



2011 Integrated Resource Plan

2010 Wind Integration Study
Public Input Meeting
February 16, 2010



Pacific Power | Rocky Mountain Power | PacifiCorp Energy

Agenda

- Meeting objective and scope
- 2010 Study process and schedule
- Key concepts for the 2010 Study
- Data inventory
- Discussion

Objective and Scope of this Meeting

- Outline the process for the 2010 Wind Integration Study (“the 2010 Study”)
- Communicate the 2010 Study schedule
- Initiate an open, forward-looking dialogue on key concepts and acceptable methods that takes into consideration
 - Data availability
 - Available modeling tools
 - Schedule

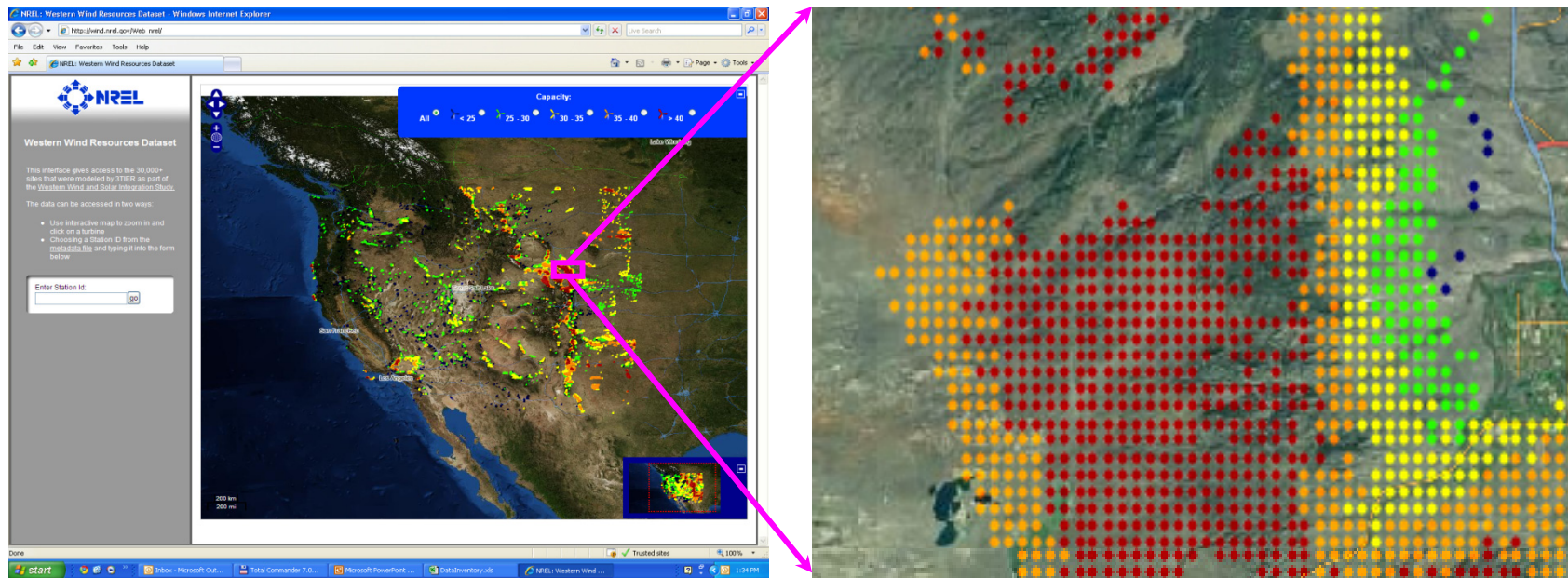
2010 Wind Integration Study: Process/Schedule

- Review other wind integration studies: *On-going*
- Inventory available data for this study: *Complete*
- Solicit stakeholder input: *February 16, 2010*
- Draft study design: *February 26, 2010*
- Comments on draft design by: *March 12, 2010*
- Final study design: *March 19, 2010*
- Draft results: *July 2, 2010*
- Comments on draft findings by: *July 13, 2010*
- Finalize study: *August 2, 2010*

Key Concepts for the Updated Wind Integration Study

- Resource costs and benefits in the 2011 IRP will be evaluated on a site specific basis
- Wind Integration
 - Incremental reserves (intra-hour)
 - Operationally, incremental reserves are required to account for wind variability, and these incremental reserves come with a cost
 - Incremental reserve volumes are driven by both short-term variability (1- to 10-minutes) and hour-to-hour variability (“forecast” error)
 - System balancing (inter-hour)
 - System balancing costs are real and occur in two timescales
 - Day-ahead
 - Hour-ahead

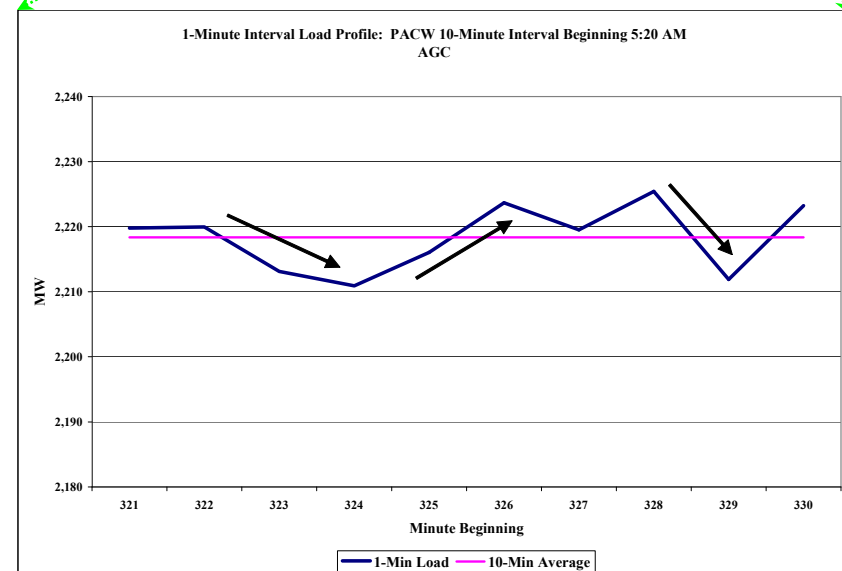
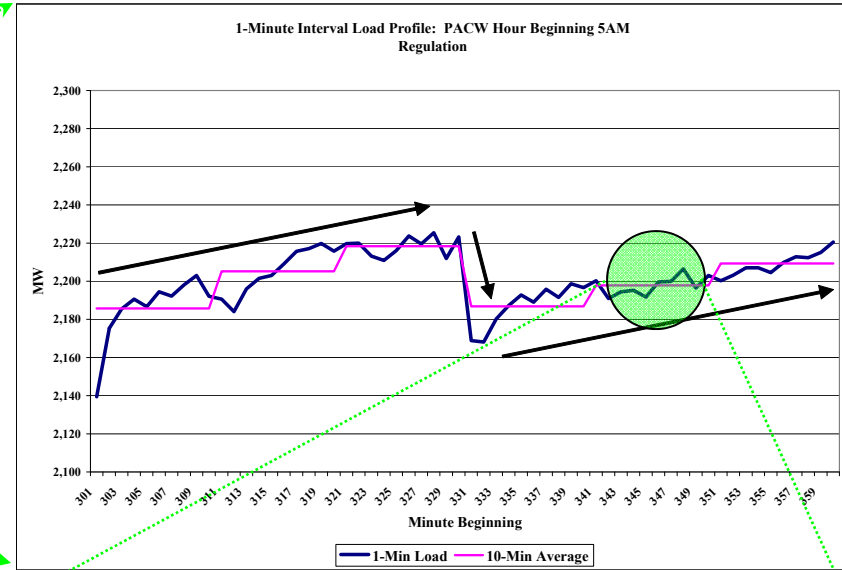
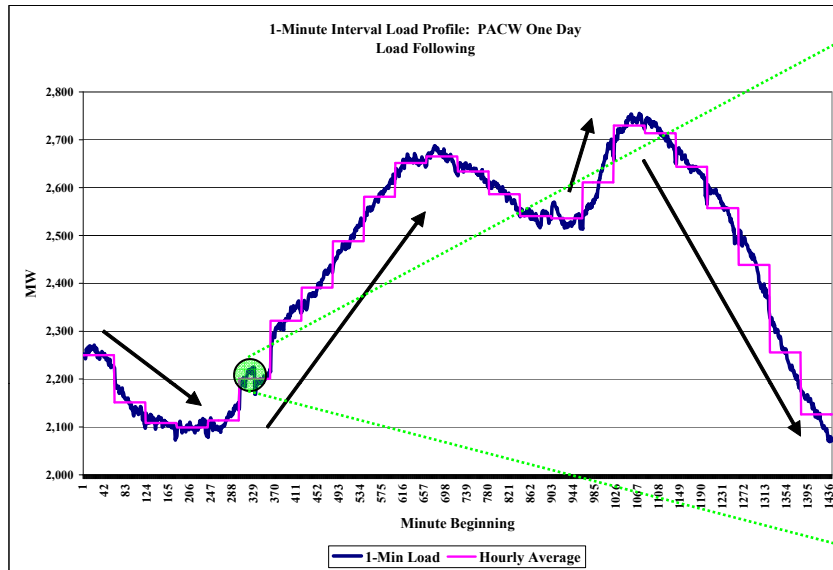
DOE/NREL/ALLIANCE Wind Data



Source: DOE/NREL/ALLIANCE

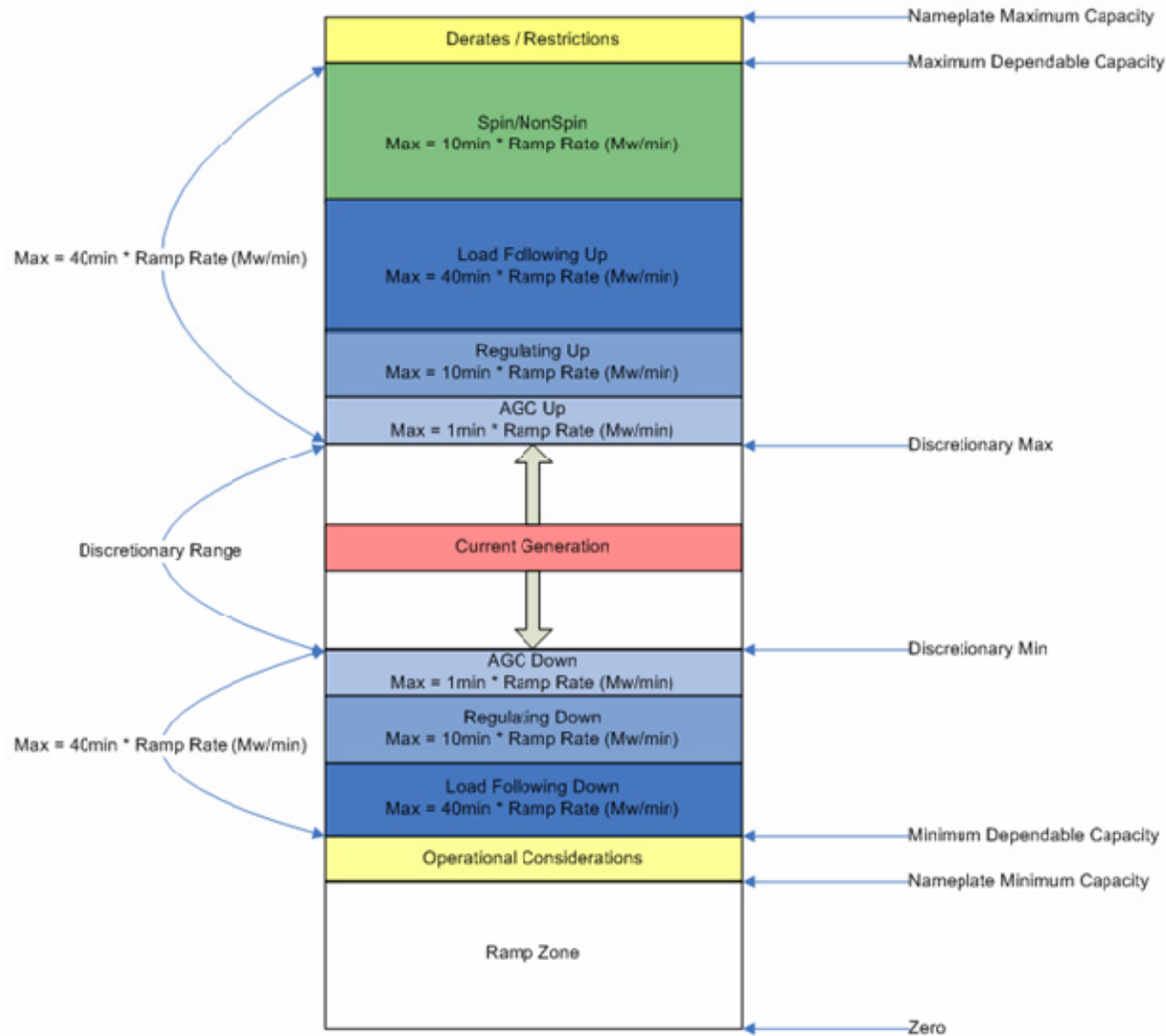
- 3Tier used numerical weather prediction models to recreate historical weather for 2004, 2005, and 2006
- Temporally sampled every 10-minutes
- Spatially sampled every arc-minute (~ 2km)
 - After screening the dataset includes 32,043 locations
 - Each location is estimated to hold 10 Vestas V-90 turbines (3 MW per turbine, 30 MW per location)

Incremental Intra-hour Reserves: Differentiation Among Reserve Types



- AGC, Regulation and Load Following reserves are *incremental* to contingency reserves
- Reserves for each are allocated to specific resources to establish a reserve “credit”
 - Load following = both AGC and non-AGC units that can be used to follow longer term trends in system fluctuations (40-minutes to hourly)
 - Regulation = on-line capacity on AGC responsive to changes in system fluctuations (1-minute to 10-minutes)
 - AGC = responsive to short duration (seconds to 1-minute) changes in system fluctuations

Incremental Intra-hour Reserves: Conceptual Approach for Reserve Allocation



Estimation of Incremental Intra-hour Reserve Cost: Discussion

- AGC reserves
 - Data intensive
 - Wind variations fine resolution time scales (seconds to minutes) are not expected to materially affect incremental reserves
- Regulation and load following reserves
 - How to best make use of available data
 - Is there a methodology that can make use of the NREL data
 - How critical is coincident load/wind generation data at the 10-minute timescale
 - Methods for using hourly load data with 10-minute wind data
 - Additional thoughts?
 - How to best capture both load following and regulation requirements without double counting or under counting
- Ascribing costs
 - Reserve stack model (spreadsheet)
 - Production cost model (PaR)

Estimation of Inter-hour System Balancing Costs: Discussion

- Option 1: Estimation of system balancing volumes and assessment of transaction costs
 - Back-dated analysis
 - Day-ahead transaction costs
 - Hour-ahead transaction costs
- Option 2: Production cost simulation (PaR)
 - Forward looking analysis
 - Requires development of hourly wind profiles
 - Two simulations
 - Fixed energy volumes without variability
 - Hourly varying energy volumes
 - Day-ahead
 - Fixed pattern (annual flat, monthly flat, daily flat, intra-day HLH/LLH)
 - Hour-ahead
 - Shift hourly profiles by one to two hours
 - Other?
- Other Options?