CALIFORNIA ENERGY COMMISSION

BENCHMARKING SYSTEM FOR CALIFORNIA COMMERCIAL BUILDINGS

Plan, Timetable, and Recommendations

COMMISSION REPORT

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Governor

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This report was prepared by the California Energy Commission's Energy Efficiency Committee as part of Executive Order S-20-04. The report will be considered for adoption by the full Energy Commission at its Business Meeting on September 21, 2005. The views and recommendations contained in this document are not official policy of the Energy Commission until the report is adopted.

INTRODUCTION

On December 14, 2004 Governor Schwarzennegger issued Executive Order S-20-04 creating the Green Building Initiative, which sets a goal of a twenty percent reduction in electricity use in commercial buildings by 2015. Implementation of the Initiative is being directed by the Green Action Team (Appendix A). The Green Building Action Plan, which accompanied the Order, directs the California Energy Commission to perform two tasks related to the energy reduction goal:[1]

1. To develop a simple, California-specific energy efficiency benchmarking system for California's commercial buildings. This system should be coordinated with the United States Environmental Protection Agency (US EPA) ENERGY STAR benchmarking system.

2. To provide the Governor with an implementation plan to benchmark all commercial and public buildings. The benchmark information should be made available to tenants and to buyers at time of sale.

This report summarizes the Energy Commission's progress to date on these tasks. The Energy Commission is being assisted in its efforts by the Benchmarking Advisory Working Group, which includes all the major utilities, state universities, and relevant state agencies.

Benchmarking is a tool that estimates energy use per square foot of building space, allowing comparison with other buildings of the same type and location and tracking building performance over time. It is a beginning step in managing a building's energy cost[2], one that should motivate the building's owner or manager to take actions to improve the building's energy profile. Benchmarking systems may increase in complexity to include other factors that influence energy use such as plug loads, intensity of use of the building, and climate.

The Executive Order directs the Department of General Services to benchmark all state owned buildings. Although benchmarking is voluntary for the approximately one million privately owned buildings, the Energy Commission is directed to work with the California Public Utilities Commission and the state's utilities to offer benchmarking services to buildings owners, managers and tenants.

BENCHMARKING TOOL

The Green Building Action Plan directs the Energy Commission, in consultation with other governmental agencies, public and private utilities, and representatives of the business community, to develop a simple building efficiency benchmarking system for

[1] The Governor's Executive Order and Green Buildings Action Plan can be found on the Energy Commission's website at: http://energy.ca.gov/greenbuilding.
[2] More information on how to effectively manage building energy costs can be found in the Energy Commission's November 200, report, "Energy Accounting: A Key Tool in Managing Energy Costs."

all commercial buildings in the State. The system was directed to be California-specific, coordinated with the US EPA ENERGY STAR benchmarking system, and helpful to building owners, managers and tenants in understanding how their buildings compare with other buildings in terms of energy use.

Energy Commission staff consulted with the investor-owned utilities in California as well as the two major municipal utility districts to solicit their input and participation in the Executive Order's tasks. On April 7, 2005, the Energy Commission held a public workshop to seek stakeholder and public input regarding the implementation of benchmarking for commercial buildings.

Based on staff work and input from many parties the Energy Commission evaluated two benchmarking systems currently available to use for commercial buildings in California: 1) the *Portfolio Manager* on-line tool from the US EPA ENERGY STAR program, and 2) Cal-Arch, a prototype tool developed by Lawrence Berkeley National Laboratory in 2002 under contract to the Energy Commission. Although there are nearly twenty benchmarking tools on the market, these two are the leading candidates for further development into the desired California-specific tool. They were both developed with public funding and are particularly applicable to the diverse, commercial sector and the whole building benchmarking activity being proposed. Also, they are potentially able to handle the complexities of a statewide benchmarking program.

ENERGY STAR[3]

ENERGY STAR was originally developed by US EPA to recognize energy efficient appliances and the brand name has spread to other products. In 1999, ENERGY STAR expanded to recognize and reward energy efficient buildings through an energy performance rating system. The ENERGY STAR benchmarking tool is the best known and best supported nationally. Its rating system is made available through the ENERGY STAR program's *Portfolio Manager* on-line tool (www.energystar.gov). Recognition labels are awarded to buildings attaining a *Portfolio Manager* rating of 75 or greater and plaques are given recognizing ENERGY STAR status to display in the building.

ENERGY STAR is a respected brand, widely recognized by consumers, appearing on many energy efficient consumer products. The application works particularly well for appliances because they can be compared nationally in a straightforward manner. Buildings, on the other hand, have their energy use affected by climate, geography, widely divergent building codes and construction practices, as well as by building use and operation practices.

A process that rewards buildings that are in the top 25 percent of the nation by obtaining ENERGY STAR rating of 75 or higher may not necessarily identify efficient California buildings. A study by Lawrence Berkeley National Laboratory found that 42 percent of the 224 California commercial buildings surveyed scored a rating of 75 or higher. This

[3] The ENERGY STAR Portfolio Manager can be found at: http://energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

high rating is probably due to more stringent California building codes and more moderate climatic conditions than efficiency of the building. Unfortunately, a high ENERGY STAR score can give the impression that building systems and operation do not require improvement. This could be a disincentive for efficiency investments.

Cal-Arch[4]

Cal-Arch, available on-line at (http://Poet.lbl.gov/cal-arch/), was designed to simply compare a building's energy use intensity (energy per square foot) with similar California buildings in the same general climate zone, and with similar size and end use characteristics. It does not have ENERGY STAR's well-established name recognition, nor does it provide recognition to high performing buildings. It does, however, have a much larger database of California buildings, and could provide a complete, localized foundation for a statewide benchmarking system. Cal-Arch also requires fewer data inputs to get a benchmark. It has not been used to benchmark buildings to the degree that ENERGY STAR has, and does not have the degree of technical support given ENERGY STAR.

Appendix B summarizes the key differences between these benchmarking programs.

Further Research

The Energy Commission's preferred commercial benchmarking tool for wide-scale deployment in California would have the following attributes:

- based on the latest data available
- statistically represents California commercial buildings
- simple to use and easy for consumers to understand
- low cost of delivery to get benchmarking score to consumers
- low cost to support program
- minimal, easy to obtain, data inputs
- provides a rating metric that is easily used by consumers including lenders, buyers and renters
- ability to differentiate between a wide variety of public and commercial buildings
- effectively motivates consumers to take action to reduce energy use
- provides ability to recognize and reward good practices of building energy management
- has clearly available technical support for outreach, customer service, and updates

Unfortunately, neither of these two tools meets all of these criteria at present. Although Cal-Arch has a large California-specific database supporting the model, it has little market presence and has not been tested on a large scale. ENERGY STAR's Portfolio Manager has significant market presence and significant technical support from the US EPA. It currently provides the only widely accepted benchmarking alternative.

[4] Information on Cal-Arch can be found at: http://poet.lbl.gov/cal-arch/

A key improvement to both systems would be to use data from the most recent Commercial End Use Survey (CEUS)[5]. The new CEUS is the most comprehensive building database available for use in California and the data is based on a collection of building characteristics and end use energy consumption data for a sample of 2,735 California commercial buildings. By comparison, the US EPA's ENERGY STAR program data contains 5,500 buildings nationwide, but only 850 in California. However, use of the CEUS data will require resolution of utility concerns about maintaining the confidentiality of customer-specific data.

The Energy Commission is initiating additional research that could improve both tools. The additional research will be conducted through contracts with the Oak Ridge National Laboratory (ORNL) and LBNL, and funded by the Energy Commission's Public Interest Energy Research (PIER) program. ORNL will perform analysis of the new CEUS data to develop simple statistical models of California commercial building energy performance. ORNL is uniquely qualified to perform this work since they developed the underlying statistical models currently used by the ENERGY STAR *Portfolio Manager*. LBNL will develop energy performance targets from the CEUS and other data sources to provide a "best practices" level of performance for each commercial customer class. LBNL will also explore how best to include these "best practice" targets into a benchmarking tool, to convey the realistic potential to save energy. The results of this work can be applied equally well to either ENERGY STAR or Cal-Arch. An improved tool is expected to be available by mid-2006.

Recommendations

Until an improved California-specific system is available, we recommend that benchmarking be accomplished by using the existing version of ENERGY STAR. Where there is the ability to compare energy use intensity among similar buildings, such as in state office buildings, a simple benchmarking calculation can identify areas for energy savings. We recommend continued effort to develop an improved California-specific tool to more adequately capture the energy efficiency ratings of California buildings.

The key advantage of the ENERGY STAR system is that it is a widely recognized and respected brand. However, since ENERGY STAR uses national data, it does not adequately represent the relative efficiency of California buildings. We recommend that benchmarking with the existing ENERGY STAR tool in California include clear communication that the benchmarking scores from the model do not reflect comparisons among similar California buildings. High ENERGY STAR scores should be accompanied by information that in California there may yet be significant energy savings to accomplish.

We recommend that benchmarking be periodically performed for a specific building, to verify the effect of efficiency improvements and document the building's energy performance over time. Those buildings that are benchmarked prior to the availability of

[5]All confidential information obtained from the CEUS survey will be properly protected

a California-specific system, should be benchmarked again once such a system is available for a true comparison with other California buildings.

We will conduct research into California building data described above, and explore how it could be incorporated into both ENERGY STAR and Cal-Arch. We intend, with the collaboration of US EPA, to develop an improved, California-specific version of the ENERGY STAR benchmarking system while preserving the national applicability of the ENERGY STAR brand.

BENCHMARKING IMPLEMENTATION

The Green Building Action Plan also directs the Energy Commission to prepare and submit to the Governor's Office a plan, timetable and recommendations to accomplish benchmarking of all commercial and public buildings in California. This includes benchmarking at the time of sale, as well as a system by which benchmarking ratings can be disclosed to tenants, buyers and lenders to advise them in making decisions.

Utility Role

All benchmarking activities require access to energy consumption data (kilowatt-hours and therms) and building specific information including type of use, the conditioned space (square feet), and climate information. The utility that is serving the customer has the best access to a majority of this data, and the ability to retain it over a period of time. Additionally, the utility is in regular communication (usually monthly through the utility billing process) with the customer. Since utilities must protect the confidentiality of their customers' data, the use of this information for benchmarking purposes may involve individual customer approvals.

The Energy Commission will continue to support the utilities' implementation of the use of benchmarking by their commercial customers, and incorporation of benchmarking in the utilities' 2006-08 efficiency programs. This will establish a foothold for benchmarking in the program portfolios of the utilities. Over the following program cycles, we anticipate that the owners or managers of all commercial buildings in California will be informed of benchmarking, encouraged to benchmark their buildings, and encouraged to undertake energy efficiency measures that may be identified subsequent to the benchmarking process.

Benchmarking of State Buildings by DGS

The Department of General Services (DGS) will continue to collect building energy use information and square footage to establish Energy Use Intensities for each building. Energy Use Intensity can be calculated by dividing energy use by the square footage of the buildings to establish and rank buildings by energy use of each building. The calculation provides a means to identify where to focus near-term commissioning and to prioritize retrofit efforts in the DGS buildings. This method is particularly suited to the State as the single owner and operator of hundreds of buildings.

We will continue to assist DGS and local governments improve the energy efficiency of their buildings. The on-going marketing efforts to all cities and counties will include specific information about benchmarking including flyers, news in local government journals and participation in government conferences.

Outreach Activities

Outreach is planned for energy services companies, builders and commercial building owners.

A workshop will be scheduled in January to further discuss issues related to the roll-out of benchmarking program offerings with the goal of beginning some initial programs in the spring of 2006.

Stakeholder groups composed of representatives from investor owned and public utilities, the Building Owners and Managers Association and the Real Estate Industry Leadership Council will be involved to assist in scaling up the benchmarking efforts. These groups can provide feedback regarding all stages of development and implementation of the benchmarking plan, and explore outreach opportunities for building owners

The Energy Commission will work with the Real Estate Industry Leadership Council to develop procedures for consumers to obtain benchmarking information on buildings being sold so that at the time of sale, this information is available to the buyer and lender if requested.

TIMETABLE

		YEAR 2005				YEAR 2006			
TASK	**Description**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
1	Public Workshops								
2	Complete Review of CEUS California- specific database								
3	Assemble and meet with Work Group to provide input into tool								
4	Work with EPA for adoption of a California specific benchmarking tool								
5	Identify and assist in collecting necessary data								
6	Work with utilities to plan and monitor roll out of programs								
7	Meet with all parties to make any program adjustments								
8	Deployment of final benchmarking tool and target program roll-out date.								
9	Include benchmarking information on utility bills[6]								

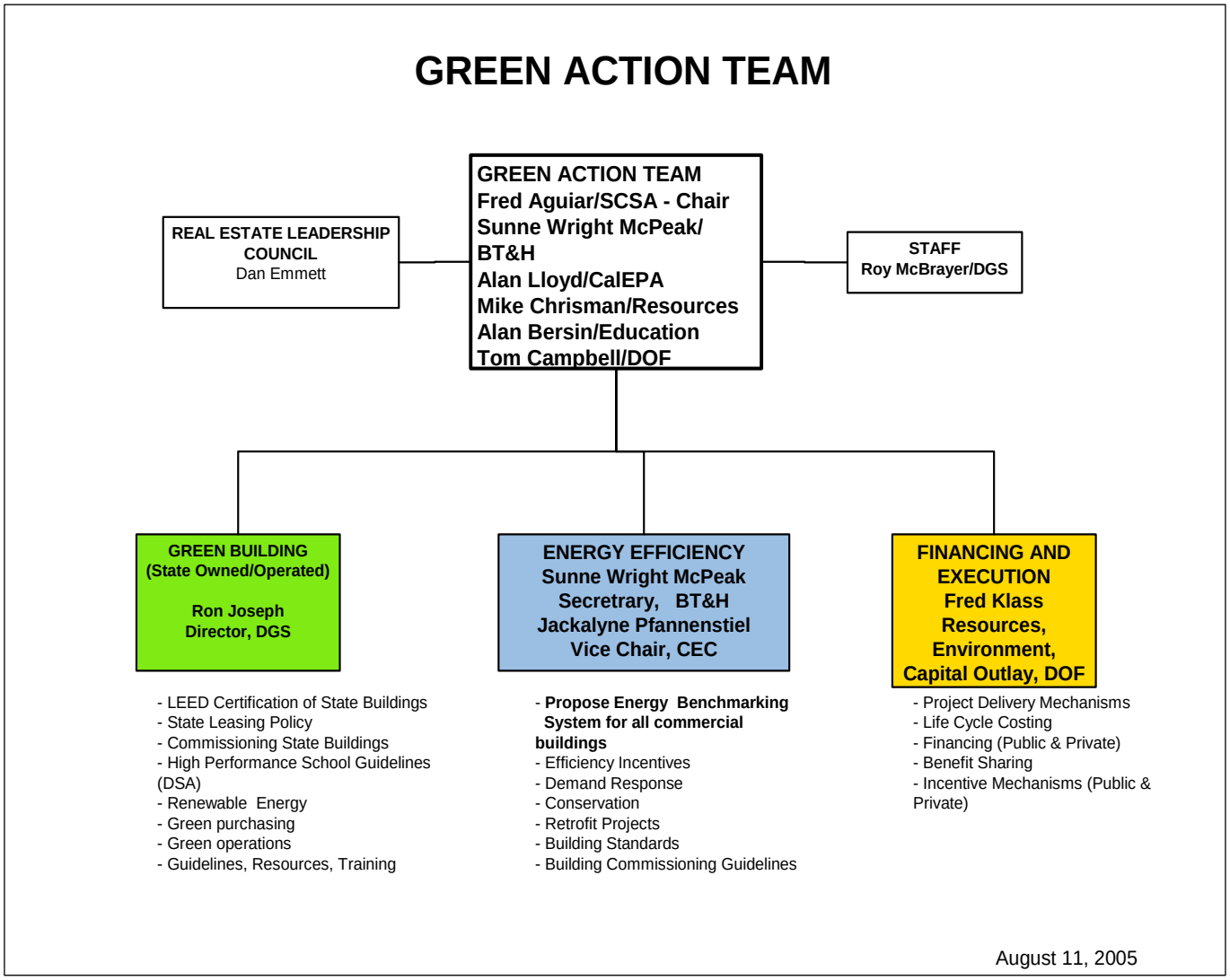
[6] Utilizing utility bills to provide benchmarking information within this timeframe is uncertain.

CONCLUSION

The Energy Commission continues to work closely with other governmental agencies, the state's commercial real estate industry, utilities, and others in the development of a California specific tool that meets their needs. This collaboration allows the benchmarking tool development process to take full advantage of new commercial data and to build on the information and experience of two of the most established benchmarking systems, the systems offered through US EPA's ENERGY STAR program and the Cal-Arch tool. It also provides a customer delivery pathway through California's utilities and other service providers which have direct relationships with commercial customers through existing energy efficiency and marketing programs.

In addition, coordination with utility efficiency programs as a benchmarking information and communication pathway is critical for wide distribution of the new commercial benchmarking system.

APPENDIX A – GREEN ACTION TEAM



Appendix B: Key Differences Between Current ENERGY STAR and Cal-Arch Models

Attributes	ENERGY STAR System	Cal-Arch System
Method of data collection	Uses a national database.[7] Phone interview. No on-site verification of information.	Uses a California database.[8] On-site verification of building characteristics.
Rating	Provides building ratings on a 1-100 scale. Emphasis on awards. Buildings are recognized for energy efficiency if they have a score of 75 or higher.	Rating expressed by energy use intensity (Btu/sq. ft.). Target building is compared with similar buildings in the same market area and climate region. No recognition award given.
Weather data	Normalized for weather, unusual events are smoothed out.	Not normalized for high energy use due to unusual weather. Buildings compared with the same climate and weather conditions.
Building comparison	Compares buildings nationally.	Compares buildings within California.
Ease of use	Requires information including number of occupants, number of computers and operating hours, however, there are default values for many of these parameters if they are not known.	Simple system, uses few inputs and variables – building type, energy use, gross square foot and zip code.
Number of buildings in data	5,500 nationwide, 850 in California.	2,200 buildings, all in California.
Maturity of Model and Customer Support Capability	Better funded and supported by on-going technical support contracts.	Limited funding to provide on-going support. Current prototype program has limited use.
Year of data update	Baseline uses 1999 data. Data update in 2003 to be released in the near future.	Baseline uses 1995 data. Data update in 2005 to be available early 2006. New data to contain 2,735 buildings.

[7] Commercial Building Energy Consumption Survey (CBECS)
[8] Commercial Energy Use Survey (CEUS)