

**1. Title:** Synergistic commercial and industrial energy and water conservation strategies.

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**3. Bren Faculty Sponsor who has participated in the development of the proposal:** Arturo A. Keller

#### **4. Proposed Project**

##### **A. Problem Statement**

As a recent Group Project (2006-7) indicated, there is a strong link between energy and water use, particularly between electricity generation and freshwater use, but also in terms of the energy needed to extract, transport, treat and distribute water. There are a number of energy and water use technologies and policies that can thus have synergistic effects, such as the reuse of reclaimed water, evapotranspiration-based irrigation controllers, block rate pricing, peak demand shifting, etc. While a recent Bren School project (Harris et al., 2009) evaluated the potential for joint energy and water conservation in residential units, there is a need to explore the potential in commercial and industrial installations. Many of these synergistic energy and water use efficiency strategies already are being considered, although there are opportunities for innovation, such as the use of blue- or UV-diodes for water treatment, which are still in the "lab beaker". In addition, at present there has not been a systematic evaluation of these strategies from a technical and economic feasibility perspective, or from an integrated energy and water policy approach.

##### **B. Project Objectives:**

The overarching question is "What is the potential of these synergistic energy and water use efficiency strategies for California?" However, questions of technical and economic feasibility would have to be addressed. In addition, some of these strategies may have land-use change or carbon footprint implications, which would also have to be considered. Finally, since some of these strategies are already available, it will be important to address policy considerations: what are the barriers to implementation? What incentives can be put in place to promote implementation? What existing policies exist to do so? Do we need a new policy or can existing policies be adapted to achieve the goals?

##### **C. Project Significance:**

The successful completion of the project would have wide-reaching implications, well beyond California. California is a useful area of focus since datasets are readily available for this project, and there is considerable interest from many parties on these issues. However, these findings would be useful in many drier regions of the world, where energy and water use efficiency would diminish the pressure on

resources. We expect to actively engage SCE (Southern California Edison), EPRI (Electric Power Research Institute) and MWD (Metropolitan Water District) in the Group Project.

#### **D. Background information:**

The project focuses on California as a suitable study area. As the project progresses, it may be useful to select a few specific regions within California for case studies. For a long time, energy and water planning have been disconnected, without an integral approach. Even today, many of the energy and water conservation programs ignore the benefits or implications for the other resource. Inventors focused on energy or water conservation seldom consider both aspects. Policymakers develop new strategies for either resource without yet making the connection between them. Thus, it is important to evaluate the wide range of energy and water conservation technologies and policies available to industry and commercial operations, determine their implications for both resources, consider their synergies, and then develop a unified strategy for promoting those approaches that have the highest benefits and are most feasible. There have been many studies done to date on some of these questions, so there is a fairly rich database to work with. However, a systematic evaluation has not been done, and the consideration of policy and economics would add an important dimension.

#### **E. Stakeholders**

Given the nature of the project, many firms could benefit from the outcome of this work. However, more specifically, energy and water utilities and regulators would be direct stakeholders, and given that this work is well aligned with their interests, there should be considerable interest in the outcome of this project.

#### **F. Possible approaches and available data**

Most of the work would involve a survey of existing literature on energy and water use efficiency technologies and policies available to industry and commercial operations, although it will be of use to consider some emerging technologies that could be implementable over the next decade. Working with SCE, EPRI and MWD, we could also develop some useful case studies of specific industries that have significant energy and water consumption, or that have made significant progress in reducing the use of these resources. This would be followed by a detailed analysis of their technical and economic feasibility, as well as other positive or negative implications (e.g. landuse change, carbon footprint, ecosystem impacts). It will be of interest to consider the extent to which different approaches can be implemented and in what timeframe, as well as the level of investment needed to achieve a certain level of improvement in energy and water use efficiency.

A review of existing Urban Water Plans throughout the state may also provide an idea of the current intent of various water agencies, and their level of consideration of energy and water conservation. Similarly, working with SCE, the students could have an idea of how relevant this is to a major electrical utility. It would also be useful to discuss with CA Dept. of Water Resources and CA Energy

Commission staff their viewpoints and plans, to make recommendations that take into consideration these important viewpoints. It would be useful to have a couple of students in Sacramento during the summer interviewing various agency staff members and to establish good communication lines with these important agencies.

A review of current and planned energy and water policies would also be necessary, to be intricately familiar with the existing regulatory environment. This should cover not only California's policies and regulations, but related policies and regulations in other western states and in countries where similar concerns are being addressed.

## **G. Deliverables**

The final report should include clear recommendations on the most appropriate and applicable strategies to synergistically increase energy and water use efficiency throughout the state, with an evaluation of the policy barriers, and possible ways to overcome those barriers, including providing the right incentives to successfully implement the recommendations.

## **H. References**

California's Energy-Water Nexus: Water Use in Electricity Generation, by B. Dennen, C. Lee, J. Lee, S. Tellinghuisen, D. Larson (2006-7 Group Project).

Joint water and energy efficiency to meet conservation challenges in California. M. Harris, P. Roehrdanz, S. Hughes, S. Bennett, R. Wilkinson, A. Keller. To be presented at the International Water Efficiency Conference, March 30 - April 2, 2009 in Newport Beach, CA

## **5. Client**

Jack Sahl is willing to be the point of contact at SCE. We have a strong level of interest from Dave Bolland at the Association of California Water Agencies (ACWA).

## **6. A commitment by the client to provide data and other information required for a successful project with no stipulation for a nondisclosure agreement or restriction to publication of the report.**

No data access problems are foreseen for existing technologies and policies.

## **7. Anticipated financial needs and sources of support**

Support will be provided by the Research Program on Energy and Water Sustainability for one student to be in Sacramento or with SCE, EPRI, ACWA members or MWD during Summer 2009.

## **8. Internship Opportunities**

Students will be encouraged to seek internship opportunities with SCE, ACWA members or MWD or some of the state agencies mentioned above.