Appendix 9.7

Card-Key Based Guestroom Controls
Evaluation Report

Attachment to
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Preface

The San Francisco office of Architectural Energy Corporation (AEC), an energy and environmental research, development, and design consulting firm headquartered in Boulder, Colorado, prepared this document for PG&E. Asim Tahir and Mat Taylor contributed to the report, and Erik Kolderup and Donald Frey reviewed it for technical quality and responsiveness. Wayne Krill of Pacific Gas and Electric Company (PG&E) provided guidance and input as project manager.

Please note that product and manufacturer names used in this report are proprietary and may be trademarked and copyrighted.

Acknowledgements

This project would not have been possible without the ongoing assistance of Steve Hutchison, PG&E's Hospitality Segment Program Manager, and Sharon Harris, Account Services Manager for major hotels.

The assistance of Jerry Eaton at the California Lighting Technology Center is most gratefully acknowledged.

0.0 Executive Summary

Card-key guestroom control systems are a mature product and are common in Europe and many parts of Asia. This product has been slow to catch on in the U.S. market but is showing signs of greater adoption and acceptance.

The primary market barrier to adoption is the perceived impact on guest satisfaction. The main factor may be the "active" nature of these controls, where a guest must interact with the system. Passive systems, such as controls based on occupancy sensors, are sometimes favored because their functions are invisible to the guest.

Marketing of the product may prove vital to widespread acceptance in U.S. hotels. "Being green" is broadly accepted and encouraged, and should the systems be introduced to guests like other "green" aspects of hotel stays, this could make a huge difference in energy consumption, peak demand, and hotel guest satisfaction.

The card-key system offers a **moderate payback and is applicable in all types of hotels and motels**. For the foreseeable future, these systems may be more applicable to boutique hotels, whereas some of the low-cost products may be better suited to mid-range and low-end motels. High-end and luxury hotels may prefer not to inconvenience their guests with card-key systems, and opt for occupancy-based controllers to manage guestroom energy.

Several variations of this product were evaluated for this report. The most basic product from Watt-Stopper replaces a standard wall switch to control the foyer lights at the entrance to the guestroom and costs $20. The Suitemaster range of controls from CSL industries has recently been introduced in the market and is expected to cost around $450 per guestroom. The Suitemaster has modules to control lights, appliances, and the room HVAC system; it even has a drive to control the drapes.

Energy savings vary significantly based on the extent of guestroom loads controlled. The values used in this report range from 712 kWh to 1,800 kWh per guestroom with paybacks in the range of 1.2 to 2.1 years.

The higher-end products that control HVAC may qualify for a PG&E incentive under the Standard Performance Contract (SPC) program. For the three cases presented in the savings summary, these incentives range from $50 to $225 and reduce the payback range to 0.6 to 1.0 years.

1.0 Evaluation Summary

The card-key guestroom control system offers a moderate to good payback and is applicable in all types of hotels and motels. In this report, the terms hotel, motel, and hospitality may be used interchangeably to refer to the entire lodging segment.

The product has seen limited use in the U.S. with some concerns about potentially negative guest experience. But product suppliers remain optimistic that this technology is going to see significant growth in the U.S. market based on their market research and an increasing awareness in the general populace regarding energy use and conservation.

Table 1-1: Evaluation Summary

Criteria	Score (1 = poor, 10 = excellent)	Notes
Speed of Implementation	6	System components for some of the products communicate wirelessly, making installation straightforward. A few products require wired connections between devices, which will make installation more disruptive.
Focus on Products	8	Product is well-defined and benefits are readily understood.
Demand Reduction	3	Moderate demand reduction; some opportunity for demand response with additional investment in centralized controls.
Cost Effectiveness	6	Significant initial cost but short payback time. Cost ranges from $100–$450 per room, based on system selected. Wireless systems may lower installation labor cost but may have higher equipment cost. The simple payback period is 1–2 years.
Persistence	4	Savings should persist over product life.
Customer Satisfaction	4	Potential risk for guest dissatisfaction, or for defeating the system by using spare card key in master switch.
Supply	4	Industry is mature in Europe and Asia but literature review indicated only two companies offering products with similar capabilities in the U.S..
Market Size	6	Applicable to the majority of hotels and motels. Controls can either cycle power to PTACs, or use a thermostat setback to reduce energy usage.
Magnitude of Energy Savings	7	700 to 1500 kWh annually per unit, or 1.5 to 3.3 kWh/ft^2-yr.
PG&E Program	6	Climate conditions and occupancy rates will impact savings. Some guestroom controls have been rebated by SPC and third-party programs.
Existing Installations	4	Numerous installations worldwide. U.S. or California installations unknown. Recent installation in LEED certified Orchard Garden Hotel in San Francisco; existing installation at the Ayers Hotel in Ontario, California.

2.0 Technology Overview

This report summarizes the status and potential market benefits of control systems that utilize card-key (entry key) systems to control HVAC systems and lights in hotel and motel guestrooms. Various vendors offer their products with a range of features and capabilities. This report focuses on the common capabilities of these products. Other control measures being evaluated and documented in separate reports are occupancy sensor based control systems, demand-controlled ventilation for event spaces, demand-controlled kitchen ventilation, and bathroom lighting controls.

Card keys have become almost universal in the hospitality industry in the U.S. for entry to guestrooms and other controlled areas. The card keys offer increased security with easily reprogrammable units. Hotel guest status, room occupancy status, and room control can be monitored from one central location with most systems.

Guestroom energy management controls utilizing the card-key system have a receptacle where the guests place their card key after they have used it to enter a room. This receptacle acts as a master switch for the guestroom and enables lights and the HVAC system. As the guest leaves the room and removes the card key from the receptacle master switch, the lights and HVAC unit are either shut off or the thermostat is set back. Certain products also draw the curtains once the guest leaves the room. In all cases, the card key determines whether the room is occupied or unoccupied and controls the room systems accordingly.

More advanced technologies use "smart chips" or proximity sensors instead of magnetic strips on entry keys, so they do not need to be inserted into the lock to gain access to the guestroom. These can still be inserted in the card-key receptacle to enable the guestroom lights and HVAC.

Most of the card-key systems are stand-alone controllers without a tie-in to a central energy management system (EMS). Some of the systems described later in the report offer an optional tie-in to a central EMS which can allow the staff to control the individual guestroom systems from the front desk.

Guestroom energy controls have been in existence since the early 1980s and are in widespread use across Europe and Asia where the cost of energy is much higher than in the United States. Recent advances in technology have increased the capabilities of these systems and lowered the cost. Most of the manufacturers are based outside the United States. Some U.S. companies license these technologies and are offering them to the hospitality industry.

2.1 Technology Description

The technology is offered from various manufacturers worldwide. Since it is a mature product in Europe and Asia, most manufacturers are based there. Some of these are discussed here to illustrate the range of features. The list here is not exhaustive and there may be additional products available in the market. A few U.S. companies have recently launched these products.

2.1.1   Messerschmitt

Messerschmitt is a German company with two products under its INCOS system. The basic system has a stand-alone controller in each guestroom, which can be configured to control lights, HVAC and entertainment systems. HVAC control is achieved by either shutting the unit off when a guest leaves or by implementing a temperature setback on the thermostat (if included in the system). Various modules can be wired to the controller to control different components. This modular system can be customized for individual customers based on their needs and budget. This product was tested in the field and findings reported in an ACEEE paper (Lau 2000). It has been imported to the United States by U.S. Import Export Corporation of America.
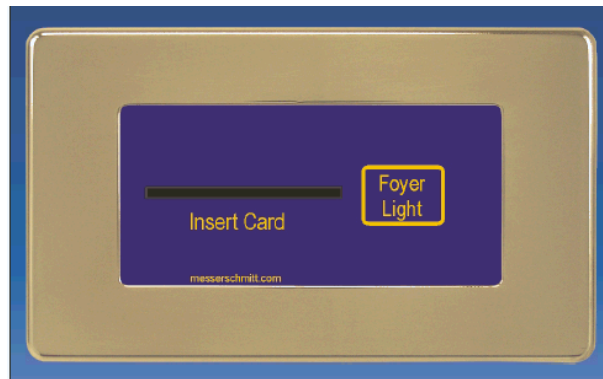
Figure 2-1: Messerschmitt INCOS System

2.1.2   CSL Industries- SUITEMASTER™ System

CSL Industries are bringing a new product to market branded as 'SUITEMASTER Integrated Hotel Suite Convenience and Control'.

The SUITEMASTER System enables guests to activate a wide range of controls. By inserting a standard card key into the key holder next to the entry door inside the guestroom, the lighting, drapes, thermostat, television, and other amenities can be enabled.

When leaving the room, the guest removes the card key and the room returns to a programmable unoccupied state. In CSL's basic system, room lights are instantly turned on when the card key is inserted and are automatically turned off after the guest removes the key and leaves the room.

Optional features include thermostat, appliance and drapery control. The temperature will float a few degrees beyond the occupied set point when the guest is not in the room and the drapes will be closed to reduce heat from the sun in the summer months. This is an automatic process that is triggered when the guest removes the card key when leaving the room.

Figure 2-2: CSL Industries SUITEMASTER™ System

The current product needs to be wired to the individual sensors and modules. Development is under way to use wireless communication technology. This will reduce the implementation cost and possibly increase market penetration, since it could more easily be incorporated into existing hotels and motels.

The SUITEMASTER system also offers an optional tie-in to a central EMS that allows the hotel staff to monitor and control the individual guestroom systems from the front desk.

2.1.3   Watt Stopper

Watt Stopper Inc. is in the process of developing a simple version of the card-key system. The product will be offered in a line voltage and a low voltage version. The line voltage version replaces a standard wall switch and acts as a master switch for all the guestroom components powered from that circuit. The low voltage version will send signals to relay switches attached to all components that need to be controlled. These relays will be connected to the master card-key switch with low voltage wire. The HVAC system can be cycled on or off; at present, there is no capacity for thermostat control. These products are expected to enter the market mid-2007 and are expected to be most attractive to mid-range hotels and motels undergoing renovation. Pricing has not yet been confirmed but is expected to be in the $20 range for both versions of the master switches. The cost of relays and low voltage wiring can bring the installation cost to $200 or more per guestroom depending on individual installations.

2.1.4   Onity Energy Saving Device

Onity is a leading provider of electronic locks, in-room safes and energy management solutions. The 'Energy Saving Device' is a card-key switch that cuts the power to the controlled circuits after a one minute delay. Functionally it is similar to the line voltage version of the Watt Stopper product.

Figure 2-3: Onity Energy Savings Device

2.1.5   Hune

Hune is a Chinese firm selling several versions of card-key controllers that work with a magnetic strip card key, card keys which have embedded chips, and contact-less switches for radio frequency (RF) technology card keys. These do not appear to be available in the U.S. market.

Figure 2-4: Hune Card-Key Receptacle

2.1.6   Entergize

The Entergize card-key system uses wireless RF technology to control the various components of the system. The main stand-alone controller is retrofitted into the entry light switch and then controls HVAC and "slave" outlets. The system is adaptable to several types of hotel HVAC systems and is fully programmable in both occupied and unoccupied modes. Included in the suite of components is a sliding door sensor that can be programmed to disable the HVAC unit if a slider is left open.
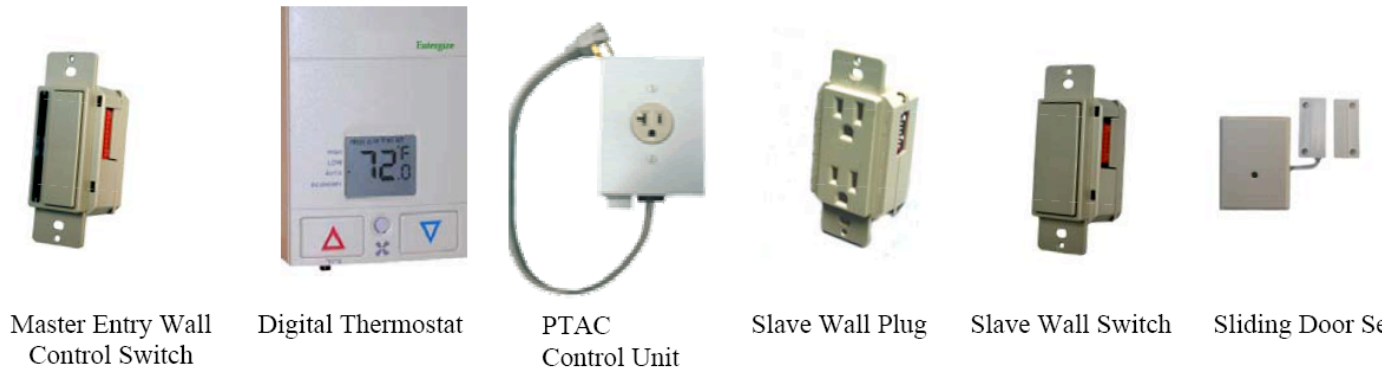
| Master Entry Wall Control Switch | Digital Thermostat | PTAC Control Unit | Slave Wall Plug | Slave Wall Switch | Sliding Door Se |

Figure 2-5: Some of the Entergize Components

2.1.7   Techotel and Climateco

Hotel control technologies from an Italian manufacturer have recently became available in the U.S. and Canada. These technologies are installed in more than 1,200 hotels worldwide and offered by EE&G Systems, the sole distributer for North America. Two product lines—Techotel and Climateco--cover the range of control capabilities that include fully functioning Building Automation System, centrally controlled Energy Management System, or an independent room control system. The room control features of these systems can be configured as either card-key or occupancy based controllers.

The Techotel (or TH3) system is a full-function building automation, energy management, and access control system. It has capabilities typically found in systems from the major controls manufacturers (Honeywell, Johnson Controls, Siemens, etc.), plus all of the hotel control and operation functions. If you want a card-key system, they put in card-key readers. If you want occupancy based control, they put in IR sensors. If you want to automatically control an awning, pool cover, or draperies, they can do that too. They control room HVAC and lights, change setup/setback, depending on whether a room is sold or not, interrupt control when a window or sliding door is opened. They can scale the system all the way down to isolated room control. Each application is tailored to the needs of the hotel. The controllers in each guest room are tied together to a central BAS through an Ethernet-based communications protocol. The multi-function capabilities of these types of systems imply a high degree of interconnectivity and rather invasive installation requirements; therefore, they are best installed in new construction or major renovation projects.

Climateco is a room energy management system capable of controlling HVAC, lighting, and plug loads. It can use a host of inputs for control and can either be a stand-alone or networked system. In its stand-alone configuration, it must be programmed from the room it controls by means of a laptop computer. In the connected mode, it can be programmed and controlled from a central point along with similar networked room controllers. It is capable of controlling the same in-room devices as the Techotel system.

2.2   Where Card-Key Systems are Applicable

Card-key systems are applicable in all hotel and motel guestrooms. Products that require wired connections for components are likely to be cost effective only in new construction, or hotels

and motels undergoing major renovation. Wireless products make installation in existing hotels and motels more cost effective and increase the potential market size.

2.3 Market Readiness (Current Status)

The card-key guestroom control systems are a mature product and are reported to be common in Europe and parts of Asia. These systems have been slow to catch on in the U.S. market. The primary market barrier is the perceived impact on guest satisfaction. The main factor may be the 'active' nature of these controls, in which a guest has to interact with the system. Passive systems, such as controls based on occupancy sensors, are sometimes favored since their functions are invisible to the guest.

There are indications that there may be a change in perception about these controls with the installation at a new boutique hotel in San Francisco, and with the new products offered by CSL Industries and Watt Stopper. The increasing popularity of the Leadership in Energy and Environmental Design (LEED®) rating system may be a factor in making this technology more appealing to the hospitality industry due to the energy savings potential.

2.4 Comparison to Related Technologies

Two related guestroom control technologies are **centralized reservation system controls** and **occupancy-based controls**.

A **centralized reservation control system** can take different forms. A typical system integrates the guestroom reservation and check-in system with an energy management system (EMS). When a guest checks in, the reservation system notifies the EMS, which activates heating and cooling equipment in the guestroom. When the guest checks out, the EMS shuts off heating and cooling or sets back temperatures. These controls use traditional wired systems and need to be installed during new construction or a major retrofit. In general, capabilities of centralized control systems can match those of stand-alone guestroom controllers, but the implementation cost can be significantly higher.

Occupancy-based controls monitor guest presence and set the guestroom to unoccupied mode after a brief time delay when guest presence is not sensed. The parameters of the unoccupied mode are also programmable.

Hotels and motels that favor occupancy-based systems over card-key systems prefer the fact that the occupancy-based systems do not require the guest to interact with the system and are 'invisible' to the guest. However, there are concerns that guests unfamiliar with the occupancy sensors may mistake them for cameras or other monitoring devices that compromise their privacy, and be dissatisfied with their stay at the hotel.

Some hotels and motels also cite concerns that the occupancy sensors may not sense a sleeping guest and could shut down. This problem may have been an issue with earlier systems; advances in sensor technology and embedded logic in the controllers make this concern a thing of the past.

A disadvantage to card-key systems in comparison to occupancy-based controls is that guests in a room with card-key controls might use a spare key to keep the master switch enabled at all times to minimize their own inconvenience. This will essentially defeat the system and reduce

savings. Card-key systems are popular in Europe and Asia, where the general public is more proactive in energy conservation and do not have a negative perception of card-key controls.

The Orchard Garden Hotel in San Francisco, California recently opened with card-key controls in all guestrooms; its sister facility, the Orchard Hotel (also in San Francisco), is being equipped with occupancy controlled sensors in guestrooms. One corporate owner choosing two different technologies for its two San Francisco hotels may indicate that each technology offers unique benefits that are applicable in specific situations.

2.5   Case Studies

2.5.1   Orchard Garden Hotel - San Francisco, California

San Francisco's Orchard Garden Hotel is built to U.S. Green Building Council (USGBC) standards in order to earn LEED certification.

This is San Francisco's first hotel to implement the card-key system to control lights and HVAC in guestrooms. After opening the guestroom door with the card key, the guest places the card in a receptacle that turns on the lights and other room systems. When exiting the room, the guest takes the card key with them, automatically "turning off" the entire room. One outlet is excluded from this control so that guests can charge laptops, cell phones and other battery-powered devices. This system is estimated to cost between $35,000 and $40,000 for 86 guestrooms and is expected to have a simple payback period of less than two years.

2.5.2   Ayers Hotel - Ontario, California

An existing installation at the Ayers Hotel in Ontario, California switches the electricity off for the entire guestroom except for outlets for the refrigerator and the alarm clock. The system turns the HVAC completely off instead of moving it into a setback mode. According to the chief engineer, guests do complain about the system and will either accept the fact that it is an energy savings measure or will ask for a second card key to override the system.

3.0 Market Opportunity, Benefits, and Cost Effectiveness

3.1   Market Opportunity

The card-key system can be implemented in the majority of hotel and motel guestrooms. The most basic system controls only some of the lights for which the card-key receptacle replaces the wall switch. The line power version of the Watt Stopper product is an example of this type of application. Functionality to control additional lights, the HVAC system, or appliances requires running control wires to these components. The low voltage version of the Watt Stopper and the wired version of the SUITEMASTER will be applicable for these kinds of installations. The need to run control wires to different components may limit application for new construction or properties undergoing renovation. According to CSL Industries, a wireless version of the SUITEMASTER system is also under development and is expected to be available in the near future. Wireless systems can potentially increase the market size by reducing the installation cost and allowing retrofits to most existing hotels and motels.

3.2   Average System Energy and Demand Savings

Guestroom energy uses can account for 40–80% of the total hotel energy consumption, depending on hotel size and type, location, and type of HVAC systems. Nationwide estimates for energy end use approximate that 80% of the guestroom energy use is for heating and cooling; the remaining 20% is plug loads and lighting.[1] This ratio may be different for California.

Average annual vacancy rates for hotels in northern California and the central valley range from 25–35%. For hotels that leave lights and HVAC systems in guestrooms running all the time, this vacancy rate offers a significant opportunity for energy savings.

PKF Consulting reports an average 77% occupancy rate for hotels in northern California and the central valley[2]. This represents savings opportunities for the 23% of the rooms that remain unoccupied. Even when a guestroom is sold it may be unoccupied for part of the time. The amount of time guests spend in the room will be lower for hotels used primarily for business travel and, usually, higher for resorts or hotels used primarily for vacation travel.

Energy savings for one card-key system in a field study in California (Lau 2000) were estimated at 43.9%. Annually, this amounts to approximately 970 kWh/yr per guestroom.

The Orchard Garden Hotel in San Francisco estimates the total cost of this system is between $35,000 and $40,000 for its 86 guestrooms; and they expect a simple payback period of less than two years. Assuming a $0.12/kWh blended electric rate, the annual energy savings are estimated at 1,800 kWh/yr per guestroom.

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[1] "Technology: Energy management systems save hoteliers money" Whitford, M., Hotel & Motel Management Dec 1998.

[2] PKF Consulting provides consulting services to the hospitality industry. The information was retrieved from their website at .http://www.pkfc.com

An evaluation of the technology by the American Council for an Energy Efficient Economy (ACEEE) in 2004 estimated a 713 kWh annual savings and a 0.2 kW reduction in summer peak demand per guestroom.

The savings will depend on the end uses that are controlled. The system in the field study (Lau 2000) did not include all the lights in the guestroom, while the system at the Orchard Garden Hotel includes all lights, HVAC systems, and the mini-bar. The most common installations are likely to be somewhere in between these two examples.

As with all HVAC measures, the amount of savings depends on system efficiencies, building envelope design, climate, and use of the guestroom. For the purposes of this report, an average energy savings of 1000 kWh/yr and demand reduction of 0.2 kW per guestroom are used.

It would be beneficial to conduct further field studies of this technology to better understand the potential range of energy savings.

Table 3-1: Estimated Energy Savings from Existing Case Studies

Source	ACEEE - Emerging Technologies Report (2004)	Lau (2000)	S. Muhle (2006)
Controlled Components	Lights and HVAC	Three portable lamps and heat pump unit. Does not include bathroom and desk light	All lights, appliances, and HVAC
HVAC efficiency	6.8 HSPF, 10 SEER	COP 3.1, EER 10.7	n/a
Baseline energy (kWh/yr)	2,850	2,166	n/a
Baseline peak demand (kW)	1.5	0.895	n/a
Energy with card-key controls (kWh/yr)	2,138	1,228	n/a
Peak demand with card-key controls (kW)	1.4	n/a	n/a
Energy savings per guestroom (kWh/yr)	712	939	1800
Demand reduction per guestroom (kW)	0.2	n/a	n/a
Cost savings per guestroom ($0.12/kWh)	$86	$113	$216
Percent energy savings	25%	43%	20%
Installation cost per guestroom ($)	$100	$100	$450
Simple payback period in years	1.16	0.89	2.08
Estimated PG&E incentive ($)	$50	$50	$225
Cost per guestroom after incentive ($)	$50	$50	$225
Simple payback period in years after incentive	0.58	0.44	1.04
Comments	Estimated by ACEEE from various sources.	Six month field study conducted at Comfort Inn, Palm Springs, California	Based on a reported system cost of $40,000, an expected payback of two years, and a 20% reduction in room energy use.

HSPF = heating seasonal performance factor, a heating efficiency rating for single room-sized heat pumps.

COP = coefficient of performance, a heating efficiency rating for heat pumps.

SEER = seasonal energy efficiency rating, a cooling efficiency rating for room-sized air conditioners and heat pumps.

EER = energy efficiency rating, a cooling efficiency rating for air conditioners and heat pumps.

3.3   Other System Benefits

Some products offer additional features, such as displaying occupancy status to housekeeping staff so they do not disturb a guest. While these features do not have direct energy benefits, they may lead to a more pleasant service experience for guests. Controlling the drapes in the SUITEMASTER product will (in addition to reducing HVAC energy costs) minimize the fading on the upholstery and decorations, adding to their useful life.

Another benefit for guests is that they will always know where their card keys are; this minimizes the inconvenience for both hotel and guests of replacing lost card keys.

3.4   Demand Response Capability

Hotels and motels have generally been reluctant to implement demand response measures in guestrooms due to concerns about potential guest inconvenience. However, additional application of card-key systems and evaluation of guest perceptions may overcome this reluctance.

3.5   Cost Effectiveness

Estimated costs for these card-key systems range from $100–$450 per guestroom, depending on the options selected. Implementation in new construction would carry lower costs, since there would be no significant increase in labor time over standard control systems for installation. Based on energy savings estimates described earlier, the simple payback period will range between one and two years.

3.5.1   Factors Affecting Cost Effectiveness

Although card-key systems are generally cost effective, there are several project-specific factors that will impact energy savings.

- Guest type – savings opportunities depend on how often a sold guestroom is unoccupied. Some types of guests spend more time in their room than others. For instance, guests that are traveling for leisure typically occupy a room for more hours than business travelers. The potential savings of the card-key controller would thus be lower in leisure hotels, motels, and resorts than in hotels and motels that cater to business travelers.
- Hotel and motel location – hotels and motels in mild climates with low heating and cooling loads will have smaller savings than hotels and motels in more extreme climates such as the central valley or mountains.
- HVAC system type – the energy saved in hotels and motels with chilled-water fan coil units in each guestroom can be lower compared to hotels and motels with packaged terminal air conditioners (PTAC) in each guestroom. Since fan coil units are served by central chiller and boiler plants, their system efficiencies are higher than PTACs. The type of HVAC systems typically varies by hotel type. High-rise and upscale hotels and motels generally have fan coil units while lower-end hotels and motels are more likely to use PTACs.
- Occupancy rate – lower occupancy generally increases energy savings. The occupancy rates of hotels and motels fluctuate due to various factors, including location, season, and

economic conditions. PKF Consulting[3] reports an average occupancy rate of 77% for hotels in northern California and the central valley. Reduced occupancy rates will increase the potential for energy savings.

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[3] PKF Consulting provides consulting services to the hospitality industry. The information was retrieved from their website at .http://www.pkfc.com

4.0 Design Considerations

4.1   Implementation Issues

Wired card-key systems are preferably installed at the time of new construction or during major remodeling, unless the low voltage wire can be installed directly in the guestroom and hidden from view. Hotel guestrooms are remodeled approximately every five to seven years, providing an ideal time to implement these systems. Wireless communication between card-key control components makes implementation simpler and allows card-key controls to be more easily retrofit without major upgrades.

The line voltage version of the Watt Stopper system requires all power to the guestroom to be run through a single circuit where the card-key receptacle is installed. If not designed into the system at initial construction or during a major remodel, this will require extensive rewiring for existing facilities. Due to these issues hotels and motels may consider using the line-voltage switch as a low cost measure to control only the foyer lights and any existing appliances fed from that circuit.

4.2   System Persistence Risks

The primary risk of card-key systems is the customer defeating the system by leaving a spare key in the receptacle when the guestroom is unoccupied. It is difficult to quantify this risk as it depends significantly on guest behaviors and attitudes.

4.3   Codes and Standards

There has been an interest expressed by the California Energy Commission and the National Resources Defense Council to include a requirement for hotel guestroom controls in future California energy standards, which will impact implementation, energy savings, and cost effectiveness. Latest information on California energy standards development is available on the Internet at http://www.energy.ca.gov/title24/2008standards/.

5.0 Energy Savings Opportunity in PG&E's Territory

The opportunity for energy savings can be estimated based on average system energy savings and estimates of new construction and retrofits. A potential market impact is shown in Table 5-1, for an assumed 10% market penetration in PG&E territory. The overall potential is estimated to be 2,540 MWh per year and 508 kW per year. The CBECS database[4] shows that during 1990-2000, approximately 80 million square feet of lodging was built in the U.S. per year. Assuming that the fraction of lodging built in California is proportional to its population (may be higher due to level of tourism in California), this amounts to 9.252 million square feet of new lodging construction in California per year.

An important market issue that could affect PG&E programs and savings claims related to card-key systems is, as noted earlier, automatic guestroom controls are being considered as a requirement for the 2008 (or potentially later) version of California's Title 24 energy standards.

Table 5-1: Potential Market Impact

National hotel construction estimate (nationwide)	80,000,000	ft^2 per year	CBECS database, Table B9, 1990-2000 [5]
California hotel construction estimate	3,809,524	ft^2 per year	Assumption that PG&E territory per capita construction rate is same as national rate
Guestroom construction estimate	2,857,142	ft^2 per year	Assumption that 75% of floor space is guestrooms
Guestroom size	450	ft^2	Assumption used in PIER evaluation for hotel bathroom lighting control[6]
Annual guestrooms added	6,349	rooms / yr	
Retrofit market	12,698	rooms / yr	Assumption that retrofit market is twice that of new construction
Market penetration	10%		Assumption
10% market penetration	2,540	rooms	
Per room savings	1,000	kWh	Assuming mix of business and leisure hotels, and varying extent of control
Per room demand savings	200	W	
Annual PG&E energy savings	2,540	MWh/yr	
Annual PG&E demand savings	508	kW	

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4 U.S. Energy Information Administration, 1999 Commercial Buildings Energy Consumption Survey: Detailed Tables, table B9.

5 U.S. Energy Information Administration, 1999 Commercial Buildings Energy Consumption Survey: Detailed Tables, table B9..

6 Siminovitch, M. 2003. Performance Analysis of Hotel Lighting Control System. PIER Lighting Research Program. Deliverable 4.2.1b. Contract 500-01-041. California Energy Commission. Aug. 2003.

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