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2006 IRP Technical Workshop
Load Forecasting

Tuesday, January 24, 2006
9:00 am – 3:30 pm (Pacific)

Meeting Summary

Idaho	Teri Carlock (IPUC)
Oregon	Ming Peng (OPUC), Bill Wordley (OPUC)
Utah	Abdinasir Abdulle (UDPU), Andrea Coon (UDPU), Nancy Kelly (CCS)
Washington	Yohannes Mariam (WUTC), Hank McIntosh (WUTC)
Wyoming	Don Biederman(WPUC)
Regional	Don Hendrickson (Energy Strategies)
PacifiCorp	In Portland: Michael Liljenwall, Betty Reed, Reed Davis, Pete Eelkema, Glen Booth, Irene Heng, Teri Ikeda In Utah: Michael Rife, Kevin Cline, Wil O'Shea

The objectives of this technical workshop were to present PacifiCorp's preliminary industrial sector load forecast, describe how the Company derives its hourly load forecast, and present results from recent price elasticity studies. This is the third and last load forecasting workshop presented for the 2006 Integrated Resource Plan[1]

PRELIMINARY INDUSTRIAL SALES FORECAST

Slides showing state average annual growth rates for the actual 1997-2004 year and forecasts years 2007-2017 were the foundation of the presentation for comparative purpose. PacifiCorp did not have complete data for the 2005/2006 years as with other years. Much of the discussion and many of the comments concerning the industrial forecast where first to understand why the data was showing up as it was shown (i.e. Positive / Negative) or why these particular variables were shown to have a explanatory significance versus other variables. Some good suggestions were made included taking out key or major customers to understand their impact on that sector within

[1] The workshop held on August 3, 2005 focused on the preliminary residential sector forecast and associated modeling system, as well as the national/state economic outlook. The workshop held on October 5, 2005 addressed the preliminary commercial sector forecast and supporting modeling system, and summarized PacifiCorp's comparison of state and Company-assumed economic forecast drivers.

the jurisdiction. During this analysis many of the variables discussed were not shown because they did not show up as significant.

Some sectors did not have state level data from Global Insight, Inc. so national or regional data was used where possible. Often natural gas or electricity price forecasts were used to assist in explaining the particular sector. A participant suggested that PacifiCorp include oil prices (National or International) since they could have impacts on some large industrial sectors. A request was also made to report the dates of the Global Insight forecasts used in the industrial models.

Major events in particular sectors were analyzed with additional focus using variables that explain the changes. An example was the reclassification of US Magnesium from SIC 28 to SIC 33 in July 2002 (Slide 12), so a year-by-year comparison of MWh between 2002 and 2003 identified this change in the forecast. Additionally some sectors within states only had a limited number of variables to work with to explain the changes in the forecast.

Utah Forecast
Since Utah was the first jurisdiction covered more time was spent going over the structure, content and outcomes of the model. All other states were setup in the same structure.

Mining: Uinta Basin coal usage in the Mountain #1 region (which includes Utah) was one of the explanatory variables in this model. The coal forecast was performed by Global Insight. Interested parties asked PacifiCorp to look into how Global Insight prepared the coal usage forecast.

An industrial production index (IPI) for Utah's Food and Kindred Products sector was not included in the Global Insight's forecast. The national IPI for this sector was tried in this model, but did not prove to be statistically significant. The best explanatory variables for this sector turned out to be region-specific natural gas and electricity prices for industrial users, as well as Utah's household growth. Household growth was added due to suggestions made in the meeting.

Petroleum and Coal Products: Global Insight did not do a forecast for Utah's IPI for this sector, so the national forecast for this sector's IPI was used. Most of UT coal is used for generation.

The Other sector includes all other industrial sectors and was not broken down any further even though it was 13% of the forecast.

Oregon Forecast
Overall, the results indicated that the decline in sales, driven by lumber and paper industries, appears to have bottomed out and long-term growth, driven by food, metals, and other industries such as glass. While the paper sector is expected to remain basically flat, the lumber sector is expected to exhibit slight growth. One comment pointed out the remaining technological inefficiencies that may remain within the lumber and paper industries. While, future sales will be monitored for this and other down-side risks, current expectations support the model results.

Wyoming Forecast
In this state, the forecast for oil & gas is assisted by forecasts generated by customers in that industry. Wyoming's industrial forecast has a particular impact on the overall state forecast due to the size of the industries located in Wyoming. Another difference is that there is an East and West split of the industrial customers within the forecast. Forecast numbers were also influenced by one to very few large customers such as in the Petroleum sector where PacifiCorp had one large petroleum refinery. A participant recommended that for the Eastern Wyoming Petroleum Refining sector, PacifiCorp check to see if oil prices are a significant driver of sales for this sector.

California, Idaho and Washington Forecast
As these were similar to the other forecasts slides there were not many questions specifically concerned with these slides.

In summary, PacifiCorp received many useful suggestions and comments on alternative variables to consider, presentation of data for future workshops, reporting of additional statistical tests, and how certain large customers affected a particular sector.

HOURLY LOAD FORECAST

PacifiCorp next portion of the workshop covered the Hourly Load Forecast. This presentation discussed the shaping of the load forecast and what variables drive the shape. The forecasted drivers had a measurable weather responsiveness that can be used in forecasting of the different jurisdictions. Again Wyoming was split into an East and West forecast. PacifiCorp first started by asking the public to help us decide between the two ways of looking at temperature (pick temperature and deviate from season or pick the season and see temperature deviate). Up to a 15% difference in the outcomes is possible depending on which temperature method was used in the model. PacifiCorp's Load Forecasting Team question to the public: Do you pick temperature and deviate from season or do you pick the season and see temperature deviate?

When reviewing the slides on primary variables and statistics for each state it was helpful to know that the Coefficient variables shown as positive reflect more A/C loads while negatives reflect more lighting loads.

General Model Specification by Jurisdiction
This part of the presentation was devoted to discussing the primary variables and statistics for each jurisdiction and how weather responsiveness varied the loads. The statistics would show the coefficient, t-value, and P-value for each of the relevant variables. R-squared values were shown for each model. Each jurisdiction had an explanation on the amount of megawatt difference if temperature varied by so many degrees. Some jurisdictions had little affected which was attributed to dominant industrial customers in that region.

Forecast Process
The Forecast Process gave an overview of the main portions of how the company looked at the details and compared it with the other models output. Two main topics were discussed one being the moving average and the other was Load Shape Adjustments. The moving average was discussed in terms of Oregon and Utah growth in hourly demand. The Load Shape Adjustments first broke out into seasons and then the day was broke down into heavy load, super peak and light load. Growth rates were provided for Utah and Oregon at these different load shape adjustment periods.

PacifiCorp had broken down the calendar into seasons and some participants were trying to understand how this was done. PacifiCorp had to use trial and error and by reviewing the shape of the forecast curves to arrive at the seasons.

Another participant asking about "True Up" of the forecast in energy and if there is an adjustment made, PacifiCorp replied that an adjustment is performed.

Improvements in the Process
PacifiCorp next discussed how additional models were added for years and for jurisdictions to help improve the granularity of the modeling and account for weather-related variability. Improvements increased the flexibility to analyze data.

Peak Demand and Jurisdiction Contribution Results
The main focus of the hourly load forecast presentation was to describe the overall historical and forecasted growth rates for each jurisdiction, targeting differences between weather adjustments, actuals and projections in different peaking categories. The peaking categories included winter and summer on a coincident peak basis. Additionally, PacifiCorp pointed out the major influences to changes in growth rates and which sectors have changed comparatively to the past.

As an aside, PacifiCorp asked participants if a presentation on how line loss estimates are prepared by the Company would be useful. The Company explained that an official line loss study is conducted every ten years. The latest study, conducted in 2001, was used for the 2004 IRP. The response was positive; participants agreed that more discussion on the estimation and use of line loss data would be valuable.

PRICE ELASTICITY

Price Elasticity in Current Models
PacifiCorp briefly summarized the use of price elasticities in its Residential and Commercial models. The value currently input into REEPS and COMMEND is about -0.1. It was also noted that real electricity price is not expected to grow faster than inflation. A participant questioned the applicability of an elasticity value when customers only see rate increases as the outcome of a rate case every two to three years. PacifiCorp responded that the Company has taken a look at this price shock effect.

Econometric Elasticity Calculations
PacifiCorp presented the results of an econometric price elasticity calculation that modeled Utah Residential customers on an annual basis over the past 23 years. Some of the variables, including price elasticity, were not statistically significant. However, the long term and short term elasticity terms were presented as -0.05 and -0.09, respectively.

Participants then discussed to what degree the elasticity study data was able to incorporate accurate price signals for customers. Issues raised included the impacts of postulated rising real prices, rate structure, and customer behavior at times of peak demand. PacifiCorp mentioned that studies on the distribution symmetry of elasticity were conducted and can be shared with participants. In response to a suggestion to analyze the impact of rate structure on demand response, PacifiCorp stated that it is difficult to separate out rate structure impacts, such as distinguishing the air conditioning reduction attributable to a DSM program such as Cool Keeper versus reductions in general. In response to participants' recommendation to study elasticity at peak demand, PacifiCorp responded that only monthly consumption is available from billing data; analysis of peak use is contingent on having Time of Use (TOU) rates and the supporting metering systems such as in California. However, one participant reported having a California study suggested that customers respond to large price increases. PacifiCorp agreed to distribute this study to all IRP participants after it was supplied to us by the IRP participant who mentioned the report..

In conclusion, the Company stated that the long term elasticity is still valid, only that shifting revenues from peak to off-peak periods is not captured.

Price Reaction of Customers Who Called About the Rate Change
PacifiCorp presented a comparison of recent to past usage patterns of Utah residential customers who have called to file a complaint regarding price increases in 2004. The intent was to find customers who were likely to be price sensitive in their usage. Of about 77 callers identified, 13 had sufficient data for the analysis. The model results indicated no significant elasticity and visual inspection of the graphed average use suggested little change in behavior. A participant recommended contacting the Utah DPU for additional customer complaint data since only unresolved complaints are forwarded to the Company. This may yield additional customers to match with monthly usage data, thereby, increasing the sample size for the analysis. *PacifiCorp Follow-Up:* PacifiCorp has contacted the DPU and is waiting for a response.

Elasticity Among Customer Sub-Groups
PacifiCorp presented the results of a two-part study of the elasticity of about 136,000 Utah Residential customers. In the first part, cluster analysis was used to discover sub-groups within the sample that were more price elastic than the overall sample. This analysis resulted in 500 total clusters. Of these, the Company used 23 clusters because they had a significant number of members in the cluster. The price elasticity for the average use of each of the 23 clusters plus a roll-up group of the smaller clusters was calculated. The results indicated two of the clusters had significant price elasticity values; the customers in these clusters represented about 2% of the total sample. The clusters were of medium-sized residential customers; it appeared that groups of large customers and of small customers did not produce any elastic clusters. Individual clusters'

elasticity values were weighted and combined yielding an overall elasticity of -0.036. A participant asked if lowering the significance number cut-off used to select the 23 clusters, a minimum of 500-customer per cluster, would change the results, and suggested doing some sensitivities using alternative cutoffs.

Potential Further Research

In summary, PacifiCorp believes that currently modeled elasticity values appear supported by these latest elasticity study results. PacifiCorp asked participants what other elasticity issues the Company should investigate for further study. A participant suggested investigating how Cool Keeper program customers respond to the program. PacifiCorp responded that this could be a good item to include in its next customer survey. PacifiCorp stated that it will consider further elasticity research when sufficient data become available.

NEXT STEPS

PacifiCorp's next Technical Workshop Meeting, devoted to renewables, is scheduled for February 10th.