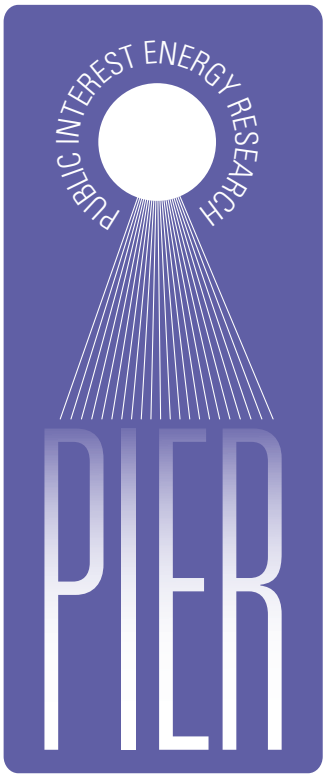
California Public Interest Energy Research

Independent PIER Review Panel Report

CALIFORNIA COUNCIL ON SCIENCE AND TECHNOLOGY



California
Independent PIER Review Panel Final Report
June 2005

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Executive Summary

This Independent Review Panel (IRP) was formed to evaluate the Public Interest Energy Research (PIER) program and to make recommendations to the Legislature and to the Governor about the PIER program's progress toward becoming a world class R&D effort. California leads the nation in fostering and implementing new sources of electricity to sustain its economy while preserving its natural environment. The contributions of PIER to this effort have been recognized by legislation extending its initial four-year charter through 2012, and by the prominent place of PIER in the new California Department of Energy (DOE) now being proposed by the Governor.

Since its inception, the PIER program has been managed by the California Energy Commission (CEC). In order for PIER to achieve its full potential, whether housed in the CEC or the proposed new California DOE, it must conform to the principles of successful R&D management, discussed in Appendix A of this report. Briefly:

1. Successful R&D management requires a strong leader, not simply a manager, of sufficient stature and authority to earn the respect of policymakers and researchers alike.
2. A successful R&D program is guided by well-established goals and objectives, in an environment that fosters innovation and minimizes bureaucratic interference.
3. A successful R&D program requires a high-quality team of managers and staff, with the knowledge to provide technical assessment of proposals and technical oversight of projects.

The PIER program is at an important point in its development. The program has been reorganized within a new division, there is a new director with a national reputation in energy research, the CEC has added a new Public Interest Natural Gas Research program to its portfolio, and the augmentation of program staff is underway. Furthermore, the proposed California DOE also includes PIER at the divisional level reporting directly to the Secretary of Energy. These are all positive changes for the program.

More challenges and opportunities await the program. Despite significant improvement in the PIER program since the first IRP review in 2001, continuing difficulties experienced in applying the principles of superior R&D management in an organization bound by civil service rules prompted a recommendation in our March 2004 interim report that the CEC undertake an analysis of the pros and cons of an internal or external organization such as a Joint Powers Authority (JPA) to administer PIER outside the CEC. This analysis has not yet been completed.

The IRP recommends that the CEC and PIER:

1. **Continue the development of a much-needed overall strategic plan (supported by an operations and procedural manual) that integrates the Public Interest Natural Gas Research program and links and strengthens the PIER program both within the CEC, with other state agencies, and with innovative national energy research initiatives.**
2. **Reconvene the long-dormant PIER Advisory Board as an independent body.**
3. **Restore PIER's workforce to at least its former level of 63 staff and 14 consultants, and procure the additional staffing needed for the Public Interest Natural Gas Research program, and undertake a professional development program.**
4. **Continue to analyze an external PIER program model or implement the needed flexibility in any proposed internal organization.**

A key issue is whether the management flexibility and risk taking that is required for a first class R&D program will be implemented in the new internal organizational structure, within the CEC or the envisioned California Department of Energy, or whether an external option will still be required. The CEC and PIER should increase efforts to implement needed flexibility in the program. This effort should continue through any proposed internal reorganization, and the CEC should diligently continue its analysis of the potential of an external PIER program model.

The PIER program is essential and since being established has demonstrated its importance to the state. Through the CEC, PIER is contributing to the State of California Energy Action Plan. In the future, PIER can and should provide the sophisticated planning tools and capabilities that must be available if the state is to set optimal energy policies for both gas and electricity supply, transmission and utilization. The promise of the PIER program is that it can cast its activities in the context of California's unique environmental, economic, and demographic forces. The PIER program can leverage collaborative work with other states through the Association of State Energy Research and Technology Transfer Institutions (ASERTTI), the U. S. Department of Energy, and other federal agencies, all in ways that provide California policymakers and administrators the data and information they need to develop well-informed solutions for addressing the state's energy, environmental, and economic needs. These are vital responsibilities and can be best accomplished by a first class energy R&D program. The road ahead presents some formidable challenges and we continue to encourage the CEC and PIER program staff to exercise the resolve, creativity, and flexibility that will be required to meet current and future organizational challenges head-on.

Chapter 1. Genesis of PIER and Independent Review Panel Authority

1.1 Charge to the Panel

Assembly Bill (AB) 1890 restructured the California electricity industry in 1996.[1] The legislation also authorized collection of a surcharge on retail electricity sales of not less than $62.5 million annually for four years to ensure a continuation of public interest energy research, development, and demonstration projects. The Public Interest Energy Research (PIER) program was established at the California Energy Commission (CEC) to implement this provision, funded at $61.8 million. Senate Bill (SB) 90 further defined the PIER program in October 1997, identifying key program areas and administrative and funding criteria.[2] While the originating legislation assured a funding level of not less than $62.5 million for four years, recent legislation continues the PIER program through 2012 at the same $62.5 million per year investment rate.[3]

Public Resources Code Section 25620.9(a) directed that an independent panel be established to conduct a comprehensive evaluation of the PIER program. The evaluation was to include a review of the public value of programs including, but not limited to, such factors as the positive impacts and benefits to public health, and the environment, and the benefits of those programs in providing funds for technology development that would otherwise not be adequately funded.

The first PIER IRP evaluated the PIER program from February 1999 through March 2001. The findings of this evaluation were provided to the Legislature and Governor in the form of two reports released March 2000 and March 2001.[4] The March 2000 report strongly endorsed the need for the PIER program in California, but also highlighted a variety of problems hindering effective program execution. These problems included the lack of a program director; a mismatch and lack of clarity between responsibilities; authority and assets for program area managers; limited coordination among other CEC programs; an overly complex and time-consuming contracting process; and, unclear connections among other federal and private-sector energy R&D activities, California's future energy-related needs, and public interest criteria. The CEC addressed many of the comments prior to the final report of March 2001.

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[1] Assembly Bill 1890, *Deregulation of the Electrical Industry*, September 23, 1996.

[2] Senate Bill 90, as amended, *Energy resources: renewable energy resources: funding* (enacted in 1997). The PIER program does not address issues related to transportation or nuclear energy.

[3] Assembly Bill 995 / Senate Bill 1194 (9/2000).

[4] CCST, *California Independent PIER Review Panel Report, March 2000*, and CCST, *California Independent PIER Review Panel Final Report, March 2001*.

The second PIER IRP started in June 2003 and evaluated the PIER program through May 2005. The CEC requested the assistance of the California Council on Science and Technology (CCST) to nominate IRP members and manage the review process. The IRP members were selected because of their competencies in areas necessary to evaluate the PIER program and their broad experience in research, development, and demonstration program management and execution.[5] The IRP reviewed PIER documentation, including draft strategic plans and PIER project summaries, met with PIER personnel and the CEC commissioners, and considered alternative R&D organizational structures. The IRP appointed subcommittees, who evaluated the program areas in more detail. (The evaluations can be found at the CCST website at www.ccst.us). In addition to reviewing whether or not the 13 expectations of the first IRP had been achieved, the second IRP examined current PIER organizational and operational issues and constraints. A preliminary report to the Legislature and Governor was issued March 2004 that addressed progress made toward the implementation of the first Independent Review Panel's 2001 recommendations. The CEC responded with a detailed staff report in July 2004. From mid 2004 through May 2005, the Independent Review Panel met, or communicated, with CEC staff to generate updated data and receive additional program information.

This document represents the final report of the second PIER Independent Review Panel.

1.2 Approach

The IRP examined PIER program planning and management practices, the context of California's state energy policies, administrative and organizational issues, research review processes and advisory committee functions. The IRP did not review or make recommendations about proposals submitted to the PIER program, because that responsibility was outside of the IRP's scope.

To provide a reference point for its work, the IRP early on developed, and shared with the CEC and PIER program management, a brief primer on the essential elements of successful R&D management. The primer provided the CEC with the IRP's basic perspectives regarding the requisites of leadership, organizational environment, and knowledge base for an effective R&D organization. The perspectives articulated in that document played a significant role in our approach to the evaluation of the PIER program. The primer was featured in our March 2004 Interim Report and appears in this final report as Appendix A: Essentials of Successful R&D Management.

[5] See Table C.1 in Appendix C, Matrix of Panel Member Competencies. Panel member selection included conflict of interest disclosure. While some panel members are under contract with the CEC or other interested parties, no conflicts of interest exist with respect to PIER.

The IRP held eight public meetings from June 2003 through May 2005. These meetings included briefings by the CEC commissioners, the CEC executive director, the Energy Research and Development Division deputy director, PIER program managers and staff on plans, execution, and results to date. The IRP included management, staffing, contracting, travel, intellectual property, review and advisory process issues as well as the core public value issues in its program review. To better frame its review of the PIER program, the IRP developed questions for the program managers to address. For the overall assessment of the PIER program, the IRP's questions focused on the program area portfolio in the context of the state's energy needs and the program manager's method of selecting, managing, measuring success and terminating projects. For specific program areas, the IRP and program area managers were requested to answer the following questions:

1. What are the overall goals and benefits of the program?
2. How is the project selection process chosen and managed?
3. What management processes are in place?
4. What lessons have been learned?

After collecting and analyzing relevant data, the IRP advised the CEC, in the Panel's March 2004 Report, of four key process and structural issues that should be addressed.

1. The CEC should give the PIER Program Manager position authority to fill vacancies and personnel shortfalls and supplement staff resources with contract staff.
2. PIER management should streamline the advisory committee process, reconstitute the PIER Policy Advisory Council and recast it as the PIER Advisory Board, reduce the number of program-area advisory committees, and link the advisory groups through shared membership.
3. The PIER Program Manager position should be given funding authority to support cross-program coordination, site visits, and staff professional development.
4. The CEC should develop plans for strategic operational processes to include the development of two parallel plans, one to include a greater degree of operational independence and authority within the CEC and the other to include a structure outside of the CEC.

Based on the CEC's responses to these recommendations and data requests, the IRP engaged in another round of fact finding by requesting the following information:

1. A report on the hiring of the replacement for the vacated program manager position.

2. A description of the various advisory committees for each PIER program area.
3. A discussion on PIER staff training and professional development allocations.
4. Data regarding the pace of research contracting comparing this year with last year.
5. An analysis of the hiring freeze on PIER civil service and contract staff levels.
6. An overall progress report on the development of the parallel plans for a strengthened PIER program both within the CEC and external to the Commission.

Chapter 2. Context and Vision: Importance of Energy R&D in California

The work of the IRP is influenced by the common perspective among Panel members of the importance of energy research and the need for California to benefit from a world-class energy R&D program. Both the original IRP and this second Panel believe that the PIER program has the opportunity to serve as the nucleus of a first-rate energy R&D organization. It is this belief that has driven both panels to challenge the CEC to think and work "out of the box" in creating a solid PIER program. It is this vision that influences the IRP's analyses and recommendations regarding the progress of the CEC's PIER program during the current review period. The rationale for this push rests with the importance of energy research and development to California's future.

California has an outstanding record of leadership in energy R&D and in the development of sound energy policies and practices. California's energy intensity (energy consumption per gross state/domestic product) is comparable to that of Germany and Japan, and significantly lower than the U.S. national average.[6] A rich mixture of low energy-intensity industries, advanced energy efficiency standards, and a relatively mild climate have contributed to California's success to date, but the state continues to face an uncertain energy future.

As a response to the energy crisis of 2001, and in order to ensure a stable energy market in the future, California's principal energy agencies recently created an Energy Action Plan for California.[7] The goal of the Energy Action Plan is to ensure that adequate, assured, and affordable electrical power and natural gas supplies are provided to California's consumers in a cost-effective and environmentally sound way. The energy agencies intend to achieve this goal through six specific actions:

- Optimize energy conservation and energy efficiency
- Build sufficient new generation
- Require renewable generation equivalent to at least 20% of sales by 2010 [8]

[6] In 2000, the energy intensity of California, expressed as total energy consumed per dollar of gross state product, was 6,405 BTU/$. U.S. Department of Energy, Energy Information Administration (EIA), 2003; and U.S. Department of Commerce, Bureau of Economic Analysis, 2003. In 2000, the energy intensities of Germany, Japan, and the U.S. were 6,352 BTU/$(GDP-PPP), 6,377 BTU/$(GDP-PPP), and 9,520 BTU/$(GDP), respectively. *World Development Indicators 2003*, World Bank.

[7] State of California, 2003. *State of California Energy Action Plan*.

[8] This goal is an accelerated version of the Renewable Portfolio Standard (RPS), which was signed into law by the Governor in 2002 (Senate Bill 1078), and requires renewable generation equivalent to at least 20% of sales by 2017.

- Upgrade and expand the electricity transmission and distribution system
- Promote distributed generation
- Ensure an assured supply of reasonably priced natural gas

While R&D is not explicitly mentioned in the six actions of the Energy Action Plan, it is essential for each and every one of these actions. R&D produces the information and the technologies that enable California to consider various options to achieve the goal of the Energy Action Plan. The information gained helps in understanding energy-environmental-economic linkages and in developing the most cost-effective solutions to address California's energy challenges. R&D leads to the development of innovative technologies that help to protect the environment while at the same time stimulating energy-related business activities. R&D provides the basis for sound policy decisions and their implementation and, in this way, contributes substantially to the enhanced living standard of California's citizens. The PIER program has provided vital information and has anticipated this direction by providing options in renewables, clean distributed generation, additional energy efficiency measures and developing mechanisms for integration to the transmission and distribution system.

The PIER program can and should also be a vital resource for development and deployment of the analytical integrated systems analysis tools required for the CEC to support state energy policy by assessing the options and trade-offs necessary to achieve the goals of the Energy Action Plan.

The PIER program therefore has contributed and must continue contributing to California's challenge of developing a vibrant economy with a small environmental footprint. This is the kind of leadership for which California is known.

2.1 California Energy Challenges

California still faces numerous challenges in its energy future. The economy is showing signs of recovery, which will lead to an increased load on the state's energy supply capacities. The state is expected to continue its rapid population growth of the last several decades. Much of this growth – and considerable internal migration – will be in inland areas, which have warmer climates than in the currently densely populated coastal areas. New construction in these regions will increase the use of residential and commercial air conditioning. Trends toward larger residences and increased electrical appliance use statewide will also increase energy usage. These increased energy demands – both base load and peak load – will further encumber an already strained generation, transmission, and distribution network. California and the Western States region currently operate with very little electric power reserve capability during peak summertime demands, and peak demand growth exceeds the

growth in generation capacity. Not only will California need additional supply, but it also must continue to reduce demand and ensure that additional supply consists of renewable power systems.[9]

As sophisticated information systems are deployed deeply into our industrial and commercial activities, and the use of information technology hence becomes integral to the functioning of the economy, the quality and reliability of electric power will be increasingly important. Modern manufacturing processes are more and more computer controlled – a power outage for less than a second can create a disruption in the production process and lead to massive financial losses. Since electricity storage capacity is limited, the introduction of clean distributed generation and improvements in California's transmission/distribution systems are inevitable.

California's transmission system was originally designed and built to serve mainly local power needs. It did not anticipate the active wholesale market. Today, the transmission system is used in ways for which it was not designed. Fragmented transmission planning, siting and financing problems are impediments to the necessary upgrade of the transmission system. However, there are alternatives to building new transmission lines. These include energy efficiency improvements that reduce overall electricity usage, peak load management, distributed generation that is located near the customer load, and emerging transmission technologies that increase the transfer capability of the existing transmission system, such as Flexible Alternating Current Transmission Systems (FACTS) or Dynamic Thermal Circuit Ratings (DTCR) technologies. All of these options require R&D support.

As part of their effort to enhance transmission and distribution capabilities, the CEC and the PIER program support research that can increase the reliability and utilization of the state's existing electricity transmission system. Currently supported projects include research focused on electric system reliability enhancements with the Consortium for Electric Reliability Technology Solutions (CERTS), the development of a real-time monitoring dynamic rating system for overhead lines, work on a sagging line mitigator (SLiM), advanced switches, and even intelligent software agents for control and scheduling of distributed generation. The PIER program coordinates this and related R&D with the California Independent System Operator (CAISO), which is responsible for maintaining a reliable and efficient transmission system for California.

Beyond the R&D supported by the PIER program and the CEC, significant electric energy and transmission R&D is being conducted by national laboratories such as the Pacific Northwest National Laboratory (PNNL) and the Oak Ridge National Laboratory (ORNL) where research is underway to make transmission systems smarter, more robust, less prone to interruptions, and more reliable.

[9] CEC, 2003. *Evaluation of the Benefits to California Electric Ratepayers from the Public Interest Research Program, 1998-2002.*

Another challenge is the steadily increasing consumption of natural gas. California has limited pipeline capacity for the supply of natural gas from other states. Currently, 85% of statewide demand for natural gas has to be imported. California is located at the western end of a complex network of pipelines that spans the United States and Canada. Increasing demand for natural gas in Nevada, Arizona and the Pacific Northwest may lead to supply constraints. California aims to reduce its dependence on natural gas through higher use of renewable energy sources, enhanced use of cogeneration (combined heat and power), and improved energy efficiency of natural gas fired power plants. Other options include the better use of storage capacity for natural gas, enhanced natural gas drilling and exploration in California, and the development of liquefied natural gas facilities to allow the import of liquefied natural gas from overseas sources.

The CEC is ramping up R&D related to natural gas. In August 2004, the California Public Utilities Commission (CPUC) issued Decision 04-08-010 making funds available for public interest natural gas research. For 2005, the Public Interest Natural Gas Research program budget has been set at $12 million. Eventually, the Public Interest Natural Gas Research program annual budget for the natural gas program should reach $25 million. In general, the research funded by this program should: (1) improve natural gas energy efficiency and environmental quality, and (2) develop renewable technologies. The CEC indicates it is developing a plan for this new public interest research initiative and has targeted August 2005 as its release date.

Climate changes impose a significant risk to California. Rising temperatures and sea levels, along with changes in hydrological and ecological systems, are threats to California's economy, public health, and environment. The PIER program is examining technologies to reduce the impact of these threats.

Targeted R&D can help to address these energy challenges through energy efficiency improvements; development of affordable, clean, and distributed energy sources; improvement of transmission line capacities and better load management; research on alternatives, such as biomass derived fuels, to natural gas for power generation; and the development of better, regional models showing the impacts of climate change and the development of climate change mitigation and adaptation options.

Chapter 3. Findings: An Evaluation of PIER Operational Issues and Response to IRP Recommendations

This chapter presents some of the data generated in response to requests for information or fact-finding for the issues and recommended actions identified earlier in Chapter One.

3.1 Expectations to Transform PIER into a High-Quality Research Program

A key activity of this IRP was to evaluate the progress of the PIER program since the first IRP issued its final report and set of recommendations in March 2001. The report concluded with 13 expectations that, if met by the CEC, would result in the transformation of PIER into a high quality research program within the CEC. Progress by the CEC in meeting those expectations received considerable attention in this IRP's March 2004 Report. Because that progress has helped to stabilize and mature the PIER program, and there has been activity in some of the areas since the report was published, we provide a brief summary of efforts regarding the March 2001 IRP suggested expectations.[10]

1. *PIER organizational responsibility will have grown through the formation of a dedicated division with program managers and functional heads solely responsible for PIER.*

   The CEC has developed a coherent PIER research team with a management and technical staff dedicated to PIER goals and objectives. Importantly, beginning in early 2005, the team has been elevated to division status within the Commission and the PIER program manager position has been recast as a division director in the CEC organization. This is a very positive step. This trend continues with the Division of Research and Development in the proposed California Department of Energy.

2. *The PIER Program Manager (now Division Director) will have been given authority to manage the PIER budget and selected authority to administer those funds.*

   The PIER program manager position has now been elevated to that of a division director. As a division director, the position now carries the elevated authority, as held by other division directors in the CEC, for managing the PIER budget.

[10] op. cit.

3. *The quality and experience base of PIER research managers will have continued to develop.*

   PIER has competent team leaders and strong technical managers, supported by a small but highly qualified technical staff. However, civil service requirements and, more recently, budgetary issues have prevented the filling of needed staff positions and the hiring of expert consultants. The results are a short-handed staff and a lack of intellectual resources in several important research areas. The recent relaxing of the hiring and budget freezes have allowed the CEC to begin filling PIER positions and to request seven new PIER staff members as part of the 2005-06 budget change proposal (BCP) process.

4. *California energy research targets will have been set and contracts or grants awarded to achieve those targets.*

   PIER has developed a set of California specific issues that are the basis of its research projects. A contracting and grants process is in place and operating. PIER programs are linked to related state programs, such as Title 24, Renewable Portfolio Standard, Air Resources Board and environmental regulations. PIER issues, which were developed in 2002, anticipated and fed into the California Energy Action Plan issues of 2003. Although in some cases long-term goals need to be more clearly defined and better articulated, PIER is generally recognized as doing a good job of linking its program to state energy policy.

5. *The PIER Program Manager (now Division Director) will have developed a management roadmap.*

   Budgetary and administrative processes have been improved and policy guidance clarified; however, important management and operational tools have not been fully developed. For example, the program still lacks an overall strategy complete with clearly articulated goals and objectives to which systems and processes are linked (e.g. an operations or procedures manual). While an overall formal management roadmap has been developed, the PIER program still lacks an effective management structure for successful implementation. With the recent launch of the Public Interest Natural Gas Research program within the CEC, it will be important for the CEC to develop a PIER program management plan and research agenda that links PIER's electric energy research with the natural gas research that should soon follow. There is an urgent need for the CEC to develop a management plan and a formal organizational structure to properly staff and more effectively manage the program. The executive director indicates that a "PIER plan" for hiring needed contractors and transitioning in more program civil service staff has been developed and, as of February 2005, is being implemented. The IRP would expect that the recent appointment of a new division director for the PIER program should accelerate plan implementation and that this effort be continued aggressively even as work is underway to develop the proposed California DOE.

6. *The PIER program will have, on average, awarded contracts in four or less months.*

   The CEC and PIER have done a good job in improving the efficiency and response time of the contracting process. The average elapsed time processing in a competitive procurement, between the announcement of the selected awardee and the signing of the contract, at one point (2002-2003 year) was reduced to 3.5 months, plus or minus two weeks. For this past year, the process now takes four months, plus or minus six weeks. Thus, the time period to process a contract award has increased 15% and the variability time has tripled. Certainly, the reduction of program consultants and contract staff, coupled with vacancies left unfilled because of a hiring freeze, have taken a toll on what had been impressive progress by the CEC to accelerate the contract processing period. The expectation is that with the hiring of seven new PIER staff members and the ability to engage independent contractors and project consultants, the CEC will be able to regain some of that lost processing time.

7. *The Legislature and Governor will have been provided with the CEC forecasts of energy trends, needs, and resources developed as part of PIER's strategic planning process.*

   PIER has not been assigned the task of providing strategic analyses and energy forecasts to the legislative or executive branches of the government. However, PIER submitted a legislatively mandated investment plan in March of 2001 outlining broad energy trends and needs, and the CEC provides monthly status reports to the Governor's office. PIER also developed a set of energy issues, which are tied to those later developed under the California Energy Action Plan and Integrated Energy Policy Report.

8. *The CEC will have requested and received legislative relief from specific constraints on PIER innovation related to contracting, streamlining, and staffing.*

   PIER has made vigorous efforts to get legislative relief on various management and administrative constraints. A number of legislative remedies were suggested and rewrites were submitted to and approved by appropriate senate staff as well as the Department of General Services for consideration as part of Senate Bill (SB) 1038. The Governor signed the bill into law on September 2, 2002. Additional review of this process is needed.

9. *PIER will have become an integrated part of California's funded energy efficiency and renewable energy programs.*

   PIER has been working more closely with the California Public Utilities Commission and utility companies through the Emerging Technologies Coordinating Council in the demonstration and deployment of PIER technologies. PIER has developed closer integration with the activities of the CEC Renewable Energy Program due to the Renewable Portfolio Standard and CEC commissioner interest. With the recent

establishment of the Public Interest Natural Gas Research program in the CEC, it will be important for the CEC to firmly articulate compatible research initiatives between PIER and the natural gas research program.

10. *The CEC will have developed a mechanism for informing the California Congressional Delegation of federal funding needs.*

    PIER's efforts, carried out with the cooperation of CCST, have established a standing relationship with the California Delegation's caucus leaders. The CEC chairman, the CEC executive director, and the former PIER program manager have given presentations to the delegation members and their legislative directors. The recent hire of a division director with strong national connections should serve to fortify this important activity.

11. *The CEC will have begun to affect the portfolio of U.S. DOE programs and their funding to meet California's energy needs.*

    PIER has been successful in establishing a close working relationship with the U.S. Department of Energy (DOE) and with its national laboratories, particularly Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory. U.S. DOE consults with PIER in a number of program areas, and as a result, the U.S. DOE has provided collaborative funds for a number of PIER projects. In addition, PIER is a participant in a U.S. DOE/multi-state program, the State Technologies Advancement Collaborative. The PIER program is a member of the Association of State Energy Research and Technology Transfer Institutions (ASERTTI).

12. *Partnerships and collaborations will have been pursued with other research centers.*

    PIER has established relationships with other energy related research centers in the state and elsewhere in the federal laboratory system. For example, PIER has a growing interaction with the National Oceanic & Atmospheric Administration on climate change. We have noted its membership in ASERTTI. There is a major contract in place with the University of California that lays out standard terms and conditions. PIER worked with the Electricity Innovations Institute of the Electric Power Research Institute to develop co-funded R&D projects. PIER is collaborating with a number of state agencies including the California Public Utilities Commission, Air Resources Board, Department of Water Resources, Department of Forestry and Fire Protection, and the Department of Conservation.

13. *PIER program advisory groups will consist of knowledgeable people from a range of stakeholders including: utility, industry, regulatory, academic, and public interest.*

    The PIER program has an elaborate advisory structure covering all program areas and with good stakeholder representation. In addition, there are annual technical review panels for each major program area that prepare detailed reports for the division director (formerly the PIER program manager). It would appear that, as the

PIER organization develops, this elaborate system could be simplified in the interest of reducing costs and increasing efficiencies while retaining the involvement of the stakeholders. This is almost certainly true if the PIER Policy Advisory Council, which has not been active, is activated. The program would benefit from its overview.

Expectations summary. This IRP finds that each of the 13 expectations of the previous IRP has been addressed, and in most cases, real progress has been made. The program areas are better defined with competent team leaders in place. Both the former PIER program manager and the new division director have impeccable records of achievement and respect in the energy research and policy arena. The move to elevate the program director position to that of division director should serve to resolve issues of authority over civil service personnel and program operating budgets. The program has a capable, yet small, dedicated technical staff. Research strategies are in development and contracting procedures have been streamlined. The program is proceeding with relevant research and is producing practical results. Cumbersome administrative practices and staffing requirements remain major concerns as well. Unless corrected, these issues will almost certainly limit PIER's ability to evolve into what should be the CEC's objective, that of creating a "truly outstanding research & development program that will benefit the citizens of California."

3.2 Providing the PIER Program Manager with Staffing/Budget Authority

For much of PIER's existence, a program manager served as its chief administrator. A contracted scientist borrowed from the Lawrence Livermore National Laboratory through an inter-jurisdictional exchange agreement filled the position. While this arrangement allowed PIER to benefit from a highly capable and experienced energy expert serving as program manager, the very structure of this position created authority issues. As a contracted position operating at a program manager level, the position did not have formal authority over the program's civil service employees and no direct formal authority over the program's budget.

The IRP recommended to the CEC that the PIER program manager be given authority to fill vacancies and personnel shortfalls and to supplement staff resources with contract staff. The IRP further recommended that the program manager be given funding authority to support cross-program coordination, site visits, and staff professional development.

During Summer 2004, the program manager position became vacant and provided the opportunity for the CEC to examine the structure of the PIER program and its program manager position. This Panel, and the first IRP, had long suggested that the Commission work to reorganize, internally, the PIER program and its management structure to allow for greater authority and flexibility. In January 2005, the CEC announced it had completed some of this work by creating the Energy Research and

Development Division and recasting the PIER program director position to that of division director. After a national search, Dr. Martha Krebs was appointed director of this new division.

According to the job description for the division director, and directives from the CEC executive director, the management authority of the new Energy Research and Development Division deputy director "is the same as the management authority for all other division directors in the Energy Commission." With this new division-wide status, the director will now have the authority and responsibility to:

- Plan, organize and direct programs and resources of the division.
- Ensure that the division's activities are responsive to state energy policy and are coordinated with other state energy and environmental programs.
- Participate in and make personnel and administrative decisions, including hiring and firing, performance evaluations, organizational structure, and workload priorities.
- Allocate division resources.
- Provide long-term vision and develop near-term strategies regarding the direction, activities, and resources of the division and its programs.
- Work with the executive director and other deputy directors to manage the Energy Commission's overall programs and organization.

Authority summary. This IRP applauds these organizational changes and believes that the newly elevated title and authority of the chief PIER administrator (now a division director) will help to address some of the staff and budget oversight weaknesses inherent in the former position. The IRP remains concerned that CEC policies and oversight by state control agencies, along with the realities of civil service procedures and salary caps, still combine to constrict the ability of the program and its director to respond quickly and creatively to energy R&D opportunities requiring rapid budget action. The proposed organization of a California DOE provides an opportunity to expand the program leader's authority.

3.3 Consolidating and Better Linking Program Advisory Committees

The number of advisory committees utilized by PIER and how those committees are coordinated has concerned this IRP. The involvement of external experts as advisors is a positive addition to the knowledge base and capability of PIER. It is important that the number and cross-relationships of advisory committees be carefully considered and managed. This is vital because of the need to rely on external and industry expertise in fashioning and executing an articulate, progressive energy R&D PIER program.

The PIER program utilizes three types of advisory bodies. The first is the single, overarching PIER Policy Advisory Council. The second type is a standing committee known as a program area advisory committee, and is generally long-term in scope. The third type of advisory body is an ad hoc program/project advisory group that is designed as a limited-term entity that focuses on a specific project, research initiative, or task.

The IRP recommended that PIER management should streamline the advisory committee process, reconstitute the PIER Policy Advisory Council and recast it as the PIER Advisory Board, reduce the number of program-area advisory committees, and link the advisory groups through shared membership. Overall, during the period under review, the CEC has maintained about the same number of program advisory committees. We are disappointed that the CEC did not convene the overall PIER Policy Advisory Council during the period of this review (June 2003 – May 2005).

The CEC is in agreement that PIER advisory committees serve a very important role in providing staff with critical technical and market related industry perspectives. Advisory committees provide an opportunity for researchers and research managers to have an ongoing dialogue with industry regarding research direction, scope, relevance and potential mid-course corrections. According to program staff, the standing program area advisory committees and ad hoc project committees require very little staff time relative to the value they provide. Advisory committee members are selected based on their respective areas of technical expertise and committees are balanced to ensure a diverse industry perspective.

The standing program area advisory committees are established to give guidance and feedback on PIER program direction on an ongoing basis for selected key program areas. These committees bring technical and market expertise to help shape the direction of research. The following table displays these standing committees. They are not associated with a particular contract, but provide overall guidance in specific program areas.

Table 3.1 List of PIER Standing Committees

Committee Name	Number of Members	Purpose: Tech & Market Advice	Purpose: Planning Advice	# Meetings in Last Two Years	Program Area Served
PIER Policy Advisory Council	15-18		X	0	Entire PIER
Air Quality Policy Advisory Committee	9	X	X	1	Environmental Program Area
Climate Change Technical Committee	8	X	X	4	Environmental Program Area
Distributed Energy Resources Integration Committee	5	X	X	8	Energy Systems Integration Program Area
Transmission Committee	8	X	X	2	Energy Systems Integration Program Area

Second, ad hoc advisory committees (separate from the standing committees) have been established to provide technical and market advice and perspectives in the form of peer reviews of technical projects during the term of the contract. Committee members are selected with approval from the Energy Commission contract manager. The committees are managed by the PIER contractors and require very little staff management time. They supplement staff efforts to gather technical insight and market intelligence and provide analysis to help PIER evaluate research results for technical merit as well as market relevance. In addition, the committees help the researchers and research managers in evaluating the current and planned research direction. At times, these committees have helped the Energy Commission contract managers in making important mid-course corrections to maximize the value of the research. All PIER research contracts include language to establish this type of advisory committee. These ad hoc committees do not exist beyond the term of a contract.

In addition, during planning phases prior to release of Requests For Proposals (RFPs), experts from the R&D and industry communities are often invited to workshops that may recommend specific program directions. PIER staff often then develop their solicitations based in part on findings from such workshops.

Advisory committees summary. We are encouraged by the use of external experts and the role their advice and counsel plays within PIER and the CEC. We continue to press the CEC to convene an overall PIER Advisory Board. That overarching

committee would provide valuable input in the formulation of program area committees and their inter- and intra-relationships within PIER and with other energy initiatives.

3.4 The Impact of Budget and Hiring Freezes

Although the PIER program is not funded by state general funds, because it is housed within the CEC, it is subject to the staffing and budget freezes that have been imposed on state agencies over the past few years. The CEC reports that from PIER's implementation in 1999 through 2004, the Energy Commission has been subject to numerous freezes. Each hiring freeze was applied without regard to program funding source. The atmosphere created by the state budget crisis was the backdrop for the hiring freezes that also made approval of additional PIER staff positions (using the Budget Change Proposal, or BCP process) virtually impossible. The combination of these two circumstances has resulted in a chronic understaffing of PIER. PIER management chose to partially address this understaffing by hiring contractors, usually in areas requiring specific, technical expertise.

In August 2003, PIER utilized 14 consultants in various capacities. The Governor then initiated the layoff process for nearly all agencies. The CEC's executive director was left with the choice of either finding nearly $1.5 million in savings by laying off civil service personnel, or by cutting the number of contractors within the Energy Commission. The latter option was chosen. Some of the very consultants used by PIER for project design, contract development, and program technical support were released.

The hiring freeze was particularly felt across the civil service staff of PIER. Prior to the hiring freeze, PIER had 63 civil service positions, 49 staff working in the program areas and 14 vacant positions. The 49 positions included six research managers, 23 engineers and two contract streamlining staff. The remaining staff was a mix of scientific disciplines including chemists, biologists, geologists, economists, and environmental scientists.

The hiring freeze was implemented and the result was a dramatic reduction in PIER's allotted workforce. As of December 2004, the number of PIER positions had been reduced from a "pre freeze" level of 63 employees to a "post freeze" status of 51 positions. Of these 51 positions, six remained vacant at the end of 2004. In addition, virtually all of the 14 consultant positions were terminated. The reductions in the combined staff and consultant workforce resulted in losing research managers, registered civil engineers, mechanical engineers, and staff members with nearly 30 years experience. This IRP has observed that the reduction in force has certainly contributed to a slowdown of the contract awards process, and the preparing and fielding of requests for research proposals.

With the softening of the layoff crisis, the CEC has undertaken several important steps to mitigate the critical loss of staff and technical expertise in the PIER program. These steps include the following:

1. PIER management developed a plan on how to attract and utilize on-site contract help. The plan justifies the number of contractors needed for the program and establishes a schedule for replacing the contractors with civil service staff. The plan further recognizes the uncertainty of replacing contractors with civil service staff given the frequency of hiring freezes and other restrictions. It recognizes that the PIER program will require, from time to time, expertise not found in any state civil service classification, therefore, necessitating hiring contractors as the need arises. The plan has been implemented and, as of February 2005, there are 14.5 full-time equivalent co-located contractors in the PIER program.
2. By the end of February 2005, the CEC was in the process of filling four of the six vacancies in the PIER program, with a commitment to fill the remaining two under the oversight of the recently hired division director for PIER.
3. The Energy Commission has submitted a budget change proposal as part of the Fiscal Year budget process that includes seven new positions for PIER as an important step in reversing the understaffing that has plagued the program in recent years. The CEC, as well, has requested an additional five positions to ramp up the newly established Public Interest Natural Gas Research program.

Beyond the deleterious effect that freezes have on staff shortages, the very imposition of staff and budget freezes have a destabilizing effect on most R&D operations. Research and development requires a stable platform of resources, staffing, and supportive policies. Being exposed to fluctuating budgets and staffing levels only serves to downgrade the research and discovery capabilities of the PIER program or any science-based R&D initiative.

Freezes summary. The IRP understands the budget and staffing decisions the CEC made in response to the recent state hiring and budget freezes. Losing 12 staff positions and an additional nearly one dozen consultants as part of the recent layoff crisis was challenging and difficult for PIER. It will take time to rebuild the technical expertise of the program and regain momentum best achieved when programs are not in the midst of a staffing shortfall. The Panel has urged that there should be a way to shield the PIER program from these actions given that its funding source is not from the state's General Fund. Because the PIER program is housed within the CEC, and the CEC is a state agency, the program will continue to suffer the vagaries of a state budget in crisis.

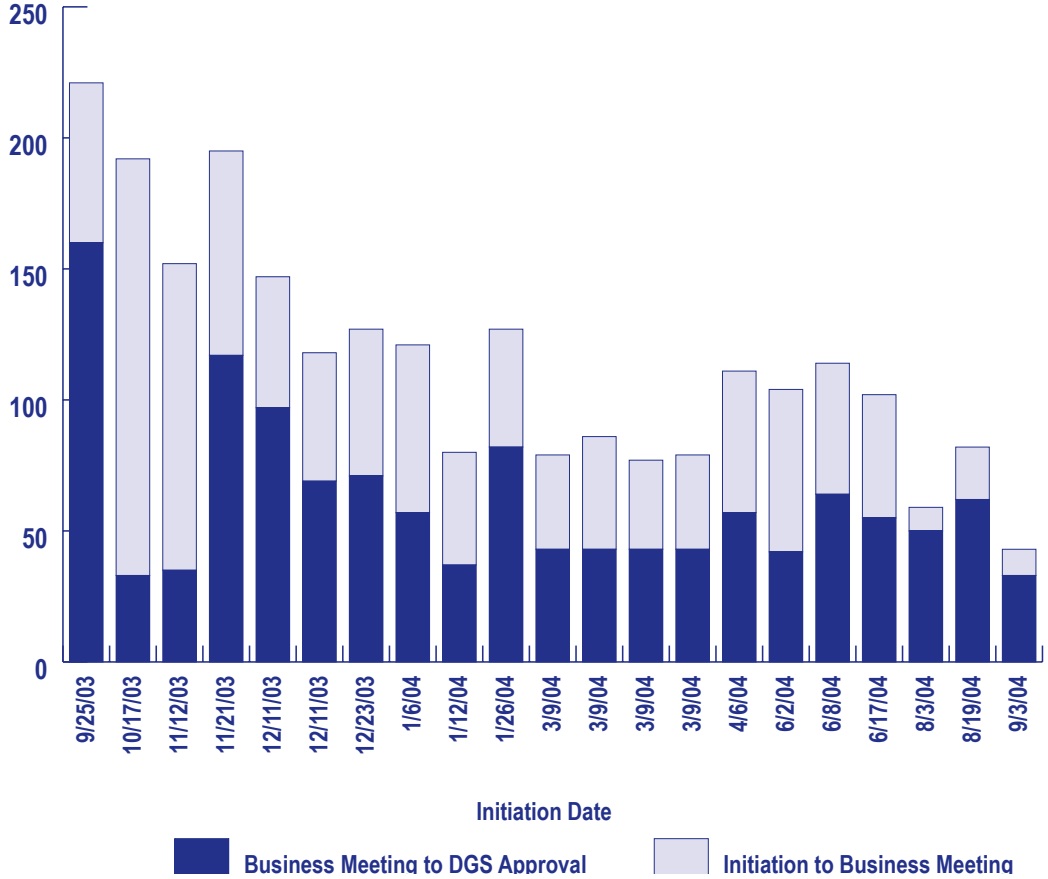
3.5 The Pace of Processing Contract Awards

The independent review of the PIER program in 2000 identified three key issues regarding the PIER contracting procedures: (1) the project selection and contracting processes were overly complex, (2) the time from receipt of a proposal to contract signature was too long, and (3) a significant portion of the process-related problems was internally imposed or inherent in the CEC's structure. The previous PIER IRP found that processing a contract during the 2000-2001 time period took an average 7.2 months, plus or minus ten weeks variability. In its March 2001 report, the first IRP challenged the CEC to improve the contracting process by:

- Reducing the time from issuance of a competitive solicitation to starting work on an executed contract to less than six months.
- Developing research agreements that are more flexible, with provisions for unexpected and mid-course corrections, yet still having appropriate levels of accountability.
- Establishing an on-going mechanism to improve the contracting process.
- Awarding contracts in four or less months on average.

In September 2001, the PIER program established a PIER Administrative Streamlining Team, called "Team Sparkey." This team created standardized work statements, revised standard terms and conditions in PIER research contracts, and established master research agreements with the University of California and the Electricity Innovations Institute to get more flexibility and to speed up the contracting process. The result was that by late 2002 the average contract process time between project award and the signing of the contract was reduced to 3.5 months, plus or minus 2 weeks.

Figure 3.1 Elapsed Time to Process Contracts and Amendments September 2003 - September 2004



This IRP has found that the current contract processing time has slipped and now takes an average of 4 months, plus or minus 6 weeks. CEC management indicates that several factors and extenuating circumstances have combined to (at least temporarily) slow down the contracting process:

- The various staff and budget freezes the state has imposed over the past several years have taken their toll on the size and deployment of PIER staff. For example, in 2001-2002, Team Sparkey consisted of two full-time and two part-time people. At the end of 2004, only one person staffed Team Sparkey.
- The contract employees assisting the PIER program were let go. They had been instrumental in assisting PIER to define and develop new projects.
- By the end of 2004, there were three contract officers assigned to PIER and three attorneys reviewing contracts as part of their activities. While this increased the number of contract and attorney resources, this meant there were more permutations of people working on contract packages

and the CEC reported more time was required to coordinate their efforts than in 2001-2002 when there was one contract officer and one attorney on Team Sparkey.

- As the staff size of Team Sparkey was reduced, PIER's overall contract processing workload increased as staff encumbered funds available from the prior year in addition to the $62.5 million available for FY 2004-05. This meant that the CEC would have to process nearly $90 million during the current program year.
- CEC policy requires that PIER submit contract packages to the Contracts Office about five weeks before the formal business meeting with the awardee. PIER reports that awardees are now taking up to six weeks after the meeting to return a signed contract and that the Department of General Services is taking as much as three week after that to return approved contracts. These time frames, too, have combined to elongate the award process.

Contracting summary. This IRP commends the CEC for meeting the challenge of the first IRP to reduce the contract award process from seven months down to four months. Prior to recent staff and budget freezes, PIER had reduced the contract processing period to an impressive 3.5 months, plus or minus two weeks. With the current effort to fill vacant PIER positions and ramp up with additional staff, our expectation is that the PIER program will continue to streamline the contracting time frame.

3.6 Developing a Stronger PIER Program Within and Outside the CEC

The PIER program's performance has significantly improved since the last review in 2001. However, the CEC is a regulatory agency with limited flexibility, a near term focus, and a risk-averse culture. Under the current civil service rules, it is difficult to attract and retain top research managers. Managers do not have the independence and authority they need to be as effective as possible. The PIER IRP believes that these problems need to be addressed before the PIER program can achieve the excellence that California citizens need and deserve. The proposed organization of a California DOE creates an opportunity to alleviate these problems.

In March 2001, and again in its March 2004 reports, the IRP strongly recommended that the CEC develop a strategic operational and implementation response to solve PIER's structural problem. The CEC was asked to develop two parallel plans, one to include a greater degree of operational independence and authority within the CEC and the other to include a structure outside of the CEC. Beyond the path of internal reorganization of the PIER program, the CEC was asked to develop and vet two models for a PIER program operating outside of the Energy Commission: (1) a Joint Powers Authority (JPA) and (2) a Public Benefit Corporation (PBC).

To strengthen the PIER program within the CEC, the IRP recommended (in its March 2004 Report) that the California Energy Commission elevate PIER to a division level program and revamp the original program manager position to one that would operate at a level featuring more budgetary and staffing authority. In so doing, and by vesting greater responsibility in the program managers, the program would be less subject to its current constraints. This change in status would be more than merely symbolic; with the director granted full authority over project selection and management of staff resources (but still guided by CEC objectives and policies), the Energy Commission would be able to attract outstanding candidates for the position. Nonetheless, the director would still be bound to civil service constraints in managing personnel. While the move to division level status would be viewed as a positive step, the IRP has cautioned that the very "DNA" of the CEC may well prohibit the development of a sufficiently autonomous and robust energy R&D program. To be sure, the problem of the cultural incompatibility of a regulatory agency as research administrator would not be addressed by this option.

The first IRP, and this current Panel, have suggested that the CEC examine, design, and critique two external program models, a JPA and PBC. This mechanism has precedent in state government. There are currently 154 JPAs in California.[11] A JPA would exist as an independent entity, with a board of directors that appoints a CEO to administer PIER. The CEC would fund the JPA. The CEC commissioners would serve on the board of directors of the JPA, thereby preserving a strong hand for CEC governance of PIER while maintaining the link between PIER and the energy policymaking function of the CEC. This would allow the CEC to continue to utilize research funded by PIER for the benefit of the state. The JPA board could, for areas such as contracting or personnel management, authorize use of rules and procedures of either JPA partner, as best suits the needs of PIER. It is this that allows the hiring of some permanent PIER staff outside civil service under the auspices of a non-CEC partner in the JPA. Once a JPA is formed, a transition of functions from the present arrangement in the CEC alone to the JPA could be planned in the best interests of a successful PIER program and good working relations with the CEC.

The creation of a PBC to administer the PIER program would allow a broad governance of PIER. Besides the CEC, private entities, such as investor-owned utilities, universities, public interest groups or other non-profit organizations could be included in the governing board of PIER. The PBC is, therefore, a reorganization option that would allow the participation of a wider range of interested stakeholders than under the CEC alone or under a JPA between the CEC and another public agency. A PBC is likely to be more effective and flexible than a public agency or a JPA since a PBC may be able to operate without the restrictions of various laws that constrain state agencies in managing personnel and resources. The inclusion of the

[11] See website of the California Association of Joint Power Authorities <http://www.cajpa.org>.

private sector is likely to enhance the market connectedness of PIER. An example of a state PBC focused on public interest energy research is the New York State Energy Research and Development Authority (NYSERDA).[12]

In response to this IRP's March 2004 Report and request for the above parallel plans, the CEC issued a July 2004 IRP Response Report. Across the 50+ pages of the document, the CEC presented a comprehensive discussion of the issues and challenges associated with pursuing the internal option of a reorganization of PIER within the CEC as well as moving towards the external models of establishing a joint powers authority or public benefit corporation to operate PIER. The CEC defined a six-step analytical approach to evaluate the three alternative organizational models:

1. Identify organizational problem statements in the IRP preliminary report, dated March 2004,
2. Identify the guiding principles that make PIER a unique program,
3. Identify the attributes of a first-class public interest R&D organization,
4. Develop a concept organization for each of the three alternative organizational constructs that addresses the guiding principles, problem statements and attributes,
5. Identify implementation implications for each alternative, and
6. Compare the organizational concepts based on the priorities used for their design.

In addition, the CEC identified six guiding principles that make PIER a unique program and against which any organizational model would be filtered:

1. Integrated with state energy policy,
2. Funds public interest energy research that benefits California electric ratepayers,
3. Complimentary with other public and private sector R&D efforts and implementation programs,
4. Non-duplicative of private sector research,
5. Clear and manageable program mission, vision and strategic objectives, and
6. Conveys high-impact information for decision making to policymakers in a timely manner.

[12] CEC, *Administration Issues and Options Concerning California's Public Interest Energy Research Programs*, Memorandum from David Abelson, CEC Senior Staff Counsel, January 20, 2004.

The CEC concluded that the internal option would require obtaining administrative and legislative exemptions in the areas of staffing, budgeting, and procurement. It projected that transitioning to a strong, reorganized PIER program within the CEC would take up to one year without legislation and two to three years with legislation.

In delineating some of the actions associated with establishing a JPA or PBC, the CEC reported that several significant steps would be required: (1) the CEC would have to register the JPA or PBC with the IRS and Secretary of State, (2) the Governor's Office and Legislature would have to approve implementation, (3) the CEC would need to seek administrative exemptions from control agency oversight, and (4) the Legislature would have to pass enabling legislation. In addition, each of these external models would require identifying partners, establishing a board governance structure, working through civil service and collective bargaining issues, and setting into place mechanisms to ensure a predominant role for the Energy Commission.

In brief, the CEC did a commendable job articulating a framework, identifying issues, and pinpointing challenges associated with each model. In its March 2004 report, this IRP "strongly recommended" that the CEC develop two parallel plans, with one focused on the strengthening of a PIER program internal to the CEC and another plan outside of the CEC. In its July 2004 report, the CEC responded with an articulation of issues and precepts. The narrative did not present plans as requested but, instead, presented a framework for what could be next steps by the Energy Commission as it moved to create and vet internal and external program models.

To confirm its advice and to ensure that the Energy Commission understood the Panel's recommendation, the IRP wrote to the chairman of the California Energy Commission in August 2004, and again in October 2004, and urged the CEC to pursue two actions. First, the IRP urged "the CEC to pursue the actions outlined in the Internal Option." Second, the Panel recommended that the CEC "move expeditiously and with due diligence" toward investigating a JPA for PIER with an appropriate research-oriented partner under the existing authority of the CEC.

The CEC moved quickly regarding the internal option. As noted earlier in this report, as of January 2005, the CEC has reorganized PIER within a new Energy and Research Development Division, has elevated the prior PIER program manager position to division director and has externally recruited a highly qualified director. We applaud the CEC for this action and view it as key progress in an important journey. These actions would need to be solidified under any new organizational structure.

The IRP is less complimentary with what it views as a demonstrable lack of progress in the development of a fully vetted external PIER program model, such as a joint powers authority. Since making this recommendation in its March 2004 report and August 2004 letter to the chairman of the California Energy Commission, the Panel has not witnessed any pattern of aggressive pursuit of this option by the CEC. Indeed, as of March 2005, CEC management indicated that a consultant had been identified to work on the external option and that a scope of work is under development.

Plan development summary. This Panel recognizes the difficulties involved in both an internal reorganization and strengthening of PIER as well as moving PIER to a model of external management. We can appreciate the hesitancies of an agency to move to a model of external, shared control for a program that enjoys a budget in excess of $60 million annually. We join with the CEC in recognizing the myriad challenges associated with an external model (legislative, control agencies, civil service regulations, collective bargaining agreements, developing balanced governing boards, and the like). We can also understand how the current reduced program workforce may have required all technical and administrative expertise to be focused, over the past few months, on just the internal options. We note, however, that the CEC's decision to utilize a consultant to advance the external option could have been initiated much earlier, since internal staff would hot have been impacted. We express our disappointment at the lack of progress and continue to urge that the CEC "move expeditiously and with due diligence" toward investigating or analyzing a JPA model for the operation of the PIER program. In the Panel's view, an external program structure could mitigate many of the policies and procedures that constrain the current PIER program and will enable PIER to mature into a world-class energy R&D operation. Depending upon its final configuration, the proposed California DOE may provide a structure that as well addresses the constraints on the current PIER program.

Chapter 4. Recommendations

The importance of energy R&D to California's economic growth, environmental performance, and science and technology leadership demands effective implementation of the PIER program. In the four years since the first IRP program review, the CEC has made important improvements to the program. PIER is better defined, has improved leadership, and in most program areas, has well conceived research strategies. The program has a dedicated and capable, albeit small, technical staff. Development and contracting procedures have been improved. The program has a balanced portfolio of projects, addresses important R&D needs, and has established valuable collaborations with other R&D institutions. PIER projects have already yielded practical results and its investments are an important, potentially vital part of the state's energy future.

The IRP applauds the CEC's efforts to reorganize and internally strengthen the PIER program by elevating the program and its program manager position to division-level status in January 2005. These represent major steps toward removing some of the operational deficiencies and structural inadequacies in the pre-division hierarchy. This internal model must not regress but be strengthened in any proposed California DOE.

Recognizing the importance of the PIER program, the California Legislature extended the program through 2012. PIER is now at a cross-roads: its stable funding, accumulated experience and expertise, and expanded responsibility for natural gas research, together with the administrative reforms that have been instituted to date all present important opportunities for the program.

However, in the past several years, workforce downsizing, hiring freezes, budget take-backs, management in transition, constraints of control agency oversight, loss of technical knowledge by non-retained consultants and departures of long-standing program employees have exacted their toll. Moreover, PIER continues to be hampered by problems that the IRP identified in its earlier reports, including autonomy issues, staffing restrictions, and the research awarding and contracting process.

The current opportunities and challenges mandate creative and decisive decision-making if PIER is to fulfill its potential. The Panel encourages the CEC to act decisively on the following IRP recommendations:

Recommendation #1: PIER Advisory Board.

- Establish and convene a broadly constituted PIER Advisory Board as required by Public Resources Code, Section 25620.11. The Board should report to the CEC, or to the Secretary of the proposed California DOE,

be external to the organization and include prominent members of the energy R&D community in addition to the organizational representatives called for in the Public Resources Code, Section 25620.11.

Recommendation #2: Staffing.

- Increase PIER's workforce to an adequate level of staffing. Chronic understaffing may well be at the core of a recent slowing down of contracting procedures and the development of innovative RFP opportunities. Staffing is currently below the "pre freeze" level of 63 civil service staff and 14 full-time equivalent technical consultants, and additional staff is needed to implement new program activities.
- Devote adequate resources to staff development and training, a critical need for a first rate R&D program.
- Press for both permanent staff and independent consultants. Permanent staff are clearly essential to manage a program that contributes to policy initiatives, recognizes research opportunities, and provides stability and expertise. At the same time, independent consultants—including short-term "rotator" staff from outside institutions—play a vital role in public R&D programs by contributing valuable research, technical and industry expertise.

Recommendation #3: Strengthening the Internal Option.

- Take creative and decisive action to seek changes to the oversight by state control agencies through legislative action and relief, and changes to specific CEC operating policies that the Energy Commission identified in its July 2004 report. These actions are still needed to transform an "internal" PIER program into a truly effective energy R&D asset. Addressing these issues must be a priority for the CEC, and remain equally critical if the CEC is reorganized from a commission to a state department of energy.

Recommendation #4: Pursuing the External Option.

- Complete the analysis of the potential for a Joint Power Authority (JPA) structure for PIER. The CEC has initiated a study of JPA opportunities: this analysis needs full support so that it can rigorously and expeditiously be determined whether a JPA can be established that incorporates the appropriate level of programmatic influence on policy as well as policy influence on the program. The IRP recognizes that a JPA structure has potential value for R&D management and execution whether PIER is constituted within an energy commission or a department of energy.

Recommendation #5: Plan and Manual Development.

- Establish on-going strategic planning activities. Individual PIER program areas have strategic plans. However, there is no clearly articulated, integrated, agreed upon PIER Strategic Plan that states overall goals, sets specific objectives, establishes priorities, and describes a path forward for meeting California's future energy needs.
- Develop an Operations and Procedural Manual. This manual should describe the orderly processes and procedures to be used to ensure transparency, fairness, and scientific and technical excellence using clearly specified evaluation criteria, rigorous peer review, and established metrics in a transparent evaluation process.
- Both the process of planning and the resulting plans are of critical value and importance to a first-rate R&D program. The IRP recommends that the planning activities be accorded high priority, and afforded an appropriate allocation of internal staff and program resources.

Recommendation #6: Progress Review and Evaluation.

- Reconvene this, or constitute a new IRP (or empower the proposed independent PIER Advisory Board) to launch a comprehensive program review and evaluation beginning January 2007. PIER is a "work-in-progress" and subsequent review would consider:
  - The progress made by the CEC to analyze an "external" PIER program operational model via a JPA or PBC and to strengthen an "internal" model through seeking the necessary legislative and state agency oversight relief required to operate a functionally autonomous R&D program.
  - The degree to which the CEC has developed, vetted, and implemented a PIER program strategic plan and management manual, that highlights clearly articulated goals, objectives, processes and procedures.
  - The relationship with, and integration of, research and development projects of the PIER program and the new Public Interest Natural Gas Research program of the CEC or the proposed California DOE.

The PIER program and its resources represent perhaps the only contemporary opportunity California's government and citizenry have to fashion an energy research and development program with the flexibility, autonomy, knowledge base, and authority to support the break-through research and discovery on which California's energy future will depend.

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Appendix A: Essentials of Successful R&D Management

The legislation that created PIER anticipated a state-managed energy R&D program that would support energy-related research not adequately funded by public or private sector organizations. PIER was expected to support a coordinated set of projects with significant public benefits; it was not simply a funding mechanism to provide contracts and grants to interested parties. In practice, this meant that PIER would need to identify state energy challenges, formulate a program for meeting those challenges, develop a strategy for implementing the program, develop and release RFPs, evaluate proposals and select projects for funding, negotiate contracts or other funding vehicles, monitor the research activity, and assess how well projects met program goals. These are the responsibilities of an R&D management organization; how well it carries out these responsibilities is determined by the organization's characteristics.

There is no single best path to a superior R&D management organization. However, certain principles pertaining to leadership, organizational environment and knowledge base guide all superior R&D management organizations, and, to some extent, all innovative organizations.[13] While no organization or program can be expected to reflect all of these principles when it launches, a superior R&D management organization will continuously incorporate these principles into its operations.

Leadership

An R&D management organization requires a strong leader, not simply a manager. A leader keeps others in focus, maintains morale, and creates an environment that enables the fullest exploitation of talents. A leader earns the trust of everyone in the organization, both above and below, and has full responsibility for and authority over intellectual, administrative, personnel, and financial areas. The leader facilitates relationships with other relevant organizations and creates and maintains an environment appropriate for R&D management.

A single leader improves accountability and consistency in program direction. He or she must have the authority to develop the vision to link program objectives to challenges, and to develop a strategy for addressing those challenges. The leader also

[13] R&D management organizations that have struggled with some of the same issues that the CEC faces in administering PIER and that, to varying degrees, have found solutions, are the Defense Advanced Research Projects Agency (DARPA), the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), the Atomic Energy Commission (AEC) and the Advanced Technology Program (ATP) at the National Institute of Standards and Technology (NIST). An excellent discussion of the experiences at the R&D organizations is contained in Corey (1997).

has the responsibility to present and defend the strategy and objectives to external oversight authorities. There are fewer tendencies for oversight organizations to micromanage if there is respect for the leader and understanding and acceptance of program plans and objectives.

A leader must be able to deploy resources, dollars and people. Activities must be coordinated among various disciplines and specialties. Each project must be embedded in a portfolio that balances the need for setting the objectives, available resources, degree of risk, and time of completion.

An R&D leader needs to control the program budget, with clear rights and authority that confer stature and respect. A leader requires the authority to use a variety of funding mechanisms, appropriate for different types of R&D activities. He or she also must have the ability to respond rapidly to a changing environment, including the relative importance of subject areas, budget and staff changes, quality of R&D performers, and program outputs and outcomes.

Innovative groups thrive on challenging work and stimulating colleagues. Such a group requires a superior leader, especially when the group must be formed quickly and action taken quickly. The leader's charge is especially difficult if the group is inherited from a prior program, or if the personnel have been designated by others. Successful leaders seek to reduce distractions, and are allowed to do so, while ensuring that information flow is sufficient to the organization's planning needs.

Successful leaders insulate their people from bureaucratic interference and ensure their autonomy, even when this protection may conflict with the organization's norms of control over decision processes, funds, contracts, and rules changes. A successful leader benefits from an enlightened administrative oversight that values the rewards of innovation more than it values control.

Organizational Environment

A superior R&D management organization has well-established concepts and processes that define the organization's goals and objectives. These goals and objectives are jointly developed with upper management and stakeholders to ensure that the right problems and the potential influence of R&D are understood. The organization must communicate with political bodies that have oversight responsibility.

A superior organization has a vital and clear objective purpose, and can link each of its activities to that purpose. It becomes the framework for purposeful R&D management.

An R&D management organization requires an environment that fosters innovative thinking and allows intelligent failure. A well-functioning organization must be open and fair. R&D management organizations must reduce the fear of nonsuccess.

Bold and risky, but well-conceived and managed projects that fail but yield valuable information must not be punished. Otherwise, only guaranteed successes will be funded, stifling innovation. This is a particularly difficult environment to develop in a public organization, wherein setbacks can be construed as mismanagement of funds. The authorities that oversee disbursement of public funds as well as citizens should prize innovation and tolerate occasional failure as an acceptable cost of the innovation process.

A successful R&D program requires an environment that minimizes oversight organization interference in program execution. Inappropriate interference by oversight organizations with established program management procedures can reduce the efficiency and effectiveness of R&D management. There is a distinction here between appropriate policy guidance and oversight functions, and micromanagement by external organizations.

Good R&D management also enables stakeholders to provide feedback to program managers in order to improve overall policies, objectives, processes, and resource allocation among program areas. The feedback process should be at least partially internal to the program.

Knowledge Base

A successful contractual R&D management organization requires a high-quality team of managers and staff. The organization's knowledge base – its ability to provide technical assessments of proposals and provide technical oversight of projects – resides in its staff. Its mission, its leader, and an operating environment in which they can be assured of the responsibility, authority and resources to perform effectively draw high-quality staff to the organization.

The leader of a superior organization should engage the most talented, knowledgeable, and experienced managers who possess the diversity to address a spectrum of challenges. Superior performance requires good content knowledge, recognized by peers. High-quality information on the technologies and disciplines involved in the programs should flow quickly and directly to the work groups.

Appendix B: Abbreviations and Acronyms

SYMBOL	DEFINITION
ASERTTI	Association of State Energy Research and Technology Transfer Institutions
BCP	Budget Change Proposal
CAISO	California Independent System Operator
CCST	California Council on Science and Technology
CEC	California Energy Commission
CERTS	Consortium for Electric Reliability Technology Solutions
CPUC	California Public Utilities Commission
DOE	Department of Energy
DTCR	Dynamic Thermal Circuit Ratings
EIA	Energy Information Administration
EISG	Energy Innovations Small Grant Program
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FACTS	Flexible Alternating Current Transmission Systems
GRI	Gas Research Institute
IRP	Independent Review Panel
IRS	Internal Revenue Service
JPA	Joint Powers Authority
NRDC	National Resources Defense Council
NYSERDA	New York State Energy Research and Development Authority
ORNL	Oak Ridge National Laboratory
PAC	Policy Advisory Council
PBC	Public Benefit Corporation
PG&E	Pacific Gas & Electric Company
PIER	Public Interest Energy Research
PNNL	Pacific Northwest National Laboratory
R&D	Research & Development (this can often include demonstration)
RFP	Request for Proposal
RPS	Renewable Portfolio Standard
SLiM	Sagging Line Mitigator

Appendix C: Biographies

PIER Independent Review Panel Members: Short Biographies

Carl J. Weinberg, Chair

Carl Weinberg is the principal of Weinberg Associates, which he founded in 1993 after 19 years with the Pacific Gas and Electric Company (PG&E) where he effectively managed and grew an internationally respected energy research and development program. Weinberg Associates was formed with the primary objective of accelerating the introduction of renewable and distributed power systems. Prior to joining PG&E in 1974, he spent 21 years in the United States Air Force. He received B.S. and M.S. degrees in civil engineering from the University of California, Berkeley and an M.S. in physics from Vanderbilt University. He is a registered civil engineer and a member of the California Civil Engineering Honor Society XE, the Engineering Honor Society, the Research Honor Society ΣX, Cal Club, and the University of California Order of the Golden Bear.

Linda R. Cohen, Vice-chair

Linda Cohen is professor for the Department of Economics at the University of California, Irvine, and the 2003-2004 Gilbert White Fellow, Resources for the Future. She received an A.B. from the University of California, Berkeley in mathematics and, in 1979, a Ph.D. from the California Institute of Technology in social sciences. Her fields of study are political economy, government regulation, government policy for science and technology, and positive political theory and law. Cohen has held positions at the Brookings Institution, the Kennedy School of Government, Harvard University, and the Rand Corporation. She was the 1998 Olin Visiting Professor in Law and Economics, University of Southern California Law School and is a member of the Irvine Research Unit in Mathematical Behavioral Sciences at the University of California, Irvine.

Robert P. (Chris) Caren

Chris Caren is the retired corporate vice president of Science and Engineering of the Lockheed Corporation, where his career spanned over 30 years. Among the positions he held at Lockheed were research scientist, laboratory director, chief engineer (Space Systems), program manager, director of the Palo Alto Research Laboratory, vice president and general manager of the Research and Development Division, and finally the corporate CTO position. He has carried out research in energy systems, low temperature technology, heat transfer, and plasma technology. Caren holds B.S., M.S. and Ph.D. degrees in physics from Ohio State University. He is a fellow of the American Association for the Advancement of Science, the American Astronomical Society, the American Institute of Aeronautics and Astronautics, and the Society of Automotive Engineers. He is also a member of the National Academy of Engineering. Caren is founder and member of the Board of Directors of Litex Inc., a company involved in automotive emission reduction systems. He is past chairman of Hawkeye Enterprises, a company that was involved in the upgrade of natural gas. He is also a member of the Board of Directors of Superconductor Technologies Inc. a company producing high-end telecommunication products.

T. Kenneth Fowler

Ken Fowler is professor emeritus, Department of Nuclear Engineering at the University of California, Berkeley. Fowler was chair of the Department from 1988 to 1994 and helped establish the multi-disciplinary Center for Nuclear and Toxic Waste Management at the University of California, Berkeley. His honors and awards include elected membership in the National Academy of Sciences; Fusion Power Associates Distinguished Career Award, 1995; and The Berkeley Citation, 1995. He was a member of the 1999-2001 review panel for California's Public Interest Energy Research Program. His areas of interest include energy research funding and the appropriate role of government in anticipating problems of energy-associated pollution and energy-associated competition for resources in its research funding policies. He also focuses on issues of public trust and confidence in institutions, especially as they relate to energy companies and energy-related governmental laboratories and agencies.

Harold M. (Hub) Hubbard

Harold Hubbard's particular interests are in the areas of research and development management; energy technologies; sustainable development; and public policy relating to science, engineering and technical systems. After receiving a Ph.D. in chemistry with a minor in chemical engineering from the University of Kansas, Hubbard joined Dupont's Atomic Energy Division. He was assigned first to Argonne National Laboratory and later transferred to the Dupont Explosive Department's Experimental Station Laboratory. When he resigned to accept a position at Midwest Research Institute (MRI) after 18 years as a member of the Dupont research staff, Hubbard was a research manager at Dupont's Eastern Laboratory. In 1970, he joined the MRI as director of Physical Sciences. Hubbard was appointed executive vice president of MRI in 1981 and then transferred to Colorado to become the executive director and CEO of the Solar Energy Research Institute (SERI) from 1982 to 1990. In 1991, after spending a year in Washington, D.C., as a visiting Senior Fellow at Resources for the Future, he was appointed the Spark M. Matsunaga Distinguished Fellow in Energy and Environment at the University of Hawaii at Manna.

Alan C. Lloyd

Governor Arnold Schwarzenegger appointed Alan Lloyd secretary of California's Environmental Protection Agency in December 2004. He recently served as chairman to the California Air Resources Board, having been appointed by Governor Gray Davis in February 1999 and reappointed by Governor Schwarzenegger in August 2004. Lloyd earned both his B.S. in chemistry and Ph.D. in gas kinetics at the University College of Wales, Aberystwyth, U.K. Lloyd served as the executive director of the Energy and Environmental Engineering Center for the Desert Research Institute at the University and Community College System of Nevada, Reno. Previously, he was the chief scientist at the South Coast Air Quality Management District from 1988 to 1996, where he managed the Technology Advancement Office that funded public-private partnerships to stimulate advanced technologies and cleaner fuels.

Johnetta MacCalla

Johnetta MacCalla is chief executive officer of ASCI, Automated Switching and Controls, Inc., a high-tech company serving the public sector, especially the transportation industry. Her specialties include system design, development and installation of communication and control systems using fiber optics, wireless radio and networked cables as well as control signaling and robotic systems. She is the publisher of over 17 papers on communications and control. MacCalla was a Hughes Doctoral Fellow and the recipient of a Bell Labs Fellowship. She is a former council member and current fellow of the California Council on Science and Technology. She is a graduate of the University of Southern California, Stanford University and Brown University. She has been project manager for many high-tech projects including BART, Port of Los Angeles, TRW, NASA, and the U.S. Military.

William J. McLean

William McLean is recently retired as director of the Combustion Research Facility at Sandia National Laboratories/California. He was responsible, under Sandia's Energy and Critical Infrastructure Strategic Business Unit, for overall program management of Sandia's Energy Efficiency research programs. He maintains close association with the U.S. Department of Energy research programs sponsored by the DOE Office of Science and DOE Office of Energy Efficiency and Renewable Energy. McLean received his undergraduate and graduate education in mechanical engineering at the University of California, Berkeley and was associate professor of Mechanical Engineering at Cornell University before joining Sandia in 1978. His past research has involved coal combustion, flame chemistry, engine combustion and alternative fuels.

Peter M. Miller

Peter M. Miller is a scientist with the Natural Resources Defense Council, Inc., a nonprofit national environmental organization. He is part of NRDC's energy project, which promotes the increased development of energy efficiency and other environmentally sound and cost-effective energy resources. His work involves research, analysis, and

advocacy at the state, national, and international levels. He has participated in utility advisory committees in California, Hawaii, and the Pacific Northwest, in numerous proceedings before the California Energy Commission, the California Public Utilities Commission and the Northwest Power Planning Council, and in rulemakings before the U.S. Department of Energy. He was appointed to the California Board for Energy Efficiency in April 1997.

Maxine L. Savitz

Maxine Savitz retired from Honeywell, Inc., where she was general manager, Technology Partnerships. She has over 30 years of experience managing research, development and implementation programs for the public and private sectors. Savitz joined Honeywell, previously AlliedSignal, in 1985. From 1987 until June 2000, she was the general manager of AlliedSignal Ceramics Components, which is the only U.S. owned silicon nitride structural ceramic manufacturer for gas turbine application. In this capacity, she oversaw the development and manufacturing of innovative materials for the aerospace, transportation, and industrial sectors. Prior to joining Honeywell, she was employed at the U.S. Department of Energy and its predecessor agencies. From 1979 to 1983, she served in the capacity of deputy assistant secretary for conservation at DOE. Her areas of interest include energy efficiency (buildings, industry, transportation) R&D, policies and programs, distributed energy resources, gas turbines, microturbines, and fuel cells and high temperature materials and application.

Jananne Sharpless

Jananne Sharpless was appointed to the California Energy Commission in January 1994 and was a member through 1999. By law, the five members of the Commission have professional training and background in specific areas - engineering and physical science, environmental protection, economics, law and one commissioner from the public at large. Sharpless filled the environmentalist position. She graduated from the University of California, Davis with a B.A. degree in political science. She has served on the United States Environmental Protection Agency Clean Air Act Advisory Committee; Federal Fleet Conversion Task

Force; chairwoman 1990 United California State Employees Campaign; and chairwoman (1986-1987) Alternative Fuels and Vehicles Review Task Force (AB 234). From 1985-1993, Sharpless was both secretary of Environmental Affairs and chairwoman of the California Air Resources Board (1991 to 1993). She was also the chief deputy secretary of the Environmental Affairs Agency (1983-1985).

Esteban Soriano

Esteban Soriano has served as a faculty member, program director, executive director, and vice president of universities and colleges. He recently retired from the University of California, Merced having served as vice chancellor for University Advancement. In his professional career, he has been awarded designation as Ford Fellow, National Research Fellow, Fulbright Scholar, and Oxford Roundtable Fellow. Soriano's disciplines are communication and market research, with an M.A. in Communications and Ph.D. in Communication Research from Stanford University. He was appointed to the City of Riverside Public Utilities Board for seven years and served as board chair and chair of the electricity and water committees of this municipal utility operation. He served on a policy advisory committee of the American Public Power Association. Soriano has served three U.S. Presidents on national boards and commissions: the national task force looking at the communication needs of rural America (Carter); the Teacher in Space Selection Panel (Reagan); and the National Skill Standards Board (Clinton).

Arnold M. Sowell, Jr.

Arnold M. Sowell, Jr. is a former deputy secretary of policy and planning for the State and Consumer Services Agency. He is currently with the office of Assemblymember Fabian Nuñez. Sowell has served as an advisor to the California Waste Board for the last five years. During that time, he also served as an advisor to the California Waste Board chairman.

Sowell has had an extensive career in state and local government having served in various positions. They include: senior consultant to then-Speaker Willie Brown;

principal fiscal analyst to San Francisco City Controller Edward Harrington; assistant to former Mayor Art Agnos of San Francisco; and senior fiscal and policy analyst in the Legislative Analyst's Office. He earned a bachelor of science degree from Oregon State University and a master of public administration degree from the University of Washington.

James L. Sweeney

James L. Sweeney, of Stanford University, is professor of Management Science and Engineering, senior fellow of the Stanford Institute for Economic Policy Research, and senior fellow (by courtesy) of the Hoover Institution on War, Revolution and Peace. His professional activities focus on economic policy and analysis, particularly in energy, natural resources, and the environment. He holds a B.S. degree from Massachusetts Institute of Technology in electrical engineering and a Ph.D. from Stanford University in engineering-economic systems.

At Stanford, he has served as chairman of the Department of Engineering-Economic Systems and Operations Research, director of the Energy Modeling Forum, chairman of the Institute for Energy Studies, and director of the Center for Economic Policy Research (now the Stanford Institute for Economic Policy Research). He currently is on the executive committee of the Interdisciplinary Program in Environment and Resources, on the faculty advisory committee of the Earth Systems Program, and part of the Global Climate and Energy Program.

Irvin L. (Jack) White

Irvin White has over 30 years public and private sector management and leadership experience in energy, environment, science and technology policy, research and development management, and relationship management. He recently retired for the fifth time—this time from his position as executive director of the Association of State Energy Research and Technology Transfer Institutions, an organization of state energy research and development organizations he co-founded in 1990. He was managing partner of The Winslow Group, a management-consulting firm that specialized in enterprise development and

management. Prior to co-founding The Winslow Group, he was the senior director for Energy Programs at Pacific Northwest National Laboratories, 1991 to 1996.

White was the president of the New York State Energy Research and Development Authority from 1981-1991. He has also served as the assistant director for Energy and Minerals in the Bureau of Land Management, Department of the Interior, and acting director for Exploratory Research at the U.S. Environmental Protection Agency. Before entering federal service, he was a member of the faculties of the Universities of Oklahoma and Arizona and Purdue University. At Oklahoma, he was co-founder and assistant director of the Science and Public Policy Program, one of the most successful programs of its kind in the country.

Matrix of IRP Member Competencies

Panel members were chosen based on an assessment of the required capabilities needed on the IRP. Table C.1 shows the match between needed capabilities and IRP member competencies.

Table C.1 Matrix of IRP Member Competencies

	Academic	Industry	Public Interest
Technology – Issues in R&D for Energy and Other Technologies	Soriano	Caren MacCalla Savitz Weinberg	
Economics/Markets – Market Impacts of Technologies, Economics of Energy	Cohen Sweeney		
General Energy and Energy Alternatives	Fowler	Hubbard McLean White	
Public Health and Environmental Impacts			Miller Sowell
State Government Policies – Contracting and Civil Service			Lloyd Sharpless

CCST PIER Review Committee Members: Short Biographies

Miriam John – Chair (2004-2005)

Miriam John is currently vice president of Sandia's California Division. Prior to her current position, John served as the director of the Center for Exploratory Systems and Development and in a number of managerial and technical roles for the laboratory, including nuclear weapons development, systems analysis, and thermal analysis/fluid mechanics R&D. John received a B.S. in chemistry from Rice University, an M.S. in chemical engineering from Tulane University, and a Ph.D. in chemical engineering from Princeton University. Concurrent with her Sandia assignments, John has been recruited for a number of defense community efforts. She is a member of the Department of Defense's Threat Reduction Advisory Committee (for which she chairs the Nuclear Deterrent Transformation Panel), the National Research Council's Naval Studies Board and Board on Army Science and Technology. She is a recent past member of the Air Force Scientific Advisory Board and DOE's National Commission on Science and Security. She is a National Associate of the National Academies of Science and Engineering.

Richard E. Balzhiser – Chair (2003)

Richard E. Balzhiser retired as president and chief executive officer of the Electric Power Research Institute (EPRI) in August 1996. He remains active in a president emeritus role at EPRI in addition to serving on the boards of Reliant Energy, Aerospace, Electrosource, and Nexant. Balzhiser joined EPRI in 1973 at the time of its founding as director of the Fossil Fuel and Advanced Systems Division. He became vice president of Research and Development in 1979 and executive vice president in 1987 before assuming the presidency in 1988. Prior to joining EPRI, he served in the White House Office of Science and Technology as assistant director for Energy, Environment and National Resources, 1971-1973. He was professor of Chemical Engineering from 1960-70, except for 1967-68 when he served as a White House Fellow in the Office of the Secretary of Defense. He was twice elected to serve on the Ann Arbor City Council. Balzhiser received his B.S. and Ph.D. degrees in chemical

engineering and his M.S. in nuclear engineering from the University of Michigan and was an Academic All American on Michigan's 1953 football team.

Michael R. Anastasio

Michael R. Anastasio is the ninth director to lead Lawrence Livermore National Laboratory (LLNL) since it was founded in 1952. Anastasio received a bachelor's degree in physics from Johns Hopkins University and his M.A. and Ph.D. in theoretical nuclear physics from the State University of New York at Stony Brook. His career at Lawrence Livermore began in 1980 as a physicist in B-Division, one of the two nuclear weapons design physics divisions. Most recently, as deputy director for Strategic Operations, Anastasio played a key role in relationships with the University of California and the National Nuclear Security Administration. He is the recipient of the 1990 DOE Weapons Recognition of Excellence Award for technical leadership in nuclear design.

Lawrence B. Coleman

Lawrence B. Coleman is the University of California vice provost for Research and professor of Physics at the University of California, Davis. He served as chair of the University-wide Academic Senate in the 1999-2000 academic year following a year as vice chair of the University of California Senate. Arriving at Davis in 1976, he was promoted to associate professor in 1982. While at the University of California, Davis he has held the positions of chair, Davis Division of the Academic Senate, 1995-1997; director, The Internship and Career Center, 1988-1994; acting vice provost, Academic Programs and dean, Undergraduate Studies, 1991-1992; and acting associate vice chancellor, Academic Programs, 1990-1991. Lawrence Coleman received a Ph.D. from the University of Pennsylvania in 1975 in experimental condensed matter physics. He received a B.A. in physics from The Johns Hopkins University in 1970.

Susan Hackwood

Susan Hackwood is currently professor of Electrical Engineering at the University of California, Riverside and executive director of the California Council on Science and Technology. Hackwood received a Ph.D. in solid state ionics in 1979 from DeMontfort University, UK. Before joining academia, she was department head of Device Robotics Technology Research at AT&T Bell Labs. In 1984, she joined the University of California, Santa Barbara as professor of electrical and computer engineering and was founder and director of the National Science Foundation Engineering Research Center for Robotic Systems in Microelectronics. In 1990, Hackwood became the founding dean of the Bourns College of Engineering at the University of California, Riverside.

G. Scott Hubbard

Scott Hubbard serves as director of the NASA's Ames Research Center in the heart of California's Silicon Valley. Prior to his appointment, Hubbard was the deputy director for Research at Ames. In March of 2000, Hubbard was called to NASA Headquarters, where he served as the first Mars program director and successfully restructured the entire Mars program in the wake of mission failures. Some of Hubbard's previous key roles include Ames associate director for Astrobiology and Space Programs; first director of NASA's Astrobiology Institute, and manager of the Lunar Prospector Mission. He is also credited with creating the Mars Pathfinder Mission. Prior to coming to Ames in 1987, Hubbard was vice president and general manager of Canberra Semiconductor and a staff scientist at Lawrence Berkeley National Laboratory. Hubbard received a B.A. in physics and astronomy from Vanderbilt University and his graduate education in solid state and semiconductor physics at the University of California, Berkeley. He was awarded NASA's highest honor, the Distinguished Service Medal, for his contributions to the Columbia accident investigation.

John P. McTague

John P. McTague is currently professor of Materials for the University of California, Santa Barbara. He is the past vice president, Laboratory Management at the University of California, Office of the President. A physical chemist, McTague received his undergraduate degree with honors in chemistry from Georgetown University in 1960 and his Ph.D. from Brown University in 1965. Brown also bestowed on him an honorary Sc.D. in 1997. McTague was founding co-chair of the Department of Energy National Laboratory Operations Board and a member of the Secretary of Energy Advisory Board from its inception in 1990 through 2000. In January 1999, he retired from Ford Motor Company, where he served more than 12 years, first as vice president of Research and then as vice president of Technical Affairs. Prior to 1986 McTague served as deputy director and acting director of the White House Office of Science and Technology Policy, and was acting science advisor to President Reagan. During the Bush administration he was a member of the President's Council of Advisors on Science and Technology and U.S. Chair of the U.S.-Japan High Level Advisory Panel on Science and Technology.

Anneila Sargent

Anneila Sargent is professor of astronomy at the California Institute of Technology (Caltech), director of Caltech's Owens Valley Radio Observatory, and director of the Combined Array for Research in Millimeter-wave Astronomy (CARMA). She received her B.Sc. with honors in physics from the University of Edinburgh, and her Ph.D. in astronomy from Caltech. Her career has been spent at Caltech where, following her Ph.D., she moved through the research faculty ranks to become a senior research associate in astronomy in 1990. She was named associate director of Owens Valley Radio Observatory in 1992 and director in 1996. She has been a professor of astronomy since 1998 and is now the first director of CARMA.

Professor Sargent was the California Institute of Technology's 1988 "Woman of the Year." She was awarded the NASA Public Service Medal in 1998 and named an associate of the Royal Astronomical Society in 2001. In 2002, she was University of

Edinburgh Alumna of the Year, and was awarded the George Darwin Lectureship of the Royal Astronomical Society in 2003.

Sargent has served on a wide variety of national advisory committees, including the National Research Council (NRC) Committee on Astronomy & Astrophysics and the NSF's Mathematical and Physical Sciences Advisory Committee.

Credits

CCST PIER Review Committee Members:

Miriam John, Chair (2004-2005)
Richard E. Balzhiser, Chair (2003)
Michael Anastasio
Lawrence B. Coleman
Susan Hackwood
G. Scott Hubbard
John P. McTague
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