

Four Corners Wind Resource Forum

The Value of Wind Energy – A Utility's Perspective

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Outline

- **Value of wind: ~8 minutes**
- **Operational & System Modifications: ~12 minutes**
- **Questions/Discussions: ~10 minutes**

Value of Wind

- **Environmental responsibility**
 - **Resource plan evaluations**
 - **Hedge against fuel price**
 - **Looking to the future**
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Value of Wind: Environmental

- **Xcel Energy is on track to reduce its emissions 30% from 2005 levels by 2020**
 - **Plant emission projects, acquiring renewable energy and through customer energy efficiency programs**
- **Xcel Energy served 15% of 2014 energy by wind**
 - **NSP: 13%**
 - **SPS: 13%**
 - **PSCo: 21%**

Value of Wind: Resource Planning

■ Resource Adequacy component:

- Rule of thumb: 10-15% of wind plant nameplate “counts” towards long-term adequacy and reliability margin of installed capacity
 - A 100MW load increase and a new 100MW wind farm would generally also include 85-90MW of additional capacity coverage, usually gas-fired backup

■ Energy component:

- New wind plants in good areas are producing around 40% capacity factor, making them a good energy supply resource

Value of Wind: Hedge Fuel Costs

■ Renewables remove fuel price risk from the supply portfolio

- From Public Service of Colorado resource planning public documents: "...the addition of this 548 MW of wind generation to our system will: 1) bring over \$300 million in savings to our customers over the PPA terms; 2) add \$5.5 million and \$3.5 million in costs for 2015 and 2016 respectively but as early as 2017 will begin providing savings which will continue for the remainder of the PPA terms; and, 3) further reduce carbon emissions by approximately 1.4 million tons annually or about a 5% reduction of total system carbon emissions."
- From NSP resource planning public documents: "...The addition of 600 MW of wind power displaces approximately 2,200 gigawatthours of electricity production annually at fossil fueled plants. Our analysis, with its conservative assumptions, shows that the wind projects we propose will result in significant costs savings to customers, as summarized in Table 1 below. Over the term of the contracts, we anticipate that customers will save, conservatively, at least \$180 million. Customer benefits increase substantially to something on the order of \$460 million if carbon regulation results in significant costs. Even if natural gas prices grow at only half the forecasted rate (1.7 percent versus a baseline of 3.4 percent) the projects are still expected to create significant benefits for our customers."
- From SPS resource planning documents: Adding ~700MW of wind is projected to reduce SPS energy supply costs by \$590M over a 20-year period.

Value of Wind: Future Consideration

■ Speaker's opinions:

➤ Prevalence of Power Purchase Agreements (PPAs) for renewable resources

- PPAs typically include a “take-or-pay” provision
- But, achieving high levels of renewable penetration (e.g. >40-50%) will put the renewable resource “at the margin” in many hours, with some output curtailed

➤ Rate-based ownership by the retail supplier may be more sensible in high-penetration scenarios

Operational & System Modifications

- **Forecasting improvements**
 - **Regional markets**
 - **Bilateral markets**
 - **Adapting the fossil fleet**
 - **Reliability standards: NERC and its regions**
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Modifications: Forecasting

- **Variability & Uncertainty**
 - Both add costs to renewable integration
 - Forecasts reduce costs of uncertainty
- **Xcel Energy wind forecasting improvements**
 - 2009: Day-Ahead 16-20% Mean Absolute Error
 - 2014: Day-Ahead 10-12% Mean Absolute Error
- **Value of % increase in DA accuracy**
 - 2014 operating cost savings estimated ~\$14M

Modifications: Regional Markets

- **Regional markets – pooled dispatch at the wholesale level**
 - **Dispatch flexibility expands from old utility balancing area to encompass entire regions**
 - **Diversity in pool reduces the average variability**
 - **Combining the balancing obligations: $1 + 1 = 1.4$**
- **Regional markets – situational response capability**

Tangent:

What makes markets more efficient?

- **Cost to transact**
 - **Speed to transact**
 - **All possible counterparties are pooled simultaneously**
 - **Diversity benefit: Pooled dispatch reduces the volatility of wind/solar generating resources**
 - **Non-price reliability benefits**
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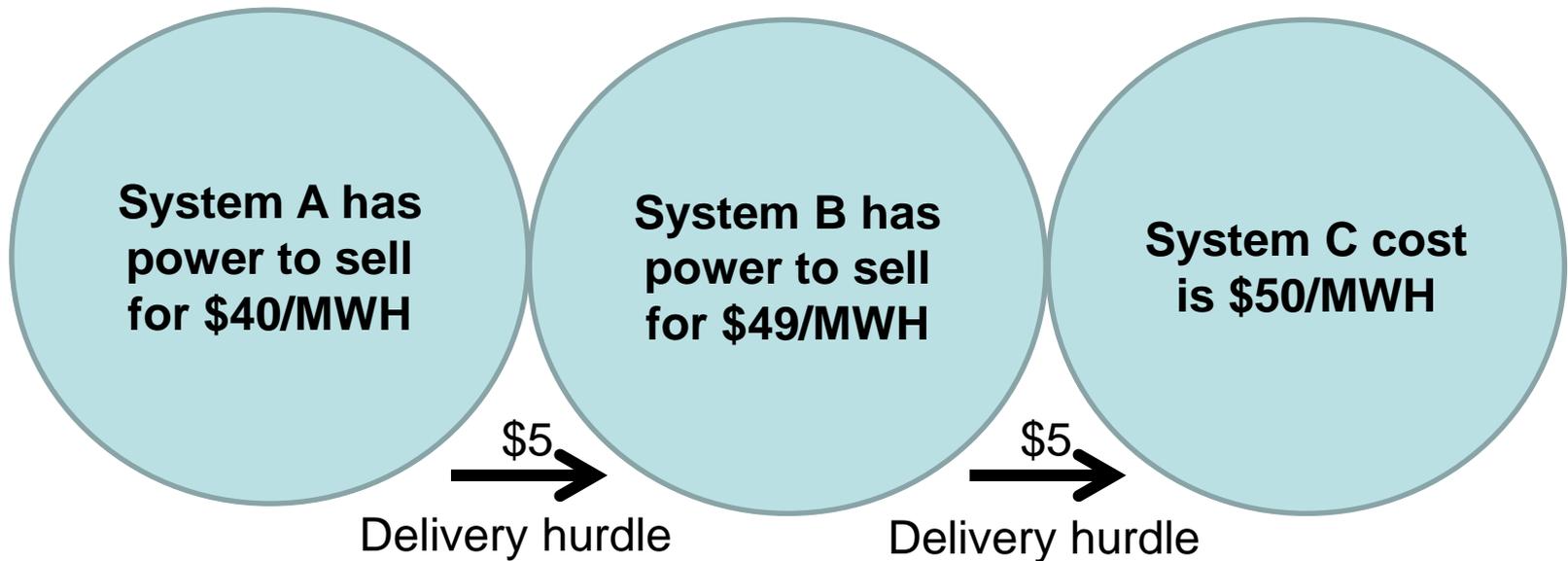
Tangent:

In the details: Cost to transact

- Before PSCo can sell energy today, the price difference must be greater than the cost of transmission service to deliver the energy
- Selling across two transmission tariffs would add yet another delivery cost: “pancaked rates”

Tangent:

Cost to transact in bilateral markets



Should System C purchase energy from System A? **Yes!**

Unfortunately in bilateral markets, System C would purchase from **neither** system. The “hurdle rate” costs are too high to transact the energy.

Modifications: Bilateral Markets

■ Bilateral markets

➤ PSCO's "flex reserve" tariff

● PSCO's policy filed at FERC, pending order:

- Carry balancing reserves only for the potential loss of wind, not for potential wind increases which can be addressed by slowing the in-ramp of wind generation if needed to preserve reliability
- Carry only the amount needed depending on the current level of wind output, not a fixed amount at all hours
- Reduces the costs of wind integration

➤ Addressing the cost to exchange energy

- Working on a multi-utility transmission tariff that would reduce "hurdle rates" within the region

Modifications: Adapting the Fossils

- **Adapting the dispatchable thermal resource fleet**
 - **Increased cycling and ramping can increase thermal stress on boiler tubes and other plant components**
 - **Some studies predict increased forced outage rates due to this effect**
- **Mitigating these concerns:**
 - **Improvements to plant controls**
 - **Increased plant operator training**

Modifications: Standards

- **Addressing reliability standards at NERC and its regions**
 - **Balancing generation/load field trial underway**
 - **NERC's "Essential Reliability Services" developments**
 - **Renewables to provide ancillary services**
 - **Electric system inertia issues under very high penetration**

Questions?