



**Memorandum from the Office of the Inspector General**

January 17, 2013

Robert Irvin, WT 9C-K

**FINAL REPORT – EVALUATION 2012-14507 – REVIEW OF TVA'S LOAD FORECAST RISK**

As part of a series of reviews to evaluate the Tennessee Valley Authority's (TVA) actions to address key risks, we evaluated TVA's load forecast risk. Load forecast was identified as a top five strategic business unit risk in the Long Range Planning Process Risk Category in fiscal year (FY) 2011. The results of our review are shown in the table below.

<b>Risk: Load Forecast Risk</b>		
<b>Risk Information</b>	<b>Mitigation</b>	<b>Our Assessment</b>
<p><u>Definition:</u> Poor forecast would contribute to added uncertainty in budgeting, capacity, and generation planning.</p> <p><u>Probability of Occurrence:</u> Even Odds.</p> <p><u>Consequence:</u> Major.</p> <p><u>Risk Owner:</u> Senior Manager, Economic Load &amp; Revenue Forecast (EL&amp;RF).</p>	<ul style="list-style-type: none"><li>Completion of Demand &amp; Energy Model Enhancements.</li><li>Contracted with the University of Tennessee Knoxville, Center for Business &amp; Economic Research (UTK Center) to provide regional economic forecasting.</li><li>The load forecasting staff is regularly implementing updated weather constants and normals, which should reduce the load forecast variance related to weather.</li></ul>	While EL&RF has taken and is taking actions to mitigate risk associated with load forecasting, we found opportunities exist to improve the mitigation strategy documentation. The documented mitigation strategy does not reflect planned actions to improve data integrity or the regular updates to the forecast models and economic drivers. Additionally, we found mitigations are generally designed appropriately. However, we noted EL&RF does not have any compensating controls to prevent inadvertent modifications to data until the Demand & Data Consolidation Process is completed.
<p><u>Recommendations:</u></p> <p>We recommend the Senior Vice President, Strategy, Financial Planning &amp; Business Development, (1) enhance the load forecast documented mitigation strategy to include the mitigations planned or already occurring but not listed as part of the strategy and (2) implement measures to reduce the likelihood of inadvertent modifications to data until the Demand &amp; Data Consolidation Process is completed.</p>		

TVA management agreed with our findings and recommendations and has taken actions to address them. See the Appendix for TVA's complete response.

## **BACKGROUND**

Load forecast has been identified in the TVA Enterprise Risk Management (ERM) program as a risk since 2010. According to TVA, ERM is a systematic process to facilitate business unit identification of risk, consistency in their analysis and communication throughout TVA, such that TVA can determine whether or not the risks should be avoided, accepted, or mitigated with a risk management plan. TVA also states that ERM is an ongoing and evolving process to protect the value of the enterprise and realize opportunities for stakeholders by promoting the efficient and effective management of risk.

According to TVA, load forecasting is an estimate or a prediction of how much electricity will be needed by the Valley's residences, companies, and other institutions in the future. TVA's EL&RF group uses inputs such as weather, historical load data, appliance saturation and efficiencies, current rates and products, as well as sources such as *Moody's Outlook* and *The University of Tennessee's Regional Outlook*<sup>1</sup> to generate their load forecasts.

In FY 2011, load forecast was identified as a top five strategic business unit risk in the Long Range Planning Process Risk Category. TVA states that a poor forecast would contribute to added uncertainty in budgeting, capacity, and generation planning. Since 2011, TVA's risk map<sup>2</sup> has shown the probability of this risk occurring at "even odds" and the consequence as "major," which results in a risk rating of "medium."

The load forecast risk rating, probability, and consequence information has not changed since fourth quarter 2010. Between the second and fourth quarters of 2010, the probability of occurrence moved from "very likely" to "even odds." Since fourth quarter 2010, the rating has remained "medium," probability of occurrence at "even odds," and consequence as "major." In fourth quarter 2012, the load forecast risk was combined with the revenue and financial forecasting risks into one. The combined risk rating has a probability of occurrence of "even odds," and consequence as "major."

While EL&RF is taking steps to mitigate the risk, according to the Senior Manager, EL&RF, due to the nature of forecasting there will always be a level of uncontrollable risk and uncertainty of outcome. According to TVA, a load forecast is uncertain because (1) there is uncertainty related to future values of key variables that drive the forecast, and (2) interactions between key variables and their impacts on future electricity consumption are uncertain and change over time. While there is uncertainty in forecasting, TVA tracks forecast accuracy to ensure the usefulness of the forecasts and develops a range of forecasts to correspond to different load scenarios. Currently, EL&RF has a load forecast variance target of 1.3 percent or lower. Over the last 12 years, the load forecast variance was greater than the 1.3 percent threshold four times.

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<sup>1</sup> TVA has contracted with the University of Tennessee to provide a regional economic forecasting report.

<sup>2</sup> A risk map is a two-dimensional graphical tool used to illustrate point estimates of risks. Each mention of the risk map throughout this report refers to the draft version.

To estimate load forecasts, TVA uses both econometric<sup>3</sup> and end-use models.<sup>4</sup> The long-term forecast is designed to estimate TVA region growth in demand for electricity in terms of both electricity sales to the end user and peak demands those end users place on the TVA system 20 to 25 years into the future. The short-term forecast is the monthly system peaks and energy used in the monthly generation plan and revenue forecast for up to 36 months.

### **OBJECTIVE, SCOPE, AND METHODOLOGY**

As part of a series of reviews to evaluate the TVA's actions to address key risks, we evaluated TVA's load forecast risk. The objective of this review was to evaluate TVA's load forecast risk to identify opportunities to improve mitigation strategies and assess whether mitigation strategies are designed appropriately to address the identified risk. The scope of this review included the load forecast risk and the mitigation plans for this risk. We considered ongoing activities and efforts to mitigate the load forecast risk from 2010 through the end of FY 2012.

To achieve our objectives, we:

- Identified and reviewed applicable policies and procedures related to load forecasting to gain an understanding of the forecasting process including TVA's Integrated Resource Plan and TVA's Long-Term Load Forecasting Process.
- Reviewed historical load forecast risk summaries to determine if the risk rating has changed since the risk was identified.
- Interviewed applicable TVA personnel including the load forecast risk owner, EL&RF personnel, and load forecast users to determine what steps are being taken to mitigate TVA's load forecast risk and the results of the mitigations.
- Reviewed monthly variance reports from September 2011 through August 2012 to verify that weather constants and normals are being updated.

This review was conducted in accordance with the *Quality Standards for Inspection and Evaluation*.

### **FINDINGS**

While EL&RF is taking actions to mitigate risk associated with load forecasting, we found opportunities exist to improve the mitigation strategy documentation. The documented mitigation strategy does not reflect planned actions to improve data integrity or the regular updates to the forecast models and economic drivers. Additionally, we found mitigations are generally designed appropriately. However, we noted EL&RF does not have any compensating controls to prevent inadvertent modifications to data until the Demand & Data Consolidation Process is completed.

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<sup>3</sup> Econometric models link electricity sales to key economic factors in the market such as the price of electricity, the price of competing energy source options, and the growth in overall economic activity.

<sup>4</sup> End-use models are used to measure how much energy will be consumed by given end uses such as residential air conditioners, office lighting, and industrial motors.

EL&RF has taken and is taking actions to mitigate the load forecast risk. Since 2011, the risk management initiative to reduce the probability of occurrence has been “implementing updated weather constants and normals<sup>5</sup> that should reduce the load forecast variance related to weather.” EL&RF’s actions to address the risk included Demand & Energy Forecast Model Enhancements and a three-phase Demand & Energy Data Consolidation Process. The Demand & Energy Forecast enhancements were completed in 2011 to develop a better hourly load model. The Demand & Energy Data Consolidation Process is ongoing and funded through FY 2013 but is not expected to be completed until FY 2014. According to the Senior Manager, EL&RF,<sup>6</sup> another action TVA took to reduce the consequence of the risk was to contract with the UTK Center to provide regional economic forecasting. TVA incorporated this regional economic outlook for the first time in 2011 and plans to continue using the UTK Center in the future.

In addition, EL&RF is updating the weather constants and normals as stated in their mitigation strategy. We reviewed monthly variance reports for the twelve-months ending August 2012 to verify the weather constants and normals were updated. We found weather constants and normals for that time period were updated monthly. We also found weather normals were recalculated to reflect new available weather data in 2011.<sup>7</sup>

While EL&RF is taking steps to mitigate risk associated with load forecasting, we found opportunities exist to improve the mitigation strategy documentation. In addition to updating weather constants and normals, EL&RF is mitigating the load forecast risk with actions such as updating forecast models and economic drivers. According to the Senior Manager, EL&RF, models and economic information are updated on a regular basis to improve forecasts. These actions are currently performed as part of the load forecast process to improve the accuracy of future forecasts; however, these actions are not documented as part of the mitigation strategy.

Another key aspect of load forecasting is the data. According to EL&RF, reliable and well-controlled data is essential for all aspects of the economic load and revenue forecasting life cycle. Data is currently pulled from multiple sources (such as e-mails, downloaded from shared drives, etc.,) and then this data, as well as data created by calculations, is stored in spreadsheets and databases but not all together in a structured or controlled data base. According to EL&RF, the Demand & Data Consolidation Process will address this issue and should reduce errors, make information more reliable and lessen dependence on any single person. The Demand & Data Consolidation Process is currently not included as part of the documented mitigation strategy.

Although we found mitigations were generally designed appropriately to cover load forecast risks, one gap was identified. Currently EL&RF does not have any compensating controls to prevent inadvertent modifications to databases until the Demand & Data Consolidation Process is completed in FY 2014. According to the Senior Manager,

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<sup>5</sup> Weather normalized constants are values used to estimate the impact of non-normal weather on measured loads. Weather normalization removes the impacts of abnormal weather from historical energy data.

<sup>6</sup> The Senior Manager, EL&RF, serves as the load forecast risk owner.

<sup>7</sup> EL&RF recalculates weather normals every 5 years to reflect new available weather data. Peak constants are updated annually, and energy constants are updated monthly.

Robert Irvin  
Page 5  
January 17, 2013

EL&RF, load forecast models and spreadsheets are not protected. This presents opportunity for inadvertent data modifications that could result in inaccurate forecasts.

### **RECOMMENDATIONS**

We recommend the Senior Vice President, Strategy, Financial Planning & Business Development:

- Enhance the load forecast documented mitigation strategy to include the mitigations planned or already occurring but not listed as part of the strategy.
- Implement measures to reduce the likelihood of inadvertent modifications to data until the Demand & Data Consolidation Process is completed.

**TVA Management's Comments** – TVA management agreed with the findings and recommendations in the report. In response to our recommendations, the Senior Vice President, Strategy, Financial Planning & Business Development, has (1) updated the risk mitigation sections of the load forecast risk summary to include activities related to updating information and models on a regular basis and (2) limited access to current economic, load, and revenue forecasting staff. See the Appendix for TVA's complete response.

**Auditor's Response** – The Office of the Inspector General concurs with the completed actions.

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Your written comments, which addressed your actions taken, have been included in the report. No further action is needed at this time. Information contained in this report may be subject to public disclosure. Please advise us of any sensitive information in this report that you recommend be withheld.

If you have any questions or wish to discuss our observations, please contact Kristin S. Leach, Auditor, at (423) 785-4818 or Greg Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the evaluation.



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OIG File No. 2012-14507

January 7, 2013

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**REVIEW OF TVA'S LOAD FORECAST RISK - DRAFT EVALUATION 2012-14507**

Strategy, Financial Planning, and Business Development (SFPBD) has reviewed the Draft evaluation report issued via email on December 13, 2012. The actions we have taken in response to the two recommendations are outlined below.

The risk mitigation section of the Load Forecast Risk Summary has been revised to include activities related to updating information and models on a regular basis (see attachment).

Data security has been enhanced through limiting access to our share drives to the current economic, load and revenue forecasting staff. In addition only two forecasting personnel, Mike Walker and I, have authority to grant access to our share drives.

We have scheduled a review of these actions with the Inspector General staff on Wednesday January 9, 2013. The intent of the on-site review is to confirm the actions and close out this review.

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WT 9C-K

RGM: RDH  
Attachment  
cc (Attachment): SFP&BD\_Q4\_2012\_Risk\_Assessment\_v7\_2012-12-18.pdf  
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