INTERIM EVALUATION OF THE
UTILITY DISTRIBUTION SYSTEM
EFFICIENCY INITIATIVE (DEI)

Market Progress Evaluation Report

PREPARED BY
Global Energy Partners, LLC

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INTERIM EVALUATION OF THE
UTILITY DISTRIBUTION SYSTEM
EFFICIENCY INITIATIVE (DEI) –
PHASE 1

Final Report
Interim Evaluation Of The Utility Distribution System Efficiency Initiative (DEI) – Phase 1

Final Report

1123-06

September 2006

Global Energy Partners Project Manager
G. Wikler
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# Glossary of Acronyms

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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>AVC</td>
<td>Automatic Voltage Control</td>
</tr>
<tr>
<td>BPA</td>
<td>Bonneville Power Administration</td>
</tr>
<tr>
<td>CVR</td>
<td>Conservation Voltage Regulation</td>
</tr>
<tr>
<td>DE</td>
<td>Distribution Engineering</td>
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<td>DEI</td>
<td>Distribution Efficiency Initiative</td>
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<tr>
<td>DO</td>
<td>Distribution Operations</td>
</tr>
<tr>
<td>DSM</td>
<td>Demand Side Management</td>
</tr>
<tr>
<td>EE</td>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>EMI</td>
<td>Electro Magnetic Interference</td>
</tr>
<tr>
<td>EOL</td>
<td>End Of Line</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>HVR</td>
<td>Home Voltage Regulator</td>
</tr>
<tr>
<td>IOU</td>
<td>Investor Owned Utility</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>kVAR</td>
<td>Kilo Volt Ampere Reactive</td>
</tr>
<tr>
<td>LDC</td>
<td>Line Drop Compensation</td>
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<tr>
<td>LTC</td>
<td>Load Tap Changer</td>
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<tr>
<td>NEEA</td>
<td>Northwest Energy Efficiency Alliance</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
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<tr>
<td>PUD</td>
<td>Public Utility District</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>T&amp;D</td>
<td>Transmission and Distribution</td>
</tr>
<tr>
<td>UDSEI</td>
<td>Utility Distribution System Efficiency Initiative</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratory</td>
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EXECUTIVE SUMMARY

The Northwest Energy Efficiency Alliance (NEEA) currently funds the Distribution Efficiency Initiative (Initiative or DEI), a multi-year phased initiative, aimed at improving the efficiency of the Pacific Northwest (PNW) electric utility distribution systems. The overall Initiative, which started in January 2003, is to be conducted in three phases, over a five-year period. These three phases are:

- Phase I - Development: Includes confirmation of costs, benefits, implementation options; and utility decision-making tools;
- Phase II - Implementation: Includes communications/marketing, and regional policy implementation, further development of support tools; and
- Phase III - Transition: Integration of project actions to market transformation.

The long-term Initiative goal is to make the design, construction, and implementation of efficient electricity utility distribution systems and Conservation Voltage Regulation (CVR) common practice in the Pacific Northwest. Currently the project is in the Phase I stage, which is aimed at measuring the utility and customer costs and benefits (energy and non-energy) associated with distribution system efficiency improvements. Phase I is likely to be completed by end of 2007. Phase I is the only phase that has been funded. Funding for Phases II & III is dependant on the results of Phase I and must be approved by the NEEA Board. Upon successful completion of Phase I, Phase II and III are likely to begin in early 2008.

The Initiative has two components - the Pilot Projects and Load Research. The Pilot Projects involve the research cost-effective design, construction and operation decisions that optimize the regulation of local distribution service voltage (CVR) along the feeder lines. A total of nine utilities are participating in the Pilot Projects portion of DEI. The Load Research effort is to measure the energy savings associated with the Initiative resulting from the installation of on-site voltage regulation equipment in residential homes (HVR or Home Voltage Regulator). A total of eleven utilities are participating in the Load Research portion of DEI.

As part of the overall DEI project, NEEA selected R.W. Beck to provide overall project management as well as research, design, and implementation activities. RLW Analytics was selected to conduct customer surveys, recruit program participants, evaluate load types, and analyze load impacts.

The objective of this study is to provide an early indication as to the effectiveness of the overall Initiative by documenting the activities and progress of key players implementing the Pilot Projects. By focusing on the Pilot Projects alone, NEEA and Global Energy Partners, sought to provide timely insight on the Initiative's challenges and achievements rather than wait until the end of 2007 to provide a summative report detailing both the Pilot Projects and Load Research efforts. Global Energy Partners interviewed key players in the Initiative, including nine of the fifteen participating utilities, implementation support contractors, and equipment vendors.

However, during the course of the study we realized that issues related to residential dropouts in the Load Research effort were critical to understanding the Initiative's progress and the CVR technology. Therefore, while conducting the interviews with the pilot participants, issues related to HVR installation and residential drop-outs were addressed for those pilot participants that were participating in the load research component as well. The list of utility contacts for interviewing was provided by the RW Beck DEI team lead, K C Fagen. Table ES-1 lists utilities that were interviewed during this study.
Table ES-1  
List of Participant Utilities Interviewed

<table>
<thead>
<tr>
<th>Utility Name</th>
<th>Whether Participating in Pilot Projects</th>
<th>Whether Participating in Load Research</th>
<th>Interviewee Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Utilities</td>
<td>Yes</td>
<td>No</td>
<td>Distribution Engineer for Pilot Project</td>
</tr>
<tr>
<td>Clark County PUD</td>
<td>Yes</td>
<td>No</td>
<td>Director of Engineering and Manager of Systems Engineering and Planning</td>
</tr>
<tr>
<td>Clatskanie</td>
<td>Yes</td>
<td>No</td>
<td>Engineering Manager</td>
</tr>
<tr>
<td>Douglas</td>
<td>Yes</td>
<td>Yes</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Eugene Water and Electric</td>
<td>Yes</td>
<td>Yes</td>
<td>Electric Engineering Manager</td>
</tr>
<tr>
<td>Grant County</td>
<td>Yes</td>
<td>No</td>
<td>Energy Services Engineer</td>
</tr>
<tr>
<td>Idaho Power</td>
<td>Yes</td>
<td>Yes</td>
<td>Engineering Leader of System Protection and Communications</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>Yes</td>
<td>Yes</td>
<td>DSM Manager and Project Engineer</td>
</tr>
<tr>
<td>Snohomish</td>
<td>Yes</td>
<td>Yes</td>
<td>Principal Engineer – System Planning and Protection</td>
</tr>
</tbody>
</table>

Findings
A variety of program aspects were explored during the interviews for this study.

1. **Utility Objectives for Participation in the DEI Project**: Global Energy Partners asked the nine utilities about their primary objectives for participating in the DEI project. The options were broadly categorized as energy savings, peak demand reduction or increased operational efficiency. Most of these utilities indicated that energy savings were their primary motivation for participation in the pilot. More than half of the respondents also indicated that increased operational efficiencies are an important consideration, and they felt that the Initiative was on the right path toward achieving those efficiencies.

2. **Role of Different Utility Departments in the Project**: Global Energy Partners asked which of the respondent's department(s) played the key role in the decision-making for participation in the project as well as implementation. About half of the utilities indicated that the Energy Efficiency department played a key role while the other half said that the Distribution Engineering/Distribution Operations department took the lead. Interestingly enough, only three out of nine utilities interviewed indicated that their senior managements played a role of any kind in the project. In contrast, NEEA project manager maintained that each utility's decision to participate was driven by senior management.

3. **Coordination of Activities among Different Departments**: Global Energy Partners asked utilities to comment on the adequacy and effectiveness of various project activities among different departments. Only three out of the nine utilities interviewed worked between the different departments. In fact, some respondents indicated that they had little or no success in coordinating various activities across utility departments. Respondents indicated that it was difficult to convince different utility departments to participate in the project as the activities fell outside their regular domains.

4. **Training Requirements for Utility Staff**: Seven out of the nine utilities interviewed indicated some kind of training that utility staff had undergone during project participation. Training was more relevant for participation in the load research project as compared to the pilots. In most cases, equipment vendors provided staff training.

5. **Customer Recruitment and Concerns**: RW Beck’s customer HVR recruitment process went smoothly, with very few concerns raised by customers during the installation phases. Some customers were not agreeable to a home survey before installation of the HVR and monitoring...
devices and were dropped out. A few customers registered frustration for the lag time in installing the voltage regulation equipment.

6. **Utility Interactions with Other Project Participants:** Utility interactions with different equipment vendors (e.g., meter supplier and voltage regulator equipment vendors) were very smooth with no complaints. Utilities were also highly satisfied with their interactions with the project contractors (e.g., RW Beck and RLW Analytics). All utilities agreed that NEEA played a critical role in the success of the pilot effort however some indicated that occasional gaps in communication can be alleviated with NEEA playing a more active role in the future program efforts.

7. **Project Cost Estimates:** Global Energy Partners asked participating utilities about their overall project costs. NEEA funded all voltage regulation equipment and metering devices. All other costs were borne by the utilities. Capital costs were for substation equipment upgrades and other equipment needed to operate the program. Operational costs related to project labor, data collection and technical trouble-shooting. Project costs ranged from as low as $40,000 to as high as $400,000.

8. **Challenges and Barriers to Project Participation:** There were a number of technical/operational difficulties including problems related to compatibility with existing infrastructures, data errors and telephone communication with the meters. There was widespread technical skepticism among utility staff, particularly from the distribution engineering departments. The HVR development and Underwriters Laboratory (UL) delayed implementation efforts. Project decision-making proved to be a challenge, particularly with utilities where cross-department cooperation was required.

9. **Likelihood for Future DEI Implementation:** Almost all utilities agreed that it was too early at the time this study was being conducted to comment on future prospects for the project - all of them were waiting for the technical analysis results to come in and would base their decision based on those results. Utility respondents offered several recommendations to improve future program efforts. Several mentioned that improvements to the project management would be necessary, there needs to be greater support within the utility (especially from upper-management), any new voltage regulation technology should be more fully developed and certified, and a high degree of communication and training is needed amongst project participants.

**Recommendations**

Based on the findings from the various interviews, below are specific recommendations for improving the pilot program:

**Project Marketing**

- Once data collection and analysis is complete, NEEA should emphasize energy savings and operational efficiency benefits of the DEI effort.
- NEEA should also target key stakeholder groups within the utility and improve communication about technical aspects of voltage regulation efforts.
- NEEA and project management firm should continue to facilitate communication across different utility departments that are involved in decision-making.
- For Phases II and III, NEEA must insure that the timing for marketing the project coincides with the utility budget cycle to reduce lag times.

**Project Management**

- NEEA should work with utilities to improve project resource allocation to ensure that sufficient resources are allocated for undertaking project activities.
- Project management firm should continue to work with utilities to insure coordination of project activities across different utility departments.
- NEEA and project management firm should work with participating utilities to develop forums for sharing of lessons learned and provide periodic updates on the project’s overall progress.
- During the next phase of the project, NEEA and project management firm should anticipate utility staff turnover and transfer and continue to respond in a timely manner.
- Project management firm and NEEA must continue to work with utilities to sustain interest and participation.
Executive Summary

Implementation

- Project management firm and equipment vendors should continue to provide utility staff training and vendor support, particularly with smaller utilities.
- Project management firm and utility technical champions should address technical/operational difficulties quickly.
- NEEA and project management firm should avoid delays in equipment installation.

Product Certification and Delivery

- For any new equipment or technology used in the next phase of the DEI project, NEEA should work with utility managers to insure that product certification requirements are well defined in advance of implementation.
- For new technology to be used in Phases II and III, NEEA should also work with equipment vendors to estimate the number of voltage regulation units that are required to be deployed and ensure that product manufacturing is scaled up to handle the increased demand.

Customer Recruitment and Participation

- The analytics contractor should solicit future customer participation by clearly articulating potential benefits.
- For any future recruitment effort, the project analytics contractor should work with utility customer service managers to set up well-defined, streamlined and uniform procedures for recruiting customers.
- For any future data collection effort, the project analytics contractor should also work with utility customer service managers to inform customers about the size and scope of the voltage regulation equipment.

Costs/Financing

- For Phases II and III, the project management team should coordinate with participating utilities to devise methods/strategies for managing project costs, particularly internal utility labor costs.
- At the outset of the next phase of the project, the project management team should undertake cost/benefit assessments for the project along with a comparison of alternative methods to attain conservation voltage regulation (as per the project deliverables agreement).
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INTRODUCTION

1.1 UDSEI PROJECT BACKGROUND

The Northwest Energy Efficiency Alliance (NEEA) is currently funding the Utility Distribution System Efficiency Initiative (Initiative or DEI), a multi-year phased initiative, aimed at improving the efficiency of the Pacific Northwest (PNW) electric utility distribution systems. The overall Initiative, which started in January 2003, will be conducted in three phases, over a five-year period. The long-term Initiative goal is to make the design, construction, and implementation of efficient electricity utility distribution systems and Conservation Voltage Regulation (CVR) common practice in the Pacific Northwest.

Traditionally, electric utilities have taken a demand-side approach to energy efficiency and conservation, focusing resources on programs to promote energy-efficient measures and conservation practices for their customers. However, industry experts have long believed that a vast, viable, and largely untapped resource for energy efficiency and peak load reduction may exist in the distribution system practices of many utilities. More specifically, scientific evidence suggests that utilities may be able to achieve dramatic energy and demand savings by lowering service voltages on distribution feeders. However, despite considerable utility research on this subject in the 1970s and 80s, few recent studies have examined this potential, and the means to attain it.

There is a general lack of awareness and information about the overall value of distribution efficiency improvements that can easily be implemented in the industry. The full range of costs and benefits are not fully recognized and implementation knowledge and tools to guide planning decisions are not available. There is limited actual implementation experience for operating distribution system efficiently since regional policies and regulatory treatment to support these improvements are not in place, and internal utility financial models for these improvements do not include the full range of costs and benefits.

First, both the NWPPC and BPA through conservation voltage reduction studies indicate that a large amount of regional energy efficiency savings exists within a relatively small number of interested customers. Thus there are a relatively small number of decision makers that can leverage a large amount of the distribution system opportunity. Larger utilities in the region are already integrating new technology such as SCADA systems, GIS, and computer modeling. With relatively small additional investments, these enhancements can also be used to significantly reduce energy consumption on the utility and customer side of the meter by optimizing the voltage levels on the distribution feeders. The smaller utilities in the region rely on guidelines and standards for designing and operating distribution systems published by entities such as the Rural Utility Service (RUS formerly REA). Opportunities exist to update these guidelines to include optimizing voltage regulation and distribution efficiency improvements.

The objective of the Initiative is to determine the costs and savings and other impacts of voltage regulation at the customer side of the meter and on the utility’s distribution system. The Initiative is evaluating a broad selection of residential customer load types to determine the energy and demand savings as a result of improved voltage regulation.

Through this initiative, NEEA has collaborated with utilities, vendors, and energy-related organizations to acquire cost-effective electric savings from a variety of efficiency strategies.

The Initiative is being implemented in three phases:

- Phase I - Development: Includes confirmation of costs, benefits, implementation options; and utility decision-making tools;
- Phase II - Implementation: Includes communications/marketing, and regional policy implementation, further development of support tools; and
• Phase III - Transition: Integration of project actions to market transformation.

Figure 1-1 provides NEEA’s logic model that maps the critical areas and solutions to existing market barriers being developed by the DEI project. The model illustrates the Initiative’s theory of change: a lack of awareness, knowledge and policy prevent the adoption of voltage regulation technology in the Pacific Northwest but NEEA seeks to overcome these barriers and induce market transformation by completing a series of demonstration Pilot Projects and Load Research. NEEA would then promote the results of the projects and research to assist better understanding of voltage regulation technology and develop policies that would facilitate the technology’s adoption. The adoption, in turn, would yield energy savings, reduce peak load, improved operational efficiency and improved service quality.

The structure of the Initiative has two components- Pilot Projects and Load Research projects. The objective of the Pilot projects is to research cost-effective design, construction and operation decisions that optimize the regulation of local distribution service voltage (Conservation Voltage Regulation or CVR) along the feeder lines. The aim of the Load Research component is to obtain estimates of customer related energy savings as a result of installation of on-site voltage regulation equipment, by targeting 500 residential homes that would have their energy and voltage metered for one year. The on-site voltage regulation equipment being demonstrated in this study is a Home Voltage Regulator (HVR) that acts as an inverter to stabilize voltage at lower levels, thereby reducing energy consumption, which results in savings for the average household that otherwise would receive higher voltages. A vendor named MicroPlanet is supplying the HVR units.

As part of the overall DEI project, R. W. Beck is serving the overall project management function, as well as conducting research, design, and implementation activities associated with the Initiative. RLW Analytics, a subcontractor to Beck, has conducted customer surveys, evaluated load types, and is analyzing load impacts.

Currently the project is in the Phase I stage, which is aimed at measuring the utility and customer costs and benefits (energy and non-energy) associated with distribution system efficiency improvements. Phase I includes multiple large-scale experiments with utility distribution systems and subsystems aimed at improving the efficiency of a utility’s distribution system. The results of these experiments will then be documented in a final report and used to develop technical and financial support tools as well as a best-practices guidebook that can be used to implement distribution system efficiency projects.
Introduction

**Market Characterization**
- Utility focus on Customer Demand-side approaches to Energy Efficiency (EE) & Conservation
- Lack of Information & Awareness about overall value of Distribution Efficiency Improvements (DEI)
- Full range of Costs/Benefits of DEI not recognized
- Lack of implementation knowledge & tools to guide planning decisions
- Insufficient regional policy & regulatory treatment

**Strategy**
- Multi-year phased initiative (3 phases; 5-yr period)
- Multiple large-scale experiments with utility Distribution system & sub-systems
- Establish DEI & CVR common practice in PNW
- Leverage on new technology upgrades by large utilities
- Update guidelines/standards published by RUS to include DEI for smaller utilities
- Evaluate range of customer load characteristics to determine savings as a result of improved voltage regulation.

**Target Audience**
- Utility
  - Management
  - Distribution Engineering & Operations
  - EE/Demand Side Management
  - Metering
  - Customer Service
  - System Planning
- Equipment vendors
- Energy-related organizations

**Development**
- Test utility options through pilots & load research at multiple sites
- Confirm costs/benefits of options
- Develop Decision-Making Tools for utilities

**Implementation**
- Communications/Marketing of results
- Widespread information dissemination
- Regional policy implementation
- Further develop support tools
- Training

**Short-term**
- Increased Awareness on utility & customer costs/benefits associated with DEI
- Enhanced capabilities to undertake DEI-related activities
- Tools to evaluate, plan, design, & implement DEI.

**Long-term**
- Improved efficiency of PNW electric utility distribution system
- Integration of DEI into EE practices & Distribution Eng.. Activities of utilities.
- Market penetration of DEI technologies

**Transition**
- Integration of project activities to market transformation

**Process Evaluation**

**Market Progress**
- kWh savings
- Peak kW savings
- Improved Operational efficiency
- Improved service quality

**Figure 1-1**
Logic Model for the DEI Project
The short-term goals of Phase I are to:

- Confirm the utility and consumer costs and energy efficiency and other benefits associated with distribution system efficiencies.
- Develop tools necessary for utilities to evaluate, plan, design and implement efficient operations of feeder voltage, collect meaningful load research data, and present pilot program empirical results that will support market transformation.

The intended project result is to confirm the overall value of operating the distribution system with a lower voltage average and within the American National Standards Institute (ANSI) Service Voltage Standard. As shown in the logic model for the DEI project (see Figure 1.1), Phase I covers the activities represented under ‘Development Activities’. If the project results from Phase I are favorable, a request will be made to the NEEA Board to fund Phase II, which will initiate a broader implementation effort. Phase II is represented under ‘Implementation Activities’ in the logic model. Phase II will in turn lead into Phase III, which is represented under ‘Transition Activities’ in the logic model. Phase I is likely to be completed by end of 2007. Phase I is the only Phase that has been funded. Upon successful completion of Phase I, Phase II and III are likely to begin in early 2008.

1.2 Purpose and Objectives of This Report

Global Energy Partners (referred to as Global) conducted an evaluation of Phase I to provide NEEA with a systematic, accurate and timely characterization and assessment of the current baseline market for distribution system efficiency. The Market Characterization and Assessment report presents a systematic assessment of the distribution efficiency practices in the nation as a whole and in the Pacific Northwest (PNW) region in particular, as it relates to the measures being implemented through the Initiative. It also documents the activities of the Phase I of the Initiative at the time the study was conducted.

The objective of this study is to conduct a process evaluation of the different project components and activities in the interim stages of Phase I of the initiative, in order to provide NEEA with an early indication if there are gaps in the on-going pilots and projects and to provide information and recommendations on future pilots or projects for NEEA to consider in Phase II of the Initiative. The approach for this study builds upon the previous work that developed the market characterization of Distribution Efficiency Initiative (DEI), with a focus on the process and programmatic aspects of the Initiative associated with different NEEA sponsored pilots and projects. This task focuses on the history, goals, objectives, roles, and issues associated with each pilot and/or project. It does not focus on the technology or equipment used in the pilot or project. The process evaluation will include the following components and activities:

- Develop/summarize a project scope for each DEI Project or Pilot- Why was the DEI Project or Pilot necessary?
- Develop/summarize the goal of each DEI Project or Pilot.
- Summarize the Roles & Responsibilities of each DEI Project or Pilot participant.
- Identify the problems, issues, and difficulties of each DEI Project or Pilot. For example, issues related to residential dropouts and possible resolutions/remedies.
- Summarize lessons learned
- Provide recommendations/suggestions for improvements in the Pilots and/or Projects.

1.3 Future Evaluation Efforts – Objectives and Scope for Final MPER

In the final stage of the study, Global will develop a final Market Progress Evaluation Report (MPER). The final MPER study will build on the current study as well as the earlier Market Characterization and Assessment Study (mentioned earlier), conducted by Global, in which it had developed a detailed baseline market characterization of the Pacific Northwest utility distribution system market. The scope of the final MPER will cover the following areas:
**Introduction**

- **Market Transformation:** It will investigate the key driving factors for utilities in undertaking initiatives for distribution efficiency improvements, the scope for market transformation and wide-scale dissemination of learning from DEI participants among a wider group of utilities, and whether DEI market transformation efforts impact IOUs and public utilities differently. On the technology side, based on a performance evaluation of the DEI technologies, the study will assess the scope for adoption and potential market penetration for these technologies.

- **Evaluation of Impact Analysis:** The final MPER will evaluate whether data collection from the pilots and the load research projects was sufficient to make a statistically significant and defensible inference regarding the outcome of the DEI project. It will investigate the degree of uniformity in data collection protocol across pilots and projects, whether the data analysis techniques account for the possible skew in data from any of the individual utility or substation practices, comment on the robustness of the data analysis techniques and on estimation of the impacts (in terms of savings, reliability, etc.).

The final MPER will be used by the Alliance along with the input from other Alliance contractor activities to determine if the Alliance should pursue Phase 2 of the Initiative and make recommendations on strategies, tactics, and new technologies to evaluate.
EVALUATION METHODOLOGY

The approach for conducting this study was to draw upon commonly employed process evaluation techniques including telephone surveys of participants and program personnel. The principal data collection activities associated with this process evaluation included the assimilation and review of all available and relevant program materials, and telephone interviews with different groups of participants in the project.

In order to collect information needed to address the issues described in the earlier section on report objectives, telephone interviews were conducted with the specific Utility Project Manager associated with the Pilot and Load Research projects. The interview guide is presented in Appendix A. In the overall Initiative being undertaken by the Alliance, there are nine utility participants in the Pilot component and eleven utility participants in the Load Research component. Table 2-1 shows all utilities participating in the pilot and load research project.

As part of this study, Global Energy Partners interviewed both utilities participating in the Pilot Projects only and those participating in both the Pilot and Load Research projects. No interviews were conducted for utilities participating only in Load Research as it fell outside the scope of this present study. At the time the scope for this study was developed, the primary area of concern was to identify the problems, issues, and difficulties associated with the pilot projects. Therefore the scope mentioned only those utilities that were participating in the Pilot. However, during the course of the study it was realized that issues related to residential dropouts in the load research projects were critical to understanding this technology and is market transformation potential. Therefore, while conducting the interviews with the pilot project participants, issues related to HVR installation and residential dropouts were addressed for those pilot participants that were participating in the load research component as well. The list of utility contacts for interviewing was provided by the R.W. Beck DEI team lead, K C Fagen.

Table 2-1
List of Pilot and Load Research Participant Utilities in the DEI Project

<table>
<thead>
<tr>
<th>Utility Name1</th>
<th>Pilot Project</th>
<th>Load Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clark County PUD</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clatskanie PUD</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Douglas PUD</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eugene Water and Electric Board</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Franklin County PUD</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Grant County PUD</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Idaho Falls Power</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Idaho Power</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hood River Electric Cooperative</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Pacific Power</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Portland General Electric</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Skamania PUD</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Snohomish PUD</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1 Utilities highlighted in **bold** are those that participated in the Pilot Projects.
Along with the utility interviews, separate telephone interviews were also conducted with lead contacts in the R.W. Beck DEI team, RLW Analytics, and the NEEA DEI Project Manager to obtain Project or Pilot history and status. A separate telephone interview was also conducted with a former employee of the HVR vendor, Microplanet, to obtain his insights into the vendor’s role and experiences during implementation of the Load Research projects. Information was also gathered from DEI Advisory Meeting that Global staff attended.
CHAPTER 3

OVERVIEW OF PILOT PROJECT ACTIVITIES

3.1 CURRENT STATUS OF UTILITY PROJECT ACTIVITIES

A range of utility options exists to increase efficiency on both the customer and the utility side of the meter. This project emphasizes the cost-effective design, construction and operation decisions that optimize the regulation of local distribution service voltage. The residential load research program and distribution feeder pilot demonstration projects are aimed at determining the total energy savings, as well as quantifying the savings for the utility and for the customer. Broadly, four options are being demonstrated for achieving this goal:

- Home Voltage Regulator Approach using a device installed at the customer’s electric meter to raise or lower the voltage as needed in conjunction with a recording meter;
- Simple voltage regulation “lite” which includes utility and contractor delivered enhancements to substations and feeders including installation of meters, setting controls, calculating line drop compensation settings, etc.;
- Large Utility Customized Approach including a combination of equipment, engineering modeling, application tools, and other actions to address the unique needs of larger utility systems; and
- Automated System Approach which requires SCADA installation and automated controls using end of the line meters to monitor and control system voltage.

This section presents a brief overview of the activities being undertaken by the nine utilities interviewed in this study. As mentioned earlier, out of these nine utilities, five are participating in both the Pilot as well as the Load Research Project, while the remaining four are participating in the Pilot only. The pilot has not yet been implemented in three utilities out of the nine considered in the study—these are Eugene Water and Electric, Grant County PUD, and Idaho Power. Table 3-1 gives a status update on the pilot activities at all nine utilities. On the Pilot side, utilities are employing a variety of strategies for voltage regulation (see Table 3-2). On the Load Research side, the five utilities interviewed in the study have completed installation of 265 HVRs (see Table 3-3).

A brief discussion on voltage regulation activities at the nine utilities is presented next.
### Table 3-1
**Status of Pilot Project Activities**

<table>
<thead>
<tr>
<th>Utility</th>
<th>Pilot Project Status (as of July 31, 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Utilities</td>
<td>Pilot completed in February 2006. All data required for analysis has already been provided.</td>
</tr>
<tr>
<td>Clark County PUD</td>
<td>One of the two substations planned has been operational since early 2006. The other substation, most likely, will not be included. Monthly data is being provided from the operational one.</td>
</tr>
<tr>
<td>Clatskanie</td>
<td>DEI piggybacked on a Clatskanie project that was already in place. Though the pilot was completed in January 2004, no data has been provided.</td>
</tr>
<tr>
<td>Douglas</td>
<td>The project started operation in August 2005. Data from August to November is available. Subsequently, there were some equipment failures (unrelated to the pilot), due to which data from November, 2005 through March, 2006 shows errors. The DEI system has not been put in place after the equipment failure correction.</td>
</tr>
<tr>
<td>Eugene Water and Electric</td>
<td>Construction for the Pilot is 90% complete, but is not operational; expected to be operational by September 2006. Monthly data is likely to come in after it starts operation, till around June, 2007.</td>
</tr>
<tr>
<td>Grant County</td>
<td>Construction for the Pilot is 90% complete, but is not operational. The project is unlikely to be operational</td>
</tr>
<tr>
<td>Idaho Power</td>
<td>Construction for the Pilot is 95% complete, but is not operational; expected to be operational by September 2006. Monthly data will be provided after the project starts operation.</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>Project has been operational since January 2006 for both substations. Monthly data is being provided. Voltage and demand data are being provided, but there are problems in getting the correct Kvar data due to instrumentation issues in one of the feeders.</td>
</tr>
<tr>
<td>Snohomish</td>
<td>Project has been operational since December 2005, and the project is likely to continue operation till further notice. Monthly data is being provided.</td>
</tr>
</tbody>
</table>

Source: Information provided by R W Beck.
### Table 3-2
Pilot Project Voltage Regulation Activities

<table>
<thead>
<tr>
<th>Utility</th>
<th>Substations</th>
<th>Approach for Voltage Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Utilities</td>
<td>Francis and Cedar</td>
<td>End-Of-Line (EOL) with Feeder improvement</td>
</tr>
<tr>
<td>Clark County PUD</td>
<td>Runyon</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td></td>
<td>Union Ridge</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td></td>
<td>Wauna</td>
<td>End-Of-Line (EOL) only</td>
</tr>
<tr>
<td></td>
<td>Delena</td>
<td>End-Of-Line (EOL) only</td>
</tr>
<tr>
<td>Clatskanie</td>
<td>Clatskanie</td>
<td>End-Of-Line (EOL) only</td>
</tr>
<tr>
<td>Douglas</td>
<td>Waterville</td>
<td>Line Drop Compensation (LDC) with SCADA</td>
</tr>
<tr>
<td>Eugene Water &amp; Electric</td>
<td>Coburg</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td>Grant County</td>
<td>Ehrata</td>
<td>Line Drop Compensation (LDC) with SCADA</td>
</tr>
<tr>
<td>Idaho Power</td>
<td>Boise Bank 1</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End-Of-Line (EOL) only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mid-feeder voltage regulation</td>
</tr>
<tr>
<td></td>
<td>Boise Bank 2</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End-Of-Line (EOL) only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mid-feeder voltage regulation</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>Union Hill</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td></td>
<td>Hazelwood</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
<tr>
<td>Snohomish</td>
<td>Murphy’s Corner</td>
<td>Line Drop Compensation (LDC) with Feeder improvement</td>
</tr>
</tbody>
</table>

Source: Information from R W Beck as on August 9, 2006.

### Table 3-3
Current Status of Utility Load Research

<table>
<thead>
<tr>
<th>Utility</th>
<th>Goal for HVR Installation</th>
<th>Number of HVRs Installed (as of 07/31/06)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas</td>
<td>50</td>
<td>49</td>
</tr>
<tr>
<td>Eugene Water and Electric</td>
<td>50</td>
<td>46</td>
</tr>
<tr>
<td>Idaho Power</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Snohomish</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Source: Information from R W Beck as on August 9, 2006.

### 3.2 CURRENT STATUS OF PROJECT COORDINATOR ACTIVITIES (RLW ANALYTICS AND RW BECK)

RLW Analytics has already set up the data analysis framework. RLW staff has been provided the final corrected data coming in from the operational projects. The expected initial data analysis results are likely to be available by the beginning of January 2007, while the final data analysis for the DEI project is likely to be completed by the third quarter of 2007. RLW will also be working on the Guidebook and Tools during the third quarter of 2006.

For the remainder of this year, RW Beck will be engaged in getting pilots operational at three utilities (Eugene, Grant, and Idaho Power), conducting mid-year analysis, and tools development. RW Beck staff will be undertaking data collection activities during the first and second quarter of 2007. The final data
Overview of Pilot Project Activities

3.3 OVERVIEW OF UTILITY VOLTAGE REGULATION ACTIVITIES

3.3.1 Avista
Avista is participating in the Pilot component only of the DEI project. Though participation in the project was initiated almost three years ago, the actual implementation has taken place only over the twelve months. Avista has only one substation with three feeders (that has supply points to around 5000 customers) participating in the Pilot. The utility has commissioned a pilot test of the PCS Utilidata AdaptiVolt system that integrates with Avista's SCADA system to automatically regulate substation voltage in order to maintain a fixed End Of Line (EOL) voltage.

3.3.2 Clark County PUD
Clark County PUD is participating in the Pilot component only of the DEI project. The utility has been operating its substations at 120-121 V for over 30 years. Clark employs LDC to maintain an average voltage of 117 V at the distribution transformer. It has two substations- one with a single feeder, and the other with three feeders participating in the Pilot. The voltage at the substations is being controlled by changing taps on the secondary winding of the transformer, called Load Tap Changing (LTC). A substation transformer load tap changer (LTC) allows the voltage at a substation to be adjusted over some range, usually +/- 10%. It is employing Line Drop Compensation (LDC) on its feeders that enables the voltage at the distribution transformer to fluctuate, so as to maintain a minimum voltage to the home at the end of line of at least 114 V.

3.3.3 Clatskanie
Clatskanie PUD is participating in the Pilot component only of the DEI project. It has been piloting the PCS UtiliData® AdaptiVolt™ system since February 2003. Three out of its four substations (Wauna, Clatskanie, and Delena) have been participating in the pilot, which together serve seven feeders. One of the participation requirements was to have regulators on all feeders of the substation. Using radio communications, AdaptiVolt™ automatically regulates the substation load tap changer in order to maintain an End Of Line (EOL) voltage range of 118V-116V. The project was scheduled to operate on a one-day-on / one-day-off basis. Data from this project is currently on hold pending the resolution of funding issues.

3.3.4 Douglas
Douglas has been participating in both the Pilot as well as the Load Research component of the DEI project. As part of Load Research, it already has 49 HVR units installed on the homes.

Similar to Clark, Douglas is using Load Tap Changing (LTC) for regulation of its substation voltage. It is employing Line Drop Compensation (LDC) for voltage regulation along the feeders with a SCADA system for automation. SCADA systems provide improved voltage regulation, along with other benefits such as reduced cost to operate substations and improved ability to restore service to customers during emergency conditions.

3.3.5 Eugene Water and Electric Board
Eugene Water and Electric Board is a participant in both the Pilot and the Load Research project since the past two years. While, the Load Research component involving installation of HVRs is currently being implemented the Pilot component is yet to be implemented. Utility staff estimates that it is likely to take three more months for completion of engineering designs. EWEB has a total of 36 substations in its system, out of which only one substation with twelve feeders is participating in the Pilot. Implementation of the Pilot will proceed after EWEB balances all feeders. Similar to Clark, EWEB is going to control the substation voltage by changing taps on the secondary winding of the transformer, called Load Tap Changing (LTC).
3.3.6 Grant County PUD
Grant County PUD is participating only in the Pilot component of the DEI. Since, October 2003, only one substation is participating in the study for which voltage regulation has not yet been implemented. Grant has been operating its substations at an average of 122V (+/- 1V) as its standard practice for over ten years. It is employing similar techniques as Douglas for voltage regulation at its substations and along the feeders. The substation voltage is going to be regulated through Load Tap Changing (LTC), and the voltage regulation along the feeders through Line Drop Compensation (LDC) with SCADA.

3.3.7 Idaho Power
Idaho Power is a participant in both the Pilot as well as Load Research. It applies LDC on its feeder lines to maintain end of line voltages at 114V. Idaho Power makes use of additional regulators and capacitors to support voltage and power factor along feeder lines, since the system characteristics of its long feeders in rural areas require extensive voltage regulation. Moreover, most of Idaho Power’s system levels and locations are capacity constrained at peak, either voltage-limited or current-limited. Only one substation along with three transformers is participating in the Pilot. Idaho Power completed installing the regulator banks along a feeder last December, but the voltage regulation is yet to be implemented. However, it is almost ready to go. On the Load Research side, it has completed installation of 75 HVRs, out of which almost 65 are in service.

3.3.8 Puget Sound Energy
Puget Sound Energy is also a participant in both the Pilot as well as Load Research. Currently the utility is implementing distribution efficiency options at two substations and all four feeders at each of these substations, as part of the DEI project. Puget Sound operates its substations at 125V, on average. It conducted an internal study in 1983 on the potential for energy savings from lowering substation voltage through LDC. This internal study determined that lowering substation voltage could result in significant savings to the utility. However, no voltage regulation project was ever implemented, because of the perception that low voltage complaints that might result. As part of the current project, it is employing LTC for regulation of its substation voltage and LDC with feeder improvements.

3.3.9 Snohomish PUD
Snohomish PUD is a participant in both the Pilot as well as the Load Research project. Snohomish has been practicing distribution efficiency since 1991, operating substations at voltage levels necessary to maintain end of line voltages at 114V through line drop compensation (LDC). Typically, Snohomish has found that a voltage range of 124V-119V at the substation (average of 123V-122V) is sufficient to maintain the minimum acceptable end of line voltage, which conserves energy compared to operating the substations at up to 126V. One of its substations with four feeders is participating in the Pilot employing LTC for substation voltage regulation and LDC with feeder improvements for end of line voltage regulation.

3.4 ROLE OF PROJECT CONTRACTORS

3.4.1 RW Beck
RW Beck is undertaking the task of overall project management, along with handling of project engineering and documentation of results from the study. Project management includes activities such as coordination of activities across the participant utilities, tracking project progress to ensure that various tasks are completed within the scheduled time, and monitoring the project budget. Project engineering involves providing technical assistance to the utilities in undertaking the various strategies related to the Pilot and Load Research projects, working with utilities in implementing these strategies and performing analyses to determine the outcomes of different options. Beck works extensively with the utilities as well as with all other market actors such as RLW Analytics, equipment vendors, and NEEA project manager.

3.4.2 RLW Analytics
RLW Analytics acts as a subcontractor to RW Beck and has been associated with the DEI project for the past two years. RLW’s function in the project is to conduct statistical analysis of the data and quantify the impacts associated with the different strategies being tried out by the utilities. As part of impact
assessment, RLW is also tasked with quantifying impacts by end-use for the customers in the load research project. RLW also managed the process of customer recruitment and residential assessment for the load research project. RLW has completed the recruitment process for participant utilities with only a few assessments yet to be done. RLW directly interacts with utilities in conducting these activities and to a very large extent with R W Beck staff.
CHAPTER 4

STUDY FINDINGS

4.1 FINDINGS FROM UTILITY INTERVIEWS
This section presents a summary of findings from interviews of utility staff primarily responsible for managing the DEI project. During these interviews, questions were asked on different aspects of program design and delivery, as well as the staff’s own experiences during the project. The different project related aspects covered during the discussion, relevant from a process evaluation standpoint, included staff experiences/perceptions on the following:

- Utility Objectives for participation in the DEI project
- Role of different utility department(s) in the project
- Training requirements for utility staff
- Customer recruitment and concerns
- Utility interactions with other project participants
- Project Cost Estimates
- Utility Perspectives on Challenges/Barriers faced during participation
- Utility Perspectives on likelihood for future implementation
- Utility Staff Recommendations/Suggestions for Improvements

A summary of the responses and observations of utility staff is presented below.

4.1.1 Utility Objectives for Participation in the DEI Project
The utility staff respondents were asked about the primary objectives for their utility’s participation in the DEI project. The options provided could be broadly categorized as:

- Energy savings
- Peak Demand Reduction
- Increased Operational Efficiency

There were a few utilities that cited participation objectives, which did not fall among any of these categories, such as service quality improvements and willingness to help NEEA in their efforts. A summary of findings from utility discussions under each of these categories is presented here.

a. Energy Savings: Six out of the nine utilities interviewed cited achievement of energy savings as their primary objective for participation in the pilot, while out of the remaining three, two assigned medium priority to energy savings. The remaining one utility was not sure whether energy savings could be achieved at all. One utility, among those that cited energy savings as their primary objective, also mentioned that it wanted to understand the savings that could be achieved by lowering the voltage for different classes of customers. Through participation in the project, utilities were interested in testing new options for energy savings in the distribution system associated with the lowering of voltages.

b. Peak Demand Reduction: Only one among the nine utilities interviewed cited peak demand reductions as a primary objective for their participation in the pilot. A staff from this particular utility remarked that the load profile of its customers was quite different from those of other utilities in the region due to the predominance of air-conditioning load- and the utility was interested in analyzing the impacts of voltage reduction strategies on their peaking demand. Six out of the nine utilities cited peak demand
reduction as only a secondary objective and would be interested in looking at the study results to see whether any peak demand reductions were achieved at all. The remaining two did not consider peak demand reduction as an objective at all for their participation in the project.

c. Increased Operational Efficiency: One of the key reasons cited for participation in the project was to achieve increased operational efficiency in the utility's distribution system. Five out of the nine utilities interviewed assigned a high priority towards making their distribution operations more efficient through various strategies being tested in the pilot such as system automation, advanced SCADA deployment, more efficient feeder operations, and reductions in transformer losses.

d. Service Quality Improvements: Two utilities mentioned that achieving service quality improvements was a primary motive for their participation in the project. A key objective was to be able to deliver better steady state voltage throughout their system, and to try out different options on how service quality could be improved.

e. Other Objectives for Participation: Two other reasons cited by utilities for participation in the project were to learn from experience of other utilities, and to help NEEA in its efforts towards providing local and regional benefits through distribution efficiency improvements. One of the pilot participants has been operating on a lower voltage for quite some time as compared to other utilities (120-121 V instead of the typical 125-126V), and was interested in learning about other utility experiences on different operating strategies and their impacts.

4.1.2 Role of Different Utility Departments in the Project

The utility staff respondents were asked which department(s) within the utility played the key role in decision-making for participation in the project as well as implementation. Participants were also prompted for adequacy and effectiveness of interactions among different utility departments and the extent to which various project-related activities were coordinated. Participants also commented on whom within the utility played the role of a technical champion in the project. A summary of the key observations on roles played by different utility departments is presented here.

a. Role of Energy Efficiency/DSM Department: Out of the nine utilities interviewed, staff from five utilities noted that the energy efficiency/DSM department within the utility played a key role in the decision-making for participation in the project as well as driving it forward through coordination among other departments. In all these utilities, the decision-maker for participation came from the energy efficiency/DSM department. Also, some of the smaller public utilities do not have an energy efficiency department. For two of the public utilities participating in the project, the energy efficiency department formed a part of ‘Customer Services’, which worked very closely with the distribution-engineering department. In some of the smaller public utilities energy efficiency/conservation actions form a part of overall power management activities. In most of these cases, the engineering and power management department took the lead. All three IOUs interviewed in this study derived the project funding from the energy efficiency department. Two among these three IOUs noted that their energy efficiency/DSM department played a key role in deciding to participate in the project as well as driving it forward, while for the third utility, the project was led by technical champion(s) from the distribution planning and operations department.

d. Role of Distribution Engineering/Distribution Operations: In seven out of the nine utilities interviewed during the study, the distribution engineering/operations department played lead role- utility personnel within this department undertook the role of a technical champion. This is especially observed in some of the smaller public utilities where the engineering/technical services department has been actively involved in decision-making and participation along with providing project funds. For the case of a particular public utility, the distribution-engineering department undertook the process of customer selection and recruitment, while the metering department primarily undertook equipment installation on the field as well as other operational activities. For one of the participant IOUs, while the energy efficiency department played a key role in the initial stages of the project as well as handling various customer-related issues, the distribution planning department has played a lead role in undertaking all other implementation activities. For utilities that are participating in the load research project, the metering department has played a key role in undertaking customer recruitment, HVR installations, as well as coordination of activities with HVR equipment vendors.
e. Senior Management Involvement: Most of the utility participants interviewed remarked that the senior management within the utility did not or played a minimal role in the project. In most cases, they were informed of the utility's decision to participate and were required for budget approval. In some cases, senior management raised concerns related to service quality implications for the end-use customer and these had to be allayed by other utility staff.

4.1.3 Coordination of Activities Among Different Departments
The utility staff respondents were prompted to comment on the adequacy and effectiveness of various project related activities among the different utility departments. Only three out of the nine utilities interviewed indicated that project-related activities across different utility departments had been well coordinated. But the others expressed concerns related to interactions among different groups of stakeholders within the utility and coordination of activities. However, in all cases, a technical champion within the utility was successful in overcoming some of these challenges and pushing the project ahead. Some of the difficulties/challenges faced are summarized here as follows:

- Involvement of different utility departments and coordination of activities: Some utility personnel interviewed suggested that it was difficult to coordinate various activities across different utility departments. This problem was compounded by the uncertainties associated with the project and the potential benefits offered. For example, for a particular IOU, a distribution efficiency project launched a decade ago had raised alarms and led to customer complaints. In this particular case, it was difficult to solicit higher management support for project participation. In some cases, the customer service center or the call center expressed concerns around receiving customer complaint calls.

- Prioritization of activities: Utility staff quite often noted that it was difficult to convince different utility departments to participate in the project as the activities fell outside their regular domain of activities and tend to be assigned lower priority.

- Resource allocation difficulties: A few utilities expressed concerns related to resource allocation for the project (both financial as well as human) in already existing resource-constrained conditions. In some cases, budget sharing in congruence with potential derived benefits from the project among different utility departments was difficult. For example, in the case of a particular utility, the energy efficiency/DSM department (which provided the major share of project funding) was not willing to go ahead with the project unless the distribution engineering department, which would derive benefits from the project, was willing to be a project stakeholder.

- Availability of technical resources: Finding the people with right kind of technical expertise was difficult- problems were caused by transfer of people across departments and shift in role/responsibilities.

4.1.4 Training Requirements for Utility Staff
The utility staff respondents were asked whether participation in the project required any personnel training. Seven out of the nine utilities interviewed indicated some kind of training that utility staff had gone through related to their participation in the project. Training was more relevant for participation in the load research project as compared to the pilots. In most cases, the equipment vendors provided training. Some of the areas covered under training were:

- Troubleshooting problems arising due to interconnection of new equipments being installed as part of the pilot with the utility's existing system. In such cases, vendor support was useful in problem solving.

- Utilities that are participating in the Load Research project had training on HVRs, provided by the equipment vendor.

- Utilities noted training requirements related to installation of meters.

- A particular utility specified the need for training related to project implementation- specifically on selection of best sites for installation of the voltage regulation measures.
4.1.5 Customer Recruitment and Concerns

The utility staff respondents were asked to describe their interactions with customers, the process of customer recruitment, their experiences with handling customer complaints, and any other kind of concerns arising on the customer side during the course of the project. For utilities participating in the load research project that involved HVR installation, customer selection and recruitment was in most cases carried out by one of the project contractors, RLW Analytics. The utility provided a list of customers to RLW, who in turn screened customers based on a number of criteria—customers were required to have a residence and not a mobile home; customers in certain geographical areas were targeted (valley areas versus mountainous areas); they needed to have appropriate phone wiring at their residence to enable meter communications; and they also had to be agreeable to have a recording meter installed and for an in-home survey prior to installation of the HVR unit. During the discussions, utility staff noted that the process of customer verification and recruitment has been a lengthy and arduous process with delays along the way. On the Load Research side, utility staffs being interviewed were asked the type of customer complaints/concerns they have been experiencing from residential customers where HVR units have been installed. Table 4-1 gives a summary of utility responses on their experiences. For the pilot projects, only one public utility out of the nine interviewed reported some kind of voltage-related customer complaints/concerns. This particular public utility received voltage complaints from a small industrial load (very small mill with less than 1 MW load) and a municipal pumping load—both lying on the same feeder. Since that time, the feeder has been turned off.

Table 4-1 Summary of Utility Responses on Customer Complaints/Concerns

<table>
<thead>
<tr>
<th>Utility¹</th>
<th>HVRs installed</th>
<th>Utility responses regarding customer complaints/concerns</th>
</tr>
</thead>
</table>
| Washington PUD-1 | 49 | • Only two calls received regarding voltage complaints from customers.  
• One of these voltage concerns was a direct result of the customer’s wiring and grounding of the meter base and panel. This problem could not be solved and the HVR unit was removed at the customer’s request.  
• The other concern was caused by a radio reception problem that was solved by relocation of the external antennae. |
| Oregon PUD | 46 | • Utility only faced a couple of complaints regarding positioning of the HVR units.  
• Customers did not like where the units were positioned and they had to be re-installed.  
• At the time of the interview, utility staff respondent was unsure as to whether HVR units were in operation. He was not aware of any customer-side voltage issues. |
| Idaho IOU | 75 | • No major complaints or concerns from customers.  
• A couple of customers were not agreeable for the in-home survey.  
• Some (exact number not indicated by utility staff) customers were intimidated by the big size of the HVR unit and did not want it to be installed.  
• No voltage complaints from customers.  
• There were a few problems (exact number not indicated by utility staff) related to phone issues—caused by interactions between the modem being used by the utility and DSL connection of customers. When the DSL filter was put in, there were problems with caller Ids. All of these problems were resolved. |
| Washington IOU | 45 | • No complaints/concerns from customers where HVRs have been installed. |
| Washington PUD-2 | 50 | • Out of the total number of customers who agreed to participate in the load research project, about half of the customers were lost due to delays in between the customer agreement and the actual installation. During these delays, customers lost interest for participation or moved residences.  
• No voltage-related complaints/concerns reported back from customers where HVRs have been installed.  
• Only one residential customer did not like the HVR unit after installation, and the unit was removed. |

¹ The names of the utilities have not been mentioned in order to preserve confidentiality of information.
Study Findings

4.1.6 Utility Interactions with Other Project Participants
The utility staff respondents were asked to provide their perceptions on experiences of interactions with different groups of project stakeholders- equipment vendors, project contractors, and NEEA. Based on these discussions, a summary of the findings are presented in the sections below.

4.1.6.1 Interactions with Equipment Vendors
Overall, utility interactions with different equipment vendors seemed to have progressed well and there were no complaints/concerns expressed by utility staff during discussions. Only one utility program manager remarked that there was scope for improvements in terms of more involvement on the part of vendors and providing greater technical support. A summary of utility responses with respect to interactions with different vendors is presented.

- **Meter Supplier:** The meter supplier seemed to have a moderate degree of influence on the project implementation. Three out of the nine utilities interviewed in this study recalled their interactions with the meter supplier, which is Hunt Power. This vendor helped utilities in the implementation of the meters as well as provided feedback on information related to data transfer and communications. But some of the smaller public utilities did not have any interactions with the meter supplier and were not able to recall the vendor’s name. One of the large IOUs complained that the vendor did not keep ‘utility staff in the loop’ when issues arose related to meter operations.

- **Voltage regulation system vendor:** Two utilities noted that PCS Utilidata (voltage regulation automation equipment vendor) has been very influential in the project in providing technical support and training on how to use the automated voltage regulation system.

- **HVR equipment vendor:** Utilities seemed to have varying degrees of interactions with the HVR equipment vendor, MicroPlanet. Some utility staff recalled the information provided by the vendor during some of the project training sessions at the start of the project and addressing queries related to HVRs. Others indicated that the vendor played a more active role on the field in providing support related to HVR installation and operations.

4.1.6.2 Interactions with Contractor RW Beck
Utilities seemed to have a varying degree of interactions with the project contractor RW Beck. Overall, utility staff indicated a high degree of satisfaction with these interactions. Seven out of the nine utilities interviewed indicated a high degree of interactions with R W Beck. They agreed to the fact that the contractor has played a very influential role in the project implementation- in training utility staff, providing technical support, and coordinating activities across different utility departments. The remaining two utilities indicated minimal interactions with the contractor.

4.1.6.3 Interactions with NEEA
Almost all utilities interviewed agreed that NEEA has been very influential in the overall project implementation. It has played a lead role in convincing the utility to participate in the project, communicated with different utility departments and coordinated activities among different groups.

Only one utility among those interviewed indicated gaps in communications with NEEA, and suggested that NEEA play a more active role. The staff interviewed indicated that there have been no interactions with NEEA or any other project participant as funding issues remain unresolved. He would like NEEA to play a more active role in resolving these issues and provide more active support on the pilot activities.

4.1.7 Project Cost Estimates
The utility staff respondents were asked questions related to project costs- provide estimates on the overall project costs as well as the breakup of the total costs into capital and ongoing costs. The primary cost components under each of these categories were also discussed. NEEA supplied the participating utilities with the HVR devices and the meters. All other costs were borne by the utilities. Participant responses varied and it was difficult to obtain uniform cost information across the nine utilities interviewed.

Total costs for pilot projects and load research for the nine utilities ranged from $40,000 to $400,000. Three of the nine utilities reported capital investments (related to the Initiative) ranging from $5,000 to
$350,000. The wide range is due, in part, to one utility’s existing voltage regulation infrastructure that did not require significant capital investment in order to implement the pilot project.

Another component of total costs mentioned by six of the nine utilities was that of labor. The two utilities that specified labor costs offered a range of expense between $4,000 and $40,000. These costs were specific to each utility’s local labor market conditions and infrastructure circumstances.

A summary of the utility comments regarding project cost estimates, are summarized in Table 4-2.

### Table 4-2
**Summary of Utility Project Cost Estimates**

<table>
<thead>
<tr>
<th>Utility</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington IOU-1</td>
<td>• Project costs form part of the DSM budget</td>
</tr>
<tr>
<td></td>
<td>• Ongoing costs are not significant- include data collection, and technical trouble-shooting</td>
</tr>
<tr>
<td>Washington PUD-1</td>
<td>• Capital costs are relatively low as not much change was made to the feeders; some capital was spent on substation metering.</td>
</tr>
<tr>
<td></td>
<td>• Additional costs include the labor costs associated with meter installation, and gathering and processing meter data.</td>
</tr>
<tr>
<td>Oregon PUD-1</td>
<td>• Was not able to estimate break-up of the costs into capital and ongoing costs.</td>
</tr>
<tr>
<td>Washington PUD-2</td>
<td>• Labor costs form the single largest cost component</td>
</tr>
<tr>
<td></td>
<td>• Materials and equipment costs have been negligible</td>
</tr>
<tr>
<td>Oregon PUD-2</td>
<td>• No estimates available on break-up of costs</td>
</tr>
<tr>
<td>Washington PUD-3</td>
<td>• Project costs are yet to be tracked</td>
</tr>
<tr>
<td></td>
<td>• Labor costs constitute the largest costs</td>
</tr>
<tr>
<td>Idaho IOU</td>
<td>• Pilot primarily funded from the utility’s capital budget</td>
</tr>
<tr>
<td></td>
<td>• Variable costs funded from DSM/efficiency rider</td>
</tr>
<tr>
<td></td>
<td>• HVRs and meters supplied by NEEA, free of cost.</td>
</tr>
<tr>
<td>Washington IOU-2</td>
<td>• 80% of the project funds derived from the EE/DSM department and the rest 20% from the Planning department</td>
</tr>
<tr>
<td></td>
<td>• Project costs are yet to be analyzed</td>
</tr>
<tr>
<td></td>
<td>• Labor costs form a large cost component</td>
</tr>
<tr>
<td>Washington PUD-4</td>
<td>• No cost concerns</td>
</tr>
<tr>
<td></td>
<td>• Operating costs are not significant.</td>
</tr>
</tbody>
</table>

1 The names of the utilities have not been mentioned in order to preserve confidentiality of information.

### 4.1.8 Utility Perspectives on Challenges/Barriers Related to Project Participation

Staff from each of the nine utilities interviewed during this study discussed the perceived challenges/barriers that they have experienced during participation in the project. These challenges/barriers are grouped into seven broad categories:

- Technical/Operational difficulties
- Technical Skepticism
- Product Development and Certification
- Project Decision-making and Management
- Resource Allocation
- Economic and Financial Challenges
- Customer-related Issues

This section presents a summary of interviewee responses under each of these categories.
Study Findings

**a. Technical/Operational Difficulties:** A variety of concerns were expressed by utility staff related to technical/operational difficulties, which primarily relate to the following aspects:

- **Compatibility with existing infrastructure:** For one of the utilities, the voltage regulator controls being tried out as part of the pilot did not interact appropriately with the utility’s existing Automatic Voltage Control (AVC) system. Therefore the existing system needed to be upgraded.

- **Data errors:** One of the participating utilities indicated that handling data errors has been a big challenge. This has been resolved to a large extent, though some challenges remain and the system has been shut off.

- **Communications to the controls:** A participating utility has been facing significant problems related to communications with the controls in its attempt to implement the AVC system. This particular utility has a PLC based SCADA system and has been facing problems in wireless communications with the PLCs. Additionally, it also faces frequent problems with the radios in getting End-of-Line (EOL) voltage back to the regulators. The PLC based SCADA system wireless communications problems would have existed even if the utility had not participated in the pilot. But the EOL monitoring system installation was undertaken as part of the pilot activity—so the problems on that account can be attributed to the pilot. The utility staff roughly estimated that of the total technical problems being faced, two-thirds of it are being caused by pilot-related activities while the remaining third would have occurred anyway.

- **Telephone communications with meters:** A participant utility experienced significant delays associated with difficulties in connecting the telephone line to the meters for data communications. Problem identification and troubleshooting led to substantial delays. The metering department at one of the utilities was not willing to support telephone communications to meters, and so the utility contracted with a third party to go with fiber connection in place of telephone connection. This did not work out well and the utility experienced problems in meter communications.

- **HVR timing clock problem:** One utility staff indicated that there were technical challenges associated with the control device in the HVR (timing clock sequence) in a few cases (5% of the installed sites). This was solved by component replacement or recalibration.

- **Robust data analysis:** One of the participating utilities expressed concerns surrounding credibility of the data analysis being conducted by an equipment vendor who supplied the system automation, primarily due to conflicts of interest. It would like to see an analysis of the results by an independent third party on what benefits were being reaped through the substation level improvements as part of the pilot.

- **Communication analysis delays:** As part of the project, a particular utility was installing remote EOL feedback to the load tap changer (LTC) in the substation. The communication path analysis for undertaking this option took a long time and caused project delays.

- **Software tool usage:** One participant utility expressed challenges in learning how to use the software tool to pull the data (from substations) off from the SCADA system in a spreadsheet form that RLW would finally require for analysis.

**b. Technical Skepticism:** Utility staff expressed technical skepticism associated with the project, primarily in the initial stages of the project, due to insufficient understanding of potential benefits and risks. Concerns remain with respect to customer voltage controls and impacts on quality of service, especially in utilities that have not yet undergone full implementation. However, utilities are waiting for the analysis results on project impacts associated with the measures being experimented with in the project.

A participant utility indicated they were skeptical of the strategies being tested out in the pilot for voltage control. This particular utility has unique load patterns (has very large air-conditioning load component) for which voltage regulation may not be the right answer for efficient system operation. A more effective strategy may entail increasing voltage at certain times of the year and reducing voltage at other times.

Staff at one of the participating utilities expressed a very high degree of technical skepticism associated with the theoretical foundation of the project and expressed disillusionment with the options being tried out as part of the pilot, unless data analysis and verification of results show otherwise.
c. **Product Development and Certification:** Issues raised related to the HVR devices and the metering equipment. A summary of these are presented.

- **HVR Certification:** There were substantial project delays associated with obtaining a UL certification for the HVRs. At the time the program was launched, the HVRs were not a certified product, and it took almost a year for approval and certification of the products.

- **Development of Meters:** Utilities also experienced delays related to development of meters. At the time the project was being readied for roll out, meter development was still in the prototype stage that led to delays.

d. **Project Decision-Making and Management/ Resource Allocation:** Utilities expressed a variety of concerns and substantial challenges associated with overall project management, resource allocation for the project, and coordination of activities across different utility departments. A summary of these are presented.

- **Project approval challenges:** A particular utility interviewed during the study indicated that getting project approval was a significant challenge that took a very long time (almost 3 years). The Transmission and Distribution (T&D) was highly resistant towards undertaking the project because it would change the way the system was operated and the perception that the department was spending money on something that was another department's responsibility and that the other department should pay for.

- **Stakeholder agreement on project participation:** Utilities have experienced difficulties in selling the project internally to different stakeholder groups within the utility and in getting their agreement for participation in the project. For some utilities, the distribution engineering/operations group was resistant to change. Therefore selling the project internally to them was a challenge.

- **Integration of project-related activities:** Utilities experienced difficulties in integrating project activities as part of the regular routine and normal operating functions of the utilities, as well as staying on track on the project.

- **Project prioritization and support:** Most utilities assign a low priority to the project, relative to other ongoing activities. This caused difficulties in allocating resources to the project that led to implementation delays.

- **Resource allocation for project activities:** Resource allocation for the project has been challenging, especially under situations where utilities are facing existing resource constraints. This has been a challenge, especially for dedicating human resources for activities such as meter installation. Meter installation delays in some cases have led to long project delays. Metering personnel are involved in a number of different activities and therefore getting resources for the project that has a relatively low priority is challenging. Some utility personnel are also of the opinion that undertaking the project activities take up too much of engineering time, which is probably not worth. However, getting adequate manpower to perform the required tasks was difficult more so because of this being a research project as compared to a full project.

- **Resistance to changes in existing practices:** Some utility personnel expressed concerns on whether the distribution engineering/operations department would be willing to undertake changes in its activities from its existing pattern in order to conform to the efficiency improvement measures being tried out in the project. A high inertia exists against alterations in existing job patterns within the utility departments.

- **Coordination of project activities:** Coordination of activities related to the project, across different utility departments, was challenging for utilities- especially the large ones. Utility personnel interviewed during the study indicated that in most utilities- ‘a big wall exists between the T&D department and the conservation/efficiency department’. Though the project initiated communications and interactions between these two departments, further initiative needs to be taken to break the barrier between the two groups.
Study Findings

• **Gathering the technical expertise for the project:** There were difficulties in having the technical expertise required for undertaking the project related activities available at all times, cause primarily by people leaving the company or having inter-departmental transfers.

• **Challenges posed by loss in time and momentum:** A few of the projects suffered considerable delays, caused by delays in HVR installation (which in turn was due to the long time taken for getting the UL certification). The respondent utilities stated that there were additional delays caused by problems in HVR functioning after installation. However, these issues were associated with telephone lines, meters and time clocks in addition to the HVR units themselves. These delays led to a large percentage of customers dropping out of the project as they are likely to have lost interest in participation due to long time lags.

e. **Economic/Financial Challenges:** Very few utilities interviewed (three out of nine) during this study expressed economic/financial challenges related to the project. Of the ones that expressed, their responses can be summarized as:

• **Budget Constraints:** Utilities face overall budget constraints, and therefore allocating resources for the project proved to be difficult. Also getting multiple stakeholders within the utility to agree to the project budget can be challenging.

• **Project Cost Justification:** Staff from two utilities faced difficulties in justifying the costs being incurred for the project. They are of the opinion that the same impacts in terms of voltage regulation could be achieved through alternate methods at a much lower cost.

f. **Customer-Related Issues:** Four among the nine utilities interviewed expressed challenges they faced on the customer-side while implementing the project. These primarily relate to the Load research project, covering the following aspects:

• **Customer recruitment and agreement for participation:** It was challenging to recruit customers and win their participation agreement as they did not perceive any direct benefits. The message in these cases that was conveyed to customers was that the quality of service delivered to them would be improved.

• **Meter installation:** One utility faced difficulties in getting the customers to agree to install the meters. In the recent past, it had replaced the manual meter reading with the AMR system, which in turn required frequent troubleshooting for proper functioning. Customers therefore were sensitive to the installation of any kind of new equipment and the repeated interactions with utility staff.

• **Visual impact of the HVR unit:** The single most frequent customer complaint that one of the utilities faced was on the adverse visual impact caused by the relatively large size of the HVR unit. In these cases, the utility moved the units to different locations and caused further delays.

• **HVR installation:** The process of making sure whether homes were ready for HVR installation was often tedious and introduced delays, especially conducting the in-home survey. It sometimes took a few weeks to get agreement from the customers for an in-house survey.

• **Loss of customer interest:** One utility experienced a large percentage of customer dropouts during a period when no project-related activities could be undertaken following a storm aftermath. There was around 6 months of time during which customer recruitment and installation activities were not being actively pursued- a large number of customers lost interest in participating in the project during that time.

4.1.9 **Utility Perspectives on Likelihood for Future Implementation**

The utility staff respondents were asked for their thoughts on the prospects for a widespread implementation of the project and on moving the project from a research stage to a large scale one. Almost all utilities agreed that it was too early at the time this study was being conducted to comment on future prospects for the project- all of them were waiting for the technical analysis results to come in and would base their decision based on those results. But some participants did share their perceptions on the current project and where they thought it could be going in the future. Based on the interview findings, two out of the nine utilities participating in the pilot are pessimistic about the future prospects and are of
the perception that a future implementation of pilot activities on a larger scale seems unlikely. Only one out of the five utilities participating in the Load Research was not optimistic about a large-scale implementation of HVR units. Utility responses are summarized here.

- One utility participant expressed the opinion that the project was unlikely to move from a pilot stage to a more widespread implementation stage. This is primarily based on the high costs of the project- he noted that the costs associated with the voltage regulation strategies being tried out were too high and that alternate cheaper methods (such as manual adjustment of regulator settings and capacitor additions to improve voltage levels) to achieve the same results exist that could help them reap 80% of the energy savings of this project at only about 20% of the cost.

- One utility staff expressed a high degree of disillusionment with the voltage regulation strategies being experimented with in this project. Due to some project funding problems, this particular utility has been unable to get their data analyzed and is seeking assistance from NEEA in assessing their own pilot as well as learning from experiences of other utilities participating in the initiative.

- One of the utility participants being interviewed was of the opinion that the utility was highly unlikely to consider a large-scale installation of HVR due to the high costs associated with the equipment.

- Before moving on to a large-scale implementation of the project, it is likely that the measures are going to be implemented in stages in different substations and in the substation feeders. The savings from the different options would need to be estimated on a feeder-by-feeder basis, based on the customer classes. It is important to have estimated impacts according to different classes of customers before deciding on a widespread implementation.

4.1.10 Utility Staff Recommendations/Suggestions for Improvements

At the end of the interview, utility staff respondents were offered suggestions for future improvements to the project. Respondents provided recommendations on a variety of project-related aspects broadly covering project management, garnering support for the project within the utility, product development and certification, greater resource availability, and higher degree of information dissemination across participants. These are summarized in this section.

**Improved Project Management**

Five out of the nine utilities interviewed offered their suggestions on different aspects of overall project management. There are:

- The project has been to some extent fragmented from the initial stages- therefore tighter integration of different project-related activities over the life-cycle of the project would enable better monitoring of project activities and feedback of analysis results at different stages of the project.

- Improved focus on project management and coordination of activities being performed by the different contractors.

- Better monitoring of task completion within pre-defined time frame, followed by realistic time-resource allocation for different project tasks.

- Greater involvement and participation from different groups of stakeholders within the utility such as the metering department, the IT department, and the call center. Also having better communication and coordination of activities between the energy efficiency/conservation department and engineering department was critical for project success.

**Greater support for the project within the utility**

Utility participants offered suggestions on methods for acquiring greater support for the project from within the utility that can be summarized as follows:

- A stronger senior management support for the project within the utility is likely to drive the project success. NEEA could make a project presentation to the senior management at the utilities and
make a compelling case for the project, instead of relying on utility staff to acquire management support. Top-down decisions were much easier to execute within the utility as compared to bottom-up efforts in garnering senior management support.

- A technical champion within the engineering group rather than from the energy efficiency/conservation group is likely to draw support from a wider group of stakeholders within the utility.
- A clearer definition of the project scope along with estimated aggregated costs for the utility and potential benefits offered are likely to make decision-making for participation in the project easier.

**Product development and certification**

- Ensure that products being deployed are proven and certified. At the time the project started the HVRs were not UL certified and it took a long time to obtain the certification, which in turn delayed the project significantly.
- A better project commissioning process would ensure that equipments being deployed are appropriately tested before being installed.

**Greater resource availability**

- Greater availability of resources (both financial as well as human) for the project is likely to ensure more on track progress.

**Higher degree of information dissemination across participants**

- A few utility participants were of the opinion that a higher degree of information dissemination among the different project participants would be helpful in learning from other utilities’ experiences. This could include a review of the activities being undertaken by the different utilities, status of the projects and plans for the future, problems being faced and learning experiences. This information sharing could take place on an ongoing basis.

### 4.2 FINDINGS FROM INTERVIEWS WITH OTHER PROJECT PARTICIPANTS

As part of the process evaluation efforts, other project participants were also interviewed- they included a former NEEA Program Manager, two of the project contractors (R W Beck and RLW Analytics), and a former employee of MicroPlanet who was intimately involved in the installation of the HVR devices. This section discusses key findings from interviews with these participants.

#### 4.2.1 Findings from Interview with Former NEEA Evaluation Manager

As part of the process evaluation efforts, the former evaluation manager at NEEA was interviewed, in order to gain insights into his experiences with respect to- project conception and initiation, marketing the project to utilities in the northwest, experience with respect to overall project management, perceived challenges/barriers, and scope for future improvements. A summary of findings from the interview, covering each of these aspects, is discussed here.

**Project Conception and Objectives**

As the logic model in Figure 1-1 illustrated in an earlier chapter, the DEI research project was designed by NEEA provides the basis for a much larger initiative for realizing the benefits associated with Conservation Voltage Regulation (CVR). The research project is aimed towards providing the information and support for dissemination of the concept on a much larger scale. The research project at the first phase will lead into the next phases of the initiative, depending on the cost-effectiveness of the different voltage regulation approaches being demonstrated in the project. The next phases involve wide-scale information dissemination for educating the utilities on the different strategies with an aim towards marketing the program to a much larger number of utilities. Almost 20 years ago, BPA had identified CVR as a potential resource for the utilities, but the concept died in later years. NEEA project is an attempt to revive CVR as a utility resource through demonstration of CVR strategies and benefits offered.
Marketing the Project to Utilities

Discussions during the interview revealed that there were difficulties in marketing the project to different utilities and in obtaining their participation in the project. Out of the nine utilities interviewed in the study, two were already undertaking some of the strategies for voltage regulation and the DEI project piggybacked on those strategies. Therefore, it was fairly easy to get these two utilities on board the project. Some of the difficulties encountered in marketing the project to utilities arose due to the following factors:

- Some utilities were not being contacted at the right time of their funding cycle leading to difficulties in decision-making with respect to project participation.
- Talking to different departments within the utility and selling different components of the project (pilot and load research) to different departments (primarily Energy Efficiency/Conservation and Distribution Engineering/Operations) has been challenging. Support of the latter department is critical for undertaking project-related activities. The Pilot Program has been primarily distribution-side driven, while for the Load Research project, the distribution department in some of the smaller utilities was interested in getting the 15 minute interval data from the meters. For the larger utilities, such data already existed and the distribution engineering showed little interest in participation in the Load Research project.
- As the project entailed large capital expense for some of the utilities, it often took a very long time to get the upper management approval.

The interviewee also noted that there were no perceivable differences between the large IOUs and the smaller public utilities in terms of their responses towards acceptance of the NEEA proposal and agreement to participate in the project. There were variations in the level of support for the project across the utilities, especially among utility management, which proved to be a key determinant for project progress. During interviews with utility staff, they remarked that senior management at the utilities did not play a significant role and in most cases were informed of the utility’s decision to participate. However, individual department managers at some utilities played a lead role in project management and implementation.

Information Dissemination Across Participant Utilities

Among the total number of project participants, there are three utilities that regularly attend the Project Advisory Committee meetings, which serve as a platform for information dissemination and review of the project activities, feedback from activities being undertaken and/or being completed and discussions on future project strategies. The objectives of the Committee are to guide and design the project. The responding utilities and the project management firm reported that, other than these committee meetings, there does not seem to be any other structured manner for information dissemination across the different participants in the project. During discussions with the former NEEA evaluation manager, he indicated that utilities, which participated in the Advisory meetings, were more involved in the project as compared to the others. He also indicated that since most of the work in the project is still in the preliminary stages, there was not much value in widespread information dissemination among all utilities at present, and would be conducted once the project results have come in. Firm results from Load Research activities are expected to come in approximately six months time. Some of the interim results from the Pilot projects have already started coming in.

Perceived Challenges/Barriers

- Utility Recruitment- Recruiting utilities for participation in the project and marketing the project to different departments within the utility was challenging (discussed in detail in the earlier section).
- Project management- Overall project management is complicated and complex as it involves managing multiple projects across the participant utilities. Also a higher degree of coordination of utility participants was required than was anticipated.
- Estimation of project time and costs- At the time of project conception, the costs and time involved for marketing of the program to the utilities was grossly under-estimated. This affected the project budget down the line as the project progressed.
Study Findings

- Coordination of technical tasks- Getting all the technical pieces in the project to work together and in coordination has been challenging. For example, getting the HVR to work with the automated meter, and managing the interfacing across different equipments.

- Project delays- A number of factors led to project delays that made managing the project within the estimated budget difficult. These are discussed here.
  - Very long delays associated with the UL certification of the HVR product adversely affected the project budget. Also there were delays associated with HVR production, which in turn affected product delivery.
  - Uncertainties in HVR costs, which kept on changing frequently, caused delays.
  - Time taken for soliciting participation from utilities was much more than estimated. This was dependent on which part of the utility's budget cycle the project was being pitched.
  - Troubleshooting of a technical problem in one of the voltage control technologies took a long time.

- Turnover of utility staff- Even recruited utilities did not stay on board all the time. Whenever there was a turnover of utility staff, the project had to be marketed to the new staff all over again.

- Utility Budget constraints- Budget constraints on the utility side made steady progress in project participation difficult.

- Retaining Participation and Interest in the Project- Keeping people interested and on board the project for the entire time since project inception has been challenging, especially under conditions of large time lags.

Future Suggestions

Near the end of the interview, the former NEEA evaluation manager expressed his suggestions on future project strategies and actions, which are summarized here.

- Devise methods for information dissemination on the project findings, at both regional and national level, highlighting benefits from both distribution and energy efficiency perspectives.

- Suggest strategies for integrating the voltage regulation options being tested out in the project with other energy efficiency measures undertaken by the utilities, as part of the overall portfolio efficiency activities.

- Enhance efforts towards marketing the project idea/concept to utilities by clearly outlining the project scope and associated costs/benefits and better communication of these ideas to utilities.

- Undertake greater information dissemination on enabling technologies through case studies that would enable easier marketing of these technologies to utilities.

4.2.2 Findings from Interview with RW Beck

During the interview with the RW Beck project manager, Mr. K C Fagen, various issues covering the following aspects were discussed- overall project management, interactions among different groups of stakeholders, reasons for project delays, utility concerns related to customer dropouts, top challenges experienced while undertaking project-related activities, and the participant's own suggestions/recommendations on potential future improvements. The findings from the interview are summarized here.

Utility Interactions

- Process of communications with utilities varies with utility size. Utility size is a critical determinant of ease of communications and interactions with utilities. Interactions with larger utilities was often complex and difficult, inherently an outcome of the internal organizational structure of large utilities and the decision-making process. For the large utilities, information flowed through different levels of utility staff before a decision could be taken related to different aspects of project participation, which in turn caused overall delays in the project. Also flow of
information along the chain of command led to loss of information. Interactions with smaller utilities entailed a smaller number of players within the utility to talk to, and a much easier decision-making process due to a flatter organizational structure. Quite often for smaller utilities, the project manager who the contractor interacted with directly was the decision-maker. So interactions were much easier for the smaller utilities as compared to some of the larger ones. This is corroborated by findings from utility interviews.

- **Problems caused by utility staff turnover or shift in responsibilities:** Turnover of utility personnel as well as shift in positions of utility staff posed a challenge over the duration of the project. Changes in utility personnel handling project tasks cause delays as the project communication needs to be reworked, the project contract terms and conditions needs to be explained again to the changed utility personnel, utility staff needs to be reeducated and job responsibilities need to be re-specified. This problem is especially significant when the project duration stretches over a long period of time.

- **Experiences with utility project management:** The interviewee was asked whether all utilities had a technical champion who drove the project within the utility. He indicated that all utilities, with the exception of one, have technical champions. For the large utilities, the success of the project implementation is critically dependent on the technical champion’s role. RW Beck’s degree of involvement and influence on the utility projects varies across the nine utilities interviewed in the study. Two of the nine utilities were already implementing measures for voltage regulation, and the DEI project piggybacked on these. In these two cases, RW Beck’s influence on the pilot implementation is perceived to be minimal as the utilities were already familiar with the strategies being undertaken. Out of the remaining seven utilities, RW Beck is perceived to have played a very influential role in getting the projects implemented in four, and had a moderate to low degree of influence on rest of the three utility projects. Based on the utility’s experiences, the most well managed project has been at a utility that has a very strong technical champion, while the most difficult to manage project has been in which the project was almost shutdown twice due to decision-making problems within the utility regarding support for the project and communications across different stakeholder groups within the utility.

- **Utility staff training:** There was no uniformity in the training procedures followed for utility staff. No procedures were set up for holding formal and structured classroom training sessions for all participants. RW Beck conducted three training seminars for participating utilities, primarily covering Load Research and to some extent the Pilot projects. Formal training sessions were held at the request of some utilities on system planning, use of various techniques related to conservation voltage regulation, and software usage. One-on-one training was held only for one utility. No formal classroom training sessions have been held for utility staff till now, but are likely to be conducted in the future.

- **Non-uniform procedures followed by utilities:** RW Beck required that the utility submit their data for analysis in a particular format. Only one of the utilities followed this format, which made the analysis work difficult. According to RW Beck’s project manager, often the technical champions in the utilities did not have the expertise to supply the data in the prescribed format.

**Interactions with Equipment Vendors**

RW Beck’s interactions with the equipment vendors were mainly through NEEA. The interviewee noted that since vendors have a contract with NEEA, their response was more prompt when approached by NEEA as compared to RW Beck. When vendors were contacted directly by RW Beck, their response was sluggish. NEEA project manager’s intervention ensured prompt response. Other than that, the three-way interactions among the parties progressed well.

**HVR Deployment Challenges**

- **Product deployment challenges:** Deployment of the HVR product in the load research project posed challenges. MicroPlanet, the HVR vendor, was new in the business and was producing HVRs on a very small scale. According to the interviewee, there were delays associated with the rolling out of the products, which in turn delayed the overall project. A realistic expectation on timely
delivery of the products for deployment is likely to have helped in keeping the project on track. Post installation, there are very few technical difficulties associated with HVR performance. There are some isolated cases of radio interference with some of the existing household equipments, but other than that, no performance problems have been encountered.

- **HVR UL certification related delays:** One of the primary reasons for delays in the project related to the process of obtaining a UL certification for MicroPlanet’s HVR device. According to the interviewee, at the initial stages of the project it was understood that utility products were not required to be UL listed. During that time, the HVR vendor claimed that it was undergoing the process of obtaining the UL listing. However, the UL certification process did not progress as fast as expected. In a later stage of the project, there were requirements from the side of some participating utilities to have the product UL listed, and at that time the HVR was still not UL certified. This is likely to have delayed the project by almost 14 months. The product is still in the process of obtaining its UL certification.

### Perceived Challenges Associated with Project Management

During the interview, RW Beck’s project manager indicated the top three challenges that he has been facing associated with project management and implementation. These are:

- **New product deployment:** HVR was a new product in the market and MicroPlanet was only manufacturing the equipments at a very small scale. The process of getting the manufacturer to scale up the production of units for the Load research project faced difficulties and took a long time.

- **Coordination of activities among the different utilities:** It was challenging for RW Beck’s project manager to coordinate activities across all participant utilities and to ensure uniformity and consistency across projects in different utilities.

- **Internal project management at the utility:** It was difficult to deal with the internal decision-making process within utilities, and the problems associated with turnover of utility staff handling project responsibilities.

### Customer Dropouts in Load Research Project

There have been instances of load research project customers dropping out after recruitment. According to RW Beck’s project manager, the primary reason for customers dropping out has been reluctance of customers to install the HVR due to the large size of the unit. There were customers who moved during the time between recruitment and actual installation. Also, because of the long delays in between the two stages customers lost interest in the project and were unwilling to participate. There have been very few customer dropouts after installation of the HVRs, and those were mainly due to radio interference problems with household equipments.

### Future Prospects for the Project

According to RW Beck's project manager, the future of the DEI project seems promising, based on the analysis results to-date. Some of the interim results, to date, demonstrate that utilities are able to attain cost-effective savings through the adoption of the different strategies being experimented with in the project- therefore utilities are likely to start planning for undertaking such initiatives. According to the interviewee, utilities are likely to reap 0.5% energy savings every 5 years for $5000. On the load research side, the price of HVR units remain high with limited production of the units- lowering of costs of these units with an increase in the scale of production is likely to promote deployment on a larger scale.

### 4.2.3 Findings from Interview with RLW Analytics

As discussed earlier, RLW’s role in the project has been to conduct statistical analysis of the project data for quantifying the impacts associated with the different project strategies, as well as to recruit customers for the load research project.

For the purposes of this study, RLW staff was interviewed on the process of customer selection and recruitment, concerns customers expressed during the recruitment process as well as participation, the
reasons customers dropped out of the project, challenges in the process of customer selection and recruitment as perceived by the RLW staff, and suggestions for process improvements. Each of these aspects is discussed here.

**Process of Customer Selection and Recruitment**

For the DEI project, RLW’s target was to recruit residential customers for the installation of 500 HVRs across the different participant utilities. At the beginning, RLW receives a list of utilities that are ready to go ahead with customer recruitment from RW Beck. For each of these utilities, RLW sends a request for customer data to the utilities, including a list of customer characteristics that are to be provided. The objective is to select a representative sample of residential customers for each utility. The sample is drawn from a random extract of 2000 residential customers. The population of 2000 customers is then stratified by their annual electricity usage (customers with a minimum of 2000 kWh annual usage and 37000 kWh maximum usage were selected), heating type (gas or electric), type of residence (single family permanent residences only were selected). There very few utilities that provided RLW with the list of selected customers who could be contacted directly for participation.

In the next stage, NEEA or the participating utility sent recruitment letters to the customer sample describing the project and soliciting customer participation. The letter also described the HVR unit and the manner in which it would reduce the customer’s electricity usage. Customers were informed that the HVR unit would be attached to their telephone line, but would not cause any interference with their usage of the line. In addition, some utilities enclosed a HVR fact sheet and a press release on the project in the recruitment package. Potential participants also had to agree to an in-home audit of their household electricity use for which an incentive of $25 would be offered. Customers were provided with a contact number for addressing any questions/clarifications. A few utilities sent reply postcards to customers asking them to mail back their decision to participate or not.

After receiving the recruitment package, customers needed to satisfy a set of qualifying criteria for HVR installation. RLW called customers to ask a set of qualifying questions. Qualifying criteria included factors such as- the type of meter socket; location of the meter and telephone box to estimate the distance between the phone box and the meter; presence of a landline phone connection; customers agreeable to use of the telephone for data transmission; and customers agreeable for a post mounting in front of their house for HVR installation. At this stage, those customers that failed to meet these criteria were dropped out. For qualified customers, an in-home energy survey was conducted. During this survey, customers had to be dropped out due to reasons such as- meter base not being suitable for the installation of the HVR unit; presence of underground gas lines in the surrounding area that did not allow any ground excavation; the right type of meter socket not being present; and certain kinds of meters not being compatible.

RLW estimates that about half of the customers who were sent recruitment requests indicated their willingness to participate in the study. And out of the total customers who were willing to participate, about a fifth actually ended up as participants in the study. This is because the remaining customers who were agreeable towards participation failed to meet the qualification criteria set for participation.

**Perceived Challenges in the Customer Selection and Recruitment Process**

- **Non-uniform procedures across utilities**: The process of customer selection and recruitment took a long time. The different utilities participating in the study had different requirements and approval processes for the customers. Utilities had variations in the list of criteria for customer qualification. Also the information for customer qualification was not well defined at the initial stage and came up only at later stages of the recruitment process, which introduced technical difficulties associated with the operation of the HVR. The non-uniformity in procedures resulted in going back and forth on the procedures with the utility staff a number of times. The time taken for qualifying the customer after having sent out the initial recruitment letter was very long (a few weeks and even months in some cases).

- **Customer communication**: For a particular utility, customers were not sent any kind of recruitment package and were cold-called. This took a long time since the customer had no prior information and the study needed to be introduced to the customer.
Study Findings

- **Customer disqualification:** For quite a few utilities, sufficient number of customers did not qualify for HVR installation after the in-home survey and audit was conducted. Reasons for customer disqualification include: no appropriate site for the post installation; wall mounting of HVR units not being allowed; willing customers with locking gates dropped in many cases because the utilities did not want to deal with contacting customers; some utilities did not allow customers with ‘ringless’ type meters; and power and gas line location problems. In these cases, a fresh round of recruitment process had to be conducted which delayed the overall progress in the project.

- **Utility interactions and cooperation:** Getting adequate cooperation from the utility in undertaking the process of customer selection and training was challenging. The project was a low priority for most utilities and most utilities were slow in responding to requests for information and feedback. Interactions with the utilities, and getting them to provide the right kind of customer information were challenging. RLW needed a final approval from the utilities on the list of selected customers that very often took a long time. Utilities with a strong project information were prompt in getting back with the information. There were additional problems associated with change in utility personnel handling the project. Whenever there was a change, the contact had to be re-established and all exchanges repeated. Also, dealing with multiple contact persons within a utility was challenging.

- **Customer dropouts:** Dealing with customer dropouts was a challenge. Since the customers were not under any kind of contract for participation, they could drop out at any stage of the project. There were long delays in installation of the HVR units after the recruitment letters had been sent out to customers and the in-home energy surveys and audits completed. These delays resulted in a loss of number of customers. During this time, customers moved from one location to the other and home occupancy altered. Some homes were remodeled during this time that no longer allowed for the installation of the HVR unit. Also a number of customers lost interest in participation due to the large time lags. Customers did not like the size and the visual impact caused by the HVR unit and wanted it to be removed. They also complained about electromagnetic interference problems with the working of their home electronic equipments. Due to customers dropping out at different stages of the project, new customers needed to be identified continuously.

- **Interactions with multiple stakeholders:** Coordination of activities, interactions with multiple stakeholders, and keeping track of correspondence with multiple groups of actors have been challenging for RLW staff. There were added complexities when some utilities hired contractors to do the site inspection- this added another layer in the information exchange and correspondence process.

- **Delays caused by HVR UL certification issues:** This resulted in a high degree of customer attrition. A large percentage of customers lost interest in project participation and dropped out due to large delays in installing the HVR units (associated with difficulties in getting the HVR product UL listed, as discussed in an earlier section) after having received the recruitment letter.

**Customer Concerns**

Overall, customers seemed willing to participate in the study. Some areas of concerns expressed by customers were:

- Large size of the HVR unit causing adverse impact on aesthetics
- Customers were unsure as to what benefits they would derive through participation
- Concerns related to telephone line usage for data transmittal

It should be noted however that during the recruitment process, customers were told that they were participants in a research project and that the HVR installation as well as the phone line usage was going to be temporary, and only during the project duration. It remains to be seen how readily customers would agree on these two aspects if the project was to be moved from the research stage to a wider scale implementation, at which point the HVR installation as well as the phone line usage were going to be a permanent phenomena.
**Reasons for Customer Dropout after HVR Installation**

For the five utilities interviewed during the study that are conducting the load research project, there have been 11 cases where customers have dropped out of the program after the HVR units have been installed. Overall, these five utilities have completed installation of 265 HVR units at customer residences. The reasons for customer dropouts for these 11 cases after HVR units were installed are summarized in Table 4-3.

**Table 4-3**  
**Reasons for Customer Dropouts after HVR Installations**

<table>
<thead>
<tr>
<th>Reasons for Dropouts</th>
<th>Number of Customers who Dropped Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer dissatisfied due to adverse impact on aesthetics</td>
<td>1</td>
</tr>
<tr>
<td>Customer does not have a landline phone</td>
<td>2</td>
</tr>
<tr>
<td>Meter readers refuse to enter customer yards where dogs are present</td>
<td>1</td>
</tr>
<tr>
<td>Phone connection problems</td>
<td>1</td>
</tr>
<tr>
<td>Electro Magnetic Interference with laptop use</td>
<td>1</td>
</tr>
<tr>
<td>Reasons not specified</td>
<td>5</td>
</tr>
<tr>
<td>Total dropouts</td>
<td>11</td>
</tr>
</tbody>
</table>

**Interactions with Different Stakeholder Groups**

RLW’s primary point of contact for the project has been with RW Beck. RLW staff commented that the project manager at Beck has been extremely resourceful and very responsive towards any kind of requests and for solving problems along the way. RLW established a very strong point of contact with Beck. Also interactions were easy since the same project manager at Beck has been handling the project all along since inception. Among the other groups of participants, RLW has had a few interactions with the HVR vendor, MicroPlanet, mainly for resolution of technical issues. RLW staff interviewed indicated that MicroPlanet too has been fairly responsive in addressing HVR related issues- at times Beck’s intervention was sought in obtaining a response from the vendor.

**Suggestions for Improvements in Customer Selection and Recruitment Process from RLW Staff**

Near the end of the interview, RLW staff was asked to provide their comments/suggestions for improvements in the process of customer selection and recruitment. The areas covered were:

- Obtain additional customer information from utilities- Greater information on customers from the utility would help in screening customers better. For example, it would be helpful to know what type of meters customers have to address some of the meter compatibility issues that arose.

- Greater responsiveness from the utility- Higher degree of responsiveness from the utility's side along with greater involvement of the utility project manager and other associated staff would be accelerate the process of customer recruitment and selection and remove some of the difficulties encountered during the process.

- Communication of project information to customers- Customers need to be provided extra information on the project activities and how these were going to impact them. Also customers need to be well educated on the potential benefits they could derive through participation. Also strategies such as sending opt-ion postcards for eliciting customer agreement on participation are helpful.

- Establish single point of contact for customers- Interactions and communications with multiple parties in the project is likely to cause customer dissatisfaction. Therefore, a single point of contact should be established for customers for communicating any aspect of the project.
4.2.4 Findings from Interview with HVR Vendor MicroPlanet

As part of the process evaluation efforts, an individual familiar with the HVR vendor, MicroPlanet, was interviewed on the vendor’s role in the project, interactions with different groups of stakeholders and coordination of activities, the types of technical problems encountered and the manner in which they were solved, perceived challenges/barriers, and suggestions for improvements.¹ The discussions during the interview are summarized here.

Role in the Project

The vendor played the role of supplying the HVR technology as well as working with the utilities to get the device installed and troubleshoot the technical difficulties. The level of interactions with the utilities varied across the different participants. For some of the utilities, a fair degree of training and educating of the different stakeholder groups within the utility was involved. In addition, it also undertook technical troubleshooting of the equipments on the field that involved interactions with utility staff and customers and bridging of communications between the two groups.

Some of the technical difficulties encountered were with respect to the protocol for HVR installation, functioning of the telephone communications, and handling of the HVR reading database. As part of the database handling, MicroPlanet staff was involved in daily checking of the database output for all of the HVR devices installed on the field, and ensuring proper metering and data recording. For performing these activities, it worked very closely with the metering department at the different utilities. For some of the utilities, the vendor managed the installation activities and played the role of interfacing communications between the field installers and the distribution engineering personnel.

Based on his experiences, the interviewee indicated that the customers expressed a high degree of interest in the product and were keen on getting feedback on product performance and how it impacted their electricity bills. There were very few who were dissatisfied with the product and wanted the HVR unit to be removed after installation. Among these, a few complained about the large size of the units. There was very small number of cases of Electro Magnetic Interference (EMI) with the working of some household equipment. These facts are corroborated by findings from utility interviews.

Perceived Challenges/Barriers

- **Barriers in new technology adoption by utilities**: As part of the DEI project, utilities have been reluctant to adopt the HVR technology. This is primarily due to difficulties in convincing different groups within the utility to adopt the technology and understanding of the potential risks associated with the HVR technology. Different groups within the utility operate as independent silos with not much interaction, making decision-making related to new technology adoption and evaluation difficult. The vendor needed to have extensive interactions with utility personnel in order to be able to convince them to adopt the technology as part of the research project.

- **Long delays associated with UL certification**: According to the interviewee, MicroPlanet did not realize at the beginning that a UL certification was required for installing the devices on the utility side of the meter. Later on in the project, the requirement for certification surfaced, as it was perceived that the HVR installation was on the customer side of the meter - going through the certification process delayed the project by almost a year and a half. Of the total project delay, 90% of it can be attributed to time taken to get UL certification.

- **Production delays**: The interviewee estimated that only about 10 percent of the delays associated with the HVR installation could be attributed to production delays associated with the development of a new technology. Since the HVR was a new product and there was no prior experience in manufacturing, there were delays in getting the different components from the parts supplier.

- **Interactions with NEEA and RW Beck**: The interviewee perceives MicroPlanet’s interactions with the these two groups to be challenging at the beginning of the project - but these interactions

¹ Note that MicroPlant declined to be interviewed directly for this study. Instead, they asked that we contact the original DEI project manager for MicroPlanet, who has since left the company. As such, the summary of findings and issues listed under the interview findings from MicroPlanet represent the input received from the former employee and not from MicroPlanet itself.
gradually improved as the project progressed as the project gradually got better defined and some of the uncertainties were resolved. The vendor, at times, played the role of bridging the communication gap between RW Beck and the field installers of the HVR units. The interviewee also indicated that there was a history of problems between the project contractor and some of the utilities, and often the vendor was caught in the middle that posed difficulties.
CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The first part of this section discusses the conclusions from this study, based on findings from interviews with utilities as well as with other groups of project participants. The conclusions are structured into a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis for the project covering different aspects such as project marketing, project management, implementation, product deployment, customer recruitment and participation, and project costs/financing. The SWOT analysis highlights the current strengths and weaknesses of the project, based on which it identifies areas of future opportunities and threats. The second part of this section discusses the recommendations/suggestions for future improvements in the project in order to realize the opportunities and manage the threats. The recommended items also cover the different project aspects mentioned before. Also, each recommended item also lists the actor or actors who are primarily responsible for acting on these and the priority level assigned to the item (three priority levels: high, medium, and low). The assignment of the priority indicates the relative importance of the item among the entire list of recommended items and the degree to which it is likely to influence project success or failure. This is in turn based on findings from the interviews and expresses the authors’ own, independent opinion.

5.1 CONCLUSIONS
Table 5-1 summarizes a variety of strengths and weaknesses of the DEI project that were observed during the course of this project. Each area is more specifically articulated in the sections that follow.

5.1.1 Strengths
Five project areas – project marketing, project management, implementation, customer recruitment and participation, and costs/financing – are offered as categories to identify and articulate the specific strengths of the DEI project.

Project Marketing
• Energy savings opportunities and scope for increased operational efficiency are the primary drivers for utility participation

Six out of the nine utilities interviewed cited achievement of energy savings as their primary objective for participation in the pilot. Along with energy savings, achieving increased operational efficiency in distribution operations has been a primary motivator for utility participation. Five out of the nine utilities interviewed assigned a high priority towards making their distribution operations more efficient through various strategies being tested in the pilot such as system automation, advanced SCADA deployment, more efficient feeder operations, and reductions in transformer losses. Other less important reasons for utility participation in the project were- to attain service quality improvements, achieve peak demand reduction, and help NEEA in its efforts towards providing local and regional benefits through distribution efficiency improvements.

• Energy Efficiency/DSM department, as well as Distribution Engineering/Operations department at utilities are lead players

Both the energy efficiency/conservation department along with the distribution engineering/operations department played a lead role in undertaking project-related activities. Out of the nine utilities interviewed, staff from five utilities noted that the energy efficiency/DSM department within the utility played a key role in the decision-making for participation in the project as well as driving it forward through coordination among other departments. In all these utilities, the decision-maker for participation in the pilot came from the energy efficiency/DSM department. In seven out of the nine utilities interviewed during the study, the
distribution engineering/operations department played lead role- utility personnel within this department undertook the role of a technical champion. This is especially observed in some of the smaller public utilities where the engineering/technical services department has been actively involved in decision-making and participation along with providing project funds. These smaller utilities do not have a separate energy efficiency/conservation department (often this is merged with Customer Services). For utilities that are participating in the load research project, the metering department has played a key role in undertaking customer recruitment, HVR installations, as well as coordination of activities with HVR equipment vendors.

Table 5-1
Summary of DEI Project Strengths and Weaknesses

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Marketing</strong></td>
<td></td>
</tr>
<tr>
<td>• Energy savings opportunities &amp; operational efficiency improvements are the primary drivers in utility participation</td>
<td>• Delays/difficulties associated with project approval</td>
</tr>
<tr>
<td>• EE/DSM &amp; DE/DO departments are lead players</td>
<td>• Challenges in project marketing to utilities-positioning the project proposal so as to maximize chances of approval.</td>
</tr>
<tr>
<td><strong>Project Management</strong></td>
<td></td>
</tr>
<tr>
<td>• Utilities highly satisfied with Beck's role</td>
<td>• Utilities placed a low level of prioritization and weak support levels</td>
</tr>
<tr>
<td>• Utilities highly satisfied with NEEA’s role</td>
<td>• Resource allocation difficulties</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td></td>
</tr>
<tr>
<td>• Adequate vendor support to utilities through implementation</td>
<td>• Difficulties in coordination of activities across utility departments</td>
</tr>
<tr>
<td>• Technical champions at utilities play a key role</td>
<td>• Technical skepticism of utility staff</td>
</tr>
<tr>
<td><strong>Costs/financing</strong></td>
<td></td>
</tr>
<tr>
<td>• Utilities do not perceive significant economic/financial challenges associated with the pilots.</td>
<td>• Limited information dissemination across participant utilities</td>
</tr>
<tr>
<td></td>
<td>• Challenges in project management/coordination</td>
</tr>
<tr>
<td></td>
<td>• Project time/cost underestimation</td>
</tr>
<tr>
<td></td>
<td>• Retaining utility interest is difficult</td>
</tr>
<tr>
<td></td>
<td>• Few technical challenges remain to be addressed</td>
</tr>
<tr>
<td></td>
<td>• Gaps in training and vendor support</td>
</tr>
<tr>
<td></td>
<td>• Problem of turnover/transfer of utility staff</td>
</tr>
<tr>
<td><strong>Product deployment</strong></td>
<td></td>
</tr>
<tr>
<td>• Product certification problems</td>
<td>• Product certification problems</td>
</tr>
<tr>
<td>• Product manufacturing and delivery delays</td>
<td>• Product manufacturing and delivery delays</td>
</tr>
<tr>
<td><strong>Customer recruitment and participation</strong></td>
<td></td>
</tr>
<tr>
<td>• Insufficient justification for customer participation</td>
<td>• Insufficient justification for customer participation</td>
</tr>
<tr>
<td>• Difficulties in customer recruitment process</td>
<td>• Difficulties in customer recruitment process</td>
</tr>
<tr>
<td>• Equipment installation delays led to customer dropouts</td>
<td>• Equipment installation delays led to customer dropouts</td>
</tr>
<tr>
<td>• Large size of the HVR unit primarily caused customer dissatisfaction</td>
<td>• Large size of the HVR unit primarily caused customer dissatisfaction</td>
</tr>
<tr>
<td><strong>Costs/financing</strong></td>
<td></td>
</tr>
<tr>
<td>• High labor costs associated with project implementation</td>
<td>• High labor costs associated with project implementation</td>
</tr>
</tbody>
</table>
Conclusions and Recommendations

**Project Management**

- Utilities highly satisfied with RW Beck's role

Seven out of the nine utilities interviewed expressed a high degree of satisfaction in their interactions with the project contractor, RW Beck. All of these utilities agreed that the contractor has played a very influential role in overall project implementation—training utility staff, providing technical support, and coordinating activities among different utility departments.

- Utilities highly satisfied with NEEA's role

Almost all utilities interviewed agreed that NEEA played a very influential role in overall project implementation. The NEEA project manager played a lead role in convincing utilities to participate in the project, communicated with different utility departments, and coordinated activities among different groups within the utility. Only one utility indicated some gaps in communications on NEEA's part, and suggested that it play a more active role.

**Implementation**

- Adequate vendor support to utilities through implementation

Overall, utility interactions with different equipment vendors seemed to have progressed well and there were no complaints/concerns expressed by utility staff. In most cases, the equipment vendors trained utility staff in the areas of interconnection of new equipments with existing ones, HVR installation and operations, and meter installation. The meter supplier helped utilities meter installations and provided feedback on data transfer and communications issues. For utilities using the PCS Utilidata system, the vendor was very involved in providing technical support and training on how to use the automated voltage regulation system. Based on information gathered during the interviews, larger utilities seemed to have more extensive interactions with the vendors as compared to the smaller-sized ones.

- Technical champions at utilities play a key role

Technical champions at utilities played a lead role in steering the project forward. Utilities that have strong technical champions have better managed projects. In five out of the nine utilities interviewed during the study, the distribution engineering/operations department played lead role—utility personnel within this department acted as a technical champion. This is especially observed in some of the smaller public utilities where the engineering/technical services department played an active part in decision-making and participation, as well as provided project funds. Findings also revealed that a technical champion from the engineering group is likely to draw wide support from different stakeholder groups from within the utility.

**Customer Recruitment and Participation**

- Low level of customer complaints/dissatisfaction

To date, the project encountered very few concerns linked to adverse impacts on customers related to HVR installation and/or voltage regulation. Overall, customers did not express dissatisfaction with the project impacts and were willing to continue participation. Very few cases of customer concerns have been in the areas of - large size of the HVR unit causing adverse impact on aesthetics; uncertainties related to benefits derived through participation in the project; and concerns related to telephone line usage for data transmittal (very few cases).

**Costs/Financing**

- Utilities do not perceive significant economic/financial challenges

Out of the nine utilities interviewed, six did not indicate any kind of economic/financial difficulties with respect to project participation. Only the remaining three indicated economic/financial challenges. Among these three, two indicated overall utility budget constraints and consequent difficulties in securing project financing. These two also noted that it was difficult to justify project costs from the standpoint of potential benefits that the project offered, in the light of the fact that most likely, similar benefits could be reaped through alternative measures at much lower cost.
5.1.2 Weaknesses

Six project areas – project marketing, project management, implementation, product certification and delivery, customer recruitment and participation, and costs/financing – are offered as categories to identify and articulate the specific weaknesses of the DEI project.

Project Marketing

- Delays/difficulties in the project approval process

Some utilities have spent a substantial amount of time obtaining project approval, primarily due to difficulties in getting participation agreements from different stakeholder groups within the utility. Utilities experienced difficulties in selling the project internally to different groups – a high inertia exists against alterations in existing job patterns within the utility departments. In situations where the energy efficiency/DSM department initiated the project, the distribution engineering/operations group was resistant to change and reluctant to undertake project implementation. This lengthened the project approval process and caused delays.

- Challenges in project marketing to utilities

Marketing the DEI project to utilities and obtaining their participation has been difficult and has taken much longer time than anticipated. For utilities that were already undertaking voltage regulation strategies, the NEEA project piggybacked on these and it was fairly easy to get these utilities to participate. Some of the challenges were associated with utilities not being contacted at the right time of their funding cycle, leading to difficulties in decision-making with respect to project funding. Talking to different departments within the utility and selling different components of the project (pilot and load research) to these departments (primarily Energy Efficiency/Conservation and Distribution Engineering/Operations) was challenging. Also, since the project entailed relatively large capital expense for some of the smaller utilities, it often took a long time to get management approval for participation.

Project Management

- Low level of prioritization and weak support level

Close to 70% of the utilities assign a low priority to the project, relative to other ongoing activities. This caused difficulties in allocating resources (human as well as financial) to the project that led to implementation delays. Also utilities experienced difficulties in integrating project activities within the regular routine and normal operating functions of the utilities, as well as staying on track in the project. The project-related activities fell outside the regular domain of activities performed by utility staff and were assigned low priority.

- Resource allocation difficulties

More than three quarters of the utilities expressed concerns related to resource allocation for the project (both human as well as financial) in already existing resource-constrained conditions. As indicated during the interviews, resource constraints were more applicable for human as compared to financial resources. For example, it was challenging to dedicate human resources for meter and HVR installation. Also, turnover of utility personnel as well as shifts in job roles and responsibilities led to difficulties in finding people with the right kind of expertise to handle technical tasks. For utilities already operating under budget constraints, justifying project costs in light of potential benefits was difficult.

- Activity coordination difficulties across utility departments

Interactions among different groups of stakeholders within the utility and coordination of project activities across these groups have been challenging, especially for the large utilities. Communication barriers between the T&D department and the energy efficiency/conservation department led to coordination difficulties. Uncertainties associated with the project and lack of sufficient information on potential benefits added to the problems. However, technical champions within utilities played a lead role and were successful in overcoming some of these challenges and pushing the project ahead.
Conclusions and Recommendations

• Technical skepticism of utility staff
The staff from almost 75 percent of the utilities was skeptical of the project, mostly in the initial stages, due to insufficient understanding of potential benefits and risks. Some concerns remain with respect to impacts on utility customers of the various measures being tested, especially in utilities that have not yet undergone full implementation. However, most utilities are anxious for data analysis results on project impacts that could allay their skepticism.

• Limited information dissemination across participant utilities
Out of the total number of project participants, only three utilities are regular attendees at the Project Advisory Committee meetings, which serve as a platform for information dissemination among participations covering- review of the project activities, feedback from activities being undertaken and/or completed, and discussions on future project strategies. Other than these Committee meetings, no other platform or structured mechanism for information dissemination across participants exists.

• Complex project management/coordination
Overall project management is complicated and complex as it involves managing multiple projects across the participant utilities. It is also challenging to ensure uniformity and consistency across projects in different utilities. During implementation, a higher degree of coordination of utility participants was required than was anticipated. Also getting all the technical pieces in the project to work together and in coordination has been challenging.

• Project time/cost underestimation
At the time of project conception, the costs and time involved for marketing of the program to the utilities and undertaking implementation was grossly under-estimated. This affected the estimated project budget as the project progressed. Also, it was realized that utilities required a higher degree of coordination through implementation activities than was anticipated at the beginning.

• Retaining utility interest is difficult
Retaining utility interest in project participation has been challenging, especially since the project has been delayed since inception. Utilities tend to lose momentum in undertaking project activities.

Implementation

• Technical challenges remain to be addressed
Forty percent of the utilities interviewed continue to face technical challenges associated with project implementation in the following areas- compatibility of new equipments with existing utility infrastructure, wireless communications with controls for voltage regulation, telephone connection with meters, data error correction and analysis, and software tool usage. Some of these challenges remain to be addressed.

• Gaps in training and vendor support
Forty percent of the utilities expressed the need for training in different technical aspects of the project. They cover mainly the areas of- interconnection of new equipments with existing ones, HVR installation and operations, and meter installation. Smaller utilities saw a greater need for training than larger utilities.

• Turnover/transfer of utility staff
Turnover of utility personnel, along with shifts in job roles/positions of utility staff associated with the project, posed challenges. Changes in utility personnel handling project tasks cause delays as the project needed to be communicated all over again to the new staff, the project contract terms and conditions had to explained, and the new staff needed to be reeducated and job responsibilities re-specified.
Product Certification & Delivery

- Product certification problems

The process of obtaining an UL certification for the HVR product delayed the project substantially. At the beginning of the project, it was felt that the certification would not be required since the utility was responsible for installing the equipment. But as the project progressed, some participant utilities came up with the need for a certification for installing the HVR units at their customer premises. From that point onwards, the process for obtaining the UL certification took a very long time (the process of approval and certification took almost a year) and introduced unanticipated delays in the project. However, these problems are associated only at the time a new product is being introduced. Therefore, this weakness is not relevant if the project does not expect to introduce new technologies or equipments in the future.

- Product manufacturing and delivery delays

Lags in manufacturing and delivery of HVR units led to project delays. The HVR vendor was new in the business and did not have the supply level sufficiently scaled up to meet the project requirements. Also, the vendor was dependent on parts supplier for assembling the final product- the supply of these parts did not take place on time, which in turn led to delays in delivery of the final product. Similar to the previous one, this problem is likely to arise only if a new product is being introduced. It is not relevant if no new products are being introduced in the future.

Customer Recruitment and Participation

- Insufficient justification for customer participation

The process of signing up customers for participation was not smooth sailing. It was hard to convince customers to participate, as they did not perceive any direct benefits through participation. In order to solicit their participation, customers were told that the quality of electricity service delivered to them would be improved.

- Difficulties in customer recruitment process

For the Load Research Project involving installation of HVRs, the overall customer recruitment process involving selection, verification and recruitment has been long and arduous that led to project delays. RLW required multiple interactions with utility staff for obtaining the appropriate customer data. Customer participation requirements and approval processes varied with utilities and were non-uniform. The qualification criteria for customers varied. Since the project was a low priority for most utilities, they were slow in responding to requests for information and feedback. Also screening of the customers, scheduling in-home energy survey appointments, and conducting the energy survey for customer qualification took much longer time than what was anticipated at the beginning of the project. For quite a few utilities, sufficient number of customers did not qualify in getting past the qualification round. For these utilities, a fresh round of recruitment process had to be conducted which delayed the overall progress in the project.

- Equipment installation delays led to customer dropouts

Delays in HVR installation at customer premises, after they had agreed to participate in the project, led to a large number of customers losing interest and dropping out of project participation. These delays were primarily caused by the long time taken for obtaining the UL certification for the product. In case of a particular utility, a natural calamity (storm) caused problems and delayed installation activities. In addition to losing interest in the project due to the lags in installation, some customers changed residences and were lost for participation.

- Large size of the HVR unit primarily caused customer dissatisfaction

The single most frequent customer complaint has been the large size of the HVR unit and the adverse visual impact on aesthetics of the surroundings upon installation at customer premises. In some cases, HVR units had to be re-installed and removed to a different location that caused project delays. There were a few customers who wanted the unit to be completely removed. Cases of Electro Magnetic Interference (EMI) problems with equipments running in the homes have been very few.
Conclusions and Recommendations

**Costs/Financing**

- High labor costs associated with project implementation

Four out of the nine utilities interviewed indicated that labor costs constitute the single largest cost component in the total project costs, primarily associated with activities such as field installation of meters and HVR units, and meter data collection and processing. They expressed difficulties in managing these costs.

**5.1.3 Opportunities**

Based on the findings from this study and as assessment of the project's strengths and weaknesses, future opportunities exist for strengthening the current project, expanding the scale of efforts, and undertaking similar activities in the future. These opportunities are likely to cover the following aspects:

**Project Marketing**

- Opportunities exist for NEEA to encourage more utilities to participate in undertaking similar voltage regulation efforts and enhance participation of existing ones- the unique selling point (USP) for the project is the potential for energy savings and operational efficiency improvements. Dissemination of results from the pilot and the load research on the actual savings achieved by different utilities is likely to strengthen such efforts.

**Project Management**

- Opportunities exist for NEEA and RW Beck to facilitate project management and coordination within the utility by targeting key players in the Energy Efficiency/DSM (EE/DSM) department and the Distribution Engineering/Distribution Operations (DE/DO) department. The role of the EE/DSM department is likely to be more critical for the load research component, while the DE/DO department plays a lead role in substation level activities.
- Opportunities exist for leveraging on the strong working relationship established between the contractor and utility in strengthening project management & implementation. Since utilities are highly satisfied with NEEA and Beck’s role in the project, further initiatives can be taken by these two groups of actors in breaking the barrier of communication among different utility departments (especially between the EE/DSM and the DE/DO department) and better coordination of activities through common and shared goals/objectives among these departments.
- Opportunities exist for sustaining utility interest and participation in the project by setting up a formal mechanism for periodic review and updates on the project progress and sharing of learning experiences among the different participants. This is also likely to help in instilling greater confidence about the project and it's achievements among the participants.

**Implementation**

- Opportunities exist for NEEA and R W Beck to strengthen the technical champion's role (belonging to the EE/DSM department for utilities undertaking HVR installation, and to the DE/DO department for utilities undertaking substation-level activities) in leading implementation activities at the utility, and leveraging on their roles/responsibilities in order to overcome barriers in communications and coordination of activities at the utility.

**Product Deployment**

- Opportunities exist for wider dissemination and deployment of voltage regulation products, depending on the current project's achievements. This is likely to enhance capabilities of the product vendors and provide scope for market expansion for these products. For all products, on-schedule deployment by ensuring production and delivery of sufficient number of units need to be managed. For new products being introduced, certification requirements need to be well specified and agreed upon by all participant groups before starting implementation activities, in order to avoid delays caused by a lengthy certification process.
Conclusions and Recommendations

Customer Recruitment and Participation

- One of the findings has been that customer dissatisfaction level has been very low. Opportunities exist to achieve a larger percentage of customer participation and attain a higher degree of customer satisfaction by managing the installation of equipments on schedule and avoiding delays between customer recruitment and installation. Also conveying a benefits-driven message to the customers on why they should participate in the project and what direct benefits they could derive is likely to encourage more customers to participate.

Costs/Financing

- Opportunities exist for better management of project costs by specifying the labor cost components and devising strategies for minimizing those costs.

5.1.4 Threats

This section summarizes the threats that the DEI project faces that are likely to hamper future progress, both in the current effort as well as a similar such efforts launched in future.

Project Marketing

- It may be difficult to solicit participation from utilities if they are not approached at the appropriate point of time in their budget cycle- contacting them at a point of time when the budget has already been allocated for future tasks/activities may not be fruitful.
- Communication barriers among different utility departments leading to difficulties in internal decision-making and stakeholder agreement among these groups is likely to threaten project progress and cause disruptions.
- Inadequate information to utilities on project opportunities and potential costs/benefits raise the risk of technical skepticism on the project’s justifications and likely achievements, thereby creating obstacles for smooth execution.

Project Management

- Inadequate resource allocation for the project at the utility, stemming from a low priority level for the project and weak support from utility actors is likely to delay the project.
- Turnover and/or shifts in job responsibilities of utility staff are likely to hamper project progress. The process of responsibility transfer and learning of the new staff can often be long and tedious, in turn causing project disruptions.
- Difficulties in coordination of project activities among different groups within the utility such as Energy/Efficiency, Distribution Engineering/Operations, Metering, Customer Service, is likely to disrupt and delay the project.
- Lack of a formal mechanism for information dissemination/sharing of experiences among participant utilities as well as updates on project progress taking place at different utilities can lead to skepticism about potential project outcomes among utility staff. Uncertainties about the project remain in the minds of utility personnel, leading to loss in momentum in project progress.

Implementation

- Non-timely installation of products at the customer end, after they have signed up for participation, can lead to loss in customer interest and dissatisfaction, leading to dropouts in participation.

Product Certification and Delivery

- Unclear definition and non-uniform agreement on product standards and certification requirements (especially with respect to new products) among all relevant stakeholder groups in the project may cause substantial disruptions in the project. Adhering to such requirements at a later stage and obtaining product certification may take a long time and cause large delays in project implementation.
Conclusions and Recommendations

- Lags in product manufacturing and delivery, especially for new products, can potentially cause large disruptions in the project. This may be caused by the production line for the products not scaled-up sufficiently to handle the project requirements, and problems in the supply of components required for manufacturing the final product.

Customer Recruitment and Participation

- It maybe hard to sign-up customers and convince them to participate in the project if they do not perceive any direct benefits through participation. The targeted customer participation level is unlikely to be achieved unless a benefits-driven message is conveyed to customers.

- When multiple utilities are participating in the project, non-uniform procedures for sample selection and customer qualification criteria is likely to introduce significant delays in the customer recruitment process and loss in customer interest for participation.

Costs/Financing

- For utilities with high labor cost component in project implementation, the project runs the risk of retaining support and sustaining the project in the long run.

- Underestimation of project time/cost requirements is likely to lead to insufficient resource allocation (economic and human), causing delays/disruptions in project-related activities.

Table 6.2 summarizes the future opportunities and threats, based on an assessment of the project's strengths and weaknesses.
Table 5-2
Summary of DEI Project Opportunities and Threats

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Marketing</strong></td>
<td>• Encourage and enhance utility participation in voltage regulation efforts</td>
</tr>
<tr>
<td><strong>Project Management</strong></td>
<td>• Facilitate project management &amp; coordination by targeting key players at utilities</td>
</tr>
<tr>
<td></td>
<td>• Leverage on strong working relationship between contractor and utility in strengthening project management &amp; implementation</td>
</tr>
<tr>
<td></td>
<td>• Sustain utility interest in participation by setting up a formal mechanism for exchange of information &amp; learning experiences.</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td>• Strengthen technical champion’s role in managing and leading implementation activities</td>
</tr>
<tr>
<td><strong>Product deployment,</strong></td>
<td>• Scope for wider dissemination &amp; deployment of voltage regulation products</td>
</tr>
<tr>
<td><strong>Customer recruitment and participation</strong></td>
<td>• Achieve higher level of customer participation and attain higher degree of customer satisfaction</td>
</tr>
<tr>
<td><strong>Costs/financing</strong></td>
<td>• Better management of project costs by devising strategies for minimizing labor costs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threats</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Marketing</strong></td>
<td>• Difficult to solicit participation from utilities if they are not approached at the appropriate point of time in their budget cycle</td>
</tr>
<tr>
<td></td>
<td>• Communication barriers among different utility departments lead to difficulties in internal decision-making and stakeholder agreement</td>
</tr>
<tr>
<td></td>
<td>• Inadequate information to utilities on project opportunities and potential costs/benefits raise the risk of technical skepticism</td>
</tr>
<tr>
<td><strong>Project Management</strong></td>
<td>• Insufficient resource allocation lead to delays</td>
</tr>
<tr>
<td></td>
<td>• Utility staff turnover and/or shifts in role likely to introduce disruptions</td>
</tr>
<tr>
<td></td>
<td>• Coordination difficulties among different utility groups likely to cause delays and disruptions</td>
</tr>
<tr>
<td></td>
<td>• Lack of a formal mechanism for information dissemination/sharing of experiences likely to raise uncertainties and cause loss in project momentum.</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td>• Delays in installing products at the customer end likely to cause dissatisfaction and dropouts.</td>
</tr>
<tr>
<td><strong>Product deployment,</strong></td>
<td>• Unclear definition and non-uniform agreement on product standards/certification requirements likely to cause substantial disruptions.</td>
</tr>
<tr>
<td></td>
<td>• Lags in product manufacturing and delivery, especially for new products, can potentially cause long delays.</td>
</tr>
<tr>
<td><strong>Customer recruitment and participation</strong></td>
<td>• Targeted customer participation level is unlikely to be achieved unless a benefits-driven message is conveyed to customers.</td>
</tr>
<tr>
<td></td>
<td>• Non-uniform procedures for sample selection and customer qualification criteria likely to delay customer recruitment process.</td>
</tr>
<tr>
<td><strong>Costs/financing</strong></td>
<td>• High labor cost component likely to risk project support and sustenance.</td>
</tr>
<tr>
<td></td>
<td>• Underestimation of project time/cost requirements is likely to lead to insufficient resource allocation difficulties.</td>
</tr>
</tbody>
</table>

5.2 RECOMMENDATIONS FOR PROJECT IMPROVEMENTS
Specific recommendations for the project are listed in Table 5-3.
Table 5-3
Recommendations for DEI Project

<table>
<thead>
<tr>
<th>Area</th>
<th>Recommended Items</th>
<th>Responsible actor/(s)</th>
<th>Priority level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation drivers</td>
<td>• Once NEEA verifies any energy savings operational benefits, the Initiative should emphasize on these benefits in marketing overall project to utilities, since these emerge as the key drivers for utility participation in the DEI project.</td>
<td>NEEA</td>
<td>High</td>
</tr>
</tbody>
</table>
| Targeting of participants| • In planning for future expansion of the Initiative and installation of additional voltage regulation technology, target key stakeholder group(s) within utilities and market project to these group(s). This is primarily the Energy Efficiency/DSM department in the case of large utilities and the Distribution Engineering/Operations department in the case of smaller utilities. Also solicit participation from other groups, say Metering, which is likely to play a key role in ‘Load Research’ projects.  
  • In case of utilities undertaking both Pilot and Load Research activities, continue to target different groups within the utility for marketing these two components- the Distribution Engineering/Operations for the Pilot and the Energy Efficiency/DSM department for Load Research. | NEEA                  | High           |
| Decision-making & communications at the utility | • Facilitate communication across different utility departments that are involved in decision-making with respect to project participation. This is especially relevant for large-sized utilities with hierarchical structures and decision-making procedures. For smaller-sized utilities with a flatter organizational structure, direct communications can be established with relevant utility staff. But for larger utilities, set up mechanisms for smooth flow if information across multiple groups and decision-making levels.                                                                 | NEEA; RW Beck; Utilities | High           |
| Information on project to potential participants | • At the time of marketing the project to utilities and soliciting their participation, undertake steps to allay technical skepticism associated with the project, among utility staff. This can be achieved by conveying information on potential risks and benefits from the project, and on possible customer impacts (likely area of concern among utility staff).                                                                                                      | NEEA                  | Medium         |
| Timing for project positioning | • Ensure that the timing for marketing the project to the utilities and soliciting their participation coincides with the utility budget cycle. This makes it easier to obtain utility agreement for participation.                                                                                                                                      | NEEA                  | Medium         |
### Table 5-3
Recommendations for DEI Project

<table>
<thead>
<tr>
<th>Area</th>
<th>Recommended Items</th>
<th>Responsible actor/(s)</th>
<th>Priority level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project resource allocation</strong></td>
<td>Address resource allocation issues for the project within the utility. Ensure that, at the project planning stage, sufficient resources have been allocated for undertaking project activities over the entire project duration. The utility project manager primarily will need to undertake this activity, along with the NEEA program manager’s guidance and oversight.</td>
<td>Utility (primarily) with NEEA’s guidance</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Coordination of project activities</strong></td>
<td>Ensure coordination of overall project activities across different utility departments. In order to achieve this, it could be helpful to identify key individuals within the departments who are likely to play a lead role in undertaking project activities and let them manage the coordination across the departments.</td>
<td>Utility (primarily) with R W Beck’s guidance</td>
<td>High</td>
</tr>
<tr>
<td><strong>Information exchange/dissemination</strong></td>
<td>Set up a forum/platform for sharing of learning experiences and dissemination of information related to project progress among participants. The forum should also provide periodic updates on the progress of the overall project to all participant utilities.</td>
<td>NEEA; RW Beck</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Coordination/support requirements</strong></td>
<td>At the planning stage, factor in the fact that a high degree of coordination may be required for participant utilities and set project timelines and job schedules accordingly. The degree of coordination is likely to vary across utilities.</td>
<td>NEEA; RW Beck</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Managing utility staff turnover/transfer</strong></td>
<td>Design mechanisms to handle problems caused by turnover/transfer of utility staff involved with the project. Whenever such turnover/transfer takes place, ensure that the knowledge and learning experiences are transferred as well to the new staff.</td>
<td>NEEA; RW Beck</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Sustaining utility interest/participation</strong></td>
<td>Undertake efforts to sustain utility interest through the entire project implementation, especially in the wake of long delays, through methods like regular interactions and providing updates on the project’s progress, reassessing difficulties being faced and devising methods for tackling these problems, and disseminating learning experiences among utilities.</td>
<td>NEEA; RW Beck</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Table 5-3
Recommendations for DEI Project

<table>
<thead>
<tr>
<th>Area</th>
<th>Recommended Items</th>
<th>Responsible actor/(s)</th>
<th>Priority level</th>
</tr>
</thead>
</table>
| **Implementation** | **Training and vendor support**  
  - Structure utility staff training course right at the start of implementation activities. Identify and fulfill gaps in utility staff training in the areas of interconnection of new equipments with existing ones, HVR installation and operations, and meter installation. Smaller utilities are likely to require higher degree of support and coordination in these areas as compared to the larger ones. | R W Beck; Equipment vendors (Microplanet & Hunt Power) | Low |
| | **Technical/operational difficulties**  
  - Address technical/operational difficulties being faced by utilities in the areas of establishing compatibility of new equipments with existing ones, wireless communications with controls for voltage regulation, telephone connection with meters, data error correction and analysis, and software tool usage. | R W Beck along with utility technical champions | Medium |
| | **Equipment installation**  
  - Installations of equipments- Avoid delays and ensure timely installation of equipments (HVR units for this project) after customer recruitment so as to avoid customer dissatisfaction, leading to fallout in participation. | NEEA; RLW Analytics | High |
| | **Specifying and planning certification requirements**  
  - Before product deployment begins, ensure that product certification requirements are well defined, conveyed to all stakeholders and agreed upon. This is especially relevant for new products that are being introduced into the market. The product certification will need to be initiated before the start of project implementation so as to avoid delays caused by the time taken for the certification process. | NEEA; Utility project managers | High |
| | **Product manufacturing & delivery**  
  - Estimate the number of units that are required to be deployed and ensure that manufacturing is scaled up to deliver the required quantities.  
  - Set production/delivery schedule for product to avoid delays in product delivery and ensure that project remains on track. | NEEA; Equipment vendors | High |
| | **Soliciting customer participation**  
  - During the customer recruitment process, clearly articulate potential benefits that utility end-use customers could derive in order to convince them to participate in the project. | RLW | Medium |
### Table 5-3
#### Recommendations for DEI Project

<table>
<thead>
<tr>
<th>Area</th>
<th>Recommended Items</th>
<th>Responsible actor/(s)</th>
<th>Priority level</th>
</tr>
</thead>
</table>
| **Customer Recruitment & Participation** | *Customer qualification and recruitment*  
- Set up well-defined, streamlined, and uniform set of procedures and guidelines for customer recruitment process across utilities.  
- Set up well-defined and uniform qualification criteria for screening and qualifying potential participants across utilities. Select the initial sample such that the possibilities of a certain percentage of customers not fulfilling the qualifying criteria for participation are factored in. This will ensure that the sample selection and recruitment procedures are not required to be repeated.  
- Establish single point of contact with one party for the customer so as to minimize customer confusion and transaction costs associated with dealing with multiple parties. | RLW; Utility Customer Service | Medium |
| **Information to customers** | *Inform customers about the size of the HVR unit so as to avoid dissatisfaction later on. Also explore alternative locations for installing the unit that minimizes the adverse impact on aesthetics of the area.* | RLW; Utility Customer Service | Low |
| **Managing project costs**  | *Devis[e] methods/strategies for managing project costs, especially labor costs, which form the largest cost component for some utilities. This will need to be undertaken primarily by the utilities, with guidance from NEEA and/or RW Beck in identifying options for labor cost reductions.* | Utility (primarily) with NEEA/RW Beck’s guidance | Low |
| **Projected cost/benefit estimates**  | *At the time of decision-making for project participation, undertake cost/benefit estimations for the project along with a comparison with alternative methods. This is likely to make a strong case for undertaking the project and better convince the utilities to participate.* | NEEA; RW Beck | Medium |
Appendix A: Interview Guide for Participant Utilities

1. Introduce yourself and Global Energy Partners as a third-party evaluator of the DEI project.
2. Confirm job title and responsibilities.
3. Ask if they feel comfortable discussing (i.e. providing answers) about DEI.

I would like to ask you about three general topics: organizations participating in this project and their interactions with each other; the project itself; and finally any comments or observations you might offer regarding the next phase of NEEA’s DEI Project.

I. Inter-departmental interactions within the utility

1. First off, I would like to ask about your utility and the roles played by the different departments.

<table>
<thead>
<tr>
<th></th>
<th>Role: Active; Aware; Not Involved; Not Applicable</th>
<th>Technical Champion: Active; Aware; Not Involved; Not Applicable</th>
<th>Comments: Technical Champion’s role</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td></td>
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<tr>
<td>EE/DSM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exec/Sr. Management</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

2. How did these departments interact with each other (primarily DE and DO)? [Prompt for adequacy and effectiveness].

3. How could these interactions be improved?

II. Utility staff training

4. Did any of your utility staff receive training? [If No, proceed to Q5]
   4a. Was the training conducted before or after the project began?
   4b. Was this timing appropriate? [If No, prompt for too early or too late].
   4c. Which staff members were trained? [prompt for general job titles and responsibilities rather than names]
   4d. Any comments or suggestions regarding training?
III. Interactions with different outside parties

5. I would like to move on to ask about interactions between your utility and other organizations. Would you please tell me about the influence the following organizations had on the implementations and outcomes of your utility’s DEI project:

<table>
<thead>
<tr>
<th>Influence on implementation of project with your utility:</th>
<th>Influence on outcome of your utility’s DEI project (to date):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very influential; Somewhat influential; Minimally Influential; Not involved in implementation</td>
<td>Very influential; Somewhat influential; Minimally Influential; Not involved in outcomes to date</td>
</tr>
</tbody>
</table>

Distribution Equipment Vendors

Customer Equipment Vendors

NEEA/DEI

RW Beck

RLW Analytics

For each of the vendors that were “Very,” “Somewhat” or “Minimally” influential on either implementation or outcomes, go on to Q6. For either of the vendors that were “Not Involved” in implementation and outcomes go to Q8.

For each of the other organizations that were “Very,” “Somewhat” or “Minimally” influential on either implementation or outcomes, go on to Q7. For any of the other organizations that were “Not Involved” in implementation and outcomes go to Q8.

6. Please describe your interaction with this vendor? [Prompt for reasons that the vendor’s influence was helpful to success or not].
   6a. Do you have any suggestions to improve interactions with this vendor?
   6b. Do you have any other comments about this vendor?
   Skip to Q8.

7. Please describe your interaction with this organization? [Prompt for reasons that the organization’s influence was helpful to success or not].
   7a. Do you have any suggestions to improve interactions with this organization?
   7b. Do you have any other comments about this organization?

8. Did your utility have any DEI-related interactions with residential customers?
   8a. [If so] Please describe these interactions.
   8b. [If there were general concerns] How did your utility address these concerns?
   8c. [If there were complaints] How were these complaints resolved?
8d. To date, how do the majority of your utility’s residential customers perceive the DEI pilot projects? [Positively; Neutral; Negatively; Unaware]

8e. Do you have any other residential customer related comments or suggestions to offer?

IV. Program Objectives

9. I would like to move on to the project itself. Of the following reasons for implementing the DEI project for voltage regulation, which were most important to your utility?

<table>
<thead>
<tr>
<th>Reason</th>
<th>Very Important; Important; Not Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce Peak Demand</td>
<td></td>
</tr>
<tr>
<td>Energy Savings</td>
<td></td>
</tr>
<tr>
<td>Increased Operational Efficiency</td>
<td></td>
</tr>
<tr>
<td>Regulator Demands</td>
<td></td>
</tr>
<tr>
<td>Vendor Recommendation</td>
<td></td>
</tr>
<tr>
<td>Other (Specify: ___________________)</td>
<td></td>
</tr>
</tbody>
</table>

For reasons designated as “Very Important” go on to Q8a otherwise Skip to Q9

9a. What makes this reason “Very Important” to your utility?

10. How did these reasons relate to your utility’s objectives for the DEI project? [Prompt for a description of the utility’s objectives].

10a. How well had the DEI project met these objectives?

V. Challenges/Barriers

11. What types of challenges has your utility faced in implementing the DEI project? If necessary, prompt for the following:

- Technical Skepticism
- Technical Barriers
- Retraining and disruptions in daily job functions of distribution operators
- Unfavorable internal test or prior implementation
- Difficulty in rolling out training to operators and/or enforcing change
- Drain on human resources to test/pilot/implement
- Project Financing/Budget
- Difficulty to quantify benefit-cost justification in a business case
- Concern over customer complaints
- Other (Specify: ______________)
12. *How were these challenges overcome?*

   12a. *What are your suggestions for overcoming similar challenges to DEI projects in the future?*

**VI. Implementation Cost Estimates**

13. *In implementing the DEI project and overcoming these challenges what type of costs did your utility incur?* [Prompt for dollar value or staff time quantities]

**VII. Overall experience/suggestions for improvements**

14. *Do you have any suggestions for the improvements to the project in its next phases?*

15. *To what extent would your utility benefit from a full-scale implementation of the DEI pilot project?*

16. *What suggestions would you offer for such a full scale DEI pilot project in the future?*

*Thank you for your time and comments.*