Renewable Energy




Electric Power 2006

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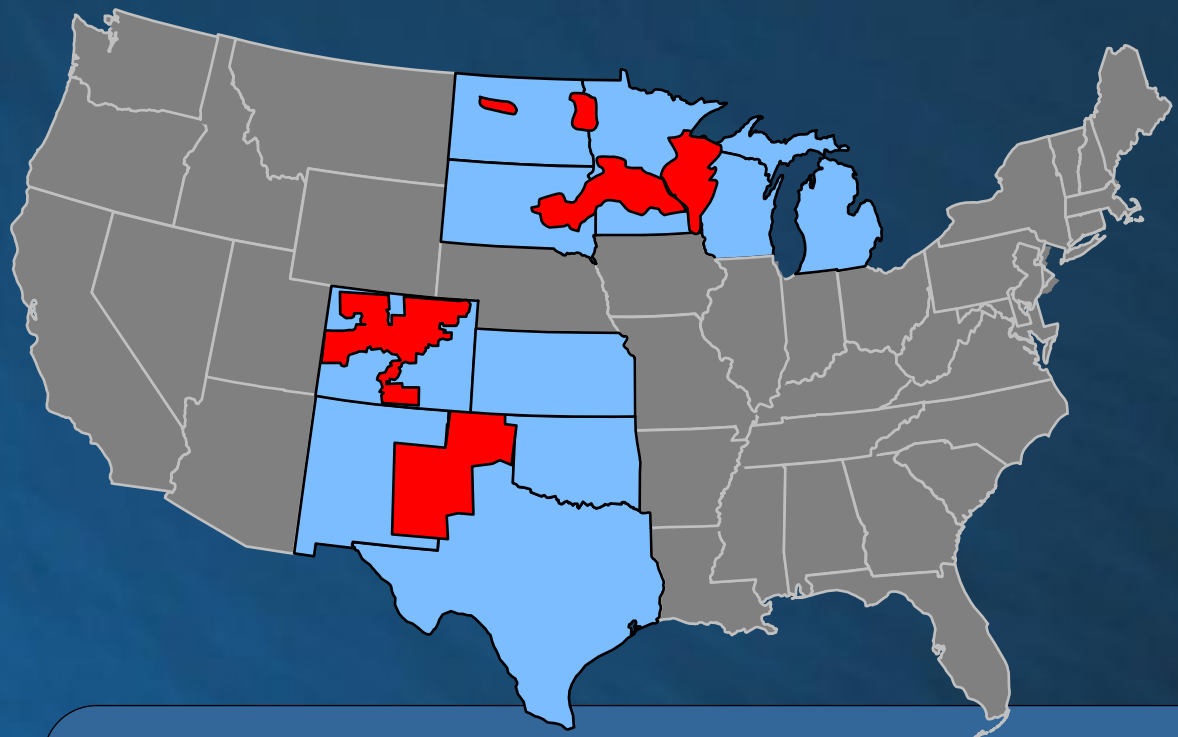
May 3, 2006

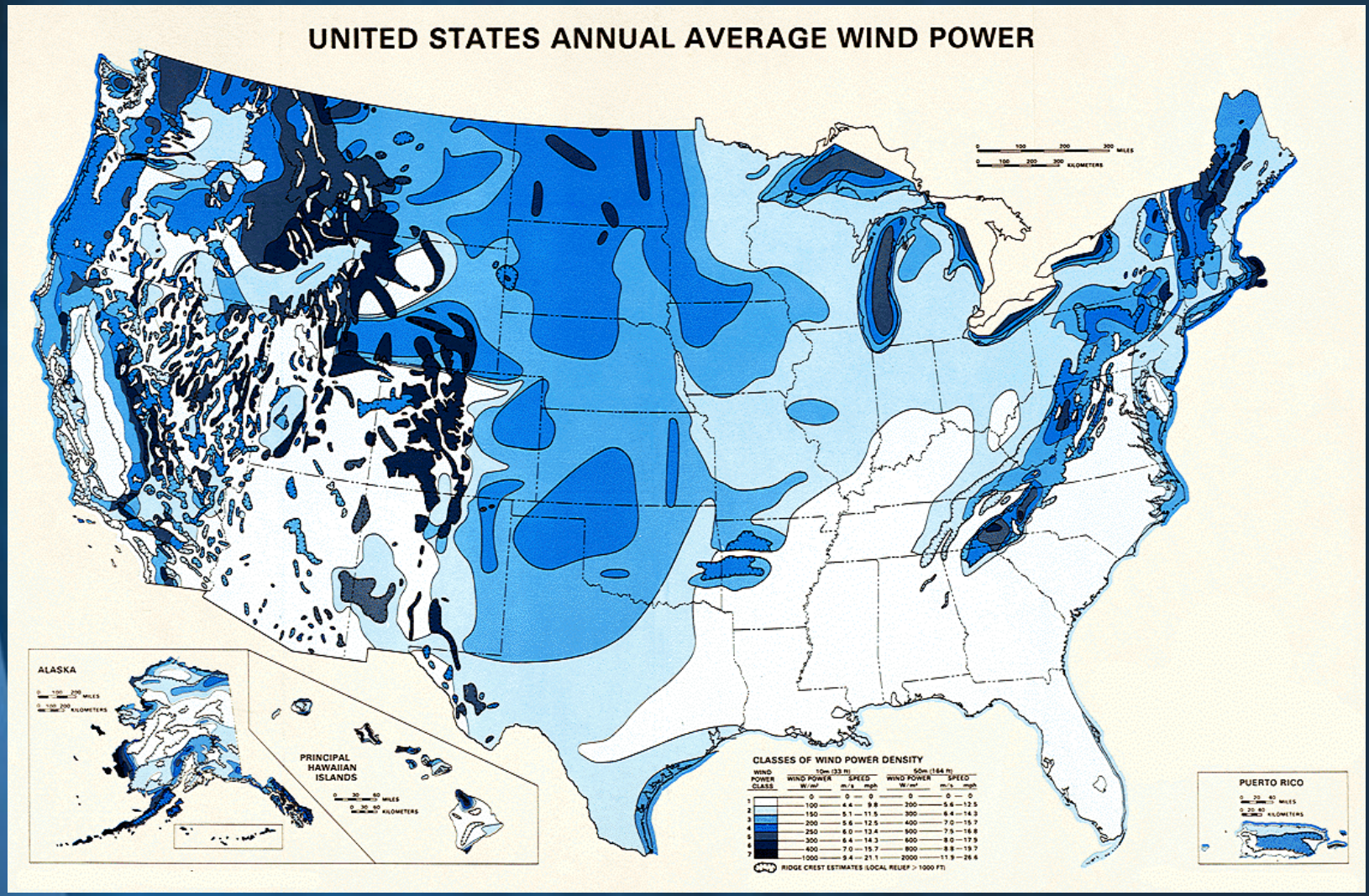
Our Service Territory



4th largest US electric and gas utility

Customers: 3.3 Million Electric,
1.8 Million Gas

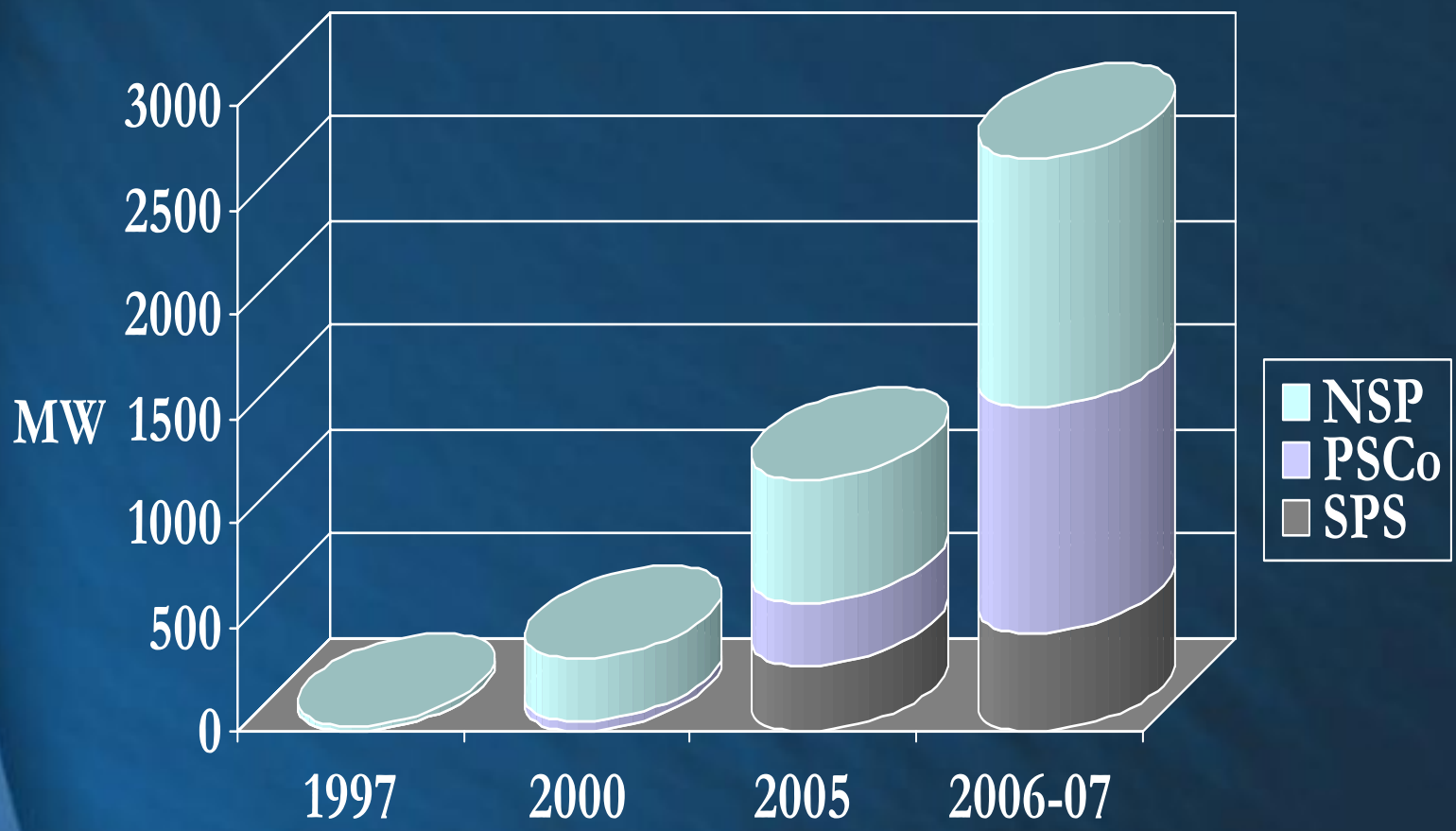
National Wind Map



Xcel Energy
An Environmental Leader

- Wind Energy
- Metro Emission Reduction Projects
- Demand Side Management
- Solar Generation
- Greenhouse Gas Policy
- Avian Protection
- Pilots of Emerging & Advanced Technologies

Xcel Energy Wind Capacity



Ancillary Service Cost study

Focused on three integration costs:

- Sub-optimal dispatch of PSCo fleet
- Additional regulation & load following reqts
- Impacts on the gas supply & nomination

	Dollars/MWh		
Penetration Level	10%	15%	20%
Hourly Analysis	$2.25	$3.32	$7.47
Regulation	$0.05	$0.06	$0.06
Gas Supply	$1.26	$1.45	$1.43
Total	$3.56	$4.83	$8.96

Ancillary Service Cost study

- Hourly Integration cost = Actual production (commitment & dispatch) costs minus lowest cost/ optimal plan with “perfect” knowledge of load and wind energy (flat profile).
- Regulation cost = Cost of the incremental regulation capacity.
  - For 10% penetration ~ 1.5 MW additional up/down
  - For 15% penetration ~ 2.5 MW additional up/down

Impacts on Gas Supply/Nominations

- The gas system must offset wind variations by providing or absorbing gas supply to gas-fired generation facilities.
- The needed flexibility of the gas system is gas storage injections and withdrawals.
- The current balancing is done using three gas storage assets

Injection/Withdrawal Resource Analysis

- Compare Reference vs. Actual for Gas Storage Injection and Withdrawal cases
- Wind energy for the day is known and only the hourly load is uncertain ("reference" case); both wind and load are uncertain ("actual" case)
- Hourly Difference = Needed change in gas storage system requirements

Gas Storage Benefits/Results

- Summer/Winter Arbitrage
- Reduction in need for financial hedge

	Dollars/MWh		
Penetration Level	10%	15%	20%
$/MWh Impact No Storage Benefits	$ 2.17	$ 2.52	$ 2.49
$/MWh Impact With Storage Benefits	$ 1.26	$ 1.45	$ 1.43

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