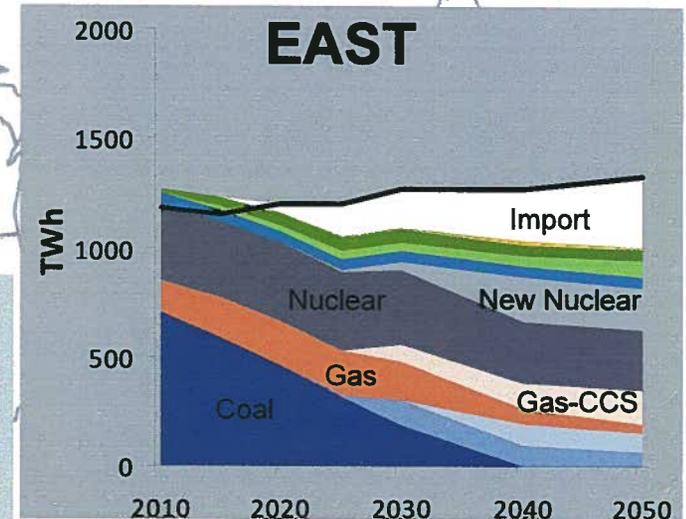
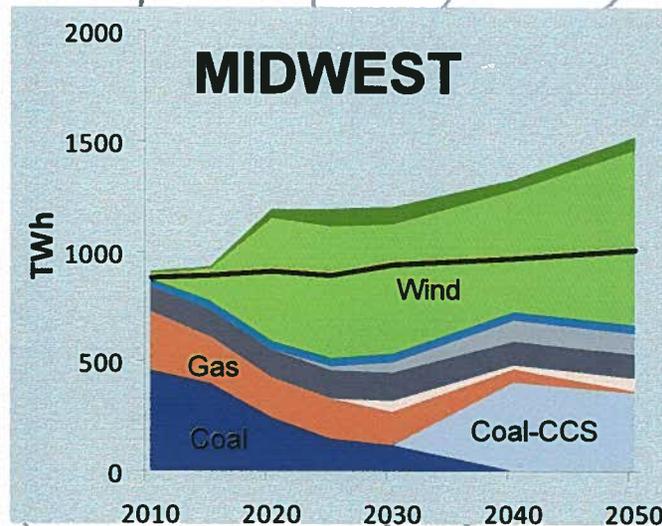
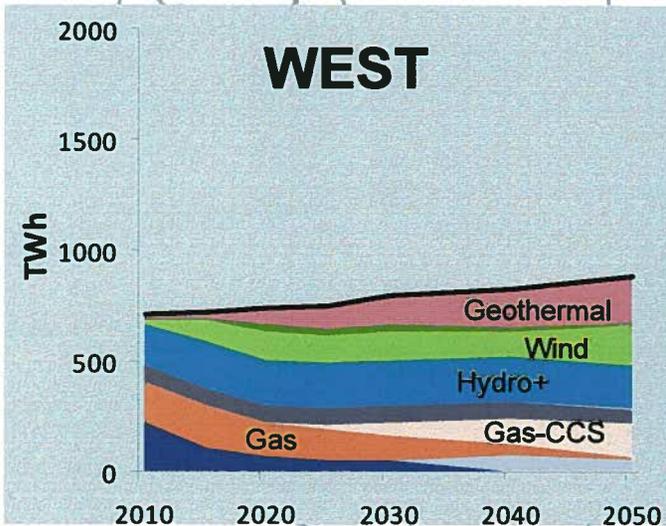
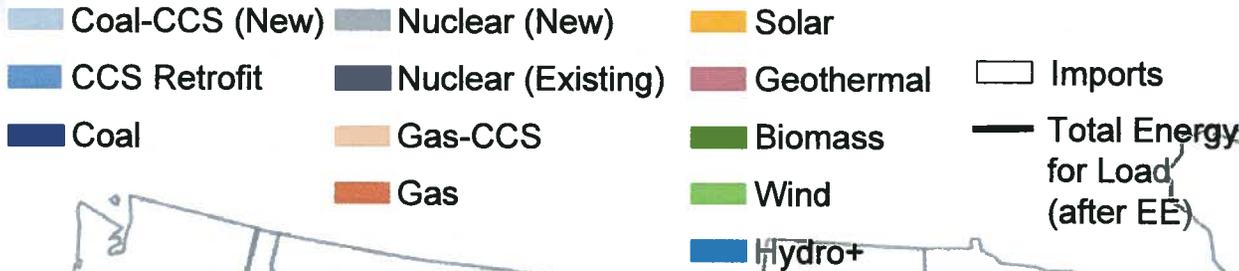
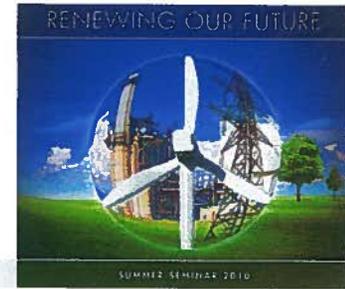
# Prism 2.0 “Test Drive” Insights... Post-2025



- AEO 2010 Reference Case
- Energy Efficiency\*
- Solar
- Geothermal
- Biomass
- Wind
- Hydro+
- Nuclear (New)
- Nuclear (Existing)
- Gas-CCS
- Gas
- Coal-CCS (New)
- CCS Retrofit
- Coal

\* Includes new programs, technology, and behavioral price response

# Prism 2.0 "Test Drive" Insights... Regional Generation Mix

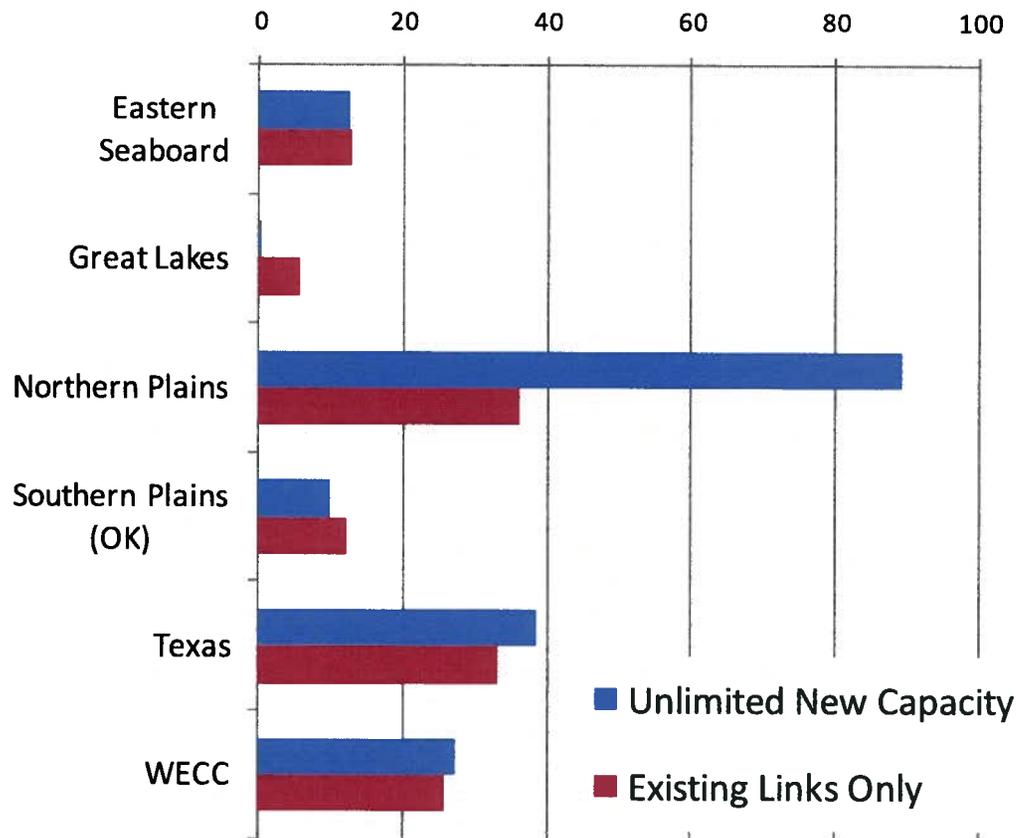


**Responses to CO<sub>2</sub> policy differ greatly by region**

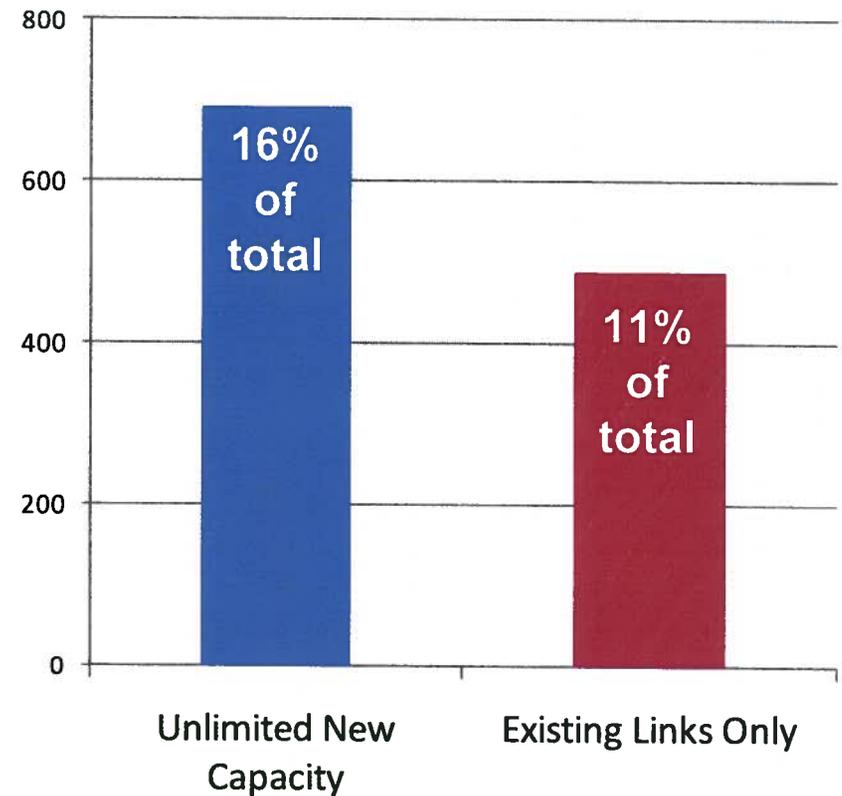
# Prism 2.0 “Test Drive” Insights... What if no new inter-region transmission?



**New Wind Additions through 2030 (GW)**

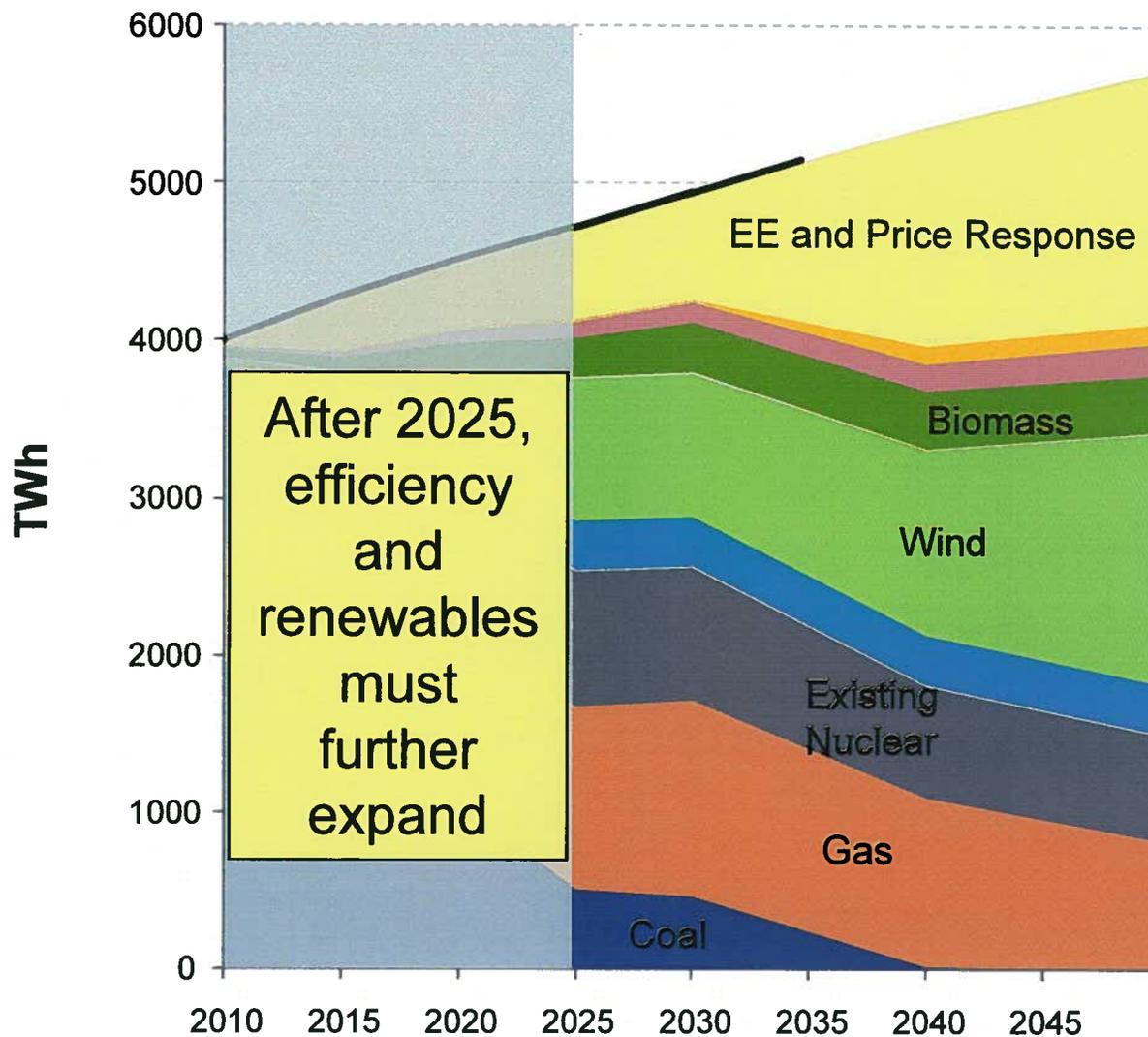


**Total US Wind Generation in 2030 (TWh)**



**Less wind, more regionally distributed**

# Prism 2.0 “Test Drive” Insights... What if no new nuclear or CCS?



- AEO 2010 Reference Case
- Energy Efficiency\*
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- Geothermal
- Biomass
- Wind
- Hydro+
- Nuclear (New)
- Nuclear (Existing)
- Gas-CCS
- Gas
- Coal-CCS (New)
- CCS Retrofit
- Coal

\* Includes new programs, technology, and behavioral price response

# What We Are Seeing ...



- **Near term response to high CO<sub>2</sub> price likely dominated by renewables, efficiency and natural gas**
  - Coal retirements offset by new renewables, efficiency
  - Natural gas fills any remaining demand
- **Wind integration costs significant at high penetration**
  - New balancing resources required (transmission, storage, smart grid, PHEVs)
  - Cycling impacts on thermal fleet → increased O&M
- **Longer term, nuclear and CCS will be important**
  - Without them, rely on more costly renewables, efficiency

ECONOMIC DEVELOPMENT  
RIDER ED-10

AVAILABILITY

Available, only at Company's option, to nonresidential establishments receiving service under Company's Large General Service or Large General Service (Time-of-Use) Schedules provided that the establishment is not classified as Retail Trade or Public Administration by the Standard Industrial Classification (SIC) Manual published by the United States Government.

This Rider is available for load associated with initial permanent service to new establishments, expansion of existing establishments, or new customers in existing establishments who make application to Company for service under this Rider, and Company approves such application. The New Load applicable under this Rider must be a minimum of 1,000 kW at one point of delivery. To qualify for service under this Rider, Customer must meet the qualifications under A. or B. below:

- A. Customer employs an additional workforce in Company's service area of a minimum of seventy-five (75) full time equivalent (FTE) employees. Employment additions must occur following Company's approval for service under this Rider.
- B. Customer's New Load must result in capital investment of four hundred thousand dollars (\$400,000), provided that such investment is accompanied by a net increase in full time equivalent employees employed by Customer in Company's service area. The capital investment must occur following Company's approval for service under this Rider.

This Rider is not available to a new customer which results from a change in ownership of an existing establishment. However, if a change in ownership occurs after Customer contracts for service under this Rider, the successor Customer may be allowed to fulfill the balance of the contract under Rider ED and continue the schedule of credits outlined below. This Rider is also not available for resumption of service following interruptions such as equipment failure, temporary plant shutdown, strike, or economic conditions. This Rider is also not available for: (1) load shifted from one establishment or delivery on Company's system to another on Company's system; (2) short-term, construction, or temporary service; or (3) electrical load that results from the shutdown or reduction of generation facilities.

DEFINITIONS

New Load

New Load is that which is added to Company's system by a new establishment after the initial effective date of this Rider. For existing establishments, New Load is the net incremental load above that which existed prior to approval for service under this Rider. The New Load shall exclude any curtailable, back-up, standby, dispatched power, or incremental power service.

Delivery Date

The Delivery Date is the first date service is supplied under the contract.

Operational Date

The Operational Date shall be the date the facility is fully operational as declared by the Customer, but shall be no more than eighteen (18) months after the Delivery Date.

Month

The term "month" as used in this Rider means the period intervening between readings for the purpose of monthly billings. Readings will be collected each month at intervals of approximately thirty (30) days.

GENERAL PROVISIONS

1. Customer must make an application to Company for service under this Rider and Company must approve such application before Customer may receive service hereunder. The application must include a description of the amount of and nature of the New Load and the basis on which Customer requests qualification shown in A. or B. under Availability above. In the application, Customer must affirm that availability of this Rider was a factor in Customer's decision to locate the New Load on Company's system. The application shall also specify the total number of full time equivalent employees (FTE) employed by Customer in all establishments receiving electric service from Company's system, at the time of application for this Rider, and on the Operational Date.
2. Customer must agree to a minimum contract term of five (5) years, with the credits being available for a maximum period of five years immediately following the Operational Date.
3. For customers contracting under this Rider due to expansion, Company may install metering equipment necessary to measure the New Load to be billed under this Rider separate from the existing load billed under the applicable rate schedule. Company reserves the right to make the determination of whether such installation will be separately metered or submetered. If in Company's opinion, the nature of the expansion is such that either separate metering or submetering is impractical or economically infeasible, Company will determine, based on historical usage, what portion of Customer's load, if any, qualifies as New Load eligible for this Rider.
4. All terms and conditions of the Large General Service and Large General Service (Time-of-Use) Schedules applicable to the individual customer shall apply to the service supplied to Customer, except as modified by this Rider.

MONTHLY BILLING

The Monthly Billing shall be the amount computed under the applicable schedule and other riders with which this Rider is used less the following Discount as computed in the formula below:

$$\text{Discount} = \text{New Load kW} \times \text{EDC}$$

Where:

New Load kW = the maximum 15-minute kW demand registered or computed (during on-peak hours when used in conjunction with the Large General Service (Time-of-Use) Schedule) associated with New Load added by Customer in accordance with this Rider.

EDC = the Economic Development Credit per kW as specified in the table below based on monthly load factor and the number of months service has been rendered under this Rider.

ECONOMIC DEVELOPMENT CREDIT (EDC)

Number of Months Service Has Been Rendered Under This Rider

<u>LOAD FACTOR*</u>	<u>1 - 12</u>	<u>13 - 24</u>	<u>25 - 36</u>	<u>37 - 48</u>	<u>49 - 60</u>
40% - 59%	\$3.50	\$2.80	\$2.10	\$1.40	\$0.70
60% - 79%	\$5.50	\$4.40	\$3.30	\$2.20	\$1.10
80% or greater	\$7.50	\$6.00	\$4.50	\$3.00	\$1.50

\*Load Factor is equal to the kilowatt-hours (kWh) used during the billing month divided by the product of the maximum 15-minute kW demand registered or computed times 730 hours.

The Discount shall be zero (\$0) for load factors less than 40% or for service after sixty (60) monthly bills under this Rider.

ADDITIONAL FACILITIES CHARGE

A monthly facilities charge equal to 2.0% of the installed cost of extra facilities necessary for service for additional metering required under Rider ED, but not less than \$25, shall be billed to Customer in addition to the bill under the appropriate rate schedule and this Rider, when applicable.

CONTRACT PERIOD

Each customer shall enter into a Service Agreement to purchase electricity from Company for a minimum original term of five (5) years, and thereafter from year to year upon the condition that either party can terminate the Service Agreement at the end of the original term, or at any time thereafter, by giving at least twelve (12) months previous notice of such termination in writing. If Customer requests a change in rate schedule from that which was approved in conjunction with Rider ED, credit under Rider ED will no longer be available. Such a change will be allowed upon thirty (30) days written notice to Company. An individual establishment will not be allowed to receive credits for more than five years under this Rider, unless Company, at its option, agrees to accept a new application and contract for qualifying New Load, and such application receives special approval by Company. If at any time during the term of contract under this Rider, Customer violates any of the terms and conditions of the Rider or the Service Agreement, Company may discontinue service under this Rider without notice and bill Customer under the applicable schedule without further credits. In the event electric service is terminated or the Contract Demand is reduced by Company or Customer before the end of the Contract Period, Customer shall pay Company in addition to all other applicable charges, the sum of all Discounts received, plus interest, for the New Load that will no longer be served by Company. The rate of interest shall be the rate per annum paid by Company for electric service deposits.

GENERAL

Kilowatt demands associated with dispatched power, incremental power, back-up, or standby service shall be disregarded from all applications of this Rider, except for the calculation of Load Factor as defined in the Monthly Billing provision.

The provisions of the Schedule with which this Rider is used are modified only as shown herein.

Supersedes Rider ED-8

Effective for service rendered on and after January 1, 2007

SCPSC Docket No. 1995-1078-E, Order No. 2006-775

ECONOMIC REDEVELOPMENT  
RIDER ERD-6

AVAILABILITY

Available, only at Company's option, to nonresidential establishments receiving service under Company's Medium General Service, Small General Service (Time-of-Use), Large General Service, or Large General Service (Time-of-Use) Schedules provided that the premise served is not classified as Retail Trade or Public Administration by the Standard Industrial Classification (SIC) Manual published by the United States Government.

This Rider is available for load associated with an existing premise served or previously served by Company, provided the premise is unoccupied and otherwise dormant for a minimum period of 60 days, as determined by Company. The Load eligible under this Rider must be a minimum of 500 kW at one point of delivery. In addition, the requested service necessary to serve the New Load must not result in additional investment in distribution facilities by Company, other than minor alterations to accommodate Customer's electrical requirements. To qualify for service under this Rider, Customer must meet the qualifications under A. or B. below:

- A. Customer employ an additional workforce in Company's service area of a minimum of thirty-five (35) full time equivalent (FTE) employees. Employment additions must occur following Company's approval for service under this Rider.
- B. Customer's New Load must result in capital investment of two hundred thousand dollars (\$200,000), provided that such investment is accompanied by a net increase in full time equivalent employees employed by Customer in Company's service area. The capital investment must occur following Company's approval for service under this Rider.

This Rider is not available to a new customer which results from a change in ownership of an existing premise. However, if a change in ownership occurs after Customer contracts for service under this Rider, the successor Customer may be allowed to fulfill the balance of the contract under Rider ERD and continue the schedule of credits outlined below. This Rider is also not available for resumption of service following interruptions such as equipment failure, temporary plant shutdown, strike, or economic conditions. This Rider is also not available for: (1) load shifted from one establishment or delivery on Company's system to another on Company's system; (2) short-term, construction, or temporary service; or (3) for service in conjunction with Economic Development Rider ED or a curtailable load rider.

DEFINITIONS

New Load

New Load is that which is added to Company's system by a customer beginning the occupation of an existing unoccupied premise.

Delivery Date

The Delivery Date is the first date service is supplied under the contract.

Operational Date

The Operational Date shall be the date the premise is fully operational, as declared by the Customer, but shall be no more than twelve (12) months after the Delivery Date.

### Month

The term "month" as used in this Rider means the period intervening between readings for the purpose of monthly billings. Readings will be collected each month at intervals of approximately thirty (30) days.

### Load Factor

For purposes of this Rider, Load Factor is equal to the kilowatt-hours (kWh) used during the billing month divided by the product of the maximum 15-minute kW demand registered or computed times 730 hours.

## GENERAL PROVISIONS

1. Customer must make an application to Company for service under this Rider and Company must approve such application before Customer may receive service hereunder. The application must include a description of the amount of and nature of the New Load and the basis on which Customer requests qualification shown in A. or B. under Availability above. In the application, Customer must affirm that the availability of this Rider was a factor in Customer's decision to locate the New Load on Company's system. The application shall also specify the total number of full time equivalent employees (FTE) employed by Customer in all establishments receiving electric service from Company's system at the time of application for this Rider and on the expected Operational Date.
2. Customer must agree to a minimum contract term of five (5) years, with the credits being available for a maximum period of one (1) year immediately following the Operational Date.
3. To continue service under this Rider, Customer must maintain a monthly load factor of 40%, as defined above.
4. All terms and conditions of Company's rate schedule shall apply to the service supplied to Customer, except as modified by this Rider.

## MONTHLY BILLING

The Monthly Billing shall be the amount computed under the applicable schedule and other riders with which this Rider is used less a credit during months 1 through 12 after the Operational Date. The credit shall be 25% of the total bill for contract demands less than 1,000 kW and 50% of the total bill for contract demands of 1,000 kW or greater, including the Basic Facilities Charge, Demand Charge, and Energy Charge, but excluding any other rider or miscellaneous charges such as charges for additional facilities. The credit shall be zero (\$0) for months when Customer's monthly load factor, as defined above, is less than 40%.

## CONTRACT PERIOD

Each customer shall enter into a Service Agreement to purchase electricity from Company for a minimum original term of five (5) years, and thereafter from year to year upon the condition that either party can terminate the Service Agreement at the end of the original term, or at any time thereafter, by giving at least twelve (12) months previous notice of such termination in writing. If Customer requests a change in rate schedule from that which was approved in conjunction with this Rider, the monthly credit will no longer be available. Such a change will be allowed upon thirty (30) days written notice to Company. If at any time during the term of contract under this Rider, Customer violates any of the terms and conditions of the Rider or the Service Agreement, Company may discontinue service under this Rider without notice and bill Customer under the applicable schedule without further credits. In the event electric service is terminated or the Contract Demand is reduced by Company or Customer before the end of the Contract Period, Customer shall pay Company in addition to all other applicable charges, the sum of all Discounts received, plus interest, for the New Load that will no longer be served by Company. The rate of interest shall be the rate per annum paid by Company for electric service deposits.

Supersedes Rider ERD-4A

Effective for bills rendered on and after January 1, 2007  
SCPSC Docket No. 2003-26-E, Order No. 2006-775

**South Carolina General Assembly**  
118th Session, 2009-2010

**S. 883**

**STATUS INFORMATION**

Senate Resolution

Sponsors: Senators Alexander, Anderson, Bright, Bryant, Campbell, Campsen, Cleary, Coleman, Courson, Cromer, Davis, Elliott, Fair, Ford, Grooms, Hayes, Hutto, Jackson, Knotts, Land, Leatherman, Leventis, Lourie, Malloy, L. Martin, S. Martin, Massey, Matthews, McConnell, McGill, Mulvaney, Nicholson, O'Dell, Peeler, Pinckney, Rankin, Reese, Rose, Ryberg, Scott, Setzler, Sheheen, Shoopman, Thomas, Verdin and Williams

Document Path: l:\s-res\tca\008elec.mrh.tca.docx

Companion/Similar bill(s): 4131

Introduced in the Senate on June 16, 2009

Adopted by the Senate on June 16, 2009

Summary: Electric line workers

**HISTORY OF LEGISLATIVE ACTIONS**

<u>Date</u>	<u>Body</u>	<u>Action Description with journal page number</u>
6/16/2009	Senate	Introduced and adopted <a href="#">SJ-68</a>

View the latest [legislative information](#) at the LPITS web site

**VERSIONS OF THIS BILL**

[6/16/2009](#)

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**A SENATE RESOLUTION**

TO RECOGNIZE AND HONOR THE MANY OUTSTANDING  
ELECTRIC LINE WORKERS IN OUR STATE AND TO  
THANK THEM FOR THEIR SERVICE TO OUR STATE.

Whereas, reliable electricity has become an indispensable part of  
the health, welfare, and prosperity of our society; and

Whereas, the provision of electricity requires the combined efforts  
of a well-trained and dedicated group of safety-oriented  
professionals; and

Whereas, electrical line work is consistently ranked among the  
most dangerous professions; and

Whereas, the South Carolina Public Service Authority, municipal  
power systems, investor-owned electric providers, and the State's  
electric cooperatives rely upon more than two thousand line  
workers to keep our State's power systems working properly; and

Whereas, line workers are frequently asked to work in the harshest  
of conditions, including natural disasters, inclement weather, and  
times of state emergency; and

Whereas, over the last five years, South Carolina's line workers  
have selflessly volunteered to leave their families to help those in  
need of assistance, rendering aid to people from as close as their  
neighbors within the borders of South Carolina to as far away as  
Louisiana to the west and Ohio to the north. Some have even  
helped in other nations; and

Whereas, in the past five years alone, more than seven hundred  
fifty of South Carolina's line workers have spent more than

1 twenty-six months away from home, responding to more than fifty  
2 different requests for help from people in need; and

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4 Whereas, these unsung heroes of our modern world quietly  
5 perform their duties without fanfare or recognition from the  
6 general public as they continue, in the words of poet Chan  
7 Gardiner, "fightin' on gales and the blizzards an' ice / Protectin'  
8 the towers and span / With effort not measured in hours or price /  
9 For one cause - service to man!" Now, therefore,

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11 Be it resolved by the Senate:

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13 That the members of the Senate of South Carolina, by this  
14 resolution, declare their appreciation to the electric line workers of  
15 South Carolina in order to recognize and honor their outstanding  
16 contribution to the welfare of our State.

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