Monitoring and Evaluation Plan

This section describes MidAmerican's proposed monitoring and evaluation (M&E) activities for the plan period. M&E activities have one primary objective: optimal program performance. Well-designed M&E activities provide comprehensive and timely data to program managers, allowing them to monitor program performance, improve program offerings, maximize participant satisfaction and reconcile actual program achievements to predicted savings goals.

The National Action Plan for Energy Efficiency (NAPPE) also has developed M&E protocols for energy efficiency programs. These protocols have been endorsed by the U.S. Department of Energy and the National Association of Regulatory Utility Commissioners (NARUC). The M&E processes utilized by MidAmerican are generally consistent with NAPPE's M&E protocols.

1. Evaluation Strategy

At the highest level, MidAmerican's proposed evaluation plans and strategy are designed to:

- ***Develop highly calibrated savings assumptions.*** Utilizing the results of MidAmerican M&E findings from its Iowa and Illinois programs, combined with historical program participant characteristics, savings algorithms are expected to provide highly accurate estimates of actual savings achieved. Most importantly, savings estimates will – where possible – be calibrated to the characteristics of individual participants

(e.g., facility size, operating hours, etc.) and thus not rely solely on deemed savings estimates.

- ***Implement a comprehensive verification strategy.*** MidAmerican will conduct a comprehensive verification strategy, utilizing site visits to verify that rebated measures were actually installed in customer homes and facilities.
- ***Conduct a thorough review of engineering algorithms.*** Engineering savings algorithms will be reviewed by MidAmerican to ensure they are reasonable and accurate, utilize appropriate assumptions and are consistent between programs for like measures.
- ***Conduct process evaluations to optimize program delivery and customer satisfaction.*** Surveys and interviews with implementation staff, customers and trade allies will provide important information to program managers regarding the strengths and limitations of program offerings and delivery.
- ***Utilize a number of rigorous impact evaluation approaches.*** Impact evaluations will utilize a rigorous suite of analytical approaches, including ex post verification of engineering assumptions, building simulations, metering analysis and statistical analysis.

MidAmerican's evaluation approach is designed to be efficient, thorough and accurate. A key element of MidAmerican's approach is that it is generally structured by evaluation function, rather than by program or customer sector. Each major function, such as process or impact evaluation, starts from a portfolio perspective, with approaches and issues that span all or most program areas. Broad cross-sector evaluation activities

will then be focused as needed for each program and will provide conclusions specific to that program.

This approach will allow substantial efficiencies in developing and interpreting the information that is gathered for each program. Not only are there many commonalities in program structure and delivery method across the various energy efficiency programs, but many of the required evaluation functions are similar, even where program delivery methods may vary. In addition, as noted, this approach will allow evaluators to look for consistencies across programs, rather than viewing each program independently.

2. Development of Savings Assumptions

While there are various techniques for estimating savings assumptions from energy efficiency measures, MidAmerican makes a concerted effort to incorporate the results of previous M&E efforts in other states and historical program participant characteristics from other states. Additionally, where possible, savings estimates are calibrated to the characteristics of individual participants (e.g., facility size, operating hours, etc.) and thus are not based solely on deemed savings estimates. MidAmerican incorporates the best data available to estimate savings inputs: deemed savings values for an average participant are actually highly customized.

This approach is facilitated through MidAmerican's Energy Efficiency Information System (EEIS) and the advanced Energy Efficiency Management Information System (EEMIS), currently under development. These systems require input of individual customer characteristics for most measures to calculate estimated savings. This approach is important as context for the M&E discussion for a number of reasons:

- It demonstrates the M&E feedback loop: results of M&E activities are used to help calibrate future savings estimations and
- This approach provides M&E activities with a substantial amount of ex ante data; thus a substantial part of the M&E plan includes reviewing and assessing algorithms/simulations, plus making ex post adjustments based on actual operating conditions.

3. Verification

MidAmerican will continue to undertake aggressive verification activities to ensure that measures have been installed. For example, in Iowa, MidAmerican currently does 100 percent on-site inspection for all:

- Self-installed equipment (e.g., insulation, water heaters, furnaces)
- Equipment with rebates above $30,000

For other programs/measures, MidAmerican will select a random sample of program participants for verification. Contractors that are new to programs or have had failed past verifications will receive an oversample of verification visits and these will gradually be reduced (although not eliminated completely) with high compliance rates.

During the site visits, MidAmerican's program contractors verify that the equipment is installed, operating and matches measure characteristics tracked in EEMIS.

4. Review of Engineering Algorithms

As noted above, many of the program measures rely on engineering algorithms to derive savings estimates. Algorithms range from relatively simple to extremely complex. For example, standard measures (generally those in the prescriptive programs) require

relatively simple algorithms that generally rely upon a change in otherwise constant-value parameters. An example is a lighting measure that simply reduces wattage parameters and/or hours of operation from one fixed schedule to another.

A nonstandard measure usually requires a more elaborate algorithm, or perhaps many algorithms integrated in a model of operation. An example of a nonstandard measure would be a variable-frequency drive on a motor, the savings depending on variations in equipment loading. Most industrial process measures are nonstandard because of their loading variability and complexity.

MidAmerican will conduct a thorough review of all algorithms, ensuring that:

- ***The assumptions are reasonable and inclusive.*** Assumptions should incorporate all the appropriate factors that may influence savings. MidAmerican will verify that the engineering algorithms incorporate, as much as possible, factors that influence savings.
- ***The algorithms utilize appropriate assumptions for MidAmerican customers.*** While many of the inputs will incorporate customer-specific values, others will come from additional data sources. For example, savings for many measures will vary based on climate zone, current code requirements and other factors that may be applied to all or many MidAmerican customers. MidAmerican will validate that the correct assumptions are applied in these cases. The verification for correct use of individual customer characteristics is discussed below in the Impact Analysis section.

- ***The algorithms are consistent between programs.*** Certain measures are offered through multiple programs, particularly prescriptive measures that also may be incorporated into a customer site. MidAmerican will verify that savings algorithms are consistent between all programs.

An audit of the engineering algorithms will be conducted in late 2009 and periodically as new measures are added.

5. Process Evaluation

Process evaluation is the review and assessment of the program administrative structure, processes and implementation. The goal of process evaluation is to develop recommendations for improving the management and functioning of the programs in order to optimize program delivery, maximize participant satisfaction and more effectively achieve program goals.

The availability of new baseline information has helped to better inform the program designs so they target the correct measures and markets. Despite this, there are several other factors that speak to the importance of performing a process evaluation of MidAmerican's programs throughout the plan period:

- New measures have been added to existing programs, and new programs have been created,
- The role of trade allies is critical for several of the largest programs and process evaluation will provide insight into their effectiveness and help determine whether this approach is working as intended and
- The effectiveness of the design and management of the programs directly affects the quality of the programs.

Likely Areas of Process Evaluation Questions

Although the various residential and nonresidential programs have been adapted to meet the specific needs of each sector and market segment, their basic structure and delivery process is fairly consistent from one program to the next. While not all steps apply to all programs, project development generally proceeds in the following steps:

- Outreach and enrollment in the program,
- Identification of measures through a walk-through audit, trade ally advice or other means (where applicable),
- Provision of technical assistance to develop project specifications and designs, where needed,
- Review of program applications required to provide financial incentives for technical services and/or installed measures,
- Verification of measure installation (generally for a sample of participants),
- Processing and release of incentive payments and
- Monitoring and verification.

One goal of process evaluations is to address program effectiveness in each delivery step. Data collection appropriate to each program is used to gather information on program delivery from participants, nonparticipants (including those that enroll but do not complete participation), program staff, program contractors and trade allies. Common program approaches are assessed through common data collection instruments, but program-specific questions also may be added, where appropriate.

Process Evaluation Tasks and Schedule

MidAmerican will conduct process evaluations of the residential and

nonresidential portfolios once each during the plan period. Where necessary, additional program-specific process evaluations will address new programs and major program changes (e.g., the inclusion of new measures with high adoption rates, changes in implementation staff or strategy, new eligibility requirements, etc.). MidAmerican's program staff also will conduct qualitative analyses of programs as appropriate to identify additional program changes and improvements. Ongoing customer feedback mechanisms will also be implemented to assess customer satisfaction and maintain consistent quality control.

The following is a likely set of tasks to be undertaken during each round of process evaluation:

- Interviews with program managers, field staff and contractors:
    - Identify individuals to be interviewed
    - Develop draft interview guides
    - Conduct interviews
- Customer surveys including participants and (where appropriate) nonparticipants:
    - Develop sampling plan
    - Select samples
    - Develop draft interview guides
    - Conduct interviews
    - Data entry and analysis
- Trade ally interviews:
    - Identify individuals to be interviewed

- Develop draft interview guides
- Conduct interviews
- Process evaluation report

6. Impact Evaluation

Impact evaluation involves measuring actual savings achieved by energy efficiency programs. The process of reconciling actual savings to predicted savings is a critical step in M&E activities and is important to ensure MidAmerican is meeting savings targets.

Analytical Methods

Savings impacts will be estimated using four main types of analytical methods: verification of engineering inputs, building simulations, metering analysis and statistical analysis.

- ***Verification of engineering inputs*** is a relatively low-cost method that can apply to a range of measures. As discussed earlier, many MidAmerican savings estimates are based on engineering algorithms and these formulas are customized as much as possible to individual customer characteristics. While the review of engineering algorithms (discussed in detail above) will verify the soundness of the algorithms themselves, this step is meant to check that the correct customer characteristics are applied. Through telephone surveys and/or site visits, the evaluator can conduct an ex post verification of critical savings parameters, including hours of use, equipment size, home/facility size and other algorithm inputs.

- ***Simulation modeling*** is the preferred method for more complex measures, multiple measures and large loads that vary according to identifiable conditions or a known schedule. This method includes both operational simulation modeling and whole-building simulation. Operational simulation modeling is typically used to estimate energy-savings impacts from complex industrial process technologies, while whole-building simulation is required for complex commercial building projects. Modeling involves elaborate engineering and computer analysis and usually requires substantial data on the systems or buildings affected by the implemented measure(s).
- ***Metering analysis*** refers to the measurement of critical factors driving savings, such as hours of use, power draw (demand) or measured consumption of end-use equipment. This method is particularly important for load control programs, where it is important to measure whether energy use is actually curtailed during specific periods. Metering analysis, however, also is important to verify self-reported inputs into engineering algorithms (e.g., hours of use) and for equipment with savings that may not be picked up through other methods, such as statistical analysis. Metering also can provide information on end-use load shapes driving the daily and seasonal patterns of savings for categories of measures (e.g., for residential cooling measures).
- ***Statistical analysis*** utilizes a regression analysis of participant energy bills before and after measure installation. Where possible, statistical analysis

incorporates a cross-sectional, time-series experimental design, including a representative sample of program participants, an equivalent sample of nonparticipants and billing periods measured pre- and post-installation. Statistical analysis also typically incorporates survey results to account for changes in demographic, firmographic and household/facility characteristics during the period of interest that can impact energy use. Additionally, data also are typically normalized to account for changes in weather during the pre- and post-installation periods.

Selection of Approach

These methods do not apply to all measures, nor does increasing complexity of the method necessarily offer a more accurate result. Certain measures, however, do require specific methods to yield reliable results. The particular method or methods chosen will depend on the complexity of the project or measure and the availability of necessary data. Moreover, MidAmerican will prioritize impact evaluation activities so program measures representing the highest proportion of savings (high-impact program/measure combinations) receive the highest level of rigor.

Expected evaluation approaches, by program, are presented in Table 1. MidAmerican will adjust evaluation approaches as appropriate as program implementation progresses and programs and measures evolve. A few key highlights regarding the proposed approaches include:

- The activities in the table refer to ex post activities (following the installation of measures), with the goal being to model savings based on actual operating conditions. So, while project documentation for several of

the proposed programs already includes the development of engineering algorithms and simulation modeling, the evaluation will review the assumptions, verify the inputs and re-run the analysis, where necessary.

- Metering analysis may be utilized for a number of programs, with the goals of both calculating savings and developing end-use load shapes for broad measure categories.
- Statistical analysis is useful for audit and new construction programs, where savings can be achieved through the installation of multiple measures.

Table 1
Preliminary Proposed Impact Evaluation Approaches, by Program

Program	Engineering Algorithms	Engineering Simulations	Metering Analysis	Statistical Analysis
Residential Programs				
Equipment	✓		✓	
Residential Audit	✓	✓	✓	✓
Load Management			✓	
Low-Income	✓		✓	
Nonresidential Programs				
Equipment	✓		✓	
Custom	✓	✓	✓	
Small Commercial Energy Audit	✓	✓		✓

Schedule of Impact Evaluation Activities

Impact evaluation activities typically will be conducted on a two-year cycle, with appropriate adjustments for individual programs and measures. The objective is to generate a full review of all programs and measures, so by the end of the plan cycle, every program will have received at least one impact evaluation.

7. Conclusion

MidAmerican is planning to implement a comprehensive set of M&E activities. These activities will provide MidAmerican's program managers with timely information and feedback that will allow them to monitor program performance, improve program offerings, maximize participant satisfaction and reconcile actual program achievements to predicted savings goals.