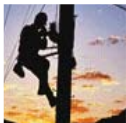


# Expanding Transmission Capacity for Renewables

## The Independent Transmission Developer Perspective

**Jerry Vaninetti**  
**Vice President Western Development**  
**Trans-Elect Development Co.**

*Joint meeting of the  
Committee on Regional Electric Power Cooperation  
and the  
Western Interconnection Regional Advisory Body  
Holiday Inn on the Bay - San Diego, CA April 8-9, 2009*



**TRANS-ELECT, LLC.**

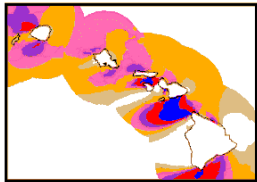
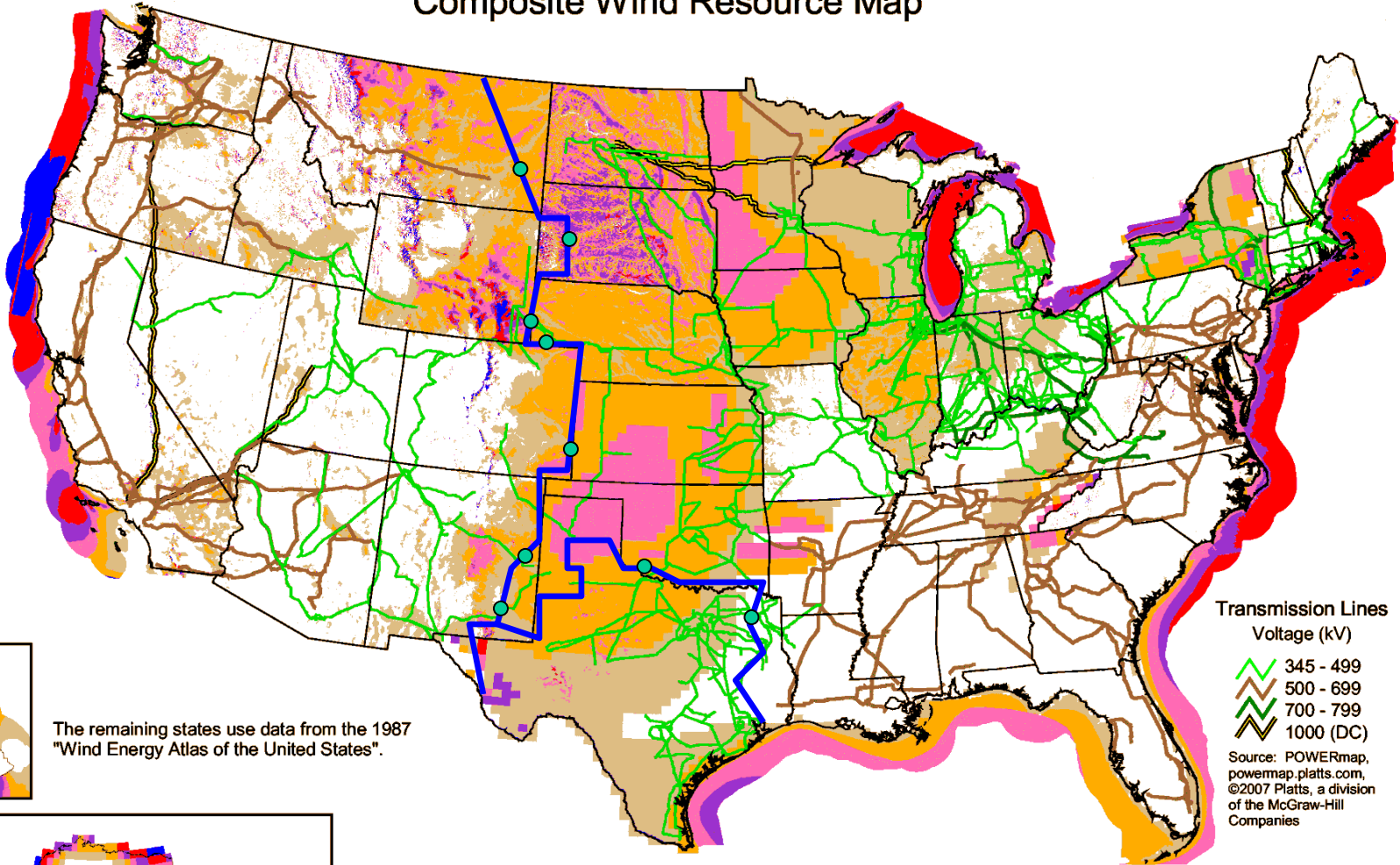
# Issues in Play

- The “need for speed”
  - The “perfect storm” – need meets opportunity
  - Public policy and stimulus package goals are aligned
- Super-sizing or right-sizing transmission lines
  - Conservation of right-of-way & economies of scale
  - Interstate “grid overlay” concept
- Designing for expansions
  - Oversized towers to accommodate future circuits
  - Delaying expensive higher-voltage substations for future installation
- Other considerations
  - Purpose: local or regional agenda and which renewables?
  - Planning: who does the planning, for whom & how done?
    - › *To what extent should transmission planning take into account generation and delivery economics?*
  - Financial: who pays, who assumes the risks & can financing be arranged?
    - › *Independent transmission has an appetite and a role to play*
  - Permitting: how to expedite, particularly for multi-state lines?
  - Regulatory: what gets built, who pays, how much, and for what purposes?
    - › *Regionalization of renewable markets and role of multi-state export lines?*
    - › *What role does reliability play?*

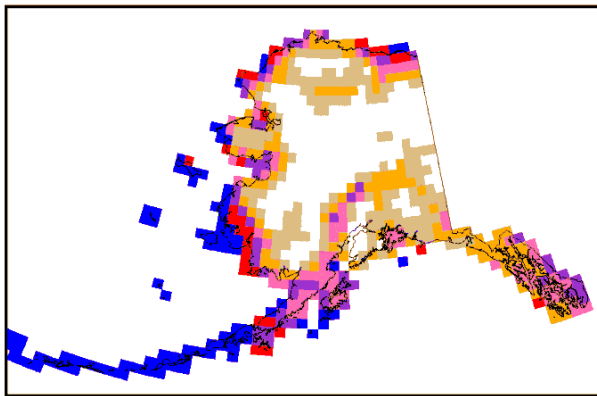
NREL Updated Maps:

- 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 (2000)
- Utah (2003)
- Vermont (2001)
- Virginia (2002)
- Washington (2002)
- West Virginia (2002)
- Wyoming (2002)

# Composite Wind Resource Map



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

- DC Ties (all ~ 200 MW except ERCOT-E @ 600 MW)
- Interconnection Boundary

Wind Power Classification				
Wind Power Class	Resource Potential	Wind Power Density at 50 m $W/m^2$	Wind Speed <sup>a</sup> at 50 m m/s	Wind Speed <sup>a</sup> 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

<sup>a</sup> Wind speeds are based on a Weibull k value of 2.0

U.S. Department of Energy  
National Renewable Energy Laboratory



# Western Governors' Association WREZ Initiative

## Preliminary WREZs

### LEGEND

- Qualified resource area
- Canadian hydropower resources
- Conventional discovered geothermal

### Solar thermal resource

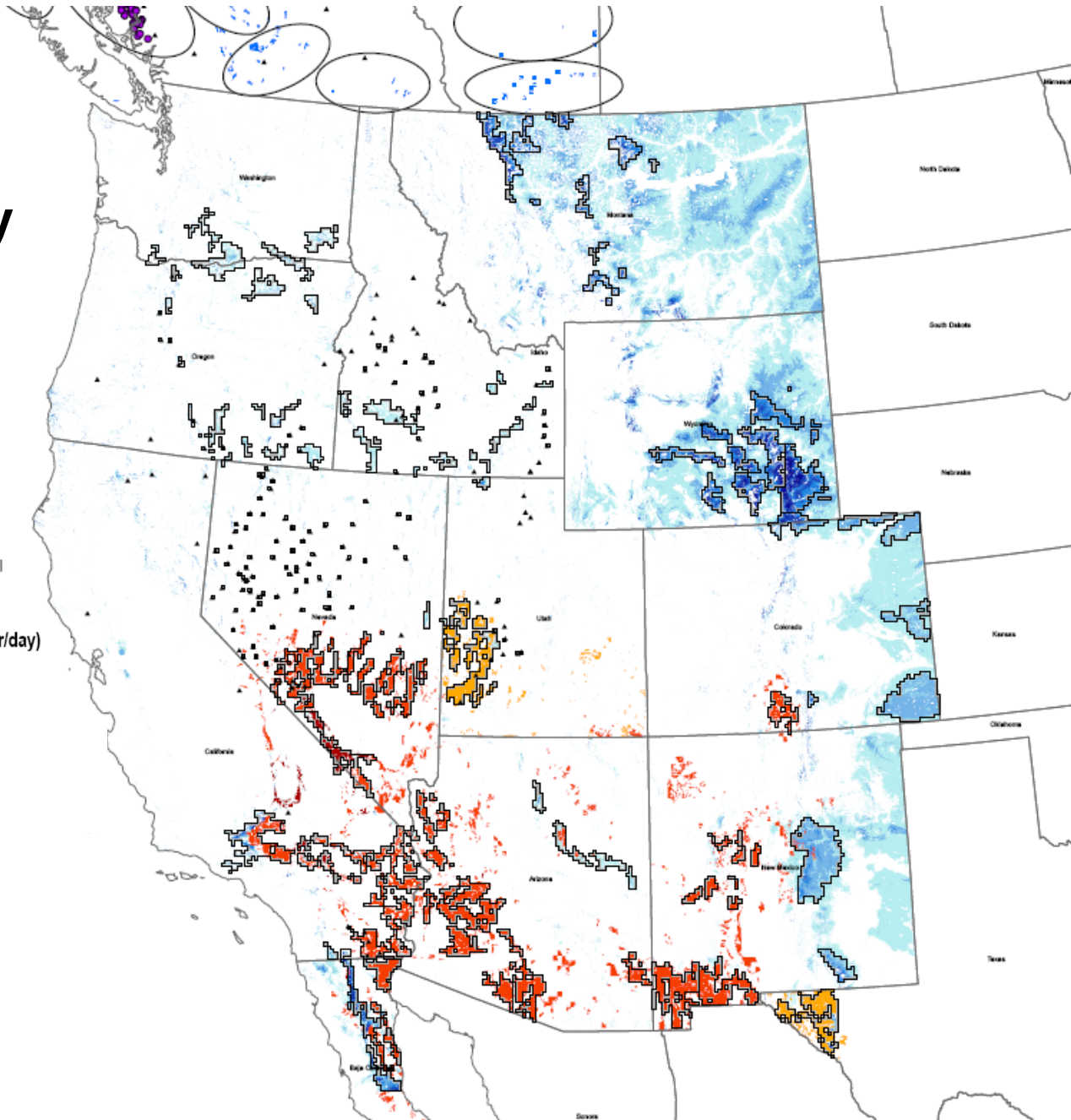
Direct normal insolation (kWh/sqmr/day)

- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 +

### Wind resource

Wind power class

- 3
- 4
- 5
- 6
- 7
- Canadian wind



# WECC High Voltage Transmission

## *Transmission Voltages*

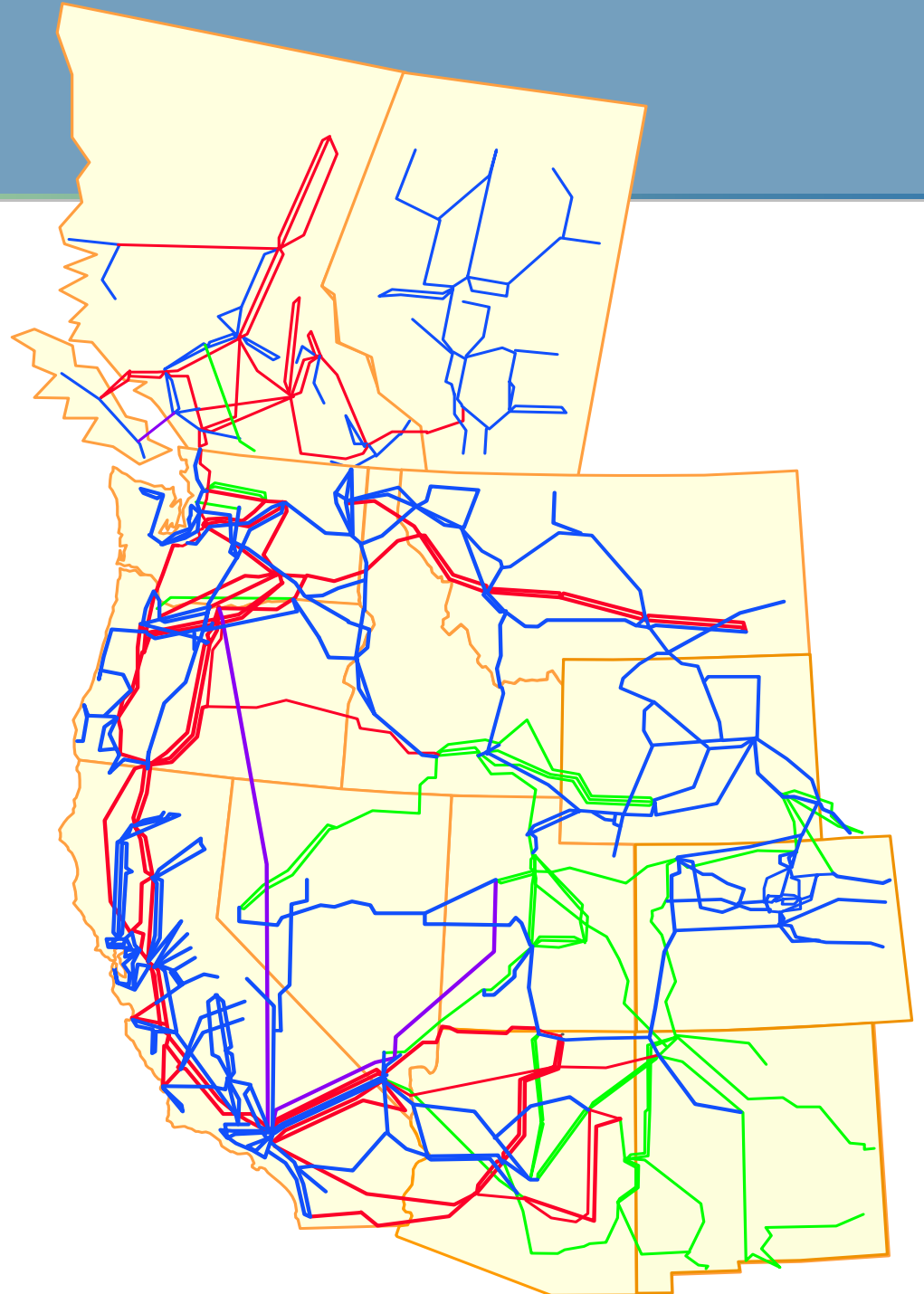
230 kV & below

345 kV

500 kV

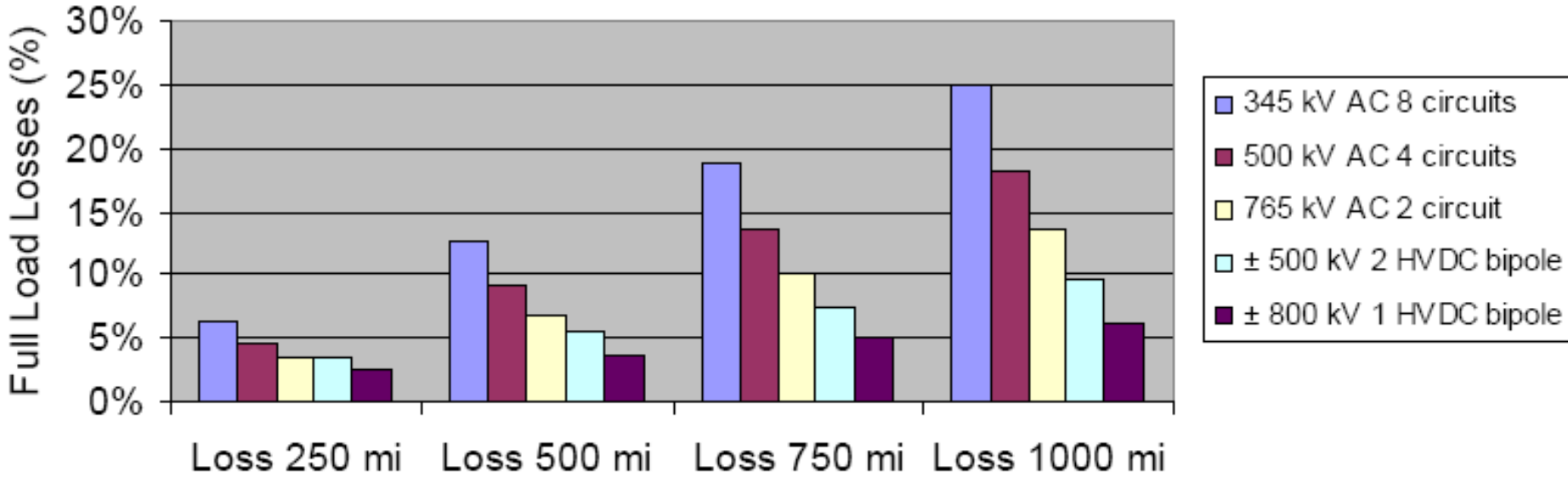
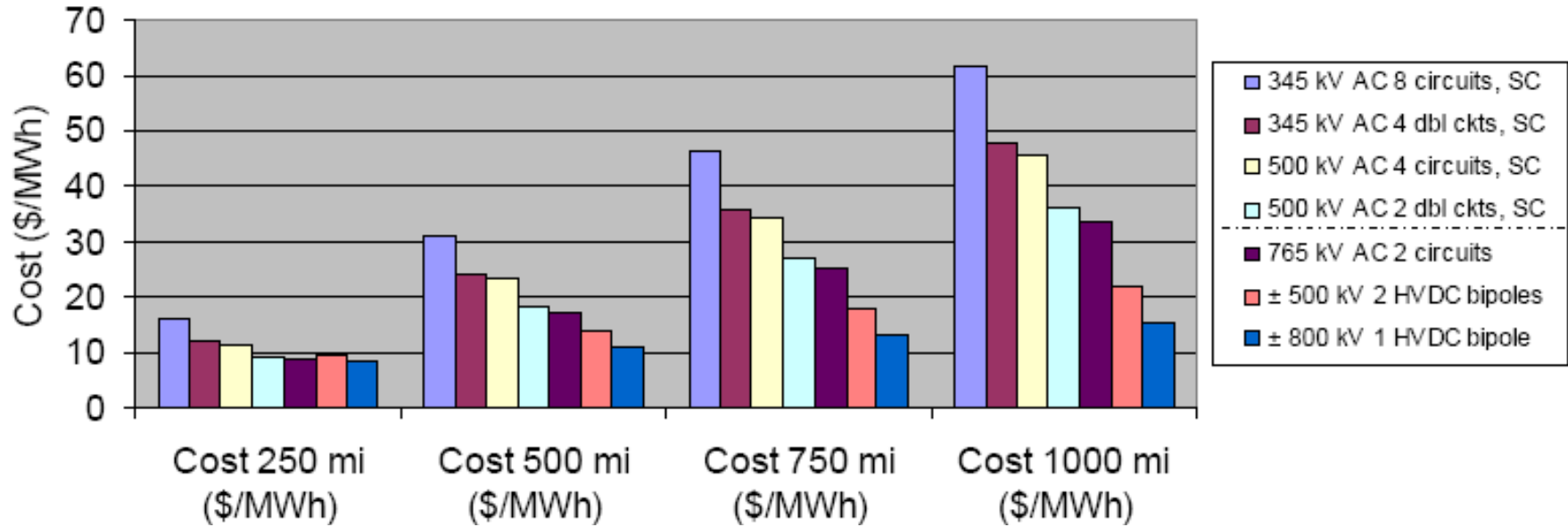
DC

- There is no 765 kV in the WECC
- WECC & DOE have held conferences on “grid overlay” issues
- Each region will want to plan its own overlay



# Comparative Costs & Losses (ABB)

(6,000 MW capacity @ 75% utilization)



# WREZ Transmission Input Assumptions

VOLTAGE	CIRCUITS	CAPACITY (1) (MW)	CAPITAL (2) (\$000/mi)	RIGHT-OF-	LOSSES (4) (Per 100 mi)	O&M+TAXES (% Capital/YR)	SUBSTATIONS	
				WAY (3) (width in feet)			\$MM/sub (5)	Spacing
230 kV - AC	Single	400	\$900	150	6.90%	3.00%	\$50	100 Miles
230 kV - AC	Double	800	\$1,440	150	6.90%	3.00%	\$50	100 Miles
345 kV - AC	Single	750	\$1,260	160	4.50%	3.00%	\$75	150 Miles
345 kV - AC	Double	1,500	\$2,016	160	4.50%	3.00%	\$75	150 Miles
500 kV - AC	Single	1,500	\$1,800	175	1.50%	3.00%	\$100	200 Miles
500 kV - AC	Double	3,000	\$2,880	175	1.50%	3.00%	\$100	200 Miles
765 kV - AC	Single	3,000	\$2,250	200	1.00%	3.00%	\$125	300 Miles
500 kV - DC	Bipole	3,000	\$1,440	200	1.20%	3.00%	\$250	Terminus

(1) Capacity limited by voltage of interconnecting lines

(2) Capital costs do not include right-of-way (ROW)

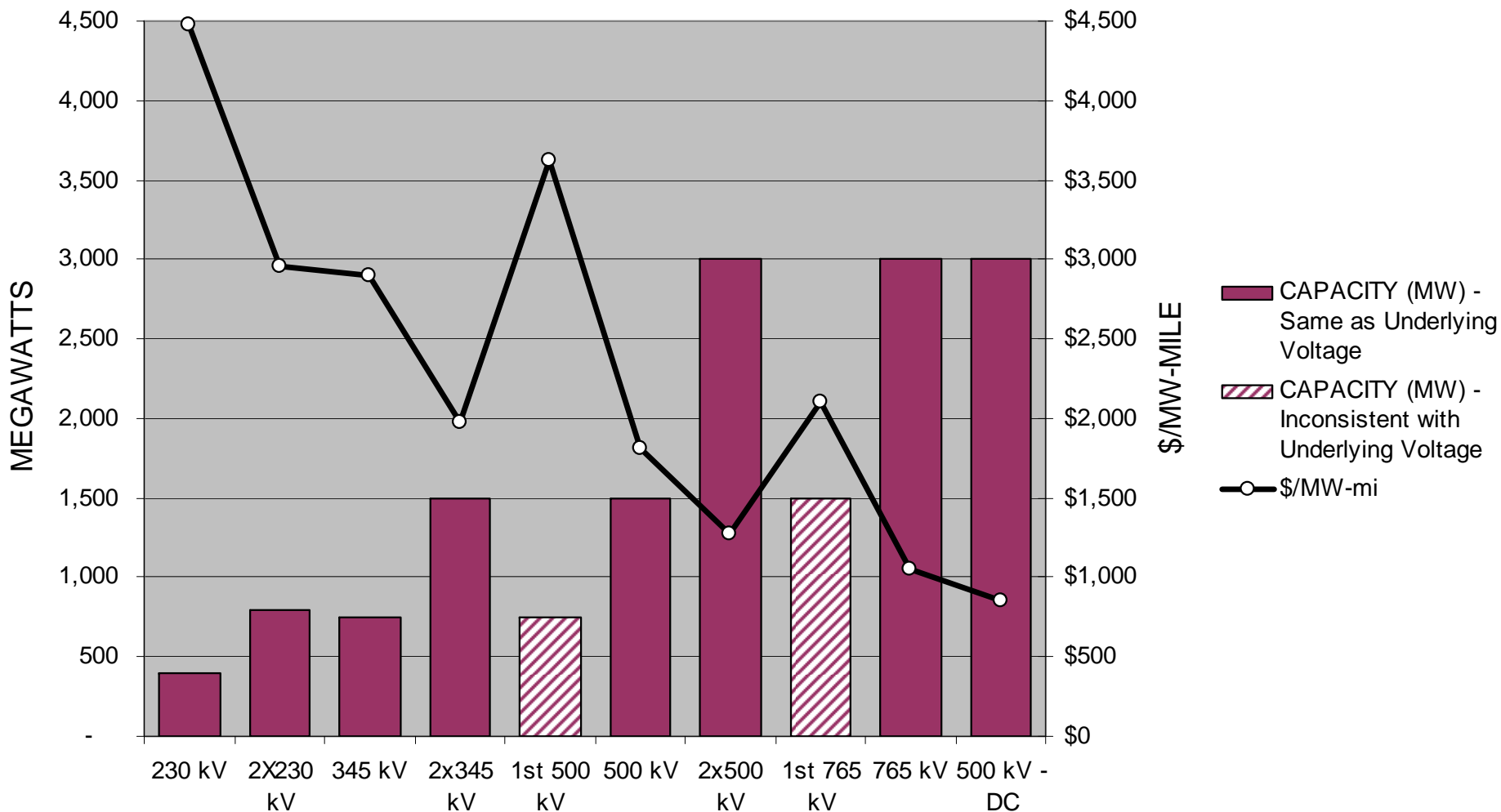
(3) Values include both land and acquisition costs that vary by region and use which may range from \$50K/mile to \$650K/mile

(4) Losses calculated at full capacity

(5) Inclusive of transformation

# WREZ Transmission Cost Comparison

(inclusive of ROW, Substations & Losses)



Assumptions: 600 miles and \$10,000/acre for ROW

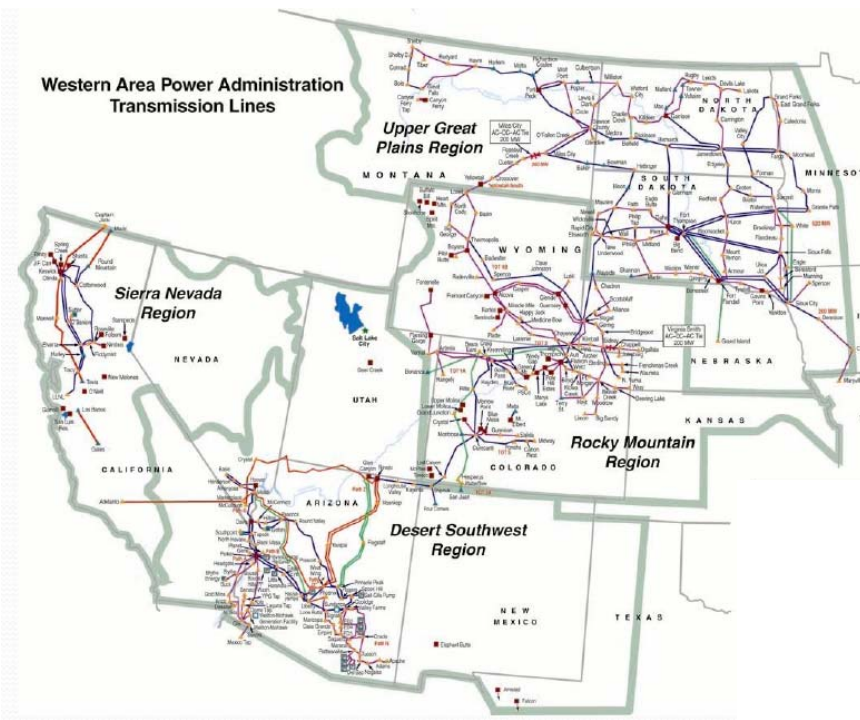
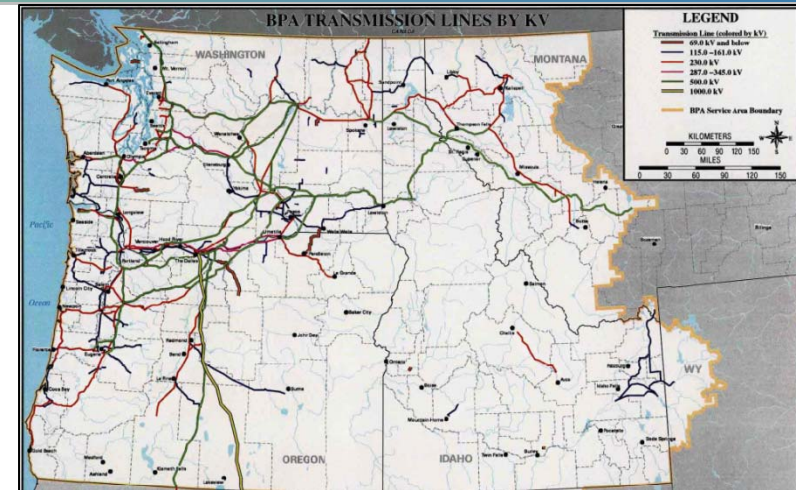
# PacifiCorp's Gateway Projects Case Study

- Planned for 6,000 MW for two double-circuit 500 kV lines
  - 3,000 MW to meet customer requirements
  - Substantial queue requests for wind injections
  - Designed for co-located wind and thermal (gas)
- Unsuccessfully solicited commitments from wind shippers and investors for 2<sup>nd</sup> 500 kV circuit
- Results:
  - two single-circuit 500 kV lines being pursued
  - Opportunity to oversize limited due to lack of commitment by shippers and investors
- Implications for other projects
  - HPX will consider both 500 kV and double-circuit 345 kV
  - Anchor shippers required (TransCanada & Anschutz)



# WAPA & BPA to the Rescue?

- Each with \$3.25 BB borrowing authority
  - A taxpayer solution
  - BPA: 15,000 circuit-miles of transmission
  - WAPA: 17,000 circuit-miles of transmission
- WAPA Participation/investment in projects
  - Over-sizing/right-sizing transmission lines
  - Enabling projects that might not otherwise be built
  - No impact on existing customers
  - Flexibility in setting of rates
  - Regional & long-term approach
  - Leveraging their hydro resources?
  - Expanded role in ancillary services?
  - Leveraging via private/public partnerships
- WAPA Selection Criteria for Projects
  - One terminus within WAPA footprint
  - Enabling renewables
  - Preserve system reliability & operations
  - In the public interest
  - Expectation of ultimate loan repayment



# Potential Outcomes

- National legislation and the stimulus package MAY address many of the “bottleneck” issues
  - Facilitation of the long-term and regional view of transmission & renewable development
  - Other issues may be more problematic: green-only lines, siting/permitting, and cost-recovery
  - While transmission planning is included in current versions of House and Senate bills, the devil will be in the details
- Utilities may continue to plan and fund to serve their internal needs, with “overbuilds” and multi-state export lines handled by external sources & processes
  - Taxpayer support leveraged via public/private partnerships
  - Roles for utilities, generators, independent transmission, and private equity
- WGA and CREPC will play an integral role in driving national and regional public policy