ANL/EAIS/TM-76

C&RE-SLC: Database for Conservation and Renewable Energy Activities

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August 1992

Work sponsored by United States Department of Energy, Western Area Power Administration

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ACKNOWLEDGMENTS

The authors would like to acknowledge the work of Nancy Collins, under whose capable direction the database was initially organized.

The authors would also like to thank Craig Hibberd and Clayton Palmer of Western Area Power Administration for comments and suggestions on an early draft of this report. Appreciation is extended to Florence Henning for editing this document and to Joyce Henry and Maisie Plut for document processing services.

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ABSTRACT

The Western Area Power Administration (Western) requires all its long-term power customers to implement programs that promote the conservation of electric energy or facilitate the use of renewable energy resources. The hope is that these measures could significantly reduce the amount of environmental damage associated with electricity production. As part of preparing the environmental impact statement for Western's Electric Power Marketing Program, Argonne National Laboratory constructed a database of the conservation and renewable energy activities in which Western's Salt Lake City customers are involved. The database provides information on types of conservation and renewable energy activities and allows for comparisons of activities being conducted at different utilities in the Salt Lake City region. Sorting the database allows Western's Salt Lake City customers to be classified so the various activities offered by different classes of utilities can be identified; for example, comparisons can be made between municipal utilities and cooperatives or between large and small customers. The information included in the database was collected from customer planning documents in the files of Western's Salt Lake City office.

1 INTRODUCTION AND BACKGROUND

In recent years, electric utilities across the country have extended their capability of providing reliable and low-cost service to energy end-users by developing energy conservation programs and exploring the applicability of renewable energy technologies. Approximately 500 utilities are currently sponsoring more than 1,300 demand-side management programs. A majority of states require utilities to formulate periodic integrated resource plans that incorporate demand-side options like energy conservation and peak-load management whenever their costs are lower than those of supply-side options. Renewable energy technologies also are being explored anew because of increased funding from the federal government. Western Area Power Administration (Western) has been a part of this trend through its program of conservation and renewable energy (C&RE) activities.

The commitment of Western to the C&RE program derives from Western's objective of providing reliable electric service while protecting the environment and optimizing energy

efficiency. Western requires all long-term firm power customers to implement certain activities that will promote the conservation of electric energy or facilitate the use of renewable energy resources. This requirement has existed since 1981 as part of the Guidelines and Acceptance Criteria (G&AC) published in the *Federal Register* on November 13, 1981 (46 FR 56140). The G&AC was amended in 1985 (50 FR 33892), after legislation reinforcing the C&RE program was passed as part of Title II of the Hoover Power Plant Act. Customers that do not comply with the G&AC are subject to a penalty — a 10% reduction in the Western power-contract commitment.

Estimates of the impact that Western's C&RE programs have had on the power needs of its customers have not been made yet. Nevertheless, some people strongly believe that conservation and alternative energy resources could significantly reduce the need of Western's customers for electricity from both Western and other supply sources. This belief was expressed in scoping meetings held in late 1990 for an environmental impact statement (EIS) on Western's Electric Power Marketing Program for the Salt Lake City Area Integrated Projects (SLCA/IP). Furthermore, some participants in the scoping meetings contended that the aggressive use of peak-load management, energy conservation, and other renewable energy activities would significantly reduce the environmental damage associated with dam operations.

The Electric Power Marketing Program EIS will include an analysis of the effects that Western's alternatives could have on its customers' C&RE plans. As part of the analysis, Argonne National Laboratory (ANL) has constructed a database of the C&RE activities that Western's SLCA customers have introduced.

Although the focus of the ANL effort is directed toward the analysis of impacts to current C&RE activities from the EIS alternatives, opportunities exist for the C&RE-SLC database to be used by Western, its customers, and other researchers. The database provides information on types of C&RE activities and allows for comparisons of activities being conducted at different utilities. Sorting the database allows Western's Salt Lake City customers to be classified so the various activities offered by different classes of utilities can be identified; for example, comparisons can be made between municipal utilities and cooperatives or between large and small customers.

The information included in the database was collected from customer planning documents in the files of Western's Salt Lake City office. Each of Western's customers is required to submit an update to its C&RE plan every two years. Customers also are required to determine goals for each of their C&RE activities and to evaluate their success in meeting these goals. The announcement in the *Federal Register* (50 FR 33897) states that Western cannot approve a customer program that offers a low energy savings and that customers must commit resources and develop a reasonable organizational strategy to demonstrate a good faith effort to reach the stated goals.

2 STRUCTURE AND USE OF THE DATABASE*

The C&RE-SLC database has been developed on an IBM-compatible personal computer through use of the FoxPro database program. This database can be used in the FoxPro program or in another compatible database program that can access DBF files. The computer file is quite large and requires approximately 2 megabytes of disk storage space. To allow for transfer to potential users, the file is compressed by using the PKZIP computer shareware program. The diskette on which the compressed version of the database is provided also contains a copy of the PKUNZIP shareware program. The database can be decompressed by copying both the PKUNZIP program and the compressed database (CRESLC.ZIP) to a subdirectory on an IBM-compatible PC. The database user would then type *PKUNZIP CRESLC.ZIP* and *Enter*. This operation results in a database file named CRESLC.DBF. The FoxPro (or other database program) manuals offer details concerning the operation of the database program software.

The C&RE-SLC database was organized to accurately represent the information included in the planning documents submitted by Western customers. For accurate representation, the database follows the same structure as the program files found at Western's Salt Lake City offices. The structure of the database is given in Table 1. The most important parts of the database are the identification of activity types, the specification of the goal that each utility has for its activities, and the description of the activities. Various other items in the database permit sorting of the activities so that relevant combinations of database records can be searched, combined, or examined for research and analysis.

Each record in the database represents an activity included in a planning-year submittal from one of Western's Salt Lake City customers. The records have been given a unique record number (*Rec_num*) for identification purposes. The record numbers were initially sequential, but the sequence has been altered as records have been dropped as a result of duplication or correction. To facilitate the sorting of the many customers in the database, each record includes the customer name (*Util_name*) and an identification number (*Util_id*) for the customer. The database contains records from 109 Western customers. Each customer may have from one to four separate planning-year submittals. As many as 15 separate activities can be described within each planning year.

The *Input_by* field is included in the database for purposes of quality control. Users of the database need not be concerned with this field.

The submittal year of the plan to which the activity is connected is given in the *Plan_year* field. The C&RE plans are proposed every three to four years, and a C&RE program verification is submitted every two years. Both the proposal and the verification consist of multiple activities and thus are represented in several records in the database.

*Throughout the text of this report, italics are used to indicate computer commands and field names.

TABLE 1 Structure of C&RE-SLC

Item Number	Field Title	Item	Length (bytes)
1	Rec_num	A unique data record identification number	4
2	Util_id	An identification number for each utility	3
3	Util_name	The name of the utility	20
4	Input_by	The name of the individual entering the record	8
5	Plan_year	The plan year corresponding to the record	4
6	Act_code	An identification number for the activity type	4
7	Requirmt	M for mandatory; V for voluntary	2
8	Activity	The type of activity	80
9	Goal	The utility's goal for the activity	200
10	Status	An activity may be ongoing, new, or complete	100
11	Desc_1	A description of the activity	200
12	Desc_2	A continuation of Desc_1	200
13	Desc_3	A continuation of Desc_1	200
14	Desc_4	A continuation of Desc_1	200
15	Desc_5	A continuation of Desc_1	200
16	Desc_6	A continuation of Desc_1	200
17	Util_type	The type of utility (Muni, Coop, etc.)	6
18	Wapa_assn	The system within which the utility belongs	10
19	GWh_sold	The GWh sales by Western to the utility	8
20	Init_plan	The year of the first plan submitted to Western	4
21	Mand_act	The number of mandatory activities	2
22	Vol_act	The number of voluntary activities	2

Because an activity tends to appear in several plans, the *Plan_year* field can be used to distinguish between an activity's initial proposal and that same activity's continuing evaluation and evolution.

Each activity is categorized by type. The codes for the activities were established in the G&AC for the C&RE program (50 FR 33892) in 1985. The codes denote the specific activities that Western's customers can select to fulfill their C&RE requirement. The codes, which are included in the database under the field name *Act_code*, are given in Table 2. Each code has an initial letter identifying its category. After the category letter, either a number or a number and a succeeding letter indicate a specific activity within the category. For example, category *F* contains all activities that improve production efficiency, and activity *F1* is an activity that increases production efficiency by improving generation equipment.

Some customers have included as many as 15 C&RE activities in a planning-year submittal. A customer can institute an unlimited number of C&RE activities, as long as a required minimal number of activities is reached. The number of activities required by each utility is determined by the amount of energy sold to that utility by Western. The schedule that determines the number of activities required is determined by the sales per year in gigawatt-hours; for 0-49 sales, 3 activities are required; for 50-99, 4 are required; and for 100 or more, 5 are required. Each activity in the database is marked either *M* for mandatory or

TABLE 2 G&AC Customer C&RE Activity List

Code Activity	Activity Name
<i>Category A — Energy Consumption Efficiency Improvements</i>	
A1	Building energy-conservation programs, which may include activities such as:
A1a	Boiler, furnace, air conditioner retrofitting, including dual fuel
A1b	Weatherization/insulation
A1c	Storm windows/doors
A1d	Insulation of air ducts, boilers, pipes, etc.
A1e	Heat-reflective/absorbing window or floor materials, waterheaters, etc.
A1f	Clock thermostats and equipment/system timers
A1g	Electrical or mechanical ignition systems
A1h	Heat pumps
A2	Energy audits
A3	Installation of energy-storage equipment, thermal energy storage
A4	Information dissemination programs
A5	Economic assessment studies for conservation activities
A6	Development of energy efficiency awards programs
A7	Building plan review/service programs
A8	Loan arrangements or assistance
A9	Conservation demonstration projects
A10	Installation arrangements/assistance
A11	Attendance at conservation and/or renewable energy training
A12	Technical assistance to end-users
A13	Listing services for suppliers/lenders
A14	Customer in-house program activities
A15	Use of infrared-heat-detection equipment
A16	Home energy-rating systems development
A17	Computer programs development for conservation/energy efficiencies or community energy-management strategies
A18	Energy-efficient lighting conversions
A19	Equipment inspection programs
A20	Improvement of operating procedures to maximize efficiencies
A21	Building code requirements
A22	Use of blower doors
<i>Category B — Renewable Energy Activities</i>	
B1	Solar thermal/photovoltaic projects
B2	Solar pond projects
B3	Daylighting technologies
B4	Active solar installations
B5	Ocean thermal gradients/tidal power
B6	Passive solar installations
B7	Small/large-scale wind turbine installations
B8	Biomass/refuse-derived fuels (RDF) projects
B9	Geothermal projects

TABLE 2 (Cont.)

Code Activity	Activity Name
<i>Category B (Cont.)</i>	
B10	Wind measurement/recording equipment
B11	Economic assessment studies for renewable resources
B12	Interconnection services to renewable-resource facilities
B13	Cooperative renewable-resource development projects
B14	Fuel cells projects
B15	Small-scale hydro projects
<i>Category C — Load Management Techniques</i>	
C1	Load-management devices/systems
C2	Rephasing operations to reduce energy consumption
C3	Demand-control techniques and equipment
C4	Consumer education
C5	Cable television metering systems
C6	"Smart" meters or automated equipment
C7	Data-management analyses or interpretation
C8	Time-of-use meters
C9	Energy-usage patterns analyses
<i>Category D — Cogeneration</i>	
D1	Cogeneration projects
D2	Scrap and waste reclamation
D3	Waste heat recovery
D4	District heating
D5	Greenhouse applications
D6	Utility/industrial interfaces as related to cogeneration technologies
<i>Category E — Rate Design Improvements</i>	
E1	Cost-of-service pricing
E2	Elimination of declining block rates
E3	Time-of-day rates
E4	Seasonal rates
E5	Interruptible rates
E6	Purchase of customer-generated renewable energy
E7	Sale and purchase of surplus power to displace petroleum fuels(resource coordination)
E8	Rate restructuring/adjustments

TABLE 2 (Cont.)

Code Activity	Activity Name
<i>Category F — Production Efficiency Improvements</i>	
F1	Improved generation equipment efficiency
F2	Lighting redesign and management (street, building, etc.)
F3	Upgrading of transmission lines and/or substation equipment
F4	Improved boiler and equipment maintenance
F5	Better sizing of boilers and/or equipment
F6	Electric motor replacements
F7	Area-wide resource assessments
F8	Agricultural improvements that conserve energy, such as:
F8a	Irrigation pump utilization/scheduling
F8b	Irrigation pump testing or efficiency improvements
F8c	Ditch lining and piping
F8d	Laser land-leveling
F8e	Pumpback systems
F8f	Alternate energy-saving water sources
F8g	Field irrigation-system improvements
F9	Any other generation or transmission efficiency improvements
F10	Power-factor corrections
<i>Category G — Other</i>	
G1	Other energy conservation activities, such as activities initiated under DOE's Residential Conservation Service (RCS) Program, Commercial and Apartment Conservation Service (CACS) Program, or other federal/state/local programs (i.e., REA, State PUC, etc.)
G2	Least-cost strategic planning

V for voluntary in the *Requirmt* field. All the activities submitted to fulfill the requirement are listed as mandatory; all others are designated voluntary.

The *Activity* field gives a brief and descriptive title to the activity. A more in-depth discussion of the activity has been included in the *Desc_* fields described below. The activity title is often similar to the name associated with the activity code, although the two need not be identical.

Each utility is required to submit a goal for each activity. Western requests that the goals be measurable; that is, it asks that quantities be specified and results be quantifiable. However, not all activities have such goals. The goals that appear in the database (*Goal*) are those specified by the customers in the program submittals. The goals are to be used in the two-year program verifications submitted to evaluate the progress and effort of the utility in accomplishing its C&RE goals.

The *Status* field in the database reflects the state of the activity at the time of the submittal. The status is usually ongoing because most activities involve an action that is to be continual, but some are one-time activities that may be completed.

An extensive description of the activity represented by each record is given in the *Desc_1* through *Desc_6* fields. These six fields are long enough to provide for an in-depth explanation of the activity. All details relevant to C&RE analysis have been included in these description fields. Because some activities, like energy audits, require very little discussion, little description will appear in the field. Other activities compel extended discussions. The six description fields permit 1,200 characters for the explanation of each activity. The descriptions presuppose a certain familiarity with the C&RE-SLC program and terminology.

Western's customers can be classified into several different types. The *Util_type* field indicates a classification for each customer. Many customers are either a cooperative or owned and operated by a municipality. Several military bases and irrigation districts are also included in the database. In the *Wapa_assn* field, the database includes the name of any association of utilities to which the customer belongs. Some utilities deal directly with Western and do not belong to an association.

To determine the number of activities required by Western, the *Gwh_sold* field displays the amount of annual energy usage by the utility. Because energy usage varies from year to year within each individual utility, this field may also be useful in studies of energy usage patterns and the actual effects of the C&RE programs on energy usage.

Each utility is required to submit an initial proposal for C&RE activities. The year of this submittal is carried by the *Init_plan* field. The initial plan is important in noting the progress in individual utility programs. Two years after the initial plan, a program verification submittal is usually sent to Western. In other words, the set of entries in the database following an initial proposal will usually be a plan with a submittal year (*Plan_year*) dated two years later.

The last two fields in the database (*Mand_act* and *Vol_act*) are used to record the actual number of activities submitted that year by the utility in any planning-year submittal. The number of mandatory activities (*Mand_act*) will match the number of activities required by the amount of energy used by the utility. The number of voluntary activities (*Vol_act*) reflects the number of extra activities that the utility has chosen to pursue.

The top three ranking customer activities within the energy consumption efficiency category were information dissemination, lighting conversions, and use of infrared heat detection equipment. For information dissemination, a search of the C&RE-SLC database showed that Western's customers endeavor to increase conservation awareness through a variety of communication mechanisms, such as quarterly publications, bill stuffers, radio/newspaper advertisements, and conservation seminars. For the majority of customers that indicated an information dissemination activity, the stated goal was identified as promoting conservation rather than as a specific quantitative amount of energy savings. Similarly, for energy-efficient lighting conversions and use of infrared-heat-detection equipment, the utility goals typically were more indicative of a penetration rate rather than an energy savings.

On the supply side, Western's customers have focused on transmission and distribution, with nearly 40% of all production efficiency programs proposing equipment upgrades to lines and transformers (*F3*). The stated goal for the production categories is generally specific in terms of anticipated energy savings. For example, one *F3* program indicated that replacing 103 miles of 69-kV line with 138-kV line and 11 miles of new line would bring system losses to less than 10%.

4 AREAS FOR FURTHER RESEARCH

The C&RE-SLC database can contribute to the analysis of Western's C&RE program in several ways. In addition to providing the foundation for ANL's research into C&RE activities for the Electric Power Marketing Program EIS, the database offers Western's customers an easy means to examine other C&RE programs that have been implemented by similar utilities.

Two topics that are not currently included in the C&RE-SLC database would greatly enhance its usefulness and expand its capacity to support C&RE research by Western, its customers, and outside parties. The first topic would be an evaluation of the historical program costs and energy savings associated with each C&RE activity. No formal evaluation of the C&RE program has been undertaken yet. Evaluations of each utility's C&RE activities could provide the basis of more meaningful identification of the essential costs and benefits of such activities. The second area of further data development would be forecasting. Western's planning and the planning of its customers could be significantly improved if forecasts of energy and peak demand reductions from C&RE activities were included in a comparable fashion for all of Western's customers.

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