Experiences in the Texas Nodal Market

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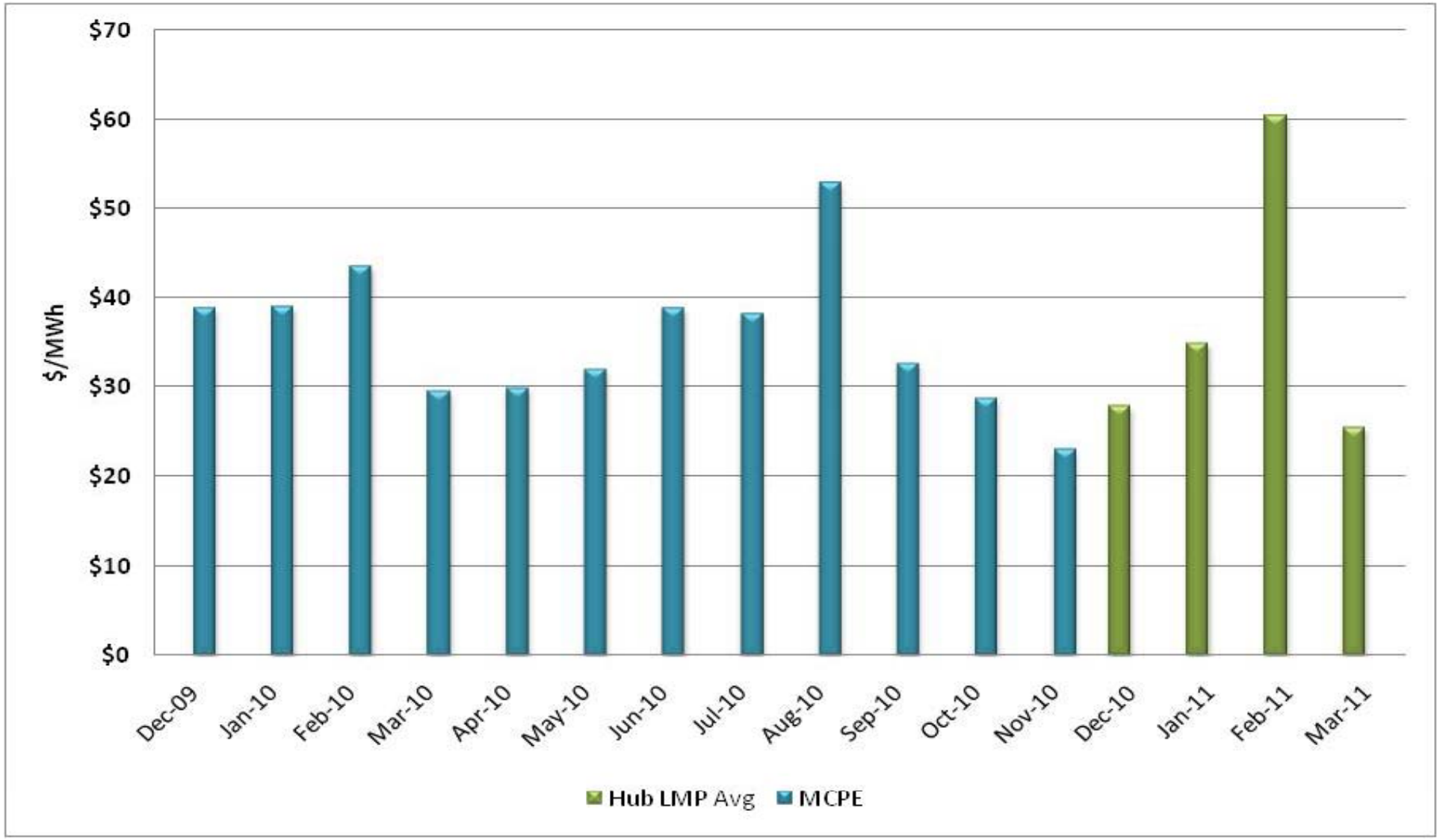
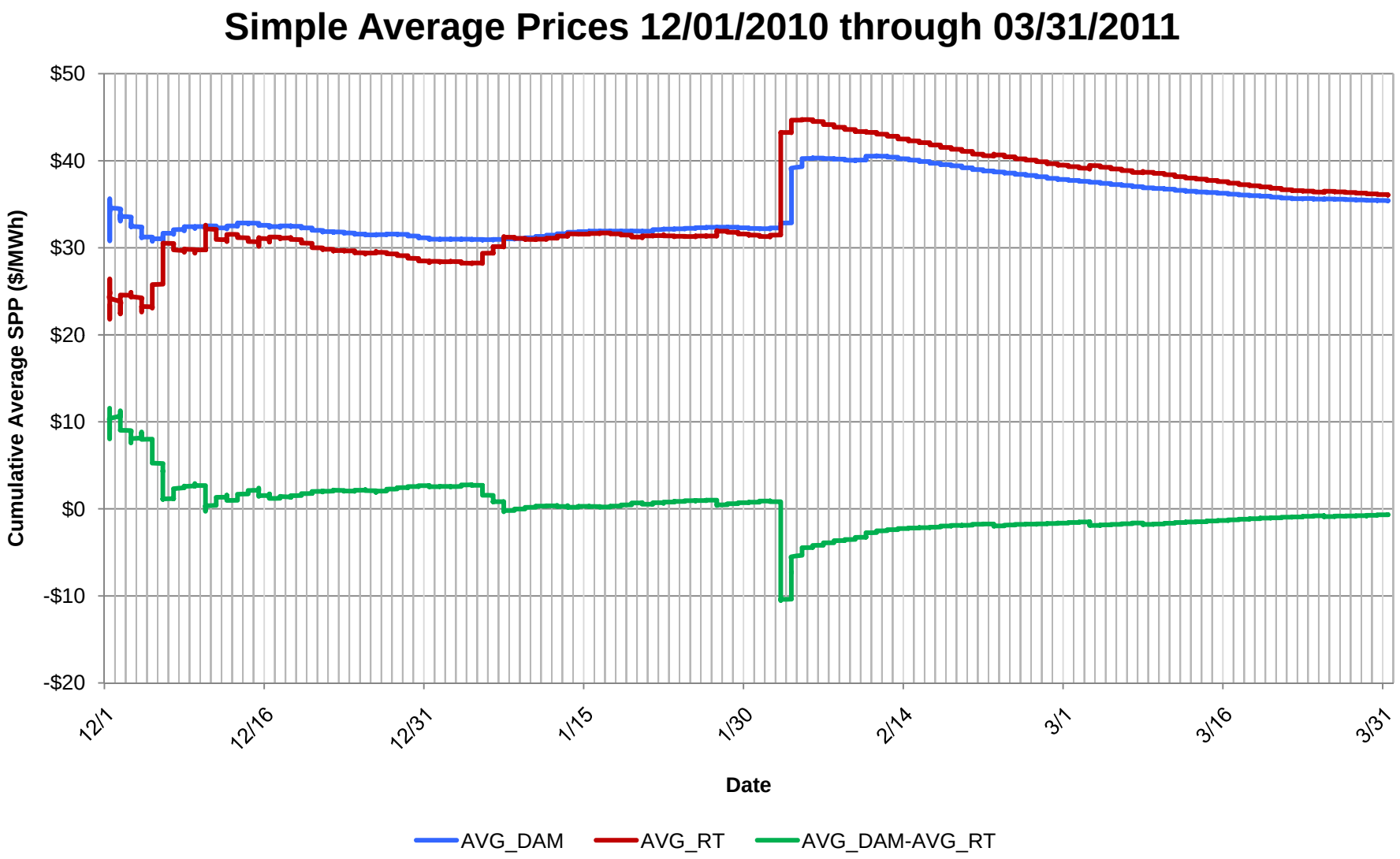
President & CEO
April 25, 2011

Average MCPE vs. Average Hub LMP



Day-ahead market/Real-time price convergence



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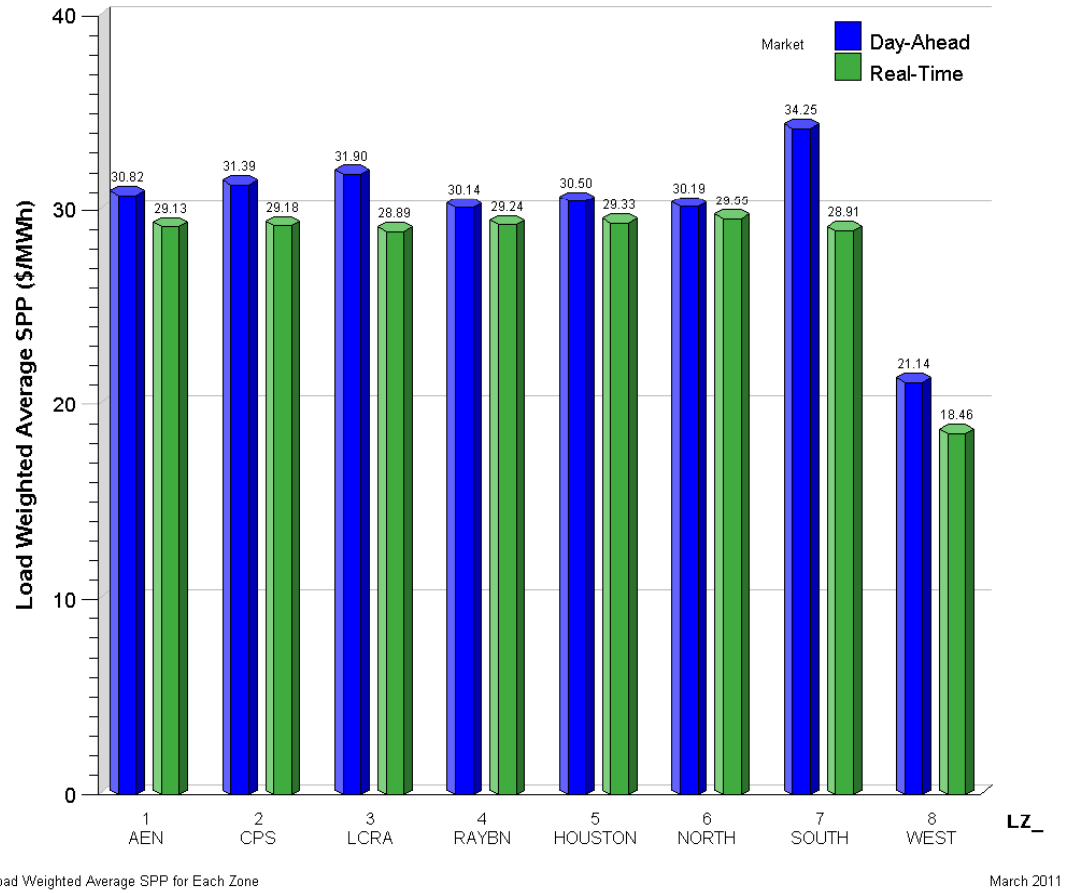
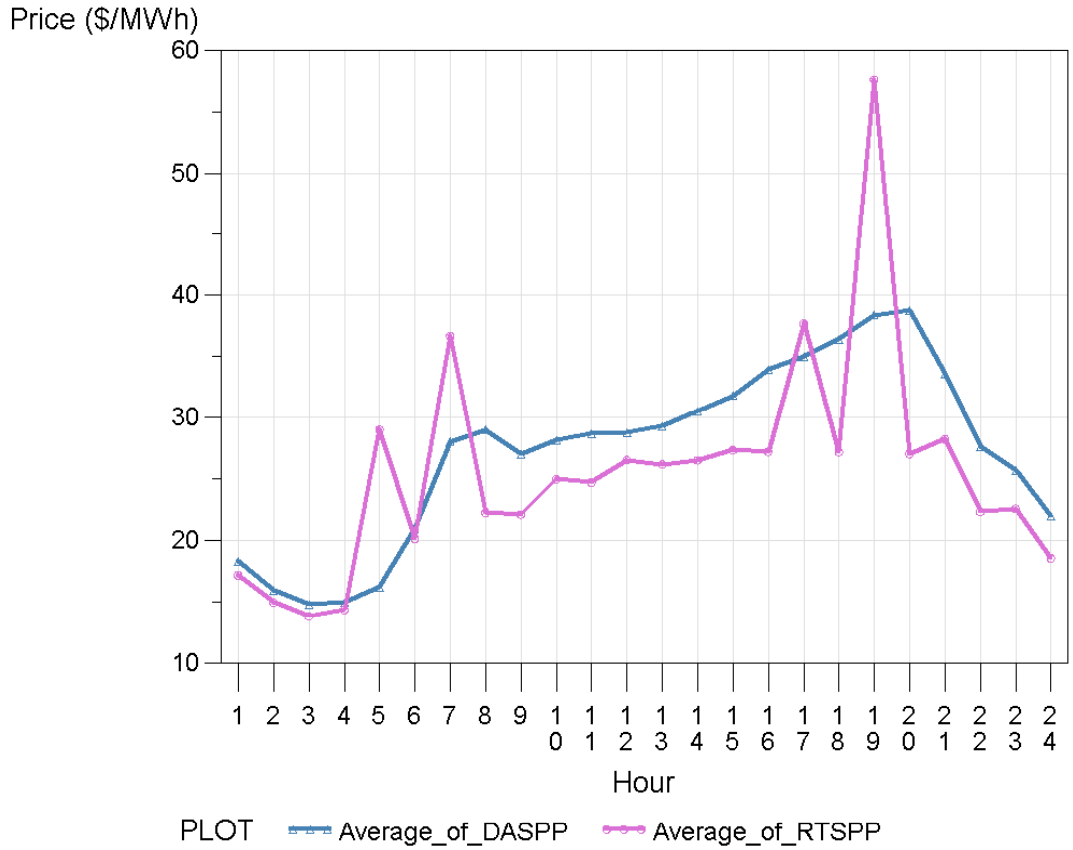


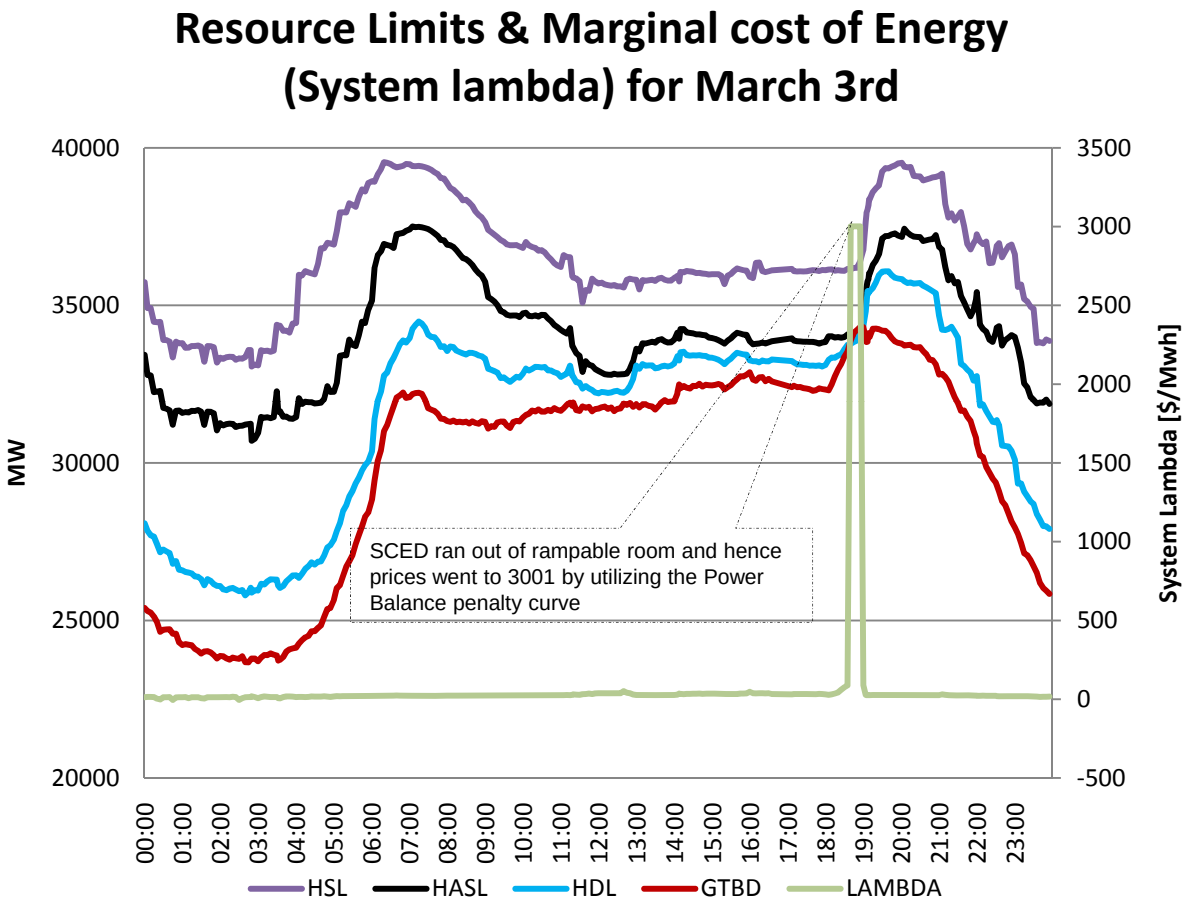
- **The load weighted average RT SPPs were slightly lower than the load weighted average DAM SPPs, which indicates a conservative approach.**

Day ahead market/Real-time price convergence



- **Day Ahead prices follow the hourly load profile more closely than real-time prices**
- **Real-Time prices are dependent on real-time ramp rate capability**

Price Spike for HR 19 on March 3rd

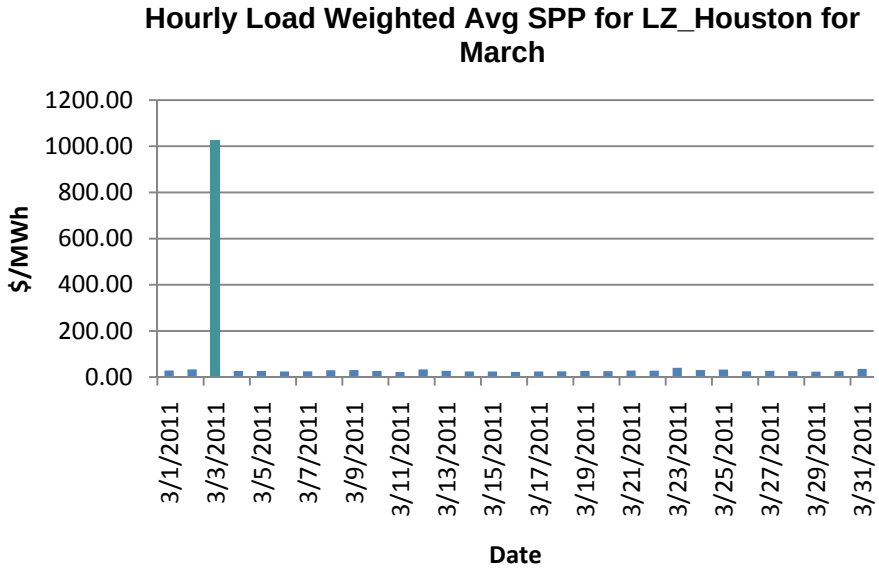


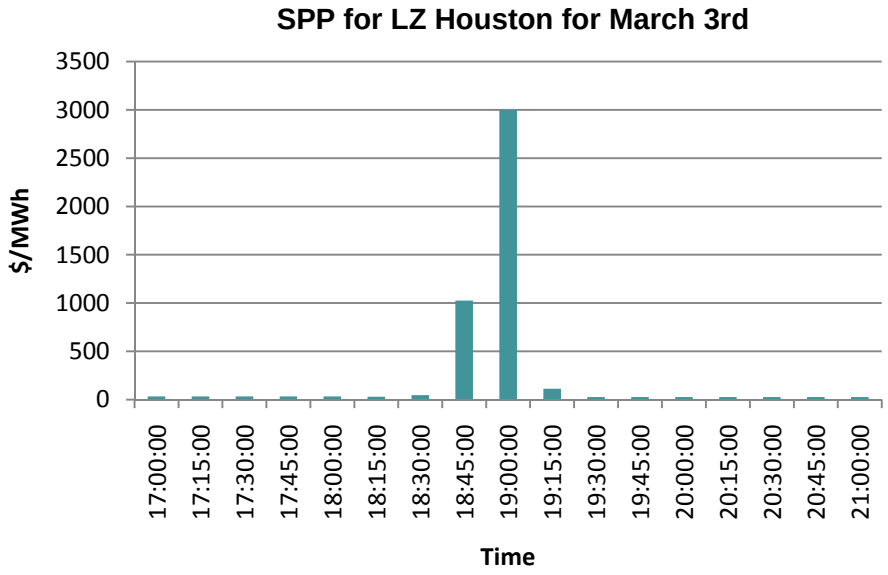
During morning and evening load ramp periods, prices can go high due to the following

- **Not enough ramp available in the system to keep up with the load growth**
- **Not enough Physical Responsive Capability available in the system**

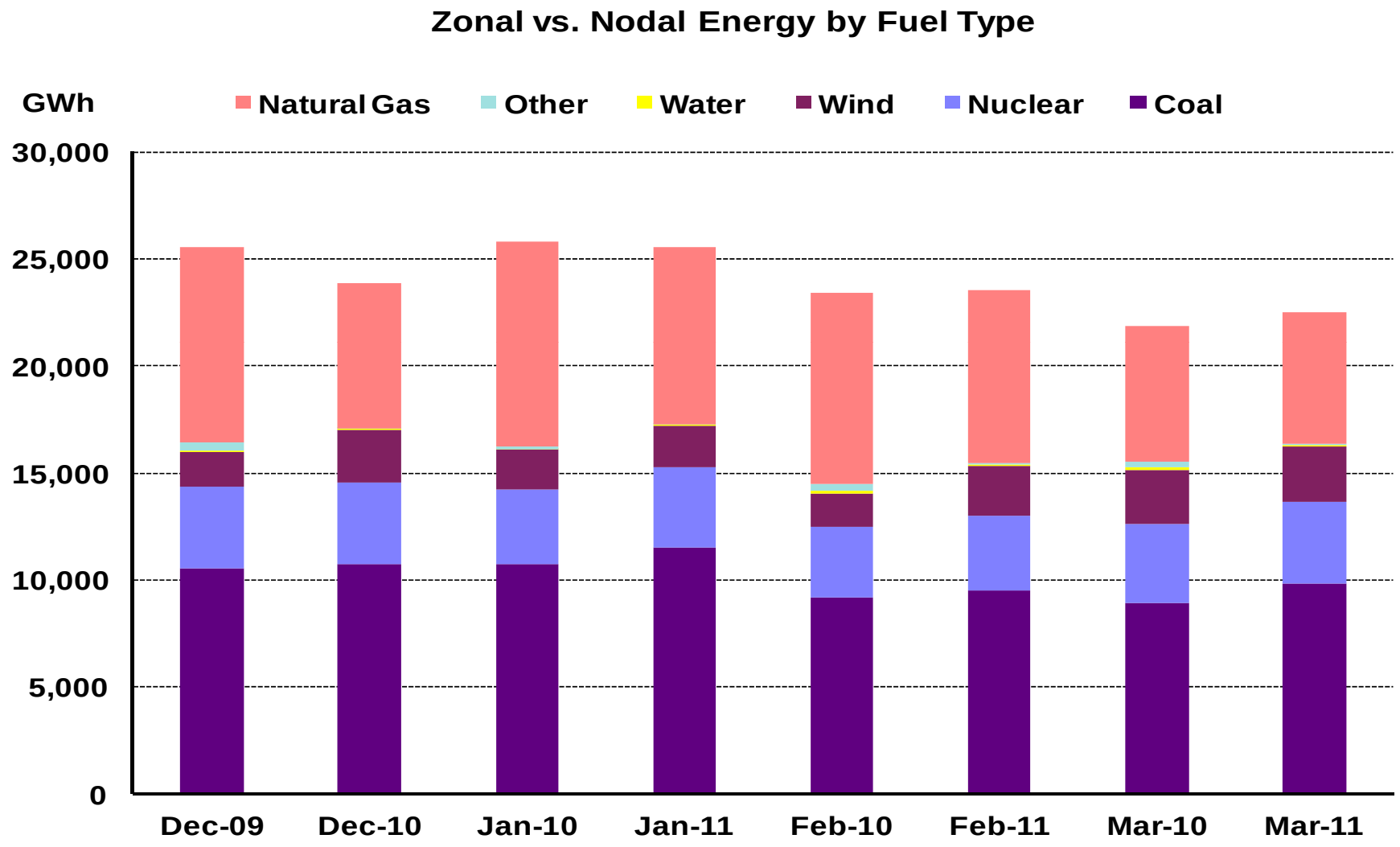
HSL – High Sustained Limit ; HASL - High Ancillary Service Limit; HDL – High Dispatch Limit; GTDB – Generation To Be Dispatched
System Lambda - the cost of the next MW that could be produced from dispatchable generation

Settlement Point Prices (SPP) for Hr 19th for March for One Load Zone (LZ)

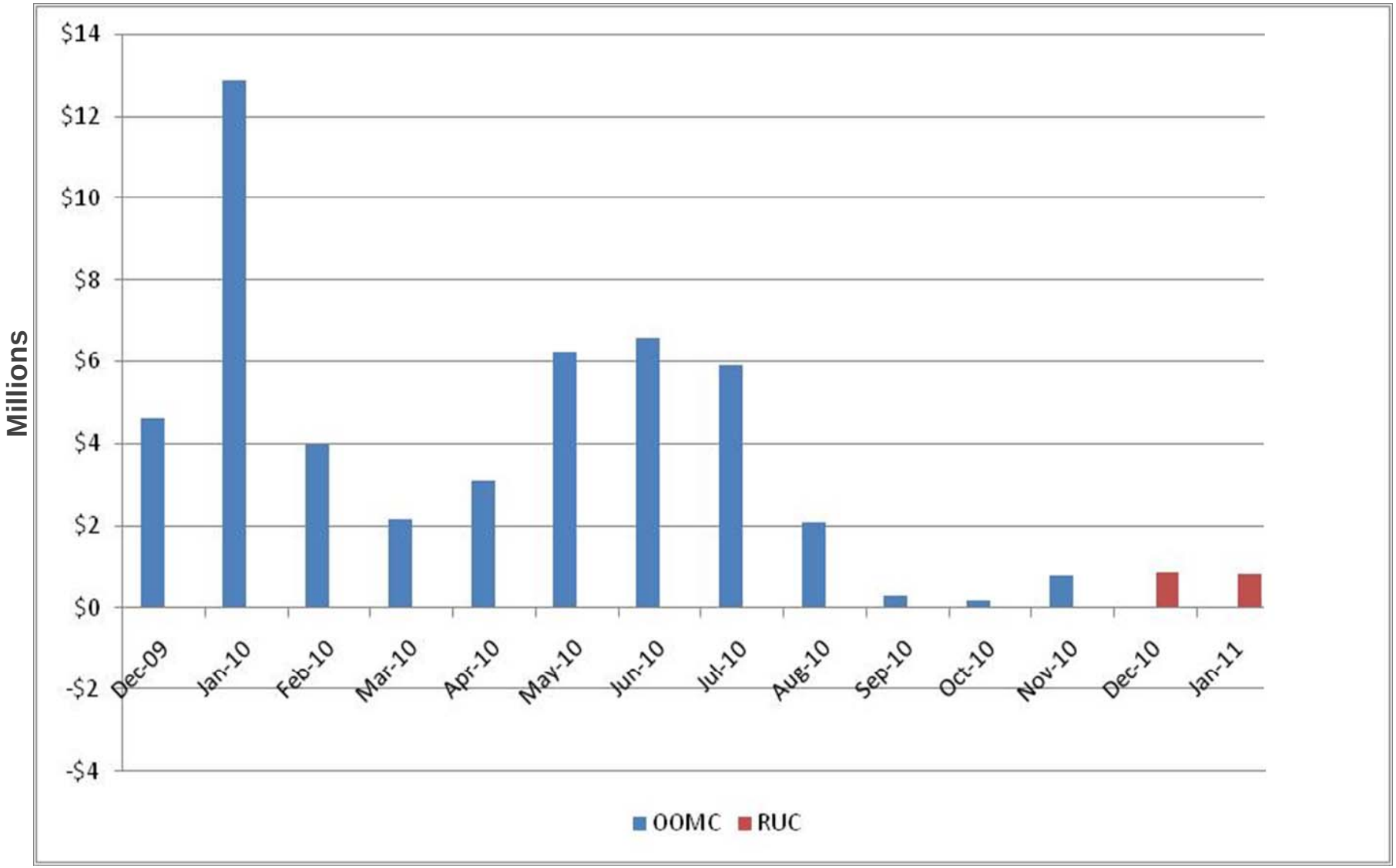




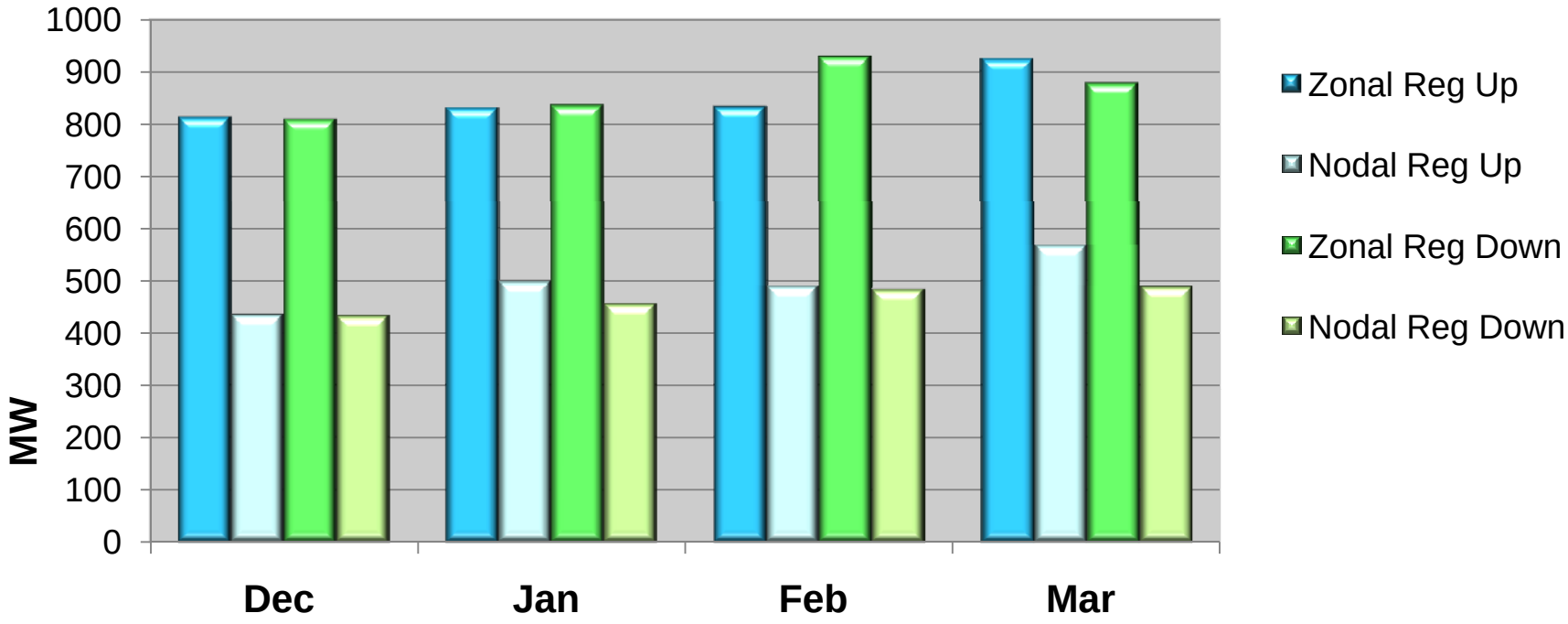
Zonal vs. Nodal: Energy by Fuel Type



OOMC vs. RUC Payments



Hourly Average Regulation Procurement

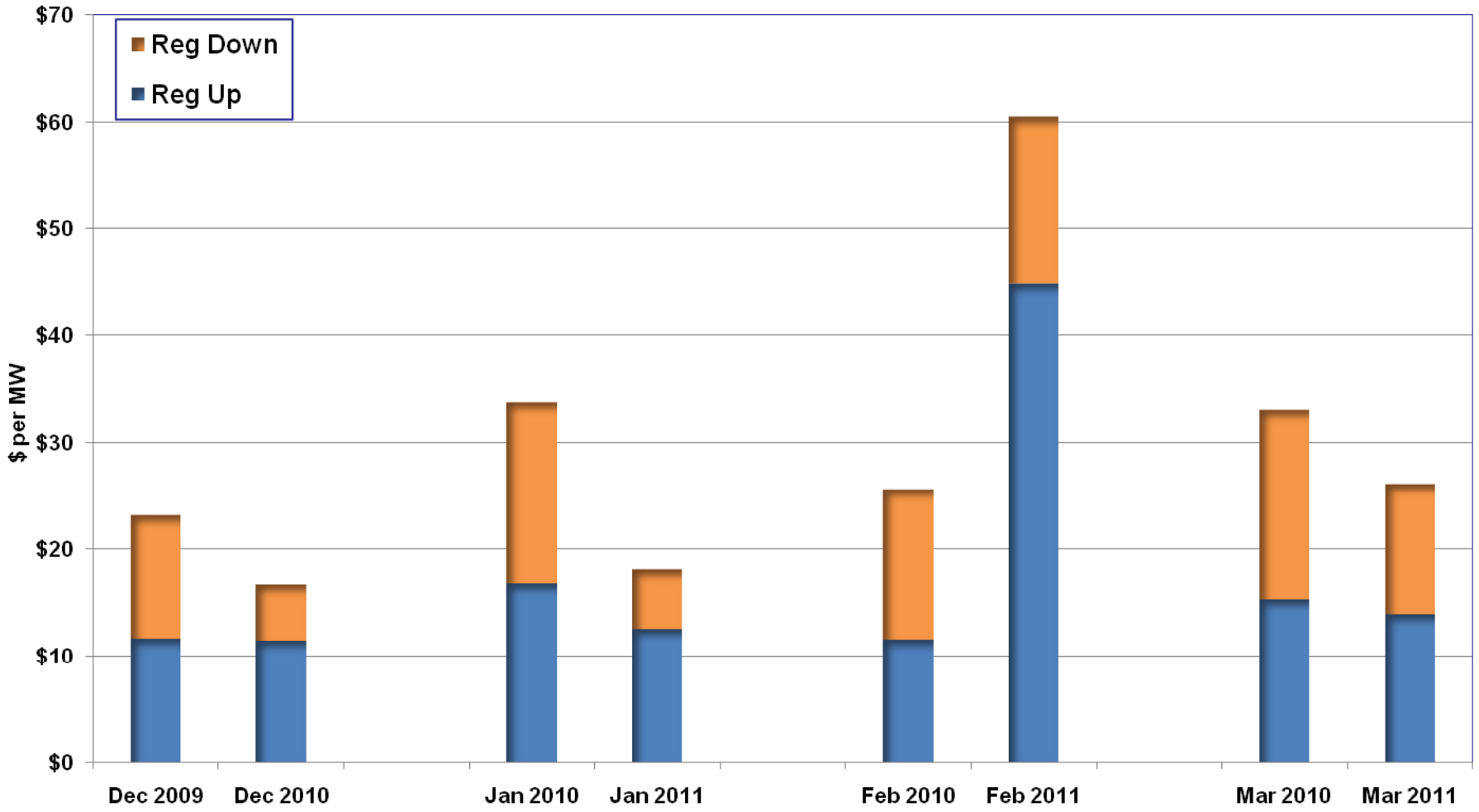


Same level of Frequency Control with lesser amount of Regulation Procured

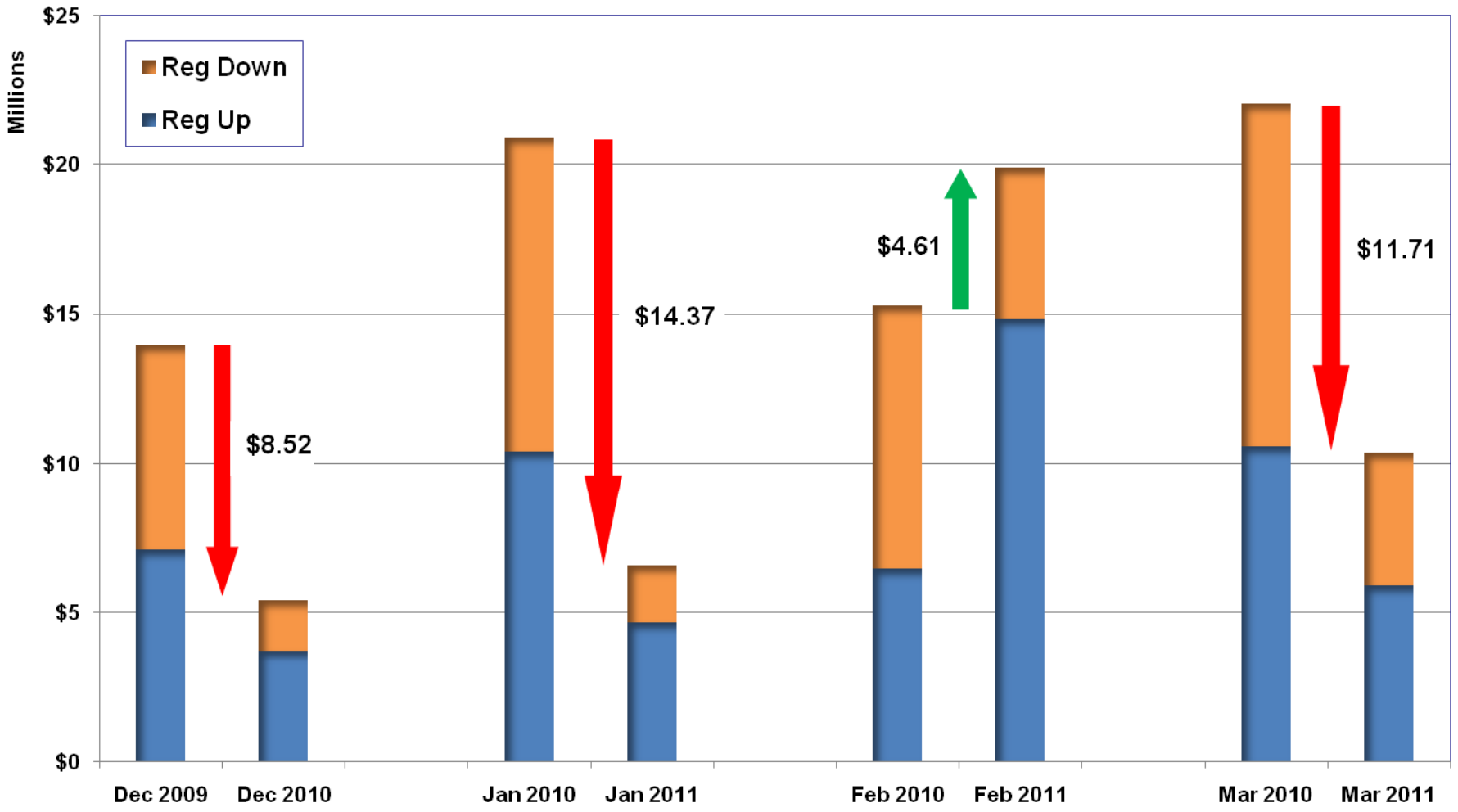
(Low CPS score for February 2011 is an anomaly caused by the EEA event on 02/02/2011)

CPS Hourly Average Scores		
Month	**Zonal**	**Nodal**
Dec	147	141
Jan	144	145
Feb	150	136
Mar	138	141

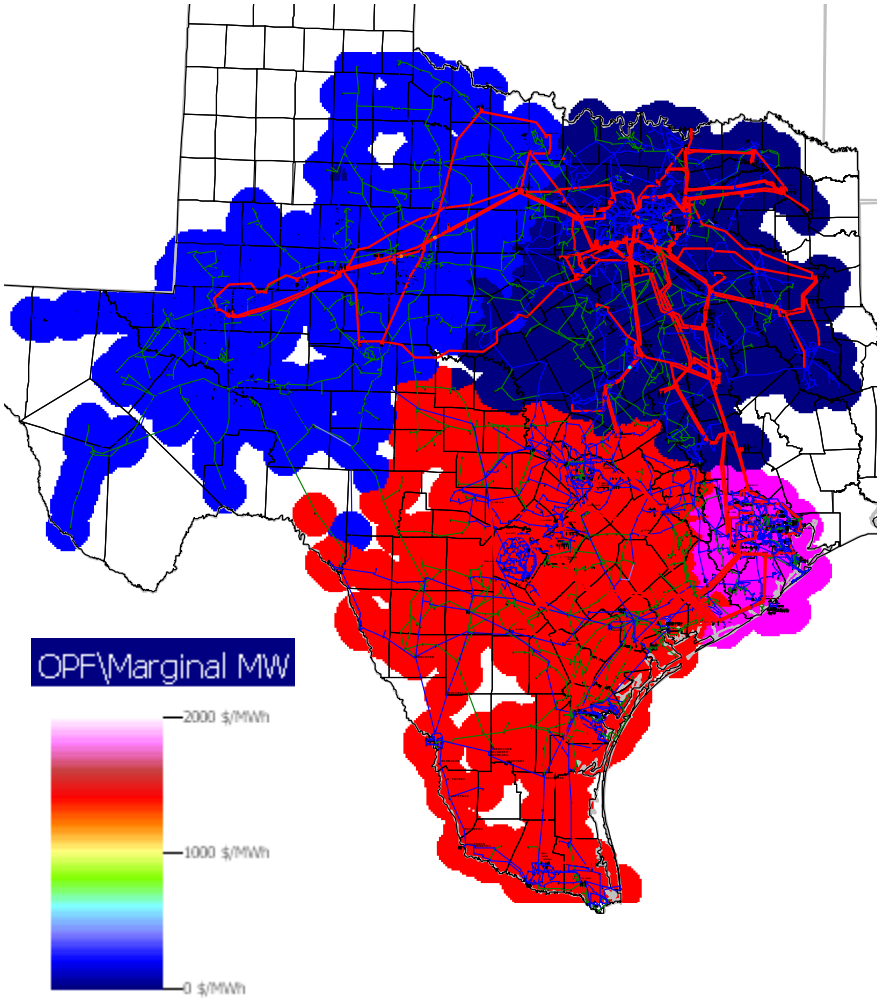
Regulation Capacity Prices

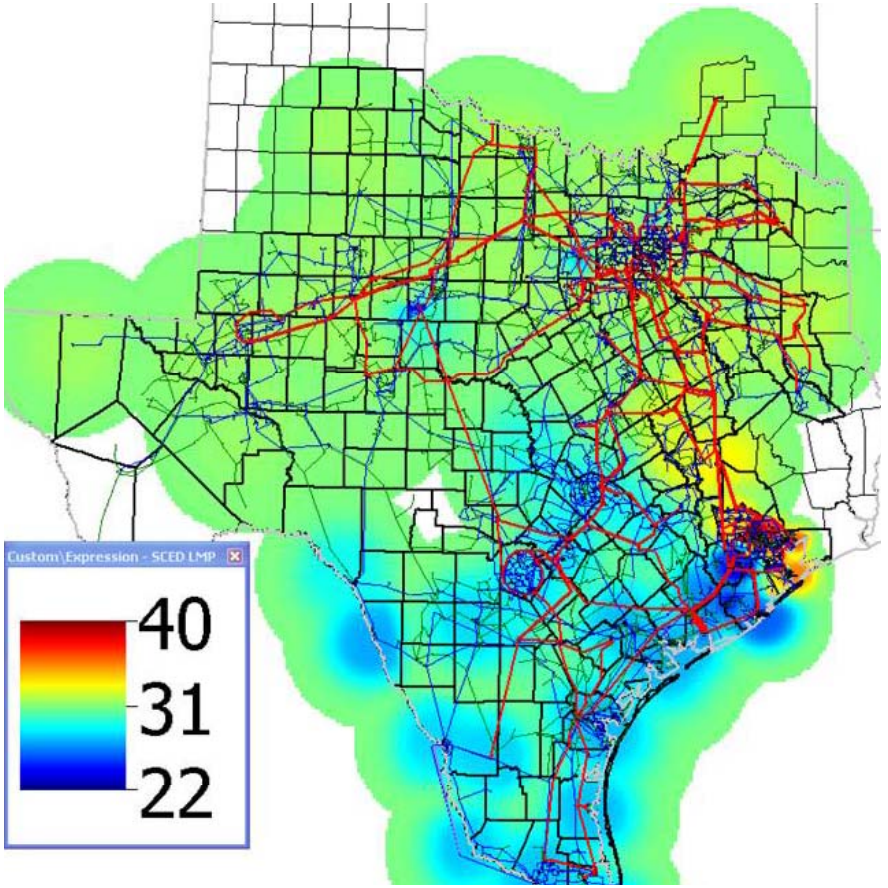


Regulation Capacity Costs

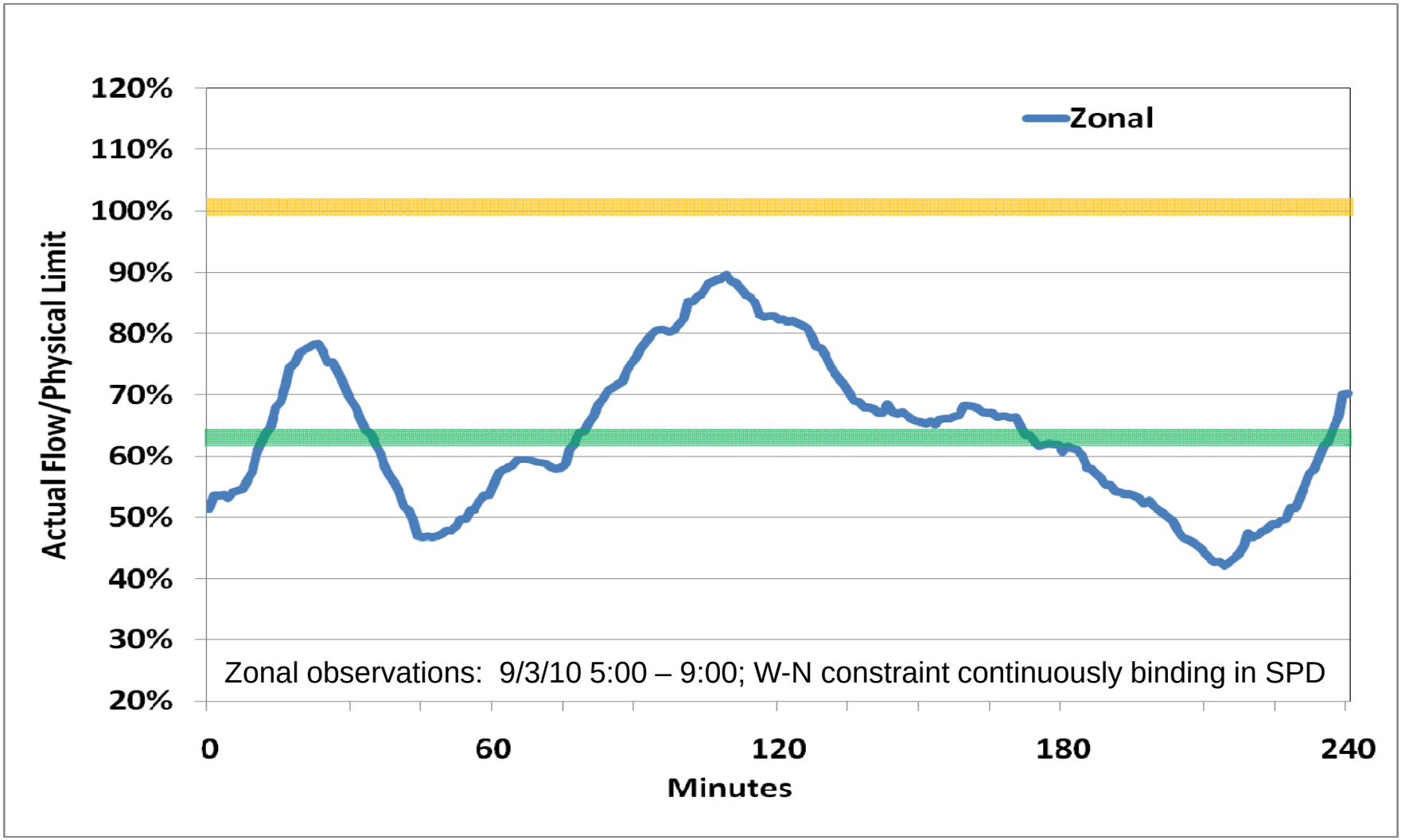


Congestion Management: 2008 Zonal vs. 2010 Nodal

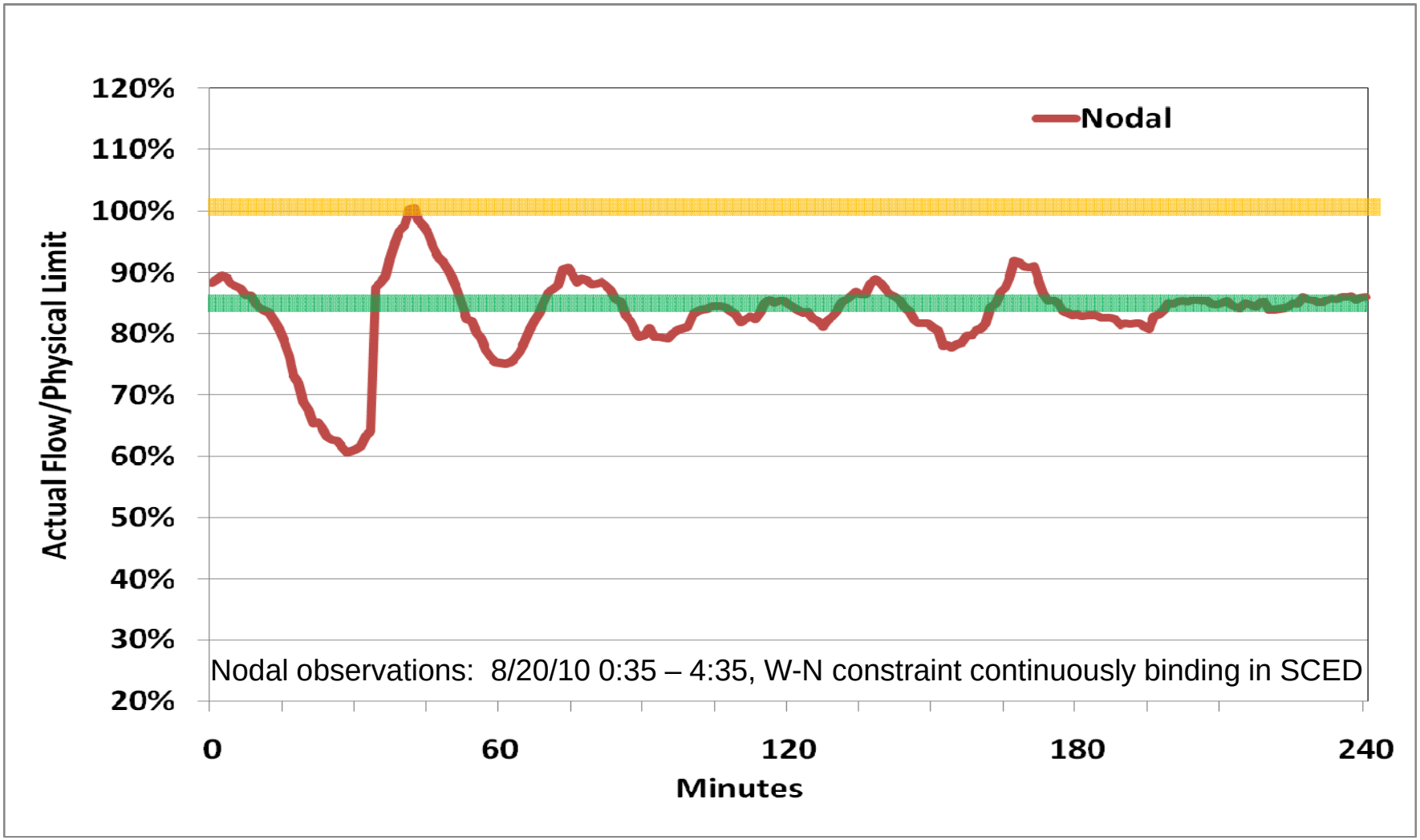




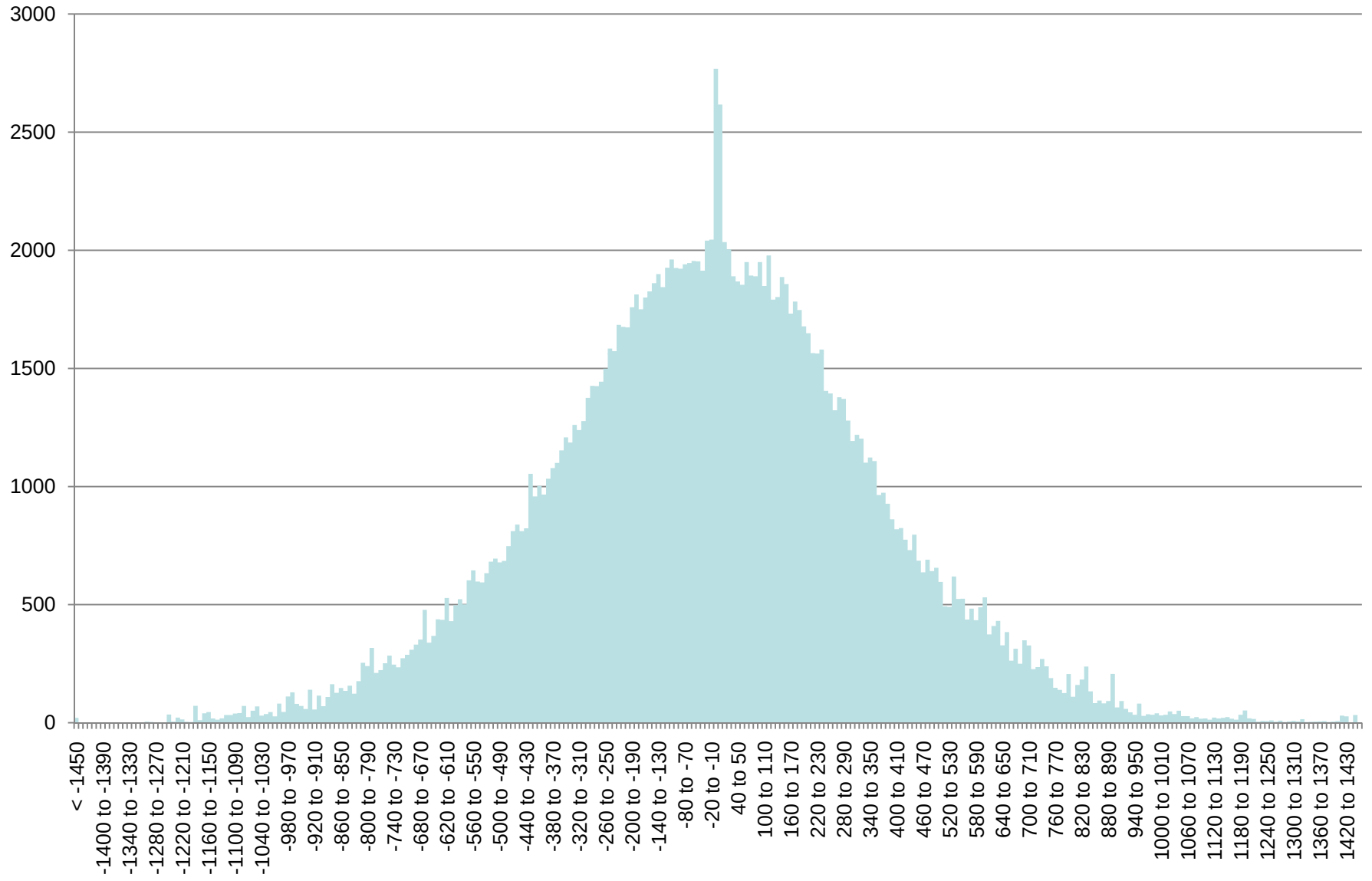
Congestion Management: W-N Stability (Zonal)



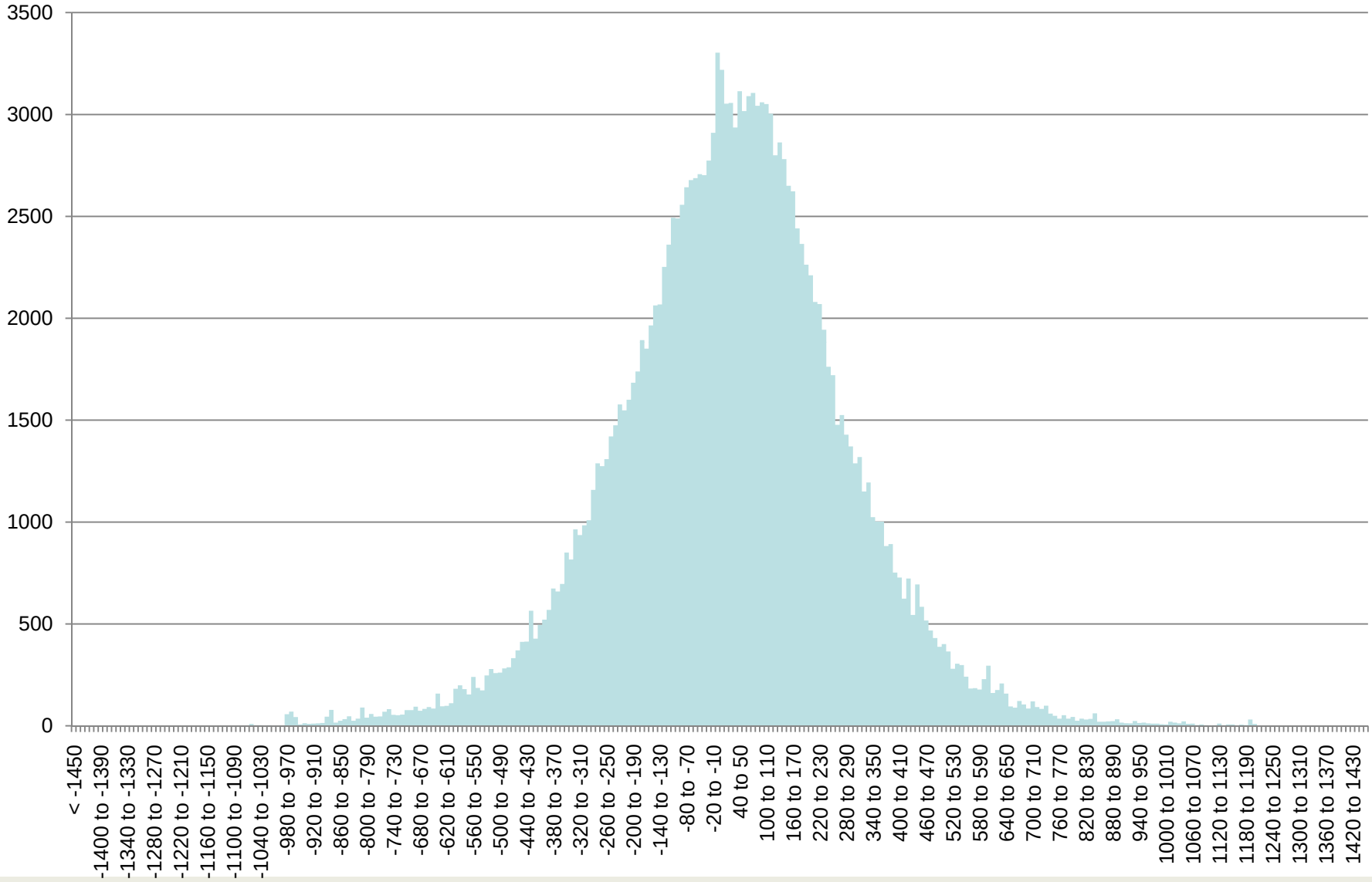
Congestion Management: W-N Stability (Nodal)



December 2009 Regulation Deployments



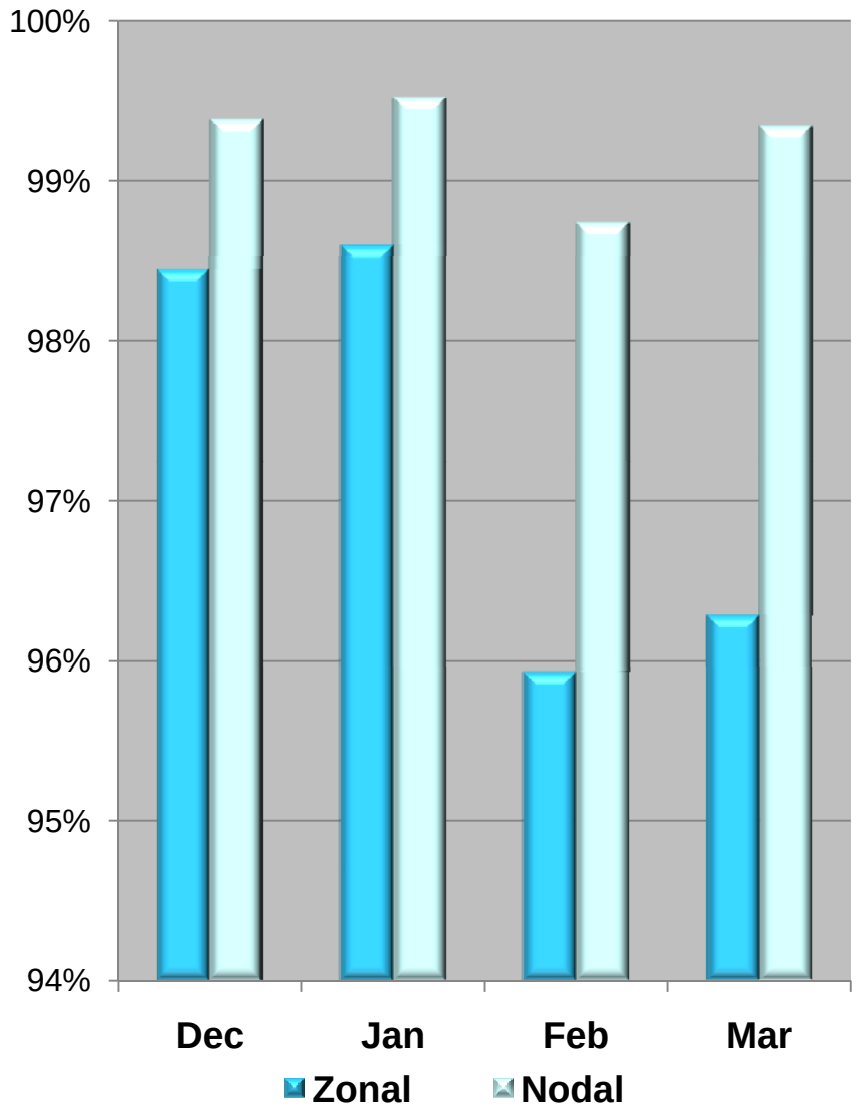
December 2010 Regulation Deployments



State Estimator Performance

- **Convergence**
  - Improved convergence in Nodal with tighter tolerances
  - Nodal tolerance – 15MW / 15MVAr
  - Zonal tolerance – 30 MW / 30 MVAr

- **Observability**
  - Protocols mandate 100% SE Observability
  - ERCOT has acquired all telemetry needed to achieve 100% observability
  - All breakers and disconnects are telemeterd in Nodal allowing us to know the state of the grid at all times
  - Zonal SE depended on normal statuses for some breakers and disconnects



Network Model

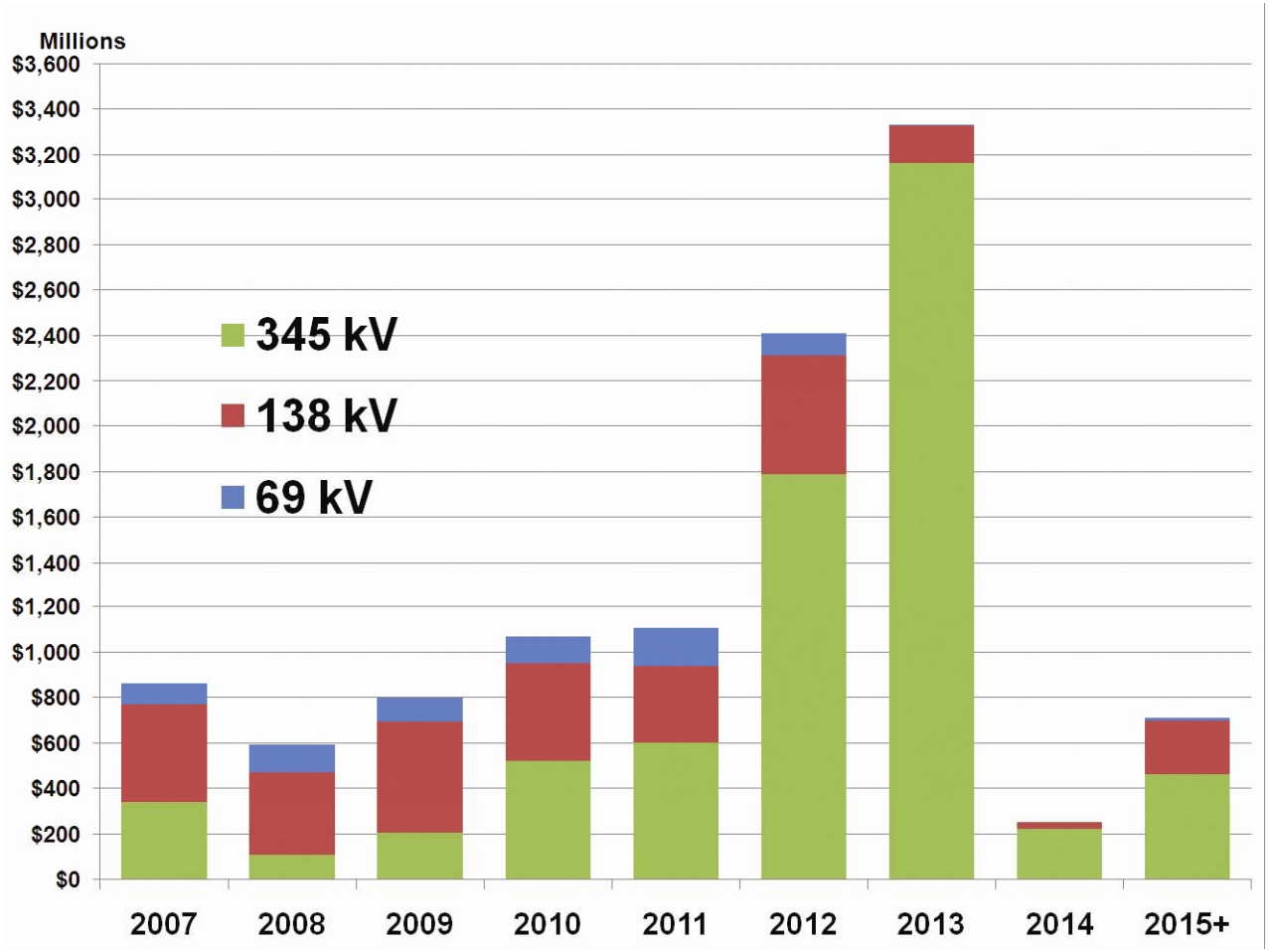
- **Consistency between models used for Operations (EMS/MMS), Planning, and CRR**
- **Increased Data accuracy as data submissions are made directly by the owners of the equipment**
- **Time-based modeling improves capability to study future cases by incorporating unique contingency and one-line sets**
- **Common Information Model (CIM) schema allows for model exchange between vendors and ERCOT participants**
- **Improved auditing capabilities to track changes**

Nodal vs. Zonal Summary

- **Telemetry**
  - Point availability improved
- **State Estimator**
  - Improved SE Convergence
  - Improved SE Solution (Lower tolerance)
- **Generation Cost**
  - Reduced cost due to resource specific vs. portfolio dispatch
- **Congestion Management**
  - More precise control
  - More economic dispatch (No out of merit)
- **Reliability Commitments**
  - Lower RUC cost vs. RPRS + OOMC
- **Ancillary Services**
  - Less Regulation required
  - Increased ancillary service location flexibility
- **COPs vs. Resource Plans**
  - Day-ahead Market financial incentives has improved COP accuracy

Transmission in ERCOT

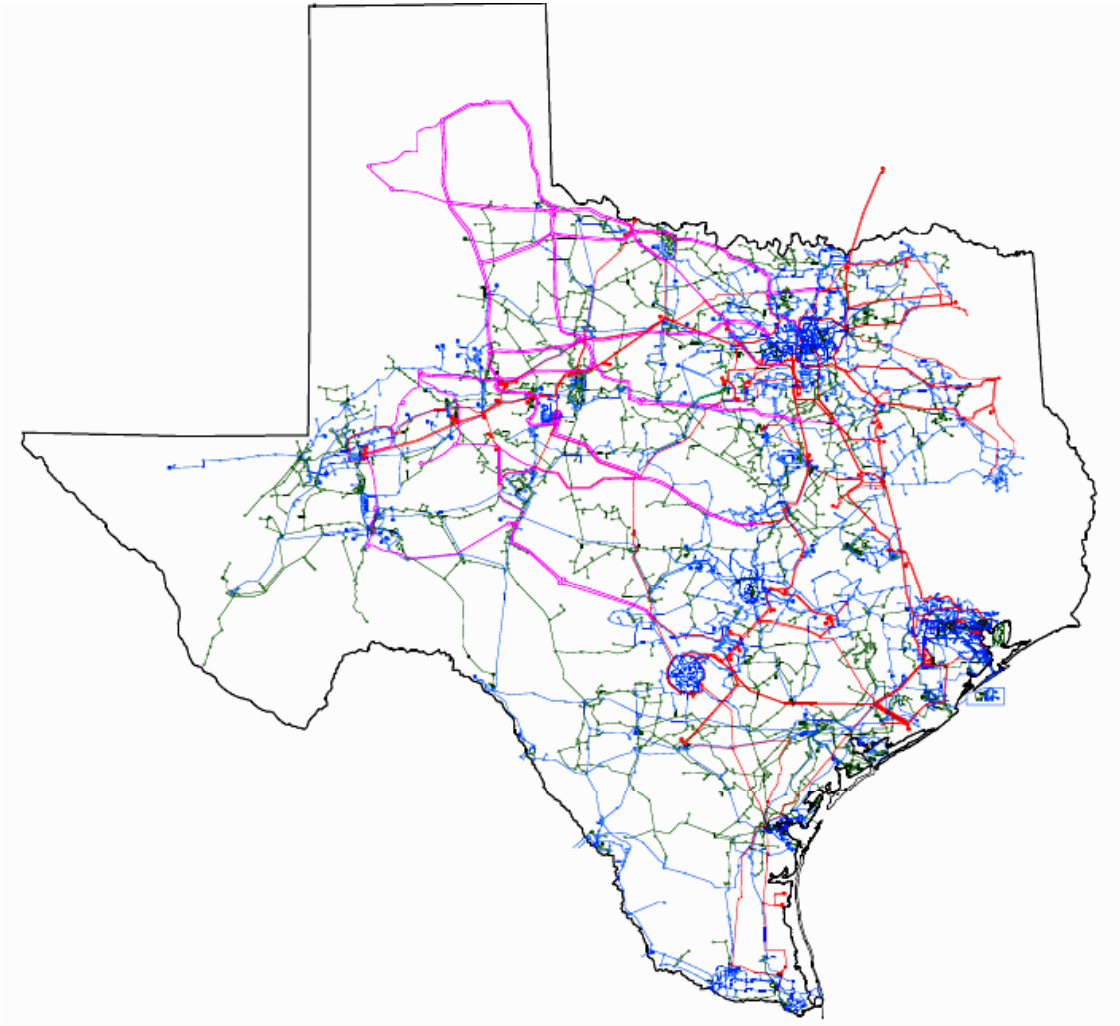
Transmission investment in ERCOT, through 2015



*Numbers are based on projects being completed in the designated year and may not reflect actual investment in that year. Costs may be spread over several years.

Our market is building transmission faster than any other

40,530 Miles of Transmission Lines in ERCOT



9,249 miles of 345 kV

19,565 miles of 138 kV

>8,500 circuit miles of transmission built since 1999

~8,000 circuit miles of transmission under study

$6.57 billion investment in transmission placed in service since 1999

$9 billion under development (Including $6 billion to support 18,000 MW of wind)

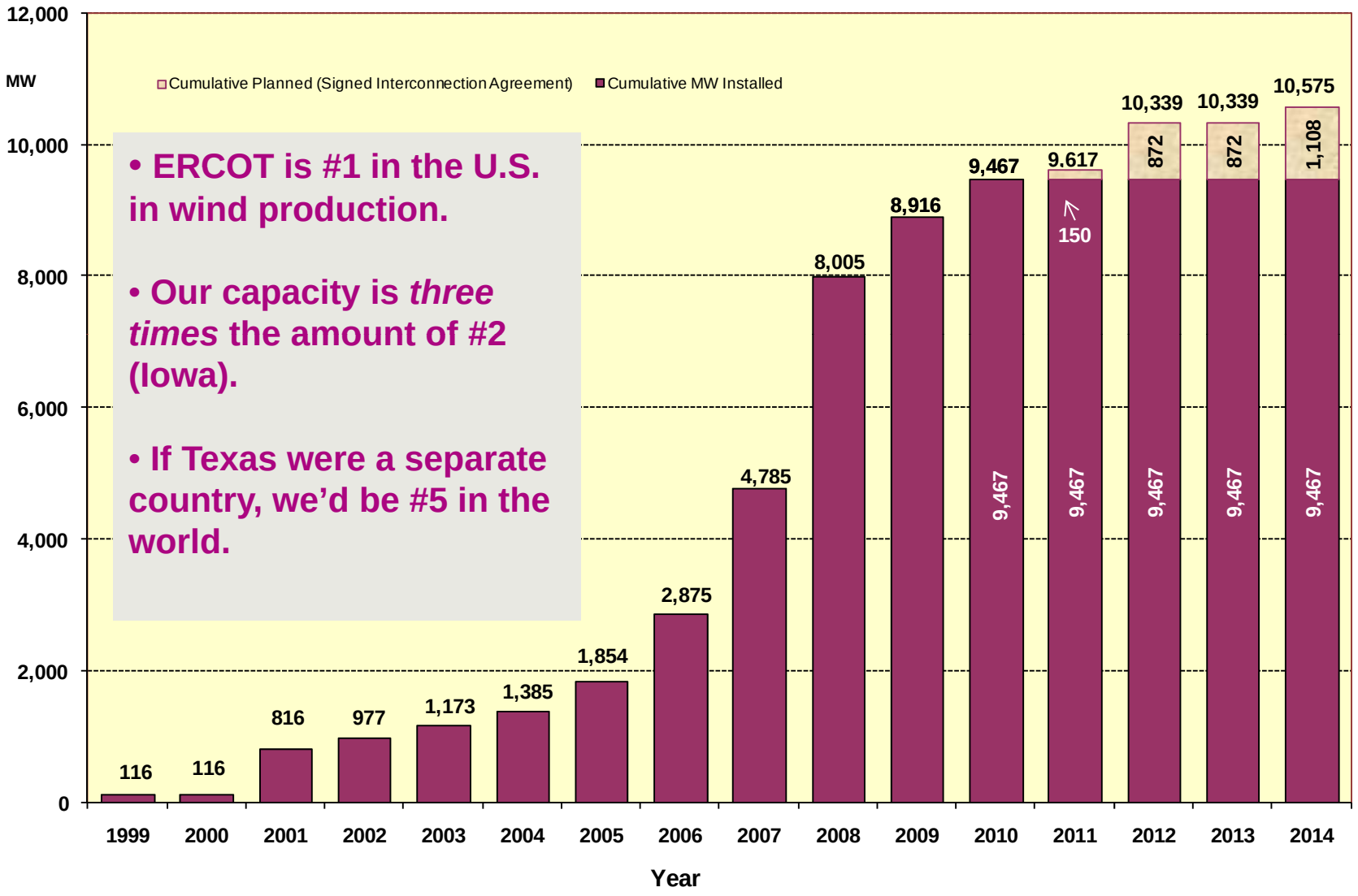
ERCOT Renewable Generation – Wind

In ERCOT Today…

- **The Current Installed Wind Capacity is ~ 9,467 MW**
  This makes Texas the largest wind power jurisdiction in North America (passing California in 2006)

- **We're studying ~ 36,000 MW in additional wind interconnection development**
  Additional bulk transmission lines are already needed in West Texas (independent of CREZ generation)

We're excelling at integrating variable resources



as of December 31,2010

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ERCOT Transmission

- 1995 amendments to the Public Utilities Regulatory Act (PURA) required PUC to ensure open access to transmission grid, allowing new independent generators to utilize transmission network.

- TX76RSB 7 adopted “postage stamp” transmission pricing structure and eliminated impact of location on transmission rates.

- Transmission Cost of Service (TCOS) ratemaking structure implemented and billed to distribution service providers (DSP).

  – DSPs recover TCOS through the TDSP delivery rate and transmission cost recovery factor (TCRF), approved by PUC, up to twice a year.

- New transmission investment is coordinated through the ERCOT regional transmission planning process and requires PUC facility certification.

- **Charge regulated delivery rates to REPs**
  - Rates based on a historical cost of service including a PUC-established return on capital investment
  - Allocation of ERCOT-wide transmission costs
  - Non-bypassable charges include the cost to deliver electricity, System Benefit Fund, recovery of true-up costs and nuclear decommissioning expenses for existing nuclear facilities