Investigation into April 17, 2006 Rolling Blackouts in the Electric Reliability Council of Texas Region

Preliminary Report

Public Utility Commission of Texas

April 24, 2006

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Preliminary Conclusions

- Root causes
  - Unseasonably high temperature in April
  - ERCOT's load forecast significantly underestimated demand for electricity.
  - ERCOT has indicated that nearly 14,500 MW of generation unavailable due to planned maintenance – within a normal range for April.
  - An additional 2,440 MW of generation became unavailable throughout the day due to unplanned outages. 1,683 MW of this occurred within 30 minutes around 4:00 PM.

Preliminary Conclusions

- ERCOT struggled to meet rapidly growing demand during afternoon because of the limited generation available.
- ERCOT's system operators took reasoned, deliberate, and decisive actions to implement and rapidly move through the Emergency Electric Curtailment Plan (EECP) when it became apparent that there was no other option. Ultimately, when additional power plants tripped, ordering rolling blackouts was the only remaining option to preserve the grid.
- The decisive actions of ERCOT system operators, combined with the rapid implementation of those decisions by generators and transmission and distribution companies prevented the need to automatically trip even more customers to prevent an uncontrolled, cascading blackout from occurring.

Preliminary Conclusions

- While operational decisions were commendable, and the emergency procedures and implementation served to achieve the precise purpose for which they were created, notice of the emergency to some market participants, the PUC, state and local leadership, and the general public was inadequate.

Status of Investigation

- The PUC has attempted to quickly obtain information about key events, timelines, notices, and activities to provide the Committee and other state leadership as much information as possible.
- All information and conclusions are preliminary.
- The PUC will perform a comprehensive and thorough review and analysis of events on April 17th. If non-compliance with statutes, PUC rules, or the ERCOT Protocols or Operating Guides are discovered, appropriate action will be taken by the PUC.

Background

- The supply and demand for electricity must match, within narrow tolerances, at all times.
- Shortage of supply results in frequency falling below the 60 hz standard.
- Power plants operate within a narrow frequency range and will trip if the system frequency falls outside of the range.

Background - Energy Scheduling for the Day

- Each day, all generators and retail electric providers/utilities inform ERCOT through their Qualified Scheduling Entity (QSE) of the energy they have arranged via contract to serve their customers for the next day.
  - These ‘resource plans’ can be updated until close to real time.
- ERCOT makes up the difference of the energy needed and that scheduled with ‘balancing energy’, which it purchases every 15 minutes based on bids it has received.
  - Balancing energy also used to manage transmission congestion in real time – not believed to be a factor on April 17.

Background – Ancillary Services

- For each day, ERCOT also acquires “ancillary services” (reserves and other services) to ensure the reliability of the system in case of unexpected events.
- All retail electric providers, municipally owned utilities, and electric cooperatives are assigned responsibility for a portion of the reserves needed based on the amount of customers/load they serve.
- These companies can self-arrange these reserves, or ERCOT will procure reserves for them based on bids.

Types of Reserves

- Regulation Service– 1,800 MW up and down
  - Generation that can instantaneously respond to changes in demand and automatically provide energy in response to electronic signal from ERCOT.
- Responsive Reserves – 2,300 MW every day
  - Generation or interruptible customers than can automatically produce energy or cut use if frequency dips. 1150 MW can be provided by interruptible customers – or Loads Acting as a Resource (LAARs).
- Non-spinning Reserves – 1,250 MW when ERCOT determines the need based on forecasted temperatures
  - Offline/unused generation or interruptible customers that can produce energy or cut use within 30 minutes upon request from ERCOT. Used to restore responsive reserves or if balancing energy all used up
- Replacement Reserves – various amounts as ERCOT determines need
  - Generation capacity or interruptible load not planned to be available next day, but called on by ERCOT because ERCOT sees the need for it because of expected insufficient supply or severe congestion.

Emergency Procedures

- ERCOT can issue Notices, Advisories, Alerts, and Emergency Notices related to weather, transmission, distribution, or generation information to alert the market about reliability concerns.
- These communications can be in response to concerns about overall market reliability or for specific local reliability issues such as the potential for transmission overloads or local shortages of generation due to congestion.
- These notices, etc. all provide advance warning prior to implementation of the emergency steps.
  - With respect to capacity, the key trigger for a notice, alert, etc. is whether or not resource plans indicate sufficient generation to meet the demand projected in the load forecast.

Examples of Notices

- May 2005 – ERCOT issued notices and alerts due to expected insufficient generation during some hours of some days.
- October 2005 – ERCOT issued notice of unavailability of DC tie to eastern interconnect because of annual maintenance.
- 4/17/06 – ERCOT issued numerous alerts regarding the potential for transmission overloads in the event of equipment failures.
- 4/20/06 – ERCOT issued notice due to the severe weather in Central Texas.

What is the EECP?

- Emergency Electric Curtailment Plan
  - Generally implemented after all available balancing energy and reserves are near full utilization.
  - In place to provide for ordered series of actions to be taken by ERCOT in case of inadequate supply of generation region wide, or on a local level.
  - Once Emergency Conditions are declared, ERCOT has more authority to order generation to deploy and to order reductions to demand in order to prevent a cascading blackout.

EECP Steps

- Step 1 – Goal: Maintain/restore 2,300 MW of un-deployed Responsive Reserve and maintain non-spinning reserve that has been deployed but not fully ramped.
  - Use other available reserves that can be deployed to increase Responsive Reserves
  - Instruct all available generation capacity be brought on-line
  - Schedule emergency power across DC ties
  - Start and fully deploy Reliability Must-Run (RMR) units that are available
- Step 2 – Goal: Maintain/restore Responsive Reserve equal to amount of largest on-line generation unit
  - Instruct TDUs to lower distribution voltage if it will be beneficial in reducing load on system
  - Instruct QSEs to curtail interruptible customers providing LAARs
- Step 3 – Goal: Maintain system frequency at 60 Hz or higher
  - Public appeal for conservation
- Step 4 – Goal: Maintain system frequency at 59.8 Hz or higher
  - Order TDUs to implement rolling blackouts to lower demand on system

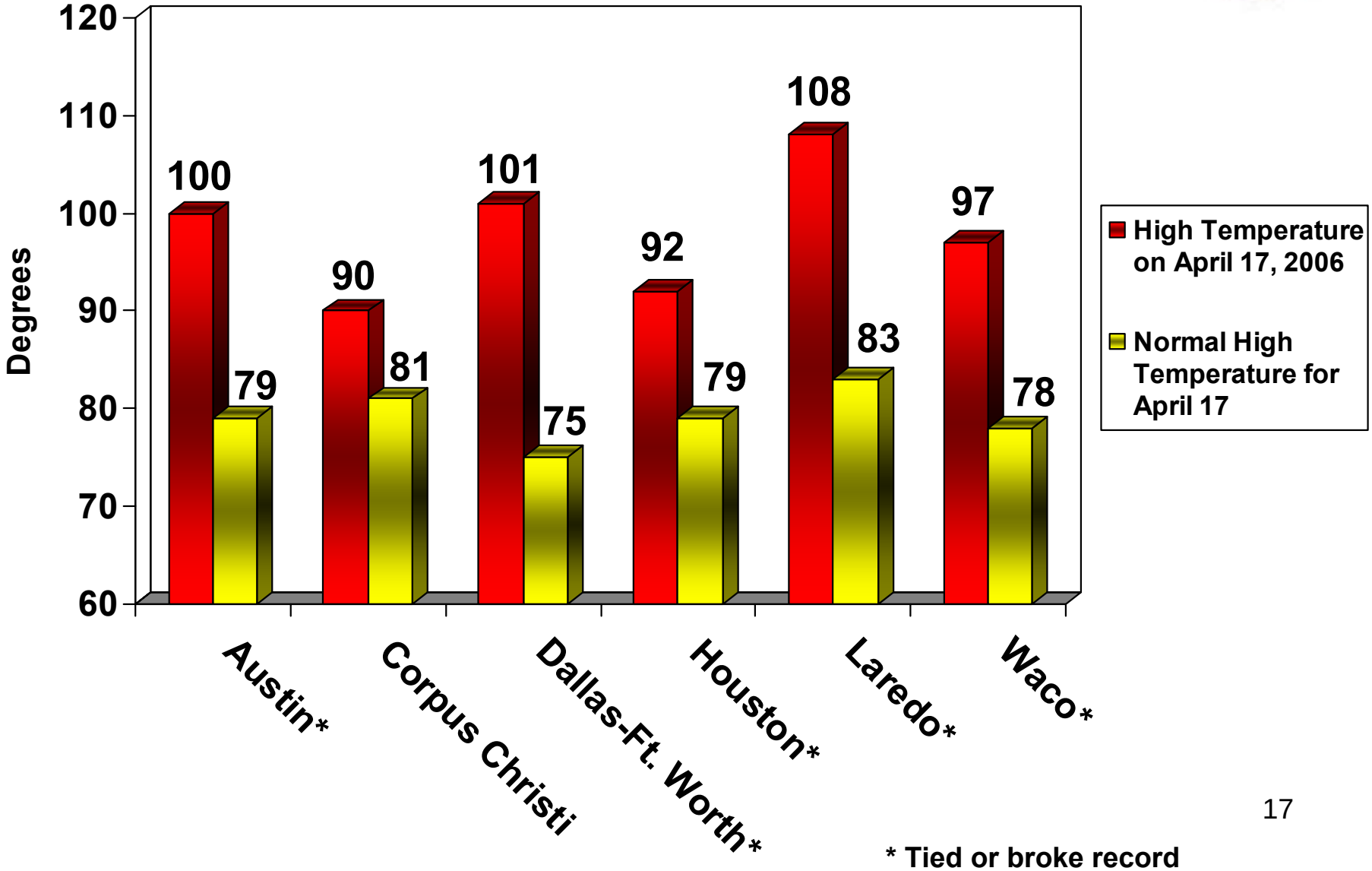
Rolling vs. Cascading Blackouts

- Rolling blackout.
  - An orderly, managed process where individual distribution feeders are intentionally cycled off and on to reduce demand on the electrical grid.
    - Target of 10-45 minutes of outages to residential and commercial customers before power restored and next set of customers turned off.
- Cascading blackout.
  - An uncontrolled, escalating event where major portions or all of the region loses power including many or all power plants .
    - Restoration of power may take hours or days, as power plants have to be restarted and sections of the grid restored slowly.
    - If EECP Steps are not successful in stopping frequency decline, automatic tripping of demand occurs.
      - 5% shed at 59.3 hz., 10% at 58.9, and 10% at 58.5

Conditions on April 17

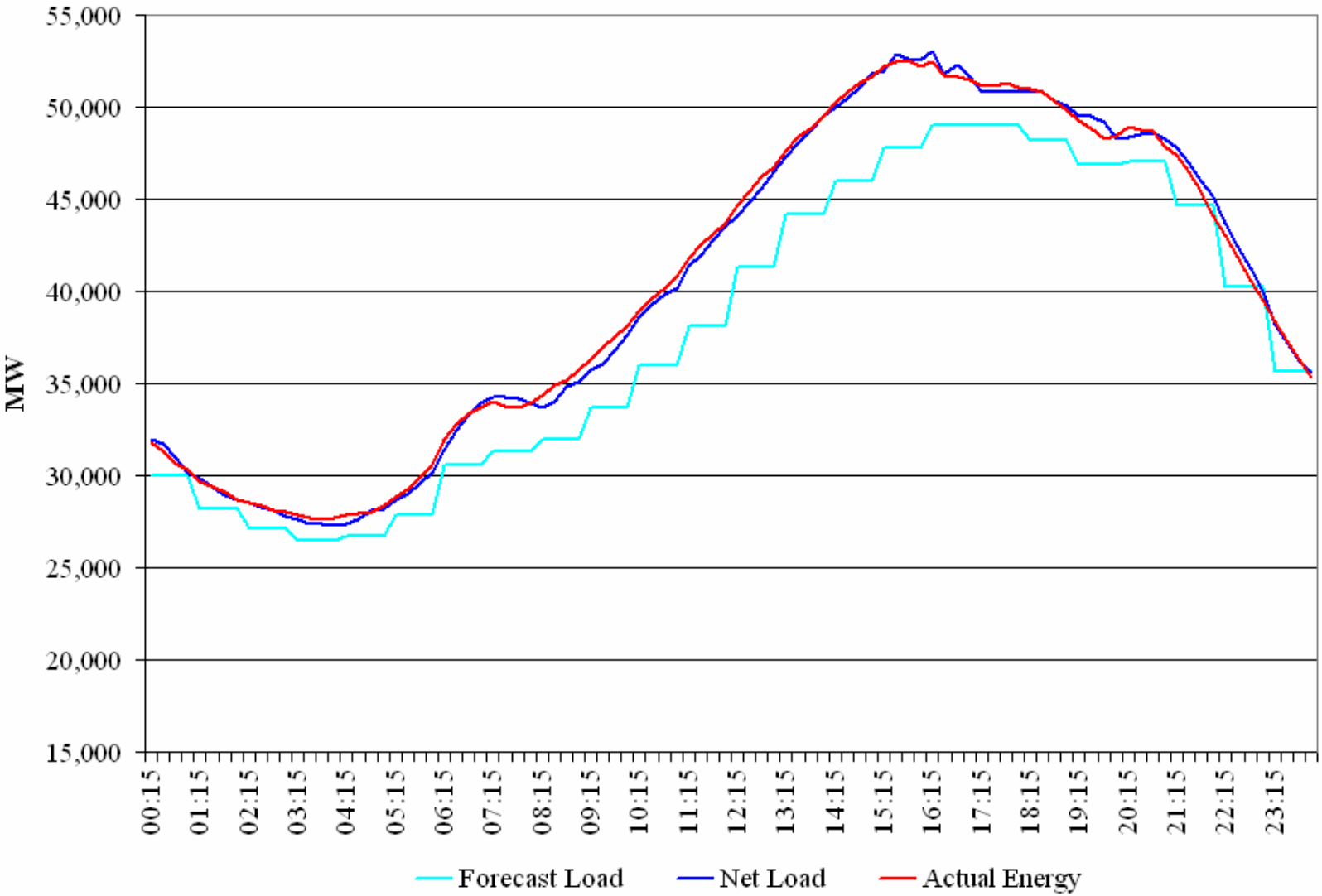
- Record setting temperature in most of ERCOT region.
  - Weather forecasts were for record heat.
  - Dry line shifted east through Dallas-Fort Worth between noon and 7pm, causing temperature to exceed forecast in DFW by 5 degrees.
- Unprecedented electricity demand during the day that was increasing rapidly during the afternoon.
  - Actual demand (would have been about 53,000 MW with out interruptions/rolling blackouts) far exceeded day-ahead forecast by ERCOT (about 49,000 MW).
  - Rate of increase in demand abnormally high for April.

Weather Conditions on April 17, 2006 Were Extremely Abnormal Statewide

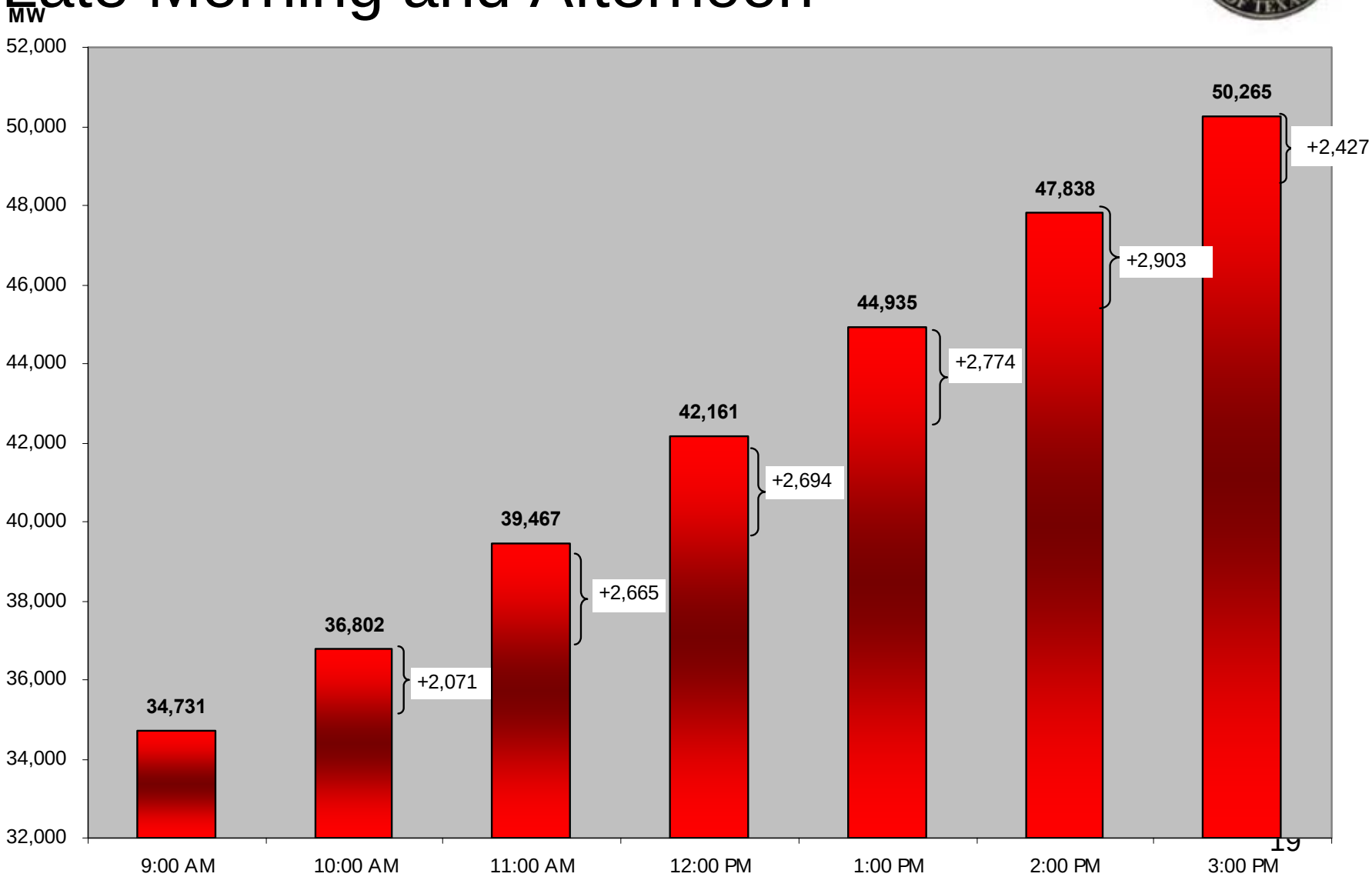


* Tied or broke record

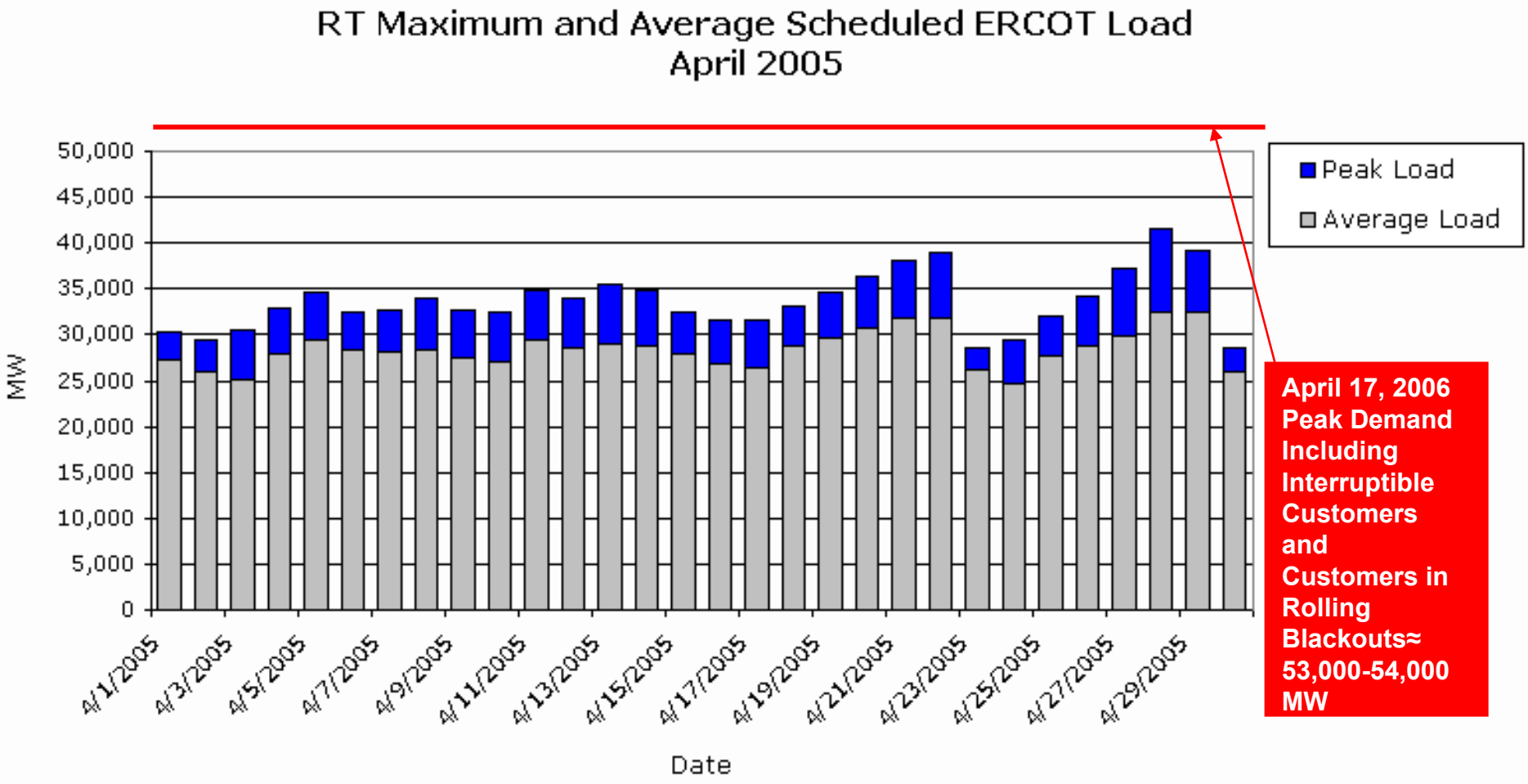
Actual Demand Far Exceeded ERCOT's Day-Ahead Load Forecast



Electricity Demand Rapidly Growing in Late Morning and Afternoon



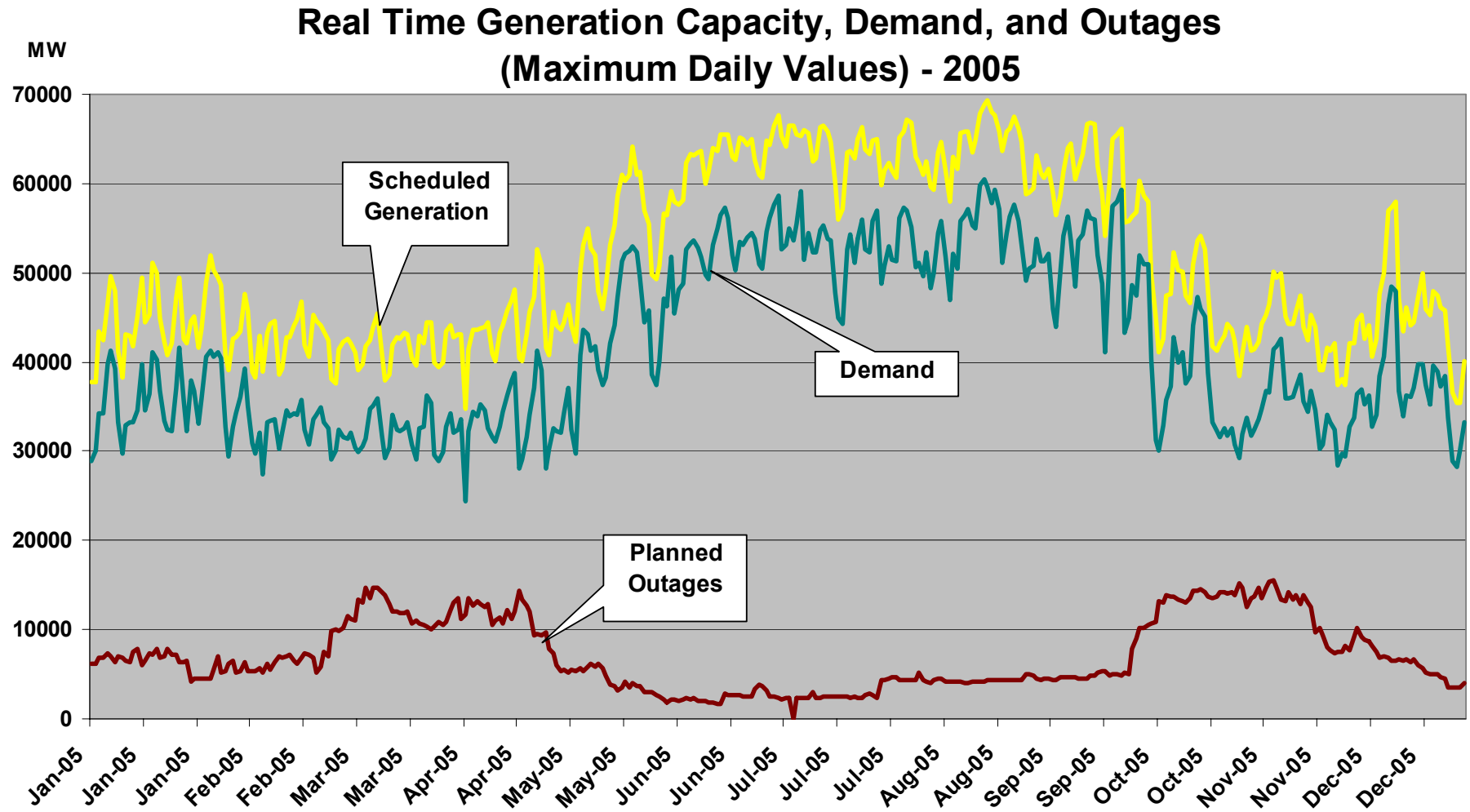
Electricity Demand Peak More than 10,000 MW Above Normal



Planned Maintenance Season

- ERCOT reported that approximately 14,500 MW of capacity was undergoing scheduled maintenance.
  - Spring and fall are normal times for maintenance to ensure capacity is available during summer and winter peaks.
  - ERCOT required to be notified of planned maintenance schedules.
  - If notice of planned maintenance is less than eight days, ERCOT can reject.
- In April 2005, between 10,000 MW and 13,500 MW were down for maintenance, depending on day.

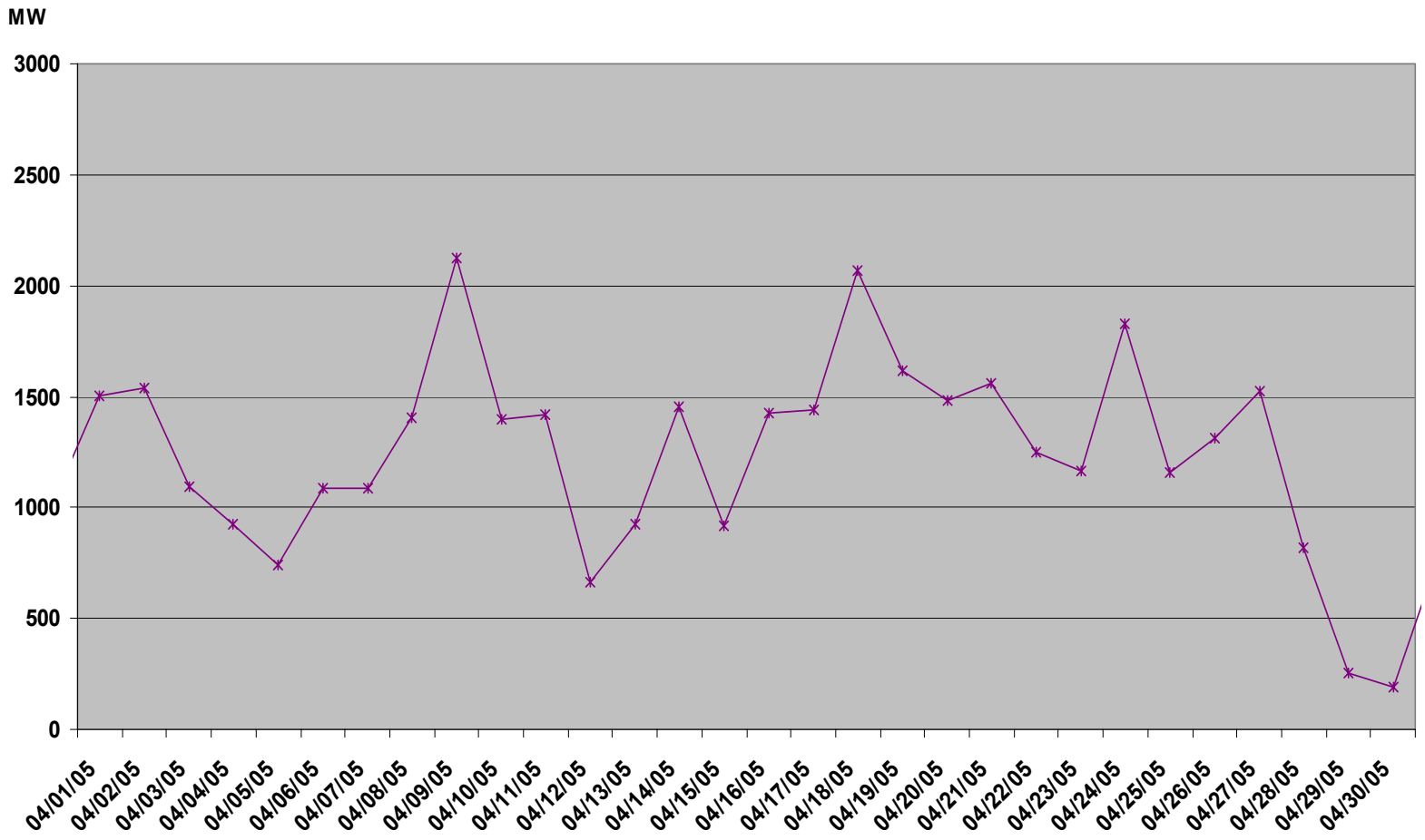
Demand, Scheduled Generation and Planned Generation Outages in 2005



Unplanned Outages

- It can also be expected that on any given day, some power plants will have unexpected problems or mechanical failures that will cause them to be offline, or limit their operation to a reduced level of output.
- ERCOT is required to be notified of all unplanned outages as soon as possible after the plant goes offline.
- As will be discussed, 2,440 MW of generation became unavailable during the course of the day on April 17, 2006.
  - 1,683 MW of that went offline in a thirty minute period around 4:00 PM

Unplanned Outages of Power Plants
April 2005



Timeline of Events

- The PUC has endeavored to develop a comprehensive timeline of events on Monday, April 17, 2006.
- This timeline will be revised as additional information is gathered and verified.

Timeline of Events – Sunday April 16, 2006

- 6 AM – load forecast for April 17 made – peak demand expected to occur at 6:00 PM with peak of 49,018 MW.
- 6 PM – after receiving schedules for the day, ERCOT runs study to determine if Replacement Reserves are needed.
  - ERCOT acquires 1,500 MW-1,600 MW of either replacement reserve or Out-of-Merit Capacity (OOMC) to meet expected needs during peak hours.
    - Unclear whether acquisition was for local congestion management or for expected system-wide capacity shortages.
    - This capacity required to be made available to balancing energy market.
  - ERCOT also procures 1,250 MW of non-spinning reserve based on forecasted temperature for the day.

Timeline of Events – Sunday April 16, 2006 (cont.)

- Because resource plans submitted by QSEs indicate that supply will be sufficient to meet demand, ERCOT does not issue any notices, alerts, or advisories.
- Initial statements that ERCOT made requests to power plant owners to bring plants out of maintenance for Monday and Tuesday have not been verified.
  - ERCOT has subsequently indicated this was not the case, and discussions with some generators support this.
  - Will be further examined.

Timeline of Events – Monday, April 17, 2006, early morning

- 1:00 AM – Updated load forecast indicates slight increase in peak demand to 49,500 MW– due to weather forecasts projecting higher temperatures. ERCOT again analyzes need for replacement reserves and determines that resource plans indicate adequate supply.
- 5:00 AM – ERCOT operator makes manual revision to load forecast to 51,600 MW based on operator's experience. Resource plans submitted by QSEs again indicate that expected capacity is sufficient to meet demand.

Timeline of Events – Monday, April 17, 2006, early morning

- At this point, had the studies indicated a capacity shortfall, ERCOT could have:
  - Issued notices, alerts or advisories of expected capacity shortage.
  - Made informal contact with generation owners to see if additional generation was available.
  - Opened additional ancillary services markets to attempt to secure additional capacity.
  - Issued Out-of-Merit Capacity (OOMC) instructions to generators to bring additional capacity on-line.

Timeline of Events – Monday, April 17, 2006, late morning

- 11:00 AM – Demand is 39,467 MW.
- 11:58 AM – Power Plant A trips off-line.
  - Rated capacity – 513 MW.
  - Running at 243 MW at time of trip.
  - Tripped due to forced draft fan failure
- 12:00 PM – Demand is 42,161 MW. Has increased nearly 2,700 MW in past hour.
- 12:23 PM – Power Plan B trips.
  - Rated capacity - 163 MW.
  - Running at full capacity at time of trip.

Timeline of Events – Monday, April 17, 2006, afternoon

- 1:00 PM – Demand is almost 45,000 MW. Has increased by over 2,700 MW in last hour.
- 1:45 PM – Non-spinning reserves begin to be deployed (680 MW).
- 2:00 PM
  - Demand is now 47,838 MW. Has increased by over 2,900 MW in past hour.
  - All available balancing energy is being used (including replacement reserve/OOMC capacity).
  - All regulation service being used.
  - 680 MW of non-spinning reserve deployed.
  - Frequency begins to decline.
  - ERCOT begins to contact generation owners who show more than 100 MW of unused capacity in their resource plans to request them to generate more energy.

Timeline of Events – Monday, April 17, 2006 , afternoon

- 2:10 PM – ERCOT obtains additional 500 MW of capacity from QSEs.
- 2:30 PM
  - Non-spin deployments increase to 830 MW. ERCOT reports holding remaining 400 MW due to transmission limit.
  - Frequency now hovering around 59.95 hz, but stops declining.
- 3:00 PM
  - Demand is now 50,265 MW, and has increased by more than 2,400 MW in past hour.
  - Frequency starts to decline again.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 3:25 PM – ERCOT declares EECP Step 1
  - ERCOT orders all QSEs to generate at maximum output for all generators online and orders all QSEs to bring any additional capacity possible online.
    - Unclear that any additional capacity was available. ERCOT had already contacted QSEs with significant available capacity. Balancing energy prices had also reached $599 per MWh, providing economic incentive for generators to put all available power to grid.
  - ERCOT obtains emergency assistance from the Southwest Power Pool across the DC ties. Additional 150 MW obtained in addition to 400 MW already coming across tie.
  - ERCOT obtains 30 MW in assistance from Comision Federal de Electricidad (CFE) across South DC tie at Eagle Pass.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 3:25 PM (cont.)
  - ERCOT also orders all RMR units online and generating at full capacity.
  - However, 4 RMR units representing a total of 740 MW capacity all down for planned maintenance.
- 3:30 PM
  - Non-spinning reserve deployments increased to 979 MW.
  - Frequency still declining - goes below 59.9.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 3:34 PM – ERCOT declares EECP Step 2.
  - All interruptible customers providing responsive reserves (LAARs-1,150 MW) ordered to cut usage.
    - Additional 50 MW of demand cut in addition to LAARs for total of 1,200 MW.
    - Other customers may have voluntarily interrupted prior to or after this point as they saw the high prices in the market. Austin Energy and CPS Energy air-conditioning cycling programs operating.
    - Initial indications are that all QSEs representing LAARs responded as instructed, but perhaps not all within 10 minutes required by ERCOT Protocols.
  - Transmission and distribution utilities (TDUs) instructed to reduce voltage if deemed beneficial.
    - Some TDUs did reduce voltage.
    - Consensus seems to be that any benefit is small, short lived, and may actually be counterproductive in a situation where key demands on system are air-conditioners and other motors.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 3:45 PM
  - Some regulation capability restored as interruptible customers shut down.
- 3:51 PM
  - Power Plant C trips.
    - Rated capacity of 255 MW.
    - Operating at 220 MW.
- 4:00 PM
  - Demand is 51,714 MW. Has increased 1,449 MW with 1,150 MW of interruptible demand removed from system (would have increased nearly 2,600 MW without interruptible customers cut).
  - No additional generation capacity or known interruptible load remaining.
  - For each 469 MW increase in demand/loss of generation, frequency will drop 0.1 hz. System can be operated for awhile at 59.8.
  - Frequency had recovered to 60.0 hz, but starts to fall again.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 4:01 PM– Power Plant D trips.
  - Rated Capacity – 220 MW.
  - Operating at 205 MW.
  - Temperature transmitter monitoring cooling air flow fails. Replaced with spare. Two attempts to restart fail.
- 4:04 PM– Power Plant E trips.
  - Rated Capacity – 222 MW.
  - Operating at 205 MW.
  - Possible that Plant E tripped because it attempted to pick up too much load resulting from the trip of Plant D. Initial check showed no major faults and unit restarted at 7:45 PM. Later analysis indicated an intermittent fault on generator thermocouple and transducer, plant taken back off-line to fix.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 4:08 PM – Power Plant F trips.
  - Rated capacity – 420 MW.
  - Operating at full capacity when tripped.
  - Plant F had been in maintenance outage and returned to service that day. Owner curtailed pre-operating tests, because of load conditions. Owner had been operating the unit at 300 MW to minimize risk of unit outage, and decided to attempt to ramp it to full output around 4:00 PM to meet the need for additional generation. Plant tripped shortly after reaching full output.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 4:13 PM – ERCOT declares EECP Step 4.
  - Frequency rapidly drops and falls below 59.8 hz shortly after 4:00 PM. Frequency ultimately dips as low as 59.73 hz.
  - Last time Stage 4 implemented (1989), 500 MW of rolling blackouts were ordered, and this was ERCOT's initial plan. ERCOT Shift Supervisor instead decides to order 1,000 MW cut due to deteriorating conditions.
  - 1,000 MW is allocated to Transmission and Distribution Utilities (TDUs) in accordance with their share of peak demand the prior year.
  - TDUs receiving notice to start rolling blackouts. One TDU reports they did not receive notice at this time.

Timeline of Events – Monday, April 17, 2006, late afternoon

- 4:15 to 4:35 PM.
  - TDUs who received Step 4 notice begins and complete initiation of first cycle of rolling blackouts.
- 4:17 PM- Power Plant G trips.
  - Rated capacity – 421 MW
  - Operating at 430 MW when Plant F tripped off-line.
  - Ramped to 469 MW because its controls attempted to pick up too much load after Plant F trip, causing trip.
- 4:25 PM – ERCOT Issues EECP Step 3
  - Public appeal for conservation.
  - Some regulation capability restored at this point as rolling blackouts implemented.
- 4:30 PM
  - Non-spinning reserve deployment increases to total 1,250 MW.
  - Frequency has recovered to 60.0 hz and stabilizes.

Timeline of Events – Monday, April 17, 2006 late afternoon

- 4:33 PM – Remaining TDU reports receipt of belated notice to start rolling blackouts.
- 4:40 PM – Power Plant A back on-line, but plant trips again shortly thereafter.
- 4:41 PM – Remaining TDU commences rolling blackouts.
- 5:00 PM
  - Demand is now 51,634. Has fallen 80 MW in past hour.
    - Peak Demand would have been between 53,000 and 54,000 MW had interruptible customers and rolling blackouts not been ordered.
    - 4,000 – 5,000 MW above day-ahead forecast.
- 5:15 PM– Power Plant H trips
  - Rated capacity – 81 MW
  - Operating at 72 MW
- 5:31 PM – ERCOT begins reducing amount of rolling blackouts.

Timeline of Events – Monday, April 17, 2006, evening

- 6:00 PM – Demand is now 51,067. Has fallen 567 MW in previous hour.
- 6:10 PM – Rolling blackouts end.
- 6:15 PM – ERCOT lifts request for voluntary conservation.
- 6:26 PM – Interruptible customers restored.
- 6:40 PM – Power Plant A back on line and generating around 460 MW.
- 7:00 PM – Demand is now 50,451. Has fallen 616 MW in past hour.
- 7:20 PM – EECP cancelled.
- 8:00 PM – Demand is now 48,584. Has fallen 1,867 MW in past hour.

Preliminary Conclusions on Operational Decisions

- Because of the weather conditions, rapidly escalating demand, and unavailability of generation, ERCOT operators struggled to maintain reliability starting at 2:00 PM. After 3:00 PM, conditions rapidly deteriorated.
- ERCOT operators appear to have made every feasible attempt to find additional generation and use all available reserves.
  - Further analysis into non-spin deployment is needed, but given conditions, it is unlikely this is a material issue
- Once all available options were exhausted, ERCOT operators made deliberative and decisive decisions to rapidly implement the EECP in order to preserve the grid.
- Given the continued rapid growth in demand and the utilization of all available generation and interruptible customers, it is likely that some level of rolling blackouts would have needed around 4:00 PM. If fewer plants had tripped, level of blackouts might have been smaller.
- Additional resource was automatic interruption of 5% of customer load when frequency falls to 59.3 Hz.

Preliminary Conclusions on Operational Decisions

- ***The emergency procedures and the implementation of those procedures ultimately served the exact purpose for which they were created.***

- ***ERCOT operators' decisive actions, combined with the rapid implementation of their decisions by market participants, avoided triggering 5% load shedding to prevent cascading blackout.***

- ***Emergency procedures as a whole provide protection against catastrophic cascading collapse of the ERCOT electricity grid.***

Implementation of Step 4 by TDUs

- TDUs received notice of Steps 1 and 2 in EECP.
  - Less than 1 hour between announcement of Step 1 and Step 4.
  - Several TDUs had contacted ERCOT prior to implementation of Step 4 to inquire about system status. ERCOT did not indicate an expectation of a need for action by TDUs when inquiries were made.
- TDUs, once notified of need to initiate rolling blackouts, generally implemented the procedures within a matter of minutes.
  - Some TDUs have an ability to entirely automate the rolling blackouts through electronic signals, resulting in first feeders being shut off within 2-3 minutes.
  - Others, especially those with predominately rural service areas, require some level of manual effort to implement the plan. Longest time was 45 minutes to complete first set of feeder trips.
  - One TDU has reported that they did not receive immediate notice of Step 4.

Implementation of Step 4 by TDUs

- The target to cycle feeders on and off is generally 7-15 minutes.
  - Some feeders re-tripped as they were being brought online due to mechanical failure or too much equipment turning back on simultaneously (i.e. air conditioning). This is why some customers reported more lengthy outages.
  - One TDU targets 30-45 minutes to minimize the number of customers affected and limit the potential for re-trips upon re-energization. This TDU targets a shorter period of time in winter months.

Implementation of Step 4 by TDUs

- All major TDUs have plans in place to provide notice to local media and local governmental official and emergency personnel.
  - Implementation is triggered by ERCOT's issuance of Step 3 of EECP – public appeal for conservation.
  - ERCOT's need to skip Step 3 and go directly to rolling blackouts (the correct decision), combined with the lack of other notice through the day meant the TDUs had no time to alert local officials and personnel in advance.
  - While its possible that TDU's could have triggered plans based on Step 1 or 2 notice, TDUs were legitimately concerned about "getting out in front" of ERCOT.

Balancing Energy Prices

- Because all balancing energy deployed, price hit highest bid
  - Prices normally average around $40-60 per MWh in April 2006, with peak prices around $150 per MWh.
  - Near $600 per MWh from 1:30 PM to 6:00 PM
  - Prices for those hours adjusted after the fact to between $200 and $240 per MWh pursuant to previously approved PUC mechanism.
- During shortages such as this, high prices are desirable and necessary for two reasons
  - Will provide incentive for generation owners to generate as much as possible, increasing supply.
  - Will provide incentive for customers, particularly large customers, to reduce energy consumption, decreasing demand.
- After the fact price mitigation mutes these signals because actual price that will be received is unknown at the time the power is needed. All that is known is that the price will be lower than posted price.
  - Commission is currently considering eliminating this price mitigation as part of broader process to ensure adequate new investment in capacity and to ensure adequate demand response in market in Project No. 31972, Rulemaking Relating to Resource Adequacy and Market Power

Effect of Balancing Energy Prices on Retail Customers

- It depends.
  - If retail customer has a contract where pricing is tied to balancing energy price, customer will see full effect of high prices.
    - Customer also gets benefit of relatively low prices in times of excess supply.
    - Customer has chosen risk level.
    - Customer has incentives to reduce consumption during periods of high prices.
  - If retail customer has fixed price contract, customer will not be affected by high prices.
    - Customer has chosen to limit risk.
    - If customer's REP has sufficient supply under contract, REP will not be affected either.
    - If customer's REP has not acquired sufficient supply, REP will bear increased cost.
  - There is a continuum of pricing options between these two extremes.

Reserve Margins

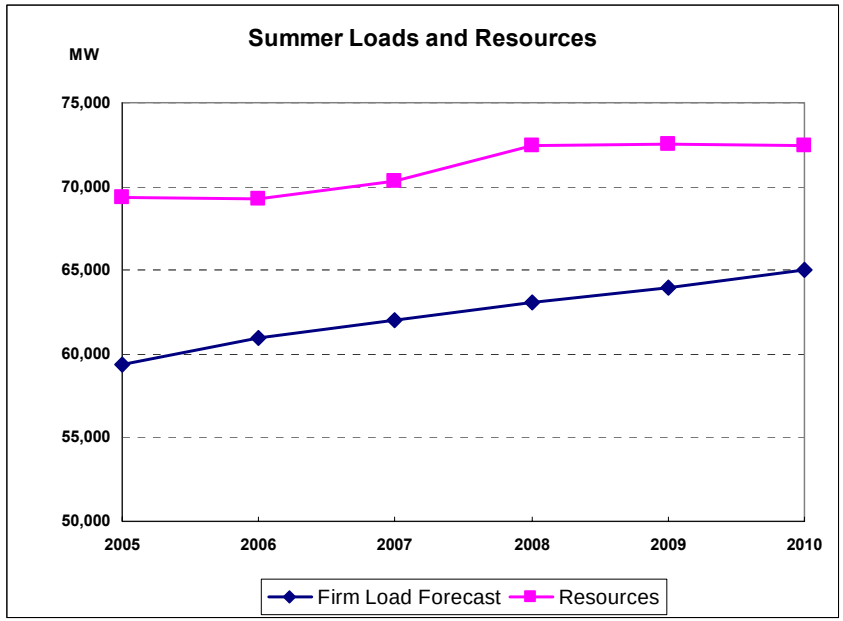
- Important to distinguish between ‘planning reserves’ and ‘operating reserves’.
  - Planning reserve analysis looks at summer peak period. Assumes some level of unplanned outages, but no maintenance outages.
  - Operating reserves represent actual available capacity on any given day.
  - As shown on April 17, a large reserve margin may not say much about actual operating reserves if a large amount of plants are unavailable due to planned maintenance.

Planning Reserve Margins

- Each year, ERCOT updates its forecast of expected peak reserve margins for current summer and next five years.
- ERCOT currently updating forecast for 2006-2011.
- Last year's analysis suggested more than ample reserves for summer 2006.

Planning Reserve Margins

- Expected Summer reserve margins from last year's study
  - 2006 – 13.6%
  - 2007 – 13.4%
  - 2008 – 14.8%
  - 2009 – 13.4%
  - 2010 – 11.4%
- Margins may be greater or less than these depending on actual return to service of mothballed plants.
- Does not incorporate recent TXU announcements.



Communications by ERCOT to Market

- Because load forecasts and resource plans continued to indicate that sufficient capacity would be available, ERCOT issued no notices, alerts, or advisories to market prior to implementation of EECP.
- Beginning at 2:00 PM, ERCOT made informal attempts to contact QSEs to request additional capacity be made available, but ERCOT's concerns about ability to meet demand was not made widely known.
- These informal efforts, combined with rapidly escalating demand, made it very likely that ERCOT would move quickly from Step 1 to Step 2.
  - Market prices, (ignoring possible effects of mitigation) also likely resulted in most, if not all, available generation being made available prior to Step 1 being implemented.
  - Only major additional capacity available was emergency assistance over DC ties.

Preliminary Conclusions on Communications to Market

- Additional notice to market of possibility of shortages of capacity would have been desirable.
  - Some QSEs became aware of problems around 2:00 PM, but most had no notice until Step 1 of EECP implemented at 3:25 PM. TDUs not aware of any problem until 3:25 PM, even though several inquired when they saw frequency fluctuations.
  - Notice that day-ahead load forecast was significantly off could have been made much earlier in day, even though analyses continued to show enough capacity.
- Current communications plans do not contemplate rapid movement through EECP steps.

Notice to Public

- Conditions on grid also made it very likely that ERCOT would move quickly from Step 3 to Step 4.
  - Step 3 appears to be triggered by declining frequency.
  - Insufficient time for public call to have any meaningful effect on consumption quick enough to avert Step 4 with rapid increase in demand still occurring.
  - ERCOT does not believe that it has the primary responsibility of notifying local customers, media and agencies.
    - ERCOT reported that many media personnel required basic information about who ERCOT is and how the market works before they could understand importance of Step 3 notice.

Preliminary Conclusions Regarding Communications to Public

- ERCOT fails to recognize that it has a tremendous responsibility to the public to provide timely notice of emergency conditions because of it has the best and most timely information available.
- ERCOT fails to proactively reach out to media to ensure that media understands EECP Steps and what ERCOT's role in market is
- New, more comprehensive process of alerts on system conditions needed.
  - Combination of "top-down" notice from ERCOT/PUC and "bottom-up" notice from local TDUs will be more effective than current system.

Notice by ERCOT to Governmental Authorities and Policymakers

- EECP Step 1 Declared at 3:25 PM
  - Situation had been deteriorating since 2:00 PM.
  - ERCOT does not appear to have attempted to contact Commissioners or Executive Director until after Step 2 had already been declared.
  - PUC became aware of declaration of Step 4 when PUC Staff member contacted ERCOT to inquire about details of implementation of Step 2. ERCOT contacted Executive Director around same time.
  - It appears ERCOT Board of Directors notified at 8:30 PM. Chairman of Board indicates that he was notified at Steps 2 and 4.
  - Governor's office, Lieutenant Governor's office, Chairman King's office, and Chairman Fraser's office notified morning of Tuesday April 18th.
- ERCOT reluctant to discuss unplanned outages with PUC.
  - ERCOT's Manager of Governmental Affairs did not have information readily available to assist PUC staff in assessing likely conditions on Tuesday.
  - Asserted confidentiality of information.

Preliminary Conclusions on Communications with Governmental Authorities and Policymakers

- ERCOT must be more proactive in informing the PUC of system conditions.
- Senior ERCOT personnel continue to be uninformed regarding PUC rule requirements.
- It is critical that PUC be kept informed of system conditions instead of having to ask the right question at the right time.
  - Within minutes of the Executive Director learning of implementation of the EECP, the PUC contacted the Governor's office and key legislative leaders.
  - The PUC issued a notice through the State Operations Center on Tuesday morning of ERCOT's expectation that additional rolling blackouts were unlikely, but highlighting the need for conservation in the afternoon.
    - A similar notice could have been issued Monday had the PUC received adequate notice from ERCOT.

PUC Interim Actions

- As of Thursday, April 20, PUC requires ERCOT to provide information by 7:00 AM, 12:00 PM , and 3:00 PM on:
  - Expected demand
  - Expected generation availability
  - Likelihood of implementation of EECP
  - Changes in load forecast, generation, and unplanned outages.
- PUC implementing comprehensive system of alerts through SOC.
  - This notice goes to every city's emergency management coordinator, mayor, law enforcement agency, and fire department in addition to DPS officers, county commissioners, county judges, and all state agencies.
  - Notice of blackouts through this system will allow cities and counties to implement emergency plans, open heat relief shelters, allocate police accordingly, etc.
  - The PUC could had issued such a warning Monday had adequate notice been given.
  - Proper notice from ERCOT is the critical trigger.

This is an Alarmingly Persistent Problem with ERCOT

- Failure by ERCOT to notify PUC of employee/contractor fraud
  - Commission passed rule requiring ERCOT to immediately notify Executive Director of PUC of ***any*** event or situation that could reasonably be anticipated to affect:
    - Reliability
    - Settlement or accounting
    - Customer registration functions
    - Public confidence in ERCOT

PUC Oversight of ERCOT

- 79th Legislature passed SB 408 by Fraser
  - "An independent organization certified by the commission is ***directly responsible and accountable*** to the commission. ***The commission has complete authority to oversee and investigate*** the organization's finances, budget, and operations as necessary to ensure the organization's accountability and to ensure that the organization adequately performs the organization's functions and duties. ***The organization shall fully cooperate with the commission in the commission's oversight and investigatory functions.*** The commission may take appropriate action against an organization that does not adequately perform the organization's functions or duties or does not comply with this section, including decertifying the organization or assessing an administrative penalty against the organization. The commission by rule shall adopt procedures governing decertification of an independent organization, selecting and certifying a successor organization, and transferring assets to the successor organization to ensure continuity of operations in the region."

PUC Oversight of ERCOT

- After passage of the PUC's rule and SB 408, ERCOT fails to notify the PUC of a major outage of the customer registration system the last week of December 2005.
  - Commissioners find ERCOT is in non-compliance with PUC rules and issue sanction letter to ERCOT directing ERCOT to comply with PUC rules.

PUC Oversight of ERCOT

- Preliminary conclusion is that ERCOT has again failed to comply with the PUC's rules regarding notice to the Executive Director of the Commission.
- Possible actions include:
  - Requiring detailed plan by ERCOT discussing how ERCOT intends to prevent additional non-compliance
  - Recommendation for Administrative Penalties

Preliminary Recommendations

- ERCOT should re-examine its load forecasting methodology.
  - Previously recommended by PUC's wholesale market monitoring consultant because ERCOT's load forecast error exceeds that of other ISOs/RTO.
- ERCOT should re-evaluate the EECP procedures to determine if additional notices of system conditions should be given to market and public and to evaluate the timing of notices.
- ERCOT should develop internal communications procedures to ensure that ERCOT officers and Communications Department are aware of situations or events in a timely manner.
- ERCOT should develop comprehensive communications plan to proactively inform the PUC and other governmental officials, as appropriate, of major events or situations as they arise.
- ERCOT should examine planned generation outage process – especially coordination of outages of RMR units
- Depending on how EECP procedures are revised, TDUs should consider notice of EECP Step 1 or 2 as the appropriate trigger for notice to local officials.

Main Areas of Focus for Comprehensive Investigation

- Development of complete timeline of events for April 17.
- Examine ERCOT's load forecasting methodology and identify areas of improvement.
- Full review of ERCOT's emergency procedures and implementation on April 17.
  - Whether or not all ancillary services were appropriately acquired and utilized (e.g. non-spin deployments)
  - Whether or not ERCOT should have implemented EECP Step 1 earlier instead of making informal efforts to secure additional capacity
  - Whether or not EECP procedures need modification
  - Whether or not one TDSPs was properly notified of EECP Step 4
  - Whether or not ERCOT complied with PUC rules regarding notice of events or situation related to reliability.
  - Development of comprehensive notice system utilizing resources at SOC

Main Areas of Focus for Comprehensive Investigation

- Full review of market participants' compliance with PURA, PUC rules, ERCOT Protocols, and ERCOT Operating Guides
  - Whether or not QSEs maintained accuracy of their resource plans submitted to ERCOT
  - Whether or not QSEs provided proper notice of planned and unplanned outages
  - Whether or not QSEs provided ancillary services when called upon
  - Whether or not all LAARs responded within time frame provided by Protocols
  - Whether or not there were additional load resources (such as non-awarded LAARs) that were willing to be interrupted
  - Whether or not TDUs appropriately implemented Step 4 of EECP
  - Identification of best practices among TDUs on implementation of Step 4 of EECP and notice to public
  - Complete analysis of all types of interruptible load utilized on April 17 (LAARs, passive load response, air-conditioning cycling programs, etc.)

PUC Activities after Receiving Notice

- Monday, April 17
  - PUC becomes aware of emergency conditions after interruptible customer ordered to shut down late afternoon.
  - PUC discovers that rolling blackouts have been ordered after a PUC staff member contacted ERCOT regarding the interruptible customers.
  - After PUC Commissioners and Executive Director are informed, PUC contacts Governor's office and key legislative leaders' offices
  - PUC contacts companies that had unplanned outages to determine causes and likelihood of return to service on Tuesday
  - PUC begins to identify areas of investigation
- Tuesday, April 18
  - PUC in contact with ERCOT and market participants to ascertain likelihood of need for rolling blackouts on Tuesday afternoon
  - PUC issues advisory through Governor's Division of Emergency Management that ERCOT believed no curtailments would be necessary, but requesting conservation between 3pm and 7pm
  - Received Chairman Fraser's request for investigation/results for April 25, 2007 hearing
  - Planning of investigation, preparation of initial information requests from ERCOT

PUC Activities after Receiving Notice

- **Wednesday, April 19**
  - Finalize plan for investigation and staffing
  - Issue information request to ERCOT
  - Begin investigation
- **Thursday, April 20**
  - Issue request for daily reports on generation adequacy for day/status reports from ERCOT
  - Interview with ERCOT CEO, COO, Director of System Operations, and Manager of Governmental Affairs and Communication
  - Preparation of information requests from transmission and distribution utilities
- **Friday, April 21**
  - Meeting with major transmission and distribution utilities to discuss events of April 17, implementation of Stage 4
- **Saturday April 22-Monday April 24**
  - Preparation of Preliminary Report to Senate Business and Commerce Committee