



Wind-Hydro Integration In the Missouri Basin

*Annual Meeting
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Matt Schuerger, P.E.*



Wind-Hydro Integration in the Missouri Basin

- ❖ New study, just getting underway
- ❖ Assess technical, economic, and institutional opportunities (and barriers) to utilizing hydro generation facilities on the Missouri River system to increase the amount of wind generation capacity in the upper Midwest, including potential to:
 - reduce ancillary service costs
 - increase overall economic and environmental value of power delivered
 - provide Missouri River management flexibility

Midwest Wind Power Development

	Wind Power (nameplate), MW			
	Existing ¹	Total Potential ²	% of State Consumption in 2010 ³	
			5%	10%
Iowa	423	62,900	779	1,558
Minnesota	401	75,000	1,120	2,240
Nebraska	14	99,100	452	903
North Dakota	66	138,400	183	366
South Dakota	44	117,200	156	313
Wisconsin	53	6,440	1,309	2,617
Total	1,001	499,040	3,999	7,997

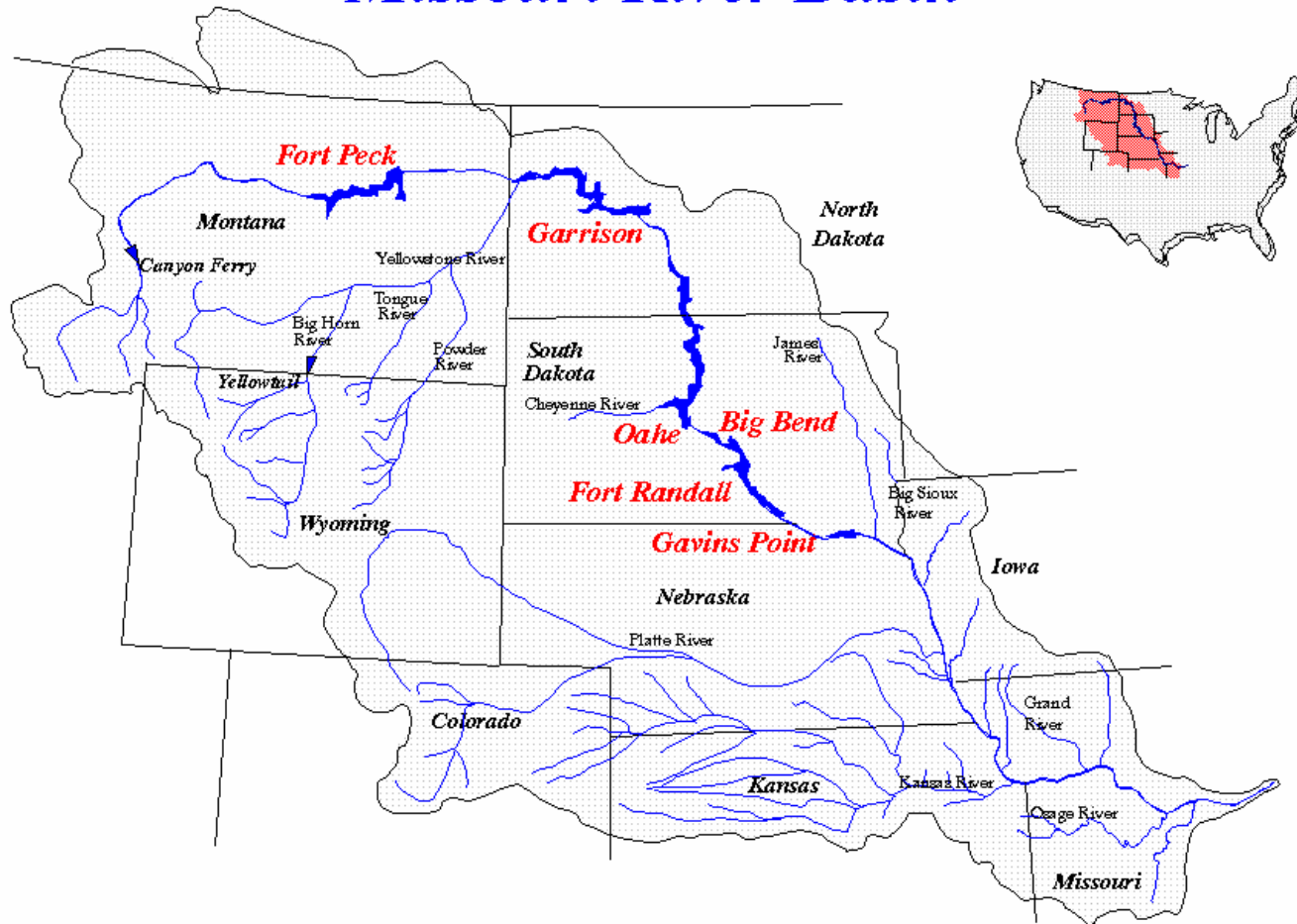
Notes:

1. American Wind Energy Association, October 2003, <http://www.awea.org/>
2. Avg MW, *An Assessment of Windy Land Area and Wind Energy Potential*, Pacific Northwest Lab, 1991.
3. Wind power capacity equivalent.

Energy Information Administration, 1999, <http://www.eia.doe.gov/emeu/states/states.html>



Missouri River Basin



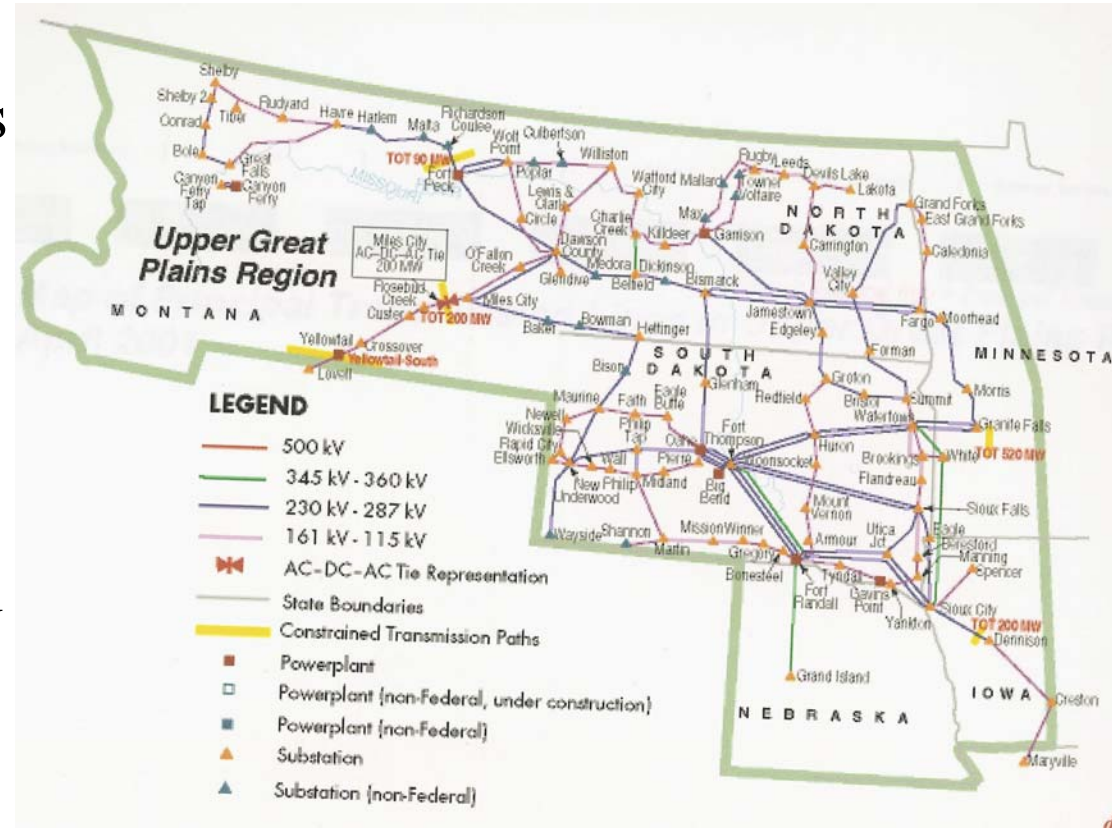
- ❖ Six dams, 2500 MW capacity (nameplate)
- ❖ Combined storage 75 million acre-feet (93 billion m³), about 3 times average annual runoff

❖ Operated by Corp of Engineers

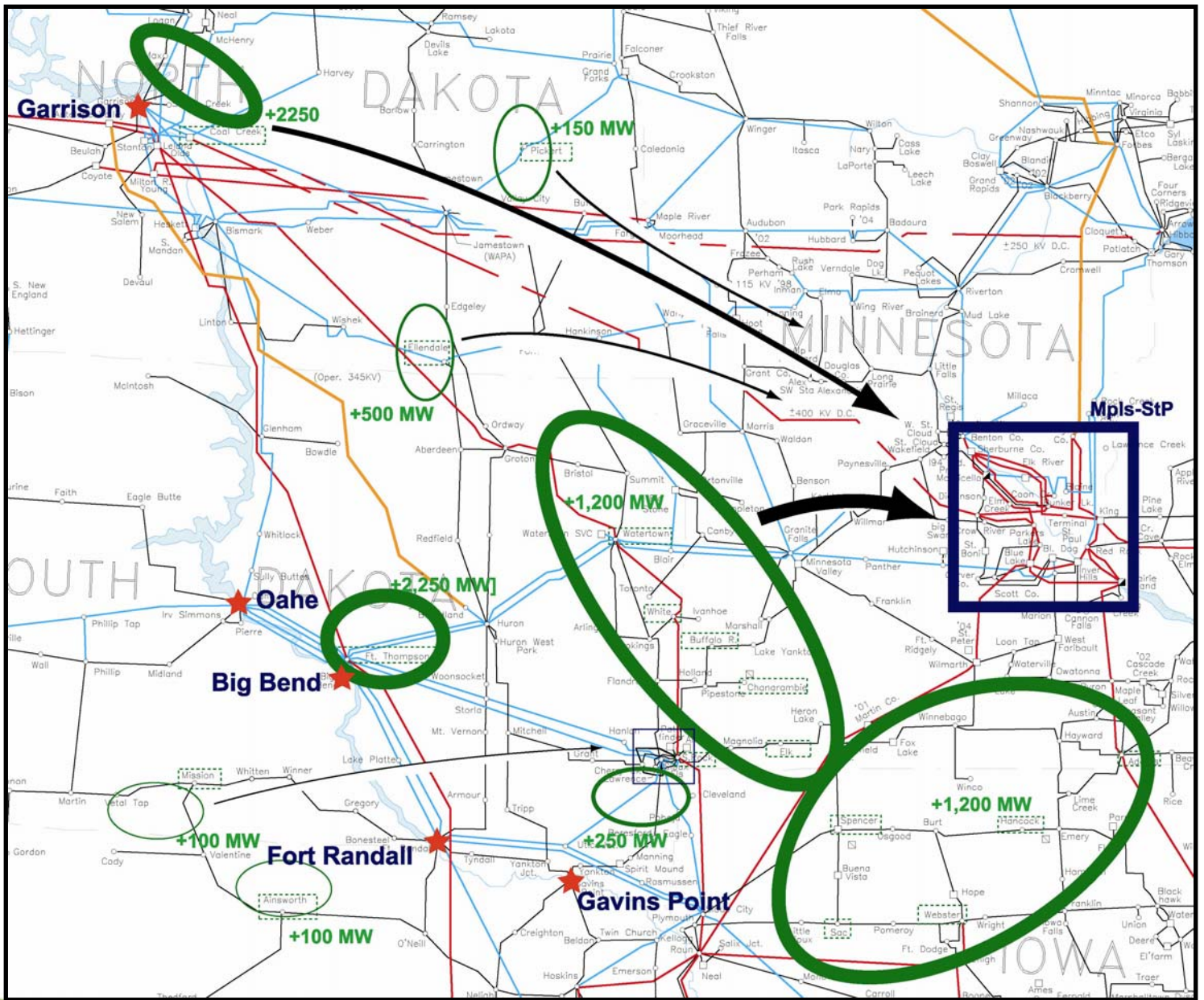
❖ Marketed by Western Area Power Administration

Western Area Power Administration

- ❖ One of four power marketing administrations within the U.S. Department of Energy
- ❖ Markets and transmits federally produced hydroelectric power
- ❖ Approximately 3300 MW of load and 2000 MW thermal generation
- ❖ Western's 636 wholesale power customers include cooperatives, municipalities, public utility districts, and project use customers.



Existing hydro power (stars) and Projected wind power (ellipses)



Issues include:

- ❖ **Competing purposes for the Missouri River System**
(fish & wildlife, flood control, recreation, irrigation, water supply & quality, navigation, and hydro power)
- ❖ **Increasing operational constraints**
(endangered species, ice jams, changes in Master Manual, increases in reserve requirements)
- ❖ **Existing, long term Preference Power contracts**
(cooperatives, municipalities, Native American communities)
- ❖ **Inter-year variations in power production due to weather**

