Cryogel's Comments on the California Energy Commission's

Proposed Load Management Standards

California Energy Commission Docket Number 08-DR-01

Submitted by:

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1. Summary of Comments:

Cryogel, of San Diego, California respectfully offers the following comments on Proposed Load Management Standards, California Energy Commission Docket Number 08-DR-01. Our comments are in support of a California Thermal Storage Standard Offer proposed by Transphase and others- including Cryogel, Calmac and KS Engineers at the CPUC in the utilities demand response CPUC proceeding A.08-06-001 and Edison's General Rate Case phase 2 (CPUC A,08-03-002).

In brief, the Thermal Storage Standard Offering is proposed to encourage the widespread adoption of thermal energy storage (TES) in California by implementation of rate designs and incentives that reflect the benefits of thermal storage to the environment, to the reliability of electrical energy supplies and to the economy of the State of California.

As outlined in Comments by Transphase submitted in this matter, " the thermal storage community has proposed a cost-effective California Thermal Storage Standard Offer for all utilities, open to all storage media, vendors and customer classes. This Thermal Storage Standard Offer would ramp up to provide up to 30

MW per year of on-peak capacity in SCE territory, 25 MW per year of capacity in PG&E territory, and 10 MW per year in SDG&E territory. The proposed payment structure would be $1400 per kW paid over a multi-year period, or substantially less than the $1950 per kW PG&E currently pays under its 3.9 MW TES program for retrofits."

These comments are also intended to support the findings of the California Energy Commission with regard to the benefits of TES and to highlight Legislative Intent in support of peak load shifting as an important component of California energy policy. We are not providing comments in support of any specific thermal storage technology or product, including our own, or to support any technical or competitive distinctions between TES technologies. We believe that consumers, with the aid of engineers and design professionals, will continue to make rational economic and practical decisions about competitive technologies. We support the position that incentives, rates and Standard Offers should be available to end users of all thermal storage technology where on-peak demand reductions can be measured and verified. It should be clear that the references to our technology and company history herein are provided only for background, including actual experience in the market, and not as means of elevating our technology or market position.

2. CEC Proposed Position that No Standard for TES is Needed:

The California Energy Commission's Proposed Load Management Standards state in part that no Standard is needed to support thermal storage because of the rate differences between on and off peak power. Based on our actual experience and historical perspective on the thermal storage market in California, we respectfully disagree with that basic position and believe that the realities of the market argue against that position.

As an example of actual experience in the TES market, Cryogel began manufacturing ice thermal storage products near Los Angeles, CA in 1991 and

enjoyed rapid growth and profitability within the first 3 years of operation. That early success, and economic benefits shared by associated design engineers, installing contractors, ancillary equipment suppliers and building owners, can be traced directly to the incentives and time-of-use (TOU) rates offered for thermal energy storage during the early 1990's.

During the early 90's, more than a dozen companies offered competitive products in a growing TES market. However, by the late '90's, many of the utility incentives had been retracted and many time-of- use (TOU) rates had been "flattened" by reducing the differential between the price of "on-peak" and "off peak" electricity. As the economic incentives and energy cost savings available to end users evaporated, the TES markets began to contract. As a result, only 4 or 5 of the companies from the early 90's remain actively involved in the business today. By 2003, market statistics show that the sales of TES equipment diminished to about 33% of their 1993 levels. Statistics show that sales of TES in California by 1997 were less than 25% of the level achieved in 1993. By 2003, Cryogel revenues fell to less than 30% of the levels posted on average between 1991 and 1995. Current market statistics are not readily available because in this decimated market, TES companies have ceased pooling market statistics which, in our opinion, had become a pointless and frustrating exercise.

Rather than repeat the economic analysis provided with Comments and spreadsheets by Transphase , we point to the obvious relationship between contraction of the market for TES and the loss of economic incentives and proper TOU rates. Common sense economics dictates that end users will simply not purchase and install equipment with returns on investment at levels as low as those resulting under current rate structures and TES program offerings. The rates and programs being proposed for the future offer more of the same and promise more of the same dismal results.

3. California Energy Commission Report on TES:

The benefits of TES on a macro scale were quantified years ago through the California Energy Commission Report , "Source Energy and Environmental Impacts of Thermal Energy Storage". The conclusions of that report are more important today than ever. The CEC cover letter introducing that study in 1996 is also quite relevant today and demonstrates CEC foresight, especially when looking back at the tumultuous history of California's energy supplies and failure of utilities and industry to collaborate in an effective manner with regard to the energy supplies and the environment.

In a letter dated February 16, 1996, Charles R Imbrecht, Chairman of the California Energy Commission stated:

> *"The electric power industry is changing. We are now in the process of moving to a more competitive electricity services industry. While competition and cost control are important in the midst of this change, other goals such as clean air remain as critical issues. We believe the cost efficiencies of competition must be balanced with environmental sensitivities.*
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> *The California Energy Commission (Commission) is responding to these changing conditions by commercializing technologies that balance competitive and environmental concerns. One such technology is Thermal Energy Storage (TES). The Commission staff has been facilitating a collaborative of TES stakeholders to identify the benefits and take actions to reduce market barriers facing TES in a re-structured marketplace. The enclosed report, Source Energy and Environmental Impacts of Thermal Energy Storage, was prepared for the TES collaborative. Based on the analyses in the report, implementation of TES could:*
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> - *Lower customer air conditioning costs by 30-50 percent;*
> - *Reduce capital investment in the Transmission and Distribution system by a billion dollars in the next decade;*
> - *Reduce Nox emission equivalent to 100,000 vehicles in the South Coast Air Quality Management District; and*

- *Save enough source energy to supply all 500,000 electric cars projected for the next decade; ”*

The California Energy Commission Report , "Source Energy and Environmental Impacts of Thermal Energy Storage" P500-95-005 (http://www.energy.ca.gov/reports/500-95-005_TES-REPORT.PDF) is well documented and need not be repeated here. However, a couple basic elements of the CEC Report deserve repeating.

The CEC Report highlights the fact that TES technology conserves energy at both the electricity generation source and the point of use. In addition, the CEC report supports the position that TES should be considered a priority in the ranking of Demand Side Management technologies in energy policy decisions. The CEC Report demonstrates that TES reduces pollution and greenhouse gasses. This results from more efficient electrical generation mix during off peak periods and reduced transmission line losses.

That same conclusion is supported by recent heat rate data and transmission efficiency comparisons produced in CPUC proceeding A.08-06-001 and Edison's General Rate Case phase 2 (CPUC A,08-03-002). At the time of publication, the CEC Report stated that by 2005, TES could reduce Carbon Dioxide emissions by 260,000 tons and Nitrous Oxide emissions by 600 tons annually. That report is even more relevant today than when it was published in view of concerns about climate change, greenhouse gas emissions and general environmental protection. While the economics of possible “cap and trade” systems or “carbon taxes” were not factored into the CEC report, it should be clear today that the real costs of emissions will be a factor in generation cost analysis and allocation. Surprisingly, it is our understanding that such costs or contingencies are not yet included in marginal cost models. In our opinion, this represents a short-sighted approach when evaluating and implementing strategies, such as peak demand reductions with TES, that could help mitigate future cost increases that seem inevitable and will fall on the shoulders of rate payers.

Contrary to the foresight and logical path forward suggested by the CEC Report, the reduction or elimination of incentives and flattening of TOU rates have had the opposite effect with devastating consequences for the TES market in California and the US. Failure to implement TES has resulted in missed opportunities to improve the reliability of the California energy supplies and to delay or avoid the need for and cost of new electrical generation and transmission capacity. Failure to implement TES has resulted in missed opportunities to mitigate air pollution and climate effects associated with fossil fuel used to generate electricity. Finally, this failure has damaged companies that invested in perfecting TES technology and resulted in a loss of associated economic activity in the State and country.

4. Economic Benefits Lost:

In the case of Cryogel, the company would have failed if not for our ability to transfer technology to foreign countries and generate revenue by licensing others to manufacture our product. Since 1996, Cryogel's manufacturing licensee in Malaysia has reported more than a 50% market share in that country and our licensee in China is now manufacturing and installing systems in that expanding market. Foreign licensing fees and royalties have returned to Cryogel in California and have saved the company from insolvency. However, the economic benefits associated with designing systems, installing the hardware, the value of ancillary equipment including tanks, piping, pumps, chillers, controls, etc., have been lost to foreign engineers, contractors and manufacturers.

During my last visit to China, I was invited to address a large group of electric utility managers, electricity rate designers, academics and business leaders regarding the environmental and economic benefits of thermal storage. The basis of my presentation was the California Energy Commission Report mentioned earlier. The Chinese acknowledged the benefits of TES as matters of engineering common sense and proper government policy toward addressing

energy shortages and the well-known air pollution problems in that country. However, when they asked about the size and growth of the TES market in the US and in California, I was embarrassed to admit that the same common sense concepts were not being implemented effectively in California or the US and that our market had been shrinking for the past 10 years. The reaction was a predictable scolding about the wasteful energy practices of Americans and suggestions of hypocrisy. Ironically, systems being installed in most foreign countries include US made TES devices or products based on technologies developed in the US and proven in California.

Reduction or elimination of incentives and flattening of TOU rates have had a devastating effect on the market for TES in California and the US. Failure to implement TES has resulted in missed opportunities to improve the reliability of the California energy supplies and avoid the need and cost of new generation capacity. Failure to implement TES has resulted in missed opportunities to mitigate air pollution and climate effects associated with fossil fuel necessary to generate electricity. This failure has damaged or ruined companies that took substantial risks by investing in the development of TES technology and has resulted in a loss of associated economic activity in the State and country.

5. Thermal Storage is Simple, Proven Technology – A Few Examples

Briefly, thermal energy storage (TES) is a proven, energy conserving, environmentally friendly technology that shifts electrical loads from air conditioning and process cooling to off-peak hours. Energy is used during nighttime (off-peak) periods to produce and store cool energy in ice, chilled water or phase change materials. The cool energy in storage is used the next day for air-conditioning or process cooling during periods of peak energy demand.

From a practical point of view, properly sized and automated TES systems can be nearly transparent to building owners and operators. Analogous to battery backup for electrical equipment, TES simply discharges cool energy to provide air conditioning as needed when electric chillers are shut down or their output is

limited to reduce demand. With TES, the flow or cool air to occupied spaces or processes is not interrupted or diminished during on peak periods or power supply alerts.

In this way, TES is superior to air conditioning cycling or interruptible rate strategies now being offered because there is no deterioration of comfort levels in buildings served by TES. TES replaces the function of chillers during on-peak periods or critical peak periods as programmed in controls or as may be dictated by dispatch signals from the utility. Because comfort levels are maintained even when chillers or air conditioning compressors are shut down, there is no need for owners or operators to consider bypassing or overriding controls thereby undermining demand reductions. TES systems are charged each night and are ready during the day as a flexible source of cooling without the electrical demand imposed by chillers or air conditioning equipment.

By way of background and more specific experience with the history of thermal storage, Cryogel introduced Ice Ball™ thermal energy storage (TES) equipment in California and the U.S. more than 17 years ago. The product received worldwide market acceptance due to simplicity of concept and flexibility with respect to practical issues of performance, installation, operation and maintenance.

Cryogel Ice Balls are 4” diameter plastic spheres filled with water. Energy is stored in ice using low cost electricity at night to freeze Cryogel Ice Balls. Cool energy is released the next day for air conditioning or process cooling. Cryogel thermal storage systems produce energy cost savings and environmental benefits by using low cost off-peak electrical energy. More than 20 Million Cryogel Ice Balls have been supplied to schools, hospitals, airports, office buildings, churches, senior & retirement facilities, government offices and industrial plants which translates to a shift of approximately 32 mW of peak electrical demand.

TES has been proven with successful systems operating for years with hundreds of examples by a number of thermal storage equipment manufacturers employing a competitive range of technologies. As just one case in point, a Cryogel ice thermal storage system was installed in a 24 story office building at the corner of 8th and Figueroa in downtown Los Angeles in 1992. Today, that system continues to cool the building for 10 hours each day with no assistance from electric chillers. The system is currently shifting a peak load of approximately 750 kW off the grid during the day, every day, without any emergency signals or calls to curtail power. There is no need for operators to rush around the building shutting down chillers in response to a call from the electric utility to curtail loads because the chiller are always off during peak hours. Tenants of the building are not aware that chillers are never operating during the day because comfort levels are normal. This thermal ice battery simply cools the building each day and is essentially invisible to everyone except the corporation paying lower monthly electric bills.

This building recently won and energy efficiency award from the local utility and building engineers report energy bills of less than half that seen in similar buildings that they have also maintained in downtown Los Angeles. The system is controlled and monitored by a single computer room and operators are not required on site during nights or weekends. The system was originally designed to shift the full air conditioning load for 8 hours. The capacity of the system exceeds design requirements such that it currently shifts the full load for 10 hours in response to a change of rate structures by the local utility. The success of this system is in its flexibility to satisfy changing electrical rate structures, simplicity of concept and operation, low maintenance requirements, permanent reduction in peak demand and lower energy costs year after year.

In addition to typical air conditioning installations in office buildings, schools and hospitals, where TES systems cycle once each day, Cryogel systems have also been proven in some of the most critical and difficult applications of TES. For example, since 1996 Cryogel has installed thermal storage systems at airports in

San Francisco, Los Angeles, Atlanta, Dallas - Ft. Worth, Ft. Lauderdale, Chicago, Phoenix and Miami to cool aircraft on the tarmac and airport terminals. These systems cool aircraft with low temperature air and cycle more than once per day because loads are constantly peaking and falling as aircraft arrive and depart. The reported failure rate on these systems is zero even under demanding service conditions. The Atlanta airport has installed two such systems and the Miami airport has installed six Cryogel systems since 1996. The fact that such facilities with critical air conditioning loads install the same equipment on a repeat basis should be clear evidence of the viability and reliability of the equipment.

TES technology is available now, it is fully developed, it is proven over the past two decades and it is as simple to understand as any battery. Following blackouts several years ago in the Northeastern US, a newspaper article appeared lamenting the fact that battery technology did not yet exist in a form that would satisfy on-site electrical demands during peak periods. The article reasoned that if electrical batteries were installed in buildings to provide power during peak periods, the distribution grid would not have been overloaded and the cascading power failures could have been avoided. It is extremely frustrating to read such articles knowing that batteries do exist in the form of TES and that these thermal batteries are designed to supplant the largest peak electrical loads in many buildings; the air conditioning load. A journalist might be excused for not understanding that energy can be stored by means other than electrical batteries and achieve the same result of shifting peak loads and reducing strain on the transmission grid. However, it is difficult to understand why this concept has not gained widespread support from the technical community responsible for the reliability of the electrical grid.

6. Legislative Intent:

Members of the thermal storage business community also invested in working with the California Legislature to clarify Legislative Intent and to help stem the negative trends described above. Legislative intent as to shifting peak electrical demands associated with air conditioning loads, and the rate structures needed

to encourage peak shifting, is well documented. TES technology is directly responsive to Legislative direction and intent.

Senate Bill 1790 (Senator Debra Bowen, D-Marina del Rey), explains that, *"It is the intent of the Legislature that the state establish cost-effective load control programs for residential and commercial air-conditioning systems" …. "The legislature finds and declares" that, "(a) Air-conditioning load constitutes 28 percent of California's peak electricity demand, the largest single component of electricity demand", and, "(b) Reducing peak load of, and implementing load control for residential and commercial air-conditioning systems by the state's electrical corporations can achieve a significant reduction of California's peak electricity demand in a cost-effective manner."* SB 1790 provides for development of air-conditioning load control programs as part of electrical service offerings as means *of "contributing to the adequacy of the electricity supply and to help customers in reducing their electric bills".*

Senate Bill 1976 (Senator Tom Torlakson, D-Antioch), described by the Legislature as *"an urgency statute",* addresses electricity rates head-on by directing the Public Utilities Commission to report back to the Governor and Legislature no later than March 31, 2003 regarding real-time pricing and metering. The logic of SB 1976 is clearly in line with the thermal storage industry noting that*, "Californians can significantly increase the reliability of the electricity system and reduce the level of wholesale electricity prices by reducing electricity usage at peak times."*

In the current economic climate, TES offers a unique opportunity for market forces to accomplish the goals of SB1976. Rather than placing demands on general funds, incentives, peak demand charges and proper TOU rates reflective of energy costs can be a sufficient incentive for architects and engineers to incorporate TES systems and for building owners to realize reasonable returns on investment.

Quoting from SB 1976*: "Electricity consumption for air conditioning purposes during peak demand periods significantly contributes to California's electricity shortage vulnerability during summer periods".*

TES focuses precisely on afternoon air conditioning loads. In fact, air conditioning loads can consume up to thirty percent of a facility's electricity demand on hot summer days. TES uses energy at night during off-peak hours to store cool energy and then provide cooling the next day during periods of peak demand. Shifting loads with TES is a cost competitive alternative to new

generating capacity, thereby improving reliability of the electricity system while avoiding expensive construction of new power plants with related environmental impacts.

Senate Bill 1389 (Senator Bowen) states that*, "the government has an essential role to ensure that a reliable supply of energy is provided ... ". This law requires the California Energy Commission to report every two years and to, "use assessments and forecasts to develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy and protect public health and safety."*

The legislation calls for an integrated energy policy with public interest strategies including load management and reduction of statewide greenhouse gas emissions.

In addition, in 2002 California voters approved a major school bond including funding and incentives for equipment to improve energy use patterns and to shift peak electrical demand. The school bond was historic for its first-ever inclusion of funding for energy efficiency and energy cost reduction components. A common thread in all the legislation is an emphasis on public benefits for Californians including improved reliability of electrical supplies, reduction in overall energy costs, new job creation and positive environmental impacts. California legislation and bonds demonstrate support for thermal storage and suggest a model for legislation in other states.

Quoting from SB 1976: *"It is the intent of the Legislature to promote conservation and demand reduction in the State of California."*

7. Thermal Storage and Other Energy Solutions:

TES is capable of substantial contributions to demand reduction goals while conserving energy as documented by the California Energy Commission. Solutions for peak electrical demand problems in California and the U.S. include new electrical generation capacity and peak shifting with off-peak thermal energy storage as well as conservation and renewable energy technologies. However, in terms of large and near term reduction of peak electrical demand, thermal

storage has definite advantages especially when compared to the construction of new power plants.

- Thermal Energy Storage is Available Now - not 2 or 3 years from now.
- Thermal Storage provides an overall reduction in the use of fossil fuels.
- Thermal Storage provides an overall reduction in air pollution.
- Thermal Storage makes most effective use of existing generation and transmission infrastructure.

Building and operating new generators and transmission lines is expensive both in terms of first costs and long term environmental impact. Spending millions of dollars to enable the continued inefficient use of power plants and the generation of ever greater amounts of air pollution is counter productive. A better option is to use existing capacity and transmission lines more effectively and in a way that reduces overall environmental damage. Using lower cost electricity during off-peak (nighttime) hours is not the complete answer but it is a practical and immediate solution to problems of peak electrical loads. The technology and equipment for storing energy at night to provide low cost air conditioning during the day has been proven over the past 20 years. Air conditioning represents the largest single use of electricity during summer months in most parts of California and the U.S. Shifting electric loads for air conditioning with thermal energy storage is equivalent to building new power plants and new transmission lines with important economic and environmental advantages. Thermal energy storage provides one means to mitigate the uncertainty and speculation as to future energy prices.

8. Conclusion:

These comments and examples are offered in support of incentives and a Standard Thermal Storage Offering. Without meaningful and positive changes such as those proposed, the opportunities flowing directly from TES to enhance California's energy reliability and security, improve and protect the environment,

and generate much needed economic activity will be squandered. We hope these comments and background information are helpful and constructive.

Respectfully Submitted,

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