

INFORMATION SYSTEMS IN THE UTILITY INDUSTRY BASED ON THE SAS<sup>(R)</sup> SYSTEM:  
A SOUTHERN CALIFORNIA PERSPECTIVE

Clark M. Roberts, San Diego Gas & Electric  
Roger B. Glaser, San Diego Gas & Electric  
James H. Sorenson, San Diego Gas & Electric  
Jacob C. Epperson, Southern California Edison

ABSTRACT

SAS Institute products have been in use for over seven years at the San Diego Gas & Electric and Southern California Edison companies. This paper surveys the information systems developed and applied using the SAS System at these two major Southern California utilities. The organizational evolution of SAS is traced, focusing primarily on the aspects of applications development and product support. Although experimentation with other fourth-generation languages has taken place in these companies, SAS Institute products continue to be the most widely used for end-user applications. The reasons for this phenomenon, and the behavioral implications of this outcome, are noted. The information systems discussed cover a broad spectrum of applications, including: accounting, materials management, engineering, operations, planning and performance measurement. Each of these systems classifies as an operational, tactical or strategic information system which has benefited the respective utility's operations in several ways. Continued growth in the use of the SAS System at these utilities is expected. The factors stimulating this anticipated growth are discussed.

BUSINESS ENVIRONMENT

The San Diego Gas & Electric Company (SDG&E) is an investor-owned public utility that provides electricity to over 940,000 customers in San Diego County and to portions of Orange and Imperial Counties in California. SDG&E also purchases and distributes natural gas to more than 590,000 customers in San Diego County. The company employs approximately 4,800 people and has an annual operating revenue of over \$1.7 billion. In the past few years, SDG&E has increased its use of purchased power to reduce the company's dependence on fuel oil and gas to produce energy. The company plans to continue this trend and become predominately an energy management company instead of strictly an energy producer.

The Southern California Edison Company (SCE) is also an investor-owned public utility, providing electricity to over 3.5 million customers in Central and Southern California. The company employs approximately 17,800 people and has an annual operating revenue of over \$5.3 billion. The company now obtains electric power from nine primary energy resources: water, oil, gas, nuclear, coal, geothermal, wind, solar and biomass - more resources than any other electric utility in the world.

The two companies jointly own the three-unit San Onofre nuclear generating station located in SDG&E's service territory. SCE owns 76% of the project and operates the station. SDG&E has a 20% interest while the cities of Anaheim and Riverside share the remaining 4% interest. These three generating units produce, at full power, 2,710 megawatts, which is enough power to serve the needs of 1.3 million households. An equivalent fossil fuel generating unit would consume 25 to 30 million barrels of oil per year, or nearly 75,000 barrels of oil per day.

With respect to sales of electricity, both companies are vertically integrated, producing and transporting as well as distributing their product. Historically, investor-owned public utilities have operated as monopolies whose operation has been regulated by various government agencies. This operating environment is what has made them typically different from other, non-regulated, businesses to manage. Due to recent and anticipated legislation, aimed at the deregulation of a portion of their business, investor-owned public utilities now find themselves competing for a share of business in markets they once had all to themselves.

INFORMATION REQUIREMENTS

Information in this industry is required not only to respond to questions of regulatory agencies, but now also for competitive decisions affecting the operations of the organizations. The concept of Management by Information (MBI), stresses the more effective use of information in the management process. As stated by Harlow (1), to be useful, all the necessary information must be available at the time decisions have to be made or questions have to be answered. It must be correct and conform to the situation. The method of expressing the information must also be flexible, so it can be presented in a manner appropriate for the situation.

These characteristics make up the elements of information, simply stated as FACTS:

F orm  
A ccuracy  
C ompleteness  
T imeliness  
S uitability

The absence of any one of these ingredients can render the information useless, resulting in unanswered questions and improper decisions.

Automating the information management process has become an essential requirement for

businesses to compete successfully in today's fast paced, constantly changing, environment. Automation can increase the availability of information and improve its flow through an organization, increasing worker productivity and improving the decision-making process.

The "Information Age" is placing ever increasing demands on information processing professionals to produce more and more automated systems. Management not only expects systems to be developed faster, but also requires them to be easy to use, flexible enough to adapt rapidly to change and to execute efficiently. Fortunately, there are more development alternatives available today to meet these challenges than in the past. Personal computers and 4th generation mainframe languages can be used directly by end-users when requirements are not complicated.

#### THE BENEFITS OF END-USER COMPUTING

Transforming the large volume of data maintained by the utilities into useful information by employing manual methods is quite laborious. Recognizing this, management has looked toward the data processing establishment for assistance. Several automated data acquisition systems have been implemented to replace manual record keeping systems. Inflexible, standardized reporting capabilities are provided with these systems and in some cases on-line access to the data is available. However, management has not been satisfied. Development has not proceeded as quickly as desired. New requirements have been surfacing faster than systems can be created to satisfy them. Also, the systems that have been implemented lack flexibility in data extraction.

As noted in general by Martin (2), the traditional techniques applied by data processing groups are not adequate enough to fulfill the information needs of utilities. As 4th generation end-user oriented software (like the SAS product line) became more widely available in the late 70's and with the introduction of microcomputers into the corporate environment in the early 80's, middle management began to realize they could fulfill a great deal of their information processing requirements internally using their own staff with assistance from the data processing organization. Initially, one or two engineers, accountants or analysts, etc., would provide part-time programming support for their respective organizations. As time went on and more personnel were trained to use computers, management began to realize the benefits and potential for end-user computing. The result has been the formalization of several end-user computing organizations that provide specialized computing support to their respective parent organizations.

Most notable among these organizations is the Automated Accounting Systems Section, which provides computing support to the Accounting Division at SDG&E; the Decision Support Systems Section, which provides modeling and computing support to all organizations at SDG&E; the

Administrative Support and Load Management Sections of the Marketing Department of SDG&E; and the Quality Assurance Information Systems (QAIS) Section, which provides information processing support to the quality assurance department at SCE (3).

The formalization of these organizations has increased their productivity and improved the quality of the services they provide by allowing them to concentrate primarily on developing computer applications within their areas of expertise. Better quality systems have been developed in less time and the maintainability of the system has improved because of programming and documentation standards. The success of these organizations can be attributed to strong leadership, management support and the use of the SAS Institute product line, their primary programming tools.

#### THE ROLE OF THE SAS SYSTEM

The SAS system has allowed end-users to quickly develop cost-effective applications that have been back-logged by data processing staffs because of higher priority systems development requests. In nearly all cases these systems pay for themselves in a short period of time because they provide information critical to efficient operation of the organization or improve the productivity of the organization's personnel.

This is primarily possible because the SAS system provides an integrated and inexpensive set of development tools that are relatively easy to use because of the extensive support, training, and documentation that are available. Another important factor is SAS Institute's philosophy and track record regarding product enhancement and expansion.

The majority of information systems that have been developed using the SAS Institute products can be classified as low transaction, intra-organizational systems that do not require concurrent update access. This phenomena will most likely change since SAS Institute has introduced several new products that provide capabilities to overcome these limitations.

Base SAS(R) was initially acquired at SDG&E in 1979 for interactive end-user statistical analysis. SCE first installed Base SAS in 1978 by the system programming organization to perform computer performance analysis. Since then the extensive growth in the use of SAS Institute products has been almost exclusively in the end-user area. The data processing organizations at both companies acquired and marketed other products for end-users: FOCUS(R) at SCE, and EASYTRIEVE(R) and RAMIS II(R) at SDG&E. The consequences of this dichotomy were confusion of end-users as to which product to use and, due to scarce resources, a reduction in the level of support offered for SAS products, especially at SDG&E.

Since BASE SAS was installed on the mainframe, both utilities have acquired: SAS/GRAPH(R),

SAS/ETS(R), SAS/FSP(R), SAS/OR(R), SAS/AF(R), and SAS/IML (TM). Base SAS and SAS/STAT (TM) for the PC were recently introduced at both companies and SAS/RTERM(R) is being evaluated for use at SDG&E. There are about 25 employees at each company currently using the SAS PC products. Beside the other mainframe end-user products mentioned earlier, both companies provide APL and TELLAGRAPH(R), while INTELLECT(R) is available only at SCE. The utilities data processing organizations of both utilities now provide primary end-user support for the installed SAS products in the form of problem consulting and in-house training. At SDG&E this service is provided to the more than 400 SAS users (150-200 actual programmers) by the equivalent of one full-time position, divided between 4 staff members. Some 1,600 SAS users (approximately 750 actual programmers) receive about 5 man years of support per year from 16 staff members at SCE.

SAS products account for the vast majority of end-user computer usage in the 6 IBM 30XX mainframes at SCE and 2 IBM 3081 computers available at SDG&E. Some of this usage is for analytic purposes, but an increasing amount can be attributed to the development and execution of various information systems applications.

#### REPRESENTATIVE APPLICATIONS

The applications of SAS products at San Diego Gas & Electric and Southern California Edison cover a wide range of functional areas. A total of 86 applications are documented in this paper as examples of this SAS spectrum of productive information systems. The examples offered here represent only a fraction of the applications of SAS products at San Diego Gas & Electric and Southern California Edison. Hopefully, however, a review of these system descriptions may satisfy certain needs at other utilities, or may evoke new ideas as to how one can use SAS products to achieve certain objectives in a cost-effective manner. The example applications are summarized in Appendix A (Application Abstracts), under the categories of:

- Accounting
- Budget Preparation and Analysis
- Computer Services
- Customer Information Services
- Economic Analysis
- Engineering and Construction
- Marketing and Conservation
- Materials Management
- Nuclear Operations
- Personnel
- Power Plant Operations
- Productivity Improvement and Measurement
- Project and Program Management
- Rate Analysis and Design
- Regulatory Reporting and
- Rate Case Preparation

Additional applications of SAS products within the utility industry have been the subject of papers presented at SAS User Group International Conferences and are published in the SUGI

proceedings. A compilation of these applications is provided in Appendix B (Related SUGI Articles).

#### FUTURE DIRECTION

In general, our outlook regarding the development of SAS based information systems is that of increased growth and expansion. We anticipate a growth in the development of SAS based information systems as more personnel discover the benefits of the SAS system through training and experience. We also expect to see an increase in the level of complexity and sophistication of developed systems as current users become more experienced and as professional data processing personnel discover the potential of the SAS product line, especially the SAS Macro language and SAS/AF.

The introduction of SAS/SHARE (TM), SAS/DMI(R), SAS/DB2 (TM), SAS/SQL-DS (TM), SAS/C (TM), SAS/CXTM, SAS for the PC and the SYSTEM2000(R) product line will also be contributing factors. These same factors could also lead to the integration of SAS into the traditional COBOL/CICS applications development process where applicable.

#### SUMMARY AND CONCLUSIONS

The utility industry is experiencing dramatic change due to technological developments, an unstable regulatory environment and competition. The information processing requirements of this industry have become intensive. One mitigating force regarding this phenomenon is end-user computing, which provides a viable alternative to the traditional techniques of information system development. The SAS system at San Diego Gas & Electric and Southern California Edison companies has allowed end-users to accomplish an enormous amount of work in a cost-effective manner, as demonstrated by the sampling of applications documented in this paper.

#### REFERENCES

1. Harlow, C., "MBI - Management by Information," presented at the IBM Japan United States European Conference, Tokyo, Japan, October 1982.
2. Martin, James, Applications Development Without Programming, Prentice-Hall, Englewood Cliffs, NJ, 1982.
3. Epperson, Jacob, "SAS Based Information Systems for the Start-up and Operation of Nuclear Power Plants," Proceedings of the 10th Annual SAS Users Group International Conference, 1985, pp. 397-406.
4. Trimble, J.H., "Can SAS Replace Traditional Programming Languages in Large System Development - A Manager's Perspective," Proceedings of the Seventh Annual SAS Users Group International Conference, 1982, pp. 335-337.

## ACKNOWLEDGMENTS

The authors would like to thank Brad Simmons from SDG&E and Wayne Hansen from SCE for their contributions to this paper, as well as the many employees from both companies that contributed system abstracts.

## APPENDIX A: APPLICATION ABSTRACTS

This appendix has been abbreviated to contain only one application description per category, due to paper length restrictions for the SUGI Proceedings. To obtain a complete version of Appendix A, please contact one of the authors listed at the end of the paper.

### ACCOUNTING

#### Lease Reporting System

Contact: Richard Hern  
Automated Accounting Systems, SDG&E

A SAS/AF based system is used by the Accounts Payable Department to assist in properly accounting for lease payments. This is yet another example of a SAS based system which replaced a Cobol system that had severe limitations and no longer met the needs of the Company. The Cobol system could not, for example, handle such things as 5-digit lease numbers, non-vehicle leases, more than one distribution line per lease, lease modifications or a change in the lease company. The lease system created with SAS is easier to use, more efficient and much more powerful. The user has the ability to create his own reports by modifying system parameters. Data is checked automatically by the system to eliminate incorrect or illogical data items. The user has total control over global assumptions which will virtually eliminate the need for routine system maintenance. Features of the system include calculations of lease amortization and amounts due lessor, creation of monthly accounting distribution and voucher requests, user control of various system formats, and various real-time and batch edits to insure data integrity. The Cobol programming staff is currently working on a new system to replace the outdated one and will take years to complete. The SAS system described above was completed in a little over a month.

#### Customer, Revenue & Consumption Reporting System

Contact: Penni McDermott, Administrative Acct.  
Cost General & Revenue Controls, SDG&E

#### Telephone Bill Payment System

Contact: James H. Sorenson, Supervisor, and  
Richard Hern, Admin. Accountant  
Automated Accounting Systems, SDG&E

#### Water Bill Payment System

Contact: Richard Hern, Admin. Accountant  
Automated Accounting Systems, SDG&E

#### Construction Order File Maintenance System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

#### Construction Order Cost Transfer System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

#### Year-end Accounts Payable Accrual System

Contact: James H. Sorenson, Supervisor, and  
Richard Hern, Admin. Accountant  
Automated Accounting Systems, SDG&E

#### Utility Income Tax Model & Calculation System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

#### Fuel Cost Reporting System

Contact: James Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

#### Purchased Power Accounting System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

#### Publications Information and Billing System

Contact: Raymond J. Carrillo, Programmer  
Business Systems II, SDG&E

### BUDGET PREPARATION AND ANALYSIS

#### Budgeting, Accounting and Reporting System

Contact: Paul Multari, Project Administrator  
Treasurer's Department, SCE

The Steam Generation Division Budgeting, Accounting and Reporting System (BARS) is an on-line database management system used for budget preparation and cost performance reporting. The system is programmed in the SAS Macro Language and uses the SAS full-screen product to manipulate the records in five budget and forecast files. The system is used by more than 50 users in fifteen geographically remote locations. BARS has several noteworthy features: a flexible security system that defines the limits of a user's access and sets up location-specific validations, real time validation of accounting, user defined sort /search, an interface with a PL/1 report generator used to produce several budget scenarios and monthly reports, interfaces with the corporate accounting system in COBOL through ISPP panels, and automated monthly cost reporting. The benefits of the system include: easier and more accurate revisions to the database, improved timeliness of products because reports are available immediately, quickly detected errors, and formats that are clearly understandable. The latter benefit also has resulted in higher quality products and more efficient use of personnel. BARS was implemented in 1986

and saved an estimated 200-250 personnel days on budget and report preparation that year. In addition, much of the budget preparation work was able to be delegated downward, allowing improved budget planning at the supervisory level.

#### Budget Estimating System

Contact: R. Shimabukuro, Engineer  
Marketing, SDG&E

#### Cost Center Budgeting System

Contact: James Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

### COMPUTER SERVICES

#### Computer Performance Evaluation

Contact: James Sibley, Systems Programmer  
Technical Systems, SDG&E

MICS(R) (MVS Integrated Control System) is used to manage the MVS computer system in the Corporate Data Center. It provides information daily, weekly and monthly about the service provided to our major clients - CICS (including Customer Information [CI]), IDMS (the corporate database), TSO (Time Sharing Options), and batch jobs, including daily corporate production. Information is collected continuously in a standard IBM format; daily MICS transforms the data into a SAS database, which it uses for its reporting. The SAS database is also used for ad hoc reports on resource usage, for trouble analysis, and for trending of computer resource consumption. Reports are used by Computer Performance Monitoring, by Operations, and for management reporting. It has frequently shown excessive client resource consumption which affects all users in the data center. With this information in hand, the users have been able to change their programs to reduce costs.

#### Directory of Datasets

Contact: Rob Rubin, Economic Analyst  
Load Research, SDG&E

#### The Equipment and Software System (TESS)

Contact: Jerry Coker, Supervisor  
Data Processing, SDG&E

#### Data Flow Analysis Tool

Contact: Yvonne Burgess, Supervisor  
Systems Development III, SDG&E

#### SAS Usage Tracking System

Contact: Clark Roberts, Sr. Plan. Sys. Analyst  
Decision Support Systems, SDG&E

### CUSTOMER INFORMATION SERVICES

#### Queueing Simulation Application for Customer Service Systems

Contact: R.S. Jarvinen, Economic Analyst  
Marketing-Program Development, SDG&E

A user-friendly, interactive queueing simulation model was developed to provide hourly information about customer waiting times, length of customer queues, and server utilization for each of 21 customer service offices in SDG&E's service territory. The interactive capability provides 7 users with immediate responses to staffing questions for slow to busy days, and with various staffing criteria (including server arrival and departure times, plus a lunch option). It uses SAS basic and macros software to generate on-line statistics as well as hard copy output, and plots of waiting time distributions and server utilization using the graphics software. When implemented, it will assist in the identification of minimum staff requirements to meet corporate customer service goals.

#### Daily Call Volume Forecasting Model for Customer Information Central

Contact: D.A. Korb, Planning Systems Analyst  
Decision Support Systems, SDG&E

#### Customer Re-billing System

Contact: R. Shimabukuro, Engineer  
Marketing, SDG&E

### ECONOMIC ANALYSIS

#### Weather Data Smoothing

Contact: Pat Kirkland, Economic Analyst  
Load Research, SDG&E

A SAS macro written in PROC MATRIX was developed to smooth SDG&E substation weather data. The smoothing method is called Lowess (locally weighted regressing scatter plot smoothing) and employs an iterated weighted least squares procedure which gives outlier data points a minimum of weight. The macro also produces an output dataset containing both the original and smoothed data. The smoothed data is adjusted to match national weather station highs and lows. Overlaying of the original, smoothed, and adjusted plots allows a visual validation of the substation data. Load Research, Forecasting, and Marketing will be using the information to study the weather impact on electricity and gas consumption.

### ENGINEERING AND CONSTRUCTION

#### The Codes and Standards Equipment Information System

Contact: Ken Collins, Authorized Nuclear  
Inspection Specialist, Western Region  
Special Inspection Services Section,  
The Kemper Group (ANII, SONGS)

The Codes and Standards Equipment Information System (CASEI) is a SAS based management information system designed to track and monitor various types of equipment that require periodic jurisdictional insurance, or American Society of Mechanical Engineers (ASME) code related inspections. The system can provide management with detailed up-to-date information concerning: equipment that is due for inspection, the specific location of the equipment, design specifications and relevant ASME code standards; the number, type and frequency of inspections for each piece of equipment; historical inspection information; and the status of recommendations resulting from prior inspections. The system has increased operational productivity by: reducing equipment down time by scheduling inspections to coincide with maintenance outages; eliminating equipment out-of-service conditions due to the expiration of required operating permits; and improving the efficiency of inspectors by leveraging their workload. CASEI is a turn-key, on-line system consisting of data entry screens, several pre-programmed reports and 2 primary dictionaries, a manufacturer abbreviation dictionary and a standard requirements dictionary. Customized reports, both graphic and tabular, can easily be added to the system. The system was developed using the base SAS system, SAS/FSP, SAS/GRAPH and SAS/AF.

Pressure-flow Program

Contact: J. MacDonald, Engineer  
Gas System Planning, SDG&E

Equipment Test Reporting System

Contact: Rob Rubin, Economic Analyst  
Load Research, SDG&E

Underground Electric Design by Location Program

Contact: Ralph J. Scarpati, Asst. Programmer  
Engineering Systems, SDG&E

Construction Work Order Interface (CWO)

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Designer Productivity Reporting System

Contact: Dick Speth, Supervisor  
Distribution Engineering, SDG&E

MARKETING AND CONSERVATION

Building Energy End Use Information System

Contact: David V. Greene, Sr. Commercial Analyst  
Commercial Energy Programs, SDG&E

An on-line system to enter, edit and retrieve customer energy end-use information. The system uses SAS/AF and SAS/FSP allowing easy access to the eleven files that make up the database. Until SAS/AF was available, it was necessary to use a PC for data entry and upload to the mainframe. By using SAS/AF we are able to move

data entry to the mainframe using a menu system. SAS/AF has resulted in about 20% reduction in the labor required to enter the data. There are about 5 people who use the data and 2 people who do the data entry.

Demographic Survey Data

Contact: Rob Rubin, Economic Analyst  
Load Research, SDG&E

Large Customer Rate Comparison

Contact: Tom Sullivan, Economic Analyst  
Load Research, SDG&E

Commercial Time of Use Analysis System

Contact: Tom Sullivan, Economic Analyst  
Load Research, SDG&E

Customer Retention Assistance

Contact: Tom Sullivan, Economic Analyst  
Load Research, SDG&E

Spa and Natural Gas Vehicle Survey System

Contact: Les Owashi, Supervisor  
Research & Analysis, SDG&E

Demand Estimating System

Contact: Glen Breed, Marketing Info. Analyst  
Marketing Research & Analysis-SDG&E

Customer Energy Management Support System (CEMSS)

Contact: Tom Oliver, Marketing Info. Analyst  
Marketing Technical Support, SDG&E

Cogeneration Market Assessment Software System (CMASS)

Contact: Eric Pulliam, Program Dev. Manager  
Marketing Program Development, SDG&E

MATERIALS MANAGEMENT

Contact: Yvonne Davis, Sr. Analyst/Programmer  
Steam Generation Division, SCE

The Steam Generation Division Maintenance Consumables Tracking Inventory System is an on-line database management system used for tracking high usage consumable items during an overhaul and providing cost reporting. This system is programmed exclusively using the SAS Macro Language and SAS full-screen product to manipulate the records in five files (including a history file). The system is currently used by numerous people who are responsible for maintaining two trailers of consumable goods and equipment. Each trailer accompanies the division maintenance crew to an overhaul to service their needs in a time and efficient manner. The Consumables System includes a flexible security system that defines the limits of a user's access; real time reporting of

inventory balances and overhaul costs; real time updating of material issues, returns and receipts; transfer of overhaul data to history files and initialization of files for the next overhaul. The benefits include: a virtually maintenance free system because all supervisors set up users security and one transaction copies data to history files and initializes the files for the next overhaul, immediate reporting of overhaul costs and inventory balances, more efficient use of personnel, reduced costs from more accurate stock balances and automated reorder information. The exact savings and number of personnel days actually saved have not been determined since the implementation of the system in the Fall of 1985. However, we can say with confidence that both productivity and overall job performance has increased as a result of the consumables trailer and its accompanying automated system.

#### Material Management System-Inventory Accounting

Contact: Wayne Young, Accounting Sys. Analyst  
Automated Accounting Systema, SDG&E

#### Materials Tracking System

Contact: K. Thomas Carr, Senior Designer  
Transmission Engineering, SDG&E

#### Quality Assurance Supplier Information System (QASIS)

Contact: Patsy Wilson, Lead Engineer  
Quality Assurance, SONGS, SCE

#### Consumables Inventory Tracking System

Contact: Yvonne Davis, Sr. Analyst/Programmer  
Steam Generation Division, SCE

#### Warehouse Management Systems (WMS)

Contact: C.W. Hahn, Manager  
Corporate Warehouse, SCE

#### Automated Picking System (ARS)

Contact: C.W. Hahn, Manager  
Corporate Warehouse, SCE

#### Will Call System (WCS)

Contact: C.W. Hahn, Manager  
Corporate Warehouse, SCE

#### Materials Analysis System

Contact: Jacob Epperson, Supervising Analyst  
Inventory Management, SCE

### NUCLEAR OPERATIONS

#### Audit Log and Report System

Contact: David Mutziger, Lead Quality Assurance  
Engineer  
Quality Assurance, SONGS, SCE

The Audit Log System maintains a log of audits in process and completed audits by Quality Assurance (QA) engineers. The audit report system provides for the scheduling, recording and trending of nuclear audits. The schedule outlines the goal and objectives of the proposed audit. The records provide for the retrieval of information on the audits through the system's very flexible search capability. The trends allow management to review present and past objectives and also to identify areas that require immediate corrective action. The audits were initially computerized in 1983. At this time history records dating back to 1979 were also entered. The initial display has been revised many times and enhanced to provide output reports useful to management. This system has been reviewed and audited by the Nuclear Regulatory Commission (NRC) in 1984, California Public Utility Commission (CPUC) in 1983, and American Nuclear Insurer's (AMI) in 1984. In all cases each party stated that the audit system was the state-of-the-art in design and use. Also, no deficiencies have been recorded in the use of the computer audit system. SCE has eliminated the need of hardcopy audit logs which is a cost savings. The present programs (approximately 12) are coordinated so that if one record is updated, the same information is automatically overlaid on to the other affected files. This also reduces data entry errors, provides for better validation and verification, and reduces man hours spent in record keeping.

#### Corrective Action Request Tracking System (CAR)

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

#### Field Surveillance Log

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

#### Document Review Log

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

#### Section XI Traveler System

Contact: Ken Collins, Authorized Nuclear  
Inspection Specialist, Western Region  
Special Inspection Services Section,  
the Kemper Group (ANII, SONGS)

#### Nuclear Regulatory Commission (NCR) Action Item System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

#### Start-up Problem Report Abstract System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

San Onofre Maintenance Management System (SOMMS) Interface

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Codes Description System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Plant Tag Number Statistic

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Nuclear Energy Organization Commitment Register (NEOCR)

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Master Tracking System Interface

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Quality Assurance Items Tracked by the Master Tracking System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Nuclear Fuel Accounting System

Contact: Rick Kern, Sr.Acct. Systems Analyst  
Corporate Accounting, SDG&E

Nuclear Fuel Forecasting Model

Contact: Rick Kern, Sr.Acct. Systems Analyst  
Corporate Accounting, SDG&E

Non-Conformance Report (NCR) Authorization List

Contact: Gary Johnson, Lead Engineer  
Quality Assurance, SONGS, SCE

Non-Conformance Report Tracking and Trending System

Contact: Gary Johnson, Lead Engineer  
Quality Assurance, SONGS, SCE

PERSONNEL

Automated Check Writing Systems

Contact: Yvonne Davis, Sr. Analyst/Programmer  
Steam Generation Division, SCE

The Steam Generation Division currently has two automated check writing systems that create Flat Allowance and Employee Expense checks. Both are on-line database management systems, written using the SAS Macro Language and the SAS full-screen product to manipulate the records in each of the files. The check writing systems are currently used exclusively by the Division Maintenance Section of Steam Generation, and are

used to create approximately 500 - 1,000 checks per month. The check writing systems include: a flexible security system that defines the limits of a user's access, real time reporting of employee expense costs, printing of flat allowance and employee expense checks, and accompanying stubs and reports. The benefits of these systems include: automated printing of checks which reduces hand-written errors and calculations, immediate reporting of employee expenses, checks printed are handed to employees in an expedient manner, and more efficient use of personnel on non-payroll functions. Cost Analyses performed on the Flat Allowance Program have shown that the Division Maintenance Payroll Section has saved approximately \$50,000 per year. This figure includes money saved as a result of preparing the checks in-house and the transfer of two payroll clerks to the warehouse.

Service Award Program

Contact: Alma Miller, Human Resource Assistant  
Employee Programs & Benefits, SDG&E

Excess Life Insurance Reporting System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

Training Notification System

Contact: Michael Salogga, Sr.Info. Analyst  
Information Center, SDG&E

Employee Technical Information System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

Quality Assurance (QA) Training System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

POWER PLANT OPERATIONS

Heat Treatment Predictive Model

Contact: Fred Jacobsen, Environmental Analyst  
Environmental Affairs, SDG&E

This batch program uses input data to predict the estimated cooling water discharge temperatures, the plant cooling water gate settings, and the estimated time required to reach the target temperature for cooling water intake heat treatments at SDG&E's Encina Power Plant. This program allows the plant to test whether a specific set of operating conditions (unit megawatt loadings) can be used for heat treatment and still allow the plant to comply with its cooling water discharge limitations. Being able to simulate heat treatments prevents costly aborted treatments due to high discharge temperatures. It also helps facilitate the scheduling of the heat treatments. This program utilizes simple data statements to calculate the above parameters.



## PRODUCTIVITY IMPROVEMENT AND MEASUREMENT

### Employee Suggestion Tracking & Reporting System

Contact: Howard Schimmerling, Administrator  
10% Solution Plan, SDG&E

An on-line system developed with SAS/AF and the SAS Macro Language tracks the status of employee cost saving suggestions. The system drastically reduces clerical requirements by obtaining current employee information, through an interface to the Company's VSAM based Employee Information System, which is used in the automatic generation of various memorandums and their corresponding mailing labels on a Xerox 2700 printer. Time consuming searches for current status information are also eliminated by having the information on-line. Since the system is used for day-to-day operations, the data are extremely accurate and subsequent summary information provided for management in the form of reports and graphics are very reliable. When SAS/SHARE becomes available, the system will be expanded to accommodate multiple users, making it even more beneficial.

### Time Study Summary

Contact: Doug Kozik, Sr. Management Analyst  
Management Services, SDG&E

### Designer Quality Control System (DQC)

Contact: Jaser A. Marabeh, P.E., CAD/CAE Admin.  
Engineering Sys.Development, SDG&E

### Gas Operations Performance Analysis System

Contact: Clark Roberts, Sr. Plan. Sys. Analyst  
Decision Support Systems, SDG&E

### Construction Callout Reporting System

Contact: Clark Roberts, Sr. Plan. Sys. Analyst  
Decision Support Systems, SDG&E

## PROJECT AND PROGRAM MANAGEMENT

### Program Status Tracking System

Contact: Ron Amundson, Supervisor  
Marketing Management, SDG&E

This on-line system is used to track the current status of marketing programs during implementation. The system is driven by a menu created using SAS/AF software. This menu gives users the option to: browse program data using the SAS full-screen product; add/update/delete program data using the SAS full-screen product; produce reports using the SAS base product; or produce graphs using the SAS graph product. In addition, the reports and graphs can be produced in a batch mode. The system is beneficial to management because it keeps all data pertaining to all programs in one place. Therefore, program managers do not have to spend time every month gathering data to produce a report for management.

### Financial Control Graphics System

Contact: Julie Stoll, Programmer Analyst  
Gas Marketing Financial Control, SDG&E

### Time Management System

Contact: James Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

### Quality Assurance Message System

Contact: Don Schone, Site Manager  
Quality Assurance, SONGS, SCE

## RATE ANALYSIS AND DESIGN

### Rate Spread Production System

Contact: Downey Beckett, Statistical Assistant  
Rate Design & Research, SDG&E

This is a batch-oriented system written in Basic SAS which accesses a database containing historical consumption information for all San Diego Gas & Electric customers (1.4 million records). Output (the rate spread) consists of a detailed frequency distribution report, which identifies sales by consumption level and cumulative statistics. These rate spreads are run for various customer groups and are widely utilized in gas and electric rate design. Prior to implementation of this system, the Rate Department relied on our Information Systems Department and production runs to obtain the rate spreads. We now have much more flexibility in producing customized rate spreads, as well as greatly reduced turnaround time when this information is requested from outside agencies, e.g., California Public Utilities Commission.

### Rate Making Tax Model & Calculation System

Contact: James H. Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

### Load Research Interactive Graphics & History Tabulation System (LIGHTS)

Contact: Pat Kirkland/Rob Rubin, Econ.Analysts  
Load Research, SDG&E

## REGULATORY REPORTING AND RATE CASE PREPARATION

### Automated Rate Case System

Contact: John C. Thompson, Supervisor  
Regulatory Information Systems, SCE

A system that integrates the input from eleven different operating departments into a single source of regulatory data. This regulatory data is summarized and is used in the SCE rate making process. SAS is used as the primary processing tool and IBM's DB2 was used as the database management system. The system contains over 20 major sub-systems with about 75 different screens and over 100 DB2 tables. All of the systems use SAS/FSP and many use SAS/AF. Data is stored in DB2, pulled into the SAS

environment for processing, editing, reporting, etc., and the results are then stored back into DB2. DB2 was selected because of the concurrent accesses required and because of the relational nature of the data. The first phase of this system (recorded data) became operational May of 1984 and the second phase (forecasted data) became operational in January of 1986.

Automated Rate Case Management Information System

Contact: James Sorenson, Supervisor  
Automated Accounting Systems, SDG&E

Customer Generation Database and Tracking System

Contact: Lonnie Mansi, Technical Analyst  
Marketing, SDG&E

Contributions, Dues & Donations Reporting System

Contact: Richard Hern, Admin. Accountant  
Automated Accounting Systems, SDG&E

APPENDIX B: RELATED SUGI ARTICLES

Related articles from earlier proceedings of the Annual SAS User Group International (SUGI) Conferences are listed below. These articles further illustrate the breadth of application of SAS Institute products in the utility industry.

SUGI 6 (Orlando FL, Feb. 8-11, 1981)

1. "SAS As A System Programmer's Tool," James D. Olehsiw, Northeast Utilities Service Company, pp. 505-511.
2. "Implementing A Computer Change MIS," Richard J. Nicole, General Telephone and Electric, pp. 512-516.

SUGI 7 (San Francisco, CA, Feb. 14-17, 1982).

1. "Performance Analysis - Honeywell Level 6 Statistics," John L. Hall, Jr., GTE Data Services, Inc., pp. 11-16.
2. "A Computer Graphics Information System for Upper Management," C. Royce Clayton and Don R. Chapman, Virginia Electric and Power Company, pp. 182-187.
3. "Geographic Display of A Multi-location Telecommunications Network," Gary C. Edgar, AT&T Long Lines, pp. 234-240.
4. "Junior Achievement Campaign Management System," Sally W. Drew and Alan D. Baker, Duke Power Company, pp. 317-320.
5. "BCAS - A User Friendly Information System Incorporating SAS and RAMIS," Arthur Boclan, AT&T Long Lines, pp. 358-362.

SUGI 8 (New Orleans, LA, January 16-19, 1983)

1. "Deterministic Inventory Modeling Using SAS," Kent W. Bannan, Virginia Electric and Power Company, pp. 40-44.
2. "A SAS Based Materials Tracking System," Roger B. Glaser, K. Thomas Carr and Clark M. Roberts, San Diego Gas & Electric Company, pp. 323-331.
3. "Task Item Tracking and Nagging (TITAN) System," Paul C. Willman, Virginia Electric and Power Company, pp. 482-486.
4. "Spot Plus - Coal Market Data Management," Robert M. Neil, Virginia Electric and Power Company, pp. 528-530.

SUGI 9 (Hollywood Beach, FL, March 18-21, 1984)

1. "Applying Pattern Recognition to Validating Time Series Data for Electric Utility Load Research," Andrew E. Allen, Tom L. Johnston and Edward L. Tabakin, Minimax Research Corporation, pp. 38-43.
2. "Residential Energy Forecasting: A Parametric Application of Box-Jenkins," Michael F. Jacobs, Florida Power Corporation, pp. 44-49.
3. "Forecasting Customer Air Conditioner Loads and Load Drops for Electric Utility Load Management Program Planning," Bruce A. Smith, Marjorie R. McRae, Louise Weiler, Minimax Research Corporation, and Richard M. Scheer, Pacific Gas & Electric Company, pp. 86-94.
4. "Mechanization of the Income Tax Accrual Using SAS," James H. Sorenson, San Diego Gas & Electric Company, pp. 331-336.

SUGI 10 (Reno, Nevada, March 10-13, 1985)

1. "A Rotation Scheduling Model Using PROC LP," Duane R. Walker, AT&T Technologies, Inc., pp. 33-38.
2. "A Time Series Approach to Modeling Daily Peak Electricity Demands," Michael F. Jacobs, Florida Power Corporation, pp. 44-49.
3. "Forecasting Residential, Commercial and Industrial Gas Demand," Jeffrey P. Brand and James D. Funk, Wisconsin Gas Company, pp. 92-97.
4. "Taking Advantage of the Mapping and Three-Dimensional Display Capabilities of SAS/GRAPH software," Bradford S. Simmons, San Diego Gas & Electric Company, pp. 207-210.
5. "A Tests Result Trend Analysis System Using SAS/GRAPH Software," Susan S. Duckworth, Middle South Services, Inc., pp. 238-243.

6. "SAS Macro Techniques for the Development of Integrated On-Line Systems," Clark M. Roberts, James H. Sorenson, John S. Willard and Roger B. Glaser, San Diego Gas & Electric Company, pp., 297-306.
7. "TESS, The Equipment and Software System," Mark Freeman and Richard David, BENDATA Management Systems, Inc., pp. 311-316.
8. "SAS Based Information Systems for Start-up and Operation of Nuclear Power Plants," Jacob Epperson, Southern California Edison Company, pp. 397-406.
9. "A Customer Sampling and Reporting System Using SAS Software," Sue M. Worline and Barbara J. Matthews, Puget Sound Power & Light Company, pp. 443-448.
10. "Computerized Material Loading Schedule: An Aid in Implementing High Density Storage Systems," Darryl W. Kolojaco, Houston Power & Light Company, pp. 877-882.

SUGI 11 (Atlanta, GA, February 9-12, 1986)

1. "Management of Time - Series SAS Databases," William R. MacHose, Pennsylvania Power & Light Company, pp. 109-113.
2. "Use of Base SAS and SAS/FSP Software in the Development of a Tracking and Scheduling System for In-house Training," John M. Plumbutt, Virginia Power, pp. 114-119.
3. "A Simple Documentation Indexing System," James M. DeYoung, Gwendolyn B. Crawford and Reina B. Cobb, Duke Power Company, pp. 310-311.
4. "A SAS/FSP Software and CLIST System for Easy Management of A Macroinvertebrate Reference Collection," Todd C. Folsom, Duke Power Company, pp. 341-345.
5. "Application and Evaluation of SAS Software and SAS/FSP Software in A Personnel Environment," Michael J. Hons, Valero Energy Corporation, pp. 346-349.
6. "Executive Information Systems Using SAS/AF Software," Linda Sampey, GTE Data Services, pp. 413-416.
7. "DBase III to SAS PC DOS - A File Management System," Robert Landon, Southern California Edison Company, pp. 623-624.
8. "A SAS Based System for Utility Rate Analysis," Eugene Y. Ho, Southern California Edison Company, pp. 699-702.
9. "Analyzing Survey Data in the Electric Utility Industry Using Several SAS Procedures," Mary Lynn Spada, Boston Edison Company, pp. 802-805.

SUGI 12 (Dallas, TX, February 8-11, 1987)  
tentative presentations to be published.

1. "A Visual Information System for Capacity Planning and Operations Management," William T. Gray, Bell Canada.
2. "Applications of Intervention Analysis to Power Plant Monitoring Data," Linda E. Bireley, Northeast Utilities Service Company.
3. "A SAS/ETS Software Forecasting and Inventory Planning System," Patrick Cardomona and David Brauer, Jersey Central Power & Light Company.
4. "An Integrated Audit System Based on the SAS System," Kirk Paul Lafler, Software Intelligence Corporation, and David R. Matzger, Southern California Edison Company.
5. "A System for Monitoring Utility Bill Reduction Programs Based on the SAS System," Wendy P. Gaviola and Eugene Y. Ho, Southern California Edison Company.
6. "Management Graphics in a Quality Assurance Environment," Shirley J. McLelland, Southern California Edison Company.

FOR FURTHER INFORMATION

The authors welcome inquiries concerning the subject matter of this paper. Interested parties are invited to contact us at the following addresses:

Clark Roberts  
San Diego Gas & Electric  
P.O. Box 1831  
Room 1601A  
San Diego, CA 92112  
(619) 696-4389

Roger Glaser  
San Diego Gas & Electric  
P.O. Box 1831  
San Diego, CA 92112  
(619) 696-4383

Jim Sorenson  
San Diego Gas & Electric  
P.O. Box 1831  
San Diego, CA 92112  
(619) 696-2239

Jacob Epperson  
Southern California Edison  
Corporate Warehouse  
P.O. Box 900  
Tulare, CA 93274  
(209) 685-3290

---

SAS(R), SAS/FSP(R), SAS/GRAPH(R), SAS/AF(R), SAS/ETS(R), SAS/OR(R), SAS/DMI(R), SAS/RTERM(R), and SAS/IMS-DL/1(R) are registered trademarks of SAS Institute, Inc., Cary, NC, USA

SAS/IML (TM), SAS/STAT (TM), SAS/SHARE (TM), SAS/DB2 (TM), SAS/SQL-DS (TM), SAS/C (TM) and SAS/CX (TM) are trademarks of SAS Institute, Inc., Cary, NC, USA

MICS(R) is a registered trademark of Marino and Associates, Inc., Vienna, VA, USA

TESS (TM) is a trademark of Software Techniques, Inc., Dallas, TX, USA

FOCUS (TM) is a trademark of Information Builders, Inc., New York, NY, USA

INTELLECT (TM) is a trademark of Artificial Intelligence Corporation, Waltham, MA, USA

RAMIS II(R) is a registered trademark of the Mathematic Products Group, Princeton, NJ, USA

EASYTRIEVE(R) is a registered trademark of Pansophic Systems, Inc., Oak Brook, IL, USA

CMASS (TM) is a trademark of Regional Economics Research, Inc., San Diego, CA, USA

CASEI (TM) is a trademark of Decision Analytics, San Diego, CA, USA

COGEN3 (TM) is a trademark of Mathtech, Inc., Princeton, NJ, USA