

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF CALIFORNIA**

Application of Southern California Edison Company (U 338-E)	)	
for Approval of Program Year 2000 and 2001 Energy Efficiency	)	<b>A.99-09-049</b>
Program Plans, Budgets, and Performance Award Mechanism.	)	
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Application of Pacific Gas and Electric Company for Approval of	)	<b>A.99-09-050</b>
Program Years 2000 and 2001 Energy Efficiency Programs (U 39M)	)	
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Compliance Application of San Diego Gas & Electric Company	)	
(U 902-M) for Approval of 2000 and 2001 Energy Efficiency	)	<b>A.99-09-057</b>
Programs, Budgets, Performance Incentive Structure.	)	
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Compliance Application of Southern California Gas Company	) )	
(U 904-G) for Approval of 2000 and 2001 Energy Efficiency	)	<b>A.99-09-058</b>
Programs, Budgets, Performance Incentive Mechanism.	)	
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**PROPOSAL FOR DIRECT RESIDENTIAL HVAC LOAD CONTROL BY CARRIER CORP. and SILICON ENERGY CORP.**

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# **EXECUTIVE AND PROGRAM SUMMARY**

## **Background**

In decision 00-07-017 dated July 6, 2000 the California Public Utilities Commission (CPUC) established an expedited process to select and immediately implement delivery of demand and energy usage reductions necessary to alleviate the current critical imbalance between electricity supply and demand in California. The CPUC directed parties to provide program options that will bring about the largest reductions in electric demand and/or electric usage reductions in the shortest period of time. The present demand response system in California has proved inadequate because of ineffective communications mechanisms, program designs and standards that make participation difficult, lack of scalability in the management infrastructure, and commercial offers that are do not speak directly to the needs of the typical electricity customer. In this proposal, Silicon Energy and Carrier offer an internet based software and hardware residential direct load control program that addresses all the limitations of present programs, and will facilitate rapid integration of the full range of residential customer demand response options into power delivery markets. As the leading national providers of energy management software solutions and advanced heating and cooling controls, Silicon Energy and Carrier are ideally suited to provide the solutions needed to rapidly address this critical need.

## **Purpose**

Carrier Corporation, through its Carrier Electronics division, and Silicon Energy are proposing a statewide Load Control Program for Residential HVAC systems that takes full advantage of the advances in internet technology, wireless communications, and smart thermostats, to meet the objectives of:

- (1) Maximum consumer-acceptable load control in peak situations
- (2) Verifiable demand and usage reduction, through real-time feedback
- (3) Customer acceptance
- (4) Ongoing data collection, measurement and verification
- (5) Developing energy price-responsiveness in the residential market segment.

This proposal includes:

- Recommended program Pilot and Rollout phases
- Recommended number of units in each phase
- Recommended rollout schedule
- MW savings by phases and for total program
- Cost estimates by phases and for total program

## **INTRODUCTION**

## **Project Specifications**

This proposal will include technologies and methodologies designed to allow the CPUC or its agents (CPUC) to:

- Offer a residential load-control program that is more acceptable to end-use customers since they retain ultimate control of their comfort
- Adjust by varying amounts residential HVAC loads during peak periods
- Identify the households contributing to load relief and the ones choosing to override the event
- Target aggregate groups for system-wide load relief, or subgroups and individual households for localized load relief
- Gain year round efficiency benefits for residential HVAC usage
- Gather information about device use and performance, enabling finer targeting of price signals in the future and verification of savings.

These benefits will be realized by enabling two-way communications to each home, with Internet interoperability between the Carrier EMI, which is based on Carrier's high-end 7-day programmable thermostat, and Silicon Energy's Enterprise Energy Management software. The Silicon Energy software will collect and store event information for later retrieval by the CPUC for program settlement, planning and tuning.

The proposed load control system will be configured to allow the CPUC to customize data gathering and display the customers' event participation patterns. The CPUC will have the ability to control the customer's thermostat, and yet the customer retains full flexibility to override the temperature setback directly from their thermostat or remotely over the Web at any time. All information is logged and can be presented in a variety of forms to the CPUC and the customer.

## **Proven Partners: Carrier and Silicon Energy**

Carrier and Silicon Energy have partnered on this proposal to offer a proven system of load control capability across the residential segment of the entire state of California. Carrier and Silicon Energy have implemented similar successful pilot programs for Puget Sound Energy (PSE) and Connecticut Light & Power (CL&P).

- Over 100 households participated in last winter's field trial which permitted PSE to adjust homeowners' temperature and allowed customers to monitor and adjust their own home heating systems while they were away. During customer focus meetings in May, we learned that customers highly value the ability to retain control and "override" the PSE temperature adjustments, and would not have participated without the feature. And yet, our data indicates that only 5% of the customers actually used the "override" feature.
- CL&P has just launched the summer pilot program, which runs until October 1, to test the system's ability to reduce residential customers' electrical demand during power emergencies. Fifty customers were recruited; with curtailments beginning in late July.

# PROGRAM DESCRIPTION

## Overview

Carrier and Silicon Energy propose a multi-phase program that addresses residential customers with a remote direct selective load control program. Depending on load relief requirements, the CPUC will be able to shed selected loads in specific geographic locations using the Internet to execute the strategies and monitor the results. The aggregate of these targeted programs will alleviate system voltage problems in a way that is less disruptive, more effective, and more acceptable to customers than more traditional load relief mechanisms.

Using Silicon Energy's Web-based software, the CPUC will be able to communicate with the Carrier EMI's remotely over the Internet to adjust the current temperature setting during peak demand periods. Depending on the initial temperature setting and the specified adjustment, the HVAC unit may shut off or continue to run during this period, in either case it will operate less frequently because of the adjusted temperature setting.

## Project Phases

**Proof of Concept** will consist of a pilot program using phone line communications to demonstrate the benefits and refine the CPUC's system requirements. In order to provide a quick, viable solution without worries of communication service coverage for this Phase, we chose existing, omnipresent phone line technology. An appropriate wireless communications solution will be evaluated and selected for deployment in later phases. This pilot phase is planned for an initial evaluation period of two (2) months.

**Phase One** will consist of a program using wireless communications to demonstrate the benefits and refine the system deployment processes for large scale rollout.

**Phase Two** will consist of large scale rollout on a statewide basis.

For all phases, Silicon Energy will provide the residential load control application on the same server platform, which will integrate into the phone line and wireless communications services, and the Carrier EMI residential load control equipment.

## Project Schedule

This proposal suggests the following schedule to implement the program:

Program Phase	Units	Implementation Schedule
Proof of Concept Pilot	100	September 2000
Phase One Rollout	200	December 2000
Phase Two Rollout	50,000	January—April, 2001

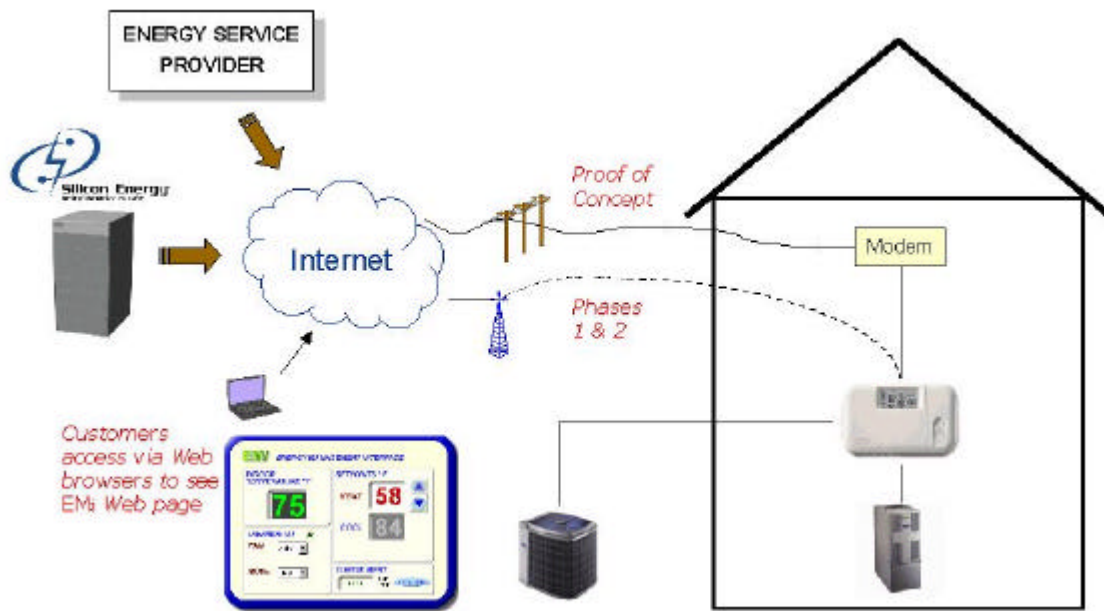
## High-Level Technology Summary:

1. Carrier will provide the *EMi*, the HVAC load control hardware, to be installed at each residential site. At the CPUC's discretion, Carrier can also provide the installation services through its extensive dealer network.
2. Silicon Energy will provide data services and software for project analysis/reporting/settlement, system administration, and event administration for the residential load control programs.
3. Appropriate communications services provider(s) will be used to control event messaging and data collection between the Carrier *EMi* and the Silicon Energy system.
4. Silicon Energy will provide administrator web data and reporting interfaces, and Carrier will provide consumer web interfaces.

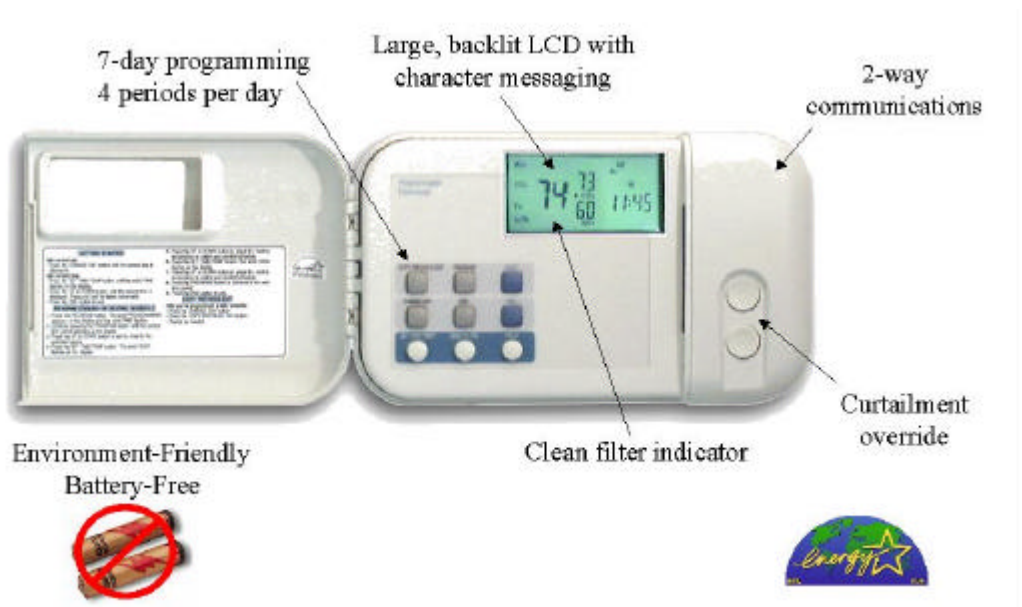
## Technical Architecture

At the heart of all Silicon Energy systems is the real-time database server, which comes complete with all the productivity tools necessary to configure and administer the software. The Silicon Energy server supports all Silicon Energy and 3<sup>rd</sup> party application modules, provides a high sustained transaction rate (hundreds/second), uses local queuing layer for bursty traffic and is highly scalable. The Silicon Energy server can be distributed across multiple CPUs and employs a unique 'push' technology to deliver targeted information immediately using high security.

*EMi*, designed, manufactured and marketed by Carrier Electronics for residential energy management, features two-way communications for delivery of value-added messages and load curtailment information. *EMi* communicates using a 3<sup>rd</sup> party device networking software integrated with Carrier's application code to remotely monitor and control the thermostats. The software enables the communication and data transmission to and from the homeowner's *EMi*, the Internet and the Silicon Energy database.



EMi is based on Carrier's 7-day programmable thermostat, which offers a wide range of functions designed to enhance indoor weather, make operation easy and optimize energy efficiency. This thermostat features a patented Smart Recovery feature designed to save energy by gradually adjusting temperatures. When it's time for a programmed temperature change, Smart Recovery begins working in advance, turning the system on and off as needed to slowly adjust the indoor temperature. Another premium feature, Auto Changeover, automatically switches between heating and cooling operation during periods when both heating and cooling are necessary. A Clean Filter indicator reminds users when it is time to clean or replace the system's air filter for optimal indoor air quality and energy efficiency. Additional features include: large push buttons which respond quickly to touch, time-saving easy set-up programming, backlit LCD with fixed character messaging (including notice of load curtailment in progress) and environment-friendly, battery-free operations.



## Fees & Costs

Project costs in this proposal are divided into hardware, hardware installation, communication fees, and software fees. A portion of the project costs is below. Program options are priced separately. Installation cost estimates are included for purpose of comparison. Carrier and Silicon Energy expect that the CPUC may want to consider consumer self-installation or contractor installation. Hardware costs can be financed at your request.

Program Phase	Units	EMi Hardware (\$/unit)	EMi Install (\$/unit)	Communication Service Fees (\$/unit/month)	Software set-up fee	Annual Software subscription license
Proof of Concept Pilot	100	\$200	\$200	\$15	\$50,000	\$56,250
Phase One Rollout	200	\$150	\$100	\$2.50	\$85,000	\$69,750
Phase Two Rollout	50,000	\$150	\$75	\$2.50	\$175,000	\$462,150

The cost schedules included in this proposal pertain to a roll-out schedule and equipment volumes of full rollout. Other program volumes will be quoted upon request. Sales Tax will be charged on any applicable services or materials based on the State Board of Equalization guidelines.

## PROGRAM BENEFITS

### Direct Load Control Benefits

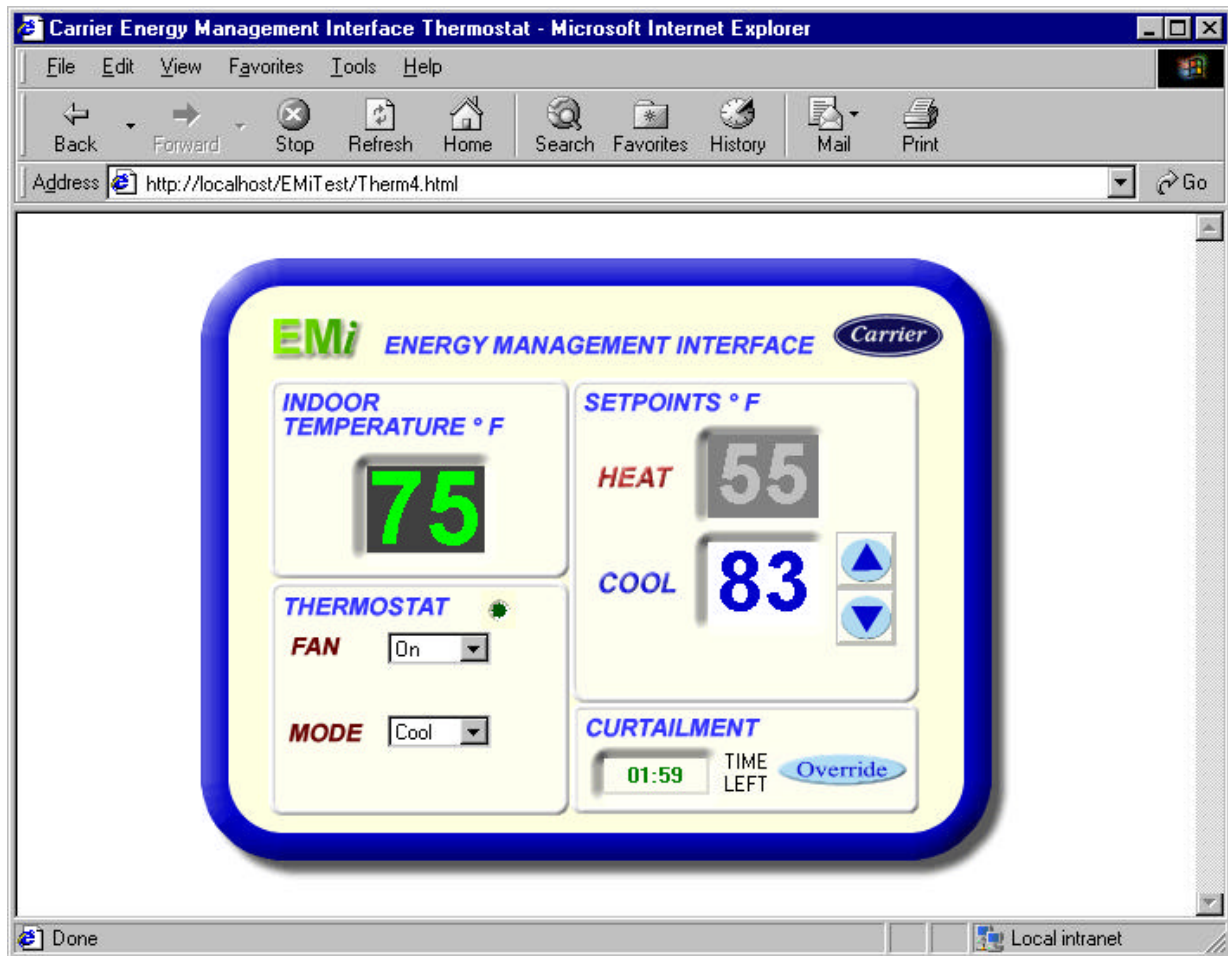
Program Phase	Units	Average kW reduction per unit	Aggregate kW reduction	Initial investment	Annual Recurring costs	Initial investment per kW	Annual recurring costs per kW
Proof of Concept Pilot	100	2	200	\$90,000	\$74,250	\$450.00	\$371.25
Phase One Rollout	200	2	400	\$135,000	\$75,750	\$337.50	\$189.38
Phase Two Rollout	50,000	2	100,000	\$11,425,000	\$1,962,150	\$114.25	\$19.64
<b>TOTALS</b>	<b>50,300</b>		<b>100,600</b>	<b>\$11,650,000</b>	<b>\$2,112,150</b>	<b>\$115.81</b>	<b>\$21.63</b>



## Ancillary Program Benefits

- Verification of program participation or non-compliance at the customer level per event
- Year-round availability, both heating and cooling season application
- Increased customer acceptance, as they retain ultimate control
- Temperature setbacks can be scaled in relation to emergency requirements, enabling better cost management and system reliability
- Added customer convenience and value through web interface for programming and control
- Year-round efficiency benefits of a programmable thermostat
- Thermostat is an "always on, always connected" user interface which can be used to display emergency messages or community announcements
- CPUC can set default (recommended) programming for customers at installation time

*Consumer interface for monitoring and adjustment/override*



## **COMPANY OVERVIEWS**

### **Carrier**

Carrier Corporation, headquartered in Farmington, Connecticut, with over 35,000 employees and operating in 173 countries, is the world's leading manufacturer and marketer of heating, ventilation and air conditioning equipment. Carrier is also a leader in the container, transport and commercial refrigeration industries. Carrier, with approximately \$9 billion in sales, is the largest of United Technologies Corporations' six businesses. UTC is a \$25 billion diversified company which also owns Otis (elevators), Pratt & Whitney (aircraft engines), Sikorsky (helicopters), Hamilton Sundstrand (aircraft systems) and International Fuel Cells.

Carrier Electronics, a division of Carrier Corporation, designs, manufactures and markets a broad range of microprocessor-based electronic modules for Carrier business units globally, as well as other HVAC/R manufacturers worldwide. These products range from on board controls for HVAC/R equipment, to thermostats and PC-based building management system (BMS) software.

### **Silicon Energy**

Silicon Energy Corporation is the premier provider of Web based energy management solutions to utilities, unregulated energy services providers, and larger end-use customers. Silicon Energy's customers include Puget Sound Energy, LADWP, Portland General Electric, Northern States Power, MidAmerican Energy, Northeast Utilities, Pennsylvania Power and Light, DTE Energy, APS Energy Services, Conectiv, Enron, ConEd Solutions, PEPCO Energy Services, Wal-Mart, USC, San Jose State, and many more.

Silicon Energy delivers unparalleled energy management capabilities by specializing in the following three areas:

- real-time acquisition, analysis and reporting of energy and facility control data,
- user-tailored access via a Web browser,
- strategic, directed actions and direct control capabilities.

With a modular software suite of market leading applications, Silicon Energy's e-business platform uses the internet for collection and remote management of energy related data. Various application modules utilize sophisticated yet easily navigated graphical tools for monitoring, analysis, and response functionality. Silicon Energy's products enable both utilities and end-users to optimize their energy management efforts through a comprehensive understanding of where, when, and how efficiently their business enterprise uses energy.

A privately held company incorporated in 1997, Silicon Energy now has over 150 employees and is the fastest growing company in the Enterprise Energy Management industry. Silicon Energy headquarters is located in Alameda, California, at the heart of the San Francisco Bay area.

In addition to software, Silicon Energy provides complete project planning and analysis, software installation and integration services, software training, and software maintenance with in-house staff. Silicon Energy's professional services ensure that our product is technically installed, functionally implemented and utilized to its maximum extent to capture the projected benefits.

#### *Silicon Energy's Solution*

The CPUC needs to mitigate peak demand consumption through the use of direct load control programs. Silicon Energy's web-based, information hub architecture is built upon an extremely flexible, reliable, and scalable platform. Upon this platform Silicon Energy has developed a modular software suite and a library of gateways that provide large scale remote monitoring and direct load control.

Silicon Energy's proposal will provide a quick time-to-market solution using leading-edge technology, while maintaining the utmost flexibility for expanding both the functionality and size of the system. Silicon Energy's proposed system will provide the required data monitoring, analysis, presentment and alarming capabilities for executing specific load control strategies.

#### *Silicon Energy's Application Modules*

To meet the CPUC's needs, Silicon Energy proposes to deliver the Silicon Energy Server Software with the Data Analyst, Energy Analyst, Alarm Manager, Universal Calculation Engine, and Enterprise Navigator application modules.

#### *Silicon Energy's Customizable Interface*

The Silicon Energy system interface can be extensively customized to meet the needs of the CPUC. The Silicon Energy solution can provide identification and branding for the CPUC, or any other appropriate brand.

## **MISCELLANEOUS**

### **Installation Timeframe**

Carrier and Silicon Energy will be available to commence with the project implementation within 30 days of contract approval, contingent on the CPUC meeting certain technical requirements.

### **Proposal Expiration**

This offer is valid through September 15, 2000. Carrier and Silicon Energy welcome the opportunity to meet and more fully understand the CPUC's needs and desired solutions.

## **CONTACT INFORMATION**

### **Carrier Contact Information**

Questions regarding this proposal or requests for more information should be directed to:

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## ***CERTIFICATE OF SERVICE***

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I, Eric L. Miller, certify that I have, on this date, caused the foregoing PROPOSAL FOR DIRECT RESIDENTIAL HVAC LOAD CONTROL BY CARRIER CORP. and SILICON ENERGY CORP. to be served by electronic mail and U. S. Mail, on the parties listed on the Service List for the proceeding in ***California Public Utilities Commission Docket No's A.99-09-049, A.99-09-050, A.99-09-057, A.99-09-058.***

I declare under penalty of perjury, pursuant to the laws of the State of California, that the foregoing is true and correct.

Executed on July 21, 2000 in San Francisco, California.

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Eric L. Miller