

Findings, Challenges and Lessons Learned from the Evaluation of ARRA-Funded Programs for the Colorado Governors Energy Office

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ABSTRACT

On Feb. 13, 2009, Congress passed the American Recovery and Reinvestment Act of 2009 with the goal of spurring economic growth and creating or saving jobs. This Act appropriated money to the Department of Energy (DOE) to encourage the implementation of energy efficiency and renewable energy projects. Much of the allocation to the DOE was distributed to state agencies to manage.

The Colorado Governor's Energy Office (GEO) is one of state agencies responsible for use and distributing ARRA funds in Colorado. GEO has allocated to spend more than \$63M, applied across three funding streams based on DOE requirements: the State Energy Programs grant (SEP), the State Energy Efficient Appliance Rebate Program (SEEARP), and the Energy Efficiency and Conservation Block Grant (EECBG). All three funding streams have specific allocation and reporting requirements, but the main goal of each is to encourage the installation of energy efficiency and renewable energy projects while maintaining or adding jobs to the economy.

In February, 2011, the GEO contracted with Nexant, Inc. and its subcontractors, Research Into Action and Group14 Engineering, to conduct an ARRA Program Measurement and Verification Project (Project) for each of the three ARRA funding streams. The main purpose of this Project is to determine the actual energy savings associated with each funding stream.

The evaluation of impacts due to GEO ARRA spending poses foreseeable challenges, including substantial technical assistance and outreach spending without direct financial incentives, program structure (heterogeneous nature of programs that have been awarded stimulus funds), consistency in program data reporting/tracking, attribution of energy savings, among others.

The Nexant team is scheduled to complete the evaluation of the 2009-2011 ARRA funded programs by the February 2012. The programs examined are heterogeneous and will span energy audits, building efficiencies (lighting, heating, HVAC), distributed renewable generation technologies (biomass boilers, PV, solar thermal and wind), transportation (alternative vehicles, traffic synchronization), energy codes (training), appliance rebates, among others. The following paper addresses our teams overall evaluation approach, challenges that were faced throughout the project, and how those challenges were overcome.

Background

The Governor's Energy Office serves as the State Energy Office and Weatherization Office for Colorado. These are agencies identified by the Federal Government as the designated recipients of the State Energy Plan (SEP) and the Weatherization Program line items in the federal budget. The office also receives funding directly from the Department of Energy through grants which include State Energy Offices as recipients or qualified applicants for competitive grants. Examples of these are the Energy Efficiency Conservation Block Grant and the State Energy Efficiency Appliance Rebate Program.

The office was established in 1977 as a response to the oil crisis and as a mechanism for managing the Petroleum Violation Escrow Funds, which were designated for the state through a lawsuit with oil exploration companies. The funds are also sometimes referred to as oil overcharge funds as that was the nature of the lawsuit.

In 2006, Governor Ritter campaigned on a platform of creating a “New Energy Economy”—one that used Colorado’s natural wealth of renewable resource capacity and intellectual capital to leverage investment in, and development of, renewable energy and energy efficiency throughout the state. The approach was premised on the concept that if Colorado were to develop a vibrant market and environment for nurturing renewable energy development, investment in manufacturing, research, installation and associated industries would follow. While developing an economic base, Colorado would simultaneously reduce harmful emissions associated with power production and become a leader in the emerging new energy sector.

In pursuit of this goal, Governor Ritter re-named the office from the “Office of Energy Management and Conservation” to the “Governor’s Energy Office” in January 2007. The duties of the office were articulated in the Executive Order, expanding from “conservation” to include energy efficiency and renewable energy development and deployment across the state.

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In February, 2011, the GEO contracted with Nexant, Inc. and its subcontractors, Research Into Action and Group14 Engineering (Evaluation Team), to conduct an ARRA Program Measurement and Verification Project (Project) for each of the three ARRA funding streams. The main purpose of the Project was to determine the actual energy savings associated with each funding stream. A number of steps were conducted throughout this Project, as outlined in the Figure below.



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appliance rebates, and others. Programs delivered to the residential, commercial, industrial, and government sectors included:

- Rebates and grants for energy efficiency improvements
- Rebates and grants for renewable energy sources
- Technical assistance
- Education and outreach

The following is a full list of the programs that were evaluated and the funding source for each. Note that several programs were funded through more one program source:

Colorado GEO ARRA Programs by Funding Sources

SEP Program	EECBG Program	SEEARP Program
Capital Investments-- Revolving Loan Program	Grants	Clothes Washers
Capital Investments--Loan Loss Reserve	Lighting	Dishwashers
Capital Investments-- NEED Grants	On-Site Renewable	Refrigerators (recycling)
Commercial Buildings Existing - Technical Assistance	Furnaces - Gas	Refrigerators (recycling)
Commercial Buildings Existing - Grants	Renewable Energy - Rebates	Water Heaters - Gas Tankless
Commercial High Performance Buildings - Technical Assistance	Residential –Codes and Standards	Water Heaters - Gas Storage
Commercial High Performance Buildings - Grants	Residential – Insulation/Air Sealing	Boilers - Gas
Greening Government	Residential – Duct Sealing	Furnaces - Gas
Renewable Energy - Grants	Residential – Energy Star New Homes	
Renewable Energy - Rebates	Residential – Energy Monitors	
Renewable Energy - REDT	Main Street Grants & Technical Assistance	
Residential –Codes and Standards		
Residential – Insulation/Air Sealing		
Residential – Duct Sealing		
Residential – Energy Star		

New Homes		
Residential – Energy Monitors		
Main Street Grants & Technical Assistance		
Furnaces - Gas		

There were two ARRA funded programs that were outside the scope of this Project and were not evaluated. These programs included Weatherization and Transmission Market Title.

Findings

The results of this evaluation were in draft form at the time of this submittal and therefore are not included in the paper.

Methodology

Evaluations seek to quantify the net savings that have been realized by the programs under review by determining the gross savings realized by projects enrolled in the programs, and the net-to-gross (NTG) scaling factors. Gross energy savings were determined through a combination of engineering analysis and site inspections of program participants. It was not deemed cost-effective to complete analysis and site inspection on a census of the program participants; therefore savings were verified for a representative sample. The program-reported savings for the sample were adjusted to reflect the review findings. This adjustment is captured in a realization rate which is the ratio of evaluation review savings to program-reported savings for the sample. For the gross savings evaluation, both ex-ante (expected savings based on baseline conditions) and ex-post analysis (actual savings based on post retrofit conditions) were conducted. Ex-ante analysis was only conducted for large impact projects that were not scheduled to be completed within the time frame of the evaluation project. The majority of projects received an ex-post analysis.

In order to estimate net energy savings, the Evaluation Team employed telephone and on-site surveys to quantify the actual impact of the GEO ARRA programs. Net savings are a reflection of the degree to which the savings are a result of the program efforts and funds. The net savings are calculated by applying net-to-gross scaling factors to the gross savings. Net-to-gross scaling factors were assessed by adapting and expanding an instrument that Research Into Action has developed with Energy Trust of Oregon. This brief instrument assesses two components of free-ridership: 1) *intention* to carry out the energy efficient project without program funds; and 2) *influence* of the program in the decision to carry out the energy efficient project.

Intention is assessed through several brief questions used to determine how the project likely would have differed if the respondent had not received the program assistance. The specific wording of the questions and the response options provided were tailored to the specific program, measure type, or sample group. The initial intention question generally was worded along the lines of: “Which of the following is most likely what would have happened if you had not received [the program assistance]?” For each version of the instrument, a limited number of program- or measure-appropriate response options were offered that represented activities that would have resulted in a range of energy savings. For example, in the generic case where the program provided assistance in undertaking some measure-based energy efficiency project, the options would be: 1) cancelled the project or postponed it at least one year; 2) reduced the size or scope of the project; or 3) done the exact same project. In some cases, the instrument includes a follow-up question to roughly quantify the reduction in project size or scope.

Program influence was assessed by asking the respondent how much influence – from 1 (no influence) to 5 (great influence) – various program elements (e.g., program-provided information, the program incentive, interaction with program staff) had on the decision to do the project the way it was done. The overall program influence was defined as the maximum influence rating for any program element.

The following provides a general outline of the methodology followed throughout the evaluation process:

- Obtain Program Data Records
- Design the Sample
- Verify the Sample
 - Level I Audits (File Reviews)
 - Develop Site-Specific Measurement and Verification Approach
 - Level II Audits (On-site Inspections)
 - Establish the Baseline
 - Calculate Impacts and Load Shape Analysis
- Estimate Net Savings
- Report the Results

Challenges

Due to the nature of the programs and the funding streams, the Evaluation Team was aware that challenges would be faced throughout the Project. Many of these challenges were recognized early in the project and therefore resolutions to these challenges were addressed in the evaluation plan. A plan for addressing these specific issues was needed in order to ensure that the Project achieved the confidence and precision necessary for accurate reporting. The remaining sections of this paper outline specific challenges that were faced during the evaluation process and how these challenges were addressed.

Challenge 1: Program Structure and Budget Allocations

While the initial reporting to the DOE outlined specific budgets allocated to each service within the funding streams, the GEO programs were established based on market sectors, market actors, and technologies. In some cases, programs combined funds from multiple ARRA funding streams to establish a more comprehensive program. The funding sources for the ARRA programs were delivered into three distinct groups: SEP, EECBG, and SEEARP, but the distribution of funds inside the funding streams varied greatly. For example, the SEP funding was broken out into eight distinct ‘Market Titles’; however, these market titles do not necessarily comprise one program or project but may incorporate several distinct programs, projects and delivery mechanisms (i.e. grants). Additionally, one program type may receive money from multiple funding sources (i.e. Main Street Initiative receives funding from the Commercial Existing Buildings, a SEP funding source, and from EECBG funds). In addition, some measures offered through the various ARRA funding sources may have been eligible for other incentives through local utility providers. Therefore, for purposes of the evaluation, it was challenging to track programs or projects back to one sole funding source.

For programs with multiple sources of funding, GEO did create a series of logic steps and rules for both its outside rebate processing firm and internal accounting to appropriately allocate the funds. However, a key consideration for the Evaluation Team was to ensure that the energy savings are appropriately allocated to the proper funding streams based on the funding source. Additionally, many of the services offered by the GEO leveraged partner funding from local governments or utilities, and the Evaluation Team also needed to consider these sources of funding and their impact.

This challenge affected the sampling strategy, the determination of gross savings and the calculation of net savings. The main solution to this challenge was through the implementation of detailed and accurate interviews with GEO program staff in order to identify the key program services (rebates, grants, technical assistance, etc.) and how they were delivered. The following sections discuss in more detail how the Evaluation Team addressed the challenges facing the sampling strategy, gross savings, and net savings.

Sampling Plan. The sampling plan for the evaluation was created in a manner to address these challenges. A nested sampling metric was utilized to meet 90% confidence interval and 10% precision at the ARRA funding stream level (SEP, EECBG, and SEEARP). A secondary objective in the sampling approach was to focus on projects in GEO programs with high impact. However, because of the inconsistency in reporting procedures utilized for the GEO Programs (in some cases, savings are reported as zero), the program budget was utilized as a proxy to stratify savings weights within the funding stream.

One example of the challenges of developing a sampling plan was for the EECBG funding stream. EECBG comprises a wide variety of services and some of the programs inside EECBG are also funded through other sources such as SEP. In an attempt to capture the energy savings attributable to EECBG, the sampling approach incorporated the populations of each activity to ensure that the DOE recommended 90/10 precision/confidence for the entire funding stream was met. In addition, the Evaluation Team stratified the EECBG funding stream by activities and cost categories (technical assistance and incentives) that have energy savings attributed to them.

Gross Savings. For determination of gross savings, it was important to properly identify which measures were installed in a project that was funded through GEO's program. Part of the challenge was that GEO sometimes provided funding for activities that were funded with other dollars as well, and there may not have been complete overlap in the funding. For example, a customer may have implemented measures A, B, C, and D, and used GEO funds for A, B, and C, but another source of funding/incentives measures B, C, and D. Therefore, during the preliminary discussions with the program participants in the sample, it was important to clearly delineate which measures/projects were GEO-funded.

Net Savings. For determination of net-to-gross scaling factors, it was important to make certain that the respondent understood the question and gave an accurate response, it was important to clearly indicate what participating in the program meant and what program they were truly participating in (and what was the funding source). This challenge was addressed during the development of the survey questions. For example, the question may have been asked: "What do you think your organization most likely would have done if the Governor's Energy Office had not helped you obtain the contract with an ESCO like ...?" It is important to get the wording right. Also, it's important to know what the range of program services are so that the appropriate influence and satisfaction questions are asked. For example, it would be confusing to ask how influential the rebate was if there was no rebate attributable to the program/measure.

Challenge 2: Quantifying Energy Impacts

The GEO has a variety of goals for their ARRA program offerings beyond energy savings. These goals include job creation, economic stimulus, and market transformation. In order to meet these varied goals, the GEO created a range of offerings to Colorado residents and businesses. The Evaluation Team allocated ARRA expenditures into cost categories that describe the services provided by the GEO Programs. These categories include:

- *Administrative.* This includes GEO staff, overhead, travel, public information and marketing and other miscellaneous administrative costs.
- *Education and Outreach.* Education and outreach costs include training and workshops offered by program staff and external consultants on a range of technical issues. Also included are outreach efforts to build participation in the various programs.
- *Technical Assistance.* Many of GEO's programs provide technical assistance from contractors to assist both the residential and commercial sector implementation of energy efficiency and renewable energy projects. This includes the residential code services.
- *Equipment Incentives.* These costs include various financial incentives including grants, rebates, loans, or loan loss reserves for energy efficient or renewable energy equipment.

The Evaluation Team recognized that the GEO is currently only attributing energy savings to services included in the cost categories of technical assistance and equipment incentives. Therefore, these services were the focus of this Project.

Because of the wide range of program types, delivery mechanisms, and measures, along with the aggressive schedule for the release of the ARRA programs, a significant challenge was found through inconsistency in program savings calculation methodology. Several different tools were utilized across the programs for tracking and reporting purposes and to complicate matters, some of the programs have several levels of implementation contractors and/or administrators.

Another challenge faced when calculating/reporting energy savings was that some programs and projects had zero energy savings associated with them. This may have been due to the timing of the installation in relation to this evaluation (i.e. several projects are still in progress and therefore have limited and untracked savings values).

The Evaluation Team addressed this challenge both in how the sampling plan was developed and through more detailed interviews with program administrators. As noted earlier, because of the inconsistency in reporting procedures and calculation methodology used for the programs (in some cases, savings are reported as zero), the program budget was utilized as a proxy to stratify savings weights within each funding stream.

The Evaluation Team also addressed this challenge through the implementation of detailed interviews with program team members who designed and/or are implementing the programs. Because DOE does not have strict guidelines on reporting energy savings for these programs, many program administrators are therefore not reporting energy savings directly to GEO. In some cases, energy savings are being calculated and tracked and this information was therefore able to be gathered directly through the program staff.

There were a few cases of programs reporting zero energy saving (i.e. Energy Monitors, NEED Grant, New Homes). For these cases, the Evaluation Team often used stipulated savings values and then conducted some on-site verification to help validate the stipulated values. If validated accurately, the stipulated values were then extrapolated to the program as a whole.

Challenge 3: Schedule

The Evaluation Team's efforts occurred as the programs were simultaneously being offered and as projects were being implemented. Additionally, some of the services offered through these programs/grants have yet to commence at all. This scheduling misalignment created some challenges in understanding anticipated budgets, reported energy savings, and detailed scope of the service and/or project. In addition, the goals of the program were developed quickly due to the aggressive schedule by DOE to utilize the ARRA funding. Program approaches were therefore inconsistent across funding streams and many program designs were evolving and changing even after the initial program roll out. The best solution to overcome this challenge was found in the program research and interview process. Detailed interviews with program staff were necessary to fully understand the history and future of each funding stream, program, and intended delivery mechanism.

A second challenge involved some of the larger projects funded through GEO. It was found that several of these projects had implementation schedules that extend well beyond the evaluation horizon, therefore the scope and completion dates were not finalized and could not be accurately evaluated before the evaluation deadline. In order to allow these projects to still be evaluated and reported through the GEO program, the Evaluation Team provided GEO with the tools to conduct their own on-going measurement and verification (M&V) and evaluation of energy savings for these projects. This will allow GEO to go back after the projects have been implemented and calculate the appropriate energy savings and budget allocation associated with the projects.

Challenge 4: Data Collection

One of the keys for effective implementation of the Evaluation Plan was access to the GEO's programmatic data. Each program utilizes different reporting processes, databases and spreadsheets to track and report energy savings from the services offered within each program. This created challenges in receiving consistent program and project level information. Additionally, outside consultants are often used by the GEO to track and report progress of the programs. In an effort to reduce the challenge associated with data collection, the Evaluation Team reviewed and quantified as much of the data as was available in the very early stages of the project so that there was a better understanding of available/non-available data early on. However, throughout the project, there was still the need to amend approaches and sample sizes based on what data became available.

Challenge 5: Attribution Identification

The process evaluation team faced several of the same challenges when assessing attribution and the net-to-gross scaling factors. The largest impact from these challenges was in identifying the counterfactuals – what the customer would have done without the program. This was mainly an issue of identifying the likely range of actions that the participant would have taken.

The variability in the types of services offered by the programs and the variability of the projects themselves made it necessary to tailor the attribution assessment appropriately. The need for comparability of results required a consistent overall approach to assess attribution. The challenge was making the individual assessments meaningful while also maintaining a consistent approach.

An example that arose during the evaluation in assessing attribution was where GEO provided grant funds to loan makers or rebate providers, so there were two stages of program influence: Would the loan have been made or the rebates provided without GEO assistance, and would the loan or rebate recipient have done the eventual project without the loan or rebate? Similarly, some programs had more than one funding source both within the ARRA funds and from outside sources such as local utility

providers. This introduced a challenge when assessing attribution because customers may not have a clear understanding of the funding source for the energy efficiency measure that was implemented and therefore which funding source has the largest impact on their decision.

Conclusion: Lessons Learned

The evaluation of Colorado GEO's ARRA funded programs is still underway and is expected to be completed by February 2012. Many of the challenges that have been faced throughout the evaluation project are a result of aggressive schedules placed on the GEO and program implementers. These challenges are being addressed as the evaluation progresses and a clear and accurate picture of the energy savings attributed to the ARRA programs will be completed.

It was no secret that the funding and tracking streams for GEO's programs was complex. The varying nature of the funding types and the urgency that was placed on the organizations who received the funding resulted in inconsistent program tracking and reporting. Direct communication with GEO staff and any outside program implementers has played a key role in understanding the program structures, funding allocations, and energy savings impacts. This communication proved invaluable throughout the evaluation process. The Evaluation Team did see some turn-over in program administrators and therefore learned that communication early in the evaluation phase helped reduce the amount of information that might later become unattainable.

A critical lesson learned was the need for consistent and centralized reporting and tracking tools across all programs. While this can often be an expensive and time-consuming process, these tools help make the programs run smoother in the long run, and helps reduce the need to 'chase down' program data during the reporting and evaluation phase.

Another lesson learned through the Project was the importance of training the program implementers about M&V protocols and standards. This will allow the evaluation phase to continue beyond the confines of the Project and will allow more current updating of program direct and indirect savings.

The Evaluation Team has found that the greatest way to overcome many of these challenges has been through the assignment of dedicated staff to a few programs within the GEO program portfolio. These staff members became specialists in their program type and could better embed themselves in the details and intricacies of each program and therefore understand the processes within a quick timeframe. Effective communication is also a key way to overcome most of the challenges.