



AWEA Windpower 2011

Detailed Market Modeling to Assess Wind Curtailment Risk

In booth theater presentations

Detailed Market Modeling to Assess Wind Curtailment Risk

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- Speaker title: Industry Solutions Manager, Energy Analytics
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Wind Curtailment: The Problem

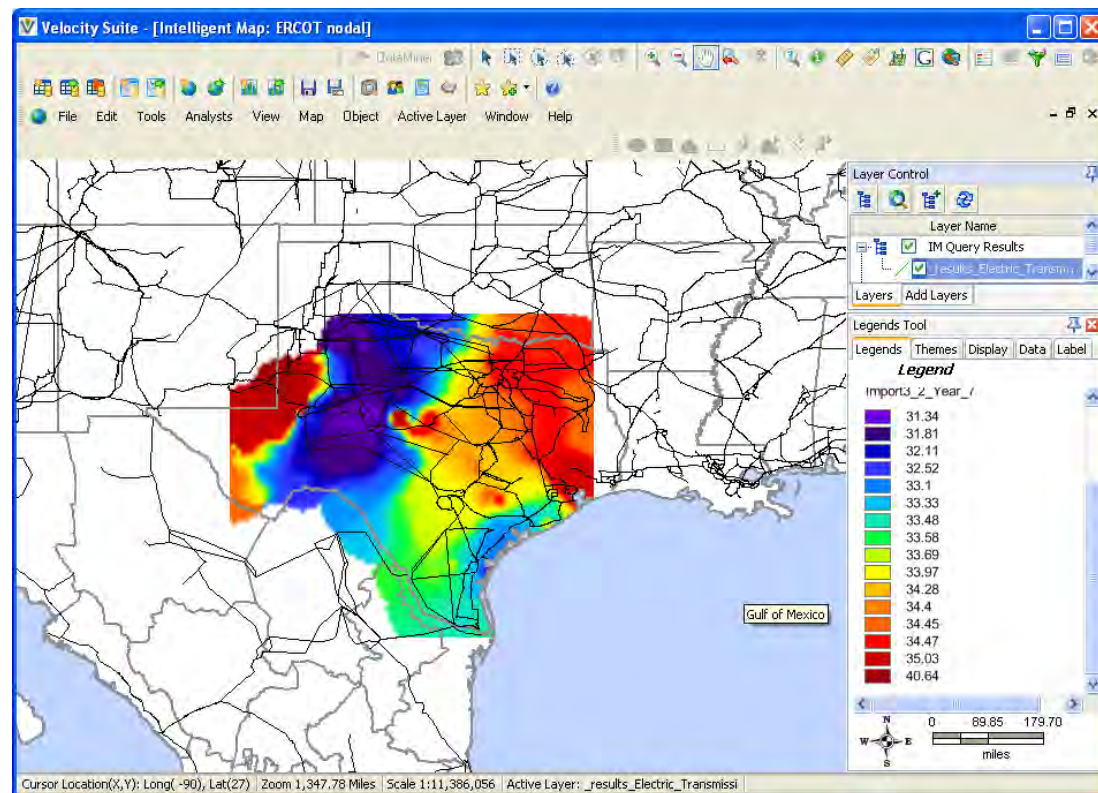
- Curtailment is direct action to reduce energy output of the wind farm
- System Operator directs the curtailment action
- Lowering the energy output = lowering energy revenue

- ERCOT wind energy curtailment grew from 1% to 17% from 2007 to 2009
- MISO curtailed 1% of overall wind energy in 2009, 4% in 2010

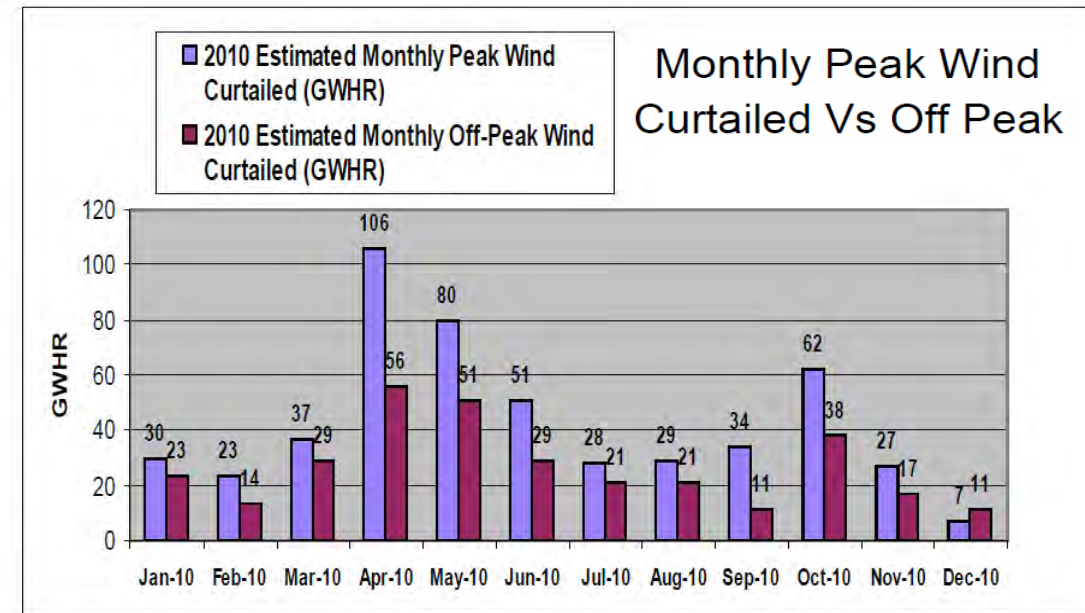
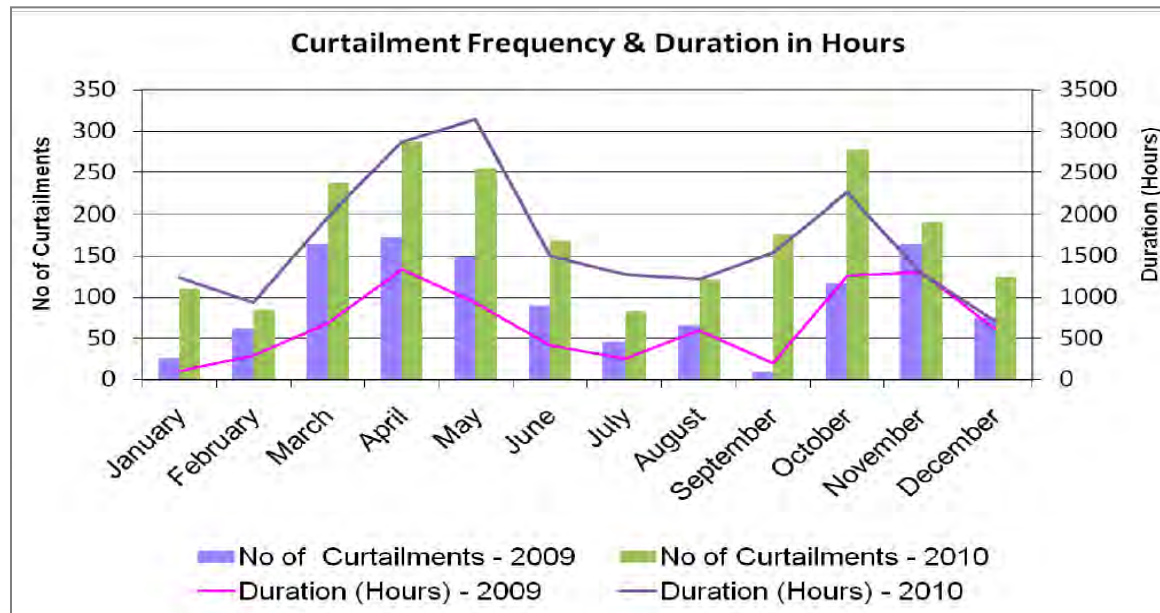
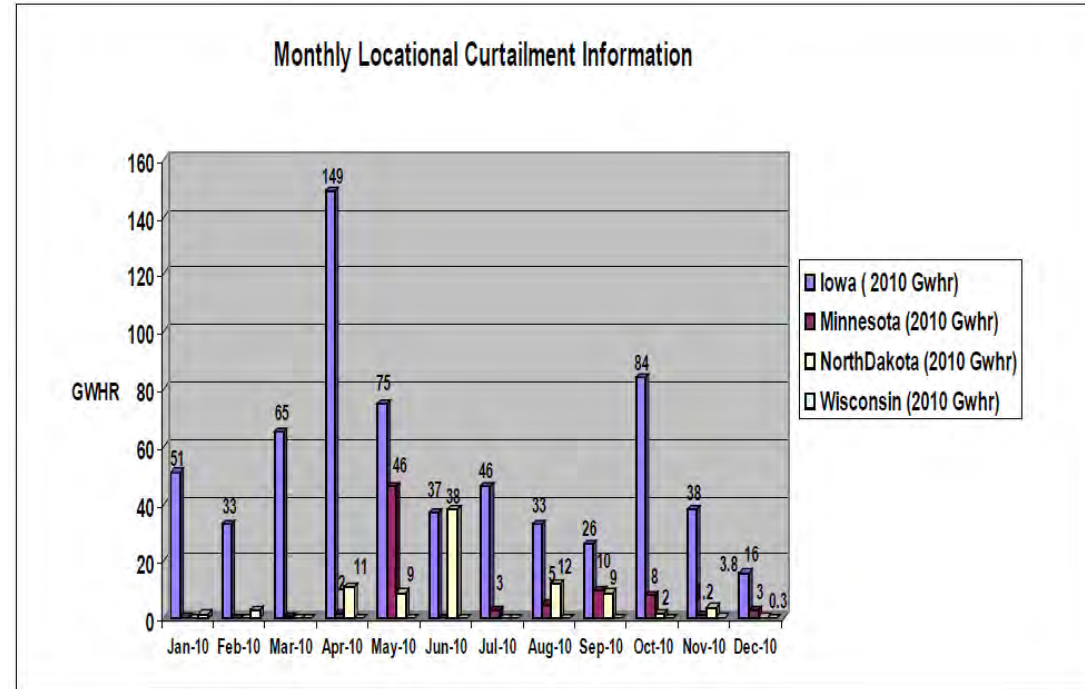
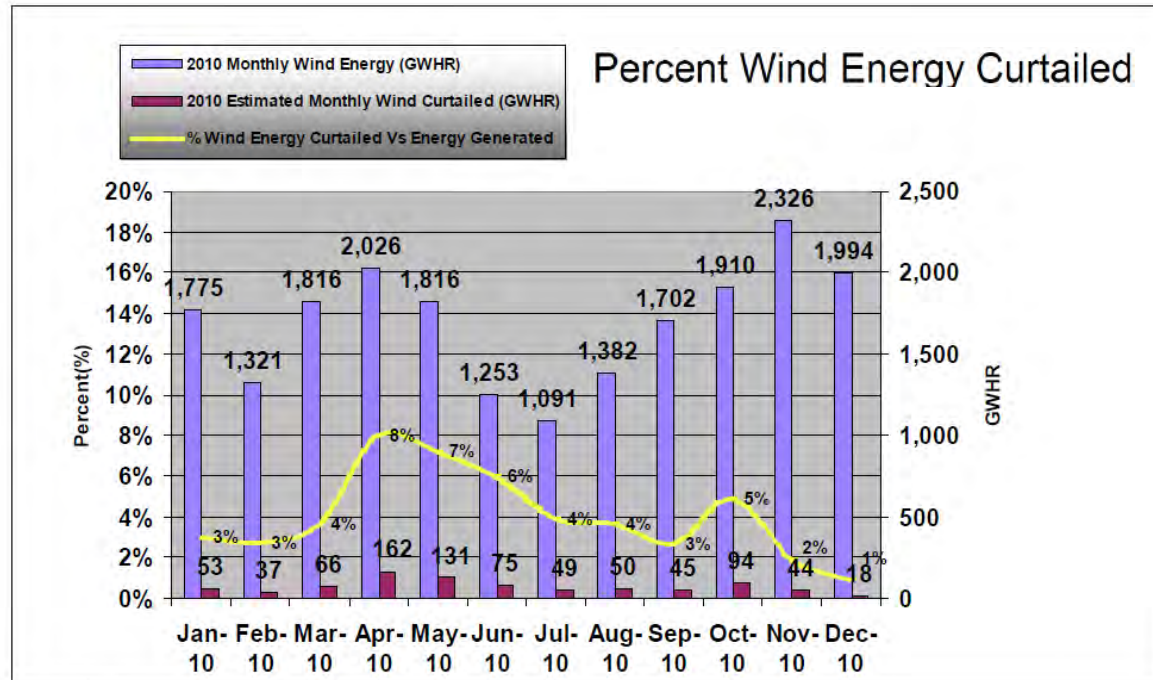
- Lost Revenue: curtailed wind energy is not unburned fuel, it's lost
- Project financing: introduces uncertainty into projected revenue stream
- Contract Penalties: \$29 million in shortfall damages at stake in TXUPM vs. FPL Case

Wind Curtailment: The Cause

- Transmission congestion
- Insufficient transmission capacity
- High Demand
- Minimum generation events
- Transmission & Generation Outages

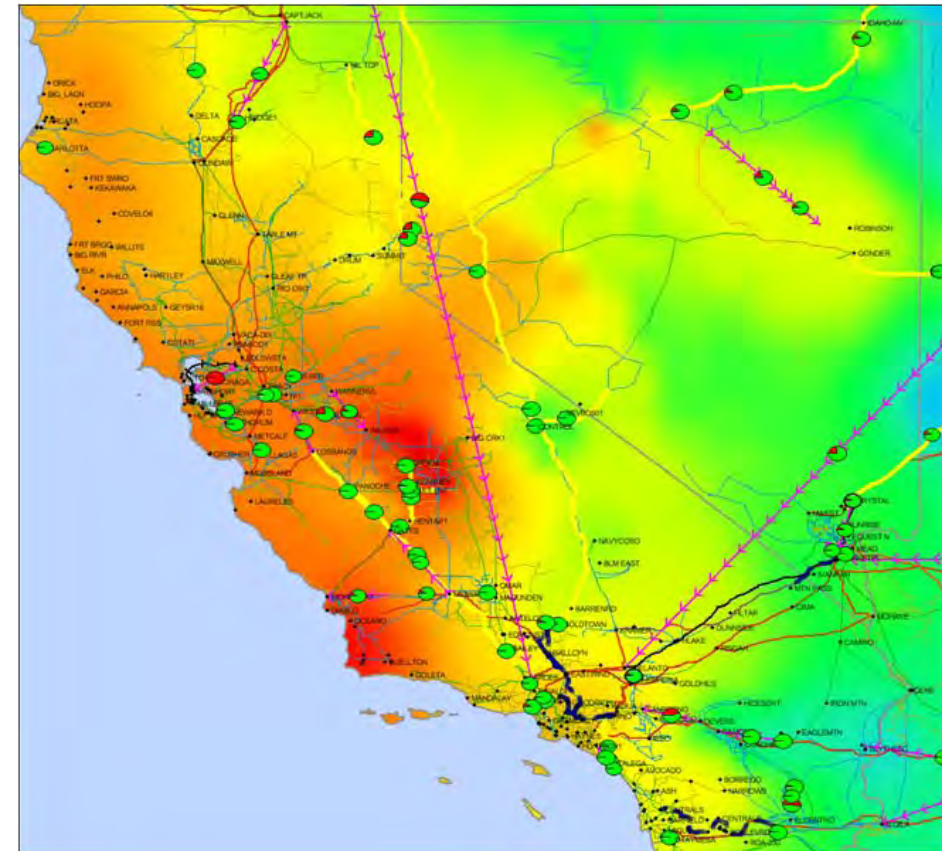
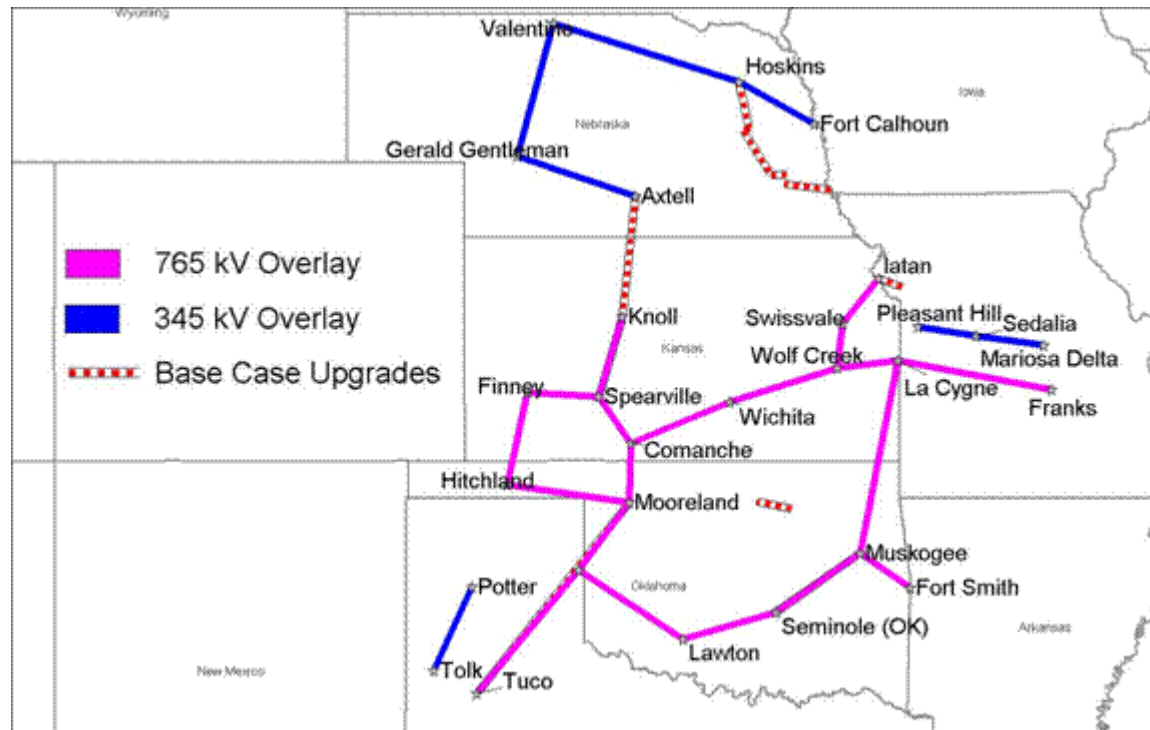


Wind Curtailment: The Effects



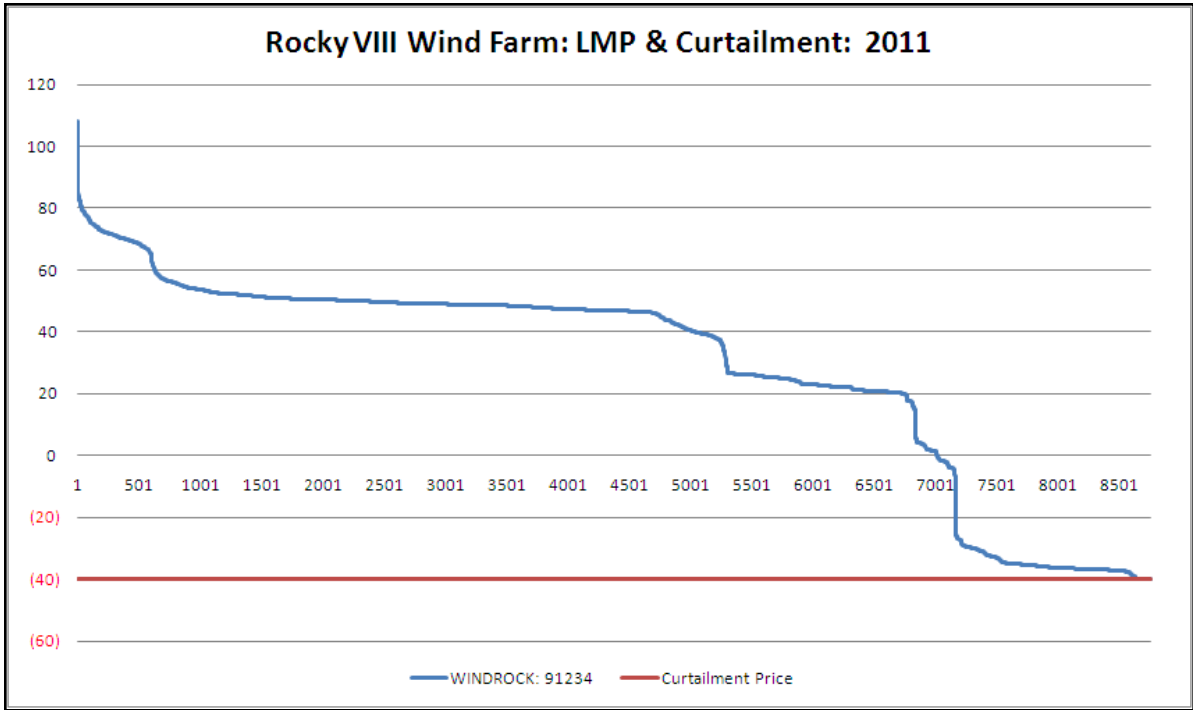
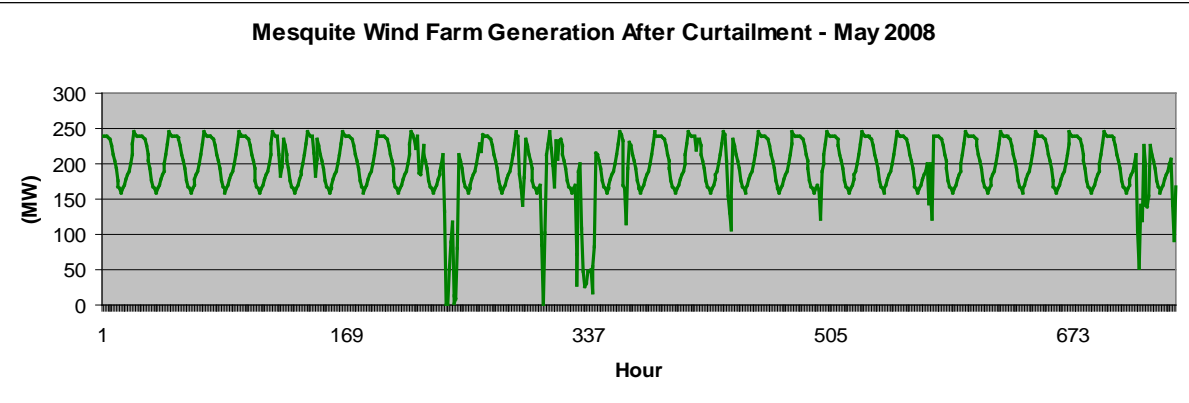
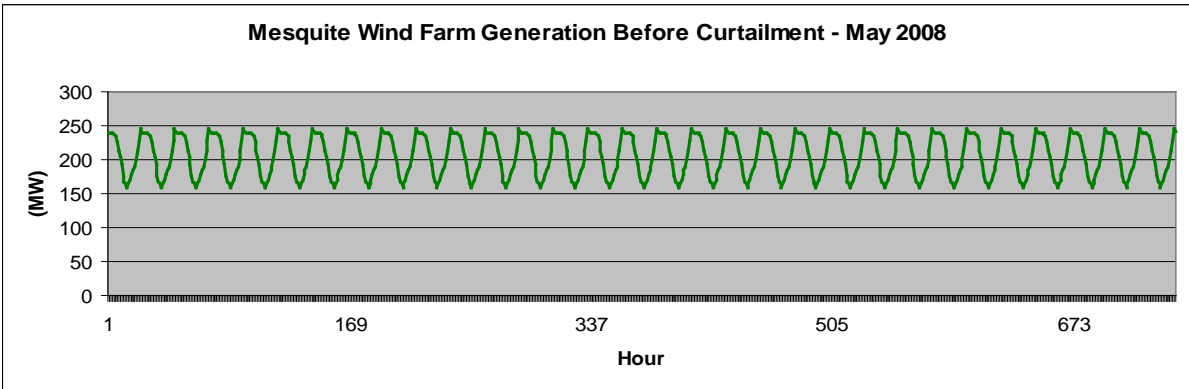
Detailed Electric System Forecasting

- Simulate the future electricity market operation over a year or more period
- Hourly chronological simulation to meet demand and ancillary services
- Day-ahead commitment and real-time dispatch of power plants
- Flowgates, transmission flows, and congestion
- Prices at market nodes and hubs



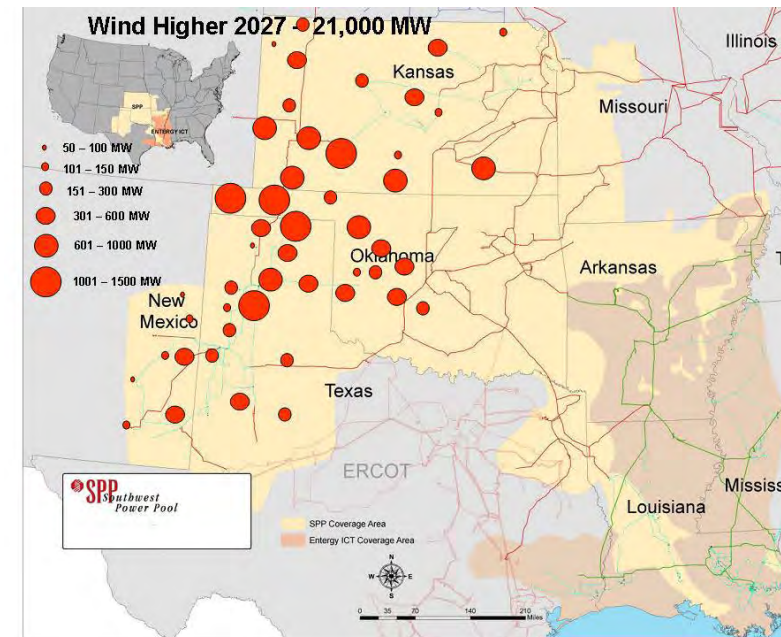
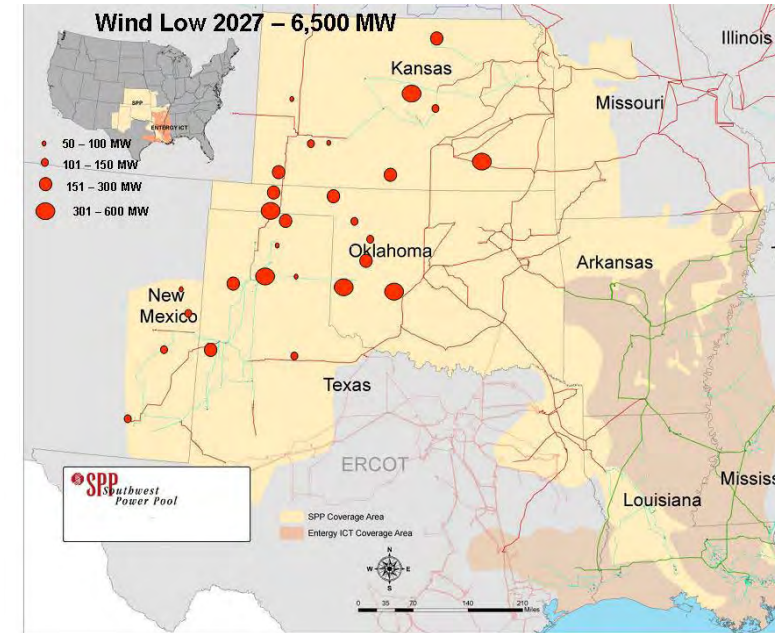
Forecasting Wind Curtailment: The Basics

- Simulate the future market, adding in the wind farm at a transmission node
- Hourly energy profile and market bid price
- Wind energy forecast uncertainty between day-ahead and real-time
- Result: forecast of curtailment events and total energy, as well as root causes



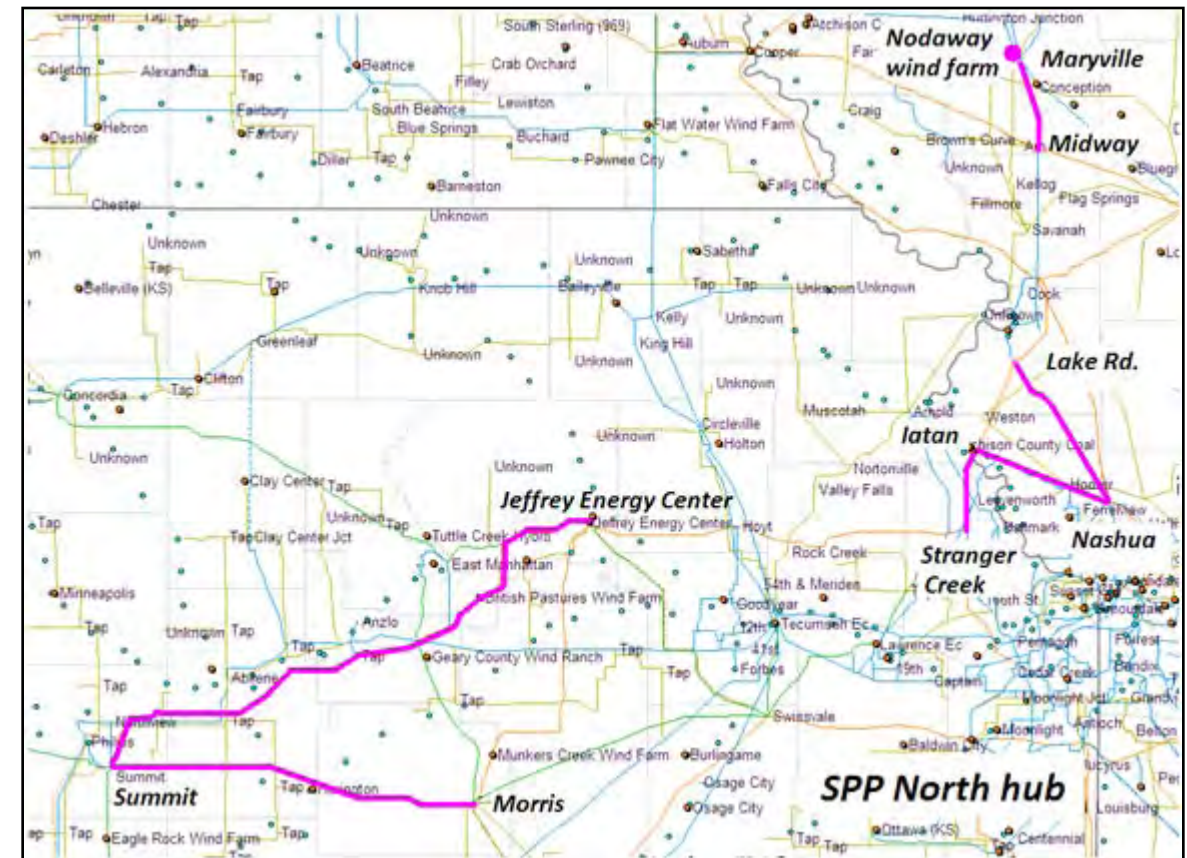
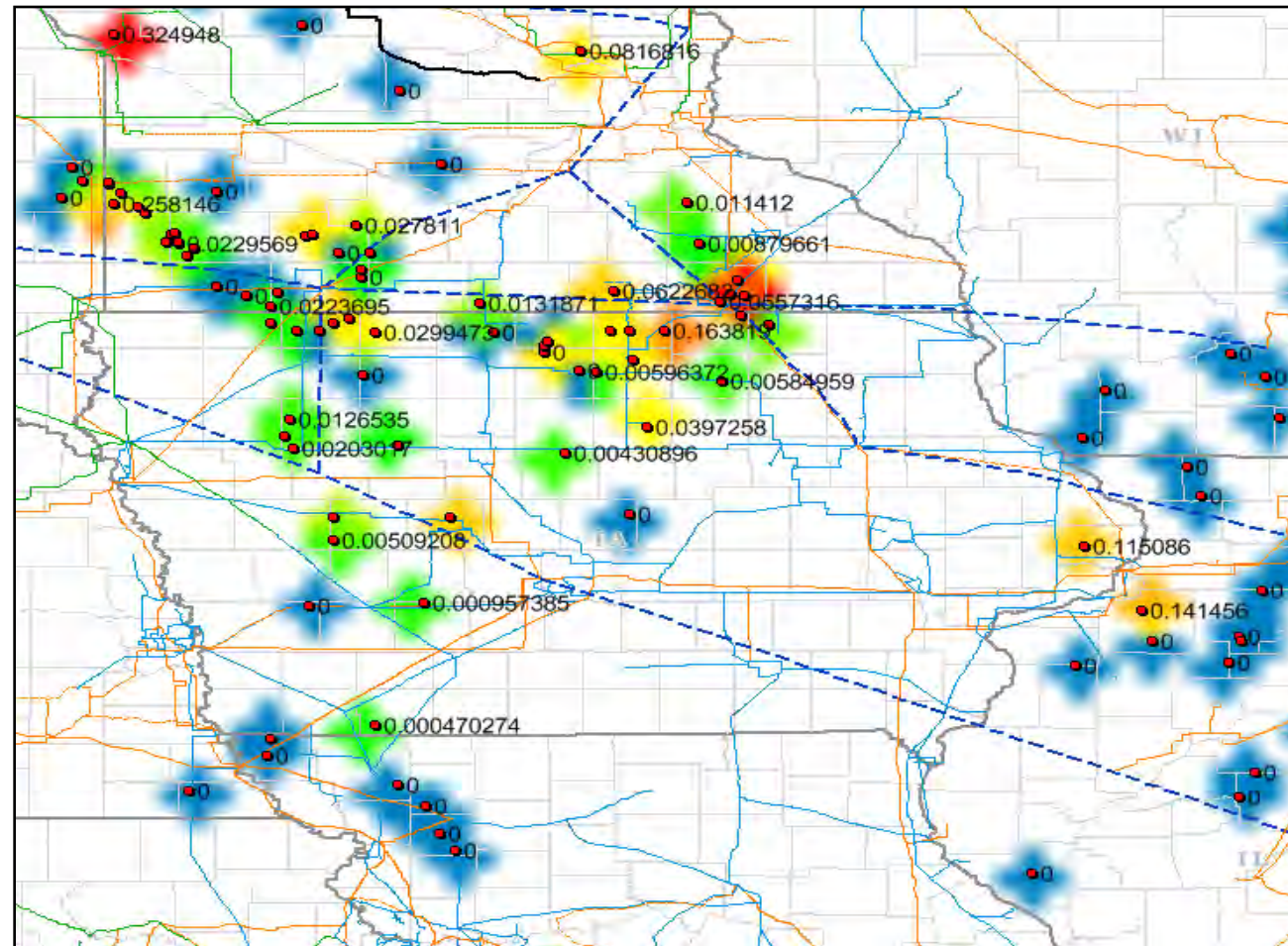
Forecasting Wind Curtailment: Uncertainty

- Assumptions about modeling year:
 - How much wind will be built in the area?
 - What transmission will be built and when?
 - What will the electricity demand be?
 - What will the natural gas price be?
 - Effect of potential environmental legislation?
- Scenario Analysis
- Sensitivity Analysis



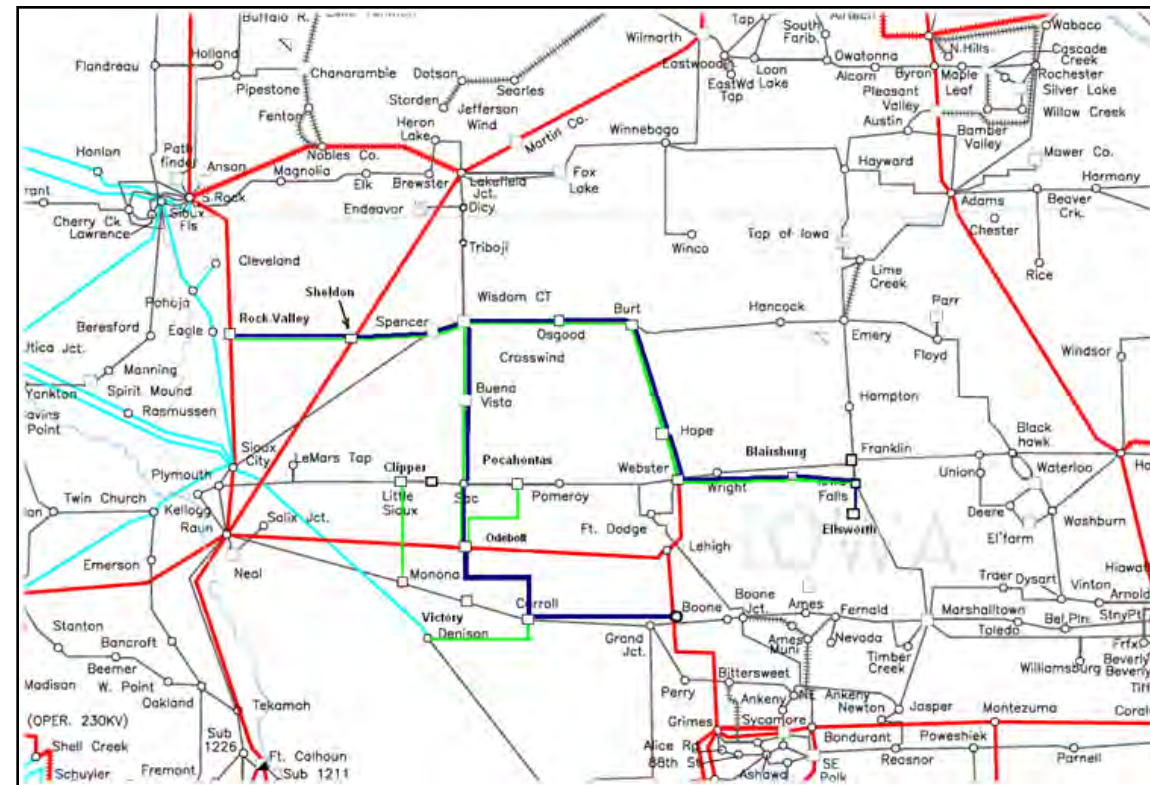
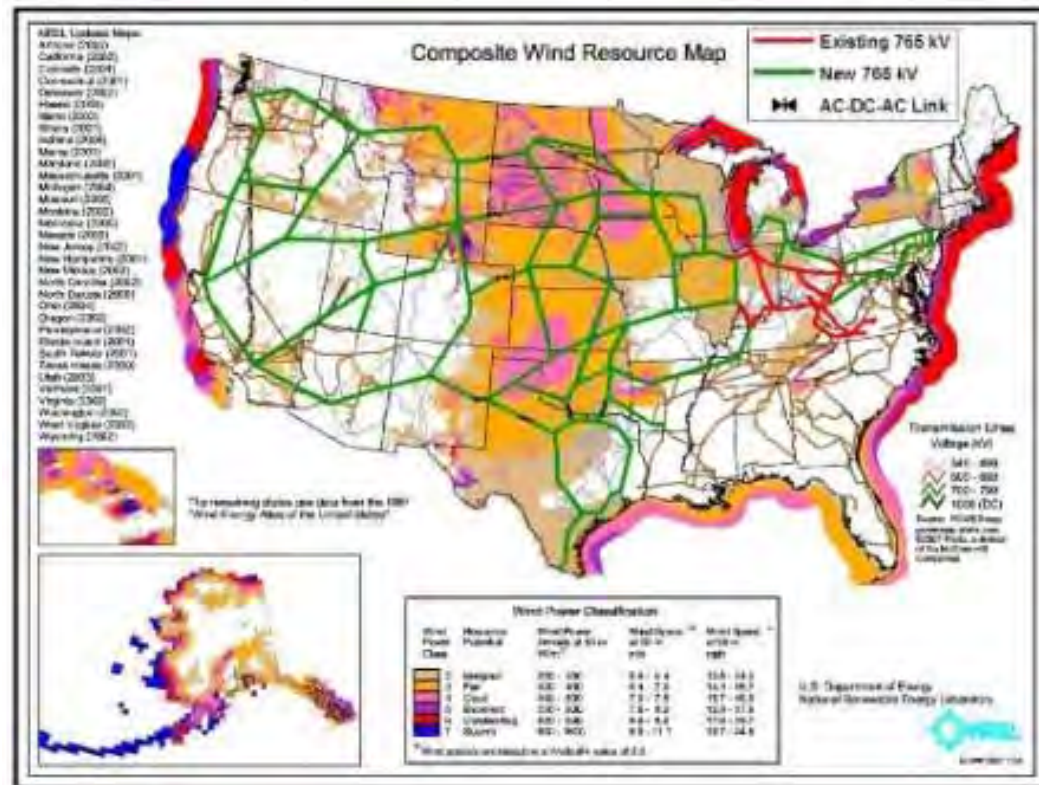
Potential Wind Curtailment: Analyzing Options

- What is the curtailment risk at each potential grid connection point?
- What are the options on farm size?
- How does curtailment change with turbine efficiency and height?
- Impact of market bids (e.g. 0\$/MWh or -40\$/MWh)?



Potential Wind Curtailment: Identifying Solutions

- The best transmission location for my wind farm project to minimize curtailment risk
- The maximum size wind farm for the location to avoid curtailment
- Specific transmission upgrades that will relieve curtailment
- The range of market bid prices that will result in acceptable level of curtailment risk



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