THE URBAN CONSORTIUM

PTI's Urban Consortium is a partnership for changes. With leaders from 50 of the nation's largest cities and counties, the Urban Consortium is dedicated to all urban areas that are the foundation of America's economic and social health. Top elected and appointed officials join together in a Consortium that seeks new partnerships to ensure that the obstacles to a secure, healthy and safe life are removed for citizens as well as businesses to flourish. Established in 1974 to explore the application of technology to pressing problems in large urban jurisdictions, the Urban Consortium (UC) has pioneered the development of many groundbreaking management systems and technologies for communities. Many of these solutions enforce and support the concept of Public Enterprise; a term coined by PTI to describe an entrepreneurial approach to improving services to citizens while generating non-tax revenues.

The Urban Consortium Energy Task Force (UCETF)

For over ten years, the UCETF has been a leader in developing local strategies responsive to the national energy situation and critical environmental concerns. The mission of the Task Force is to:

- improve energy efficiency, cut costs and develop revenue from local energy assets
- develop innovative yet practical approaches in energy management
- create sustainable programs that balance the economic vitality of local governments with energy, environment and quality of life issues
- provide a stimulating arena where local government officials can share experiences and gain valuable perspectives on energy technologies
- address the overlap between energy and environmental policy issues

UCETF membership includes elected officials, management and technical professionals from urban cities and counties. Its links to national organizations, such as the National Association of State Energy Officials (NASEO), the National League of Cities, National Association of Counties, and the International City/County Management Association assures the wide-spread exchange of information and technology. The UCETF applied research and development program, funded in part by the US Department of Energy, has successfully addressed diverse energy problems, identifying solutions for our nation's largest urban cities and counties. Some of the UCETF's achievements include:

- saving local governments and citizens millions of dollars by lowering energy bills
- developing and implementing sustainable energy planning methods and programs for cities and counties
- testing environmentally sound alternative fuels and means for fuel distribution in municipal fleets
- making existing and new buildings more energy efficient by using new technologies and education programs
- creating joint utility and local government programs to offer residential, commercial and industrial sector incentives for sound energy management practices
- evaluating and combining project results for replication in other cities and counties
- building the capability of local government staff and leveraging public funds with private investments

Public Technology, Inc.

PTI is a non-profit institution created in 1971 by the major national associations of local and state governments. Our mandate is to create and disseminate new technology in society, responsive to the needs of local governments. Today, the National League of Cities, the National Association of Counties, and the International City/County Management Association provide policy leadership and sponsor the efforts of PTI.

PTI uses a consortium of entrepreneurial and innovative cities and counties to provide an effective and coordinated urban laboratory in the technology research, development and commercialization cycle. PTI also seeks to involve local government in technology standard setting processes. PTI's work is conducted through 3 task forces, Energy, Environment and Telecommunications and Information.

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ENERGY MANAGEMENT ACTION PLAN

**Developing a Strategy for Overcoming Institutional Barriers
to Municipal Energy Conservation**

**Energy Task Force of the
Urban Consortium for Technology Initiatives**

**Hetch Hetchy Water & Power, Bureau of Energy Conservation
City & County of San Francisco, California
1992**

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MASTER

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PREFACE

1992 Urban Consortium Energy Task Force Publications

With staff, management, and business services provided by PTI, the Urban Consortium (UC) addresses the critical needs of large local governments through 3 task forces: Energy, Environment, and Telecommunications and Information. The Urban Consortium Energy Task (UCETF) was set up with the main objective to improve urban energy management and decision-making through applied research and technology transfer.

The UCETF focuses on developing and sharing new approaches and innovative solutions to energy management problems with local governments. Projects are organized in thematic units and co-managed by a member of the Task Force.

A description of the Units and projects included in the 1992 program are as follows:

ENERGY, ENVIRONMENT, ECONOMIC AND SOCIAL DEVELOPMENT

"Sustainability" is a planning goal to provide an integrative systems approach to meeting all our needs for today and tomorrow. Evaluating the needs of citizens and developing effective and efficient ways to meet those needs is a primary responsibility of local governments. Cities and counties are currently beset by a wide range of problems that in fact are symptoms of some common and pervasive ills. Our problems with energy, environment, economic and social development are related in a complex and interdependent way. These problems, therefore, cannot be effectively solved through a piecemeal approach without recognizing and addressing the interdependent relationships between these areas. The 1992 Energy, Environment, Economic and Social Development consist of:

Dade County, FL — A Long Term Urban Carbon Dioxide Emission Reduction Program

Pima County, AZ — Sustainable Community Implementation Partnership

Portland, OR — Sustainable Business Development Program

San Jose, CA — Negotiating a Demand Side Bid: The City of San Jose Case Study

San Jose, CA — "Green Aisle" Research Program

Santa Clara, CA — Fuel Cell Demonstration Partnership Program

Austin, TX — Sustainable Building Sourcebook

Chicago, IL — Downtown District Cooling: A 21st Century Approach

Chicago, IL — Role of Municipal Governments in the Design and Implementation of Energy Efficiency Codes and Standards Designed to Capture Lost Efficiency Opportunities

Seattle, WA — Coordination of Energy and Air Quality (CEAM)

St. Louis, MO — Earthways Home Project: An Educational Center for Sustainable Urban Development

Tucson, AZ — Minority Marketing for Resource Conservation

Washington, DC — Energy Auditor Training Course for High School Students

ENERGY EFFICIENT FACILITIES

Activities involving energy efficient facilities are part of a national effort to achieve maximum cost-effective energy productivity in the building sector. New technologies and management/administration practices to advance energy efficiency in facilities require major partnership efforts and transfer programs. Multifamily housing that has a large concentration of low-income families presents a unique challenge to lowering energy costs and maintaining energy efficient facilities. Both existing building stock and near-term new construction need to be made much more energy efficient if we are to meet local, state, and national objectives related to energy security, energy supply, and energy affordability. Space heating and cooling, lighting, water heating, refrigeration, cooking, ventilation, building envelope, energy efficient codes implementation, operation and maintenance (O&M), education, etc. are areas where opportunities exist to improve energy efficiency. The 1992 Energy Efficient Facilities Unit consists of:

Boston, MA — Energy Efficiency Outreach Partnership

Columbus, OH — Integrating Operations and Maintenance (O&M) for Energy Efficiency with O&M for Improving Indoor Air Quality

Hennepin County, MN — Integrated Rehab and Weatherization Program for Low Income Suburban Homeowners

Memphis, TN — Upgrade Energy Building Standards and Develop Rating System for Existing Low-Income Housing

New Orleans, LA — Utilization of Energy Efficiency to Support Homeownership Affordability

Detroit, MI — Energy Optimization of Water Distribution System

Montgomery County, MD — CFC Maintenance and Conversions in Chillers: The Commercial Building Response to the 1990 Clean Air Act

New York City, NY — Development of an Energy Services Corporation

Phoenix, AZ — Solar Cooling Demonstration Project

San Francisco — Energy Management Action Plan (EMAP)

TRANSPORTATION

It is frequently said that the goal of transportation strategies should be moving people, not vehicles. But in the day and age of satellite networks, cellular phones, and personal computers, we can redefine transportation as access to goods, services, and information to meet the needs of local governments and their citizens. Alternative transportation fuels are still a major piece in a very large and complex puzzle facing local governments that includes wide-reaching concerns about transportation. There are many factors related to transportation that affect local governments: increasing congestion, crumbling infrastructure of roads and bridges, unchecked urban/suburban sprawl, and the increased "paving over" of our communities that leads to urban heat islands. Federal, state, and urban governments each share in the responsibility and must play a role in providing a sustainable and multi-faceted transportation system that is based on comprehensive and integrated planning at all levels. The 1992 Transportation unit consists of:

Houston, TX — Public/Private Partnership to Identify Barriers & Provide Solutions to Implement Large Scale Fleet Natural Gas Vehicle Utilization

in Ozone Non-attainment Areas

New York City, NY — Energy and Economic Implications of Transportation Demand Management Strategies

Pittsburgh, PA — Natural Gas Infrastructure Development

Seattle, WA — Telecommuting for City Employees

Albuquerque, NM — A Fully Integrated Multi-Fuels Service Stations

Denver, CO — Technical Comparison Between Hythane (H₂/CNG) and CNG Fueled Vehicles

Las Vegas, NV — Reduction of Diesel Exhaust Emissions in Urban Mass Transit Vehicles with Alcohol Injection Systems

San Diego City, CA — California Clean Air Act - A Compliance Strategy for the City of San Diego's Non-Emergency Fleet

Reports from each of these research projects, including this report, are specifically designed to aid the transfer of proven experience to other local governments. Readers interested in obtaining additional reports or further information about the Urban Consortium Energy Task Force should contact:

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ACKNOWLEDGEMENTS

The EMAP project is the outgrowth of forward-thinking energy conservation programs established by the San Francisco Bureau of Energy Conservation. The success of these programs is a credit to Director John F. Deakin, who cultivates a fertile work environment by steadily encouraging innovation.

The Bureau's EMAP project team was the creative engine behind this year's work. Danielle Dowers originated concepts of interconnection among institutional barriers, leading to the project's key findings. Christine Vance designed and managed the Boiler Program, whose pilot year served as an important element in the EMAP we developed for San Francisco, and lent her experience in developing holistic energy conservation programs to the general EMAP process we developed for other jurisdictions. Terry O'Sullivan's interest in understanding San Francisco budget structure and municipal utility operations contributes greatly to ongoing discussions of potential incentive programs.

The Bureau has been privileged to work with a cooperative and capable project partner, the San Francisco Recreation & Parks Department. Administrative Analyst Garrett Furuichi's commitment to the project has been invaluable. Through their professionalism, the department's Structural Maintenance staff, under the direction of Superintendent Jim Lucey, Electrician Supervisor Mario Avendaño, and Chief Engineer Frank Bezak, are helping the Bureau develop effective programs to improve the efficiency of the department's facilities. Assistant General Manager Phil Arnold, who successfully obtained funding for an energy-conservation electrician crew in an extremely tight budget year, provided essential buy-in from the department's upper management. The cooperation of busy Recreation staff, especially those in the Aquatics division directed by Lynne Greenlaw, greatly enhanced our retrofit efforts.

Several other offices supported and guided the Bureau's efforts to overcome institutional barriers. Ann Peterson from the California Energy Commission has been a committed and knowledgeable partner. Virginia Waik from the City of Palo Alto's energy office asked many probing questions and offered suggestions from her own research into institutional barriers. Energy staff from the City of Berkeley, as well as environmental staff from the San Francisco offices of Recycling, Water Conservation, and Clean Water added their valuable experience and reviewed our work. All of these organizations continue to work with the Bureau and each other as a network for sharing the common pursuit of a sustainable future.

Despite the overwhelming nature of barriers such as those we explored in this project, we find that most local government employees seek fundamental improvements to the institutions within which they work. It is to them that we dedicate the EMAP project.

Doug Johnson, Project Manager

It's as if our work takes place in a dense jungle, where we have worn paths through a small region, but want to reach much farther. In the EMAP process we take time away from our intense rushing on those familiar paths to climb a tree and scout the impenetrable areas surrounding us. We can see what those areas are made of and how they are connected, where a path through them might be cleared and what it could lead to. This can feel like lost time in the short-term rush, but it is an essential and efficient investment in reaching the long-term goal of urban sustainability.

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*[Organizational Note: This report includes an **EMAP Strategy Guide** (presented in **Chapter 5**) as a general tool for other energy offices to use in developing plans to address institutional barriers in their jurisdictions. The **Guide** is designed so that it may be used independently from the rest of this report.]*

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* The EMAP Strategy Guide is paginated independently so that it can be used separately from the rest of this report.

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ABSTRACT

Energy offices working to improve the efficiency of local government facilities face not only technical tasks, but systemic limitations due to *institutional barriers*. These barriers include: budget structures that do not reward efficiency, a generally low awareness of energy issues, and purchasing procedures based only on minimizing initial cost. The Bureau of Energy Conservation is working to remove such barriers in the City & County of San Francisco through the development of an Energy Management Action Plan, or EMAP. In addition, the Bureau has developed a methodology for other local government energy offices to use in designing Energy Management Action Plans for their jurisdictions.

The Bureau first identified and listed 37 institutional barriers in areas such as Operations & Maintenance, Purchasing, and Facility Design. These barriers were then reorganized into three groupings--Policy & Attitudes, Budget & Incentives, and Awareness & Information--and mapped onto a system diagram that illustrates how the barriers interrelate. This characterization expresses our key finding: that barriers mutually reinforce each other, and that the three groupings of barriers hold each other in place. Permanent change therefore requires a holistic approach that addresses mutually-reinforcing barriers in all three groupings.

The second phase of the project involved researching the chosen setting for the project, the City's Recreation & Parks Department, which the Bureau selected as a model department. We compiled quantitative information about facility energy use into a Departmental Energy Review. Through staff interviews, we learned how barriers affect conservation in the department and how decisions that impact energy use are made at various levels.

The Bureau then generated ideas for projects to remove specific barriers. We rated these projects according to their potential impact and the resources required to implement them. Based on the ratings, and with an emphasis on addressing barriers in each grouping on the systems diagram, the Bureau selected a set of projects for implementation. Four of the six projects selected form a synergistic set focused on Recreation & Parks maintenance staff: a cost-sharing lighting retrofit program, a boiler efficiency program, a departmental energy tracking system, and a budgetary incentive program for conservation. The other two projects are City-wide in scope: promotion of a new term contract supplying energy-efficient lighting materials, and publication and distribution of our *ENERGY NEWS* newsletter.

Drawing on our experience identifying barriers, gathering information, and designing and selecting projects to address barriers, the Bureau created a general methodology, the **EMAP Strategy Guide**, to assist other energy offices in developing EMAPs for their jurisdictions.

During the course of the project, the Bureau made progress toward removing institutional barriers in San Francisco, and now has an EMAP to use as a guide for ongoing work. Other jurisdictions can further this process by developing their own EMAPs, beginning to implement measures, and sharing their experiences with others.

The work described in this report was funded in part through a grant awarded by the Energy Task Force of the Urban Consortium for Technology Initiatives.

CHAPTER 1: PROJECT OVERVIEW

1.1 PROJECT CONCEPT

"Sustainability will require a major restructuring of traditional institutions so that decisions are based on an equitable accounting of all costs to be borne today and in the future... It is unlikely that societies can be persuaded to make rapid changes on the scale necessary to leap into sustainability. A strategy more likely to succeed is a coherent long-term program with a clearly defined set of objectives and a process for achieving them. This strategy will require a major restructuring of urban communities and a redirection of many traditional institutions."

The Sustainable City Project Report, UC/ETF Year 10

"Traditional institutions" are often identified as a major obstacle between the unsustainable reality of the present and visions of a sustainable society. Traditional institutions are the reason that sustainable energy strategies suggested by conservationists such as Amory and L.Hunter Lovins, who estimate that state-of-the-art technologies and designs could save 80% of the energy consumed by buildings, are so far from being realized. Why do local governments still use grossly inefficient incandescent light bulbs to illuminate facilities? Why do local government designers often not specify energy-efficient (and *cost*-efficient) lighting, motors, and HVAC equipment for new construction? Why are their maintenance budgets so low that equipment runs inefficiently and fails prematurely? Why do they pass up investments in energy-efficiency with high rates-of-return, continuing an unnecessary drain on local government funds?

Public energy offices working toward sustainability inevitably experience the effect of ***institutional barriers*** that impede their efforts. Such barriers include not only proverbial bureaucratic red tape, but poor decision-making procedures, low awareness of energy issues and efficient technologies, and budget structures that give no incentive for efficiency. Energy programs in older jurisdictions with deeply entrenched bureaucratic structures are especially likely to work within such an environment.

These barriers fundamentally limit the success of public energy programs, so addressing them is an essential component of an energy office's work. Yet the institutionalized nature of such barriers makes them exceedingly difficult to work on. System-wide barriers influence operations across departmental boundaries, so removing them involves coordinating a large

number of people. A number of questions arise when facing this intimidating task: What exactly are the institutional barriers that impede energy conservation? Which barriers are most important to work on? If we could change them, what would we propose? How much can we take on?

This situation can only be remedied by a comprehensive, thoughtfully-guided, long-term program that works to streamline *"the system"* even as it achieves concrete short-term goals. Energy offices need a strategic planning tool that they can use to identify institutional barriers that inhibit their work, and to develop an effective and realistic plan for removing them. The Bureau of Energy Conservation designed the **Energy Management Action Plan (EMAP)** to be such a tool. In this project, the Bureau developed and put into action an EMAP for San Francisco, and developed an **EMAP Strategy Guide** to assist other energy offices in designing their own EMAPs.

1.2 PROJECT BACKGROUND AND PURPOSE

San Francisco's Bureau of Energy Conservation, like most other local government energy offices, operates in an environment that limits program effectiveness. We frequently run up against a list of *"if onlys"*: *if only* Purchasers used a Life-Cycle Cost procedure; *if only* departments got to keep energy savings as an incentive for conservation; *if only* there were a consistent, enforced policy that mandated energy efficiency; *if only* energy-efficient equipment was as readily available to city purchasers as standard items on contract.

Bureau staff watch for opportunities to streamline processes and institutionalize energy-wise practices. Some successful efforts in the past have given us a taste for the benefits of designing new programs to circumvent institutional barriers. The Bureau's Simplified Energy Conservation Measures Program (SECMP) is an example of such a success: in the early years of the Bureau, each lighting retrofit, regardless of scope, required a specific budget request. This meant that the period between specification and actual implementation of even a small retrofit was typically a year or more, since acquiring funds involved submitting a request in November for funding the following fiscal year, which is often not available until September. In addition, funding was never certain, so the Bureau could not make a solid commitment to perform any given retrofit. This uncertainty made facility staff less enthusiastic about assisting us in the auditing and specification stages of a project.

To improve this situation, the Bureau designed the SECMP as a way to perform a series of medium-scale lighting retrofits (about ten \$10,000 retrofits a year) out of one capital improvement fund. The Bureau obtains the funding without specific projects being determined in advance, and can now respond almost immediately once specifications for a project are finalized. This greatly simplifies our work, and increases cooperation from facilities staff.

While we have made some gains, there has not been a comprehensive plan of action that

holds promise for long-term, permanent, system-wide change. Dissolving the underlying barriers that limit our work is a daunting task--staff never have enough time to address such large concerns in the face of immediate exigencies. As our programs have matured, they have reached limits dictated by institutional barriers. For example:

- ▶ the Bureau's Design Review & Assistance Program was not learning of upcoming new-construction projects early enough in the design process to have input, and faced designers who were unaware of many efficient technologies, unwilling to specify new equipment that facility maintainers were unfamiliar with, and had no policy mandating efficient design;
- ▶ the Lighting Retrofit Program realized how much more effective it could be if departments had an incentive, through energy savings being available for other uses, to pursue energy conservation themselves;
- ▶ the distribution and promotion of new efficient technologies such as electronic ballasts and compact fluorescents progressed sluggishly due to purchasing disadvantages and a general lack of familiarity with the products and their multiple advantages.

In other words, improving the efficacy of our programs virtually *required* the Bureau to address institutional barriers.

At the same time, the Bureau was in contact with several other agencies interested in overcoming institutional barriers:

- ▶ eventual project partner and model department Recreation & Parks wrote to us that they wanted to make energy conservation a high priority;
- ▶ the City of Palo Alto contacted us to participate in a brief survey that they designed to identify the most thorny barriers faced by local governments around the state;
- ▶ the California Energy Commission conducted a series of discussion groups on barriers to energy conservation;
- ▶ the City's other environmental agencies, which the Bureau had begun to meet with informally, expressed frustration with barriers similar to those the Bureau faces.

The interest of these groups made the Bureau confident that work on a strategy for overcoming barriers would be timely and valuable to others, and also that we would have help with the project.

We realized that a plan developed to address the barriers that most limit our work in San Francisco would be a unique match between the specific opportunities we discovered and the resources available to us, and would not necessarily be immediately useful to other communities. Thus, in order for us to generate the a truly transferable product, it was important to consider a more general case as we created a plan for San Francisco. Thus, the dual purposes of the project were to create an EMAP to aid the Bureau's work, and to use the experience gained in this process to design a general **EMAP Strategy Guide** to assist other energy offices in developing EMAPs for their jurisdictions.

Through this project, the Bureau stepped back to examine "the big picture," to learn more about where and why our efforts encounter resistance, what motivations are needed for City staff to make energy-efficiency a high priority, and who might buy into our mission as allies,

staff to make energy-efficiency a high priority, and who might buy into our mission as allies, giving us additional leverage. We worked to understand not only the characteristics of individual barriers, but also the interconnectedness of barriers that offers clues towards removing them. We then generated an EMAP that serves as a long-range planning tool, and used it to select actions for immediate implementation.

These actions addressing specific institutional barriers have already yielded concrete results for the Bureau:

- ▶ we held a well-received Boiler Efficiency Workshop for Recreation & Parks engineers, addressing the lack of ongoing education in operations and maintenance;
- ▶ Recreation & Parks has funded an electrician to perform lighting retrofits, addressing lack of buy-in from departments;
- ▶ we developed a prototype version of an Departmental Energy Tracking system for Recreation & Parks to address the lack of useful energy use information currently available to departments;
- ▶ we have initiated an ongoing discussion about strategies to offer departments an incentive to conserve, to address the current absence of such an incentive;
- ▶ we created and are promoting a term contract supplying energy-efficient lighting materials to the City, addressing the difficulty in purchasing new efficient technologies;
- ▶ we produced and distributed a second copy of our *ENERGY NEWS* newsletter; addressing the lack of awareness of energy conservation opportunities.

This was the purpose of developing the EMAP: to implement a set of projects that are designed specifically to address barriers and selected because they support each other.

Having invested time in creating the EMAP, the Bureau also benefits by having a long-range plan to reference for guidance in choosing program directions. Other energy offices can benefit similarly from generating an EMAP for their jurisdictions. We believe the synergism of many local governments pursuing such a path at once and exchanging information can bring about major institutional change toward urban energy sustainability.

1.3 PROJECT DESIGN

In the EMAP project, the Bureau pursued two parallel tracks concurrently: developing a specific EMAP for the City & County of San Francisco (focusing on project partner Recreation & Parks Department as a model department) and developing the **EMAP Strategy Guide** to help other energy offices create EMAPs for their jurisdictions. The first track was structured around four steps:

1. listing institutional barriers, then organizing them to study their interconnections;

2. gathering information about Recreation & Parks through a quantitative Departmental Energy Review (centering on consumption data at each facility) and through interviews with departmental staff;
3. using the information from the first steps to generate ideas for projects that work to remove institutional barriers;
4. developing a set of criteria for rating the projects and selecting a complementary set of projects based on these criteria and the amount of resources the Bureau has to commit.

When we completed these four steps, we possessed an Action Plan that laid out the top priority projects for immediate implementation. Fig. 1.1 shows the EMAP development process schematically.

FIGURE 1.1 Schematic of the EMAP Development Process

The four steps above also form the foundation of the second track, developing the general **EMAP Strategy Guide**. The development of the general **Guide** was closely tied to the process of developing our EMAP for Recreation & Parks: at each step in the process, the Bureau considered the general case, keeping detailed documentation to aid in identifying important aspects of the process. Peer review from representatives of other energy offices (the Cities of Palo Alto and Berkeley were project partners, as well as the California Energy Commission) and other San Francisco environmental offices (Recycling, Water Conservation, and Clean Water) provided valuable input based on a range of their own experience, helping us keep a broad view.

1.4 SUMMARY OF PROJECT RESULTS

The EMAP project, both in concept and in practical execution, was founded on much that was already known about barriers and project design. The Bureau built upon this foundation to increase our knowledge in several areas, with the following results:

- ▶ The project identified 37 specific institutional barriers, and defined the specific ways in which each barrier inhibits efficiency.
- ▶ The Bureau studied how these barriers interrelate on several levels, from specific causalities between individual barriers to an overall tendency for different groups of barriers to reinforce each other. This behavior is illustrated on a *system diagram* (Figs. 2.2 and 2.3) which categorizes barriers into three main categories (*Policy & Attitudes*, *Budget & Incentives*, and *Awareness & Information*) that tend to lock each other into place, as well as a fourth category (*Coordination Issues*) that affects the flexibility of the entire system.
- ▶ Through past experience with the successes and failures of energy conservation programs, we determined that the critical factor in successfully overcoming institutional barriers is addressing interrelated barriers in all three of the above areas. This was an important finding, in that it enabled us to use our understanding of barriers and their interrelations to form a strategy for effectively addressing barriers.
- ▶ We developed a systematic process for developing potential projects addressing key barriers, and for selecting the highest priority projects for implementation. Using this process, we selected a set of pilot projects for implementation in San Francisco.
- ▶ The Bureau undertook pilot projects to: create a term contract supplying energy-efficient lighting materials to City departments; develop an energy newsletter for City maintenance personnel; launch discussions of possible budget incentives for departmental conservation; begin development of an improved departmental energy bill; and share costs on lighting retrofits and boiler improvements with the Recreation & Parks Department, a project partner serving as a "model department." These projects have yielded positive results, both subjective improvement of barriers as well as measurable dollar savings.

These results, along with other practical lessons we learned from this project, are discussed in more detail in the body of the report and in the **Conclusion**. One last, optimistic finding from our experience: projects focusing on removing institutional barriers *do* effect change, and including such projects in the overall program mix of an energy office can greatly improve the environment for pursuing energy-efficiency.

1.5 REPORT ORGANIZATION

This report chronicles the Bureau's development of an EMAP for the City & County of San Francisco (focusing on project partner and model department Recreation & Parks) and presents a generic process for developing an EMAP.

- CHAPTER 2** describes institutional barriers, both in concept and actual details, as groundwork for the work of generating a plan for overcoming them. First we define the concept of institutional barriers. Next we present our compilation of barriers, first defined individually in a list, then grouped on the *system diagram*, an organizational model for understanding the interconnections between barriers. We report on the input from our reviewing partner cities and agencies, and compare our barriers and organizational scheme with the findings of other agencies that have studied barriers.
- CHAPTER 3** describes the EMAP process through which the Bureau defined, selected and implemented projects to overcome institutional barriers in the City. We describe San Francisco's specific situation to clarify distinguishing characteristics as well as areas of similarity to other cities. We describe our collaboration with the Recreation & Parks department, which provides a proving ground in a microcosm of the entire City structure. We give details on the process we used to design projects, the methodology we used to select several of these for implementation, and the actual projects we are undertaking: four focusing on Recreation & Parks and two addressing barriers on a City-wide scale.
- CHAPTER 4** evaluates the progress of our work toward removing institutional barriers to energy conservation in the City & County of San Francisco, summarizes the key findings of the EMAP project and the many lessons learned through the project, and recommends directions for ongoing efforts.
- CHAPTER 5** presents the **EMAP Strategy Guide**, a working methodology for other energy offices to use in developing EMAPs for their jurisdictions.

CHAPTER 2: INSTITUTIONAL BARRIERS

The concept of *institutional barriers* is at the core of this project, and a solid understanding of barriers is the foundation on which to base the development of an EMAP. This chapter first defines our use of the terms *institutional barrier*, *sustainability* and *EMAP* (Section 2.1). It then presents the list of barriers that the Bureau has identified, with examples of how the barriers manifest themselves in the environment in which the Bureau works (Section 2.2--the barriers are listed at the end of the section in Fig. 2.1). The list of barriers evolved into the *system diagram* (Figs. 2.2 and 2.3 in Section 2.3), which shows interconnections between the barriers and leads to a guideline for dismantling institutionalized barriers. In Section 2.4 we compare our list of barriers and organizational scheme with the findings of other agencies that have studied barriers. Finally, we report on the contributions of project partners who reviewed the Bureau's work identifying barriers (Section 2.5), and show the commonality of institutional barriers.

2.1 DEFINITIONS

The EMAP project focused on identifying and addressing institutional barriers to energy efficiency in local government jurisdictions. The concept of institutional barriers, however, is also broadly applicable to most organizations. The work of our project partners from other San Francisco environmental offices, for instance, is constrained by institutional barriers similar to those we face. Therefore we propose two definitions, one for the general case and one for the specific case that this project has focused on.

In the general case:

institutional barriers are patterns of operation that inhibit an organization's progress toward effective, efficient fulfillment of its mission.

In the specific case of this project, which seeks to improve the efficacy of local government energy offices:

institutional barriers are patterns of local government operation that inhibit progress toward effectively and efficiently increasing energy-efficiency.

The Bureau's mission, most simply defined as increasing energy-efficiency in the City & County of San Francisco, is similar to that of other environmental agencies in the City and elsewhere: to make our jurisdictions *sustainable*. Because the nature of this work so often involves changing established institutional procedure, overcoming institutional barriers is particularly relevant to such agencies. The report from *The Sustainable City Project* (ETF Year 10 from San Francisco, Portland, and San Jose) presents the following definition:

sustainability is a state of operations that provides for the present needs of a populace without compromising the ability of future generations to meet their needs.

In the EMAP project, the Bureau worked to develop a strategy, or Energy Management Action Plan (EMAP), for removing the institutional barriers that most impede our office's programs. We define this strategy as follows:

an Energy Management Action Plan (EMAP) is a strategy to overcome institutional barriers to energy-efficiency, consisting of a set of specific projects designed to remove barriers and a methodology for making ongoing decisions about project design, priority, and implementation.

The above definitions cover the fundamental concepts underlying the EMAP project. To ensure clarity, one additional minor definition should be mentioned. In this report, we refer to *facilities maintenance workers*; although this term in a full sense could include carpenters, painters, etc., we use it in a more limited sense to refer specifically to those personnel closely involved with energy equipment, generally comprising only electricians and engineers.

2.2 COMPILATION OF INSTITUTIONAL BARRIERS

As a beginning step in the EMAP project, the Bureau project team compiled a list of institutional barriers that we had encountered in our work. These were aspects of the City's operations that:

- ▶ make program implementation difficult;
- ▶ give no incentive (or actually give counter-incentives) for energy-efficiency; or
- ▶ ignore energy-efficiency as a criterion in decision-making.

Barriers were categorized into six areas: *Motivation, Design, Information/Communication, Operations & Maintenance, Purchasing, and Retrofits*. Additions and comments by other energy officials (from the Cities of Palo Alto and Berkeley and the California Energy Commission--their input is discussed in **Section 2.4**) were incorporated, resulting in the

current list shown in **Fig. 2.1** at the end of this section. The list is not meant to be definitive; there are sure to be barriers that we missed, and variations on those we listed. Energy offices developing their own EMAPs are encouraged to adjust the list to suit the unique situation in their jurisdiction.

Barriers listed range from universal to discrete, from general inhibitive attitudes to specific disadvantageous structures or procedures. Some lead to obvious, definable project solutions, others only suggest directions to work towards. Some require long-term solutions aimed at large-scale structural change, others only require a subtle shift in an energy office's operational methods. Some major barriers require a major effort to overcome them because they must be treated in their entirety, while other large barriers can be addressed in smaller portions. Because the Bureau did not believe any categorization could thoroughly distinguish between the diverse personalities of the barriers, we steered away from developing any such system.

To give a feeling for how some of these barriers come into play in the Bureau's work in San Francisco, several specific cases are described below (see also **Chapter 3** for details about the barriers we have addressed with specific projects selected from our EMAP process):

- ▶ The Bureau promotes compact fluorescents for use in City buildings where they are the simplest retrofit for small incandescent bulbs. Like other retrofit measures, compact fluorescents require an initial investment, but the return over the life of the unit is much greater than the initial cost. In order to switch from incandescent bulbs to compact fluorescents in a typical application, a department must go from buying three \$0.60 bulbs a year to one \$15.00 compact fluorescent every three years. This switch is difficult, since maintenance divisions that are responsible for purchasing materials such as light bulbs do not pay for the electricity, and thus do not save funds from lowered energy costs. The overall materials cost is more (with no funding to cover the increase) and the timing of purchases, assuming they are made on an as-needed basis, is awkwardly long compared to the funding cycle. (This is a case of **MI No Budget Incentive**)
- ▶ The Bureau is beginning to work more closely with City architects on facility renovations. Straightforward design recommendations, such as specifying electronic ballasts and T8 lamps for new fluorescent lighting, are not mandated by a policy, and are met with the question, "*How much more will this cost?*" The incremental costs, even if obviously cost-effective, are seen as additional to expenses covered by bonds funding the work. To include these specifications, the Bureau has to acquire separate capital funding. (**M2 No Policy, D3 ECM First Cost**)
- ▶ A consultant to the Bureau specified variable-frequency drives (VFDs) for a new HVAC system as part of a renovation. The Design Engineer in charge of the project contacted the shop at Public Works responsible for motor maintenance. The shop staff asserted that VFDs were too complicated to maintain, and that maintenance workers had disabled the few that had been installed in the past. This convinced the Design Engineer to specify less-efficient standard motors. (**OM4 Technology Anxiety**)
- ▶ Many maintenance staff are not trained in equipment efficiency, so they are not fully aware of the energy impact of their work. In addition, maintenance staff are often not

given adequate funding, so they are constantly hustling just to keep equipment operational. (*OM1 Lack of Maintenance Knowledge, OM2 Low Maintenance Funding*)

- ▶ Occasionally, a facility that the Bureau has retrofit does not show the decrease in usage expected after the project is completed. In one such case, new high-wattage security lighting was installed shortly after our work was complete. In another case, the steady addition of electronic office equipment has increased the facility's load despite ongoing conservation projects. In such cases, education is required to ensure that *avoided costs* are included in a cost-benefit analysis, not just the bottom-line change in energy usage. (*I2 Savings Fall Short*)
- ▶ The Bureau promotes the incorporation of energy-efficient electronic ballasts and T8 lamps into routine maintenance of existing fluorescent fixtures. However, maintenance staff balk at changing burned-out ballasts to the newer efficient combination because retrofitted fixtures will (for a time) differ from adjacent fixtures in the appearance of the light (since the T8 lamps have a different color) and in maintenance requirements, forcing the lamp-changer to keep track of an additional type of lamp. (*R8 Mixed Technologies*)
- ▶ A prospective lighting retrofit was put on hold indefinitely because some of the existing ballasts were old enough to have PCBs, and the City has no coordinated system for dealing with them as hazardous waste. (*R6 Environmental Issues*)

These examples demonstrate how individual institutional barriers affect the Bureau's work. While an understanding of the mechanics of each barrier is important, it is equally critical to examine the connections between the barriers (*Section 2.3* explores these connections, beginning page 15). Through such examination one can envision steps necessary for change, and these steps will be the basis for creating an EMAP.

FIGURE 2.1 List of Institutional Barriers

Purchasing

Barrier	Description	General Solution
P1 First-Cost Purchasing	Purchasing is based on lowest first cost, resulting in selection of products which cost much more over their lifetimes.	Create a policy that mandates specific equipment; educate purchasers on fiscal logic of Life-Cycle Cost purchasing methodology.
P2 New Technologies Hard to Get	Purchasing contracts for equipment do not include new efficient products, giving traditional equipment undue price and administrative advantages.	Locate existing government contracts that include new efficient items, or create your own, making the products as easy to purchase as those on existing contracts.
P3 Unfamiliar Technologies	Purchasers and specifiers hesitate to buy new efficient equipment that they are unfamiliar with.	Educate specifiers and purchasers about efficient products, and demonstrate a demand for them.

Design

Barrier	Description	General Solution
D1 No Design Expertise	Designers lack expertise in energy-efficient design practices and equipment.	Identify and develop resources for design review and training; provide technical guidance.
D2 Unknown Projects	Energy review is not formally integrated into the design process so opportunities for review of planned projects are missed.	Study design process and identify key design staff; develop and institutionalize a mechanism for identifying upcoming opportunities.
D3 ECM First Cost	Designers balk at cost-effective energy-efficient design because it costs more than traditional designs.	Obtain funds for incremental costs; educate funders about decreased future operating costs.
D4 No Continuity	Assisting designers on one specific project does not result in knowledge carried over to future projects.	Teach general energy-efficient design principles, using specific projects as case studies.
D5 No Ongoing Education	Designers are not kept current on evolving energy-efficient equipment and practices.	Demonstrate benefits of keeping designers up-to-date, and supply materials, contacts, and training.

(Fig. 2.1 Institutional Barrier List cont'd)

Motivation

Barrier	Description	General Solution
M1 No Budget Incentive	Savings from conserved energy do not directly accrue to the department responsible for the conservation, thus there is no direct budgetary incentive for such conservation.	Structure a shared-savings program, allowing a conserving department to spend a portion of savings resulting from their efforts on departmental needs.
M2 No Policy	There is no definitive policy mandating energy-efficiency and conservation, leaving energy decisions to individual discretion at facilities.	Convince individual decision-makers of the need for conservation, stressing benefits that overlap their agenda; help policy-makers create/enforce policies.
M3 Nearsighted Planning*	Decision makers are most responsive to short-term visible issues, and are not motivated to plan long-term.	Make efficiency an issue that decision-makers cannot ignore by publicizing the risks of inaction.
M4 Low Awareness	Staff (and public) do not fully understand or value the benefits of conservation.	Develop education programs for staff (and the public where appropriate).
M5 Low Priority	Immediate, critical issues (such as staff cutbacks) make energy conservation a low priority, especially in terms of funding.	Educate funding decision-makers about the benefits of conservation, emphasizing financial aspects and overlap with their agenda.
M6 Incomplete Buy-in	Projects are not fully supported by those who are uninformed or outside of the decision-making process.	Cultivate lines of communications (in both directions) with all involved parties.
M7 Change Resisted	Because changing the <i>status quo</i> is difficult and perceived as risky, staff resist change.	Use tangible project results to reduce perception of risk and illustrate the benefits of changing.
M8 Loan Anxiety	Financial officers are unwilling to pursue loans for energy conservation projects because of the perceived risk and a low awareness of benefits.	Through success stories and thorough analysis, demonstrate to decision-makers that risk is low and return-on-investment high.
M9 No Constituency	Public support for energy efficiency is diffuse, so decision-makers are not pressured to support efficiency.	Develop ties with local organizations that support conservation; publicize programs and enlist support.

(Fig. 2.1 Institutional Barrier List cont'd)

Information/Communications

Barrier	Description	General Solution
IC1 Poor Tracking	Facility energy use is not adequately tracked so billing errors are not found and valuable info regarding facility performance is unavailable.	Improve or create the tracking system to provide information to the appropriate departmental staffpersons in a useful format.
IC2 Savings Fall Short	Savings from ECMs fall short of projections due to faulty analysis, load increase, etc.	Directly measure savings when possible, document assumptions, follow up on projects., and emphasize <i>cost avoidance</i> .
IC3 Invisible Results	Project savings are difficult to demonstrate due to poor tracking or inadequate monitoring hardware.	Increase tracking and monitoring capability; use well-measured results from similar projects to back up projected results.
IC4 Out of Touch	Miscommunication or lack of communication—"one hand not knowing what the other is doing"—limits the effectiveness of programs.	Determine all relevant parties and keep them informed; establish permanent channels of communication between them.
IC5 Non-Budget Benefits	Benefits such as reduced maintenance or environmental externalities are not directly reflected in the budget and so are valued less.	Quantify these benefits, and educate budgetary staff about their importance both in terms of departmental missions and fiscally.
IC6 Lots of Facilities	Energy offices have insufficient resources to audit all municipal facilities in order to determine which need the most attention.	Identify existing resources that catalog facility data, develop a system-wide tracking system, and characterize facilities for comparison.
IC7 New Technical Information	New efficient technologies raise many questions regarding performance and other issues that are difficult to keep pace with.	Cultivate a network of information resources from government and private designers, research labs, professional associations, vendors.

(Fig. 2.1 Institutional Barrier List cont'd)

Operations & Maintenance

Barrier	Description	General Solution
OM1 Lack of Maintenance Knowledge	Maintenance staff are not trained in basic maintenance, especially the energy efficiency aspect of their work.	Help maintenance staff get training, including efficiency; demonstrate the cost-effectiveness of this investment.
OM2 Low Maintenance Funding	Underfunded maintenance results in premature deterioration and inefficient operation of equipment.	Educate budgetary and O&M decision-makers on the fiscal implication of poor maintenance.
OM3 Waiting for Failure*	Funds for "emergencies"—ie. failed equipment—are more available than for routine maintenance, so equipment is not maintained.	Restructure maintenance funding to support cost-effective ongoing maintenance.
OM4 Technology Anxiety	New efficient products are not embraced by operators who are accustomed to familiar equipment and fear new complexities.	Provide training on new technologies, reference resources, and case studies of peers that use such technologies successfully.
OM5 Job Preservation	City facility maintainers keep equipment in a condition where it requires continual attention in order to guarantee their jobs.	Show the extensive work that is currently not being performed that could be if maintenance resources were freed up.

(Fig. 2.1 Institutional Barrier List cont'd)

Retrofits

Barrier	Description	General Solution
R1 Insufficient Funding	Low funding levels do not allow energy offices to implement cost-effective retrofits.	Educate decision-makers about the need for conservation and the long-term costs of <i>not</i> investing in efficiency.
R2 No Multi-Year Contracts	Because laws restrict contracts to one year, third-party financing is not possible.	Convince policy-makers of the value of third-party financing, and seek to make it legal.
R3 Funding Delays	Obtaining funds for energy retrofits requires substantial effort and delays implementation.	Set up funding that can be used flexibly, with less administrative effort, for projects yet-to-be-identified.
R4 Isolated Projects	Isolated retrofits at individual facilities are not fully integrated into departmental operating procedures.	Retrofit groups of facilities that offer similar opportunities and can be tied functionally under common policies.
R5 Narrow Focus	Equipment retrofits lose additional savings (or fail to realize expected savings) due to non-equipment factors, such as occupant behavior.	Look for opportunities that complement equipment change-out; meet with occupants before and after retrofits to identify issues and opportunities.
R6 Environmental Issues	Energy-saving retrofits can tie into other environmental issues, such as "generating" hazardous waste when replacing fluorescent ballasts.	Establish contacts and coordinate efforts with other city and regulatory agencies responsible for dealing with these issues.
R7 Action, Not Studies	Facility staff are discouraged by lack of action (usually due to a lack of funding) and resent studies that do not seem to lead to any action.	Provide some action in the near term to gain confidence; demonstrate the value of audits and other studies to facility staff.
R8 Mixed Technologies	Replacing old equipment (such as magnetic fluorescent ballasts) on an as-needed, partial replacement basis results in a confusing mixture of technologies.	Perform comprehensive retrofits to change all equipment at once; organize replacement on an orderly basis coordinated with operators.

2.3 THE SYSTEM DIAGRAM

The linear listing of institutional barriers, while sufficient for defining each barrier, lacks information about how the barriers influence each other. This information is critical when faced with the task of developing a strategy for removing barriers. We know from experience that addressing a single barrier as if it were an isolated problem does not result in the optimum solution envisioned, and that a successful approach requires working on several mutually supporting fronts at once. This is because the barriers reinforce each other, holding each other in place and inhibiting energy-wise decisions and actions. If we are to transform the web of institutionalized barriers into a clear-flowing network where decisions tend naturally toward energy efficiency, we need to examine how all the barriers are interconnected.

The Bureau's first efforts at identifying connections between barriers produced a spaghetti-like maze of connections. Simplifying the graphic in order to make it more comprehensible, we focused on the first order of connections, with the knowledge that in reality all of the barriers are interconnected. We looked for similarities that suggested appropriate groupings,

Fig. 2.2 Simple System Diagram

and then looked for the primary causality of the barriers--which seemed to lead to which. Almost all barriers fell into one of three groupings: ***Policy & Attitudes***, ***Budget & Incentives***, and ***Awareness & Information***. These groupings are intimately connected: the lack of education, awareness, and information about energy conservation feeds an attitude that keeps energy conservation a low priority; because energy conservation is a low priority, policies are not implemented to ensure that the budget structure provides an incentive for the most prudent energy choices; the lack of a budget incentive to conserve creates an environment where education, awareness and information are not sought. (Fig. 2.2 shows this inter-relationship schematically.) Like three engaged gears, when any one resists motion, they all slow down.

Placing all the barriers into their respective groupings and drawing lines to indicate their primary connections resulted in the full ***system diagram*** pictured in Fig. 2.3. The set of barriers that make up each grouping are drawn from all categories of the List of Barriers (Fig. 2.1). Whereas the List organized barriers by operational area (such as Purchasing or Retrofits) the system diagram groupings characterize barriers by their root nature, *how* they affect operations.

Most barriers fall into one of these three groupings, but several barriers act in a more general manner. These are treated as a fourth category called ***Coordination Issues***. Typically these barriers involve the need for improved communication and coordination between involved parties. Because they generally affect the entire system, these barriers are placed in the medium surrounding the three main groupings. If the three groupings are gears, these issues are lubricants that either help the system spin smoothly or gum up the works.

The diagram uses lines to show direct connections between barriers, with arrowheads to indicate causality. An arrow pointing from ***P1 First-Cost Purchasing*** to ***P2 New Technologies Hard to Get*** indicates that the lack of a Life-Cycle Cost purchasing procedure contributes to the difficulty in procuring new efficient technologies. As described earlier, the three groupings have a specific interaction; we find the causal flow between the three groupings to be predominantly in a clockwise direction.

In interpreting the information on the diagram, the Bureau views the barriers as situations that lie somewhere along a spectrum. For instance, ***P3 Unfamiliar Technologies*** on the diagram represents the current status of purchasers' and specifiers' familiarity with new efficient technologies, which falls somewhere between entirely unaware to completely informed. The goal of an EMAP project focussed on this barrier would be to move this situation toward the ideal end of the spectrum.

A biological metaphor can clarify the interactions described by the diagram. The entire system is like an organism whose vitality depends on the integrated, healthy operation of three internal organs, which in turn rely on internal components that work together. The functions of the organs are interrelated, so that their overall performance is limited by the least effective organ. In addition, components floating in between the organs are needed for effective neurological connections. The organism tends toward equilibrium by reinforcing the state that is most entrenched; a healthy component will quickly tire and degenerate if connected components are unhealthy, and a poorly operating component will be rejuvenated if connected components are healthy.

Fig. 2.3 Full System Diagram

With vitality defined as the process of generating a sustainable City, our organism is not thriving at present. Decisions are not based on energy-efficiency and other features of sustainability. However, as we work on barriers, the components of the organism will begin to function in ways that reinforce decisions based on sustainability.

The system diagram was key in the Bureau's understanding of the nature of institutional barriers. It gave form to our general experience that a holistic approach was needed to effect permanent results. From this diagram, we concluded that:

a successful project to eliminate institutional barriers must include focused work on barriers in each of the three groupings.

For example, the Bureau created an Energy-Efficient Lighting Materials term contract as a step towards increasing the usage of efficient lighting products in the City. While the contract directly addresses ***P2 New Technologies Hard to Get*** in the ***Budget & Incentive*** grouping, it will be only nominally successful in increasing the City's usage of the efficient products unless concurrent efforts are undertaken to:

- ▶ educate City decision-makers about the value of the efficient products;
- ▶ provide information to City staff who use the efficient products;
- ▶ pursue policies that mandate usage of the efficient products; and
- ▶ ensure that departments have sufficient funding to afford the additional first-cost, perhaps through a budgetary incentive and a Life-Cycle Costing procedure.

In other words, other barriers from all groupings need to be addressed for the solution to one individual barrier to take hold.

Unlike the interlocking barriers represented in the three groupings, barriers that fall within ***Coordination Issues*** may be tackled independently with success. Often the solution is to improve communication channels. Such improvement acts to create a better environment for the other components in the system to improve.

These general findings guided our process for designing potential projects and selecting a set of projects for implementation, the topic of **Chapter 3**.

2.4 PEER REVIEW FROM PARTNER CITIES AND AGENCIES

The Bureau met with two sets of project review partners to get outside input into the project process and to increase the knowledge base informing our work. The first meeting, with representatives from other City environmental offices, reviewed the listing and organization of institutional barriers. The second meeting, with representatives from energy offices in other jurisdictions, also reviewed the barriers, but focused more on the evolving

methodology for developing an EMAP. By adding insight from experiences in a range of settings, these partners helped ensure the usefulness of the final EMAP to other jurisdictions. Those involved also grew interested in the benefits of continuing to meet regularly to discuss how we each fare in our struggles with institutional barriers.

Most individuals attending had substantial experience with certain institutional barriers in their setting. Interviews with them individually would provide more detail about those specific barriers. Because of staff resource limits, the Bureau has chosen a strategy of pursuing this information only when it is directly applicable to our EMAP projects.

City Environmental Offices

The first meeting was attended by representatives from some of San Francisco's environmental offices: the Recycling, Water Conservation, and Clean Water programs. Our goals for the meeting included ascertaining:

- ▶ the partners' level of familiarity with the institutional barriers we had listed;
- ▶ the need for additional barriers to be listed;
- ▶ the degree to which barriers present problems for partners;
- ▶ the success of attempted solutions to barriers.

A further goal was to look for ways that the environmental offices might join forces in working on common institutional barriers.

As we suspected, the partners were quite familiar with the concept of institutional barriers and the role of barriers in impeding their work. Excluding barriers dealing solely with energy issues, the partners had encountered a significant number of the barriers in similar forms to the Bureau's experiences. Water Conservation expressed special frustration with trying to purchase new efficient items like low-flow showerheads (*P2 New Technologies Hard to Get, P3 Unfamiliar Technologies*). Recycling said that their Green Office program (aimed at inducing a higher rate of recycling and use of recycled materials) had been unsuccessful due to a lack of awareness and buy-in from secretarial staff, and the absence of any policy dictating compliance with the program (*M4 Low Awareness, M6 Incomplete Buy-in, M2 No Policy*). Clean Water's efforts to irrigate Golden Gate Park with reclaimed water were blamed for damage to sensitive plants (*R6 Environmental Issues*); Clean Water also found themselves unaware of a facilities-surveying project being conducted within their own department which could present a valuable opportunity to couple their office's projects with other ongoing work (*IC4 Out of Touch*).

The approach taken so far by the other environmental offices to address barriers can be summarized as "*going to the top*". The partners concurred that efforts should focus on those individuals with authority to make policy. Policies take the pressure off of others, such as the Purchasing Department, who hesitate to operate differently because of the risk of being blamed for a problem. With a policy in place, the partners maintained, their work becomes enforcement rather than marketing. In order to create a sustainable policy, policy-makers must be educated and convinced, and their buy-in must be spread throughout the organization.

The partners agreed that having information readily accessible to City staff is essential. The new products and operations inherent in the work of the environmental offices require the support of a large portion of the City's staff, and this support is contingent on the staff being confident that they have experts to call on for assistance. This means that the offices need to provide appropriate, helpful materials; offer easy, direct consultation over the phone or on-site; and offer educational programs.

One common issue that tied our situation as an energy office to that of the Recycling and Water Conservation offices was the need to incorporate new products, such as compact fluorescents, low-flow toilet valves, or recycled paper, into standard usage. This effort, in each case, encounters specific barriers around the procurement of these items, plus a host of attitudinal barriers that inhibit the adoption of the products into common usage. Overcoming these barriers necessitates work on policies, budgets, and education, in order that the usage of the products is mandated and funded, and that the new products, as well as the spirit behind them, are understood and adopted. Only then will the system facilitate decisions that lead to sustainability.

The Recycling office's work to incorporate recycled goods into City operations is a good example of the need for such a holistic approach if permanent change is to be accomplished. The Recycling office has accomplished a lot, with a City ordinance mandating usage of some products and term contracts set up to supply them. However, awareness and implementation of the ordinance and contracts, as well as understanding of the products and their value, is low, so the situation is only somewhat improved. As the Recycling office works on these problems, *relevant barriers in all three groupings on the system diagram will have been addressed*, and City paper purchasers will begin to make the desired decisions. Similarly, the Bureau's work to create a term contract to supply compact fluorescents and electronic ballasts will fall short of the goal to have them integrated into City operations without undertaking the associated effort of promoting the items and their value, as well as obtaining appropriate policies mandating their use.

The information shared at the meeting pointed to several opportunities for the environmental offices to join forces in working on barriers, ideally accomplishing more united than individually:

- incorporating new products into the City's purchasing operations
- integrating sustainable design features into new construction and major renovation projects

Although discussion of these opportunities was limited, all participants agreed that joining our efforts may be the most potent way of advancing such practices. The entrance of a newly-created Environmental Commission that will make recommendations to the Board of Supervisors may offer a context for the efforts of our offices to be tied together into a comprehensive strategy towards sustainability. Ongoing communication between our offices will enable us to coordinate our common struggles by sharing our successes and planning collaborative efforts.

Local City Energy Offices

The second peer review meeting involved representatives from the energy offices in the San Francisco Bay Area cities of Berkeley and Palo Alto, as well as a representative from the California Energy Commission (CEC). All partners were familiar with institutional barriers and had been addressing them in various ways: Berkeley uses an innovative arrangement with a community non-profit to fund and perform municipal retrofits; Palo Alto had recently circulated a survey to twelve California cities to learn how they were structured and what barriers their energy programs encountered; and the CEC representative had coordinated several discussion groups on barriers to energy efficiency in the public sector, involving local governments, hospitals, and school districts.

The partners added several barriers to our existing listing; for instance, Palo Alto's energy office had been frustrated by the unwillingness of their government to take on loans that offered the means to perform energy retrofits with high returns. Notes from the CEC's discussion groups echoed many of the barriers we had listed and added several that we had not. Interestingly, each of the CEC's discussion groups also organized barriers into three categories as we had done, with differing definitions. The Bureau's groupings were developed over a longer period of time and so have some claim to being more refined, but there is no one correct organization of barriers. As discussed earlier (see **Section 2.3**) the groupings and connections we have chosen to emphasize are a simplification of a complex system where each barrier is connected to all others; thus, the process of simplification can lead to other valid organizations.

The partners at the meeting singled out several strategies as particularly valuable:

- ▶ Case studies can be key in convincing decision-makers to undertake proposed actions which seem risky by demonstrating that although they have not yet been tried in that jurisdiction, they have proven themselves elsewhere. One partner related that Huntington Beach, California is undertaking two large retrofits as a strategy for helping them out of fiscal crisis. Such an example can be key in countering the common perception that energy-efficiency is a positive but non-essential investment that cannot be considered when budgets are tight.
- ▶ Monitoring of facility energy use should be a priority, since the unknowns that often cloud the actual results of energy projects reinforce the perception of risk. Detailed monitoring can show savings that are otherwise unclear, and factors that affect project savings can be isolated so that unachieved savings can be properly attributed and future planning will be better informed.
- ▶ Giving visible recognition to individuals or groups that are good models of energy-efficient practices works to further reinforce their commitment and to encourage similar participation from others.

A portion of the meeting was dedicated to reviewing the draft EMAP methodology that the Bureau had designed. This methodology was grounded in the strategic planning process that the Bureau typically uses for setting program direction. Project partners recommended several changes to the methodology, but approved of the overall format. The revised list of steps that resulted was used to create the final EMAP methodology presented in **Chapter 5**.

The meeting raised the participants' appreciation of the value of regular inter-jurisdiction communications. Such meetings offer an excellent opportunity for sharing experiences and learning of case studies where a particular strategy has worked. The partnership with others who face similar struggles was inspiring as well. Such groups, meeting regularly to discuss progress in addressing institutional barriers, could form a strong foundation for a decentralized local network of energy offices. Other environmental offices, such as Solid Waste, Recycling, Toxics, and Water Conservation, may be valuable participants as well, if the discussion topics are broad enough.

The Bureau also mailed a letter to the twelve local jurisdictions that Palo Alto's energy office had contacted earlier for their brief survey. The letter described the EMAP project, and solicited *success stories*, cases where a strategy to overcome an institutional barrier had worked. We got very little response, pointing to the common response to an overwhelming workload: "*There's no time to do big picture thinking!*" Many jurisdictions may also not recognize ways that they have overcome institutional barriers. In an effort to encourage local governments to do some "big-picture" energy planning, the Bureau plans to distribute the EMAP report to Bay Area energy offices, and to make it available on a wider scale through such networks as the Association of California Energy Officials.

2.5 COMPARISON WITH OTHER STUDIES

Several other agencies have studied the effects of institutional barriers on energy conservation programs. We reviewed these studies to ensure that we were covering the territory well; they mainly served to independently validate our findings, because their findings paralleled ours to a great extent. They identified many of the same barriers, and grouped them into categories very much like the Bureau's (see table in **Figure 2.4** below). The studies are described briefly below; they drew on resources including municipal, state, and federal officials, utilities, consultants, university and institute researchers, and non-profit organizations promoting energy-efficiency.

Study 1: ***Energy Efficiency in the Federal Government: Government by Good Example?***
Office of Technology Assessment, Congress of U.S., 1991. (OTA-E-492)

113-page report reviewing federal spending on energy and examining opportunities for improving efficiency. The focus is on federally-owned buildings, but vehicle fleets and assisted housing are touched on too. Barriers to energy conservation are reviewed for six case studies, and discussed in a chapter on *Constraints on Increased Energy Efficiency* that tries to answer why the potential for savings (which they estimate at 25%) is not being captured.

Study 2: *1992 Energy Efficiency Report*

California Energy Commission, 1993.

Results of two public focus groups on barriers as well as general CEC experience are presented in a 5-page chapter on the current state of energy efficiency in the government sector.

Study 3: *What is Commissioning and How Much Does It Cost?*

Nancy Benner and Diana Bjornskov, Portland Energy Conservation, Inc., 1993

Presentation from Plenary Session of the National Conference on Building Commissioning, organized by PECL. The authors conducted a survey of conference speakers and used the responses to rank their list of barriers

Study 4: *Green Lights Program* (flyer)

U.S. EPA, Air and Radiation, 1992. (EPA 430-F-92-013)

One of the topics addressed on this one-page flyer is "tackling barriers that impede the widespread use of energy-efficient technologies."

FIGURE 2.4 Comparison with Other Studies

EMAP Categories

Study	Policy & Attitudes	Budget & Incentives	Awareness & Information	Coordination Issues	Other
1) OTA	low priority	LACK OF INCENTIVES	INFORMATION CONSTRAINTS		RESOURCE CONSTRAINTS
2) CEC	LACK OF INTEREST	LIMITED FINANCING	LACK OF INFORMATION		
3) PEC	PERCEPTUAL / ATTITUDINAL	FINANCIAL	education	ORGANIZATIONAL / INFRA-STRUCTURE	LEGAL / REGULATORY
4) EPA	low priority	difficult financing, split incentives	lack of information and expertise		

CAPITAL LETTERS indicate a category of barriers; small letters indicate a single barrier

CHAPTER 3: DEVELOPING OUR EMAP

Chapter 3 presents the Bureau's process of designing and implementing projects designed to impact institutional barriers in the City. This process led to the generic EMAP methodology presented in **Chapter 4** as the **EMAP Strategy Guide**, and serves as a case study for others seeking to address institutional barriers. This chapter's sections describe:

- ▶ the **CONTEXT** (**Section 3.1**) for our work, including the specifics of our situation here in San Francisco in 1992, and our partnership with the Recreation & Parks Department;
- ▶ the first stage of **GATHERING INFORMATION** (**Section 3.2**) through a quantitative Departmental Energy Review and Staff Interviews;
- ▶ the core **PROJECT DEFINITION AND SELECTION PROCESS** (**Section 3.3**);
- ▶ the **RECREATION & PARKS PROJECTS** (**Section 3.4**) that we selected and are implementing, comprising the Retrofit Cost-Sharing, Departmental Tracking System, Budgetary Incentive, and Maintenance Training projects;
- ▶ and **CITY-WIDE PROJECTS** (**Section 3.5**), the Energy-Efficient Lighting Materials Term Contract and the *ENERGY NEWS* Newsletter for facility maintenance staff.

3.1 CONTEXT

The Bureau's work in designing an EMAP and subsequently implementing projects can serve as a case study for others designing their own EMAPs. Such an illustration provides a feel for the overall process and allows others to learn from the things we did that worked and those that didn't. As background for understanding the barriers that most affect the Bureau's programs, it is important to be familiar with San Francisco, and also with the specific department, Recreation & Parks, that we choose to work closely with.

San Francisco's Situation

The City & County of San Francisco, like many local governments, is in a state of financial crisis. Departmental budgets for fiscal year 1992-93 have seen significant cuts--some departments have lost 20% of their funding--and more cuts are expected before the year is out.

This state of insufficient funding makes energy conservation by departments difficult, because energy conservation is not interpreted as part of the department's central mission and is therefore a low priority. The potential for investments in conservation to actually *relieve* financial hardship by retaining energy dollars is overlooked, both because departmental staff rarely look beyond the immediate budget cycle and because saved energy dollars do not accrue to the department. Since projects often take more than one year to break even, those with a short-term view cannot justify any investment even if the return over the life of the project is many times the initial cost. The question is rarely reformed to ask, "*What is the cost of not performing this work?*" Given the choice between spending as little as possible this year or spending as little as possible in a ten year span, current practices inevitably choose the former. This inability to recognize the longer-term fiscal ramifications of decisions to "save" now is a major failure in management.

The City's 1982 Master Plan includes an Energy Component that states as its goal for the municipal sector:

"To establish the City & County of San Francisco as a model for energy management"

and goes on to discuss policies that include funding cost-effective conservation measures to reduce demand, integrating life-cycle costing into purchasing procedure, and planning for regular scheduled maintenance. The Bureau of Energy Conservation is the City agency charged with pursuing these objectives. Given the fiscal environment, the Bureau's lack of political clout, and that this policy goal is actively pursued by few other agencies in the City, energy decisions are effectively left to individual judgement on many levels within departments.

Political receptivity to energy conservation, however, may be on the upswing in San Francisco. The Board of Supervisors recently created an Environmental Commission to advise them. The Board President also stated that the budget structure should be revised to allow departments to keep revenues they generate. Such an incentive could include energy savings resulting from retrofits. It is in this climate that the Bureau has initiated the EMAP process to address institutional barriers that impede our energy conservation programs.

The Bureau's programs deal primarily with saving energy in the 700 municipal facilities, but also serve the private sector, as in the development of a Commercial Energy Conservation Ordinance or the energy assistance element of a neighborhood economic development plan for the Bayview/Hunter's Point neighborhood. Besides coordinating small and large municipal retrofit programs, the Bureau is beginning to train City architects and engineers in the area of energy-efficient design practices, developing an energy component for an emergency plan, and assisting Hetch Hetchy Water & Power (the City's municipal hydro-electric utility) develop demand-side planning strategies. The EMAP project grew out of a need to address the institutional barriers encountered in the operation of these programs.

Significant institutional barriers affect the Bureau's work, barriers that are common in other local jurisdictions:

- ▶ In the departmental budgeting structure, energy costs are a line item expense that is treated as if it is out of the department's control. Increases in usage are covered through supplemental appropriations; decreases, rather than becoming retained funds to be used for

other needs, simply result in a reduced line item in the following year's budget. Departments thus have no financial incentive to pursue conservation, since they will not realize any savings.

- ▶ The City design process for major renovation and new construction projects does not include a formal energy review process, and the designers are not up-to-date on efficient technologies and design practices.
- ▶ Purchasing rules function to minimize initial cost, not life-cycle cost.

Addressing these barriers requires as much assistance as possible. The Bureau is blessed with several valuable resources:

- ▶ the California Energy Commission, which provides technical assistance and some capital loan funding, and has experience with institutional barriers around the state;
- ▶ Lawrence Berkeley Laboratories, which supplies data concerning performance of efficient technologies;
- ▶ the San Francisco community, which includes an active environmental constituency.

San Francisco's situation is unique, but also substantially similar to other local government jurisdictions. The details differ, but the general institutional barriers that the Bureau faces are recognizable as the barriers that impede conservation efforts in many other jurisdictions.

Recreation & Parks Department Collaboration

"One of my highest priorities is the development of an energy conservation program and an analysis of usage. In the spirit of creating a "planetary insurance policy" and the immediate budgetary needs, we are committed to reducing our consumption of electricity and gas. I would like to...develop and promote a model program that other departments and communities could follow."

General Manager, Recreation & Parks Dept.

In planning for the development of an EMAP methodology and also for working on our institutional barriers in San Francisco, the Bureau decided to work with one department as a microcosm of the entire city. By doing this we sought to reduce the scale and complexity of the project to a manageable level, and to work with a cooperative partner that was motivated to tackle these issues. We believed that a successful program with one department would serve as a foundation for extending the work to the city at large. While we chose to address some institutional barriers on a City-wide basis (projects discussed in Section 3.5), our primary focus has been on projects within our chosen partner department, Recreation & Parks.

This decision to focus our resources has worked well for us. The most noticeable benefits have been the depth of knowledge about the department's facilities and operations we have developed and the trust built between Bureau and departmental staff. Addressing institutional

barriers with even one cooperative partner has sufficiently challenged our limited staff resources, but this level of effort has certainly accomplished significant progress along the path toward the larger goal of overcoming institutional barriers on a city-wide scale.

Our criteria for selecting a department to work with included:

- ▶ the level of cooperation we could expect from departmental staff;
- ▶ the level of the Bureau's familiarity with the department's facilities and staff ;
- ▶ the potential for energy savings in the department's facilities;
- ▶ the range of facilities in the department and the extent to which they are representative of facilities throughout the city;
- ▶ the visibility and political suitability of the department as a model.

We decided to consider only those departments that are budgeted through the General Fund (rather than a department that is supported through its own revenue, such as the Airport) since budgetary reform for these departments would be the most straightforward and have the most financial effect.

Recreation & Parks ranked well in all of these areas: departmental staff are highly cooperative, from facility maintenance staff to recreation staff to top administrators (whose commitment is evidenced by the quote heading this section); the Bureau had already retrofitted several facilities within the department, performed numerous audits, and established relationships with departmental staff; we had found numerous opportunities to save both electricity and natural gas; the department's 150 diverse facilities include gyms and pools, an administrative office, a maintenance yard, athletic fields, and irrigation pumps; and the department is respected within City government and very visible to the community at large, especially youth, presenting an opportunity for public education. While certain areas of the department are considered revenue-producing (such as Candlestick Park and the Yacht Harbor) the majority of the department's facilities are supported chiefly through the General Fund.

The closest contender was the Fire Department, with whom the Bureau has worked extensively in the past. Knowledge of the department's facilities, almost entirely fire stations, is fairly complete, and departmental staff are typically eager to work with the Bureau. Focusing on a set of forty similar facilities offers the advantage of simplicity, but would make the work less relevant to the range of other City facilities. Another significant factor was the relatively low potential for energy savings. Also, while Recreation & Parks has their own maintenance staff, Fire Department facilities are maintained by the Department of Public Works. This favored working with Recreation & Parks since retrofits are generally more efficient with one less department involved and because we could increase in-house experience and interest in energy conservation.

The Bureau initiated the EMAP project during a particularly distressing budget cycle: Recreation & Parks took an 18% budget cut and lost 80 staff to early retirement in fiscal year 1992-93. Understandably, their interest in energy conservation centers on the potential for immediate financial benefit, but long-term energy efficiency was clearly a departmental priority as well. Although the department could not afford a high level of staff and funding

resources for conservation projects, they were able to arrange funding for the Retrofit Cost-Sharing project. The Bureau believes fiscal contribution is important because it adds substance to the partner's commitment to the project. This particular funding was only obtained through the persistence of key departmental administrators. These same administrators also shared valuable information about departmental operations; such allies were critical to the success of our program.

The format for our collaborative process with Recreation & Parks consisted mainly of small informal meetings scheduled as needed. The Bureau set up a formal meeting between our project team and Recreation & Parks' top managers to open the project, and will report to these managers on the project's progress.

3.2 GATHERING INFORMATION

The Bureau's first step in working with Recreation & Parks was to gather information in order to characterize the department's energy use, evaluate the potential for improving energy-efficiency, learn about departmental operations, and to uncover barriers as directly experienced by departmental staff. Information was acquired in two ways: quantitative information was collected to form a Departmental Energy Review, and qualitative information was solicited through a series of staff interviews. The resulting characterization added depth to our understanding of the specific manifestation of institutional barriers in Recreation & Parks, and informed our project definition and selection process (Section 3.3).

Departmental Energy Review

The Bureau conceived the Departmental Energy Review as a compendium of information related to energy use to serve as a profile of the Recreation & Parks Department. The Review comprises:

- ▶ ***facility usage data and performance evaluation:*** this information helped the Bureau find trends in usage over the last five years, prioritize facilities to plan retrofits, monitor past retrofits, and identify anomalies where billed usage greatly differed from the usage expected at a facility.
- ▶ ***operating schedules and contact persons for facilities:*** these were necessary in order to coordinate site visits to facilities. The schedules also help quantify hours-of-operation for energy calculations.
- ▶ ***maintenance schedules and procedures:*** awareness of maintenance schedules, such as the annual cycle of month-long pool closures for maintenance and renovation, allowed us to mesh equipment retrofits with existing work. Coordination with maintenance staff

minimized impact on facility operations and the risk of conflicts. This information also provided a profile of current maintenance practices.

- ▶ **capital improvement plans for upcoming years:** this knowledge helped the Bureau become more involved in the design process in order to ensure that energy-efficiency is incorporated as a high-priority criterium in new buildings and renovation. Installing efficient equipment in conjunction with such capital improvement projects is highly cost-effective, especially when compared to the costs of retrofitting the facility later.
- ▶ **staff organizational charts:** these helped the Bureau understand information channels, funding processes, and decision-making structures in Recreation & Parks. Key people identified in the structure became candidates for the staff interview component of the information gathering phase.

This information was compiled in a binder and used not only for our own reference, but for showing Recreation & Parks personnel the type of information used to track energy savings, trends in departmental usage, and the financial potential of conservation. Photos of a recent lighting retrofit at a gymnasium were included to familiarize staff with typical energy conservation measures and their tangible benefits, such as improved lighting.

The core of the Departmental Energy Review is the profile of electricity and natural gas use for Recreation & Parks' facilities. The basic tool that enabled the Bureau to use this type of information is our energy accounting software, which tracks monthly data for all City facilities. The Bureau installed the energy accounting software 6 years ago, setting up a working relationship with the energy accountants at Hetch Hetchy Water & Power in order to obtain raw data. The system gives us convenient access to historical usage data, and allows us to normalize comparative years, adjusting for factors such as weather or operating hours.

By using a spreadsheet program to manipulate the raw data from the energy accounting system, we were able to perform valuable analysis: we learned which facilities (and types of facilities) use the most natural gas, which use the most electricity, and which seem to be most efficient and inefficient. We used the spreadsheet's sorting capability to group facilities by facility type and to rank facilities by amount of energy use. We also used the program's graphing capabilities to present information in different formats such as:

- ▶ Tables of annual use by facility, dating back five years for electricity and two years for natural gas. The facilities are grouped into families such as pools, gymnasias, and playgrounds in order to compare similar facilities;
- ▶ Area graphs and pie charts of the department's usage, showing the overall contribution of each family of facilities;
- ▶ Tables and graphs of historic monthly usage for individual facilities.

This data identified unique characteristics of Recreation & Parks' energy use, both on a department-wide level and on an individual facility level, and informed the Bureau's decisions about where to best invest resources.

Fig. 3.1 shows the distribution of energy costs borne by Recreation & Parks. The natural gas-dominated distribution is quite different from that of other departments: the City's municipal sector as a whole spends four times as much on electricity as on natural gas!

(This is despite a low electric rate; because the City owns its own source of electricity--Hetch Hetchy hydro-electric dam in the Sierras--most departments in San Francisco's municipal sector, like the Recreation & Parks, pay only 2.9 ¢/kWh.) This factor guided the Bureau to focus more effort on natural gas conservation than we may have if we had not recognized this important factor (the Bureau's programs are primarily focused on electricity conservation due to the priorities of our principal funding source, Hetch Hetchy Water & Power). In addition, the nine swimming pools use almost half of the department's natural gas, so they were identified as prime candidates for efficiency measures. Knowing this information regarding energy-cost distribution going into our project definition and selection process enabled us to evaluate the energy-saving impact of different retrofit programs. A Boiler Efficiency Program and a Lighting Retrofit Program were both selected to be components of our EMAP strategy (see Section 3.4).

Fig. 3.2 illustrates the department's electricity use over the last five years. The overall use is divided into the usage of families of similar facilities, so that their individual contributions can be evaluated separately. As is apparent by the increasing width of its stripe, Zoo usage has increased dramatically. While we have not reached a conclusive explanation for this particular trend (a new sewage treatment plant under construction nearby is one possible culprit), it has been valuable to know how various sectors of the departments are changing. Such information (including the facility-by-facility breakdown shown in Fig. 3.3) can enable the department to target those facilities with increasing costs (or reward those with decreasing costs), and to see the energy-cost ramifications of changes in everything from large scale infrastructure, equipment (including new office equipment), maintenance, and occupant habits.

FIGURE 3.1 Recreation & Parks Annual Energy Cost Breakdown

FIGURE 3.2 Five-year Departmental Electricity Profile

Fig. 3.3, a section from a table that includes 130 other facilities grouped into families such as Parks, Irrigation Pumps, and Playgrounds & Field Houses, provides the detailed information underlying Figs. 3.1 and 3.2. This format is also the foundation for the Departmental Energy Tracking system that we developed as one component of our EMAP (described in Section 3.4). The two right-hand columns compare use for the most current year to use for the last year and to use five years ago respectively. This comparison brings to light facilities whose use is changing significantly, whether increasing or decreasing. Sunset Recreation Center gym was the site of a full lighting retrofit in July 1988--its use has dropped significantly. Portola Recreation Center gym, on the other hand, has doubled its use over the last five years, possibly because of increased hours of operation.

This type of information helped us target our retrofit efforts. For both lighting and boilers, we compared the use of similar facilities, correcting for relevant factors such as facility size, hours of operation, and weather, to identify those facilities that are most inefficient.

Fig. 3.4 contains similar data for natural gas use, although without a five-year history. While electricity data is sent to the Bureau on computer diskette, the natural gas data is only available on paper, so our records are less comprehensive. Such data does serve, however, to provide more detail about the distribution of energy use among the department's facilities.

FIGURE 3.3 Five-Year Electricity Use by Facility and Family

Family Building		Annual Electricity Usage, kWh					% Dept'l Total	Trends:	
		86/87	87/88	88/89	89/90	90/91		5-yr	1-yr
pool	BALBOA	255,520	265,280	269,360	273,760	260,960		2%	-5%
pool	NORTHBEACH	276,840	215,280	250,800	242,280	239,280		-14%	-1%
pool	GARFIELD	231,143	213,141	197,105	231,600	237,440		3%	3%
pool	ROSSI	303,280	241,720	291,000	252,960	232,280		-23%	-8%
pool	SAVA	210,449	151,415	201,206	194,565	196,277		-7%	1%
pool	M.L. KING	189,520	206,080	175,800	188,600	193,600		2%	3%
pool	COFFMAN	148,800	142,880	189,120	158,400	155,520		5%	-2%
Pool totals:		1,615,552	1,435,796	1,574,391	1,542,165	1,515,357	11.8%	-6%	-2%
gym	SOMA	0	0	0	194,035	166,136			-14%
gym	OCEANVIEW	117,610	155,885	165,080	156,963	149,449		27%	-5%
gym	EUREKA	92,600	108,080	103,240	110,200	122,160		32%	11%
gym	JOSEPH LEE	124,642	103,056	88,063	103,257	118,954		-5%	15%
gym	UPPER NOE	113,010	131,230	127,817	120,938	109,709		-3%	-9%
gym	POTRERO HILL	115,255	115,856	108,028	109,033	103,326		-10%	-5%
gym	CHINESE	104,560	100,560	106,000	107,040	100,320		-4%	-6%
gym	JACKSON	67,600	77,600	77,680	89,080	95,120		41%	7%
gym	ST. MARY'S	76,526	97,954	90,549	88,248	83,719		9%	-5%
gym	SUNSET	177,360	152,160	109,920	71,840	81,600		-54%	14%
gym	GLEN PARK	58,711	76,842	68,606	71,679	69,087		18%	-4%
gym	PORTOLA	33,240	44,280	48,480	63,560	64,720		95%	2%
gym	MILTON MYERS	75,840	80,480	77,440	80,960	63,040		-17%	-22%
gym	MOSCONE	0	12,279	38,605	36,487	36,102			-1%
Gym totals:		1,156,954	1,256,262	1,209,508	1,403,320	1,363,442	10.6%	18%	-3%

The Bureau ranked Recreation & Parks facilities by use to determine which facilities are the large users, and therefore which facilities offer large potential for savings. On a gross level, the dominance of a relatively small number of facilities is evident. On a facility-specific level, one can see that the pools, which again use almost half of the department's natural gas, vary in their individual usage. This is telling because the majority of the pools are quite similar in layout, load, and schedule, implicating inefficiencies in certain pools' boilers.

FIGURE 3.4 Natural Gas Use by Facility, 1991

Facility	Therms	Cost
Various Large Facilities:		
ZOO GARDEN	106,353	\$53,175
GOLDEN GATE NURSERY	95,142	\$52,950
GOLDEN GATE CONSERVATORY	57,155	\$28,575
MCLAREN LODGE (Admin. Build.)	31,179	\$15,590
	289,829	\$150,290
Pools		
ROSSI POOL	90,611	\$45,300
BALBOA POOL	73,924	\$37,000
GARFIELD POOL	56,208	\$28,100
HAMILTON POOL	48,847	\$24,425
SAVA POOL	44,329	\$22,200
KING POOL	42,904	\$21,450
COFFMAN POOL	42,689	\$21,350
NORTH BEACH POOL	36,271	\$18,135
MISSION POOL	10,811	\$5,000
	446,594	\$222,960
Rec/Park High-priority		
RANDALL MUSEUM	15,204	\$7,602
JOSEPH LEE REC CENTER	14,489	\$7,250
KEZAR STADIUM	11,854	\$6,615
MOSCONE REC CENTER	11,474	\$5,950
CHINESE REC CENTER	11,028	\$5,500
	64,049	\$32,917
All 70 Other Facilities	391,821	\$139,959
REC & PARK TOTAL	1,192,293	\$546,126

Fig 3.4 shows the high gas users in Recreation & Parks, including both those facilities that the Bureau is most interested in because of the opportunity for savings (such as the pools) as well as facilities that are a high priority to Recreation & Parks maintenance staff because of burdensome equipment problems.

FIGURE 3.5 Pre- and Post-Retrofit Electricity Use at Eureka Valley Recreation Center

Fig. 3.5 details the monthly use at Eureka Valley Recreation Center for two years before a lighting retrofit and the year after the retrofit. The use pattern is fairly consistent, as indicated by the similar shape of each line. If the two years prior to the retrofit are averaged to create a baseline year, the savings are seen to be approximately one-third. This sort of concrete proof that a retrofit is saving energy helps departmental personnel see the benefit of such projects. As a further step, one can chart the financial outflow and inflow to show savings steadily paying back the initial investment, then effectively generating revenue through avoided energy costs.

Staff Interviews

The Bureau conducted interviews with selected Recreation & Parks staff (Fig. 3.5 lists these interviewees) as well as several personnel from other departments. Our chief goal was to learn from their experience and creative ideas; we also wanted to inform them about energy conservation, the Bureau's work, and the specifics of the EMAP project.

To identify personnel for formal interviews, we used the organizational chart and departmental recommendations. (We also had impromptu discussions with personnel at their facilities.) Since every departmental staff-person makes decisions that affect energy consumption--whether turning lights on and off, specifying products, or setting policy--the

FIGURE 3.6 Recreation & Parks Staff Interviewed (by division)

Bureau selected informants from all levels of Recreation & Parks, ranging from top administrators to part-time lifeguards. This enabled us to learn about the diversity of concerns and agendas, gauge staff understanding and interest in energy conservation throughout the organization, and demonstrate openness to *all* departmental staff in order to avoid resistance due to exclusive allegiances.

While we were committed to exploring the full range of staff input, we also sought to identify those individuals in the department with the authority to effect large-scale change in departmental operations, since these could be key allies in overcoming institutional barriers. The formal interviews, typically one-time meetings for an hour, were introduced by a letter endorsing the project from a respected high-level Recreation & Parks administrator. All of the personnel interviewed remained available as contacts; several have become valuable liaisons through whom the Bureau learns about the internal goings-on in the department.

Our goal was to learn how the department operates. This included learning about the inevitable conflicts between strong personalities; different approaches to the department's mission; tactics that are taken to work the system--in short, valuable *unofficial* information. The following list illustrates the type of information we learned from the interviews:

- ▶ relationships between facility recreational staff, the engineers who maintain facilities, and departmental management. Knowing the sensitivities of each group helps us tailor our program to be acceptable to all involved.
- ▶ the extent of central authority over staff out at recreational facilities, and therefore the extent to which staff make autonomous decisions. This information helps us know who is truly responsible for the operations of a facility when we undertake a retrofit or other program at a facility.
- ▶ dissatisfactions with past energy conservation projects, such as a lighting retrofit performed at a pool where the Aquatics staff was not consulted. This helps us plan better communications with facility staff.
- ▶ examples of money-saving ideas that have not been supported because the system is too inflexible. This added ideas to our process, and provided case studies of past attempts at change.
- ▶ the state of in-house Recreation & Parks maintenance, which is losing staff and funding. This helped us learn about departmental maintenance priorities that can be linked to energy conservation projects.
- ▶ the in-house design process for new facilities and renovations. This is the first step toward incorporating energy conservation features into future designs.
- ▶ the budget process, both formal and behind-closed-doors. This is a first step toward understanding the ongoing underfunding of needed maintenance, and an eye into how a returned-savings incentive program might operate.
- ▶ the duties entailed in different staff positions, giving us an understanding and empathy for their positions, essential to creating solutions acceptable to all.

Besides providing valuable information about the department's operations, the interviews served us in several other ways. They:

- ▶ measured the awareness and priority of energy conservation in the department. In general, Recreation & Parks staff knew basic concepts of energy conservation, and thought of conservation as something that should be a priority, but not really part of their job.
- ▶ validated the institutional barriers we had described. As a result of their own experiences, many of the interviewees mentioned specific barriers on their own. This showed us that the general problem of institutional barriers is almost universally acknowledged. While we encountered a fair amount of cynicism, the majority of people talk about how "*the system*" should be, indicating a capacity for change.

For most of the information we gathered through the interviews, this was the only way to acquire it. There is no substitute for the day-to-day experience of those in the department. While the value of such information is difficult to quantify, the Bureau found that conducting these interviews and adopting an open-ear attitude were very productive strategies. This research gave the Bureau a foundation from which to conceive project ideas that could specifically target the barriers as they exist in Recreation & Parks.

In preparation for possible work on developing an energy tracking system and a budgetary incentive, and on streamlining purchasing channels, we also interviewed two people from

other departments: the energy accountant at Hetch Hetchy Water & Power who performs the monthly billing and annual projection functions, and a Chief Purchaser in the Purchasing Department. Like the Recreation & Parks interviews, these contacts provided a wealth of information that is not available through printed material. This information ranged from the details of official procedure to the reality of how things really work, what will be politically easiest to change, and who might be willing to work for such change.

3.3 PROJECT DEFINITION AND SELECTION

synergism: interaction of discrete agencies such that the total effect is greater than the sum of the individual effects.

Webster's dictionary

The Bureau's work to this point--compiling information on the interrelated institutional barriers operating in San Francisco and researching the specific conditions within Recreation & Parks--provided a foundation for the core work of the EMAP development: conceiving of projects which directly address institutional barriers and selecting the most promising projects for implementation.

The Overall Process

The tasks of project definition and selection were performed by a project team consisting of five of the Bureau's eight staff, each contributing to a different degree. This team gave us broad representation of the office's experience. The departmental energy review and staff interviews were performed by the project manager, which conserved the office's resources; for project definition and selection, we needed creative input from the entire team.

The overall process for these tasks consisted of a series of team meetings, interspersed with independent work by the project manager to plan the process and to set up decision-making formats for the team to use. Except for several full-team meetings at the beginning of the process (to provide initial direction) and again at the end (for final consensus), meetings typically consisted of two or three staff focussed on specific tasks. This was time-efficient and took advantage of individuals' special interests and expertise.

At early meetings, we agreed on basic principles, such as "*start small, helping ensure success, then use the success to sell bigger efforts,*" and "*choose project components from each grouping on the system diagram to gain the synergy of a holistic approach.*" We also defined our goals: to create and implement a plan to overcome institutional barriers and lay groundwork for future work, and to document our process in order to develop a generic

methodology. From there, we tried two structures for developing projects: first, we focused on the concept of a *model facility*, then we moved on to defining sets of complementary *project elements*. Our final task was to develop criteria that allowed us to select the most promising projects from the menu of proposals, and to take on the appropriate amount of work.

The Model Facility Approach

Our first approach focused on the idea of finding a single model facility. This was a natural extension of the "*start small*" strategy which led us to choose a single department as a project partner. Given the limited resources of a small office, working with a single facility offered the advantage of allowing us to be more comprehensive in our approach. We could direct a variety of efforts at the facility, such as lighting and heating retrofits, maintenance improvements, an educational program to encourage energy-wise habits, and a budget incentive mechanism to return energy savings to the facility. If one facility could be greatly improved in such a comprehensive manner, it could serve as a valuable example to garner buy-in for expanding such work to the rest of the department and City.

We chose four Recreation & Parks facilities, very different from each other, to assess how well a single facility focus might satisfy our needs: Candlestick Park, a 55,000-seat stadium that hosts professional football and baseball; Balboa Pool, a pool typical of the City's nine public pools; a Golden Gate Park irrigation pumphouse, typical of other pumping facilities in Recreation & Parks, the Water Department, and the Department of Public Works; and McLaren Lodge, a landmark building which houses Recreation & Parks administrative offices.

Next we listed criteria that would help us evaluate how well projects at each facility might achieve our goal, which was to create a model that would serve as the basis for expanding the work of overcoming institutional barriers to other facilities in Recreation & Parks and eventually City-wide. Specifically, the criteria judged the:

- ▶ potential for energy savings at the facility, including the attainability of the savings;
- ▶ manageability of projects at the facility, including the level of the Bureau's familiarity with the facility and its staff, the level of cooperation expected from the staff, and facility size.
- ▶ merit of the facility as a model, including the transferability of the results based on similar facility type or budget structure, and the political significance of the facility to upper departmental management;
- ▶ ease of evaluation, including the degree to which removal of institutional barriers could result in change that is striking and clear.

The four facilities and the list of criteria were laid out on a rating table (see **Fig. 3.7**). The table uses a shading scheme to highlight factors that make a given facility particularly attractive (shown as black shading) or unattractive (white shading) as a model; gray shading indicates that the factor does not strongly characterize the facility in either direction.

FIGURE 3.7 Model Facility Rating Table

General Info:	Candlestick Park	Golden Gate Park Pump	Balboa Pool	McLaren Lodge
Overall Electricity Usage, kWh/yr	5,000,000	200,000	200,000	200,000
Overall Natural Gas Usage, th/yr	110,000	0	60,000	31,000
Similar Facilities	Convention Ctrs, Airport	Others in Water, Rec/Park, Sewage	Other pools and Rec centers	Admin. bldgs., landmark bldgs.
Overlap with other efforts:	ongoing upgrades	GGP Bond work	lighting retrofits, boiler retrofits	staff campaign?
Potential: (first line is how much potential, second line is how easy it is to realize that potential)				
Energy savings (quantity)	high		high	low
Energy-efficiency improvement	low	low		high
Equipment retrofit	low		high	high
Behavior/operations changes		low		
Maintenance improvements	low		high	low
Increasing awareness	high	high	high	high
Budget restructuring	high	high	high	high
	low		low	low
Managability:				
Size/complexity of facility	high	low		
Complexity of staff structure		low	high	
Cooperative attitudes		yes		
Info (audits, relationships, etc.) in-hand		no	yes	
Potential as a model:				
Similar to other facilities in Rec/Park	no		yes	yes
Similar to other facilities City-wide				yes
Important to decision makers in Rec/Park			yes	yes
Important to decision makers City-wide			yes	yes
Ease of Evaluation:				
Documentation of savings using FASER	hard	easy		
Additional equipment monitoring	easy			
Assessing decision-maker response		easy		easy

Shading Scheme:

good
neutral
bad

This factor makes a project at this site more attractive

This factor does not help or hurt prospects at this site

This factor makes a project at this site less attractive

At a rough level (since all criteria are weighted equally), the ratings show that Balboa Pool and McLaren Lodge are the most favorable of the four facilities. If the number of positive factors are summed, then decreased by the number of negative factors (black-shaded spaces minus white-shaded spaces), the totals run: -3 for Candlestick, +4 for the Pumphouse, +7 for Balboa Pool, and +7 for McLaren Lodge. We figured the winner to be Balboa Pool, because the only significant weakness was that we would face a tough coordination task in working with Recreation & Parks administrative, maintenance, and aquatics staff, plus the public users of the facility. Although McLaren Lodge effectively scored the same, its weaknesses were more serious. The potential for energy savings is high at the pool (due to inefficient incandescent lighting, and a huge natural gas use where small efficiency improvements can have big savings), but it is much lower at the Lodge. Since a clear demonstration of savings is crucial to favorably impressing decision-makers, the Lodge's low potential for savings was a significant flaw in its value as a model.

Although this determination was fairly clear in its conclusion, the Bureau decided not to set out immediately to create a model facility. At the time, the complexity of working with the various divisions of Recreation & Parks staff seemed daunting to some of the Bureau's project team. After six months of working with staff in these various groups--learning how they operate, and gaining their trust--this complexity no longer feels so serious. The difficulty of this task simply points to the nature of taking on systemic problems in a holistic way.

The Bureau rolled the concept of a model facility into a broader project design structure that was taking form, the *Project Element Approach* detailed in the following section. Since implementing our first set of projects with Recreation & Parks (**Section 3.4**), the idea of converging on a model facility is resurfacing as a the natural extension of those projects. This realization shows us that our EMAP contains ideas for future projects aimed at removing barriers as well as a mechanism for determining the proper time to implement these projects.

The Project Element Approach

In a new approach to structuring our process, we sought to define indivisible "*project elements*" to target specific barriers. "*Create a poster to promote energy conservation in public pools*" is an example of such a project element, targeting **M4 Low Awareness**.

Generating ideas for project elements was fairly easy. First the project manager listed the many project ideas that had been discussed to date (as part of the EMAP process or historically). Then the project team reviewed the barrier list with the goal of generating project solutions to respond to each institutional barrier. Some of the project elements we generated were most appropriate when focused on Recreation & Parks; others, like the *ENERGY NEWS* Newsletter, were City-wide by nature. In addition, a few projects focused on a department other than Recreation & Parks, such as working with the Hetch Hetchy Water & Power to upgrade the City's energy billing system. The resulting list of project elements (see **Fig 3.8** for an abbreviated list and **Appendix A** for the full list) became a palette for the composition of an overall project strategy.

FIGURE 3.8 Abbreviated List of Project Element Descriptions

Project Elements addressing barriers in the Policy & Attitudes grouping

"Policy Primer" [Low Awareness, Low Priority, No Policy]

Prepare a document to be distributed to targeted policy makers, including departmental managers, Board of Supervisors, Mayors Office, CAO... to describe the nature of investments in energy efficiency and the fiscal ramifications of making the decision to not act. The document could go as far as proposing specific policy actions.

"Design Policy at BOA" [No Policy, No Continuity]

Through ongoing work with Bureau of Architecture designers, convince decision makers to set out standard guidelines (such as *"always specify electronic ballasts"*).

"Recognition Program" [Low Priority]

Through the Newsletter, an award program, or similar effort, give credit to those who are making it a priority to incorporate EC into their designs, O&M work, or decision making.

Project Elements addressing barriers in the Awareness & Info grouping

"Set Up Rec/Park Tracking" [Poor Tracking]

Get monthly usage information to Admin and O&M staff; develop a system for them to use the data.

"Hold Design Workshops" [No Design Expertise; No Ongoing Education]

Try to reach all designers at BOA through workshops that address the key principles of EC design.

"Newsletter" [Low Awareness; Unfamiliar Tech; No Buy-In]

Produce the *ENERGY NEWS* to inform dept'l staff about recent projects and programs, give recognition

"Poster" [Low Awareness; No Constituency]

Design a public education poster on energy conservation to post in retrofitted facilities.

Project Elements addressing barriers in the Budget & Incentives grouping

"Promote EELM Contract" [Hard to Get New Tech]

Complete an Energy-Efficient Lighting Materials contract, then contact Purchasers and specifiers in each department to let them know about the products.

"Rebate Program" [ECM First Cost]

Offer funds or materials to defray the additional expense of energy-efficient materials now available through the contract.

"Departmental Retrofit Crew" [No Buy-in, Isolated Projects, Uninformed Installer]

By offering to share costs and helping to identify energy and maintenance-saving projects, obtain buy-in from Rec/Park to provide electrician labor to perform a batch of retrofits.

"Life-Cycle Cost Purchasing Policy" [First-Cost Purchasing]

Convince Purchasing Dept. to practice LCC, starting with very simple items like MPG on vehicles.

FIGURE 3.9 One Set of Project Elements

Set of Elements focusing on Rec/Park Maintenance Staff   Goal: To increase the energy-efficiency of Rec/Park facilities by working closely with maintenance staff.   1. O&M Workshops (Awareness/Info)   ▶ Hold Boiler Efficiency workshop for Rec/Park engineers.   2. Boiler Retrofits (Budget/Incentive)   ▶ Focus first year of the Boiler Program efficiency improvements on Rec/Park facilities.   3. Retrofit Guidelines (Awareness/Info)   ▶ Develop the Boiler Guidebook to help departmental staff identify cost-effective measures.   4. Boiler Consultant (Awareness/Information)   ▶ Hire a boiler engineer to provide expertise for identifying/analyzing efficiency measures.   5. Energy Conservation Electrician Crew (Budget/Incentive, Policy/Attitudes)   ▶ Learn Rec/Park maintenance procedure in order to coordinate with Bureau retrofit procedure.   ▶ Work with crew to identify and implement retrofits.   6. Promote the EELM Contract (Budget/Incentive, Policy/Attitudes)   ▶ Promote the wide usage of contract items within Rec/Park.   7. Create Departmental Tracking System (Awareness/Info, Policy/Attitudes)   ▶ Get monthly usage data to maintenance and admin staff, help them design a system to use it.   8. Lamp List (Coordination)   ▶ Use the monthly lamp purchase reports to track down large incandescents in Rec/Park.   9. CAMS Retrofit Coordination, Small-scale (Coordination)   ▶ Connect Bureau, Capital Assets Management Survey, and Rec/Park facilities staff to ensure that equipment installed by the CAMS retrofit program is efficient.   10. O&M Incentive (Budget/Incentive)   ▶ Research budget strategies that reward Rec/Park maintenance folks for lowered energy usage.   ▶ Formally propose a strategy to Hetch Hetchy and Rec/Park.

We next organized the project elements by looking for the natural focus of each element--such as a facility (or group of facilities), a group of people (such as pool maintainers), or a process (such as new construction design)--and then grouping those barriers with a similar focus into "sets". Different sets of project elements could contain the same element if it fit well in each. Within each set we tried to include a range of project elements so as to address barriers in all three groupings on the system diagram (Awareness & Information, Policy & Attitudes, and Budget & Incentives) to take advantage of the synergy that results. Because it was not always simple to include elements from all three areas and keep the set focused, which was the primary intent of grouping them into sets, we relied on the selection process to ensure that we choose a well-rounded assortment of complementary project elements. The set shown in **Fig. 3.9** (one of six sets of project elements we created--see **Appendix B** for descriptions of all sets--and the one from which we selected most of our elements for immediate implementation) lacks many project elements that directly address barriers in the

Policy & Attitudes grouping. In this case, we considered also choosing the Policy Primer project element (shown on the rating table under Solo Elements) as a complementary component of our overall approach. The Solo Elements were project elements that we considered individually (rather than or in addition to being included in sets) either because they did not naturally associate with the others or because their effect was so universal that they would complement any of the group projects.

The next step was to develop criteria with which we could evaluate the project sets. We needed to evaluate them element by element, since we would most likely have to choose a subset of a full project set due to limited staff resources. We arrived at the following criteria, which are used on the rating table shown in Fig. 3.10:

- ▶ ***Is this project something we are already doing, are committed to doing, or plan to do?*** If so, we would most likely continue our commitment or plans.
- ▶ ***Is this project something we are planning to implement through another program?*** this was helpful in cases where new full-scale funded programs had grown from the EMAP process.
- ▶ ***Does this project involve large-scale structural change to the City system?*** This enabled us to measure our commitment to time-intensive efforts to effect major structural change. We wanted to make sure to tackle some large-scale core barriers, while trying not to overload ourselves.

On the rating table, these three criteria were simply checked if true. The first two helped us take the projects that we are already involved with into consideration, influencing us to choose other projects related to existing efforts, and keeping us aware of our existing staff obligations. The third helped us ensure that we were indeed addressing some of the toughest barriers (since they are inevitably the core issues) while at the same time helping us ration the number of them we addressed. We decided we should make sure we chose one such barrier, and no more initially.

We scored the criteria below with a 0, 1, or 2, indicating a low, medium, or high degree of that category. Categories were set up so that high scores were signs of a good project.

- ▶ ***Does this work overlap with work the Bureau has wanted to do for other reasons?*** This is similar to the first criterion above, but without any commitment yet. This indicates whether a project would be undertaken only because it is a valuable part of a strategy to overcome barriers, or if it accomplishes immediate goals of other programs as well.
- ▶ ***Does this project need to happen "now or never"?*** Some opportunities, because they require integration into existing projects such as design review of new construction, are time-critical. We used this criteria to evaluate the sensitivity of a project to timing, including the possibility that it may only occur as part of the EMAP project and be difficult to justify later.
- ▶ ***Do we have the information needed to undertake this project in-hand?*** This measured how ready we were to begin implementation without further research being required.
- ▶ ***How synergistic is this project with the other projects it is grouped with?*** This evaluated how important this project was to the synergy of its project set. It might be very important

Rating Table

Project Element

Project Table

Bureau is already doing or committed to doing this work

Bureau has plans to do this work through other projects

we have needed info in-hand

is synergistic with the rest of its project

adds to Rec/Park synergy

adds to Hetchy synergy

is clear and simple

we can expect cooperation

is a good model for future work

overlaps stuff Bureau will likely do anyway

will be done now or never

has direct City-wide benefit

requires big structural change

PROJECTS														TOTAL SCORE	TIME REQ'D
1. Energy-Efficient Lighting Materials															
1.1 Promote the EELM Contract	X		2	2	0	0	2	2	1	1	0	2		12	Med
1.2 Newsletter			2	2	0	0	2	2	1	1	0	1		11	Med
1.3 Rebate Program			0	2	0	0	0	1	1	0	0	2		6	Med
1.4 Life-Cycle Cost Purchasing			0	2	0	0	0	0	2	0	1	2	X	7	High
1.5 Lamp List			1	1	0	0	2	2	0	1	0	1		8	Low
2. Tracking															
2.1 Improve Internal Billing Procedures			1	2	0	2	0	1	0	2	0	1		9	High
2.2 Create Departmental Tracking System			1	2	2	2	1	2	2	0	1	1		14	Med
2.3 Rec/Park Incentive			0	2	2	2	0	1	2	0	2	0	X	11	High
3. Rec/Park Facilities Maintenance Staff															
3.1 O&M Workshops		X	2	2	2	0	1	2	1	2	0	1		13	Med
3.2 Boiler Retrofits		X	2	2	2	0	1	1	1	2	1	0		12	High
3.3 Retrofit Guidelines		X	1	2	2	0	1	1	2	2	0	2		13	High
3.4 Boiler Consultant		X	2	2	2	0	1	1	1	2	0	1		12	High
3.5 Energy Conservation Electrician Crew	X		2	2	2	0	1	2	1	1	2	0		13	High
3.6 Promote the EELM Contract	X		2	2	1	0	2	2	1	2	0	2		14	Med
3.7 Create Departmental Tracking System			1	2	2	2	1	2	2	0	1	1		14	Med
3.8 Lamp List			1	1	1	0	2	2	1	1	0	1		10	Med
3.9 "Capital Assets Program" Coordination			1	1	1	0	1	1	1	0	0	1		7	Med
3.10 O&M Incentive			0	2	2	1	0	1	2	0	2	1	X	11	High
4. Rec/Park Design Review															
4.1 CIP Notification		X	1	2	1	0	1	1	2	2	0	1		11	High
4.2 Design Policy for City Architects		X	1	2	1	0	1	1	2	2	0	2	X	12	High
4.3 Incremental Cost-Sharing		X	2	2	1	0	1	1	1	2	0	2		12	Med
4.4 Design Workshops		X	2	2	1	0	1	1	2	2	0	1		12	Med
4.5 Recognition Program		X	2	2	2	0	2	2	2	1	0	2		15	Med
4.6 O&M Workshops		X	1	1	2	0	1	1	2	1	0	1		10	High
4.7 Design Guidelines		X	1	2	1	0	1	1	2	2	0	2		12	High
4.8 Policy Primer		X	1	2	0	2	1	1	1	1	1	2	X	12	High
5. Model/Facility															
5.1 Retrofits	X		2	1	2	0	0	2	1	1	0	0		9	High
5.2 O&M Incentive			0	2	2	1	0	1	2	0	2	1	X	11	High
5.3 Recreation Staff Incentive			0	2	2	1	0	0	2	0	2	0	X	9	High
5.4 Monitoring			1	1	1	1	1	2	1	0	0	0		8	Med
5.5 Poster			0	1	0	0	0	2	1	0	2	1		7	Low
6. Incentive															
6.1 Admin Staff Incentive			0	1	1	1	0	1	2	0	2	0	X	8	High
6.2 O&M Staff Incentive			0	1	1	1	0	1	2	0	2	0	X	8	High
6.3 Recreation Staff Incentive			0	1	1	1	0	0	2	0	2	0	X	7	High
6.4 Retrofits	X		2	1	1	0	0	2	1	1	0	0		8	High
Solo Project Elements															
ENERGY NEWS Newsletter			2	2	0	0	2	2	1	2	0	2		13	Med
Promote the EELM contract	X		2	2	0	0	2	2	1	2	0	2		13	Med
Policy Primer			1	2	0	2	1	0	1	1	1	2	X	11	High

if it is the only project from a grouping on the system diagram, because it would leave the rest of the project set unsupported, like a three-legged stool with one leg missing.

- ▶ ***How synergistic is this project with other work with Recreation & Parks in general?*** This is similar to the previous criterion, except it looks at the overall departmental effect.
- ▶ ***How synergistic is this project with the development of Hetch Hetchy?*** This gave credit to several projects that would advance the municipal utility's capability or openness to demand-side measures, including changing the departmental energy budgeting structure.
- ▶ ***How well does this project serve as a model for further work on institutional barriers?*** This judges how transferable a project is, and how striking its success would be to decision-makers.
- ▶ ***How significantly does this project directly benefit the City?*** This criterion evaluates the immediate benefits of a project, rather than its symbolic effects as a model.
- ▶ ***How simple is this project's concept?*** This checked for both manageability as well as the ease with which the concept would be grasped by those participating and those to whom we would be trying to impress with the results.
- ▶ ***Can we expect cooperation from those we need to work with on this project?*** This served to give credit for those situations in which others were especially supportive of the Bureau's work, and lower the score when we anticipated potential resistance.

Totalling individual criteria scores gave each project element an overall comparative score. The scores for individual project elements ranging from a high of 15 to a low of 6. Because each category holds identical weighting on the rating table, the system was rather crude, but it proved adequate for revealing major trends that allowed us to prioritize projects.

We assigned staff-time investment ratings to each project: Low (0.5 person-days/week or less), Medium (0.5 to 1.5 p-d/w), and High (greater than 1.5 p-d/w). We then totaled our time commitments to projects that were already underway or committed to as part of the EMAP program, such as ***promoting the Energy Efficient Lighting Materials term contract and Retrofit Cost-Sharing***, and determined how much further staff-time we could afford to dedicate to EMAP projects.

The completed rating table gave us the information to make the complex decision regarding which project should be implemented to be most effective. We first eliminated the Design Review grouping from further consideration because we had plans for it as a full program with separate funding, and thus it was in effect selected without us needing to set aside EMAP resources for it. Next we focused on the efforts we were already involved with. For instance, the Bureau's fledgling Boiler Program offered a great chance to overlap with work we already planned on doing: by focusing the Program's pilot year on Recreation & Parks, its training, information, and retrofit components could serve to overcome numerous institutional barriers in our model department, while the Program could begin by working on known facilities, working with cooperative staff.

Project 3, focusing on the ***Recreation & Parks Facilities Maintenance Staff***, stood out as the front-runner because its group of projects received high scores and overlapped with work we were already committed to performing. The team also liked ***Project 5***, focusing on a

Model Facility, because ideally it would clearly illustrate the benefit of a coherent holistic approach that would then be copied by other facilities. The resulting selections included six of nine projects within **Project 3**, two independent City-wide elements, and a commitment to performing some part of **Project 5** as time allowed and when it seemed most appropriate. It also seemed that some set of facilities retrofitted through **Project 3** could substitute for the single ideal facility we had not found.

Because we had paid attention to including representative project elements addressing barriers in all three system diagram groupings, our task of selecting a synergistic set of project elements was simplified considerably. As an example of this synergy, the set we chose included:

- ▶ **"Promote the Energy-Efficient Lighting Materials (EELM) term contract"**, which addresses **New Technologies Hard to Get (P3)** from the **Budget & Incentives** grouping to make the financial aspect of purchasing energy-efficient products more feasible;
- ▶ **"Energy Conservation Electrician Crew"**, which addresses **Incomplete Buy-In (M6)** from the **Policy & Attitudes** grouping by undertaking energy retrofits with Recreation & Parks demonstrating their commitment to energy conservation by funding an electrician solely for these projects;
- ▶ **"Create Departmental Tracking System"**, which addresses **Poor Tracking (IC1)** from the **Awareness & Information** grouping to provide energy use data to Recreation & Parks maintenance and administrative decision-makers

These projects reinforce each other: the Recreation & Parks facility maintenance staff installing retrofit technology are learning to incorporate energy conservation goals and techniques into their work; the new EELM contract will enable them to buy efficient equipment as easily as standard materials; tracked energy usage data will enable them to target and monitor retrofits; and the cost-sharing arrangement creates an attitude of participation in the departmental staff. The synergy of the set of projects we selected creates an environment where change can take hold.

The set of project elements that we selected included one issue requiring major structural change: **"Create a Budgetary Incentive."** Choosing to address one such major structural barrier was the Bureau's balance between wanting to work on core issues while also recognizing our staff-time limits.

Looking Back on the Process

Designing and selecting projects to change an institution is an all-encompassing, big-picture task, and the Bureau project team learned a lot by going through it. The task's broad nature makes it essential to get sufficient input from all persons involved so each feels confident in the results of the process, yet it is equally important to limit discussion in order

to reach decisions. This balance point varied at different stages of the Bureau's process. For instance, work on the Model Facility approach involved: two people working closely to develop an evaluation structure; the project manager then using the resulting information to independently set up a decision-making format; and finally the full project team reviewing the structure.

Due to staff-time limitations, the latter steps of the project element rating process--grouping the projects, creating the set of criteria, and laying out the rating table--was performed primarily by the project manager. In addition, the manager took a first cut at rating each of the projects, and totalled the scores for each project. This was not ideal; we would have preferred for each member of the project team to fill out a rating table themselves, rather than having to trust in the groundwork laid by one person. Fortunately, the overall results of the rating process made sense to everyone, indicating a consistency in the team's judgements.

We learned that different people take different approaches to this type of creative process. Two distinct approaches became evident: *methodical* and *gut-feel*: some Bureau staff preferred to gather extensive tangible information to support judgements, while others preferred to move faster by relying chiefly on their feel of the situation to make judgements. The methodical approach is more accountable; the gut-feel is less time-intensive. In general, the degree to which the first group accepted intuitive judgements depended on the amount of experience the judgements were based on. People from both schools saw the advantages of the other, and we incorporated both approaches by acknowledging the need, due to limited time, for some intuitive guesses based on incomplete information or documentation, while also agreeing on a required level of certainty and thoroughness, below which no judgement should be made without further research. (Further discussion of lessons learned by the Bureau during the EMAP project appears in **Chapter 4**.)

In all, our project design and selection methodology successfully produced a plan for action, an EMAP. It generated ideas for projects aimed directly at overcoming institutional barriers, and provided a way to choose those best suited for immediate implementation. It also provides us with an ongoing planning tool for directing a long-term program for overcoming barriers. The following sections present the project elements that the Bureau selected and has begun implementing.

3.4 RECREATION & PARKS PROJECT ELEMENTS

The Bureau's project selection process led to implementation of four main project elements from the project set focused on the Recreation & Parks facility maintenance staff, described in this section, as well as two City-wide projects described in **Section 3.5**. As discussed in **Section 3.3**, these projects constitute a synergistic set that addresses barriers in all areas of the system diagram in order to effect permanent change.

Rec/Park Project Element 1: Lighting Retrofit Cost-Sharing

"Facilities used by departments supported by the General Fund continue to be in a state of increasingly serious disrepair. The cost of not funding repairs and improvements only increases the problem. Every year the City delays, the capital plant experiences more problems and the total cost to remediate becomes higher."

San Francisco's Chief Administrative Officer

Energy retrofits can be used to offset the trend of deferring maintenance and capital improvement. Most retrofits not only save energy but have other benefits, such as decreased maintenance and improved performance. For instance, a typical lighting retrofit at a Recreation & Parks gymnasium decreases maintenance because of longer lamp life, increase light levels in recreation areas, and decreases liability by ensuring that EXIT signs and outdoor security lighting are functional.

The Bureau operates a **Lighting Efficiency Program** that performs approximately ten \$10,000 retrofits annually. Some of this funding for fiscal year 1992-93 was committed to sharing costs with Recreation & Parks on a series of lighting retrofits.

Early in the Bureau's meetings with Recreation & Parks, one of the department's administrators suggested that Recreation & Parks would investigate funding an electrician for a year to perform lighting retrofits if the Bureau would be responsible for funding materials purchases and providing project guidance for the crew. Through the Departmental Energy Review completed earlier, we knew that retrofit opportunities existed in sufficient quantity to keep an electrician busy for a year. The Bureau also knew, through the staff interviews, that the Recreation & Parks electricians and their Superintendent were committed to energy conservation, and were also too overloaded with other work to take on many retrofit projects without additional staff, so this was an excellent opportunity. Retrofits performed under such a cost-sharing arrangement would provide experience and a sense of ownership within the department.

Finding funding for a new electrician in a year with large budget cuts and a hiring freeze was not simple. Recreation & Parks had recently reviewed lease agreements with several large tenants, who were legally obligated to pay for their energy costs but, to date, had not been paying. The department cleverly used the increased revenues from upholding these lease agreements to offset the costs of the electrician. Although departmental administrators value the long-term benefits of energy retrofits, the City's budget process has a strictly one-year perspective; if Recreation & Parks had tried to justify the position based on energy savings resulting directly from retrofits performed, the budget request would have stood no chance since only first-year savings would count.

Because the lease agreement revenues would not cover the entire cost of the electrician, the Bureau committed to covering the rest of the cost through demonstrable savings resulting from retrofits and corrected billing errors, and if necessary a direct fund transfer from the Bureau. This was important to ensure that the department was not putting other programs at risk by committing funding for the electrician.

In the one and one-half years preceding the approval and imminent hiring of this electrician crew, the Bureau's Lighting Efficiency Program, coordinating with electricians from the Department of Public Works, had performed lighting retrofits on three facilities: Eureka Valley Rec Center in July '91, Sava Pool in February '92, and Hamilton Pool in May '92 (Fig. 3.11 presents a typical project; Fig. 3.4 shows the effects of the Eureka Retrofit). Through these retrofits the Bureau learned about the unique factors affecting retrofits at pools and gymnasias, such as liability issues, facility closure procedure, and the effects of corrosive air. This experience led to a plan for retrofitting six similar facilities with the new electrician.

FIGURE 3.11 A Typical Lighting Retrofit at a Pool

Qty	Existing	Changed to:	change kW	hrs/yr	Savings kWh/yr
45	200W inc.	2xT8 fluorescent	6.21	3500	21,735
20	500W inc.	175W metal halide	1.46	3000	4,380
6	200W inc.	35W high-pres. sodium	0.83	4000	3,312
10	2x25W inc.	LED Exit sign, 5W	1.38	8970	12,379
8	100W inc.	18W compact fluor.	1.10	3000	3,312
Total Savings:					45,118

The Bureau approached the retrofits at Sava and Hamilton Pools, performed after the EMAP project was underway but before the new electrician was hired, with some new ideas in mind. One was to improve the level of communication between the Bureau, the Recreation & Parks maintenance staff, and the Aquatics staff at each pool (addressing *IC4 Out of Touch*). A lighting retrofit completed several years ago at Rossi Pool provides a good case study of poor communication. The retrofit was completed during the pool's annual month-long maintenance shut-down, when the pool's staff returned and they were surprised to find the new lights. They were unaware that the retrofit was happening, and had had no input. The Recreation & Parks maintenance staff knew the retrofit was happening, but were not given an opening for input (the retrofit was installed by Public Works electricians, not Recreation & Parks electricians). The Bureau, with a lighting consultant, had decided to replace the twenty 750-Watt incandescent fixtures over the pool with fourteen 400-Watt metal-halide fixtures, increasing light levels but leaving some of the original fixture locations vacant. We learned after the retrofit that peripheral vision, essential to watching swimmers in the entire pool at once, depends on an even distribution of light, and the new layout left a higher degree of contrast than had existed before the retrofit. Months later, several of the original incandescent fixtures had been rehung by a Recreation & Parks engineer over areas that lifeguards found too dark. Because no communication channel existed between pool staff and the Bureau, they responded by reinstalling inefficient lights rather than calling on us to adjust the retrofit. The outcome of this project was not only a retrofit that was not as efficient as it could have been, but a degree of mistrust in the workings of the Bureau as well.

Due to such experiences, the Bureau now tries to address concerns and solicit input *before* each retrofit. (This was made easier by working within the department with in-house electricians, who are familiar with all the parties that need to be kept in the loop.) One way we have done this was by attending a staff meeting of the Senior Swim Instructors from each pool in order to introduce the Bureau and describe the proposed retrofits and acquire the support of the Aquatics director. For the Hamilton and Sava pool retrofits, we made site visits to discuss proposed changes with the staff at each facility. Post-project communication has been important too: at Sava Pool, the Bureau has had to respond to several issues, such as reorganizing the timer-controlled security circuit.

Another new approach taken by the Bureau has been to add a public education component to our retrofit process. The Bureau designed a flyer (**Fig. 3.12**) to be posted on bulletin boards at sites where lighting retrofits are performed. This flyer describes the benefits of the retrofit, gives credit to the City agencies involved, and suggests ways that the facility's patrons can help save energy. Pools and Recreation Centers are visited by a high volume of the general public, and a change in lighting is readily apparent to anyone who visits the facility regularly, so these retrofits are an excellent opportunity to increase public awareness of energy conservation potential.

The funding arrangement for the retrofits is fundamentally different than the Bureau's traditional relationship with Public Works as the sole installer of energy retrofits. Because the "*client*" department and the installing department are the same for this project, the Bureau only has to coordinate with one department, not two. This greatly simplifies communications and reduces administrative hassles. The situation also involves the departmental staff in

FIGURE 3.12 Educational Flyer

In the City's Pools and Recreation Centers:

More Light, Less Energy!

The lights in some City Pools and Recreation Centers are being changed to new fixtures that give more light while using much less energy. Changing to energy-efficient lights saves our City money and takes a load off the environment.

YOU can help save energy too:

1. **TAKE SHORT SHOWERS** (it takes energy to pump and heat water)
2. **DRY YOUR HAIR WITH A TOWEL** (Dryers use as much electricity as fifteen 100-watt light bulbs!)
3. **RIDE A BIKE, A BUS, OR WALK** to the gym or pool

To learn more about energy conservation, visit the **PACIFIC ENERGY CENTER**, 851 Howard St.

Eureka Valley Rec Center with new lights

Hamilton Pool with new lights

This project is a joint effort of the City & County of San Francisco's:
Recreation & Parks Department
Bureau of Energy Conservation
Department of Public Works

Photos by PUC Photo Lab

Spring, 1993

Recycled Paper

energy work, ideally leading to a situation where they identify and initiate retrofits on their own, with the Bureau's involvement reduced to one of reviewing the proposed project and signing off on an expenditure of our funds for lighting materials. To encourage maintenance staff to generate their own conservation retrofits, the Bureau emphasizes the maintenance benefits of energy-efficient technologies, factors from which they directly benefit.

In the past, the Bureau's lighting retrofit program has worked in a wide range of City departments, seeking to lend our funding and resources to as many facilities and personnel as possible. This approach has the advantage of influencing all sectors of the City structure, if only to a limited extent. The current work with Recreation & Parks offers a new set of advantages. Focusing on a set of facilities allows us to learn the specific needs of a type of facility, such as the pools, so that we can retrofit them in a more efficient "*cookbook*" manner. The ongoing close relationship with the electricians enables us to continually promote switching to new technologies like electronic ballasts/T8 lamps and compact fluorescents. (We have found that demonstrating the advantages of these technologies once is not enough to make maintenance personnel switch gears because traditional ways have a lot of inertia. We are working to promote the new products as many ways as we can, through such efforts as the Energy-Efficient Lighting Materials term contract and the *ENERGY NEWS* Newsletter discussed in Section 3.5.) Our experiences working with Recreation & Parks facility maintenance personnel will not only establish a strong relationship with Recreation & Parks for ongoing progress toward the vision of a model department, it will give us information for working closely with *other* departments as we move back toward a fuller City-wide approach.

The *Retrofit Cost-Sharing* project, like the other projects we selected, begins to address many institutional barriers. As an example of the broad effect these projects can have, we list below the barriers most addressed by this particular project:

- ▶ Since upper-level management in Recreation & Parks support the aims of the energy conservation work enough to set aside valuable funding for cost-sharing on the retrofits, the Bureau is overcoming *M6 Incomplete Buy-in*.
- ▶ By taking advantage of high-visibility lighting retrofits in public buildings by posting educational flyers, the Bureau is taking a step toward overcoming *M9 No Constituency*.
- ▶ Because Recreation & Parks facilities are being retrofit by their own maintenance staff, we are less likely to be *IC4 Out of Touch* with any involved party.
- ▶ Energy retrofits can partially compensate for *OM2 Low Maintenance Funding*, since new equipment usually performs better and requires less maintenance than the equipment it replaces.
- ▶ Because we are in close contact with maintenance staff, we are able to answer concerns regarding new efficient products in order to avoid *OM4 Technology Anxiety*.
- ▶ We can also work closely with the Recreation & Parks purchaser in order to make sure there are no problems procuring what may be *P3 Unfamiliar Technology*.
- ▶ At least for this one department for one year, we have made significant progress in overcoming the limit of *R1 Insufficient Funding*.

- ▶ Working with a similar set of facilities like the City's pools helps ensure that the retrofits do not become ***R4 Isolated Projects***, but are fully integrated into the department's maintenance procedures and operational policies.
- ▶ By meeting with facility staff to encourage energy-wise habits, and posting educational information for the public, the retrofits no longer have such a ***R5 Narrow Focus***.
- ▶ By using departmental electricians to install retrofits, we train them in energy-efficient lighting principles, overcoming the problems of ***OM1 Lack of Maintenance Knowledge***.
- ▶ Our approach to facility retrofits emphasizes comprehensive replacement of all inefficient lighting, even that which is less cost-effective because it is used less, so that there is no confusion from ***R8 Mixed Technologies***.

Rec/Park Project Element 2: Boiler Efficiency Program

The Bureau's **Boiler Efficiency Program** is new and less developed than the Bureau's lighting program, due both to the historical emphasis placed by Hetch Hetchy Water & Power (the City's hydro-electric municipal utility) on electricity conservation and the inherent complexity of heating system retrofits. The general funding structure of the Program is similar to that of the effective lighting program: the Bureau obtains a pot of money designated for small yet-to-be-identified retrofits.

Capital funds became available in 1992, the first year of the Program. In light of Recreation & Parks' atypically high natural gas use, the Bureau decided to take advantage of the overlap between the Boiler Program's goals and EMAP by focusing the initial phase of the Program on Recreation & Parks facilities as part of the EMAP project. The Program design reflects a holistic approach very in-line with EMAP principles: it features not only funding for retrofits, but a training component through the ***Boiler Efficiency Workshop***, and a technical reference component, which includes a ***Boiler Guidebook*** for identifying cost-effective conservation measures and a professional mechanical engineering consultant available to review proposed retrofit measures. These components are an integrated whole, each addressing barriers that affect heating plant efficiency. This approach strengthens the effort to effect real change in the department's approach to maintenance.

The Boiler Program is significantly different from the Bureau's electricity conservation programs, such as the Lighting Efficiency Program. While Bureau staff have acquired enough knowledge about the technical aspects of lighting to accomplish the majority of our retrofits without any outside consultation (we are actually known as "the lighting people" to many City staff, and are at least as learned on the topic as most City designers), natural gas retrofits are sufficiently complex that the Bureau does not have the ability to perform retrofits *without* outside consultation. In lighting retrofits, savings result from replacing lamp A with lamp B; boiler efficiency measures often require sophisticated tuning of a dynamic system. Direct measures such as the creation of the Energy-Efficient Lighting Materials contract (which

supplies City facility maintainers with efficient lighting products) have no parallel in the realm of natural gas conservation. These differences make for an interesting contrast between the Boiler Program and the project elements focused on lighting retrofits.

Funding

The general funding arrangement for heating system retrofits is almost identical to that for the lighting retrofits, with Recreation & Parks engineers committed to providing installation labor while the Bureau provides funding for materials. (The Bureau's funding will also cover contractor labor for installations beyond the capability of departmental staff, like burner installation, but the department has an incentive to provide as much labor as possible to make the most use of the finite amount of funding available through the Bureau.) Because of the general lack of funds for equipment repair through normal budget channels, the likelihood of this type of work being done without the Bureau's funding was slim (*OM2 Low Maintenance Funding*).

The heating equipment in Recreation & Parks facilities is typically old (circa 1950) and requires sensitive attention. The boilers in the nine pools are a high priority, and receive the most regular maintenance, but this is still not at an adequate level to ensure top efficiency. Resources are even less available for other facilities where heating is deemed less critical--the heating systems in several gymnasiums have been non-operational for several years, with no funding to repair or replace them. The mode of the engineers can be characterized as "*putting out fires*" rather than one of preventative maintenance.

The Bureau had a number of existing audits on Recreation & Parks facilities to draw upon for energy-saving retrofit recommendations. Funding had not been available to implement most of the recommendations until the Boiler Program was established. Bureau staff reviewed these audits to generate a list of site-specific ECMs with paybacks of three years or less. Because maintenance at Recreation & Parks is underfunded, the engineers' immediate concerns focused on boilers that were non-functional or required constant attention. Unfortunately, this does not always intersect with the mission of saving energy. The Bureau worked with the department's Chief Stationary Engineer to define ways in which both priorities could be met. By mixing energy retrofits that offer quick paybacks with high-priority maintenance projects, they assembled an overall package with an overall payback of approximately 3 years, to meet the Bureau's investment criteria.

Before any retrofits were implemented, however, the Bureau purchased a portable combustion analyzer for use by the Recreation & Parks engineers. They had used standard "*dumbbells*" for boiler combustion testing, but because they found them cumbersome to work with, regular analysis was being performed infrequently. The new electronic combustion analyzer will make analysis much easier to perform and will allow for automatic feedback on excess air and stack temperature readings when performing boiler tuning adjustments. It was an important first step to provide for easy boiler tuning before implementing any conservation measures, because all retrofit options must be evaluated from the tuned condition to eliminate false performance estimates.

Boiler Efficiency Workshop

"It's like buying a new car every three years in order to save money on changing oil."

Bureau staff

"Like they say, a stitch in time saves nine."

Superintendent of Structural Maintenance, Rec/Park

Ongoing maintenance is a crucial factor in running buildings in an energy-efficient manner. Too often, funding for such maintenance is seriously neglected because funds are tight. However, this path is fiscally unwise, costing the City much more in the long run. Maintenance alone, without capital expenditures, can typically save 5-10% of natural gas use. In addition, regular maintenance can avert safety problems, improve the comfort and operation of facilities for occupants, and keep equipment from breaking down often.

Along with increased funding, education is essential in enabling facility staff to maintain their buildings in an energy-efficient manner. Because maintenance staff are typically kept busy just fixing broken down equipment, there is no time for true maintenance, let alone continuing education to learn about the finer points of maintaining equipment for efficiency (*OM1 Lack of Maintenance Knowledge*). The Bureau has used the *ENERGY NEWS* Newsletter and short informal meetings to educate facilities staff about efficient lighting technologies (see description in **Section 3.5**); heating system technologies are more complex, and a much higher level of education is needed to adequately train boiler maintainers.

The Bureau found that maintenance personnel have concerns about changing their established routines, and this can make them unenthusiastic about adopting recommendations for new procedures. The chief concern is that new procedures will require additional attention from staff that are already busy (*OM4 Technology Anxiety*), but often there are also specific concerns about energy conservation recommendations due to prior experiences where recommendations failed for one reason or another, or were never implemented after time was invested in assisting with pre-project studies. The caution of facility maintainers is understandable, since they are the ones who take direct blame from occupants for such things as heating system problems. Because the Bureau had money in place to use on heating system improvements, Recreation & Parks maintenance staff were motivated to participate in the Workshop because they could put the knowledge into practice immediately.

The Bureau had begun discussions with the California Energy Commission (CEC) about holding a Boiler Efficiency Workshop as a part of the Boiler Program's integrated effort to improve the City's heating system maintenance. When the Boiler Program was linked with the EMAP in the selection process, we decided to focus this Workshop on Recreation & Parks engineers. The four-day course was given by a professional boiler technician, and included on-site boiler instruction, working hands-on with systems that the engineers actually maintain. The instructor met with the Bureau and Recreation & Parks Chief Engineer and visited several sites before the workshop in order to agree on a tailored focus to make the information most appropriate to the specific facilities and staff.

The Workshop covered (see **Appendix E** for full agenda):

- ▶ boiler types;
- ▶ history and construction of boilers;
- ▶ basic principles of combustion;
- ▶ water and gas controls and control diagrams; and
- ▶ boiler energy conservation measures

The workshop also included a thorough hands-on training on the new combustion analyzer. The full Recreation & Parks maintenance crew attended all four days of the Workshop. The information presented in the Workshop provides a basis for the department's engineers to undertake upcoming retrofits, and together with the new combustion efficiency analyzer, can help them improve boiler maintenance practices. The Bureau hopes to demonstrate savings from both the retrofits and improved maintenance in order to promote better maintenance funding. The Departmental Tracking System presented later in this Section will be a valuable tool in monitoring these savings.

Boiler Improvement Guidebook

The Bureau developed a Guidebook (see sample in **Appendix F**) to be used in conjunction with the Workshop. The Guidebook details a set of boiler-related energy conservation measures in six categories:

- ▶ Combustion Efficiency
- ▶ Thermal Efficiency and Heat Transfer
- ▶ Reduction of Standby Losses
- ▶ System Controls
- ▶ Boiler Load Matching
- ▶ Reduction of End Use and Distribution Losses

We designed the Guidebook to be an easy-to-use reference for identifying energy conservation measures that are most suitable for a given building (it is most likely that only a few of the measures in the Guidebook will be appropriate at any one location). To facilitate identification of appropriate measures, the measures are placed within a matrix with heating system "*symptoms*."

Technical Consultant

Because heating systems are generally complex and varied, they require extensive experience to fully understand them. The Bureau has some in-house expertise in heating systems, but often this is often not sufficient to trouble-shoot technical problems, evaluate the best applications for energy conservation measures, and perform cost savings calculations. (In

contrast, lighting energy conservation applications require a level of expertise that is easier to develop in-house.) To improve our office's on-line capability in this field, the Bureau contracted with a professional mechanical engineer specializing in boiler efficiency. This provided the Bureau added assurance that its natural gas conservation investments were sound.

The various components of the Boiler Program address barriers in concert, creating a whole where each part supports the others. Providing an easily accessible fund designated solely for efficiency improvements will partially counteract the situation where maintainers are *Waiting for Failure (OM3)* because funds for replacing equipment that is no longer usable is often easier to procure than funding for regular ongoing maintenance. Having access to such funding will also work to make conservation higher on Recreation & Parks priority list (*M3 Low Priority*).

The Workshop was conducted after the fund for retrofits was established and the combustion analyzer purchased, so engineers can put the training into practice immediately (*R7 Action, Not Studies*). The Guidebook, in conjunction with the Workshop and the availability of the technical consultant for follow-up, addresses the *Lack of Maintenance Knowledge (OM1)* and alleviates fears about new equipment that produce *Technology Anxiety (OM4)*.

Combining project elements in education and funding increases the probability of affecting permanent change. Using the Departmental Tracking System to document the benefits of such an approach, we can use this first-year application of the Boiler Program as a model for expanding such work in the City.

Rec/Park Project Element 3: Departmental Energy Tracking System

As City departments make energy conservation a high priority, they will need not only information on how to increase efficiency, but detailed information on the energy use of their facilities. The Bureau designed a prototype Departmental Energy Tracking System to provide this valuable facility energy use information. The development of this System focuses on Recreation & Parks as a pilot in order to refine monthly statement formats and departmental procedures for using the information.

The Bureau currently tracks electricity usage for all City facilities using FASER energy accounting software (natural gas data is available only on paper copy, will be entered into FASER for key facilities as needed). The Bureau uses the data for prioritizing facilities for retrofits and monitoring the performance of projects.

Currently, Hetch Hetchy's interdepartmental billing accountant sends similar data to each department in monthly statements. However, the information is presented in a very unclear format, listed alphanumerically by meter number with no facility names. Thus for example, a

Recreation & Parks analyst who wants to find out how much energy a specific facility uses would have to know the meter numbers for the facility, find them on a list of about 200 meters, and total them. To check if a specific month's usage is normal relative to other months would require looking through past lists.

Because this format makes information so inaccessible, Recreation & Parks accountants typically file these reports away without a glance. If departments are to make energy conservation a priority, they *need* the information in these reports. Since Recreation & Parks began focusing more on energy use for the EMAP project, this need has shown itself through several queries from the department's budget analyst who was exploring the energy impact of different facility closure options to meet future budget cuts.

An ideal Energy Tracking System would distribute to each department monthly statements that readily display how much of each type of energy was consumed at each facility, and allow comparison with recent months, past years, and other facilities. It may be advantageous to have the data supplied on electronic media as well, enabling departmental analysts to create custom reports for internal departmental use.

Fig. 3.13 shows the draft tracking format generated by the Bureau for Recreation & Parks. It is organized by families of similar facilities, enabling comparison of usage at a facility with others like it. The current month's usage is compared to the baseline usage for that month derived from averaging previous years' usage, enabling historical comparisons. Subtotals show the contribution of each family to the entire usage. The cumulative year-to-date usage is also compared to a baseline figure. The graph charts the department's use relative to the amount budgeted allowing anticipation of shortages or excess funds. This monthly data can be copied into a historical spreadsheet with previous months' data so that graphs of month-to-month usage can be generated to present trends visually, as in the graph in Fig. 3.13.

In addition to providing information on a well-formatted document, a successful Departmental Energy Tracking System needs to have a procedure for using it. Our liaison in accounting at Recreation & Parks is excited about the idea of using such reports to set up his own analysis as needed. The reports can be distributed to key administrators, facility users, and facility maintainers, who can use them in the following ways:

- ▶ **Administrative managers** can use the information to make informed decisions about closures or decreased hours to meet budget cutbacks, and be able to answer questions such as, *"How much does a night of lighting Kezar Stadium cost us?"*
- ▶ **Recreation managers** can use the information to motivate improved energy-conscious behavior on the part of their staff by providing a mechanism for monitoring the success of such programs. This could be done by tracking decreases relative to a determined baseline energy usage and monitoring changes relative to that, with graphs of usage for each facility to encourage conservation;
- ▶ **Facility maintainers** can use usage data to monitor equipment performance, identifying trouble spots where usage increases dramatically, and set maintenance priorities;
- ▶ **Accounting staff** can check for billing errors. While processing usage data for the Departmental Energy Review, the Bureau found a billing overcharge of \$22,600! The mistake was obvious, but would have gone unnoticed under the current system.

FIGURE 3.13 Prototype of Departmental Energy Tracking Report

MONTHLY ENERGY TRACKING REPORT

Dept: Recreation & Parks
E Type: Electricity
Month: May 1992

Family	Building	Use, kWh		Use, kWh	
		May 1992	% baseline	YTD	% baseline
pool	BALBOA	21,747	98%	258,350	97%
pool	NORTHBEACH	19,940	98%	241,274	99%
pool	GARFIELD	19,787	107%	261,184	118%
pool	ROSSI	19,357	88%	229,957	87%
pool	SAVA	16,356	103%	170,925	90%
pool	MLL KING	16,133	102%	191,664	100%
pool	COFFMAN	12,960	98%	153,965	97%
	Pool totals:	126,280	99%	1,507,319	98%
gym	SOMA	13,845	92%	164,475	91%
gym	OCEANVIEW	12,454	100%	147,955	99%
gym	EUREKA	10,180	114%	111,980	104%
gym	JOSEPH LEE	9,913	111%	113,403	105%
gym	UPPER NOE	9,142	91%	120,680	100%
gym	POTRERO HILL	8,611	94%	102,293	93%
gym	CHINESE	8,360	97%	99,317	96%
gym	JACKSON	7,927	117%	89,809	110%
gym	ST. MARY'S	6,977	96%	84,417	97%
gym	SUNSET	6,800	69%	89,760	76%
gym	GLEN PARK	5,757	100%	68,396	99%
gym	PORTOLA	5,393	127%	59,327	117%
gym	MILTON MYERS	5,253	83%	62,410	83%
gym	MOSCONE	3,009	88%	35,741	87%
	Gym totals:	113,620	97%	1,349,961	96%

The Bureau will work with Recreation & Parks staff to develop a system for using the energy usage data contained in the prototype monthly statement. The format of the statement and the system for using the information will be refined, working toward a statement that is easy to use and easy to generate and a system that has obvious advantages for a department. We will then consider ways to introduce this format into the established billing system in the City.

Rec/Park Project Element 4: Budgetary Incentives

"My highest priority will be to reform the City's budget structure. If a department generates funds it should get to keep them, not lose them back to the General Fund."

President of the Board of Supervisors

"Yeah, these are good [energy conservation] projects, but I don't get the savings--talk to the Bureau of Energy Conservation, they're the only ones who can do things like this."

Recreation & Parks Maintenance Superintendent, to a vendor

The discussion of departmental budget incentives at high levels of City government is a positive development; the lack of incentives for efficiency has been accepted for too long. Unfortunately, the very fact that the issue is being talked about at high levels without any clear resolutions in sight indicates the depth to which it is institutionally rooted and the major work entailed in changing the situation. The Bureau found this issue to be the most difficult of the project areas to address, yet it is arguably the most crucial we face.

The lack of a budget incentive for energy conservation creates an environment where departments can virtually ignore the impact of energy costs. This is, of course, very fiscally inefficient for the City. The situation exists because each department's energy costs are funded through a line item in their budget which is considered out of their control: increases due to inefficiency are covered with few questions asked, while decreases due to conservation are withdrawn from the line item in future budget cycles. This means that savings from departmental conservation accrue to the City's General Fund for reallocation to other priorities. If these savings, or a portion of it, were returned to the department responsible for them, they would have a financial incentive to pursue conservation.

The purchase of a compact fluorescent is a simple example of how this structure disserves the City. Installing a compact fluorescent in place of an incandescent light bulb for a typical application saves the City \$25 in energy costs, and \$40 in labor changing lamps, but it costs \$10 more to purchase. Because department funds for purchasing lighting materials are based on the lower price of the incandescents, and because the energy savings is not returned to departments and the maintenance savings are not immediately available as budget dollars,

departments do not have the resources to make the most cost-effective decision. Each time a department does not purchase a compact fluorescent for an appropriate application, the City loses \$55 that would otherwise be available.

In researching what other jurisdictions have done, the Bureau had difficulty finding exemplary models of functioning budgetary incentive structures. Some jurisdictions have tried to set aside energy savings with the intent to use them for further conservation projects or to return them to a department, only to have the funds commandeered by a hungry General Fund for other uses. There are some success stories, such as the following two strategies:

- ▶ Phoenix operates a widely respected reinvestment program where savings accumulate year-to-year in a revolving energy conservation fund (funds are not, however, returned to the department where they are installed);
- ▶ The State of Oregon instituted a shared-savings program in Spring of 1992 that allows state agencies to retain half of the project savings for the project life (or 15 years). To date no agencies have taken advantage of the program. Agencies surveyed by the state's Department of Energy are generally enthused about the program, but have held back for a variety of reasons, for instance the unknown drain on staff-time posed by an untried administrative process, and the disqualification of cogeneration projects due to demands from utilities.

These programs inspired us, but did not offer an instant transferable framework for a system here in San Francisco. Therefore the Bureau started from scratch, generating a wide range of concepts for an improved budget structure. Our first step was to lay out the existing situation.

Because electricity for the departments comes from Hetch Hetchy Water & Power, the City's municipal utility, and is billed internally, savings analysis is somewhat more complicated than if departments were directly paying a public utility. If a department saves energy, Hetchy has more energy to sell to customers outside the City; in addition, if demand is demonstrably reduced, Hetchy can theoretically incorporate the reduction into future load forecasts to project more capacity available down the road. When a department uses less energy, Hetchy also gains a little from avoided wheeling charges and transmission losses, since the electricity is sold to users closer to the source than San Francisco.

Some departments in the City, such as the Airport, Water Department, and Candlestick Park are "*revenue-generating*" since they sell a service to the general public or have tenants. Since they can pass their energy costs on, such departments are "*charged*" (interdepartmentally by Hetchy) a higher rate (about 9¢/kWh, approximately PG&E market rate) than General Fund departments (about 3¢/kWh, the same as paid by Hetchy customers outside). The value of conserved electricity to the City is about 4.6¢/kWh when transmission losses and wheeling charges are accounted for, so the City actually *loses* money when revenue-generating departments save energy, since the City makes a profit from selling the energy. This is a major disincentive for energy conservation in these departments.

Natural gas is bought from Pacific Gas & Electric, making gas conservation analysis a simpler matter. Conservation saves the City money directly, and departments are eligible for the utility's rebate programs. Departmental budgets are still based on current use however, so

there is no mechanism for returning savings. The appeal of the rebates, though, has been enough to induce several of the better-funded facilities to undertake retrofits.

Because the interdepartmental charge for electricity is low for a General Fund department like Recreation & Parks, potential dollar savings from energy conservation are less than in the private sector. Recreation & Park spends \$300,000 on electricity annually, and \$600,000 on natural gas; energy costs account for about 1.5% of the department's \$58 million budget. Although dollar savings from retrofits and energy-wise habits can be significant, they are small enough that they would more appropriately serve to motivate effort from recreation staff or facility maintenance staff than to help overall departmental funding. (These are the people whose actions can actually accomplish savings as well.) Facility maintenance staff also benefit from reduced maintenance that results from energy retrofits, which can serve as a reinforcing incentive as well.

Once we had studied the existing situation, we discussed a variety of schemes for allowing departments to benefit from saving energy: paying departments a lump sum based on monitored savings from projects; estimating savings and paying the department up front; delaying downward adjustment of departmental energy budgets and permitting departments to use excess funds for other purposes. We debated many questions: should funds come through the budget or be a separate payment? What parties--the General Fund, the departments' general budget, the departments' facility maintenance crew or recreational staff--should savings be split between? Should the savings be pegged for further conservation work or free for other priorities? Should savings from Bureau-funded projects be returned to departments as well? How can usage be monitored so that savings is attributed to the correct factors? Studying these questions provided a foundation for conceiving possible changes to the existing budget structure.

The Bureau knew of a previous effort in San Francisco to incorporate a system that would hold departments accountable for energy increases, if not reward them for energy decreases. In 1982, the Mayor's Office released a plan that set up departmental line items for energy costs. The plan proposed that specific energy conservation targets would be set, with no budgetary increases for most departments and specific decreases for some. It also stipulated that quarterly electricity and natural gas energy use would be reported as a performance measure. This amounted to a "*frozen energy budget*" concept where a department was responsible for any increases in energy costs. The history of this plan is unclear, since 1982 predates the memory of current staff and an adequate documentation system. The current budgeting system is not in line with the intent of the plan; it treats energy costs as uncontrollable by budgeting them each year based on the previous year's usage with an inflationary amount tacked on as a buffer, then granting departments supplemental appropriations if they go over budget. This system does not hold departments accountable for energy increases, nor does it allow them to keep savings from conservation. The energy line item has also become another chess piece in the game of budget justification: some clever departments negotiate for a higher energy line item (which is safe from cuts once approved since energy consumption is seen as uncontrollable), then move unspent excess funds to other categories, although most departments simply lose any excess. Although departments stand to gain if they can keep savings, they may well be concerned about increasing accountability.

Those departments who are currently working the existing system to their advantage would be unlikely to lend active support to a move toward a new system.

The idea of the frozen energy budget, which holds departments accountable for increases in usage, was attractive to Bureau staff when combined with a mechanism for holding the budget fixed when usage *decreases* due to conservation, and allowing departments to use the excess funds for other departmental priorities. A variation on this plan was to decrease the frozen budget amount by a small regular amount, such as 1% each year for ten years, as an incentive to the General Fund.

After several rounds of preliminary internal discussions concerning how an incentive might be structured, the Bureau arranged for a first meeting with a top manager from Hetch Hetchy Water & Power and a financial analyst. All at the meeting agreed that there is a problem with the existing budgetary structure; this openness was encouraging to us. Many good ideas were mentioned, including an energy conservation ordinance, rebates on compact fluorescents, and an adder for bonds that would cover incremental costs of efficient design. No immediate actions were planned other than continuing the process of discussing possibilities.

The current status of the Bureau's work on a budgetary incentive remains one of exploration. Several key milestones have been reached: we have generated thorough discussion inside the Bureau to get all ideas out on the table, and we have taken the first step in promoting this cause with Hetch Hetchy, an essential ally. Other projects of the EMAP program are putting in place tools that will facilitate a trial venue for an incentive plan: the **Retrofit Cost-Sharing** will provide an example of the types of activities the program should reward, and the **Departmental Energy Tracking System** will provide the means for documenting the actual performance of the retrofits.

3.5 CITY-WIDE PROJECT ELEMENTS

The Bureau chose two City-wide projects for immediate implementation through the EMAP selection process. Both projects support the Recreation & Parks projects, as well as overcoming institutional barriers City-wide. The Energy-Efficient Lighting Materials term contract supplies efficient materials to City facility staff at a good price with minimal hassle, directly addressing *New Technologies Hard to Get (P2)*. The *ENERGY NEWS* Newsletter:

- ▶ educates facility maintenance staff, addressing *Unfamiliar Technologies (P3)*, *New Technical Information (IC7)* and *Technology Anxiety (OM4)*;
- ▶ promotes the Bureau's programs, addressing *Low Awareness (M4)*;
- ▶ recognizes staff for energy conservation efforts addressing *Change Resisted (M7)* and *No Continuity (D4)*.

The Newsletter also gives the Bureau a vehicle for expanding our EMAP work from one model department to the City as a whole by sharing Recreation & Parks' successes with staff in other City departments.

City-wide Project Element 1: Energy-Efficient Lighting Materials Contract

"I don't want you installing them [compact fluorescents] in the branch libraries until we know that replacements are available and how much they will cost."

Chief Engineer, Public Libraries

New energy-efficient lighting technologies such as electronic fluorescent ballasts and compact fluorescents offer simple energy conservation measures. Electronic ballasts with T8 lamps are not only more efficacious than standard products, they provide higher quality light by improving the color temperature and eliminating flicker and hum. Compact fluorescents can be screwed into sockets in place of inefficient incandescent light bulbs without the labor of an electrician, typically saving 75% of the original energy consumption and requiring one-tenth the maintenance.

The Bureau works to keep facility maintenance personnel aware of these new efficient technologies. Staff awareness alone, however, is not enough to put these technologies into service; the barrier of *New Technologies Hard To Get (P2)* still stands in the way.

The chief aspect of this barrier in San Francisco was that unlike their traditional competitors (core & coil ballasts, F40-T12 lamps, and incandescent bulbs) these new efficient products were not covered under a term contract with a local supplier. The City has an existing lamp contract that specifically excludes specialty items like T8s and compact fluorescents, and an existing electrical materials contract that is based on a trade book that only includes products which are currently bought in high volumes. Because the new products were not on contract, facility staff who wanted to buy them faced the administrative hassle of obtaining competitive bids from three vendors (as opposed to ordering off a blanket purchase-order from a contract vendor), and had to pay market prices rather than heavily discounted contract prices. These issues became frustratingly obvious to the Bureau when we tried to purchase these products for our own retrofit projects. For instance, fluorescent fixtures with electronic ballasts and T8 lamps cost almost twice as much as a standard fixture and took up to two months for delivery, compared to one week for the standard fixtures.

An additional problem for departmental personnel, beyond all these administrative hassles, was the difficulty of knowing which product to purchase (*P3 Unfamiliar Technologies*) and who carries the products (the best suppliers are not always the same as those used for other products). These barriers were significantly impairing the Bureau's program to integrate new efficient technologies into City facilities, whether we were working to convince facility staff to begin purchasing them or even when we wanted to purchase them ourselves and install them at no cost to the department, as the quote above shows.

The Bureau explored the possibility of using the State of California's contract, which is made available to local jurisdictions. It covered some of the items we desired, such as electronic ballasts and T8 lamps, but was incomplete. A strong disadvantage was that materials were only available through a Los Angeles supplier. City electricians are used to the convenience of an in-town distributor where they can get materials over the counter on short notice. We decided these problems were sufficient to rule the state contract out at the time (although recent improvements to the contract--it covers more items and has a Bay Area distributor--may cause us to re-assess our decision).

The Bureau then began to explore the possibility of creating our own contract through the City's Purchasing Department. Our timing was good: our first meeting with Purchasing followed on the heels of a directive from the Mayor's office urging Purchasing to get more of the City's purchasing covered by term contracts. Purchasing, although not able to spend a great deal of time on developing our contract, was committed to it in concept.

The first task was to decide what should be on the contract. We considered all of the items that we use regularly for retrofits that are not listed in either the existing Electrical Materials or Lamp contracts. This included a wide range of products, from the common (electronic ballasts) to more specialized products like compact fluorescent down-can retrofit kits and LED exit signs. We settled on a core selection (which we can expand in upcoming years if desirable) covering four main items: electronic ballasts, T8 lamps, compact fluorescents (including self-ballasted units and PL lamps), and fluorescent fixtures equipped with electronic ballasts for T8 lamps.

The Bureau faced the choice of promoting electronic ballasts for T8 lamps (which save 30% over traditional equipment) *and* T12 lamps (which only save 15%), or just promoting the electronic ballast/T8 combination. The ballasts for T12s would allow electricians to leave existing lamps when changing ballasts; since the lamp color and replacement type remains unchanged (unlike the change inherent in switching to T8s) such change-outs would be easier to integrate into regular maintenance as *the* replacement for all burned out ballasts. The Bureau decided, however, that the advantages of greater savings and superior light quality were important enough that we should promote only the more-efficient T8 variety, avoiding confusion from having both technologies (*R8 Mixed Technologies*) and encouraging adoption of the best technology.

In order to write specifications that would adequately define quality products, we drew on several reference sources for input:

- ▶ the California Energy Commission's Advanced Lighting Guidelines handbook gives a detailed technical sample specification for electronic ballasts (similar information is available through publications of Rensselaer Polytechnic Institute's Lighting Research Center);
- ▶ research conducted by Lawrence Berkeley Laboratories provided technical information on the performance of compact fluorescents and electronic ballasts. This information was valuable for understanding details like harmonics and power factor;
- ▶ Green Seal's standards for compact fluorescent products provide a detailed reference for understanding the technology.

Along with technical background for preparing specifications, the Bureau needed to learn about the term contract format and process. Because we wanted to prevent substitution of poor-quality products, we paid close attention to the specifications, but we had to also understand the flexibility required by the Purchasing Department in order to allow fair competition. For instance, we had to compromise on our desire to define appearance as well as function for certain products, although appearance can certainly be a factor in the acceptability of products like compact fluorescents.

The Purchasing Department also required the Bureau to project the quantity of materials that would be bought using the contract. We based estimates on the quantities that our programs had been using, plus some assumptions about how much other departments would use. The latter depends a lot on how well we are able to publicize the products on the contract. One piece of data that we used to estimate how much lighting materials the City purchases was the "*lamp list*." This is a monthly printout, furnished to us by the supplier that holds the current lamp contract, that details the month's lamp purchases by department. A similar list (for a full year) was obtained from the supplier holding the Electric Materials contract to determine ballast consumption quantities.

Once the contract package was completed, we distributed it to likely bidders. The Purchasing Department had an existing list of electrical suppliers that were customary bidders on this general type of equipment. The Bureau added others to the list that were known to us because they carry energy-efficient products, still unfamiliar to a lot of the traditional distributors. Interest in the contract was high--ten businesses responded with bids.

The next step was to evaluate the bids. The Bureau took responsibility for numerically analyzing the bids, a task that became fairly complicated because we had the option of splitting the contract items between different bidders if significant savings could be achieved by doing so. In addition, there were affirmative-action and delivery discounts to take into account.

In order to make the final award, which did not go to the lowest bidder (probably a good outcome for the Bureau in terms of product quality and supplier dependability), Purchasing needed documented justification for the decision, so our final task in obtaining the contract involved reasoning through the valid reasons to justify not choosing the low bid.

In Fall 1992, the new contract was in place (see **Appendix C** for a Product Price List). The Bureau has since purchased materials from it for retrofits. The work that remains is to encourage departments to begin purchasing these products for appropriate applications. When the contract first appeared, the Bureau sent an announcement to 40 key maintenance personnel involved in the specification and purchasing of lighting products. The announcement included a memo, a price list, and cut sheets on several products. A month later, the *ENERGY NEWS* Newsletter went out to a mailing list of 600 maintenance personnel, with the lead article "Purchasing Efficient Lighting Materials Gets Easier" (see the Fall '92 issue of the Newsletter in **Appendix D**).

The next step is to follow up with phone-calls, in order to answer questions and help departmental staff identify uses for these products. We have identified specific instances where a department can switch a routinely purchased product to one of the newer ones on the

EELM contract; the City's fire stations, for example, can use 11-Watt compact fluorescents in the red lights outside the engine bay doors. We plan to focus significant effort on advocating for departments to convert appropriate lighting purchases of ballasts and lamps to this new contract. The potential savings are large, and we believe that the conversion will snowball once enough people have adopted the new products.

Another step is to begin planning a revision of the contract for next year's bid process. The Bureau will expand the contract to include several new items, such as LED exit signs and a broader selection of compact fluorescents so that preferences for different applications can be exercised. In addition, the Bureau may undertake a limited "rebate" program in which we would share costs on the contract items. This would mitigate the effect of extra initial expense to the departments, partially making up for the lack of a direct incentive from lowered energy costs.

This project has accomplished the most concrete structural change so far from our EMAP work. It directly addresses *P2 New Technologies Hard to Get* in the Budget/Incentive grouping on the system diagram (**Chapter 2**), and provides a valuable complement to:

- ▶ efforts in the Awareness/Information grouping, such as providing *New Technical Information (IC7)* through the Newsletter;
- ▶ efforts in the Policy/Attitudes grouping, such as overcoming *Incomplete Buy-in (M6)* from maintenance directors in order to obtain policies mandating the usage of the efficient equipment;
- ▶ additional efforts in the Budget/Incentives grouping, such as a "rebate" program through which the Bureau can pay for a portion of every efficient part purchased.

These efforts aim to create a holistic program that can effect permanent improvement. The synergy that makes these efforts a powerful force is also at work on a larger level--the integration of these products into regular maintenance practices will increase awareness and buy-in for other energy conservation programs.

City-wide Project Element 2: *ENERGY NEWS* Newsletter

"Energy conservation has fallen through the cracks--people are more concerned about deterioration of the infrastructure."

Public Works engineer

"Hey, I read your Newsletter--you know how San Francisco's the number one recycling city? Maybe we can become the number one energy conservation city!"

Lighting Maintenance Worker

Energy conservation needs to be kept in open view of departmental facility maintainers and decision-makers so that it is not forgotten in the face of the many pressing issues demanding attention. Conservation, like maintenance, tends to be treated as an item that can be deferred rather than one that should be part of basic ongoing housekeeping. The Bureau has decided that an important part of our effort is to keep the ideas of energy efficiency and conservation, as well as information about the specific workings of the Bureau's programs, in view of City facilities maintainers and decision-makers.

In Summer 1991, the Bureau decided to invest the resources in creating a newsletter, and in the Fall, distributed the first *ENERGY NEWS*. The second, much-improved issue came out in the Fall of 1992 (see Appendix C for copies of both newsletters). The purpose of the newsletter was conceived as promotion, education, and recognition, and both issues of *ENERGY NEWS* have reflected a balance of these three ingredients.

Promotion: The primary goal of the Newsletter is to promote the Bureau's Lighting Efficiency Program by showing how it works, and encouraging departments to participate. Each issue included a description of the retrofits completed in the previous year, including information about the types of lighting replaced and installed, energy savings and other notable benefits expected from the project, and profiles of the departmental staff that we worked with. (In order to make energy retrofits attractive to readers, special attention was given to benefits that are appreciable to them, such as reduced maintenance loads for facility maintainers). These case studies serve to define the program and lead readers to envision how a similar project might work in their facilities. We also use the Newsletter to announce new programs such as the award of the Energy-Efficient Lighting Materials contract. In the second issue, we also listed other Bureau programs, such as **Design Review & Assistance Program**, to inform the reader about the overall energy conservation effort underway in the City.

One tool for promotion is the "*testimonial*," a letter of appreciation from departmental staff regarding a Bureau retrofit in their facility. After receiving several of these unsolicited, the Bureau began to actively pursue them when appropriate. Quotes from "*clients*" offer an outside endorsement of the benefits of our programs.

Education: Technical information about efficient lighting products is also featured in the Newsletter. We have included brief pieces summarizing the features of electronic ballasts/T8 lamps and compact fluorescents, as well as a graphic showing the efficacy (light output per watt) and lamp life of different lighting technologies. In the future, we may have information on other useful technologies, such as sensors. Descriptions of the Bureau's recent retrofits also provide technical information on typical energy-efficient lighting strategies.

Both issues included an editorial to explain how energy use relates to environmental issues, making the connection between efforts towards conservation in City facilities and lessening environmental damage. To illustrate this message we used a graphic comparing lifetime carbon-dioxide emissions for a compact fluorescent and its incandescent equivalent.

Recognition: Energy conservation is often seen by City staff as the sole responsibility of the Bureau. We wish to promote a view of energy conservation as part of many people's job, since in fact the commitment of maintenance staff is fundamental in achieving ongoing long-term efficiency. If we can leverage the alliance of this large block of people, the effort invested in producing the newsletter pays back manyfold. In an immediately practical sense, the Bureau needs departmental participation to identify and perform retrofits effectively.

One way to engage maintenance personnel is to recognize them for their efforts when they do participate in energy conservation work. We have done this in the newsletter by featuring photos of personnel who have been instrumental in our work, mentioning the names of departmental contacts for completed projects described, and printing special "thank you" boxes to commend individuals for their assistance.

In the first issue, we also mentioned several awards the Bureau's lighting program has garnered, giving readers pride in being a part of a successful, recognized program.

One of the key issues with the Newsletter was deciding on an audience and developing a database of these individuals. Initially, we decided the primary audience would be departmental facilities maintenance workers, primarily electricians and engineers, since they are the ones with the most direct control over the energy consumption of facilities. (This parallels our selection of projects from the EMAP, focusing on the Recreation & Parks maintenance staff.) A secondary audience would be departmental managers who have some role in supporting energy conservation or maintenance in general as a departmental priority. We mailed the first issue to approximately 700 individuals, about 90% of whom were facility maintenance personnel. We obtained the names from the Civil Service Department by requesting a list of all employees with certain job titles that typically were involved in facilities maintenance. For the second issue we refined the list, removing several positions that seem unlikely to be involved in the type of work we want to overlap with, as well as adding:

- ▶ High-level decision-makers, such as the City's Supervisors and department heads, whom we want to make more aware of energy conservation as a priority and inform about our programs;
- ▶ contacts in energy offices in other jurisdictions nation-wide with whom we want to share information about our office, perhaps providing a useful example.

The personnel database is a valuable tool--for example, it greatly simplified the task of creating a distribution list for the announcement of the Energy-Efficient Lighting Materials contract.

Writing, producing, printing, and distributing each issue of the Newsletter required a significant amount of staff-time, although the process is now more established and should be less time-intensive in the future. The incidental feedback the Bureau has received has been positive; in the future, we may try to assess the Newsletter's benefit by interviewing readers.

CHAPTER 4: CONCLUSION

4.1 FINDINGS & LESSONS LEARNED

The Bureau entered the EMAP project with the belief that:

institutional barriers are the principal factor limiting the success of local government energy conservation programs.

Having completed the project, we are more keenly aware of this truth (and empowered by the programs we have put into action). This is the key concept that underlies the entire project.

The compilation and definition of specific barriers, as listed in Fig. 2.1, provides a basis for addressing the network of institutional barriers on a manageable yet effective scale. A major conceptual finding of the project was arriving at an understanding of how barriers interrelate, as shown on the system diagram (Fig. 2.3). This understanding led us to conclude that:

barriers can be removed successfully only by addressing their interrelated nature.

Practically, this meant addressing multiple barriers that exist in the different functional areas of *Policy & Attitudes*, *Budget & Incentives*, and *Awareness & Information*. Such an understanding created a structure for designing holistic projects that we believe are most effective at creating permanent change.

We learned many valuable approaches while developing our EMAP, both through the actual work designing and implementing projects, as well as through our internal processes as we performed that work. The following are our most important operational findings.

By *starting small*, focusing the bulk of our efforts on a single department rather than the entire City, we kept our projects at a more manageable level. This enabled us to take on a wide range of projects, enhancing the comprehensive aspect of our approach. Narrowing the focus of the subject to the Recreation & Parks department thus contributed to our goal of creating a model of such a comprehensive approach. After creating this model, we aim to *build on success* by using it to promote similar work elsewhere in the City. Our general method in creating a model has been to support projects with Bureau resources at first, and

waiting until others are convinced of the success of our proposals to pursue their contribution. Our selection of Recreation & Parks to serve as a model department was based in large part on the fact that we had already established relationships with key personnel in the department and valued the opportunity to *work with allies* who were in support of energy conservation. Certain individuals exhibited a strong drive to pursue projects in line with our goals; in these cases it was to our advantage to *ride their enthusiasm* by designing our projects to work with their momentum. We found it necessary to *identify the other agendas* of people we worked with, so that we were aware of any perceived conflicts or beneficial overlap. Such overlap between the Bureau's work and the department's goals presented valuable *win-win situations* where we could cost-effectively achieve both sets of goals at once. This served to increase buy-in on the benefits of energy conservation.

Our work in developing an EMAP taught us that such planning is an *iterative process*. We repeatedly planned, took action towards implementation, then returned to evaluate and reassess the actual results of our planning. In these iterations our project team discussed many ideas; *thorough documentation* was valuable in keeping track of it all. This also helped us share amongst ourselves information that was uncovered not in a full team meeting, but from individual or small-group work, or interviews with Recreation & Parks staff-persons. We *split the research* between Bureau staff according to individual interests and expertise, making the process more time-efficient. When meeting to undertake tasks such as project rating, we learned to *value different approaches*, such as those who prefer to make decisions methodically and those who prefer to make them intuitively. Such diversity gave us the benefit of different styles (in this case, a combination of thoroughness and time-efficiency).

We realized, once we began to list ideas for projects that address institutional barriers, that we already had a lot of good ideas about what needed to be done; the ideas were an impressive assortment when all written in one place. To remember such ideas that you may have had at one time and forgotten about, a good strategy is to *recall case studies* where a project was not ideal and the ideas you had at the time about how the situation could be made better. In combining project elements to form synergistic sets, we tried to *find common themes* in order to focus and balance the set. Once we were to the point of selecting from among the many project ideas, we knew that we needed to limit ourselves, yet we also were compelled to take on core problems that anchor the web of barriers. Our balance point was to *select one major project*, the pursuit of a budget incentive for energy conservation. Trying to do more would be too much, and less would not fulfill our goals. Such major projects usually involve the need for fundamental structural or procedural change, which require one to *go to the top* levels of management to obtain official changes in policy.

The task of developing an EMAP is a very important and complex one, and it requires a significant time investment. We found it necessary, as is the case with most projects, to *estimate staff-time investments high* so that we did not over-commit ourselves. This provides the necessary space to *take your time*, since creative thinking needs a fair amount of time to be most effective.

All of these operational guides, although certainly not new, were valuable findings of the EMAP process, and will inform the Bureau's ongoing work in all areas. We also learned several specific lessons from our work, either approaches that were not working well for the

Bureau, or simply areas about which our understanding needed to evolve:

- In the Boiler Program, the Bureau learned that departmental staff may come to the collaboration with an agenda that conflicts with that of the Bureau, and that clear communication is needed to define the parameters of the collaboration. The Bureau's primary goal is to save energy, while looking for win-win situations where conservation work can also accomplish departmental goals. Departmental engineers, however, are primarily concerned with keeping boilers operational, with energy conservation playing a secondary role. Thus they are sometimes attracted to using the Bureau's funding for much-needed equipment repair, whether or not such repair saves energy. This presents a situation in which it is difficult for the Bureau and partner department to reach consensus on how to spend the available funds. To clarify our investment criteria, the Bureau generated tables such as that shown in **Fig. 4.1**, which specify investment limits (based in this case on a 3-year payback) for a given improvement in efficiency at different facilities. (Because the Bureau has identified many measures with a 1-year payback or less, a 3-year overall payback criteria allows inclusion of other measures with a longer payback that may be of high priority to the department.) Information such as this is creating a groundwork

FIGURE 4.1 Investment Limits for Natural Gas Retrofits

Facility	Annual		Investment Limit for %Savings		
	Therms	Cost	5%	10%	20%
G.G. PARK NURSERY	95,142	\$52,950	\$7,943	\$15,885	\$31,770
MCLAREN LODGE	31,179	\$15,590	\$2,339	\$2,339	\$2,339
ROSSI POOL	90,611	\$45,300	\$6,795	\$6,795	\$6,795
GARFIELD POOL	56,208	\$28,100	\$4,215	\$4,215	\$4,215
RANDALL MUSEUM	15,204	\$7,602	\$1,140	\$1,140	\$1,140
JOSEPH LEE REC	14,489	\$7,250	\$1,088	\$1,088	\$1,088
CHINESE REC	11,028	\$5,500	\$825	\$825	\$825

for the departmental staff to understand the nature of our funding criteria--a necessary basis for reaching agreement on the measures to be funded-- as well as the general nature of conservation investments.

- As described earlier (page 48) the Bureau had on occasion performed lighting retrofits with inadequate communication between the Bureau and the staff using and maintaining

the retrofit facility. Such lack of communication had resulted in retrofits that were not completely acceptable to these staff, and also created a lack of trust regarding the Bureau's motives and operations. A classic example of such a project is the de-lamping at several large administrative facilities that occurred in the 1980's without consulting either the staff working under the lights or the maintenance staff. Although it is tempting to bypass the extensive debate (many times founded on mistaken understanding about lighting equipment) that typically surrounds any such radical move, effecting permanent change that has the buy-in of all interested parties requires that we take on the task of educating and convincing others of the benefits of such actions. We have learned that the long-term loss of cooperation that results from making independent judgements is more significant than any immediate energy savings.

- ▶ In **Chapter 3** (page 46) we discussed two approaches that Bureau staff took in evaluating project ideas proposed for our EMAP: we labelled them *methodical* and *gut-feel*. Before we identified these as two differing--and valuable-- approaches, the difference generated a tension between those who were used to the approach that came most naturally to them. By finding the merit of each approach, we avoided a stalemate and created a beneficial cooperation.
- ▶ The final stages of our project definition and selection process, most notably filling out the rating table that established the ranking of the projects, was performed in large part by the project manager rather than the entire project team. While this did not appear to strongly affect the actual results of the process (this is impossible to be certain of), greater participation would have ensured that all perspectives were fully represented. Our chief constraint was the time schedule of this project, and secondarily the general difficulty with clearing room in busy schedules for such planning. In future rounds of planning (without the first constraint) we will work to involve the full team in this critical stage of the EMAP process.
- ▶ The selection process also left out collaborators from the department(s) that project elements focus on. Soliciting further input from such partners outside the Bureau (such as those interviewed at an earlier stage when gathering information) can provide a more detailed knowledge of: what will work in the departmental context; who has the power to make certain decisions; and what the particular obstacles are bound to be.
- ▶ Some of the project elements that we selected address barriers through very concrete means, such as producing the *ENERGY NEWS* Newsletter, while others, such as developing a budgetary incentive, offer no such concrete approach. We have learned that the approach of simply having regular discussions about a topic such as budget incentives, although not as obviously beneficial as direct action, is also a valuable strategy for generating eventual action down the road. Such discussion keeps ideas developing and maintains a high level of sensitivity to relevant information, such as examples from other jurisdictions and key contacts in our City government.

4.2 EVALUATION OF PROGRESS & ONGOING WORK

The Bureau of Energy Conservation made significant progress in removing institutional barriers this year. The EMAP process focused our efforts onto projects that were tailored to suit the needs of our specific situation as well as the particular resources available. Each of the six project elements we selected is producing change even in the early stages of implementation. The four elements focused on the Recreation & Parks department are generating an increasing degree of energy consciousness, especially among maintenance staff, on whom the project set is focused. The two City-wide elements are increasing participation from maintenance staff and managers across the City, as they become aware of simple ways they can adopt energy conservation as one of their goals.

The Recreation & Parks electrician sponsored through the *Lighting Retrofit Cost-Sharing* project element was hired in early 1993 and at press-time is near completion of the program's first retrofit, a complete lighting change-out at Garfield Pool during its annual maintenance shut-down. The pool was lit entirely by incandescent bulbs, from 500-Watt bulbs over the pool to 25-Watt bulbs in exit signs. These are being replaced by metal-halide high-bay fixtures, fluorescent fixtures with electronic ballasts and T8 lamps, compact fluorescents, high-pressure sodium security exterior lights, and LED exit signs (the fluorescent fixtures and compact fluorescents are being supplied through the new Energy-Efficient Lighting Materials contract). This work will cut the lighting load in half. The next retrofit planned, at Oceanview Recreation Center, will replace forty-two 400-Watt mercury vapor fixtures in the gymnasium with eighteen 400-Watt metal halide fixtures, not only saving energy, but providing much better light than currently exists and restoring the integrity of the fixture mountings (a fixture fell several years ago--despite the liability potential, the department was unable to find funding to repair the equipment until participating in this cost-sharing arrangement). This type of "win-win" situation where we accomplish our goal of conserving energy while simultaneously serving other needs has been a valuable way to cement collaboration and buy-in.

Not only are we upgrading lighting equipment, we are establishing valuable relationships with the department's maintenance staff and administrative decision-makers. The maintenance staff are learning about the benefits of new efficient equipment, both the general benefit of saving energy dollars (although this benefit does not accrue in their funding) and the direct benefit of decreased maintenance load (from longer-lived lamps and new equipment) and increased occupant satisfaction from the Recreation staff that work in the facilities. These incentives motivate the maintenance staff to learn more about the new technologies, and to be eager collaborators with the Bureau. The cost-sharing arrangement, where the Bureau and Recreation & Parks split labor costs on a series of retrofits performed by maintenance staff dedicated to conservation projects, reflects a degree of buy-in from the department's management. This buy-in is the product of a desire for fiscal savings, improved facility conditions, and environmental responsibility. Choosing as a partner a department with such allied intentions was key to the success of our work together. We hope that by starting small, with a single cooperative department, we will be able to create a successful and convincing demonstration to promote expanding this work into other departments throughout the City.

The ***Boiler Efficiency Program*** has also generated enthusiasm for the potential of energy retrofits. By educating Recreation & Parks engineers through the Boiler Efficiency Workshop, providing reference information through the Boiler Guidebook and hiring a boiler efficiency professional, and offering cost-sharing funding, the Program design reflects a holistic EMAP approach. The Workshop was held soon after the Bureau's funding was in place, and after discussions had begun regarding the strategy for applying the fund to specific conservation measures, so the engineers were receptive to learning about efficiency measures since they could immediately put the knowledge to practical use.

The Bureau and Recreation & Parks engineers are in the process of evaluating and selecting sites for energy-efficiency projects, seeking the best way to use the limited funds to accomplish Program goals. The Bureau's Departmental Energy Review turned up impressive figures showing the huge proportion of Recreation & Parks' energy costs that go to natural gas for heating the pools, making them a natural focus for efficiency measures. Compiling the existing audits performed on major energy-using Recreation & Park facilities also helped guide the Bureau's focus for gas retrofits. While surveying possible retrofit sites, the Bureau and Recreation & Parks engineers are using the draft Boiler Guidebook to identify conservation measures as well as to evaluate the Guidebook.

The Bureau's first-year funding for the Boiler Program will cover approximately ten retrofits in Recreation & Parks facilities, achieving high paybacks in some of the City's most intensive natural gas using facilities. The future direction of the Program will be to choose other facilities with high gas use and focus both funding for retrofits and training on the facilities' maintenance staff.

Information regarding the economic aspect of conservation, such as the table in **Fig. 5.2**, complement the technical information presented in the Workshop and Guidebook. Greater understanding of energy conservation principles engendered through this ongoing learning process can lead to an improved maintenance policy, and demonstration of the fiscal benefits of efficiency after retrofits have been completed will help promote higher maintenance funding.

The ***Departmental Energy Tracking System*** we are developing for Recreation & Parks is in a prototype stage. The Bureau has developed a format (shown in **Fig. 3.13**) that can be produced with a small amount of staff-time each month. It presents data in a far more usable format than that currently used by the Hetch Hetchy billing system. Our next step is to supply the prototype to Recreation & Parks accountants, maintenance staff, and managers for their feedback. We project that with minor revision, the department can begin using this information to chart the performance of individual facilities, families of similar facilities, and the department as a whole. This will be a useful tool for planning and monitoring retrofits and potentially behavioral programs aimed at improving staff energy habits. The Tracking System will also be a necessary component of a departmental budget incentive, since any structure that allows the department to retain savings will need accurate documentation of those savings and the calculated baseline use which they are based on. Through this pilot project with Recreation & Parks, the Bureau hopes to demonstrate the value of the Tracking System as a first step to extending its use throughout other City departments by making it the standard reporting format used by Hetch Hetchy Water & Power

Our discussions of a departmental *Budget Incentive* have carried us to a new understanding of the complex structures involved, the possible levels of change, the desired outcomes, and the political allies needed. While no one solution stands clear yet, we have made progress toward the full understanding needed to propose a solution. Our exploration has also brought us into more contact with City decision-makers who have some of the political clout necessary to effect any major solution, from Hetch Hetchy utility analysts to a representative from a City Supervisor's office. One strategy that we may employ involves the *Policy Primer* project element, which was not selected for immediate implementation in this round of the EMAP selection process. This element calls for the Bureau to "go to the top" by publishing a short paper, targeted at high-level City planners and decision-makers, that describes the benefits of energy conservation programs to the City, the barriers that impede conservation programs, and proposed actions that should be taken to remove these barriers.

The Bureau and the Purchasing Department finalized the *Energy-Efficient Lighting Materials term contract* (a product/price list appear in **Appendix C**) in the Fall of 1992, setting up a relationship with a local vendor to supply compact fluorescents, electronic ballasts, T8 lamps, and basic fluorescent fixtures with electronic ballasts and T8 lamps. Because the contract was late in being awarded, it will soon be up for renewal. The Bureau decided to extend the contract with the current vendor and list of items, since the bid process was time consuming last year, and the relationship with the vendor has been satisfactory. (This meant postponing for a year the opportunity to put more items on the bid list, such as LED exit signs and fixtures using compact fluorescent lamps.) The vendor understands that use of the contract may be spotty for a while due to the nature of the items, and has been responsive to the inconsistent flow of orders. They have also provided us with reports of purchases off the contract, including which department and person originated the purchase. This helps us monitor problems, encourage those who are trying new equipment, and promote the contract by giving recognition to those who have used it. The maintenance superintendent at the Municipal Railway purchased a large quantity of compact fluorescents, and claimed proudly to be "99% incandescent-free." The Public Works staff at City Hall purchased compact fluorescent replacements for lamps installed by the Bureau throughout corridors three years ago; this was a key accomplishment, since such retrofits are potentially not permanent if facility staff do not (or can not afford to) reinstall the more expensive lamps.

The Bureau has taken initial steps to promote the contract. We sent a letter with information about the contract to approximately fifty upper level maintenance staff, with the hopes that the information would find its way to those who actually order lighting materials. A short time later, we published the ENERGY NEWS Newsletter with a lead article on the new contract. This resulted in several calls requesting information, and the pace of orders picked up. Several departments have made purchases of significant quantities of compact fluorescents, either to replace existing ones or to try them out. A Wastewater Treatment Plant contacted the Bureau about the possibility of replacing ballasts with T8 lamps, and is considering how this could be done on a department-wide scale. The Bureau uses the contract for fluorescent fixtures in lighting retrofits, like the current one at Garfield Pool as part of the Recreation & Parks cost-sharing partnership, as well as in other facilities (such as a recent retrofit at a children's day-care center at the Community College) through Public

Works. The electricians at Public Works are growing accustomed to using the new fixtures, now that they are as simple to get as standard fixtures off the Electrical Materials contract, and are beginning to use them in jobs they undertake independent of the Bureau, such as the renovation of a large Social Services building that is currently proposed.

All together, the trend toward using this equipment is building momentum. The main barriers still in place are an official policy requiring use of this equipment for appropriate applications and the lack of a financial incentive, since the energy savings from a compact fluorescent are necessary to make the purchase cost-effective *to the purchaser*. Despite these factors, interest is high enough to begin using the items anyway. In the near future, the Bureau plans to promote the contract further by calling each of the individuals who received the announcement to help them to use the contract if they have not yet, and to resolve any problems. The Bureau will also seek to improve the range of items covered by the contract through future rounds of contract bidding.

The second issue of the *ENERGY NEWS Newsletter* served many purposes. It shared information regarding the new Energy-Efficient Lighting Materials contract and the Bureau's retrofit program, gave brief descriptions of other Bureau programs of interest, credited many of the maintenance staff that have been valuable allies in our work (including photos of three electricians), and described the links between energy conservation and environmental problems. While we seldom receive energetic response to the Newsletter, we often hear in quieter ways that maintenance staff have seen it and absorbed some of the information. The Newsletter is giving the Bureau's work much higher visibility, which serves not only to bring more projects to our doorstep from maintenance personnel (and encourage them to pursue conservation projects on their own), but also to inform administrative managers of our activities and the potential of energy conservation. Increasing awareness in this way can create valuable buy-in from sectors not typically involved in energy retrofits in San Francisco; this may be a critical factor in accomplishing major change such as budget restructuring to allow departments to retain energy savings.

The three objectives the Bureau set out to accomplish at the beginning of the EMAP project were to:

- 1. Develop a general EMAP**, useful to other departments and municipalities, that includes a methodology for identifying and analyzing institutional barriers as well as a guide for implementing actions to remove barriers;
- 2. Develop a custom EMAP for Recreation & Parks and implement solutions**, making Recreation & Parks an exemplary department that will serve as a model of sustainable practices for the community;
- 3. Improve coordination** between City personnel involved in energy issues and **increase overall awareness of energy issues** in City personnel.

For the most part, we have accomplished each of these goals. The general EMAP guide foreseen at the beginning of the project has become the **EMAP Strategy Guide** published in this report. We feel that it captures a process that worked well for the Bureau, and hope that other energy offices can benefit by using it to address barriers in their jurisdictions.

Although Recreation & Parks is not yet an ideal model department, they have begun to establish maintenance and administrative practices that make energy conservation a high priority, and are creating an environment where ongoing innovative pilot projects can thrive. One such project that we may soon look to undertake is the *Model Facility* set of project elements, based on the original rating process the Bureau tried. Our relationships with staff in all divisions in the department have evolved to a point where focusing the current efforts--lighting retrofits, boiler efficiency improvements, the tracking system, and an incentive program--on a single facility will be relatively simple. A program aimed at improving staff habits could be added. Balboa Pool, the top scorer in the Bureau's first round of project rating, is still the prime candidate.

The information in the *ENERGY NEWS* Newsletter--sent to over 500 City facility maintenance personnel, from Light Fixture Maintenance Workers up to Buildings & Grounds Superintendents, as well as administrative managers--is certainly increasing the awareness of City staff regarding energy issues. It is also providing the basis for a common understanding of how energy conservation can be integrated into each person's work. By presenting the EELM contract, staff now know where they can purchase efficient lighting materials. By describing the range of the Bureau's programs, others can see where they can fit in. To a lesser but significant extent, the educational flyer designed to make pool and gym patrons aware of energy conservation lighting retrofits in the facilities they use makes an important link with the community.

The Boiler Workshop significantly increased awareness and coordination among Recreation & Parks boiler maintainers. This Workshop reached virtually all staff in the department responsible for maintaining boilers. The Boiler Program plans to use the experience from this workshop to hold similar workshops for other departments. Workshops covering other issues and aimed at different staff--such as a Life-Cycle Cost workshop for the Purchasing Department--would be valuable for creating a common understanding of energy issues. The Bureau's 1993 Energy Task Force research project, *Intervention Strategies for Energy-Efficient Municipal Buildings*, is currently holding workshops for City designers and maintenance chiefs to describe basic "Energy-Efficient Lighting Design Practices" that should become standard (such as specifying electronic ballasts and T8 lamps in new construction). These workshops are part of a program to examine the numerous key points in the life of a building where energy issues need to be addressed, from concept through design, commissioning, and maintaining. The program may include parts of the *Design Process* set of project elements and is designed with EMAP principles in the fore; the current workshops, for instance, are directly addressing barriers in the *Awareness & Information* grouping on the system diagram, and are accompanied by a limited commitment to pay for incremental costs for efficient equipment that is more expensive than the current standard that it replaces (*Budget & Incentives*) and a push for instituting a *de facto* policy that stipulates these five design criteria (*Policy & Attitudes*).

Our meetings with representatives from energy offices in the neighboring cities of Palo Alto and Berkeley and from San Francisco City offices of Recycling, Water Conservation, and Clean Water were valuable. We plan to organize another meeting of local energy offices to present the EMAP Strategy Guide, and to establish a format for an ongoing exchange. The environmental offices are meeting on a regular basis, and are currently planning an environmental booth for the City's many street fairs and a Speakers' Bureau to present a slide show on issues of energy conservation, water conservation and pollution, and recycling to community groups.

The one task that the Bureau was unable to perform to the extent it originally hoped was researching innovative solutions that other jurisdictions are implementing to overcome institutional barriers. This was partly due to the lack of a common language about institutional barriers, a condition which this report can improve, and also partly due to the lack of frequent in-depth communication between local government energy offices. We strongly encourage energy offices to form local networks to share solutions close to home, and to look for ways to connect with other jurisdictions nation- and world-wide that are doing work that relates to ours. Please keep the Bureau of Energy Conservation on your lists; we welcome any questions and would much appreciate the benefit of hearing about your experiences designing programs to overcome institutional barriers. They will certainly help us in our work, and can also serve as case studies for others that contact us regarding such work.

All energy conservation staff face institutional barriers to some extent, and to some degree we all work to address these barriers. The Bureau hopes the EMAP methodology and our experience designing and implementing an EMAP here in San Francisco serves as a valuable tool for those seeking to plan an effective long-term strategy for overcoming institutional barriers to municipal energy conservation.

CHAPTER 5: THE EMAP STRATEGY GUIDE

"Your report is an excellent focus on why stuff doesn't happen. Have you considered publishing excerpts? ...Everyone is searching for a way out."

Energy Manager, City of San Luis Obispo

While developing our EMAP for San Francisco, the Bureau documented the process of that development in order to provide a generic methodology for other energy offices to use. This documentation included taking detailed notes at all meetings, regularly charting the process on a time-line, and noting lessons that we learned in order to pass them on as tips.

The EMAP Strategy Guide presented in Chapter 5 is the end product of this effort. Through the benefit of hindsight, we filtered our experiences to create a simple yet complete process for others to follow. The basic structure of this process is identical to that of the Bureau's process; the steps described in the Guide are:

- ▶ ***Identifying Barriers***
- ▶ ***Research***
- ▶ ***Designing Projects***
- ▶ ***Selecting Projects for Implementation***

We detail the goal and tasks for each step, and provide tips and examples from the Bureau's experience. We also provide blank forms to facilitate the process.

The Guide is designed to be used independent of the rest of this report, and is therefore paginated differently so that it can be copied and distributed separately from the entire report. The Bureau plans to send the Guide to a set of California local governments, and to make the full report available to those who want to refer to it as a case study. The California Energy Commission serves as an information hub for local governments in the state, and has offered to collect and share the experiences of energy offices working to overcome institutional barriers through developing and implementing EMAPs.

We encourage other energy offices to examine the role of institutional barriers in their jurisdictions, and to undertake some level of EMAP process to address those barriers. *All* energy offices gain each time a jurisdiction invests time in such work, since each success will inform and support further efforts. We urge every energy office to not only undertake a program aimed at barriers, but to share your experience with other offices through formal and informal networks.

Energy Management Action Plan (EMAP) Strategy Guide

Hetch Hetchy Water & Power/Bureau of Energy Conservation, City & County of San Francisco

1992

What's an EMAP and why does an energy office need one?

An EMAP, or Energy Management Action Plan, is a strategy designed to address the institutional barriers to energy conservation faced by local government energy programs. Some common barriers are:

- low awareness of energy-efficient technologies and their benefits;
- budget structures that give no incentive for efficiency;
- insufficient training for design and maintenance staff;
- purchases made on the basis of lowest first-cost rather than lowest life-cycle cost;
- a lack of strong policies mandating efficiency.

To be most effective, energy programs need an ongoing strategy for addressing such barriers. In developing an EMAP, an energy office designs projects to address barriers, prioritizes projects for implementation, and creates a long-term strategy for ongoing efforts.

What's in the EMAP Strategy Guide?

In 1992, the Bureau of Energy Conservation developed an EMAP to address barriers that impede their energy programs in San Francisco. Focusing on the Recreation & Parks department as a model, the Bureau: generated a list of projects aimed at overcoming barriers; selected a set of projects that synergistically reinforce each other; and implemented these projects. Based on this experience, the Bureau produced this Guide to present a generic process that other energy offices can use to develop their own EMAPs. Each jurisdiction can adapt the scope and approach of the generic process to suit their own unique situation. The process comprises four steps: Identify Barriers, Research, Design Projects, and Select Projects for Implementation. For each step, the Guide describes specific tasks and goals, gives tips from the Bureau's experience, and provides examples from the Bureau's work.

How does an energy office use the Strategy Guide?

The Bureau formed an in-house project team that met regularly for several months to define the barriers we face and generate creative ways to address them. We are now implementing several of the projects we designed. Other energy offices can use this Guide to undertake a similar process. The Bureau received valuable input from representatives of other Bay Area energy offices and San Francisco environmental offices; we encourage others to form such networks. As your work develops, please tell us about it so that we may in turn benefit from your experience.

For more information about the EMAP process or Bureau programs, contact
Director John F. Deakin at 1155 Market Street, 4th Floor, SF CA 94103 or (415) 554-3180.

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Setting Up the Process

Goal: *To gauge the level of effort you want to invest in the EMAP process, plan the process on a time-line, and organize the project participants.*

Tasks: 1. *Review the EMAP process...*
...described in this Guide. Determine the extent to which institutional barriers limit the success of your programs.

A Schematic of the EMAP Process:

2. *Decide how much time you can invest...*

...in the EMAP process and compare with the proposed time-line shown in the Examples section on the next page. Use the blank time-line (in the back of the Guide) to plan *your* process.

3. *Choose a setting...*

...for your EMAP. This could be your entire jurisdiction, or some subsection of your jurisdiction [Like the Bureau's collaboration with the Recreation & Parks department as a "model" department].

4. Form a project team...

...and choose a coordinator to organize meetings, take notes, and prepare and distribute materials. A team effort ensures a range of creative approaches; if your office is small, look for others outside the office (from other departments in your jurisdiction, other local energy offices, even the community at large) with allied interests and familiarity with your setting to serve on the project team. *[The Bureau's team comprised five in-house staff: two came only to overall guidance meetings, two worked regularly on the project, and one coordinated the overall process. Several outside agencies--the California Energy Commission, Berkeley and Palo Alto energy offices, and San Francisco Recycling, Water Conservation, and Clean Water offices--reviewed our work.]*

Process: The Guide presents a generic process (see the time-line in the Examples section) and for each Step suggests formats for performing the tasks. These formats include: full team meetings for consensus on project direction, small group discussions to explore ideas in depth, and individual work to coordinate the process and review information. The proposed process is meant as a starting point; modify it however necessary to suit your particular conditions. Most tasks involved in the EMAP process benefit from iteration, so you may choose to revisit certain Steps throughout the process.

To set up the process:

- ▶ ***Copy and distribute the Guide*** (or this introductory section) for each member of the office to review.
- ▶ ***Meet*** with office staff to discuss the benefits of developing an EMAP. Assess staff interest and availability, and decide on a level of time investment in the process (the Bureau's suggested time-line, shown in Examples, involves regular meetings every two weeks for approximately five months). Select a project team and a project coordinator. Discuss possible settings on which to focus the EMAP process.
- ▶ ***Meet again*** to lay out your process on a time-line and to decide, if possible, on a setting (this decision can wait until Step Two when you can gather more information).

Tips:***Start small***

Focusing efforts on a small setting makes projects more manageable, ensures that you work with those most allied with your goals, and allows you the flexibility to try various creative approaches. *[For instance, the Bureau chose to focus first-year EMAP efforts on the Recreation & Parks Department as a "model" department because we had an established relationship with departmental staff, who are cooperative and interested in energy conservation, as well as a fair amount of existing information on their facilities.]*

Build on success

A proven success is easier to promote than an untried concept. Once you have a working solution on a small scale, the demonstrated success of the approach can be promoted on a larger scale.

Work with allies

The cooperation of those in the setting you chose to focus on is crucial; make this an important factor in choosing your setting and in designing projects in Step Three.

Keep detailed notes

Your project team will generate many valuable ideas that can be lost if not documented. Ideas that are not immediately practical can become useful later.

Examples: In each section of the Guide, the Bureau provides examples from their work to illustrate the process. The time-line on the following page shows the EMAP process as described in this Guide. The meetings shown occurring every two weeks are full-team meetings; work in between these meetings can be done individually or in small groups. This proposed timeline is based on the level of effort invested by the Bureau in developing their EMAP, and requires staff-time equal to approximately one full-time person. If you can invest more staff-time than this, your work can be more detailed; if you cannot invest this much, your time investment in the EMAP process can still yield significant guidance.

In addition to in-house project team meetings, the Bureau met with partners from other agencies. We encourage you to schedule such meetings too if possible. We include a blank time-line for you to use in laying out your process.

Proposed Time-line:

Step	Week																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Setting Up the Process	m	m	m																							
Step One: Identifying Barriers					m	m	m	m	m																	
Step Two: Research						m	m	m	m	m	m	m	m													
Step Three: Designing Projects														m	m	m	m	m	m							
Step Four: Selecting Projects																				m	m	m	m			

m = meeting

Blank Time-line:

Step	Week																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Setting Up the Process																										
Step One: Identifying Barriers																										
Step Two: Research																										
Step Three: Designing Projects																										
Step Four: Selecting Projects																										

Step	Week																									
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Setting Up the Process																										
Step One: Identifying Barriers																										
Step Two: Research																										
Step Three: Designing Projects																										
Step Four: Selecting Projects																										

Step One: Identifying Barriers

Goal: *To identify key barriers that your programs face and examine how the interrelated barriers mutually reinforce each other.*

Tasks: 1. *Review the Bureau's list of institutional barriers...*

...(in the back of the Guide, page 26) in which the Bureau categorizes barriers by the context in which they occur (Purchasing, Retrofits, etc.). Identify those barriers that your programs encounter, including any not on the Bureau's list.

2. *Examine the Bureau's system diagram...*

...to see how institutional barriers interconnect to reinforce each other. Understanding the interrelated nature of your barriers provides the groundwork for designing effective projects to overcome them.

On the system diagram, the Bureau categorizes barriers into three primary groupings that represent the fundamental way in which the barriers act to limit energy programs: *Policy & Attitudes*, *Budget & Incentives*, and *Awareness & Information*. The barriers within these groupings are tightly related, and tend to hold each other in place, as do the three groupings on a larger scale. If other groupings make more sense to you, create your own diagram map connections between barriers as you experience them in your setting.

A Simple Schematic of the System Diagram:

3. *Decide which barriers play the most significant role...*

...in limiting your energy programs, both through direct effects and through support of other barriers.

Process: *To identify your barriers:*

- ▶ *Individually review* the Bureau's list of barriers and the system diagram.
- ▶ *Meet with the full team* to discuss the conceptual basis of the list and diagram, and begin sharing perceptions of your jurisdiction's barriers.
- ▶ *Individually*, examine the barriers and their connections further. Team members can each map out barriers to see how they reinforce each other.
- ▶ *Meet again* to map barriers onto a system diagram together, working toward a common picture of the barriers that impede your programs

Tips: *Identify case studies*

Share experiences in which some aspect of your jurisdiction's operations impeded the efforts of your programs; this will help pinpoint specific barriers. *[One Bureau project manager told our team about the time a City designer would not specify an efficient variable-frequency drive motor in a new Fire Station because the equipment maintainer, who had not received any education about this technology, asserted that it was too complex and he would just end up disabling the VFD anyway.]*

Look for common themes

Find ways in which barriers are similar in order to group them. The Bureau formed three primary groupings based on the manner in which the barriers impede energy conservation.

Examples: The system diagram on the next page shows the interconnections between barriers that the Bureau experiences in San Francisco (despite the tangle of connections, the diagram is greatly simplified, since in reality *all* of the barriers are interconnected!).

We cluster barriers into three primary groupings based on how the barriers act to impede energy conservation programs: *Policy & Attitudes* includes barriers that maintain an environment where the most energy-efficient and cost-effective decisions are not mandated by formal policy or supported by a favorable attitude. *Budget & Incentives* includes barriers that revolve around structures and procedures that make it financially difficult to make energy-wise decisions. *Awareness & Information* includes barriers that involve the low level of understanding of the benefits of energy conservation, resulting from a lack of education and clear information. The fourth grouping of barriers shown, *Coordination Issues*, work in a broad way to inhibit efficiency through such things as poor communication.

The arrows between the three groupings indicate the general direction of causality: low awareness of energy conservation's benefits creates a situation where no policies strongly mandate efficiency; the lack of strong policy allows budget structures that discourage conservation; and the lack of incentive keeps awareness of energy conservation from growing. This causality flows clockwise through the fine lines connecting individual barriers.

If the Bureau's system diagram does not look quite right for your situation, draw another system organization that is more appropriate.

The Bureau's System Diagram:

Step Two: Research

Goal: *To gather quantitative and qualitative information that provides a basis for the effective design, prioritization, and implementation of projects aimed at overcoming institutional barriers.*

Tasks: 1. *Gather information on energy use...*

...in the setting you have chosen. This most often takes the form of monthly utility-supplied billing information, which can be tracked with energy accounting software (or by hand if you do not have such software). The information can be organized in different ways: similar facilities can be grouped to compare usage; facilities can be indexed according to square footage or hours-of-use to compare efficiency; facility usage can be tracked historically (see Examples). All of these formats help to focus your efforts on key facilities and opportunities.

2. *Gather information on staff organization,...*

...experience, and perceptions throughout your chosen setting. This includes learning how decisions are made, what different people's jobs entail, the level of people's awareness of energy conservation, the barriers that the staff in your chosen setting perceive, and the projects (energy and other) they would like to see happen. *[The Bureau conducted interviews with Recreation & Parks staff at all levels to acquire this information (see chart in Examples), including not only key division managers, but staff that maintained or worked in the department's facilities. We gained a great deal of valuable unofficial insider knowledge regarding actual decision-making procedures, good and bad working relationships, etc.]*

3. *Gather information on resources available...*

...to your office, such as allies elsewhere in your jurisdiction, local and state energy offices, or your utility. *[The Bureau received valuable input on barriers from the state energy office, several local government energy offices in the Bay Area, and other City environmental offices, like Recycling and Water Conservation; in addition, we have used research facilities like Lawrence Berkeley Lab for support on technical issues.]*

Process: The research for Step Two can be conducted at the same time as you study institutional barriers for Step One. Step Two is the longest step on the Bureau's suggested time-line because it requires a fair amount of work to gather the broad range of information need to provide firm groundwork for your EMAP.

To gather information for your EMAP:

- ▶ ***Meet*** to share ideas on information you want to gather and various sources, and plan tasks, such as collecting energy data or conducting interviews.
- ▶ ***As individuals or in small groups***, perform the research tasks identified in your first meeting.
- ▶ ***Meet again as necessary*** to share your findings.

Tips: ***Split up research***

Different team members can focus on specific areas according to individual interests and expertise.

Identify other agendas

Determine the goals of staff (especially manager-level decision-makers) in the setting you have chosen in order to design EMAP projects to overlap with their agenda.

Quantify savings

Quantify program savings (including indirect savings such as decreased maintenance requirements, increased worker safety and productivity, and lower environmental externality costs) to promote the cost-effectiveness of your projects. Adopt consistent methodology for these calculations. Also document other benefits that are difficult to quantify financially [*the Bureau, for instance, solicits letters of appreciation from staff in facilities where our lighting retrofits have improved workplace comfort*].

Listen as much as talk When interviewing staff (formally or informally) your primary goal is to learn from them; ask questions and listen to *their* perspective.

Examples: Below are samples of various formats that the Bureau used to review energy use in the Recreation & Parks Department. The pie chart shows the distribution of the department's energy costs by type of facility *[from this the Bureau decided to target natural gas consumption in pools]*. The 5-year profile shows how various sectors of the department's facilities have grown in recent years. This graph is based on more detailed facility information like that shown in the 5-year table on the next page. The graph of Eureka Valley Rec Center electricity use shows the results of a lighting retrofit; such figures are useful to demonstrate that conservation projects do have an effect. The second table on the next page details recommended conservation measures from existing audits that our research uncovered.

The final figure shows the three divisions in the Recreation & Parks department and the staff we interviewed in each (we also interviewed an energy accountant for the City's municipal utility and an analyst at the Purchasing department).

Annual Energy Cost Breakdown:

5-year Electricity Profile:

Eureka Rec Electricity Use:

5-year Electricity Use by Facility:

Family	Facility	Annual Electricity Usage, kWh					% Dept'l Total	Trends:	
		86/87	87/88	88/89	89/90	90/91		5-yr	1-yr
pool	BALBOA	255,520	265,280	269,360	273,760	260,960		2%	-5%
pool	NORTHBEACH	276,840	215,280	250,800	242,280	239,280		-14%	-1%
pool	GARFIELD	231,143	213,141	197,105	231,600	237,440		3%	3%
pool	ROSSI	303,280	241,720	291,000	252,960	232,280		-23%	-8%
pool	SAVA	210,449	151,415	201,206	194,565	196,277		-7%	1%
pool	M.L. KING	189,520	206,080	175,800	188,600	193,600		2%	3%
pool	COFFMAN	148,800	142,880	189,120	158,400	155,520		5%	-2%
Pool totals:		1,615,552	1,435,796	1,574,391	1,542,165	1,515,357	11.8%	-6%	-2%
gym	SOMA	0	0	0	194,035	166,136			-14%
gym	OCEANVIEW	117,610	155,885	165,080	156,963	149,449		27%	-5%
gym	EUREKA	92,600	108,080	103,240	110,200	122,160		32%	11%
gym	JOSEPH LEE	124,642	103,056	88,063	103,257	118,954		-5%	15%
gym	UPPER NOE	113,010	131,230	127,817	120,938	109,709		-3%	-9%
gym	POTRERO HILL	115,255	115,856	108,028	109,033	103,326		-10%	-5%
gym	CHINESE	104,560	100,560	106,000	107,040	100,320		-4%	-6%
gym	JACKSON	67,600	77,600	77,680	89,080	95,120		41%	7%
gym	ST. MARY'S	76,526	97,954	90,549	88,248	83,719		9%	-5%
gym	SUNSET	177,360	152,160	109,920	71,840	81,600		-54%	14%
gym	GLEN PARK	58,711	76,842	68,606	71,679	69,087		18%	-4%
gym	PORTOLA	33,240	44,280	48,480	63,560	64,720		95%	2%
gym	MILTON MYERS	75,840	80,480	77,440	80,960	63,040		-17%	-22%
gym	MOSCONE	0	12,279	38,605	36,487	36,102			-1%
Gym totals:		1,156,954	1,256,262	1,209,508	1,403,320	1,363,442	10.6%	18%	-3%

Recommended Nat. Gas ECMs for Balboa Pool:

Facility	Audit	Recommended Measure	Cost	Savings	Payback
Balboa Pool	1984 TEM	1. Pool Cover	\$5,664	\$3,992	1.42
	1984 TEM	2. Timedclock for HV/Vent/DHW	\$1,962	\$7,206	0.27
	1984 TEM	3. Outside Air Lockout	\$527	\$1,177	0.45
	1982 Rhea	4. Timedclock for Pool Pump (kWh)	\$253	\$970	0.26
	1984 TEM	5. Boiler Electric Ignition	\$521	\$3,168	0.16
	1984 TEM	6. Convert to Individual Showers	\$2,369	\$3,350	0.71
	1986 BTUC	7. Boiler Electric Ignition	\$550	\$1,024	0.54

Recreation & Parks Staff interviewed:

Step Three: Design Projects

Goal: *To design project elements that address specific institutional barriers, and to group complementary elements into projects that can effect permanent change.*

Tasks: 1. *List possible project ideas...*

...including a brief description of the tasks involved and the barrier(s) addressed. Try to make these project *elements* distinct, indivisible efforts focused on a specific barrier (see samples of elements from the Bureau's work in Examples section). Begin by examining how your existing programs address barriers and listing further ideas that have been talked about in your office, then review your barrier list and system diagram to generate new ideas for project elements to address each barrier.

2. *Group project elements...*

...with a similar focus into synergistic *sets*. The sets can focus on a facility (or group of facilities), a group of people, or a process (such as purchasing lighting equipment). Give special attention to combining project elements in such a way that each set of elements addresses barriers in all areas of the System Diagram. The Bureau found that such combinations reinforce each other. Note that a given project element can be used as a component in multiple proposed sets (see sample sets from the Bureau's EMAP in Examples section).

Process: *To create project elements and combine them into sets:*

- ▶ *Meet* to compile existing project ideas and to go through your list of barriers generating project ideas to address each barrier. Divide the resulting list of projects among individuals (or small groups) for further definition.
- ▶ *As individuals or in small groups*, define each project idea in terms of the barrier(s) it addresses, the system diagram group the barrier(s) is from, the work entailed in the project, and any special characteristics of note (such as an existence or lack of valuable allies, facility information, and working relationships, all factors that affect the potential of the project element). Distribute the results of this work for all to review.

- **Meet again** to clarify the projects, then assemble project elements with a common focus into sets, placing emphasis on combining elements so as to address barriers in all groupings of your system diagram.

Tips:

Start small

Focusing your first projects on the smallest viable subject will increase project manageability and ensure a successful model.

Cultivate allies

Design projects to take advantage of those individuals or groups in your setting that understand and share your goals.

Go to the top

Systemic change often requires upper management to set or change policy. In your project design, plan for the eventual need to approach top decision-makers.

Weigh clout vs. autonomy

In choosing working relationships with politically powerful agencies in your jurisdiction, weigh both the benefits of additional clout through affiliation and the benefits of operating autonomously without oversight.

Give first, get later

Demonstrate the value of your project ideas with your own resources initially; ask for contribution of resources from other agencies only when you have provided sufficient grounds for their buy-in.

Find win-win projects

Design projects to overlap the agenda of others in your setting [*for instance, the Bureau's retrofits at Recreation & Parks facilities replaced equipment that the department's maintenance staff also wanted replaced*].

Approach from many angles

Institutional barriers are held in place by many reinforcing aspects of "*the system*," so removing any barrier requires addressing it in as many ways as possible.

Ride enthusiasm

Design projects to take advantage of enthusiastic and capable staff in cooperating departments.

Examples: Below is a list of project elements generated by the Bureau to address barriers in the Awareness & Information grouping. Following that is one of our project sets, this one focusing on a process, the in-City design of new construction and major renovation.

Project Elements from the Awareness & Information grouping:

Goals: To improve the level of energy information available to our office and dept'l staff;
To educate designers, maintainers and decision-makers about efficient technologies.

"Zoo Design Review" *[No Design Expertise]*

Use the proposed renovation of most of the Zoo over the next decade as an opportunity to include energy-efficient design review.

"Set Up Rec/Park Tracking" *[Poor Tracking]*

Get well-formatted monthly energy use info to Rec/Park Admin and O&M staff.

"Hold Design Workshops" *[No Design Expertise; No Ongoing Education]*

Train City designers through workshops addressing basics of energy-efficient design.

"Hold O&M Workshops" *[Lack of Efficiency Expertise; No Ongoing Education]*

Train O&M staff on energy-efficiency measures for the equipment they work on.

"Newsletter" *[Low Awareness; Unfamiliar Tech; No Buy-In]*

Produce a new issue of *ENERGY NEWS* to let departments know about the last year's projects and programs that are available, give recognition to our allies, etc...

"Poster" *[Low Awareness]*

Design a public education poster on energy conservation to post in facilities after lighting retrofits to inform the public.

"Monitoring" *[Invisible Results]*

Install lighting or motor loggers and submeters to monitor end uses. Chart energy savings from retrofits or improved energy habits; isolate increases due to new equipment, such as computers.

"Lamp List" *[Lots of Facilities]*

Using the monthly lamp purchase report, trace purchases of large incandescents as well as efficient products to the originating purchaser and facility.

Set of Project Elements focusing on Rec/Park maintenance staff:

Goal: To increase the energy-efficiency of Rec/Park facilities by working closely with maintenance staff.

1. **O&M Workshops (Awareness/Info)**
  - Hold Boiler Efficiency workshop for Rec/Park engineers.
2. **Boiler Retrofits (Budget/Incentive)**
  - Focus first year of the Boiler Program efficiency improvements on Rec/Park facilities.
3. **Retrofit Guidelines (Awareness/Info)**
  - Develop the Boiler Guidebook to help departmental staff identify cost-effective measures.
4. **Boiler Consultant (Awareness/Info)**
  - Hire a boiler engineer to provide expertise for identifying/analyzing efficiency measures.
5. **Energy Conservation Electrician Crew (Budget/Incentive, Policy/Attitudes)**
  - Learn Rec/Park maintenance procedure in order to coordinate with Bureau retrofit procedure.
  - Work with crew to identify and implement retrofits.
6. **Promote the EELM Contract (Budget/Incentive, Policy Attitudes)**
  - Promote the wide usage of contract items within Rec/Park.
7. **Create Departmental Tracking System (Awareness/Info, Policy/Attitudes)**
  - Get monthly usage data to maintenance and admin staff; help them design system to use it.
8. **Lamp List (Coordination)**
  - Use the monthly lamp purchase reports to track down large incandescents in Rec/Park.
9. **CAMS Retrofit Coordination, Small-scale (Coordination)**
  - Connect Bureau, Capital Assests Management Survey, and Rec/Park facilities staff to ensure that equipment installed by the CAMS retrofit program is efficient.
10. **O&M Incentive (Budget/Incentive)**
  - Research budget strategies that reward Rec/Park maintenance folks for lowered energy usage.
  - Formally propose a strategy to Hetch Hetchy and Rec/Park.

Step Four: Select Projects for Implementation

Goal: *To select project elements for implementation by rating them in terms of criteria you develop.*

- Tasks:**
- 1. Create a list of criteria...**
...by which to evaluate projects (the Bureau's criteria are listed in Examples). Lay these criteria out on the blank rating table along with your sets of project elements.
  - 2. Rate each project element...**
...for each criterion, and designate the staff requirements for each element.
  - 3. Choose project elements...**
...that rate high and fit within your available staff resources.

Process: *To select project elements:*

- ▶ *Meet* to define the criteria by which to evaluate project elements, create a scoring scheme, and roughly estimate the amount of staff-time needed for each element. Lay these criteria out on the rating table with your sets of project elements listed in element-by-element.
- ▶ *Individually* fill in the table by rating each project element according to the criteria.
- ▶ *Meet again* to compare scores, and fill in a rating table together, reaching agreement on scores. Use the totals for each element to prioritize them. Determine your available staff-time for implementing EMAP project elements, and select projects.

Tips: *Take your time*

Selecting projects is an arduous process, and it is the culmination of your work to develop an EMAP.

Value different styles

Some people prefer to have rational justification for each decision, others prefer to follow their intuition. Both are valuable: the former allows for greater thoroughness, and the latter allows decisions to be reached faster.

Select essential projects

When deciding which of several project elements to choose, determine which are most essential to the success of the overall set of projects you are selecting.

Select one major project

Consider selecting at least one project that addresses a major institutional barrier, and consider limiting yourself to one such project.

Estimate staff requirements high

Projects (especially ambitious efforts aimed at institutional barriers!) tend to grow larger than originally projected, so be generous with time estimates for each project.

Examples: Below is a list of the criteria that the Bureau used to rate project elements, and a description of our scoring scheme and staff requirement designations. The Bureau's rating table follows, with a blank rating table provided.

Criteria for Rating Project Elements:

This first set of three criteria were simply checked yes or no for our reference:

- ▶ **Is this project something we are already doing or committed to doing as a part of the EMAP project?** If so, we would most likely continue our commitment or plans.
- ▶ **Do we plan to do this work through another funded project?** This flagged those projects that the Bureau is already involved in independent of EMAP, but that are addressing institutional barriers. This was valuable because we could select project elements that worked synergistically with these existing projects. It also gave us an overview of the work our office is doing to address barriers.

- ▶ **Does this project involve major structural change to City system?** This enabled us to measure our commitment to time-intensive efforts to effect major structural change. We wanted to make sure to tackle some large-scale core barriers, while trying not to overload ourselves.

We used the following criteria to rate project elements with a score of 0, 1, or 2, indicating a low, medium, or high degree of that category. Categories were set up so that high scores were signs of a good project. The total for each project element gave us an overall score for comparison; although the scoring system is crude, it helped us determine our top priorities.

- ▶ **Does this work overlap with work the Bureau has wanted to do for other reasons?** This indicates whether a project would be undertaken only because it is a valuable part of an strategy to overcome barriers, or if it accomplishes immediate goals of other programs as well.
- ▶ **Does this project need to happen "now or never"?** Some opportunities, because they require integration into existing projects such as design review of new construction, are time-critical. We used this criteria to evaluate the sensitivity of a project to timing, including the possibility that it may only occur as part of the EMAP project and be difficult to justify later.
- ▶ **Do we have the information needed to undertake this project in-hand?** This measured how ready we were to begin implementation without further research (such as audits) being required.
- ▶ **How synergistic is this project with the other projects it is grouped with?** This evaluated how important this project was to the synergy of its project set. This might be very important if it is the only project from a grouping on the system diagram.
- ▶ **How synergistic is this project with other work with Recreation & Parks in general?** This is similar to the criterion above, except it looks at the overall departmental effect.
- ▶ **How synergistic is this project with the development of Hetch Hetchy Water & Power?** This gave credit to several projects that would advance the municipal utility's capability or openness to pursuing demand-side measures, including changing the departmental energy budgeting structure.
- ▶ **How well does this project serve as a model for further work on institutional barriers?** This judges how transferable a project is, and how striking its success would be to decision-makers.
- ▶ **How significantly does this project directly benefit the City?** This criterion evaluates the immediate benefits of a project, rather than its symbolic effects as a model.
- ▶ **How simple is this project's concept?** This checked for both manageability as well as the ease with which the concept would be grasped by those participating and those we would be trying to impress with the results.
- ▶ **Can we expect cooperation from those we need to work with on this project?** This served to give credit for those situations in which others were especially supportive of the Bureau's work, and lower the score when we anticipated potential resistance.

Staff-time Requirements:

We assigned to each project element one of the following ratings:

Low (half a person-day per week or less)

Medium (half to one and one-half person-days per week)

High (more than one and one-half person-days per week)

The Bureau's Rating Table:

The Bureau's Rating Table:

Bureau is already doing or committed to doing this work
Bureau has plans to do this work through other projects
we have needed info in-hand
is synergistic with the rest of its project
adds to Rec/Park synergy
adds to Hetchy synergy
is clear and simple
we can expect cooperation
is a good model for future work
overlaps stuff Bureau will likely do anyway
will be done now or never
has direct City-wide benefit
requires big structural change

PROJECTS

TOTAL
SCORE TIME
REQ'D

1. Energy Efficient Lighting Materials

1.1 Promote the EELM Contract	X		2	2	0	0	2	2	1	1	0	2		12	Med
1.2 Newsletter			2	2	0	0	2	2	1	1	0	1		11	Med
1.3 Rebate Program			0	2	0	0	0	1	1	0	0	2		6	Med
1.4 Life-Cycle Cost Purchasing			0	2	0	0	0	0	2	0	1	2	X	7	High
1.5 Lamp List			1	1	0	0	2	2	0	1	0	1		8	Low

2. Tracking

2.1 Improve BLHP's Procedures			1	2	0	2	0	1	0	2	0	1		9	High
2.2 Create Departmental Tracking System			1	2	2	2	1	2	2	0	1	1		14	Med
2.3 Rec/Park Incentive			0	2	2	2	0	1	2	0	2	0	X	11	High

3. Rec/Park Facilities Maintenance Staff

3.1 O&M Workshops		X	2	2	2	0	1	2	1	2	0	1		13	Med
3.2 Boiler Retrofits		X	2	2	2	0	1	1	1	2	1	0		12	High
3.3 Retrofit Guidelines		X	1	2	2	0	1	1	2	2	0	2		13	High
3.4 Boiler Consultant		X	2	2	2	0	1	1	1	2	0	1		12	High
3.5 Energy Conservation Electrician Crew	X		2	2	2	0	1	2	1	1	2	0		13	High
3.6 Promote the EELM Contract	X		2	2	1	0	2	2	1	2	0	2		14	Med
3.7 Create Departmental Tracking System			1	2	2	2	1	2	2	0	1	1		14	Med
3.8 Lamp List			1	1	1	0	2	2	1	1	0	1		10	Med
3.9 CAMS Coordination			1	1	1	0	1	1	1	0	0	1		7	Med
3.10 O&M Incentive			0	2	2	1	0	1	2	0	2	1	X	11	High

4. Rec/Park Design Review

4.1 CIP Notification		X	1	2	1	0	1	1	2	2	0	1		11	High
4.2 Design Policy at BOA		X	1	2	1	0	1	1	2	2	0	2	X	12	High
4.3 Incremental Cost-Sharing		X	2	2	1	0	1	1	1	2	0	2		12	Med
4.4 Design Workshops		X	2	2	1	0	1	1	2	2	0	1		12	Med
4.5 Recognition Program		X	2	2	2	0	2	2	2	1	0	2		15	Med
4.6 O&M Workshops		X	1	1	2	0	1	1	2	1	0	1		10	High
4.7 Design Guidelines		X	1	2	1	0	1	1	2	2	0	2		12	High
4.8 Policy Primer		X	1	2	0	2	1	1	1	1	1	2	X	12	High

5. Model Facility

5.1 Retrofits	X		2	1	2	0	0	2	1	1	0	0		9	High
5.2 O&M Incentive			0	2	2	1	0	1	2	0	2	1	X	11	High
5.3 Rec Staff Incentive			0	2	2	1	0	0	2	0	2	0	X	9	High
5.4 Monitoring			1	1	1	1	1	2	1	0	0	0		8	Med
5.5 Poster			0	1	0	0	0	2	1	0	2	1		7	Low

6. Incentive

6.1 Admin Staff Incentive			0	1	1	1	0	1	2	0	2	0	X	8	High
6.2 O&M Staff Incentive			0	1	1	1	0	1	2	0	2	0	X	8	High
6.3 Rec Staff Incentive			0	1	1	1	0	0	2	0	2	0	X	7	High
6.4 Retrofits	X		2	1	1	0	0	2	1	1	0	0		8	High

Solo Project Elements

ENERGY NEWS Newsletter			2	2	0	0	2	2	1	2	0	2		13	Med
Promote the EELM contract	X		2	2	0	0	2	2	1	2	0	2		13	Med
Policy Primer			1	2	0	2	1	0	1	1	1	2	X	11	High

Blank Rating Table:

PROJECTS	CRITERIA										TOTAL	STAFF
											SCORE	REQ'D
1												
1.1												
1.2												
1.3												
1.4												
1.5												
1.6												
1.7												
1.8												
2												
2.1												
2.2												
2.3												
2.4												
2.5												
2.6												
2.7												
2.8												
3												
3.1												
3.2												
3.3												
3.4												
3.5												
3.6												

Implementation & Ongoing Work

Goal: *To implement projects selected from your EMAP, and to maintain an ongoing program that works to remove institutional barriers.*

Tasks: 1. *Implement projects...*

...selected from your EMAP, adjusting strategies and estimates of staff-time investment as needed.

2. *Periodically review...*

...the results of the EMAP projects you have implemented, evaluating how successful they have been in overcoming the barriers at which they were targeted. When the goals of initial projects are achieved or more staff resources become available, update the original EMAP and select new projects.

3. *When designing new programs...*

...use your EMAP to incorporate components that address institutional barriers

4. *Keep in touch...*

...with other energy offices to discuss your work and to share experiences with institutional barriers. Please also keep the Bureau informed of findings from your work so that we may improve our programs.

Process: Meet regularly to review the progress of EMAP projects and to plan ongoing work. When possible, meet with representatives from other energy and environmental offices to share experiences about institutional barriers.

Tips:***Be flexible***

Collaborating with other organizations on innovative projects will require flexibility regarding timing, style, and direction.

Focus on the long-term

EMAP projects are meant to overcome barriers that have been a long time in forming and that will take time to remove. Even as you work on projects designed to produce real results in the present, retain a vision of your long-term goals.

Find partners

Contact other local energy offices, your state energy office, and other agencies (such as local government environmental offices) in order to establish a network of agencies addressing institutional barriers.

The Bureau's List of Institutional Barriers:

Motivation

Barrier	Description	General Solution
M1 No Budget Incentive	Savings from conserved energy do not directly accrue to the department responsible for the conservation, thus there is no direct budgetary incentive for such conservation.	Structure a shared-savings program, allowing a conserving department to spend a portion of savings resulting from their efforts on departmental needs.
M2 No Policy	There is no definitive policy mandating energy-efficiency and conservation, leaving energy decisions to individual discretion at facilities.	Convince individual decision-makers of the need for conservation, stressing benefits that overlap their agenda; help policy-makers create/enforce policies.
M3 Nearsighted Planning	Decision makers are most responsive to short-term visible issues, and are not motivated to plan for the long-term.	Make energy conservation an issue that political decision-makers cannot ignore by publicizing potential and risks of inaction.
M4 Low Awareness	Staff (and public) do not fully understand or value the benefits of conservation.	Develop education programs for staff (and the public where appropriate).
M5 Low Priority	Immediate, critical issues (ie. staff cutbacks) make energy conservation a low priority, especially in terms of funding.	Educate funding decision-makers about the benefits of conservation, emphasizing financial aspects and overlap with their agenda.
M6 Incomplete Buy-in	Projects are not fully supported by those who are uninformed or outside of the decision-making process.	Cultivate lines of communications (in both directions) with all involved parties.
M7 Change Resisted	Because changing the status quo is difficult and perceived as risky, staff resist change.	Use tangible project results to reduce perception of risk and illustrate the benefits of changing.
M8 Loan Anxiety	Financial officers are unwilling to pursue loans for energy conservation projects because of the perceived risk and a low awareness of benefits.	Through success stories and thorough analysis, demonstrate to decision-makers that risk is low and return-on-investment high.
M9 No Constituency	Public support for energy conservation is diffuse, so decision-makers are not pressured to support conservation.	Develop ties with local organizations that support conservation; publicize programs and enlist support.

Design

Barrier	Description	General Solution
D1 No Design Expertise	Designers lack expertise in energy-efficient design practices and equipment.	Identify and develop resources for design review and training; provide technical guidance.
D2 Unknown Projects	Energy review is not formally integrated into the design process so opportunities for review of planned projects are missed.	Study design process and identify key design staff; develop and institutionalize a mechanism for identifying upcoming opportunities.
D3 ECM First Cost	Designers balk at cost-effective energy-efficient designs because they cost more than traditional designs.	Obtain funds for incremental costs; educate funders about decreased future operating costs.
D4 No Continuity	Assisting designers on one specific project does not result in knowledge carried over to future projects.	Teach general energy-efficient design principles, using specific projects as case studies.
D5 No Ongoing Education	Designers are not kept current on evolving energy-efficient equipment and practices.	Demonstrate benefits of keeping designers up-to-date, and supply materials, contacts, and training.

Purchasing

Barrier	Description	General Solution
P1 First-Cost Purchasing	Purchasing is based on lowest first cost, resulting in selection of products which cost much more over their lifetimes.	Create a policy that mandates specific equipment; educate purchasers on fiscal logic behind Life-Cycle Cost purchasing methodology.
P2 New Technologies Hard to Get	Purchasing contracts for equipment do not include new efficient products, giving traditional equipment undue price and administrative advantages.	Locate existing government contracts that include new efficient items, or create your own, making the products as easy to purchase as those on existing contracts.
P3 Unfamiliar Technologies	Purchasers and specifiers hesitate to buy new efficient equipment that they are unfamiliar with.	Educate specifiers and purchasers about efficient products, and demonstrate a demand for them.

Information/Communications

Barrier	Description	General Solution
IC1 Poor Tracking	Facility energy use is not adequately tracked so billing errors are not found and valuable info regarding facility performance is unavailable.	Improve or create the tracking system to provide information to the appropriate departmental staffpersons in a useful format.
IC2 Savings Fall Short	Savings from ECMs fall short of projections due to faulty analysis, load increase, etc.	Directly measure savings when possible, document assumptions, follow up on projects., and emphasize cost avoidance.
IC3 Invisible Results	Project savings are difficult to demonstrate due to poor tracking or inadequate monitoring hardware.	Increase tracking and monitoring capability; use well-measured results from similar projects to back up projected results.
IC4 Out of Touch	Miscommunication or lack of communication (<i>one hand not knowing what the other is doing</i>) limits the effectiveness of programs.	Determine all relevant parties and keep them informed; establish permanent channels of communication between them.
IC5 Non-Budget Benefits	Benefits such as reduced maintenance or environmental externalities are not directly reflected in the budget and so are valued less.	Quantify these benefits, and educate budgetary staff about their importance both in terms of departmental missions and fiscally.
IC6 Lots of Facilities	Energy offices have insufficient resources to audit all municipal facilities in order to determine which need the most attention.	Identify existing resources that catalog facility data, develop a system-wide tracking system, and use indexing to characterize facilities.
IC7 New Technical Information	New efficient technologies raise many questions regarding performance and other issues that are difficult to keep pace with.	Cultivate a network of information resources from government and private designers, research labs, professional associations, and vendors.

Retrofits

Barrier	Description	General Solution
R1 Insufficient Funding	Low funding levels do not allow energy offices to implement cost-effective retrofits.	Educate decision-makers about the need for conservation and the long-term costs of <i>not</i> investing in efficiency.
R2 No Multi-Year Contracts	Because laws restrict contracts to one year, third-party financing is not possible.	Convince policy-makers of the value of third-party financing, and seek to make it legal.
R3 Funding Delays	Obtaining funds for energy retrofits requires substantial effort and delays implementation.	Set up funding that can be used flexibly, with less administrative effort, for projects yet-to-be-identified.
R4 Isolated Projects	Isolated retrofits at individual facilities are not fully integrated into departmental operationing procedures.	Retrofit groups of facilities that offer similar opportunities and can be tied functionally under common policies.
R5 Narrow Focus	Equipment retrofits lose additional savings (or fail to realize expected savings) due to non-equipment factors, such as occupant behavior.	Look for opportunities that complement equipment change-out; meet with occupants before and after retrofits to identify issues and opportunities.
R6 Environmental Issues	Energy-saving retrofits can tie into other environmental issues, such as "generating" hazardous waste when replacing fluorescent ballasts.	Establish contacts and coordinate efforts with other city and regulatory agencies responsible for dealing with these issues.
R7 Action, Not Studies	Facility staff are discouraged by lack of action (usually due to a lack of funding) and resent studies that do not seem to lead to any action.	Provide some action in the near term to gain confidence; demonstrate the value of audits and other studies to facility staff.
R8 Mixed Technologies	Replacing old equipment (such as magnetic fluorescent ballasts) on an as-needed, partial replacement basis results in a confusing mixture of technologies.	Perform comprehensive retrofits to change all equipment at once; organize replacement on an orderly basis coordinated with operators.

Operations & Maintenance

Barrier	Description	General Solution
OM1 <i>Lack of Maintenance Knowledge</i>	HVAC maintenance staff are not extensively trained in the energy efficiency aspect of their work.	Help HVAC maintenance staff get training in efficiency; demonstrate the cost-effectiveness of this investment.
OM2 <i>Low Maintenance Funding</i>	Underfunded maintenance results in premature deterioration and inefficient operation of equipment.	Educate budgetary and O&M decision-makers on the fiscal implication of poor maintenance.
OM3 <i>Waiting for Failure</i>	Funds for replacing equipment are more available than for routine maintenance, so equipment is not maintained.	Restructure maintenance funding to support cost-effective ongoing maintenance strategies.
OM4 <i>Technology Anxiety</i>	New efficient products are not embraced by operators who are accustomed to familiar equipment and fear new complexities.	Provide training on new technologies, reference resources, and case studies of peers that use such technologies successfully.
OM5 <i>Job Preservation</i>	City facility maintainers keep equipment in a condition where it requires regular attention to keep their jobs.	Show the extensive work that is currently not being performed that could be if maintenance resources were freed up.

Appendix A: The Bureau's Project Elements

Policy & Attitudes Grouping

Goals: To raise the priority of energy conservation (EC) in the minds and actions of decision-makers;
To lower the perception of risk associated with investment in newer efficient technologies;
To obtain more complete buy-in on the principle of EC from decision-makers;
To ultimately develop a policy that mandates including EC in all relevant decisions.

"Policy Primer" *[Low Awareness, Low Priority, No Policy]*

Prepare a document targeting policy makers, such as departmental managers, Board of Supervisors, Mayors Office, CAO... The document (or its cover letter) could be adapted for each recipient, and would describe the benefits of investments in energy efficiency, and the fiscal ramifications of making the decision to not act. The document could also propose specific policy actions.

"Garner Public Support" *[No Constituency]*

Make and maintain contacts with public organizations concerned about EC so we can rally their support if needed on a policy move.

"Design Policy for City Architects" *[No Policy, No Continuity]*

Through ongoing work with Bureau of Architecture designers, convince decision makers to set out standard guidelines (ie. always specify electronic ballasts).

"In-house Rec/Park Policy" *[No Policy]*

Propose policy changes inside Rec/Park that support other efforts we undertake there.

"Recognition Program" *[Low Priority]*

Through the Newsletter, an award program, or similar effort, give credit to those who incorporate EC into their designs, O&M work, or decision making.

Budget & Incentive Grouping

Goals: To make newer EC technologies readily available at good prices;
To have Purchasers use Life-Cycle Costing procedures;
To promote quality O&M;
To minimize the administrative effort required to obtain and use funds for EC projects;
To create structure that allows EC savings to directly benefit departments.

"Promote Energy-Efficient Lighting Materials Contract" *[Hard to Get New Tech]*

Award an EELM contract, then contact purchasers and specifiers in each department to let them know about the products, how to use them, and how to get them. Provide initial supplies of the items for maintenance staff to try out.

"Life-Cycle Cost Purchasing Policy" *[First Cost Purchasing]*

Convince purchasing to adopt LCC as a matter of practice, starting with very simple items like vehicle mileage.

"Rebate Program" *[ECM First Cost]*

Offer funds or materials to defray the additional expense of energy-efficient materials that will be available through the contract.

"Incentive Program for Recreation Staff" *[No Budget Incentive]*

Propose an incentive program to Rec/Park for a small set of facilities, such as the pools or the Rec centers, to encourage staff participation.

"Incentive Program for Maintenance Staff" *[No Budget Incentive]*

Include energy costs with facility maintenance budget so the maintenance crew can take advantage of EC projects they perform.

"Incentive Program for Administrative Staff" *[No Budget Incentive, No Buy-in]*

At McLaren Lodge, identify behavioral adjustments that could save energy, and structure an incentive program so savings can remain in Rec/Park.

"Departmental Billing Fixed Line Item" *[No Budget Incentive]*

Convince BLHP/Hetchy to try out the 1982 procedure of fixing the energy line item, only to be increased by special well-defined request. Include a mechanism for the department to keep some of the extra funds if they use less than budgeted.

"Develop TESTER Project Cost/Benefit Analysis Tool" *[Non-Budget Benefits]*

Make TESTER spreadsheet useful to City decision-makers (and other energy offices) so that they can analyze the potential of ECMs.

"Departmental Retrofit Crew" *[No Buy-in, Isolated Projects, Uninformed Installer]*

Offer to share costs, help to identify energy and maintenance-saving projects, and obtain buy-in from Rec/Park to provide electrician labor to perform a series of retrofits.

Education, Awareness & Information Grouping

Goals: To measure the results of EC projects in enough detail to document actual savings;
To track energy usage in facilities well enough that we are aware of any noteworthy changes;
To provide monthly energy data to departments, so they can analyze facility performance;
To educate designers, O&M personnel, and decision-makers about EC technologies.

"Zoo Design Review" *[No Design Expertise]*

Use the proposed renovation of most of the Zoo over the next decade as an opportunity to interpose EC design review methodology.

"Golden Gate Park Design Review" *[No Design Expertise]*

Provide design assistance on the bond work on GGP infrastructure (including pumps and lights).

"Improve Departmental Energy Billing" *[Poor Tracking]*

Bring Bureau in-house tracking up to date with new computer and software. Learn about the City's current tracking, billing, and forecasting/budgeting processes and look for potential improvements.

"Set Up Rec/Park Tracking System" *[Poor Tracking]*

Get monthly usage information to Rec/Park Admin and O&M folks, and develop a system for them to use the data.

"Hold Design Workshops" *[No Design Expertise; No Ongoing Education]*

Try to reach all designers at Bureau of architecture through workshops that address the key principles of EC design.

"Hold O&M Workshops" *[No Ongoing Education; Lack of Efficiency Expertise]*

Bring O&M staff up to date on EC measures for the equipment they work on.

"Newsletter" *[Low Awareness; Unfamiliar Tech; No Buy-In]*

Print a 1992 version of the *ENERGY NEWS* newsletter to let departments know what has been happening, what is available, give recognition, etc...

"Poster" *[Low Awareness]*

Design a public education poster on EC to post in facilities where EC efforts are focused to clue in the public, building their awareness and getting their participation.

"Monitoring" *[Invisible Results]*

Install monitoring equipment (lighting or motor loggers, submeters...) on facilities to learn about the specific end uses of energy in a building. Isolate increases in usage due in new electronic office equipment, or from changing occupant habits; track the savings from retrofits.

Coordination Issues

Goals: To have open channels of communication with departments regarding EC issues;
To employ a comprehensive approach to EC projects;
To have an ongoing relationship with agencies that handle environmental issues we intersect with.

"Lamp List" *[Lots of Facilities]*

Use the monthly lamp purchase report to trace purchases of large incandescents and other interesting items such as compact fluorescents the originating purchaser and facility.

"Indexing" *[Lots of Facilities]*

Use FASER energy accounting data coupled with square footage data, weather data, hours of use, or other relevant data to index facilities to locate least efficient ones.

"Retrofit Guidelines" *[Isolated Retrofits]*

Produce generic guidelines for retrofits of similar facilities for use by departmental staff.

"CIP Notification" *[Unknown Projects]*

Create a procedure within Rec/Park and BOA for early notification of upcoming design review opportunities. Also coordinate with CAMS to learn when they identify large projects.

"Capital Assets Management Survey Coordination" *[Lots of Facilities]*

Agree with CAMS program that they will provide us with basic audit information from facilities they survey, and use this information to guide our projects. Also get them to notify us when they are going to change any energy-consuming equipment so we can be in the loop on the replacement equipment.

Appendix B: The Bureau's Sets of Project Elements

List of Project Sets:

1. Energy-Efficient Lighting Materials
2. Tracking
3. Rec/Park Facilities Maintenance Staff
4. Rec/Park Design Review
5. Model Facility
6. Incentives

Solo Elements

Promote EELM Contract
ENERGY NEWS Newsletter
Policy Primer

1. Energy-Efficient Lighting Materials

Goal: To get proven energy-efficient lighting materials "out of the labs" and into widespread use by the City.

1. **Promote the EELM Term Contract** (Awareness/Info, Budget/Incentive)
  - ▶ Send an informational letter along with announcement of award to a list of dept. contacts
  - ▶ Visit specifiers and purchasers (City-wide, but especially Rec/Park) to further educate them
  - ▶ Re-energize the EELM distribution program by following up on facilities we have worked with and involving more.
2. **Newsletter** (Awareness/Info)
  - ▶ Put out an issue of the Newsletter focusing on the contract, and distribute to our mailing list of 600 engineers.
3. **Rebate Program** (Budget/Incentive)
  - ▶ Establish a "rebate" for departments to promote the use of new products.
4. **Life-Cycle Cost Purchasing** (Policy/Attitudes)
  - ▶ Establish a simple LCC policy for items on the contract, so that these products are bought whenever appropriate.
5. **Lamp List** (Coordination)
  - ▶ Scan monthly lamp purchase info for inefficient bulbs as well as independent purchases of compact fluorescents.

2. Tracking

Goal: To enable departmental staff to improve conservation efforts by tracking energy use at their facilities.

1. **Improve City Energy Billing Procedures** (Coordination)
  - ▶ Interview folks in the billing division to assess the current state of tracking, billing, and budgeting.
  - ▶ Make recommendations for improving their procedures.

2. **Create Departmental Tracking System** (Awareness/Info, Policy/Attitudes)
  - Create a more useful format for monthly billing statement to the departments.
  - Propose a procedure at Rec/Park for regular review of energy use data; identify useful applications.
3. **Rec/Park Incentive** (Budget/Incentive)
  - Propose to Hetchy and Rec/Park a mechanism for allowing Rec/Park to retain a portion of demonstrated energy savings.

3. Rec/Park Facilities Maintenance Staff

Goal: To increase the energy-efficiency of Rec/Park facilities by raising the awareness and motivation of the maintenance staff.

1. **O&M Training Workshops** (Awareness/Info)
  - Hold Boiler Efficiency workshop for Rec/Park engineers.
2. **Boiler Retrofits** (Budget/Incentive)
  - Focus first season of the Boiler Program on Rec/Park facilities, performing cost-effective energy conservation measures from past audits.
3. **Retrofit Guidelines** (Awareness/Info)
  - Develop the Boiler Guidebook in conjunction to help departmental staff identify and analyze potential energy conservation measures.
4. **Boiler Consultant** (Awareness/Info)
  - Hire a professional boiler consultant to lend expertise to evaluation of possible efficiency measures.
5. **Energy Conservation Electrician Crew** (Budget/Incentive, Policy/Attitudes)
  - Learn Rec/Park maintenance procedure in order to coordinate with Bureau retrofit procedure.
  - Work with crew to identify and implement retrofits.
6. **Promote the EELM Contract** (Budget/Incentive, Policy/Attitudes)
  - Promote the wide usage of contract items within Rec/Park.
7. **Create Departmental Tracking System** (Awareness/Info, Policy/Attitudes)
  - Get facility-specific monthly usage data to maintenance staff, with examples of how they can use it.
8. **Lamp List** (Coordination)
  - Use the monthly lamp purchase lists to track large incandescents purchased by Rec/Park.
9. **CAMS Coordination, Small-scale** (Coordination)
  - Connect Bureau, Capital Assets Management Survey, and Rec/Park facilities staff to ensure that equipment installed by the CAMS program is efficient.
10. **O&M Incentive** (Budget/Incentive)
  - Research budget strategies that reward Rec/Park maintenance folks for lowered energy usage.
  - Formally propose a strategy to municipal utility and Rec/Park.

4. Rec/Park Design Review

Goal: To ensure that all new construction and renovation in Rec/Park is energy-efficient.

1. CIP Notification (Coordination)

- ▶ Work with Rec/Park and City architects in order to insert a step in their process that notifies the BEC of upcoming projects.
- ▶ Get CAMS program to alert the Bureau when they identify work to be done on Rec/Park facilities.
- ▶ Review designs for current projects.

2. Design Policy (Policy/Attitudes)

- ▶ Convince Rec/Park designers, project managers, and the City architects they work with to adopt a set of energy-efficient design recommendations as the standard practice.

3. Incremental Cost-sharing (Budget/Incentives)

- ▶ Commit funds to provide any additional initial cost required to specify energy-efficient equipment for new construction/major renovation projects.

4. Design Workshops (Awareness/Info)

- ▶ Set up workshops for City designers to increase their knowledge about contemporary energy-efficient design.

5. Recognition Program (Budget/Incentive)

- ▶ Initiate a program that gives awards and public recognition to those designers who make energy-efficiency a priority.

6. O&M Workshops (Awareness/Info)

- ▶ Bring O&M staff up-to-speed on current energy-efficient equipment, so that architects can feel OK specifying it.

7. Design Guidelines (Awareness/Info)

- ▶ Assemble design information from past experience into a guideline for future work on similar facilities.

8. Policy Primer

- ▶ Review current SF energy-related policies and policy interpretation and implementation.
- ▶ Research policies in other cities that may have application in SF.
- ▶ Study the process for changing policy.
- ▶ Review current Bureau work to identify and analyze policy problems.
- ▶ Prepare information on energy issues in high quality presentation, distribute to appropriate audience.

5. Model Facility

Goal: To create an example of how City facilities could be more energy-efficient by focussing improvements on one facility.

1. Retrofits (Budget/Incentive)

- ▶ Work with Rec/Park facility maintenance staff to perform electric and gas ECMs at the chosen facility.

2. O&M Incentive (Budget/Incentive)

- ▶ Allow O&M staff to retain a portion of energy savings attributable to their work at the facility.

3. Rec Staff Incentive (Budget/Incentive)

- ▶ Allow Rec staff that work at the facility a portion of energy savings attributable to their behavioral changes.

4. Monitoring (Awareness/Info)

- ▶ Install monitoring equipment at the facility to accurately ascertain what to attribute savings to.

5. Poster (Awareness/Info)

- ▶ Create and display a public poster in the facility that describes the project and energy issues in general.

6. Incentive Project

Goal: To structure the budget so that it allows for a portion of savings to return to those responsible for accomplishing the savings.

1. Admin Staff Incentive (Budget/Incentive)

- ▶ Promote conservation at Rec/Park administrative office, structuring a return of savings to the Rec/Park general fund.

2. O&M Staff Incentive (Budget/Incentive)

- ▶ Same as above at selected facilities.

3. Rec Staff Incentive (Budget/Incentive)

- ▶ Same as above at selected facilities.

4. Retrofits (Budget/Incentive)

- ▶ Perform electric and gas retrofits in conjunction with programs for behavioral change.

Appendix C: Energy-Efficient Lighting Materials Term Contract Product/Price List

City & County of San Francisco ENERGY-EFFICIENT LIGHTING MATERIALS Term Contract #77490

PRODUCT/PRICE LIST

Supplier: Maltby Electric, 336 7th Street, 863-5000

T8 Lamps		[use with electronic ballasts]	
1.	FO32 T8 lamps	Osram FO32W/735K	\$1.82
PL Lamps		[for use with compact fluorescent ballasts]	
2.	5-watt	[25-watt inc. equiv.]	Osram Dulux S F5TT27K \$1.94
3.	7-watt	[40-watt inc. equiv.]	Osram Dulux S F7TT27K \$1.94
4.	9-watt	[40 to 52-watt inc. equiv.]	Osram Dulux S F9TT27K \$1.94
5.	13-watt	[60-watt inc. equiv.]	Osram Dulux S F13TT27K \$2.00
6.	9-watt quad	[40 to 52-watt inc. equiv.]	Osram Double Dulux F9DTT/27K \$4.47
7.	13-watt quad	[60-watt inc. equiv.]	Osram Double Dulux F13DTT/27K \$4.52
Compact Fluorescents		[screw in to replace incandescent bulbs]	
8.	7-watt	[40-watt inc. equiv.]	Osram Dulux EL 7W \$13.97
9.	11-watt	[40 to 52-watt inc. equiv.]	Osram Dulux EL 11W \$13.97
10.	15-watt	[60-watt inc. equiv.]	Osram Dulux EL 15W \$13.31
11.	20-watt	[75-watt inc. equiv.]	Osram Dulux EL 20W \$13.56
12.	27-watt	[100-watt inc. equiv.]	Panasonic EFD 27 LE \$15.43
13.	11-watt w/ reflector	[40 to 52-watt inc. equiv.]	Osram Dulux EL-R 11W \$16.77
14.	15-watt w/ reflector	[60-watt inc. equiv.]	Osram Dulux EL-R 15W \$17.91
15.	18-watt capsule	[75-watt inc. equiv.]	Panasonic EFT 18 LE.T \$13.56
Electronic Ballasts		[use for 4-foot and 8-foot fluorescent fixtures]	
16.	EB for 1 or 2 FO32T8 lamps, 120V	Magnetek B2321120	\$21.54
17.	EB for 1 or 2 FO32T8 lamps, 277V	Magnetek B2321277	\$22.30
18.	EB for 3 FO32T8 lamps, 120V	Magnetek B3321120	\$23.81
19.	EB for 3 FO32T8 lamps, 277V	Magnetek B3321277	\$24.75
20.	EB for 4 FO32T8 lamps, 120V	Magnetek B4321120	\$25.47
21.	EB for 4 FO32T8 lamps, 277V	Magnetek B4321277	\$26.10
22.	EB for 2 F96T12 lamps, 120V	Magnetek B275R120	\$27.06
23.	EB for 2 F96T12 lamps, 277V	Magnetek B275R277	\$28.11
Fluorescent Fixtures		[all fixtures with electronic ballasts for FO32 T8 lamps]	
24.	Wrap, 4-foot, 2-lamp, narrow	DayBrite CA-2224-4, T8/EB	\$49.79
25.	Wrap, 4-foot, 2-lamp, wide	DayBrite CA-7224-4, T8/EB	\$64.15
26.	Wrap, 4-foot, 4-lamp, wide	DayBrite CA-7244-4, T8/EB	\$90.26
27.	Wrap, 8-foot, 4-lamp, narrow	DayBrite CA-2224-8, T8/EB	\$96.09
28.	Wrap, 8-foot, 4-lamp, wide	DayBrite CA-7224-8, T8/EB	\$108.75
29.	Wrap, 4-foot, 3-lamp, wide	DayBrite CA-7234-4, T8/EB	\$133.30
30.	Wrap, 8-foot, 8-lamp, wide	DayBrite CA-7244-8, T8/EB	\$133.30
31.	Corridor, 4-foot, 1-lamp	DayBrite WB-140, T8/EB	\$62.92
32.	Corridor, 4-foot, 2-lamp	DayBrite WB-240, T8/EB	\$62.92
33.	Damp location, 4-foot, 1-lamp	DayBrite VR1-4D, T8/EB	\$81.20
34.	Damp location, 4-foot, 2-lamp	DayBrite VR2-4D, T8/EB	\$81.20
35.	Industrial, 4-foot, 2-lamp	DayBrite FL-1024-4U, T8/EB	\$68.18
36.	Industrial, 4-foot, 3-lamp	DayBrite FL-1034-4U, T8/EB	\$102.55
37.	Industrial, 8-foot, 4-lamp	DayBrite FL-1024-8U, T8/EB	\$132.92
38.	Industrial, 8-foot, 6-lamp	DayBrite FL-1034-8U, T8/EB	\$149.27
39.	Surface, 2-foot x 4-foot, 2-lamp	DayBrite SB242-MFS02D, T8/EB	\$100.26
40.	Surface, 2-foot x 4-foot, 4-lamp	DayBrite SB244-MFS02D, T8/EB	\$112.45
41.	Vandal resistant, 4-foot, 1-lamp	DayBrite SL-2414-4, T8/EB	\$102.55
42.	Vandal resistant, 4-foot, 2-lamp	DayBrite SL-2424-4, T8/EB	\$114.58

CITY & COUNTY OF SAN FRANCISCO

ENERGY NEWS

A Newsletter for Facility Maintenance Personnel

PUC/BUREAU OF ENERGY CONSERVATION

Issue 2, Fall 1992

Local Firm Awarded 92/93 Contract **Purchasing Efficient Lighting Materials Gets Easier**

The Purchasing Department recently awarded a one-year contract for Energy-Efficient Lighting Materials to San Francisco-based Maltby Electric. The new contract covers compact fluorescents (CFs), electronic ballasts (EBs), T8 lamps, and fluorescent fixtures equipped with EBs, all items that are not available through existing term contracts.

These products have rapidly entered the mainstream in the lighting industry. The City of San Jose, for example, now uses EBs exclusively, and U.C. Berkeley has retrofitted over 35,000 ballasts in four years. CFs are replacing incandescent bulbs in many applications, from office buildings to restaurant chains to homes, spurred on by PG&E rebates.

These technologies are popular because not only because they save energy (75% for CFs, 30% for EBs with T8s), but also because they decrease maintenance (CFs last ten times as long as typical incandescents, and EBs are guaranteed for over twice as long as electromagnetic ballasts). Another plus: high-frequency EBs with T8 fluorescent lamps, compared to standard ballasts with F40 lamps, provide fuller spectrum light with no flickering or loud hum. This superior lighting quality can

significantly improve a work environment.

City facilities are already taking advantage of these products: CFs are used in City Hall corridors and restrooms, Main Library stacks, Fire stations, Civic Auditorium, Youth Guidance Center, War Memorial, the Mission Cultural Center's gallery and the Bayview Opera House, to name a few sites. The 2,000 CFs distributed by the BEC last year will save about 400,000 kWh annually, equivalent to the usage of the Social Services building at 150 Otis. EBs and T8 lamps are replacing standard ballasts in Hall of Justice hallways, and recent retrofits at City College, Central Shops, and Rec/Park pools have also used fixtures with EBs and T8s.

There are lots of applications for these products in S.F. facilities! This contract makes it much easier to purchase the materials you need for new projects, as well as replacement lamps for completed projects.

For a Product/Price List and Fact Sheets describing items available through the Energy Efficient Lighting Materials contract, call the BEC at 864-6915. To open an account, contact Maltby Electric Supply at 863-5000.

Electrician Kevin Walcott of City College, holding an HID fixture supplied by the BEC to replace incandescent fixtures around campus that he has identified as prime candidates for retrofitting

1991/92 Lighting Retrofit Highlights

BEC's municipal facilities lighting retrofit program completed nine more retrofit projects in FY 1991-92. Headed by DPW/Bureau of Building Repair electrician Mike Buckley, crews replaced incandescent lights with efficient HID and fluorescent fixtures, saving the City a projected \$400K over the lifetime of these projects.

At Central Shops, facility managers David Cowley and Jim Johnson wanted to improve nighttime security

See HIGHLIGHTS, page 2

Highlights...

continued from page 1

lighting while saving energy. 500W quartz floodlights were replaced with 150W HPS fixtures. In addition, 300W bulbs in the gas pumping, auto shop, and steam cleaning areas were retrofitted with HPS lowbays, and the locker room and lounge areas, originally lit by 300W incandescents, was retrofitted with fluorescent fixtures using EBs and T8 lamps, drawing only 62W per fixture.

At **Hamilton and Sava Pools**, 500W incandescents in the natatoriums were replaced with 175W and 250W MH fixtures. Locker rooms were converted to fluorescent lighting. All EXIT signs, formerly using two 25W bulbs each, are now lit with 14W CF kits or 5W LED arrays. Rec/Park electrician **Paul Unlacke** followed up at Sava by installing a timeclock on a security lighting circuit that was previously hard-wired for 24-hour operation.

At **City College**, incandescents throughout the cafeteria's kitchen and chef training facilities in Smith Hall and the Statler Wing were retrofitted with fluorescents. In addition, the BEC is supplying HID security fixtures to City College electrician **Kevin Waight**, who has identified opportunities to install these fixtures in place of incandescents.

Over one hundred 105W incandescent bulbs in the **Opera House** marquee overhang have been replaced by 15W CFs with built-in reflectors, for an 85% savings in energy consumption. 27W CFs were used to replace 200W incandescents in catwalks over the stage, and fluorescent fixtures were installed in hallways in the wardrobe area.

The architectural appearance of antique iron fixtures at **Bernal branch library** was retained while light levels were vastly improved by an incandescent-to-MH conversion using prismatic glass reflectors. Incidental benefits of this project include reduced maintenance and improved seismic safety, due to replacement of fixture hangers. The Library shared project costs.

"As a result of your efforts, many areas of Central Shops are now better lit at less expense...the savings in energy costs and in maintenance to replace burned-out lights is considerable. The new brighter security lights on the roof last approximately ten times as long as the previous lights, and they use only 1/3 as much electricity... This is an excellent investment."

David Cowley
Gen. Superintendent
Central Shops

"The retrofit is a great success... everyone who enters our door notices the vast difference in brightness from the past darkness... We savour, not only the new, vastly improved lighting levels, but also the energy and manpower savings, the built-in seismic safety improvements and the environmental benefits for the future."

Dorothy Myers
Branch Librarian
Bernal Branch Library

A variety of technologies, including HID security lights, EBs with T8 lamps, and CFs were used to upgrade **Police stations**. Between these retrofits and energy-efficiency measures designed into **DPW/Bureau of Architecture's** plans for remodeling and replacing existing stations, almost all Police

Auto repair bay at **Central Shops** with new 150W HPS lowbays

Hamilton pool natatorium with new 175W MH fixtures

Bernal branch library, with retrofitted antique fixtures

Department facilities are improving their energy-efficiency.

The BEC is always looking for new projects. Please contact us at 864-6915 if you know o' any good candidates for our energy-efficient lighting program.

One simple thing you can do to save the Earth Energy Conservation and the Environment

Everywhere we turn we find barriers to meeting our society's still-growing demand for energy. Fossil fuels that power our vehicles and generate electricity yield emissions that poison our air and water; nuclear power produces deadly waste; and widespread use of renewable energy continues to be delayed by economic and political biases that favor traditional sources.

Is there a solution to this problem that will allow us to maintain a healthy environment? Clearly we need to reduce our present energy appetite while at the same time seeking environmentally and socially acceptable ways to meet our remaining energy needs.

As building new power plants becomes more expensive and less acceptable to society, everyone from utilities to manufacturers to government agencies to consumers is discovering the hidden potential of energy conservation. In the area of lighting, some experts estimate that by fully implementing the most efficient existing technologies and

designs, we could reduce our present demand for electricity by as much as 80-90%!

Not only does energy-efficient lighting reduce energy bills, it often cuts maintenance costs (via extended lamp life), improves quality and quantity of light available, and reduces our impact on air and water quality.

Even the small act of changing one incandescent 75W bulb to an 18W compact fluorescent lamp can save enough energy to prevent the release of 228 pounds of carbon dioxide into the atmosphere (CO₂ is the suspected leading culprit in global warming). This is the same amount of CO₂ emitted by the average motor vehicle in San Francisco over the course of one week.

The bottom line is: everyone involved in maintaining, designing or purchasing lighting equipment for City facilities can help preserve our environment, reduce the municipal deficit, and improve facilities all at the same time by choosing energy-efficient products.

The PUC's Bureau of Energy Conservation (BEC) promotes energy conservation through direct equipment retrofits in municipal facilities as well as through municipal policy planning and design review. Working with City planners, community leaders, and local businesses, the BEC also promotes energy efficiency in the private sector. Created in 1981, the BEC joins similar programs in cities around the world in working toward an environmentally sustainable future.

This newsletter is produced by Doug Johnson, Richard Engel, and Danielle Dowers. Feel free to contact us at 864-6915.

Quick Notes

☛ Thanks to those who filled out and returned the Municipal Facilities Survey (enclosed with the last issue of *ENERGY NEWS*). Some of these have already led to retrofits. If you still have a copy of the survey, it's not too late to send it in (call us if you would like another copy).

☛ The BEC's Capital Project Design Review & Assistance Program advises City engineers and architects on energy-efficient design options for new construction and major renovation projects. Integrating energy design expertise into early planning for CIPs is the most cost-effective route to efficient facilities. Through our input on designs for the new Sheriff's facility, the new Main Library, fire and police station bond projects, and branch library renovations, the program has already identified savings worth more than \$1 million annually.

☛ At S.F. General Hospital a major retrofit is underway, including installation of 578 screw-in and hard-wired compact fluorescents, 400 efficient EXIT signs, and 26 occupancy sensors. Chief Engineer Ron Bass and his crew are also considering replacing fan motors, insulating pipes, extending the Energy Management System, and improving the facility's power factor.

☛ The U.S. Department of Energy (DOE) is funding the BEC to investigate the Institutional Barriers at the root of energy-inefficient operations. Solutions include developing incentives for departments to pursue conservation projects, and

See QUICK NOTES, page 4

Quick Notes

Continued from page 3

instituting a tracking system where useful monthly energy statements are sent to facility staff. The BEC is joining forces with "model department" Rec/Park to implement pilot projects. Results from the research and projects will be used to guide programs in other S.F. departments, and will also be published nationally by the DOE so that other local governments may benefit from our experience.

Hetch Hetchy Water & Power, BEC's principal funding

source, incorporated conservation measures into their recent office remodel. The BEC specified electronic ballasts and T8 lamps for all of the office's fluorescent fixtures and occupancy sensors to turn off lights in restrooms, storerooms and conference rooms when these spaces are unused.

A Boiler Maintenance Training Seminar, sponsored by the California Energy Commission, is planned for Rec/Park engineers this winter. In addition, a troubleshooting Boiler Guidebook is in the works.

Abbreviations:

W	watt (the basic unit of power consumption and production)
kW	kilowatt (1,000 watts)
kWh	kilowatt-hour (1 kW of power being used for 1 hour; the unit of energy that utilities use for billing)
HID	high-intensity discharge
HPS	high-pressure sodium
MH	metal halide
T8	1"-diameter fluorescent lamp used with EBs
CF	compact fluorescent
EB	electronic ballast
LED	light-emitting diode

Thanks to the BBR Electric Shop for their professional installation of lighting retrofits:

Mike Buckley
Chuck Baumann
Willy Cabrera
Tom Demeritt
Jim Reed
Mike Tate
Richard Levittin
Morgan Walford
Ron Carmichael
Ernie Erhard
Derek Green
Ruben Cabrera

DPW/BBR Electrician Mike Buckley atop the City Hall dome, site of an early BEC energy retrofit

War Memorial Electrician Lyn Shlmlzu has found a wide range of applications for CFs throughout her facility

All photos in ENERGY NEWS are the work of Carmen Magana and Gretchen Hildner of the PUC Photo Lab

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PUC/Bureau of Energy Conservation
110 McAllister, Room 402
San Francisco, CA 94102

CITY & COUNTY OF SAN FRANCISCO

ENERGY NEWS

A Newsletter for Facility Maintenance Personnel

BUREAU OF ENERGY CONSERVATION

FALL, 1992

INTERDEPARTMENTAL MAIL

Appendix E: Boiler Workshop Agenda

**BOILER CLASS OUTLINE
CITY OF SAN FRANCISCO
PARKS AND RECREATION
JAN. 19, 20, 21 & 22
1993**

LESSON #	TOPIC OF CLASS	SCHEDULE
1	ENERGY AND ENERGY EVALUATION:	DAY ONE
2	WATER & THE CONSERVATION OF MATTER:	
3 3 A	THE HISTORY OF BOILERS & CONSTRUCTION: BOILER LAB & SURVEY:	
4	NATURAL GAS & COMBUSTION:	DAY TWO
4 A	COMBUSTION LAB & TESTING:	
5 5 A	WATER SIDE SAFETY CONTROLS: BOILER LAB & SURVEY:	
6 6 A	GAS SAFETY CONTROLS & CODES: BOILER LAB & SURVEY:	DAY THREE
7 7 A	HOT WATER RESET CONTROLS: RESET LAB & TESTING:	
8	BOILER CONTROL WIRING DIAGRAMS:	
9	BOILER QUIZ:	DAY FOUR
10	EVALUATION:	

CLASS ROOM TIME IS 8:15 AM TO 3:30 PM. EACH DAY.

A BREAK WILL TAKE PLACE AT APPROXIMATELY 10 AM AND AT 2PM.

A LUNCH BREAK WILL TAKE PLACE AT 11:30 TO 12:30.

Appendix F: Sample from the Boiler Guidebook

SIMPLIFIED BOILER IMPROVEMENT GUIDEBOOK

A. COMBUSTION EFFICIENCY IMPROVEMENTS

Energy Conservation Measure	Expected Benefit	Search For	Relative Cost
A1. Draft Diverters (A stack damper may also provide this function.)	Reduced excess air (This device will slow the escaping hot gasses when excessive negative draft draw exists in the stack.)	High % excess air High exhaust temperature	Installation: Low Maintenance: None
A2. Flue stack vent caps on stack	Reduced excess air (Cross winds will draw additional air through atmospheric boilers)	High excess air on windy days	Installation: Low Maintenance: None
A3. Replace atmospheric burners with power burners (forced draft)	Reduced excess air	Excess air 100% plus	Installation: Moderate Maintenance: Low (Check fan annually)
A4. Over-fire draft control (Can provide stack damper function also.)	Reduced excess air when the boiler is firing and reduced heat going up the stack by natural convection when the boiler isn't firing.	Boilers with a tall stack Note: Installation will cost less if the boiler already has a modulating damper.	Installation: Moderate Maintenance: Low Most components are electrical
A5. Low excess air burners	Lower excess air	Burners with high excess air Note: Old burners that will require replacement are especially good candidates.	Installation: High/Moderate Maintenance: Low

REPORT AND INFORMATION SOURCES

Additional copies of this report,

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Developing a Strategy for Overcoming
Institutional Barriers to Municipal Energy Conservation**

are available from:

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For further information on the work described in this report, or information on other energy programs in San Francisco, please contact:

**Hetch Hetchy Water & Power,
Bureau of Energy Conservation
Attn: John F. Deakin, Director
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