Memorandum from the Office of the Inspector General

September 28, 2012

Robert M. Balzar, OCP 2K-NST

REQUEST FOR FINAL ACTION – AUDIT 2011-14244 – AUDIT OF TVA'S DIRECT LOAD CONTROL PROGRAM

Attached is the subject final report for your review and final action. Your written comments, which addressed your management decision and actions planned or taken, have been included in the report. Please notify us within one year from the date of this memorandum when final action is complete.

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, please contact Michael A. Driver, Audit Manager, at (423) 785-4813 or Rick C. Underwood, Director, Corporate Governance and Finance Audits, at (423) 785-4824. We appreciate the courtesy and cooperation received from your staff during the audit.

David P. Wheeler

David P. Wheeler
Deputy Assistant Inspector General
(Audits)
ET 3C-K

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Attachment
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OIG File No. 2011-14244

Office of the Inspector General

Audit Report

To the Vice President,
Energy Efficiency and
Demand Response

AUDIT OF TVA'S DIRECT LOAD CONTROL PROGRAM

Auditor
Michael A. Driver

Audit 2011-14244
September 28, 2012

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APPENDICES

Audit 2011-14224 – Review of TVA's Direct Load Control Program

EXECUTIVE SUMMARY

Why the OIG Did This Audit

The Tennessee Valley Authority (TVA) established the Direct Load Control (DLC) program in the 1970s as a means to shift load from on-peak/high-priced periods to off-peak/low-priced periods. This was to be done through the installation of radio-controlled switches to cycle[i] air conditioners and water heaters for either reliability or economic purposes. Participating distributors install the switches (which are provided by TVA) on end users' equipment, and the distributors receive monthly credits on their wholesale bills for each switch. Presently, there are 12 distributors participating in the DLC program. Credits provided to these distributors during 2011 ranged from $5,909 to over $1 million for a total cost to TVA of $2,365,819.

The OIG (Office of the Inspector General) audited TVA's DLC program to address concerns received regarding the benefits of the program. Our specific audit objectives were to assess the effectiveness of (1) the program and (2) TVA's oversight of the program.

What the OIG Found

We determined the DLC program is not operating effectively, and TVA is not employing two key oversight mechanisms afforded by the DLC contract.

- The program is not operating effectively because (1) much of the DLC program equipment is outdated and in disrepair, and (2) the program cost is substantially higher than the savings TVA achieves. The computer system used to regulate the program is over 20 years old, and there are limited resources available to provide upkeep and maintenance on its software and hardware. In addition, the equipment (transmitters and repeaters) required to operate the system are about 30 years old and prone to operational problems. TVA personnel estimated the program had a net cost of about $2.2 million to TVA in fiscal year 2007.
- TVA is not using two key contractual oversight mechanisms for verifying (1) the program is operating as intended and (2) distributor reports to TVA are accurate. The first oversight mechanism gives TVA the right to perform an annual audit to determine the operational condition of installed switches. According to program managers, the only review of the installed switches performed under this mechanism occurred in

[i] Cycling is the orderly turning "off" and "on" of switches through the use of the DLC program.

2006. The second oversight mechanism requires distributors to supply TVA with an annual listing of participant information. No distributor has provided participant information since the current Program Manager took over the position in 2010.

By not using the contractual oversight mechanisms, TVA cannot determine if (1) the switches for cycling power off at peak demand periods are actually working and (2) it is actually getting the intended benefit from the credits paid.

What the OIG Recommends

We recommend TVA's Vice President, Energy Efficiency and Demand Response:

- Perform a cost-benefit analysis to determine whether the benefits TVA derives from the DLC program are greater than the annual cost of the program (including the credits being provided to distributors and the cost of the equipment needed to effectively continue the program).
- Periodically audit each distributor participating in the DLC program to determine the effectiveness of the installed switches and modify distributor credit calculations accordingly.
- Discontinue application of the wholesale credit to the extent required information is not reported by participating distributors.

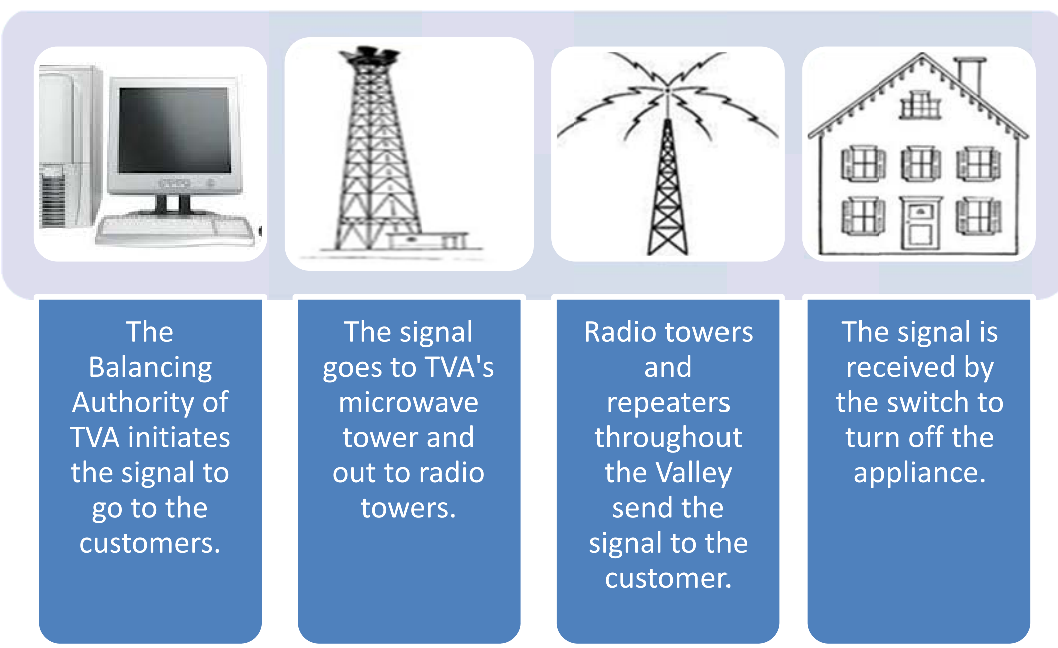
TVA Management's Comments

TVA management agreed with our findings and stated steps are currently underway to correct the deficiencies and create a cost-effective replacement program in conjunction with the Smart Grid Pilot project. See Appendix B for TVA management's complete response.

BACKGROUND

Energy efficiency and demand-side management programs have been a part of the Tennessee Valley Authority (TVA) energy supply resource mix since the late 1970s. The programs were initiated in response to the rising cost of energy and construction of new electric generating units. These programs promoted energy conservation and the efficient use of electricity. The Direct Load Control (DLC) program, which was also established by TVA in the 1970s, was offered to distributors as a means to shift load from on-peak/high-priced periods to off-peak/low-priced periods.

In order to implement the DLC program, radio-controlled switches are installed to cycle[1] air conditioners and water heaters for either reliability or economic purposes. DLC contracts between TVA and distributors require TVA to provide switches for storage water heaters at no cost to the distributor. We were informed by the current Program Manager that TVA would also provide switches for regular water heaters. The distributor is then responsible for installing the switch on the end-use customers' equipment. The switches are used to cycle the equipment off through use of a radio-controlled signal originated by TVA. The signal is initiated by the Balancing Authority desk of TVA and repeated through the use of radio transmitter towers throughout the Tennessee Valley to distributors and customers who participate in the program. However, since this type of communication is one way, there is currently no communication ability in the DLC program that allows TVA to know whether or not a switch is working. The following is a pictorial representation of the steps taken when DLC is initiated.



1 Cycling is the orderly turning "off" and "on" of switches through the use of the DLC program.

The DLC contracts between TVA and its distributors allow switches to be activated up to 96 times a year or 16 times a month. The contracts also establish the length of time the switch can be activated as well as the recovery time between activation. TVA estimates it can obtain a system-wide load reduction of 30 megawatts (MW) during cycling. Participating distributors receive a credit on their monthly bill for each installed switch. The credit amount for the switch is dependent upon the type of equipment it is installed on as shown below.

Storage Water Heater	$5.50
Standard Water Heater	$4.75
Air-Conditioner Unit	$1.15

The DLC contracts stipulate that a standard water heater is 30 gallons while a storage water heater is 40 gallons, or if installed after September 30, 1997, 50 gallons. While the contract allows a credit for air-conditioner units, TVA management stated cycling of air-conditioner units has been discontinued due to negligible benefits, programming complexity, and a high potential for adverse public impact.

Participating distributors provide the necessary information for TVA to credit the wholesale power bill. (Note: Because this is a credit on the wholesale power bill and not an actual payment to the distributor, it is not reflected on TVA departmental budgets.) Presently, there are 12 distributors participating in the DLC program. As summarized in Table 1 below, credits provided to these distributors during 20 [illegible] 1 million for a total cost to TVA of $2,365,819.

	Summary of DLC Credits Provided by TVA in 2011	
	Distributor	**2011 Billing Credit**
1.	Bristol Tennessee Essential Services	$1,010,811
2.	Powell Valley Electric Cooperative	419,349
3.	Middle Tennessee Electric Membership Corporation	312,075
4.	Central Electric Power Association	149,661
5.	Electric Power Board of Chattanooga	138,295
6.	Huntsville Utilities	128,821
7.	Gibson Electric Membership Corporation	63,529
8.	North Georgia Electric Membership Corporation	48,399
9.	Nashville Electric Service	46,811
10.	Lexington Electric System	24,849
11.	Southwest Tennessee Electric Membership Corporation	17,310
12.	Jackson Energy Authority	5,909
	Total	**$2,365,819**

Table 1

The DLC contracts that are currently in place are dated October 1, 1997, and require TVA to provide 10 years' prior written notice to terminate the agreement. However, the distributor can terminate the agreement at any time upon 30 days' prior written notice to TVA.

TVA's Integrated Resource Plan, which was accepted by the TVA Board of Directors on April 14, 2011, stated that from 1996 to 2008, TVA programs offered in conjunction with distributors of TVA power resulted in a cumulative demand reduction of more than 545 MW. It further stated nearly 90 percent of this total was derived from TVA's EnergyRight® residential program. The remainder of the reduction was attributed to residential DLC programs for air-conditioning and water heating and large commercial and industrial programs, or approximately 54.5 MW over nearly 12 years.

We scheduled an audit of the DLC program because of concerns we received regarding the benefits TVA receives from the program in comparison to the annual costs associated with the program. A complete discussion of our audit objectives, scope, and methodology are included in Appendix A to this report.

FINDINGS

Our audit of TVA's DLC program determined:

- The program is not operating effectively because (1) the DLC program equipment is outdated and in disrepair, and (2) the program cost is substantially higher than the savings TVA achieves. TVA personnel estimated the program had a net cost of about $2.2 million to TVA in fiscal year 2007.
- TVA is not employing two key oversight mechanisms afforded by the DLC contract. Specifically, TVA has not (1) performed a quality assurance audit since 2006 to determine the operational condition of installed switches for those distributors participating in the program nor (2) required the annual reporting by distributors of customers with switches. This results in TVA providing credits for switches without knowing whether or not they are operating or where they are installed.

The following provides a detailed discussion of each of our findings.

THE DLC PROGRAM IS NOT OPERATING EFFECTIVELY

Our audit found the DLC program is not operating effectively because (1) the DLC program equipment is outdated and in disrepair, and (2) the program cost is substantially higher than the savings TVA achieves.

Program Equipment is Unreliable or Inoperable

The DLC program is only as effective as the equipment used to operate the program. Based on interviews we conducted with various former and current TVA employees associated with the program, we determined the program is not effective because of unreliable and inoperable equipment. Specifically, we were informed:

- The computer hardware and related software for the DLC program is over 20 years old, and it is very difficult to find anyone to maintain or modify the system.
- The transmitters and repeaters used by TVA to send cycling signals to distributors (and to the ultimate customer) are about 30 years old. According to TVA officials, some of this equipment has not worked for over 2 years, and currently, the only functioning transmitter is providing a signal to just one distributor – Bristol Tennessee. Accordingly, the signal is not being transmitted to eleven distributors who received billing credits of about $1.3 million in calendar year 2011. We were informed it is hard to find repair and replacement parts due to the age of the transmitter equipment. In a 2007 presentation to TVA management, it was estimated a major capital upgrade of approximately $600,000 was needed to make the system operational. However, TVA officials informed us the upgrades have not been made.

Program Cost Exceed Potential Benefits

In addition to the operational inefficiency of the program's equipment, an earlier study performed by TVA personnel found the DLC program was not cost beneficial. The study, which reviewed the programs costs during 2007, found the costs of the program were substantially higher (over eight times higher) than the avoided costs the program provided. Specifically, TVA's study found the net cost to TVA for providing the program during 2007 was $2.2 million as follows:

- Total costs incurred by TVA during 2007 were $2.5 million including (1) $2.2 million in billing credits provided to the twelve participating distributors, (2) $200,000 in program costs, and (3) $87,000 for switches that were provided to the distributors.
- Although TVA's study indicated there was no mechanism for determining actual load reductions during cycling, TVA estimated the cycling would have only achieved savings of about $290,000.[2]

In summary, the cost of the DLC program is continuing to grow although the benefits derived from the program are limited. As shown in Table 1 (on page 2), the billing credits provided by TVA were $2.36 million in 2011, which is $166,000 more than TVA reported it had incurred during 2007. Based on the increased

[2] TVA's study also reported although air-conditioning units are not being cycled, TVA is still providing billing credits of about $108,000 each year for air conditioners. Our review of billing credits during 2011 indicated this level of credits is still being provided, although TVA informed us it is not sending a signal to the air conditioner switches.

level of credits TVA is incurring and the costs necessary to operate the equipment effectively, it does not appear the program can provide a positive return for TVA.

TVA IS NOT EMPLOYING TWO KEY OVERSIGHT MECHANISMS AFFORDED BY THE DLC CONTRACT

The DLC contracts allow TVA to perform a quality assurance audit not more than once every 12 months to determine the operational condition of the installed switches used in calculating the credit applied to the distributor billing. According to program managers, the only review of the installed switches performed under this mechanism occurred in 2006 when results showed less than 50 percent of the 86,000 installed switches were in service. Information supplied by TVA regarding this review did not document sample sizes or tests performed and did not state which distributors were reviewed nor the customers selected for testing. Since the credit TVA provides distributors is directly derived from the number of operating switches reported by the distributor, the audit clause of the contract is the only tool TVA has to verify the number of switches used to calculate this credit.

The second oversight mechanism requires distributors to provide TVA with an annual listing of participant information in a specified computer format. If this information is not received, TVA has the right to discontinue the application of the billing credit. According to TVA personnel, no distributor has provided this information since the current Program Manager took the position in 2010. However, distributors have continued to receive the credits on their wholesale power bill as TVA has not enforced these contract provisions.

RECOMMENDATIONS

We recommend TVA's Vice President, Energy Efficiency and Demand Response:

- Perform a cost-benefit analysis to determine whether the benefits TVA derives from the DLC program are greater than the annual cost of the program (including the credits being provided to distributors and the cost of the equipment needed to effectively continue the program).
- Periodically audit each distributor participating in the DLC program to determine the effectiveness of the installed switches and modify distributor credit calculations accordingly.
- Discontinue application of the wholesale credit to the extent required information is not reported by participating distributors.

TVA Management's Comments – TVA management agreed with our findings and stated steps are currently underway to correct the deficiencies and create a cost-effective program in conjunction with the Smart Grid Pilot project. Specifically, management stated it plans to:

1. Develop a replacement option strategy including meeting with the Cycle and Save participants and seek potential options.

2. Audit each distributor participating in the DLC program per the terms of the contract to determine the effectiveness of the installed switches and modify distributor credit calculation accordingly per the terms of the current contract.

TVA Management also stated Energy Efficiency & Demand Response, Customer Relations, DSM Pricing, and the Senior Advisor to the CEO have formed a Strategic Planning Team to address issues identified by the audit and present options to participating distributors. TVA plans to complete the program change by FY 2013.

See Appendix B for TVA management's complete response.

Auditor's Response – We agree with management's planned actions to create a cost-effective replacement program and to audit each distributor participating in the program and modify distributor credits accordingly. We still recommend that TVA discontinue application of the wholesale credit until required information has been reported by participating distributors.

OBJECTIVES, SCOPE, AND METHODOLOGY

The Office of the Inspector General audited the Tennessee Valley Authority's (TVA) Direct Load Control (DLC) program to address concerns we received regarding the benefits of the program. Our specific audit objectives were to assess the effectiveness of (1) the program and (2) TVA's oversight of the program. The objective was not to assess TVA's system of internal controls related to the DLC program. Therefore, controls associated with the DLC program were not tested as part of this audit. To achieve our objectives, we:

- Interviewed TVA personnel to determine the criteria TVA uses to assess the effectiveness of the program.
- Reviewed monthly credits provided by TVA to determine if they followed criteria established through the contract with the distributor.
- Interviewed TVA personnel to determine if the DLC program is functioning as intended, switches are installed, and radio signals are transmitted and received.
- Reviewed the distributor contracts to obtain an understanding of TVA's rights to oversight of the program.
- Determined whether the oversight mechanisms included in the contract are implemented to ensure the effectiveness of the program.
- Interviewed TVA personnel tasked with oversight of the program to determine whether activities have been performed to monitor the program.

When evaluating results of our audit work, we used both qualitative and quantitative factors when considering the significance of an item. The dollar expenditures from this program (approximately $2 million annually) would be the basis for determining quantitative significance of an item or transaction and are not significant to TVA as a whole. However, there are items that could be qualitatively significant to the program and our audit objectives. We would consider an item significant that would (1) prohibit the DLC program from being able to achieve its objective of significantly reducing peak demand by shifting energy use to off-peak hours or periods of low demand for electricity, (2) lower the available megawatt reduction available through the program (reported as 69.6 megawatts for the cumulative participation in the program during 1995 and 1996), and (3) cause TVA reputational harm.

The scope of the audit was the DLC program for the period January 2010 through December 2011. Fieldwork was conducted between November 2011 and July 2012. This performance audit was conducted in accordance with generally accepted government auditing standards. Those standards require we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Tennessee Valley Authority, 1101 Market Street, MR 3M-C, Chattanooga, Tennessee 37402-2861

September 25, 2012

David P. Wheeler
Deputy Assistant Inspector General (Audits) – ET 3C-K

RESPONSE TO THE REQUEST FOR COMMENTS – DRAFT AUDIT 2011-14244 – AUDIT OF TVA'S DIRECT LOAD CONTROL PROGRAM

Energy Efficiency & Demand Response (EEDR) has received and reviewed the DRAFT audit of the Direct Load Control (DLC) program titled, "Cycle & Save" and takes no exception to the findings. The following are steps currently being taken to correct these deficiencies and to create a cost effective program in conjunction with the Smart Grid Pilot project.

TVA EEDR team has been working to develop a replacement solution for the Legacy Cycle & Save DLC program. Based upon these findings, EEDR will be taking the following steps to address the recommendations of the OIG:

1. Develop a replacement option strategy including meeting with the Cycle and Save participants and seek potential options.

2. Audit each distributor participating in the DLC program per the terms of the contract to determine the effectiveness of the installed switches and modify distributor credit calculation accordingly per the terms of the current contract.

EEDR, Customer Relations, DSM Pricing and the Senior Advisor to the CEO have formed a Strategic Planning Team to address these issues and present options to participating Distributors. This program change is expected to be completed by FY 2013.

Submitted by:

William G. Jackson Jr., Acting Senior Manager Demand Response

Cc: Joseph J. Hoagland, Senior VP, Policy & Oversight
Robert M. Balzar, Vice President, Energy Efficiency & Demand Response