

Do Day-Ahead Electricity Prices Reflect Economic Fundamentals?:

Evidence from the California ISO

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This paper presents a novel test of the informational content of day-ahead electricity prices. It is hypothesized that if day-ahead markets for electricity are efficient, then the day-ahead prices will reflect the processed information and expectations of all market participants regarding the next day's electricity load and thus the prices may be useful in actually predicting the next day's load. We test this hypothesis using data for the PG&E aggregation area in the California ISO (CAISO). The results provide evidence of a positive and significant relationship between the hourly day-ahead electricity price (relative to the natural gas price) and the subsequent actual hourly load. The reported relationship is sufficiently robust to produce a

forecast based on the day-ahead hourly price relative to the price of natural gas, some binary variables, and a number of estimated ARMA disturbances that is considerably more accurate than the ISO's day-ahead forecast. This improvement in the forecast accuracy is readily apparent if one compares Figure ES1 with Figure ES2. Specifically, the vertical band of the scatter diagram is much smaller under the ARMA based forecast. Over the one-year evaluation period, the root-mean-squared-error (RMSE) of CAISO's day-ahead forecast was about 4.06 % of the mean load; the error was about 1.33 % using this paper's methodology.

It is fair to presume that most of the improvement in forecast accuracy can be accounted for by the ARMA terms. Indeed, significant improvements in forecast accuracy can be achieved with a number of other ARMA specifications. The salient point for our purposes is that regardless of the ARMA process modeled and the consequent time series pattern of residual autocorrelations, the statistically significant positive relationship between the day-ahead price variable and actual load remains robust supporting the proposition that day-ahead prices reflect economic fundamentals.

These findings have implications for load forecasting even in the absence of a day-ahead market for electricity. For example, it should be possible to enhance the forecast accuracy of a conventional forecast using the ARMA methods presented in this paper. The findings also have implications for energy policy. The benefits of the Smart Grid cannot be achieved merely by installing smart meters. Consumers also need to face prices that reflect economic fundamentals. The findings of this paper suggest that the CAISO's day-ahead wholesale prices meet this requirement.

Figure ES1. CAISO's Day-Ahead Forecasted and Actual Load for the PG&E TAC, 1 April 2010-31 March 2011.

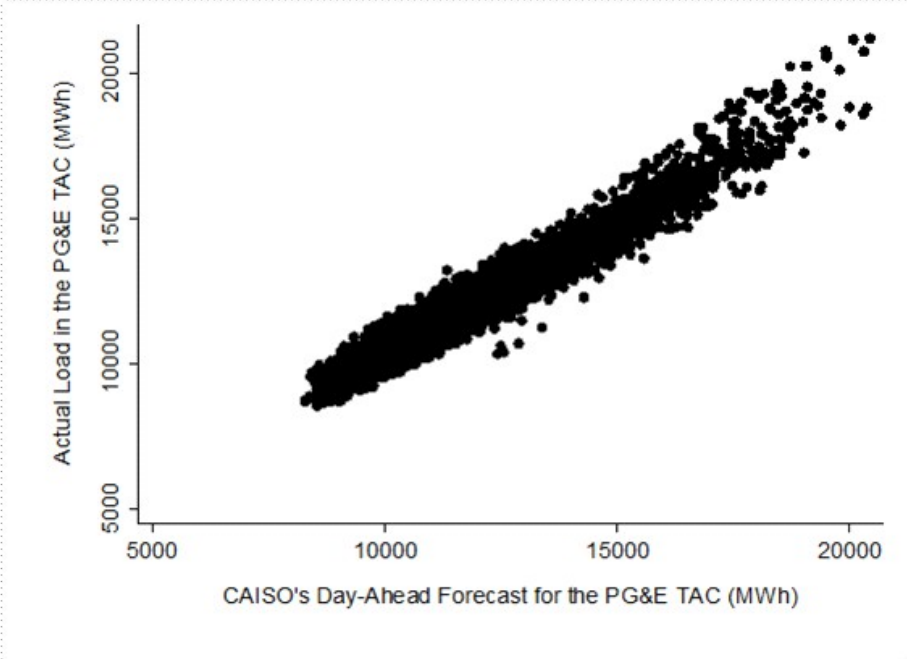


Figure ES2. Actual Load and the ARMA Based Forecasted Load for the PG&E TAC, 1 April 2010 – March 31 2011

