

**Proposal
MISSOURI STATEWIDE
RESIDENTIAL
LIGHTING AND APPLIANCE
SATURATION AND
EFFICIENCY STUDY**

January 4, 2005

**Prepared for:
Missouri Department of
Natural Resources**

**A Joint Study for
Ameren UE,
Kansas City Power and Light,
Aquila, Inc,
Empire District Electric Company,
Columbia Water and Light,
and
Springfield City Utilities**

Prepared by:

A handwritten signature in black ink, consisting of a series of loops and a long horizontal stroke extending to the right.

RLW ANALYTICS

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Introduction

RLW Analytics (RLW) is pleased to submit the following proposal to the Missouri Department of Natural Resources and the sponsoring Investor Owned Utilities (referred hereafter as "Sponsors"), to conduct the 2005 Missouri Statewide Residential Assessment ("Assessment"). As the contractor for the Midwest Energy Efficiency Alliance's residential assessment for the State of Illinois, RLW is very familiar with the similar issues and objectives of this study.

Currently, RLW Analytics is conducting a residential baseline study for the California investor owned utilities. RLW Analytics is responsible for all on-site data collection and baseline documentation. RLW is recruiting and conducting 500 residential on-site surveys to support the needs of the residential baseline study. For this project, RLW's programming staff has developed a data collection application that runs on a Personal Digital Assistant (PDA). The PDA application communicates with an SQL database for storing, uploading and downloading information, and has been designed to collect all of the on-site information required by this assessment. RLW has invested many hours performing software testing and quality control, and as a result we are very pleased to offer this tool for this study. We are confident that with only minor modifications the tool will be easily adapted for the proposed project.

Significant project efficiencies and cost savings will result from the tools and staff experience RLW is developing through our involvement in the California study. Additionally, RLW possesses all of the data structures and analysis queries that were developed for this current study. We plan to reapply many of the tools, efficiency databases, database structures, analysis queries and applications that we are currently using for the California study. Through these efficiencies we hope to offer the greatest number of on-sites, the fastest study turnaround, and an ideal final product.

Lastly, we are very pleased to offer the Sponsors the core team RLW is using for the current California residential study. Roger Wright will be the Project Director, Ed Smyth will be the day-to-day Project Manager and primary contact point, Stacia Okura will manage the appliance database analysis, April Garcia will manage the lighting database analysis, Amber Watkins will manage and conduct the customer recruiting activities, Jeff Staller will manage the field data collection activities, and Tom Standifur will manage the information technology (IT) tasks. Each of these individuals are experienced and familiarized in these roles.

Background and Goals of the Project

This study is designed to serve the Missouri investor-owned and municipal utilities to provide baseline information on residential appliance, building, equipment, and lighting saturations and efficiencies. The overarching goals of this assessment is to provide baselines of saturation and efficiency characteristics for use in understanding future energy savings potential and past accomplishments in the residential sector.

There are four primary objectives that this study needs to achieve:

Objective 1: Onsite surveys of approximately 285 single-family homes will be completed to build a Missouri baseline inventory and energy use estimate of for lighting and appliances in the existing California residential market.

Objective 2: Development of a database of residential lighting and appliance saturations and efficiencies.

Objective 3: Set up a web based tool that will provide utility staff and other parties the ability to conduct "what-if" scenario analyses on the data collected from the sample of homes.

Objective 4: Calculate and present technical, economic, and market potential analyses for energy efficiency opportunities to help target future programs that will have the largest and/or most cost effective impact on peak demand and energy consumption.

The RLW Team

The Right Team for the Job. RLW bring to the project tremendous strength for this project. RLW Analytics brings a long history of successful impact and process evaluations of energy efficiency and market transformation programs throughout the United States. RLW has extensive experience in the design, delivery, and evaluation of energy programs. We offer a depth of expertise in project management, interviewing, sampling, survey design and implementation, engineering and energy analysis, statistical analysis and report writing.

The RLW team provides the geographical coverage required to accomplish the large number of onsite surveys required in Objective 1. MDI is a field engineering and consulting firm based in Barrington, Illinois. MDI brings a large staff of energy auditors and data collection experts that RLW has worked with in the past. RLW's staff committed in this proposal are located in Sonoma, California, Clarklake, Michigan, Troy, NY, and Middletown, CT.

Roger Wright, President and founder of RLW Analytics, will be project director. Roger has a Ph.D. in mathematical statistics from The University of Michigan and is one of the leading consultants to the utility industry. On this project, Dr. Wright will be responsible for overall project design and management, statistical sampling and analysis.

Ed Smyth will serve as day-to-day Project Manager and Senior Consultant for this project. He will be supported by Matt Brost, Western Regional Manager. Matt has managed RLW's successful California 1999-00 study and our current 2004-05 California study, in addition to many other large statewide evaluations and baseline studies.

Team Qualifications

The RLW team offers the technical skill and experience necessary to complete all aspects of this study. We are very familiar with existing research and methodologies for tracking market transformation programs. We have very strong skills in:

- Project planning and research design
 - Survey and interview design
 - Sample design and selection
- Data collection (Program staff, participants and non-participants)
 - Interviews
 - Telephone surveys
 - Mail surveys
 - Trade ally and business surveys
 - Stated preference surveys
 - Mystery shoppers
 - Focus groups
 - On-site engineering & auditing
 - Metering and monitoring
- Analysis
 - Qualitative analyses of interview-based findings
 - Quantitative analyses of survey-based findings including:
 - Univariate analyses
 - Bivariate analyses
 - Multivariate regression analyses
 - Participation modeling
 - Discrete choice modeling
 - Economic and environmental analyses

We have also worked on several projects in which an important component was a user-friendly Access database. Examples are:

- A project for the California Energy Commission to integrate data from three previous NRNC impact evaluation studies into a user-friendly Access database.
- The NRNC Baseline Study, which also provided a user-friendly Access database with information developed through audits and DOE-2 simulations of 990 new construction projects collected in five separate studies.
- The California Utilities 1999-00 Study that delivered a user interface for conducting what-if analyses on the study data.
-

We believe we are the best team for this assignment because we offer the most appropriate combination of proven statistical and data collection skills. In many prior California projects such as the NRNC persistence study, the NRNC impact evaluation studies, and the NRNC baseline study, we have led the field with innovative methods of statistical sampling, data collection, and analysis that were simple, direct, and cost effective. Here are a few examples of our successful creativity:

- The use of ratio estimation for survival analysis in NRNC persistence studies.

- The use of the internet to survey architects and engineers in the NRNC Baseline study.
- The use of sophisticated auditing and engineering modeling techniques combined with model-based statistical sampling (MBSS) in the NRNC impact evaluation and the NRNC Baseline study.
- The development of a new user-friendly software tool in the California Energy Commission and NRNC Baseline studies for analyzing data from an Access database using MBSS stratified ratio estimation techniques.
- Development of handheld applications for use in data collection that streamline on-site data collection efforts and result in more cost effective data collection and better data integrity.

Thank you for considering our proposal. We appreciate this added opportunity to serve Missouri's Investor-owned and Municipal utilities.

Workplan and Quality Control

The Challenges of this Project

In our view the following issues are vital to the success of this project.

- Sample Design,
- Methodology: On-site Auditing versus Telephone Survey
- Managing Complex Data,
- Providing a user-friendly web based database and analysis summarization tool, and
- Providing a useful trend analysis comparing the results to the previous study and other existing research.

We will discuss each of these critical issues in the following sections.

Sample Design

A solid sample design is critical in any project in which data are collected for a subset of the target population. Without the structure of a well-planned sample design, results from the sample can be biased or an excessively large sample can be needed to achieve the required level of statistical precision. Moreover, there is little or no basis for attaching confidence intervals or other measures of statistical precision to the results.

Conversely, a well-planned sample design guides both data collection and analysis.

RLW has gained a deep appreciation of the practical aspects of sampling from years of experience in conducting all sorts of energy studies. One of the less technical but extremely important challenges in sampling is to obtain a suitable sampling frame. If the sampling frame is incomplete, the findings will be unavoidably biased. Conversely, the sampling frame must contain an accurate measure of size, climate zone and residence type to support efficient stratification. RLW will proportionally allocate the approximately 285 sample sites by a simple ratio distribution for each utility based on their residential customer size.

Our primary method of analysis will be stratified ratio estimation. Ratio estimation is suitable whenever we are interested in the ratio between the population totals of two variables. Ratio estimation has been relevant to DSM evaluation because the realization rate is the ratio between the total actual savings and the total tracking savings among the participants in a program. Ratio estimation is central to this project because saturation levels are ratios. In particular, the whole focus of this project is the ratio between the total number of an appliance at a given efficiency level and the total number of all comparable appliances. In the following paragraphs we explain the precision that we will achieve with a sample size of 285 using ratio estimation.

There are two key components to determining the sample size required by a study: the desired level of relative precision and the analysis model(s) characterizing the population and the study objectives. With simple random sampling, assuming the population size is large relative to the sample size and assuming the 90% level of confidence, the formula for estimating the required

sample size is $n = \left(\frac{1.645cv}{rp} \right)^2$, where cv = coefficient of variation of the target variable in target population, rp = desired level of relative precision, and n = required sample size.

In this application, an example of our primary objective would be to estimate the proportion of refrigerators that were manufactured after 1990, which is analogous to estimating the parameter p in a Bernoulli probability distribution. It can be shown that the coefficient of variation associated with a Bernoulli random variable is at most 1.0, in the case that $p=0.5$.

If we conservatively assume a coefficient of variation of 1.0 and a population size large relative to the planned sample size, a survey of 285 participants is expected to provide a relative precision of at most $\pm 10\%$. Since we have conservatively assumed a $cv = 1.0$, our estimate of the expected relative precision is an upper bound. For example, suppose the true proportion of refrigerators manufactured after 1990 was 65%. Then the cv would be approximately 0.76, and our sample of 285 participants would be expected to be more precise.

Of course the expected statistical precision will depend on the key objectives of the project. We will finalize the sample design in cooperation with the sponsors following a more in-depth discussion of the priority placed on different objectives and a review of the current sampling frames. This proposal and the budget is based on the current estimated sampling of 285.

Methodology

This proposal details our preferred approach, followed by an appendix that modifies approaches to match the budget given in the proposal request.

Our initial proposal to the Missouri DNR was for the use of the 2002 Illinois residential assessment as a proxy for Missouri residential characteristics, supplemented by data from the US Census American Housing Survey and a short telephone survey. This was based on the constraint of the initial budget given of approximately \$45,000. In the time period since then, two changes have occurred that have given us an opportunity to change the proposed scope of work. One is the tripling of the proposed budget by incremental funding agreement from other utility sponsors. The other is RLW's successful launch and use of the on-site data collection methodology for other residential assessments in California and the Northwest.

The simple matrix below highlights the general characteristics and differences in the two main approaches of telephone versus on-site:

Methodology	Accuracy	Detail	Cost	Best Use
Telephone Survey – Self reported building characteristics, lighting, and appliance details	Modest	Basic	Low to moderate	To collect data on energy efficiency awareness and perceptions
On-site auditing	High	High	Moderate to high	To collect data for saturation assessments and potential studies

Table 1: Research Methodologies for Residential Assessments

Telephone Survey

A telephone survey that depends on self-reports for single family home characteristics has the following common attributes:

Accuracy. As would be commonly expected, most homeowners will have only a general knowledge of their home characteristics, and it would not be expected that they would also likely be able to describe them accurately. This is particularly true for shell characteristics like insulation, lighting, or window types. This was found by RLW in the Illinois residential assessment to be true, where we compared a study performed through a phone survey conducted by another state organization against our own on-site results. As one example, the phone survey showed about 70% of respondents claimed to have or are interested in getting “energy efficient” lighting, while the on-site audits showed only about 22% actually had compact fluorescent lamps or similar efficient lighting.

Detail. Homeowners could only be expected to give very general descriptions of ages and descriptions of appliances and lighting fixtures.

Cost. The largest advantage is of course the price, which makes telephone survey methods cost effective for many types of consumer research.

Best Use. A series of questions to capture the respondent’s level of awareness and perceptions of energy efficiency and energy use work best for this methodology.

Onsite Auditing

The onsite audits of Objective 1 are vital to this project for two reasons. First, we are relying on onsite audits to provide reliable information on lighting and appliance saturation and energy use in the Missouri residential market sector. Second, these data will lay the groundwork for developing future residential programs aimed at transforming the residential market towards energy efficiency.

For this reason, the onsite audits must be conducted accurately and cost effectively, both for their own sake and for the sake of the other tasks. While MBSS is the theoretical foundation of our consulting practice, our experience in collecting onsite energy data is the practical foundation of much of the excellent reputation that RLW enjoy in the industry.

An on-site audit approach that depends on self-reports for single family home characteristics has the following common attributes:

Accuracy. Because we use trained engineers familiar with residential construction and operating characteristics, we can fully rely on the accuracy and content of the data.

Detail. Auditors can capture appliance model numbers and heating/cooling system nameplates, as well as correctly document lighting fixtures and types.

Cost. The on-site approach has a large cost component, which in many projects is an acceptable tradeoff to sponsors for the higher degree of accuracy.

Best Use. Pertinent to this research project, an on-site method like the one we are primarily proposing is a best fit. In addition, awareness and perception data collection can concurrently take place during an on-site visit.

As mentioned earlier, RLW has developed an application for use with a handheld auditing tool. RLW is using the HP IPAQ Personal Digital Assistant and several add-on accessories. The tool package we will use for this project is shown in Figure 1. The HP IPAQ is equipped with a digital

camera (see accessory on top of IPAQ in image below) that automatically stores pictures within the project it is capturing photos for. We have also purchased the snap-on keyboard accessory so that auditors are not required to know "graffiti[®]", the standard written language used with PDAs. The device also requires the use of a portable modem for connecting to the Internet for data uploads and downloads, in addition to secure digital (SD/IO) flash memory card for storing the data, which offers a much more fault tolerant medium and method for gathering and storing on-site data.

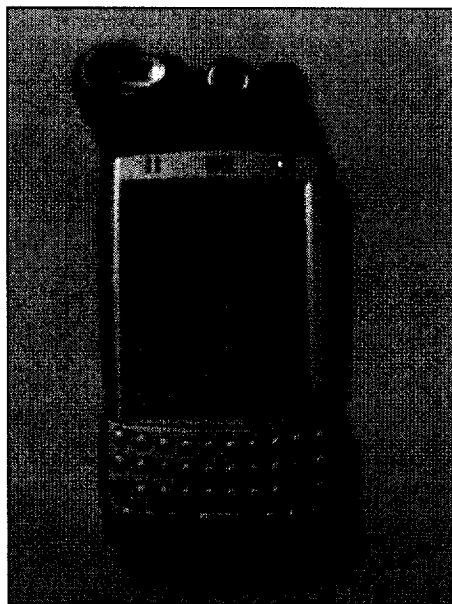


Figure 1: Hewlett Packard IPAQ

In addition to the hardware that will be used, RLW will also employ the use of our software application that has been developed for a similar residential on-site data collection project that has exactly the same needs and requirements as the study we are proposing. Figure 2 provides an example of the look and feel of our application. The first picture is the customer information page, which displays the appointment specifics, including customer name, address, and appointment time. This information is uploaded to the handheld each day when the auditor connects to the Internet. Further information is also provided, including special notes and driving directions.

The second image of the three is the main menu for entering appliance and lighting information. From this page the auditor accesses the specific input areas for the categories shown on the picture (e.g., refrigerators, freezers, hot water heating, etc). To ensure no data goes uncollected, a checkbox appears once data have been collected for the specified number of units. For example, the picture below shows that data have only been collected for heating equipment. The customer indicated one heating system, and since the checkbox has been checked, the application is indicating that data for one heating system have been gathered. In another example, the customer has indicated that they have two thermostats, however since the checkbox has not been checked this means there has not been data collected for two thermostats (possibly one, but not two).

The third picture simply shows populated data for a washing machine. This is the look and feel of most screens where data collection is required. In this example the software asks for usage information, fuel type, manufacturer, model number, age (customer provided) and manufacture data (from nameplate if available). New records are easily added if it is determined that more than one unit is present.

Figure 2: Screen Captures of Hand-held Application

Another great feature of our application is the ability to make necessary changes to the software in almost real-time. Using the Pocket PC Combo Box Controls interface, RLW programming staff can easily modify the hand-held application to improve and streamline data collection efforts. For example, if an auditor calls RLW and asks for a "breakfast nook" added to the list of possible room types, then RLW can use the interface shown in Figure 3 to make this software enhancement. Once the change has been made, a modified version of the software application is sent to each of the handhelds once the auditor connects the PDA to the Internet.

Figure 3: Pocket PC Combo Box Control Screen

Managing Complex Data

The ultimate objective of this project is an accurate tracking database to understand efficient lighting and appliance saturation in the residential market. Moreover the database must be user-friendly – that is, it must be easy for a typical program manager to query the data and obtain relevant information. This is not as simple as it might seem.

The data must be accurately entered. In the case of the onsite audits, the data will be downloaded directly from the field auditor's hand-held computer to the master database. Quality assurance is further reinforced by the fact that the hand-held application minimizes the potential for data entry error through the use of drop down menus, range checks, and other data validation tools. This technique will reduce the chance for data entry error. As statisticians we understand the importance of accurate data entry.

The auditors will be able to observe make and model number, but not energy efficiency. Our experienced staff will use existing databases and manufacturer-supplied information to determine the size and energy efficiency of each appliance or piece of equipment. These efficiency look-up tables, which already exist in the 1999-01 database, will be updated by RLW with new information acquired from the source of these databases. Model numbers will be matched first using automated procedures developed for the previous study; all other unmatched model numbers will be looked up manually by RLW personnel.

A couple of critical issues that we have identified in previous California studies relating to the model number matching process are addressed as part of this study. Those past issues include:

1. Model numbers for newer units (i.e., refrigerators hot water heaters, air conditioners, etc.) were easier to match than they were for older units. In the past, this created baseline results there were biased toward the more energy efficient units.
2. Efficiency databases do not account for degradation. Results presented in the past studies were more than likely biased since the efficiency values identified through the model number matching process did not take into account degradation of unit energy consumption over time.

It is very important that these issues are taken into consideration for the proposed study. RLW proposes to deal with the first issue by recalculating the weights to rebalance the representation of age ranges for the matched appliances for this Study data. The product of these efforts will produce analysis results that are not biased by the actual match rates RLW will obtain. For example, the findings from our past 1999-00 California Study for hot water heaters, as shown in Table 2, show that the match rate for units manufactured between 1995 and 2000 was 56%, even though the saturation of units of this age in the population was 38%. Units manufactured between 1985 and 1989 had a match rate of 13%, even though this age group represents 21% of the population. In a perfect situation, the match rates would more closely resemble the saturation rates, as is the case for the 1990-1994 age bin shown in Table 2.

By recalculating weights for the appliances that were successfully matched to efficiency data, we believe we can eliminate match rate bias. Weighting of the data would serve as

mathematical adjustment to the match rates so that each matched appliance more accurately represents its contribution to the overall baseline efficiency.

Age	Number of Units Matched	Percent of Units Matched	Age Distribution of all Water Heaters (n = 754)
1995 -2000	183	56%	38%
1990 -1994	91	28%	29%
1985 -1989	41	13%	21%
1980 -1984	9	3%	7%
1979 or older	3	1%	5%
Total	327	100%	100%

Table 2: Manufactured Date of Matched Hot Water Heaters

Management of the next issue regarding unit degradation is not as cut and dry, nor is it as critical to the success of the project as is the previous issue. RLW has conducted secondary research to determine if it is feasible to adjust the efficiency databases for degradation. For example, if we have determined through secondary research activities that unit energy consumption (UEC) for refrigerators is 10% more after 10 years of operation, we would propose multiplying the UEC in the database for all units manufactured in 1994 by 1.10, units manufactured in 1995 would be multiplied by 1.09, and so on if the degradation were linear. Research activities such as what we are proposing could become extremely time intensive, so in the interest of all stakeholders we propose using degradation assumptions built from our previous and current California studies. We will then create a revised estimate of efficiency for appliances and equipment that is determined to have degradation over time. The project team will decide if RLW should supply the revised estimate of efficiency, or use "as manufactured" efficiency for use with the appliance database tool.

Once the onsite data have been input into the database and matched with the efficiency databases, the analysis can begin. The efficiency categories, age ranges, and other analysis bins developed for this study will be the same as our California 2004-05 Study, unless the project team determines they should be changed. All categories used will be reviewed at the project initiation meeting; required changes will then be implemented by RLW while the on-site data is being collected.

By creating links between these tables in the database, we will map the audit information into the energy efficiency categories. An additional table will provide the case weights for the analysis.

Providing a User-Friendly Database and Analysis Software

The final big challenge to the success of this project is to produce a user-friendly version of the database and analysis engine for use on the Internet. In our previous California studies RLW has provided an Access database that included an extensive number of analysis queries, which were used to develop all results found in the statewide report. Additionally, we provided our MBSS Visual Basic tool. The MBSS VB tool interacts with the Access database for calculating ratio estimates, saturation levels, sample sizes and error bounds. For this project we propose to provide the same thing, except that the tool would be accessed via the Internet by anyone wishing to use it, and the user interface would be more user-friendly than the past application.

The only limitation is the ability to create new queries. In our past California 1999-00 Study we trained users to create new queries for conducting their own "what-if" analyses, but soon

realized that this was a relatively difficult exercise for even advanced Access and MBSS users. We also came to the realization that the queries developed by RLW for producing the findings in that report covered 90% or more of what users were hoping to access the data for, therefore there was little need to create new queries. Based on this experience, we believe that the queries used in our California projects, and a few additional queries that RLW will add, will be sufficient for the great majority of users. For those few queries that will be requested, RLW will provide up to 5 added queries that will be updated on the Internet analysis tool up to six months after the project report has been delivered. The Sponsors will be asked to provide and approve all requests for added analysis queries.

The lack of need to train users on creating new analysis queries will greatly simplify the tool RLW will provide. Users will be able to "slice and dice" and drill down into the data far beyond the data that will be provided in the statewide report. RLW will produce easy to follow user interfaces (web pages), on-line tutorial and training pages for using the analysis tool, in addition to data disclaimers and other valuable information the user should know when using the analysis tool.

The tailored application for this study will have the following capabilities:

- Calculate ratio estimates, e.g., of the saturation level of a set of appliances, classified by any available categorical variable such as climate zone, utility, residence type, or year.
- Calculate the underlying sample sizes
- Calculate the appropriate model-based error bounds

This software can be used to create one-way, two-way or multi-way tables categorizing the market share of specified appliances and measures by any specified dimensions.

Making the MBSS VB application and the lighting and appliance databases available to a large number of users over the Internet will take some development time. There are also several details that will need to be addressed before the scope of work can be fully defined. That said, our proposed approach for making the MBSS/Access Tool "Web-based" is to make the current MBSS VB application a stand-alone program compatible only with recent versions of the Microsoft Windows operating system.

Users are required to install the software on their computers along with the two survey databases (one containing the appliance data, the other containing lighting data). Because of the size of the two databases, distribution of the software was often limited to direct distribution on CD-ROM. Results of the analyses were stored back in the databases, requiring the user to open the files in Microsoft Access to view the values.

This method of analysis required that users not only have the authority to install new software on their machines (a privilege often restricted in many enterprise IT environments), but it also required them have at least a rudimentary knowledge of MS Access in order to perform simple investigations.

Our proposal is to take the functionality of the original MBSS VB software and make it available to users on the web. The current software will be modified to run as a Common Gateway Interface ("CGI"), which is easily worked into a web site accessible from any standards compliant web browser.

The main page will be simple and easily incorporated into the site of the hosting agency. Dynamic HTML will be used to allow the user to select which database, category and analysis queries, grouping and summary variables they would like to evaluate as well as allowing them to specify any of the special options (Ratios for Each Site, Proportions of Total, etc.).

Results will be calculated and displayed immediately in the user's web browser, completely eliminating the need for them to have access to any database software. Because the bulk of the existing analysis engine will remain unchanged, a significant portion of the development time (and expense) will be eliminated. Since the original application had a relatively simple user interface, the adaptation to use within a web browser is expected to be straightforward.

Because the analysis engine will be implemented as a CGI, this will eliminate complexities associated with the installation and configuration of specialized development languages such as DreamWeaver, Perl or PHP. The only requirement for the web server will be that it be configured properly to allow CGI scripting, and that it runs on a Microsoft Windows Server platform (the use of a particular web server such as Apache or IIS is irrelevant as long as the CGI requirement is met, which is the default configuration of most common web servers).

The actual database access will be performed by the CGI application and can be configured to use any standard Windows database API such as ADO or DAO, according to the capabilities of the server.

Changes to the user interface, such as the addition or removal of queries or variables, will be easily implemented as simple updates to the underlying database and corresponding changes to the front end web site.

Scope of Work by Task

In this section we discuss the tasks required to complete this project.

Task 1: Project Initiation Meeting

A telephone project initiation meeting will be held upon the signing of the contract. This meeting will include all key RLW Analytics staff, the Sponsors, the Department of Natural Resources, representatives of the Missouri DPS, and others who have an interest in the study. Prior to the meeting, RLW will prepare and distribute an agenda, including a list of the team members to be present. The meeting will cover:

- Refinement of research objectives and methods,
- Alternative methodologies,
- Data requirements,
- Available data and secondary sources,
- Relevant issues,
- Survey Instrument review and comment,
- Demonstration of RLW's existing hand-held data collection application,
- Web based tool and required information needed to begin development,
- Project schedule, and
- Communication and management protocols.

Following the meeting, RLW will develop and distribute a detailed memorandum summarizing the meeting.

<i>Deliverables</i>

- | |
|----------------------------|
| a) Agenda
b) Memorandum |
|----------------------------|

Task 2: Submit a Proposed Research Plan

Within 30 days of selection, RLW will deliver a detailed research plan to the Sponsors for review by the project team. The research plan will be a refinement of this proposal, including developments and issues determined at the project initiation meeting. At this time RLW will also submit the draft recruiting and onsite survey instruments, since they are so critical to the success of the project. This will allow the Sponsors the ability to review and critique the survey design and content.

Another critical element will be the access and use of utility records to contact customers. RLW has extensive experience with the careful handling of confidential customer records provided to us from utility customers in past research projects and evaluations. RLW will be fully prepared to sign and adhere to any confidentiality agreements required by the various sponsors.

We would request the following from each of the sponsors to develop our research plan and prepare for the project launch:

- Database of single family residential accounts that includes name, address, phone, and annual energy use
- Confidentiality agreements (if required)
- Logos that can be utilized in the recruitment letters, or, several boxes of letterhead shipped to our California office.

RLW will address all comments provided by reviewers in the final research plan. Upon completion, within 10 days of receiving feedback RLW will deliver to the Sponsors the final plan, which will include the following sections:

- Study Objectives
- Sample Design
- Data Collection Approach and Procedures
- Data Analysis Approach and Procedures
- Lighting and Appliance Databases
- Web-based Analysis Tool
- Final Report and Deliverables
- Appendices - survey instruments and secondary research findings.

Deliverables

- c) Draft Research Plan – January 2005
- d) Final Research Plan – February 2005

Task 3: Develop Telephone Recruiting and Onsite Survey Instruments

RLW will also bring the survey instruments used in the past California studies to the project initiation meeting for review and comment. Additionally, RLW will also present the data collection tool we are currently using for the residential baseline study we are using in the Pacific Northwest. With these tools, the project team will develop the requirements of the data collection efforts.

Based on the outcome of the review of these instruments and tools RLW will revise the paper form of the recruiting and onsite survey instruments. RLW anticipates there will possibly be minor revisions to the instruments by all stakeholders to be satisfied with the content and structure. This task will be conducted in parallel with the development of the research plan so that they can be delivered at the same time.

Once all onsite survey content is finalized, RLW will modify our existing hand-held data collection application for use in this study. RLW will modify the Visual Basic.NET code that is the foundation of our data collection application that runs on Hewlett Packard IPAQ hand-held PDA's. Additionally, RLW will merge all customer sample design data to our SQL database which is compatible with the hand-held data collection application. We developed the application so that it is not only a data collection tool, but that it also interacts with the recruiting database. This streamlines the process of notifying field staff of their daily appointments, allowing them to automatically upload and download information that is stored in the recruiting database, including customer name, address, appointment time and date, directions and more.

Additionally, the software automatically uploads software enhancements to the PDA each time there has been a modification to the application.

Based on the past iterations of data collection requirements we have had in our previous California studies, we envision there will be very few required modifications to the application. The tool we developed for the Pacific Northwest was almost 100% based on the field data requirements of the 1999-00 California Study. As a result of our data collection development protocols, we believe we can be in the field relatively quickly once the research plan and survey instruments have been approved. RLW staff will test all changes on a sample of homes before full implementation of the data collection activities.

Onsite Survey Instrument

The on-site survey will have two sections, a customer interview section and a lighting and appliance inventory section. The customer interview section will collect information on the size of the home, demographics and socio-economic information of the occupants, and other information important to the study stakeholders. For example, we would ask customers basic questions about recognition and perception of the Energy Star label. This portion of the survey will be administered at the beginning of the onsite survey. A sample of data to be collected can be found below for each of these sections.

Demographics

- Home Area (Square Feet)
- No. and general age groups of residents (children under 18, adults, or seniors over 65)
- Income Level
- Age of home
- Basic energy attitudes and awareness

Major Appliances

The goal of the second part of the on-site survey will be to inventory data on lighting and major appliances. During the walk-through appliance inventory audit, the auditor will record nameplate, manufacturer, model number, and other valuable data for major appliances and lighting technologies. Table 3 summarizes the appliances and relevant data that should be surveyed during the on-site.

Appliance Type	Manufacturer	Model #	Type	Fuel	Age / MFG Date	Other
Primary / Secondary Air Conditioner	Nameplate data	Nameplate data	e.g. split, Heat pump, win/wall etc.	Gas / Elec	Years	T-Stat Type
Primary / Secondary Furnace	Nameplate data	Nameplate data	e.g. split, Heat pump, etc.	Gas / Elec	Years	T-Stat Type
Domestic Hot Water	Yes	Yes	Storage/Inst	Gas / Elec	Years	
Dishwasher	Yes	Yes	NA	Gas / Elec	Years	
Clothes Washer	Yes	Yes	Standard / Hor. Axis	NA	Years	
Primary / Secondary Refrigerators / Freezers	Yes	Yes	Cubic Feet, side by side, top freezer, etc.	NA	Years	

Table 3 Residential Appliance Survey Data

Building Shell Characteristics

Data could be collected for wall and attic insulation. Our existing tool is currently set up to do this, and would not require any re-engineering. RLW's hand-held application is also currently set up to collect the following information for windows:

- Predominant window type – aluminum, wood, vinyl
- Predominant number of panes – one, two, three
- Square footage by orientation
- Shading fraction by orientation

Household Lighting

The onsite data collection will also include a comprehensive inventory of lighting fixtures and lighting technologies in use. The bullets below summarize the data that will be collected on residential lighting technology and usage. Once again, data to be collected can be added, dropped or modified to meet the goals of the study. We suggest gathering the following data for each fixture in the house:

- **Fixture Type** - Track lighting, table lamp, chandelier / hanging, torchiere, recessed can, recessed lighting-other, wall mount, ceiling fixtures, ceiling fan, etc.
- **Room/Location** – Bathroom, master bedroom, bedroom, hallway, dining room, other exterior, porch light, etc.
- **Number of lamps (in fixture)** – one, two, three, four, etc.
- **Lamp Type** – Incandescent standard, incandescent decorative, CFL integrated, CFL non-integrated, halogen, etc. (RLW would use the same list of lamps from previous study, and the associated lamp codes. Of course the list would be updated to be comprehensive)
- **Lamp Wattage** – Watts per lamp, for fixtures that do not require moving or disturbing a lens cover.
- **Controls** – Dimmer, photocell, motion sensor, combo sensor, time-clock.

Deliverables

- e) Draft and final customer letter – February 2005
- f) Draft recruiting instrument – March 2005
- g) Draft onsite survey instrument - March 2005
- h) Final recruiting instrument - March 2005
- i) Final onsite survey instrument - March 2005

Task 4: Update Database of Survey Data

In our previous California studies RLW developed and delivered an appliance database and a lighting database. Two databases were delivered due to the great number of records that were contained in each of the databases, which produced rather large file sizes. In general, the databases delivered contained the following elements:

- Tables
 - Customer information data (provided by the utilities)
 - Appliance and lighting data collected during the onsite visits
 - Demographic information collected during the onsite visits
 - Efficiency tables used to match model numbers
- Queries
 - Analysis queries used to manipulate data contained in tables
 - Analysis queries used by the MBSS VB analysis software

For this study, RLW will likely deliver nearly the same products. One of the great project efficiencies RLW can offer the IOUs on this project is the ability to reuse the tables and queries previously developed for the past California studies. No other contractor can offer this because the queries are specially designed to interact with MBSS. Our approach will be to use a "stripped-down" version of the previously developed database, which will be populated with the new data. Under this approach all the queries and table formats previously developed can be reused without the need to redevelop them. Reusing the database also allows us the ability to avoid additional project dollars that would otherwise be spent on developing the analysis database.

Updated Efficiency Databases and Sources

One key task required in our past and current California studies was to update efficiency databases from sources. The first step used by RLW was to automate the model number matching process using a series of data queries developed for the sole purpose of matching model numbers collected onsite to model numbers found in the efficiency databases. For model numbers that were not matched using the automated process, hand matching was conducted using other sources. The following points discuss the databases used for these activities and the updates that we will use for this study:

- **Association of Home Appliance Manufacturers (AHAM):** In the previous study RLW purchased AHAM's refrigerator/freezer efficiency database for use in identifying UECs of refrigerators. AHAM's database is extremely extensive, accounting for all major brands of refrigerator/freezers, with the exception of Whirlpool brand. The database was purchased for the 1999-00 study at a cost of \$10,000. Unfortunately, we have learned through AHAM that their refrigerator/freezer listing program closed in July 2003, which means they maintain no data for refrigerator/freezers manufactured after this date. The good news is that for this study we can purchase the remaining directories covering January 2000- July 2003, for a minimal cost of \$1,500. RLW has reserved funding for this in the budget.

AHAM also maintains an efficiency database for window/wall air-conditioners. In the previous study the data was not purchased due to budget limitations. In the 1999-00 Study the match rates for window/wall air-conditioners was poor. A recommendation was made in the 1999-00 Study final report to purchase the AHAM window/wall database (if a future

study were to be conducted) for improving match rates. In our newest California study, we have already purchased the newest AHAM data at a cost of \$300 per year of data.

- **California Energy Commission Databases** - Databases source files containing all appliances certified to the California Energy Commission as meeting the current efficiency standards are available for downloading in Microsoft Excel at http://www.energy.ca.gov/appliances/appliance/excel_based_files/. The following databases will be used and all have been updated between 2003 and 2004 by the CEC. There is no cost for this data.
 - Central air conditioners and heat pumps
 - Clothes dryer
 - Clothes washers
 - Dishwashers
 - Electric and gas water heaters
 - Furnaces
 - Non central air conditioners and heat pumps
 - Refrigerators
- **Air-conditioning and Refrigeration Institute (ARI):** PrimeNet is ARI's applied and unitary certified performance ratings directory database for air conditioners, heat pumps, and other HVAC equipment. You can access product information, including certified capacity ratings, certified efficiency (SEER) ratings, sound ratings, energy efficiency ratios, coefficient of performance, pressure drops, and much more. Although there is not database that can be included with the efficiency database, this source will be used to hand match model numbers of air-conditioners to efficiency data. <http://www.ariprimenet.org>
- **Carrier Blue Book** - This publication provides capacities and efficiencies for residential cooling and heating systems for all major manufacturers. This resource isn't provided in database or Microsoft Excel format making it a last resort reference material since the equipment will be looked up manually. However, for the 1999-00 Study we found this to be one of the best sources of efficiency information. We already have the newest bluebook that replaced our five year old copy.
- **HVAC Partners** - HVACpartners.com is a website that provides efficiency ratings for all products in the United Technologies family of HVAC products. This includes Carrier, Payne, Day & Night, and BDP products. This is a new reference that RLW would use for determining HVAC efficiencies. <http://www.hvacpartners.com>

Task 5: Data Collection

We propose to conduct 285 onsite surveys. This objective is complex and will consume more resources than any other task in the project. We have broken this task down into the following subtasks:

- Task 5.1: Surveyor Training
- Task 5.2: Customer Letter
- Task 5.2: Recruiting and Scheduling
- Task 5.3: On Site Surveys
- Task 5.4: Surveyor Management and Quality Control

Each of these subtasks is described in the following sections.

Task 5.1: Surveyor Training

A one-day training session will be conducted for each auditor before on-site work begins. During the training session we will train and discuss the following topics:

- The purpose of the project,
- The procedure for verifying the site visit with the homeowner,
- The importance of being on time and courteous,
- The protocols for dealing with unanticipated problems,
- The procedure during the audit,
- The best methods of collecting and recording the information,
- How to operate and collect the data using the hand-held,
- The procedure for transferring on-site data to master database, and
- Any other relevant topics.

All of the RLW field auditors have a considerable amount of experience in the field and with utility customers. All have worked on projects similar to this and are very comfortable conducting onsite visits with customers.

Task 5.2: Customer Letter

The first task that RLW will undertake is a mailing to the study sample. The mailer will inform customers that they have been selected to participate in a study, why the study is being conducted, how they can participate, and what is involved if they choose to participate. The intent of the letter is to improve participation rates, thereby reducing non-response bias. The content of the letter will be carefully articulated to clearly convey the purpose of the study and why it is important that they participate. We will provide a 1-800 number to call if they have further questions, or are interested in participating. Of course regardless of a call-back, RLW will contact the customer to secure participation in the study. Soon after the letter has been mailed the telephone recruiting will begin.

Task 5.3: Recruiting and Scheduling

Skillful recruiting is important in order to minimize bias from non-response and improper tracking of sample disposition. RLW recruiting personnel are highly qualified and experienced, and they understand the need for quality data and the importance of the project. The recruiter will be responsible for the following tasks:

- Obtain telephone numbers when needed,
- Verify that the home is the correct sample point,
- Explain the need for the survey and the importance of the information,
- Describe the time required for the audit, and
- Schedule the onsite visit.

The recruiter will also maintain sample disposition information and produce daily status reports comparing the current sample to the sample design. Finally the recruiters will work with the auditors to resolve any unanticipated problems. The sample disposition data will be used to estimate response rates and calculate final case weights for use in the data analysis.

To improve communication between survey staff and recruiting staff, RLW will be responsible for scheduling all sites. RLW personnel will then be responsible for surveying sites.

In order to expedite the recruiting process and aid in customer participation we are suggesting that the customer be provided with a participation incentive of \$25. Our experience suggests that an incentive will do the following:

- Increase customer response rates,
- Result in better field data,
- Reduce time budgeted for recruiting.

Lastly, to minimize potential for customer no-shows and missed appointments, the recruiter will call all appointments the day before to remind customers of their appointment and offer the opportunity to reschedule, if requested. Recruiters will also provide customers with utility contact information should they desire to validate the study and RLW and MDI as the contractors conducting the work.

Task 5.4: Onsite Surveys

The trained auditors will conduct the onsite audits according to the schedule set by the recruiter. RLW will develop an on-line calendar system that will allow auditors the ability to identify the projects that they have been assigned. The recruiters will use this tool for scheduling appointments and notifying customers of the auditor's name that will be visiting them.

Using their hand-held PDAs, the auditors will obtain daily fieldwork agendas the day before each appointment. The PDA application will be designed to automatically sync with the recruiting database and download all appointments for the auditor. Under this approach it is unnecessary for the auditor to contact the recruiter, unless they foresee any problems with the schedule provided. The daily downloads will provide the auditor with every piece of information they will need to conduct the onsite, including special notes provided by the recruiter, maps and directions, and of course customer name, address, and appointment information.

First the auditor will conduct the interview with the occupants, where demographic and behavioral questions are addressed. Next, the auditor will conduct the walk-through audit of the home and record the lighting and appliance data into the hand-held.

The RLW/MDI team will conduct approximately 20 surveys (i.e. one week of surveys) before holding a conference call with the study team to discuss the results of the pilot activities. These surveys will act as pilot sites for testing the recruiting and survey instruments. A discussion of issues raised from the on-sites will be held to resolve problems and streamline the remaining 285 on-site surveys.

Once the Sponsors have approved RLW to move forward with the fieldwork, RLW will begin recruiting and fielding sites again. The project will proceed at full speed up to the vacation season between July and August. We learned in Illinois residential assessment that this is a poor time to recruit customers and conduct onsite visits. During this time customer no-shows were high, scheduling was difficult and refusals were high.

Task 5.5: Surveyor Management and Quality Control

Senior level staff at both RLW and MDI will be available to auditors on a daily basis to answer questions and maintain quality control. Senior staff will review random samples of uploaded survey data, hold conference calls with all surveyors to discuss unforeseen issues that arise, and to provide guidance and training on project efficiency. The field supervisors will report to the RLW Project Manager regularly so that all parties are familiar with current findings and activities.

<i>Deliverables</i>

- | |
|---|
| <ul style="list-style-type: none">j) 285 Residential On-site Surveys – April –July 2005k) Training Material – April 2005l) Customer Recruiting Disposition Log – April 2005m) Monthly Memos Summarizing Progress - Ongoing |
|---|

Task 6: Database Summarization Tool

Aside from delivering a well designed, accurately populated database of household appliance and lighting data, the project must also deliver a tool that can be used by program designers, managers, evaluators, and other parties for understanding efficiency and saturation characteristics of California residences. This task will be conducted in conjunction with the data collection tasks. As the data is being collected for the 2004-05 Study, RLW development and programming staff will work with the 1999-00 Study databases and MBSS VB code to develop the web-based tool. This approach will allow this task of the project to move forward so that when the 2005 data have been collected, the web based tool will be very close to being a complete product.

Upon completion, this approach will also produce a product that will allow access to the study data, allowing other parties the ability to produce their own "what-if" trend analyses.

As with the previous tool we developed, this application will be tailored for this project and will have the following capabilities:

- Calculate ratio estimates, e.g., of the saturation level of a set of appliances, classified by any available categorical variable such as climate zone, residence type, or year
- Calculate the underlying sample sizes
- Calculate the appropriate model-based error bounds

This software can be used to create one-way, two-way or multi-way tables categorizing the market share of specified appliances and measures by any specified dimensions. The resulting tables can be easily exported to Excel and displayed graphically.

Here are some examples of the type of statistics that one could obtain:

- Average UEC of refrigerators
- Saturation of refrigerators by age bins

This type of information can be developed for all sites, or for various classifications of residences. Using the standard queries that we will provide in the database, the sites can be classified by any combination of the following variables (or any additional variables that are deemed necessary):

- Level of Efficiency
- Utility Service Territory of Residence
- Type of Residence
- Size of Household
- Square Footage
- Income Level, etc.

Task 6.1: Develop Web Interface

The online version of MBSS VB will be implemented as a CGI program that will be compatible with any Microsoft Windows based web server. Because the user interface requirements are

relatively straight forward, the engine itself will be able to be integrated seamlessly into the hosting agencies website.

Provisions will be made to install and test the software before the pages are made available to a general audience. Requirements for the server running the MBSS VB analysis engine are as follows:

- Running a recent version Microsoft Windows Server operating system (Windows NT Server version 4.5.1, Windows 2000 Server, Windows 2003 Server, etc.)
- Running web server services such as Apache version 1.3 or above or Microsoft IIS Server.
- Web Server will be configured to allow CGI scripting

At the onset of the project, a determination will be made to decide if these requirements can be fulfilled by existing servers at any of the potential hosting agencies. If not, provisions will be made to configure a server to provide the required functionality. For our California projects, for example, we have researched two possible hosting agencies including the CEC (www.energy.ca.gov) and CALMAC (www.calmac.org), of the two, CALMAC is running a Windows server that would work well for this project, whereas the CEC website would not be a good option because they are not running a Windows server. Regardless, this is not a critical issue because a preconfigured server could be purchased to host the website at minimal cost to the utilities.

Task 6.2: Develop Backend CGI Program

The server-based analysis CGI program will be an adaptation of the current MBSS VB software modified to run without a user interface, both getting its input from, and providing output to the web server. The way CGI works from the Web server's point of view is that certain locations (e.g. <http://www.example.com/mbss.cgi>) are defined to be served by a CGI program. Whenever a request to a matching URL is received, the corresponding program is called, with any data that the client sent as input. Output from the program is collected by the Web server, augmented with appropriate headers, and sent back to the client.

Because the basis for the proposed CGI is MBSS VB, a Windows based Visual Basic program, this brings about the requirement that the CGI (web) server also be based upon Microsoft Windows.

Task 6.3: Testing

RLW senior programming staff will test the database application throughout the development of the previous two tasks. Rigorous testing will be conducted to ensure that when this aspect of the project is final, the application will operate as intended without software bugs.

Task 6.4: Develop Help Pages

RLW will develop easy to follow tutorial web pages for training new users on the functionality of the web-based MBSS tool. The help pages will guide users the process of conducting a couple of different analysis scenarios, which will include screen captures of the actual process to improve the learning process. The help pages will also include links to a data dictionary for understanding each of the analysis variables, links to the report, and links to other important references. The web site main page will also provide a high level summary of the study objectives, methodology employed, sample sizes, and estimates of statistical precision.

Moreover, the web page will provide similar information for the 1999-00 study, since this database will also be accessible on the website for analysis.

<i>Deliverables</i>

- | |
|---|
| <ul style="list-style-type: none">n) MBSS VB Web-based Tool for Conducting Efficiency and Saturation Analysis for both the 1999-00 Study and the 2004-05 Study data – June 2005o) Software Documentation – June 2005p) On-line Documentation and Help Screens – June 2005 |
|---|

Task 7: Development of Residential Appliance and Lighting Database and Analysis Output

The ultimate objective of this project is an accurate tracking database to understand efficient lighting and appliance saturation in the residential market. Moreover the database must be user friendly – that is, it must be easy for a typical user to query the data and obtain relevant information. This is not as simple as it might seem.

There are multiple components to the development of the database of residential appliances and lighting, their saturations and energy use. As stated earlier, many of these components are in place and are ready for use on this study. They are:

- Consolidate auditor site information in a central database,
- Merge sampling weights into site tables,
- Merge auditor site information with energy efficiency databases (e.g. CEC, ARI),
- Create efficiency categories (i.e. Low, Medium, High) and merge with site information,
- Develop a list of variables for comparisons and contrasts, and
- Develop a special software tool for summarizing saturation, efficiency levels, and other characteristics collected during on-site audit.

Task 7.1: Consolidation of Onsite Information

Our new hand-held application is designed to automatically download all onsite data to an SQL database that is hosted at RLW's Sonoma office. Downloads happen automatically anytime the hand-held is connected to the Internet. Downloaded data will be stored in the SQL database which is structured in the same way as the 1999-00 databases, which allows us to reuse all analysis queries that were developed for the previous study. As the data is consolidated it will go through an automated QC process in addition to a manual QC process.

Task 7.2: Merge of Weights

Once the sites are merged into the central database, a lookup table will provide the sample design case weights for the analysis in each table in the database. Each site in a given stratum will have a corresponding case weight that we define to be the number of sites in the population that the site is thought to represent. The following formula defines the stratum weight to be the ratio of the number of sites in the population in that stratum to the number of sites in the sample in that stratum. Each stratum will have a corresponding weight, and accordingly, each site within the stratum will be associated with that weight. These weights are used to expand the sample to the population.

$$w_h = N_h / n_h, \text{ where } h \text{ is the stratum number}$$

Task 7.3: Merging of Saturation and Efficiency Information

As discussed earlier in this proposal, the auditors will be able to observe make and model number on-site, but not energy efficiency. RLW will use all available resources to match the model numbers collected on-site with a reliable source of efficiency ratings and/or unit energy. Matching will be done using the matching queries that were used in the 1999-00 Study, in addition to manual matching processes when automated processing is not successful.

Task 7.4: Creation of Efficiency Categories

A second set of lookup tables will translate appliance type, size and energy efficiency into efficiency categories – depending on the end use. Development of categories and analysis queries was an extremely time consuming effort in our past California studies, so reusing them equates to substantial time and cost savings for the benefit of the Missouri utility sponsors.

Lastly, there will be numerous variables for which the data can be analyzed by. In the previous study we allowed the user the ability to “slice and dice” the data using numerous variables of interest. For example, users could analyze the data by utility service area, income range, climate zone, and much more. We recommend using these same variables, and perhaps adding a few more if necessary.

Task 7.5: Weighting Adjustment for Unmatched Appliances

An exciting task that RLW will perform as part of this project is a weighting adjustment to the appliance data. The adjustment will be performed in order to remove the upward bias in efficiency due to the lower matching rates for older models. As discussed in the previous section, one of the study flaws identified in our past 1999-00 California Study was that new appliances were easier to match to efficiency data than were older appliances. We have good reason to believe that these uneven match rates produced more efficient overall baseline appliance efficiencies than is actually the case.

To improve the findings of the study, we will calculate new weights for the appliance efficiency data in order to account for the uneven match rates we expect to encounter.

The first step in calculating the new weights will be to group the efficiency data within age bins by appliance. The appliance weight will be calculated by dividing the total number of appliances in the sample (both matched and unmatched) by the number of matched appliances within each age bin. Then this appliance weight will be multiplied by the sample weight to project the appliance efficiency to the population. The appliance weight will ensure that each appliance with efficiency within the given age ranges has the same proportional representation as the total number of appliances within that age range with and without efficiency.

Task 7.6: Conduct Analysis of Lighting and Appliance Data

Using the data structures and analysis queries that were developed for the previous study, RLW will conduct the lighting and appliance analysis. The analysis will be conducted at the statewide level, and at the utility level. Furthermore, users of the web-based tool will find a plethora of ways to analyze the data far beyond what is presented in the report, using a host of categorical variables for "slicing and dicing" the data.

Task 7.7: Conduct key Technical, Economic, and Potential analyses

Lastly, the analysis tasks will lead into conducting the technical, economic, and potential analyses for key measures. We will utilize the assumptions and models previously designed and set up from our 2002 Illinois residential assessment (see Appendix D: Potential Analysis for description of these analyses).

<i>Deliverables</i>

- | |
|---|
| <ul style="list-style-type: none">q) Lighting and Appliance Database; including Customer information tables, efficiency tables, forms and analysis queries – August 2005r) Database Documentation – August 2005s) Conduct Technical, Economic, and Potential analyses – August/September 2005 |
|---|

Task 8: Reporting and Presentation of Findings

Task 8.1: Draft Report

RLW will produce a comprehensive draft final report that details the results of the study. The major components of the draft final report will be the following:

- A full characterization of the inventory for residential appliances and lighting at the statewide level,
- A summary of the saturation levels of appliances and lighting by efficiency levels at the statewide level, and
- A comparison of the previous study findings to the current study findings at the statewide level.

The following is a brief outline of the draft report.

Introduction and Executive Summary

This section will serve as an overview of the approach and the findings. It will be suitable for independent distribution to a non-technical audience as an executive summary of the study. This section will contain only top-level findings and a brief overview of the methodology.

Study Methodology

This section will provide a detailed discussion of the methods employed in the study. This section will assist the readers in understanding the approach and goals of the study. This section will cover the methods used to develop the sample design, conduct customer recruiting and on-site data collection, and analysis of the in-home data. This section will provide the context needed for interpretation of the findings.

Characterization of Residential Appliances and Lighting Inventory

This section will present the study findings on the residential appliances and lighting inventory. From this section, the reader will gain an understanding of the current state of residential appliances and lighting.

Technical, Economic, and Market Potential

This section will present an analysis that assesses the technical, economic, and market potential of key household measures (see Appendix A: Initial Measures for a detailed description of initial measures). In order to propose within the budget given to us, we would utilize these steps in order to provide meaningful results within the task budget allowed:

- Market adoption rates we developed for the Illinois study would be used in this assessment as well.
- Key measures that show the largest impact will be calculated. This will entail keeping the potential analysis within approximately 10 to 12 measures that would show the highest promise of energy savings and/or peak load impact.
- Programmatic recommendations will be given on a strategic level, i.e. if the lighting baseline shows sizable market potential for compact fluorescents, we will identify that by the opportunity to promote lighting through a program without detailing specific programmatic design or direction.

Database Development and Web-based Tool

This section will discuss the development of the database, the data sources and how that data is analyzed by the MBSS Tool. This section will also discuss the MBSS summarization tool theory and how it should and should not be used. A section will be devoted entirely to the web-based tool, including user instructions, help information and disclaimers. This section will also be presented on the website that hosts the tool, and will be in a format that can easily be distributed as a stand-alone document.

Appendix

The appendix to the report will contain all supporting information, such as database documentation, survey instruments, etc.

Task 8.2: Final Report

RLW will allow stakeholders ample time to review the final report material and provide comments and input. RLW will make reasonable changes to the report based on the comments received. RLW will produce a final report once all comments have been received. RLW will distribute as many bound copies of the report as requested by the client, not to exceed 20.

Task 8.3: Public Presentation and Web-based Software Training

RLW will formally present the results of the study to the project stakeholders at a time that is convenient for the study group. During this meeting RLW will also demonstrate the web-based tool and provide training for those interested in this aspect of the presentation. RLW will arrange this as a web-based presentation to allow other parties the ability to participate in the training activities.

Deliverables

- t) Draft Report – September 2005
- u) Final Report and Databases – September 2005
- v) Final Report Presentation and Web-based Tool Training – September 2005

Task 9: Project Management

Task 9.1: Monthly Status Reports

The RLW Team will provide monthly status reports that discuss the activities in the previous month, for which the invoice represents, in addition to work planned for the upcoming month. The RLW Project Manager and the Sponsors will agree upon the format of the monthly report and invoice detail early in the evaluation period.

Deliverables

- w) Monthly Status Reports – Ongoing

Section 4 - Project Management and Qualifications of Key Personnel

Project Management

Figure 4 shows the organization of RLW team. Dr. Roger Wright will be the overall Project Director. Ed Smyth will be the Project Manager and a primary contact person.

RLW has assigned the team's experts in each major task area to lead the task. Roger Wright, Ph.D. will be in charge of the overall study design. Mr. Matt Brost of RLW will provide overall project management support for RLW's California staff.

The RLW team will divide the geographical coverage required to successfully implement the large onsite survey required. MDI will be responsible for the audits in the larger St. Louis area and eastern Missouri where they would be closest. RLW will be responsible for the audits in the larger Kansas City area and western parts of the state. This will minimize costs and facilitate communication and coordination. Customer recruiting efforts will be managed by April Garcia on a statewide basis, assisted by Amber Watkins. Joe O'Malley, Principal for MDI, will direct MDI's efforts. MDI brings a large staff of energy auditors and data collection experts that are very familiar with the Midwest. RLW will lead its own team of auditors and data collection experts. Jeff Staller will manage the RLW onsite survey team.

Economic, technical, and market potential will be conducted by Senior Engineer Glenn Haynes. Mr. Haynes had performed the similar task for the Illinois statewide assessment in 2002, and has retained the DOE2 models used in that study.

As with our past California studies, Stacia Okura will manage the development and analysis of the appliance and lighting databases, respectively. Lastly, Thomas Standifur will modify the on-line analysis tool. Mr. Standifur will also be responsible for managing the hand-held application updates and data downloads.

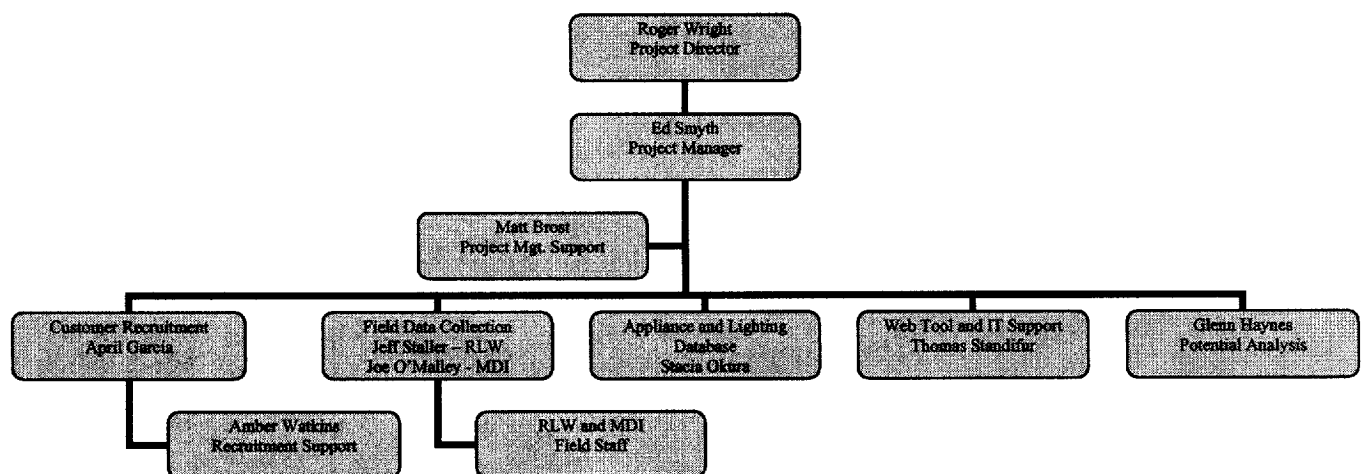


Figure 4: Project Staffing Organization

Qualifications of Key Personnel

This section provides brief sketches of each of the principle staff persons on this project. Detailed resumes are provided with our corporate qualifications.

Roger Wright, Principal

Dr. Roger L. Wright is one of the premiere statistical consultants serving electric and gas utilities. He founded Roger L. Wright and Associates in 1970 and formed *RLW Analytics, Inc.* in 1989, leaving the position of Statistics and Management Science Department Chair at the University of Michigan Graduate School of Business Administration. Dr. Wright's work has included the development and practical application of innovative statistical sampling and analysis methodologies including Model Based Statistical Sampling, Model Based Domains Analysis, and the Engineering Calibration Approach. Dr. Wright continues his commitment to advancing the state of the art in energy marketing, load research, and DSM evaluation through his work at Northeast Utilities, Wisconsin Electric, Pacific Gas and Electric, and other innovative utilities.

Matt Brost, Western Regional Manager

Mr. Brost has been actively involved in the field of energy consulting for nearly ten years. Mr. Brost's concentration during this time has focused primarily on the evaluation of utility energy efficiency programs, baseline studies, and market research studies. In the last nine years while working for RLW Analytics Mr. Brost has developed a broad set of skills and interests in the energy field. In this time Mr. Brost has held several positions, beginning as a college intern, then going on to junior consultant, consultant, and finally Sr. Consultant and Western Regional Manager. In 2002 Mr. Brost became a minority owner of RLW Analytics Inc., this next step in his career is offering further professional development in an industry he finds rewarding and intellectually stimulating.

Mr. Brost has worked on numerous commercial, industrial and residential project evaluations, baseline studies, retention studies, research projects and market transformation initiatives during his time with RLW. Mr. Brost also has a number of published papers and has made many public presentations in the area of energy efficiency, program evaluation, and baseline studies. Clients Mr. Brost is responsible for include PG&E, SCE, SDG&E, SCG, in addition to utilities in Texas and the Pacific Northwest. Currently Mr. Brost is managing the 2002-03 California Statewide ENERGY STAR® New Homes Program Evaluation and the 2002-03 California Statewide Savings By Design Evaluation. In another large project in the Pacific Northwest, Mr. Brost is RLW's project manager for the Distribution Efficiency Initiative, a multi-utility study on voltage regulation technologies for residential energy efficiency.

Edward Smyth, Senior Consultant.

Mr. Smyth has seven years experience in the energy industry. He holds a MBA from the College of St. Rose with a comprehensive graduate portfolio in energy industry financial analysis, economic analysis, and strategic planning. As a project manager and senior consultant at RLW, Mr. Smyth manages and works on all facets of market research: project management, in-person and telephone interviewing, survey instrument design, data analysis, final report write ups, and program recommendations. These skills have been used in research projects for the Massachusetts Department of Energy Resources, Northeast Utilities, NSTAR, NYSERDA, Oncor, and the Chicago Community Energy Cooperative. He managed the audit function, data collection, DOE2 technical potential analysis, and final report for an Illinois residential energy

efficiency assessment study for the Midwest Energy Efficiency Alliance. Mr. Smyth provided market research and analysis for a contract team supporting the NYSERDA ENERGY STAR Residential Appliances and Products Marketing Program, and is providing marketing outreach and customer services as a partner with Landsberg Engineering for the NYSERDA Small Business Audit Program.

Before joining RLW, Mr. Smyth worked in the deregulated energy industry for AllEnergy Marketing Company as a natural gas sales representative, and two years as an energy consultant for LaCorte Companies, a regional electrical contracting, electrical service, and telecommunications service company. Mr. Smyth handled a number of concurrent exterior lighting design and installation projects in roles as a designer and project manager. During his LaCorte tenure, Mr. Smyth had done comparative rate analysis and consultation with Fuji Processing, provided lighting upgrade design and consultation for the banking industry, and constructed lifecycle cost analyses for energy efficiency project proposals.

Stacia Okura, Senior Analyst

Ms. Okura is a Senior Analyst at RLW Analytics' Sonoma Office. Her responsibilities include sample design and data analysis for market research, load research and energy efficiency projects, database development and management, as well as project management and support for the senior staff. Stacia recently assisted in a sample design for Southern California Edison's 2003 Energy Smart Thermostat Program that included short-term end-use metering for an embedded subset of the whole building metered sampled projects. She supported the implementation of the load research project by ensuring that the installations followed the sampling plan. Stacia also currently completed work as the lead analyst on a project that investigated the relationship between the physical environment and worker performance in office spaces. She utilized multivariate regression models and completed numerous tests for statistical significance, correlation, multi-collinearity, and other data patterns. Stacia is currently working on an evaluation of the CA Energy Star Homes Program, which entails numerous survey designs and analyses, an ex-post energy savings estimate, and a building characteristics analysis.

Glenn Haynes, Senior Engineering Consultant

Mr. Haynes is currently a Senior Consulting Engineer and technical lead analyst for a team of engineers and technical staff responsible for conservation program impact evaluations, on-site and telephone data collection, building energy simulation using DOE2, billing data analysis and end-use metering. During his four years with RLW Analytics, he has been project manager or lead engineer for numerous impact evaluations and impact potential studies for residential and C&I programs. Project experience relevant to this one includes analysis of a multifamily HVAC tune-up program pilot for the City of Austin, Texas, a similar analysis of a single family central AC tune-up program for Florida Power Corporation and a commercial AC project for National Grid throughout Rhode Island and Massachusetts. The latter project, currently in the final analysis phase, included 4 months of true power and temperature monitoring of 47 AC units.

Mr. Haynes' previous experience in the energy industry includes two years in research, nine years in HVAC design engineering, six years with the City of Austin and seven years at Florida Power Corporation (FPC) as a DSM Project Evaluation Engineer. At FPC, Mr. Haynes specialized in residential and commercial program design and administration, the collection and evaluation of robust residential and commercial end-use data, and the integration of end-use load shapes into DOE2 models to estimate impacts and cost-effectiveness of the company's residential and

C/I conservation programs. At The City of Austin, Mr. Haynes was responsible for impact evaluations for residential and commercial energy conservation programs. He used computer modeling techniques with BETA (Building Energy Thermal Analysis) and DOE2 that included close calibration to averaged billing data, interfaced with statistical analyses and benefit/cost analyses.

April Garcia, Analyst

Ms. Garcia is a Research Analyst at RLW Analytics' Sonoma office. Her responsibilities include sample design, survey instrument design, qualitative and quantitative survey analysis, data analysis for energy efficiency projects, database development and management, and support for the senior staff. April is currently working on the 2003 CA NRNC BEA study where she is assisting with the sample designs and database development. She recently completed a survey analysis of the SDG&E DMOP mobile energy workshops program. She also recently completed a series of sample designs for the NEEA Conservation Voltage Regulation Project and is in charge of compiling a population for the multi-family aspect of the project.

April possesses a Master's Degree in Research Psychology from a program that focused heavily on sample design and statistical analysis. She completed attitudinal research to measure biases toward people with disabilities using existing survey instruments to gauge explicit (conscious) attitudes and emotions. She designed an original survey that included Likert scales to capture implicit (unconscious) attitudes and emotions. April analyzed the resulting data using SPSS and a repeated measures ANOVA technique and summarized her findings for her thesis.

Thomas Standifur, Information Technology Manager

Since joining the RLW team two years ago Mr. Standifur has spearheaded the implementation of many of RLW's technological changes. He has brought online a SQL server enabling field staff to directly download data from anywhere in the world. The SQL server works in conjunction with a handheld data collection instrument that allows for instant onsite data entry that he helped develop. In addition to keeping the office up to speed, Tom designs many of the databases that are crucial to the work RLW performs. He has established new security measures to keep RLW's libraries and client information safe from outsider intrusion. Bringing the office back up to speed with current and upcoming information technologies has allowed RLW to sharpen its competitive edge.

Jeffrey P Staller, Consultant

Mr. Staller's main responsibilities include performing on-site energy audits, installation of short term metering equipment, DOE2.1e building energy analysis simulation and gross savings analysis of commercial and residential buildings. These skills are typically utilized for load research projects and utility DSM impact evaluations. He also performs DOE2.1e model calibration, data analysis, and on-site interviews with building engineers and telephone surveys. His non-residential experience comes from performing the aforementioned tasks while evaluating non-residential DSM programs for Pacific Gas and Electric, Southern California Edison, Northeast Utilities, and Portland General Electric. Further experience comes from residential load research and DSM projects for Central Iowa Power Cooperative, Northeast Utilities Connecticut and Central Power and Light, and non-residential baseline studies for the states of California, and New Jersey.

Timeline and Staffing Plan

Project Schedule

The anticipated project schedule is shown in Table 4. The table shows each task or deliverable of the project together with the completion or delivery data. The schedule will be updated throughout the project to keep the Sponsors completely informed. Currently the schedule matches the Sponsors' preferred schedule.

Task	Task Description	2005									
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
1	Project Initiation										
1.1	Agenda										
1.2	Project Initiation Meeting										
1.3	Memo										
2	Research Plan										
2.1	Draft Research Plan										
2.2	Final Research Plan										
3	Telephone and Onsite Survey Instruments										
3.1	Telephone Recruiting Instruments										
3.2	Onsite Data Collection Instrument										
3.3	Revise Hand-held Application for Current Study										
4	Update Database of Survey Data										
4.1	Acquire Efficiency Databases for Inclusion (ALREADY COMPLETED)										
4.2	Update Database with Efficiency Information (ALREADY COMPLETED)										
5	Data Collection										
5.1	Training										
5.2	Customer Letter										
5.3	Recruiting										
5.4	Onsite Data Collection										
5.5	Surveyor Management										
6	Database Summarization Tool										
6.1	Revise Code										
6.2	Produce On-line Product										
6.3	Testing										
6.4	Create Help Screens										
7	Residential Appliance and Lighting Database and Analysis Output										
7.1	Consolidation of Auditor Information										
7.2	Merge of Weights										
7.3	Merging of Saturation and Efficiency Information										
7.4	Creation of Efficiency Categories										
7.5	Weighting Adjustment for Unmatched Appliances										
7.6	Conduct Lighting and Appliance Analysis Activities										
7.7	Perform Potential Analyses										
8	Draft and Final Reports										
8.1	Draft Report										
8.2	Final Report and Database										
8.3	Public Presentation										
9	Project Management										
9.1	Status Reports										

Table 4: Project Schedule

Resource and Cost Summary

Cost Proposal

The total cost of this project is **\$138,874**. Table 5 summarizes the total project cost by task and company. RLW will complete the majority of the work; MDI will only assist in the data collection efforts. A significant amount of the contract will go to direct expenses and travel costs. Task 5 requires the most direct expenses, \$26.00 for each the 285 participants in incentives has been budgeted, totaling \$7,410¹. Another \$13,206 has also been budgeted for travel costs associated with the 285 site audits.

In terms of the onsite surveys, the RLW Team will complete each site visit for a total cost of \$80,114 . This includes travel expenses, surveyor management, travel to and from the site, and of course the in-home audit activities.

We recognize that this cost proposal is about \$8,000 over the anticipated budget shown in the RFP. Because the on-site task absorbs so much of the budget, we have looked to be as cost-efficient as possible with the other tasks. We are amenable to adjusting our approaches in order to make a cap of \$130,000 as initially identified by the sponsors.

¹ Each participant gets \$25.00 because there is a \$1.00 fee for every money order purchased.

Task	Task Description	RLW	ASW	Direct Costs	Travel Costs	Total
1	Project Initiation	\$ 2,400				\$ 2,400
1.1	Agenda	\$ 440				\$ 440
1.2	Project Initiation Meeting	\$ 1,645				\$ 1,645
1.3	Memo	\$ 315				\$ 315
2	Research Plan	\$ 4,070				\$ 4,070
2.1	Draft Research Plan	\$ 3,320				\$ 3,320
2.2	Final Research Plan	\$ 750				\$ 750
3	Telephone and Onsite Survey Instruments	\$ 4,030				\$ 4,030
3.1	Telephone Recruiting Instruments	\$ 1,160				\$ 1,160
3.2	Onsite Data Collection Instrument	\$ 1,670				\$ 1,670
3.3	Revise Hand-held Application for Current Study	\$ 1,200				\$ 1,200
4	Update Database of Survey Data	\$ -				\$ -
4.1	Acquire Efficiency Databases for Inclusion (INCLUDED)	\$ -				\$ -
4.2	Update Database with Efficiency Information (INCLUDED)	\$ -				\$ -
5	Data Collection	\$ 38,620	\$ 19,584			\$ 80,114
5.1	Training	\$ 960	\$ 1,872	\$ 250	\$ 500	\$ 3,582
5.2	Customer Letter	\$ 2,220	\$ -	\$ 50		\$ 2,270
5.3	Recruiting	\$ 12,260	\$ -	\$ 7,410		\$ 19,670
5.4	Onsite Data Collection	\$ 20,640	\$ 16,416		\$ 13,700	\$ 50,756
5.5	Surveyor Management	\$ 2,540	\$ 1,296			\$ 3,836
6	Database Summarization Tool	\$ 3,880				\$ 3,880
6.1	Develop Web Interface	\$ 1,780				\$ 1,780
6.2	Develop Backend CGI Program	\$ 600				\$ 600
6.3	Testing	\$ 600				\$ 600
6.4	Develop Help Pages	\$ 900				\$ 900
7	Appliance and Lighting Database and Analysis Output	\$ 27,400				\$ 27,400
7.1	Consolidation of Auditor Information	\$ 3,600				\$ 3,600
7.2	Merge of Weights	\$ 860				\$ 860
7.3	Merging of Saturation and Efficiency Information	\$ 3,000				\$ 3,000
7.4	Creation of Efficiency Categories	\$ 430				\$ 430
7.5	Weighting Adjustment for Unmatched Appliances	\$ 1,820				\$ 1,820
7.6	Conduct Lighting and Appliance Analysis Activities	\$ 7,960				\$ 7,960
7.7	Compare Findings to Previous Study Findings	\$ 9,730				\$ 9,730
8	Draft and Final Reports	\$ 13,480				\$ 13,480
8.1	Draft Report	\$ 8,880				\$ 8,880
8.2	Final Report and Database	\$ 4,600				\$ 4,600
8.3	Public Presentation and Training	\$ -				\$ -
9	Project Management	\$ 3,500				\$ 3,500
9.1	Bi-Weekly Conference Calls	\$ -				\$ -
9.2	Summary of Conference Calls	\$ -				\$ -
9.3	Status Reports	\$ 3,500				\$ 3,500
Project Totals		\$ 97,380	\$ 19,584	\$ 7,710	\$ 14,200	\$ 138,874

Table 5: Summary Budget by Task and Firm

Detailed Cost Proposal by Contractor

This section provided detailed budgets for RLW and MDI separately. Figure 5 and Figure 6 present detailed budgets for RLW and MDI respectively. Presented in the detailed budget tables is staff billing rates, hours by staff member and task, and total hours by staff person. The costs included in these figures do not include travel or direct expenses.

		Wright	Smyth/ Brost	Okura/H aynes	Tom S.	Hennessy	Garcia	P. Carter	Eng I	Eng II	Analyst / Phone	Cost
		\$220	\$125	\$95	\$75	\$140	\$70	\$60	\$60	\$60	\$50	
1	Project Initiation											\$2,400
1.1	Agenda		2	2								\$440
1.2	Project Initiation Meeting		8	6	1							\$1,645
1.3	Memo		1	2								\$315
2	Research Plan											\$4,070
2.1	Draft Research Plan	2	8	8		8						\$3,320
2.2	Final Research Plan	1	2			2						\$750
3	Telephone and Onsite Survey Instruments											\$4,030
3.1	Telephone Recruiting Instruments		2	2				8		4		\$1,160
3.2	Onsite Data Collection Instrument		8	2					8			\$1,670
3.3	Revise Hand-held Application for Current Study				16							\$1,200
4	Update Database of Survey Data											\$0
4.1	Acquire Efficiency Databases for Inclusion											\$0
4.2	Update Database with Efficiency Information											\$0
5	Data Collection											\$36,670
5.1	Training								16			\$960
5.2	Customer Letter			4				4			32	\$2,220
5.3	Recruiting			8							230	\$12,260
5.4	Onsite Data Collection								224	120		\$20,640
5.5	Surveyor Management		16						9			\$2,540
6	Database Summarization Tool											\$3,880
6.1	Develop Web Interface	4			12							\$1,780
6.2	Develop Backend CGI Program				8							\$600
6.3	Testing				8							\$600
6.4	Develop Help Pages				12							\$900
7	Residential Appliance and Lighting Database and Analysis Output											\$27,400
7.1	Consolidation of Auditor Information						40				16	\$3,600
7.2	Merge of Weights			4				8				\$860
7.3	Merging of Saturation and Efficiency Information									50		\$3,000
7.4	Creation of Efficiency Categories			2				4				\$430
7.5	Weighting Adjustment for Unmatched Appliances			4				24				\$1,820
7.6	Conduct Lighting and Appliance Analysis Activities		8	16			40	40	4			\$7,960
7.7	Potential Analyses		14	84								\$9,730
8	Draft and Final Reports											\$13,430
8.1	Draft Report	2	16	24			32	32				\$8,880
8.2	Final Report and Database		8	16			16	16				\$4,600
8.3	Public Presentation											\$0
9	Project Management											\$3,500
9.1	Bi-Weekly Conference Calls											\$0
9.2	Summary of Conference Calls											\$0
9.3	Status Reports		28									\$3,500
	Project Totals	9	121	184	57	10	128	136	261	174	278	\$97,380

Figure 5: RLW Budget Detail

		Mngmt	Auditor A	Auditor B	-	Cost
		\$120	\$72	\$72	\$0	
1	Project Initiation					\$0
1.1	Agenda					\$0
1.2	Project Initiation Meeting					\$0
1.3	Memo					\$0
2	Research Plan					\$0
2.1	Draft Research Plan					\$0
2.2	Final Research Plan					\$0
3	Telephone and Onsite Survey Instruments					\$0
3.1	Telephone Recruiting Instruments					\$0
3.2	Onsite Data Collection Instrument					\$0
3.3	Revise Hand-held Application for Current Study					\$0
4	Update Database of Survey Data					\$0
4.1	Acquire Efficiency Databases for Inclusion					\$0
	Update Database with Efficiency Information					\$0
5	Data Collection					\$19,584
5.1	Training	6	8	8		\$1,872
5.2	Customer Letter					\$0
5.3	Recruiting					\$0
5.4	Onsite Data Collection		120	108		\$16,416
5.5	Surveyor Management	11				\$1,296
6	Database Summarization Tool					\$0
6.1	Develop Web Interface					\$0
6.2	Develop Backend CGI Program					\$0
	Testing					\$0
6.3	Develop Help Pages					\$0
7	Residential Appliances and Lighting Database and Analysis Output					\$0
7.1	Consolidation of Auditor Information					\$0
7.2	Merge of Weights					\$0
7.3	Merging of Saturation and Efficiency Information					\$0
7.4	Creation of Efficiency Categories					\$0
7.5	Weighting Adjustment for Unmatched Appliances					\$0
7.6	Conduct Lighting and Appliance Analysis Activities					\$0
7.7	Compare Findings to Previous Study Findings					\$0
8	Draft and Final Reports					\$0
8.1	Draft Report					\$0
8.2	Final Report and Database					\$0
8.3	Public Presentation					\$0
9	Project Management					\$0
9.1	Bi-Weekly Conference Calls					\$0
9.2	Summary of Conference Calls					\$0
9.3	Status Reports					\$0
	Project Totals	17	128	116	0	\$19,584

Figure 6: MDI Budget Detail

Corporate Qualifications

Dr. Roger L. Wright, President of *RLW*, first founded Roger L. Wright and Associates in 1970. In 1989, Dr. Wright left the position of Statistics and Management Science Department Chair at the University of Michigan Graduate School of Business Administration, and joined Curt Puckett of Consumers Power Company to form *RLW Analytics*. Since then, *RLW* has grown to more than 30 full-time employees at four offices in California, Michigan, Connecticut and New York.

RLW is a recognized industry leader in providing innovative analytical, engineering and market research consulting for energy companies and organizations. Our consultants are experts in energy auditing and DOE-2 modeling, load research and load monitoring, statistical sampling, econometrics, energy analysis, market research, software development, and project management. We have collected detailed information at thousands of residential, commercial and industrial sites, built thousands of DOE-2 models, implemented numerous telephone surveys, and statistically summarized the resulting information in meaningful terms for each project. Our Shape-IT™ and Compare-IT™ software tools are designed to help users make profitable energy supply and equipment retrofit decisions. Our Electric Markets Survey provides users with current market intelligence on the deregulated electric marketplace.

Our firm's other innovations include the Model-Based Statistical Sampling (MBSS™) Software for sample design and analysis, and the Engineering Calibration Approach (ECA™) for understanding the energy use of market segments. In addition, *RLW Analytics* has brought a new dimension to load research analysis with Visualize-IT™. This powerful 3-D data visualization tool enables the efficient editing, analysis and presentation of metered load data.

RLW Analytics has a simple corporate purpose, encompassed in its mission statement:

"Our mission is to develop and transfer practical solutions to our clients' challenges, following sound engineering principles, innovative statistical analysis and creative market research."

RLW Analytics and *MDI* are well known in the program evaluation and market transformation field and will provide the Sponsors with a vast amount of expert knowledge and experience relating to both process evaluation and market assessment. Appendix X details *RLW* experiences and qualifications.