MUSSEY GRADE ROAD ALLIANCE

"Preserving Historic Mussey Grade"

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July 27, 2010 **BY EMAIL**

CEC/BLM

Energy Commission Docket Unit
Docket #: 08-AFC-05
1516 Ninth Street, MS-4
Sacramento, CA 95814

VIA: Christopher Meyer Cmeyer@energy.state.ca.us; jennifer.jennings@energy.state.ca.us

RE: Imperial Valley Solar Project (SES Solar Two) ; Statement Before Commission at July 26, 2010 Hearings

Attached please find the **PUBLIC COMMENTS OF DIANE CONKLIN, SPOKESPERSON, MUSSEY GRADE ROAD ALLIANCE, RAMONA, CALIFORNIA** and the testimony of Dr. Barry Butler in the CPUC proceeding A.06-08-010, referred to in the public comments.

Regards,

/S/ Diane Conklin

Attachment (2)

PUBLIC COMMENTS OF DIANE CONKLIN, SPOKESPERSON, MUSSEY GRADE ROAD ALLIANCE, RAMONA, CALIFORNIA BEFORE THE CALIFORNIA ENERGY COMMISSION, MONDAY, JULY 26, 2010 IN THE MATTER OF IMPERIAL VALLEY SOLAR PROJECT (SES SOLAR TWO), DOCKET #: 08-AFC-05

Commissioner Byron and Eggert, Hearing Officer and Parties,

My name is Diane Conklin. I am the spokesperson for the Mussey Grade Road Alliance in Ramona, CA. The Alliance is a grassroots, community-based organization dedicated to the preservation of historic Mussey Grade and environs.

As background, the Alliance was an intervener in the Sunrise Powerlink (SPL) proceeding and brought the issue of fire to the CPUC. As a result, the CPUC – for the first time – included fire issues in the EIR/EIS. Fire was deemed an unmitigable significant impact of the line. As a result of the approval of the line – a southern route – the Alliance continues to oppose the line with other parties.

The Alliance is also engaged in several other CPUC proceedings at this time, including a rulemaking proceeding in which the Alliance has proposed new rules re the issue of powerline-ignited wildland fires.

From our past experience in CPUC proceedings the Alliance has learned that in large projects there are often promises made. Here in this CEC proceeding we have promises made about a lot of issues. For example:

- promises made as to the efficacy of the Stirling technology – that is that it will work;
- the promise that the project's use of local water will not deplete the existing water basin *and* the parallel promise that another source of water will be forthcoming soon;
- the assurance that there are no significant wind impacts related to this project, including the continuous control of the dust of the desert after 30,000 Stirling Dishes are installed – while the western area in the vicinity of this project is eyed for energy wind generation;
- the assurance that there will be no adverse effects on this project by future earthquakes, including any disruption of generation or chance of explosions – and this in light of the fact that recent earthquake activity in Mexico affected the area.

On the other side of these promises are:

- the guaranteed use of public land to develop a project that is private and profit making;

- the assured use of public stimulus funds to scale up an essentially untested and unproven technology;

- the fact that Sempra's Sunrise Powerlink, which is connected at the hip to this project, was not affirmatively conditioned by the CPUC to carry *any* required percentage of renewable energy. While we purportedly have a Buyer and a Seller of electricity, we do not have a guarantee of what will actually be bought, sold or used;

- a potential eventuality that should SDG&E not actually use electricity generated by this project the investors in Stirling could conceivably recover lost revenues by payments for energy not take;

- the certainty that overriding considerations of environmental concerns will be forthcoming;

- the basic fact that by going in this energy direction – massive Stirling Dish technology with its massive environmental impacts – also has the not so obvious effects, which are generally ignored such as:

1. The tethering of the ratepayer to investor owned industrial projects that serve the privately owned utility industry (IOUs) and private energy suppliers at the expense of energy reliability and sustainability for the future.

For example: Think of solar rooftop installations all over the County of San Diego, SDG&E's service territory, versus a $2+ billion transmission line and an approximately $2 billion for Stirling Dishes. Ask yourself which you think will be more viable in the coming decades.

As rooftop solar technology advances, can you imagine these Stirling Dishes serving the ratepayers and public better than electricity they could generate themselves on their own property and without the massive impacts this project will also deliver?

This local generation, distributed and combined with conventional technology, is the obvious choice for the future.

Another effect not discussed so readily is:

2. The mutual support between SPL and the Stirling project. From the beginning the Alliance has been concerned with the interconnection between these two projects, especially the reliance of SDG&E on Stirling at the CPUC and the reliance by Stirling on SDG&E's purchase of their power at the CEC. This is an exercise in mutual back scratching.

But the most serious problem of all is whether this 100-year-old technology, not used very often in the last century, will actually work.

The 2007 CPCU testimony of expert Dr. Barry Butler, former SAIC (Science Applications International Corporation), a competitor of Stirling SES, along with his cross examination gives us another picture – to wit:

1. That the Stirling Dish technology is not cost competitive with conventional power generation such as wind and solar at this time; (p.4)

2. Major reliability problems exist with these dishes. On average once every 40 hours a problem occurred which required shut down and maintenance, which means that a great deal of time and effort and money must be spent on maintenance; (p.5)

3. Dish Stirling is a pre-commercial technology that holds promise but "there is no possible way" Dish Stirling solar can move from high cost prototype models to large scale production now; (p.6) and

4. Solar concentrating photovoltaic doesn't have any moving parts – they just sit there and look at the sun.

With the example of the bad federal regulation in front of us all in the form of BP and the Gulf oil disaster, the Alliance respectfully requests that the CEC exercise its best and highest judgment with respect to this application, which the Alliance believes should be denied, and requests that you do deny the application.

Thank you for the opportunity to speak.

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a Certificate of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project	Application 06-08-010 (Filed August 4, 2006)

PHASE I DIRECT TESTIMONY OF DR. BARRY BUTLER ON BEHALF OF CONSERVATION GROUPS

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Dated: June 1, 2007

Testimony of Dr. Barry Butler on Dish/Stirling Solar Technology

1. INTRODUCTION

My name is Barry L. Butler, PhD. As more fully outlined in my resume, Appendix A, I have a PhD in Materials Science and am the former vice president and manager of SAIC's Solar Energy Products Division. I joined the Solar Energy Research Institute, the predecessor to the National Renewable Energy Laboratory, in 1978, soon after it began operations. Prior to that time I worked at Sandia National Laboratory specializing in solar optical materials. I wrote the chapter on cooperative solar thermal commercialization activities in the book "Implementation of Solar Thermal Technology" published by MIT Press in 1996. I have written or co-authored over 10 technical papers on all aspects of dish/Stirling solar technology development. I was the president of the Concentrating Solar Power Division of the Solar Energy Industries Association from 1998 to 2002, and I am the owner of Butler Sun Solutions, a firm specializing in the design and sales of solar hot water heating systems.

2. BACKGROUND

San Diego Gas and Electric (SDG&E), a company owned by Sempra Energy, has filed an application to the CPUC claiming a 150 mile, 1000 MW transmission line is needed to import energy into San Diego County to ensure the reliability of the regional transmission system on peak demand days, and has further suggested the transmission line is needed to encourage the development of renewable power in Imperial Valley. SDG&E has signed a power purchase agreement (PPA) with Stirling Energy Systems (SES), Phase I of which is for a 300 MW dish/Stirling array, a total of 12,000 of their 25 kW dish/Stirling systems, in Imperial County that must be delivered in increments between 2008 and 2010, as is stated in the CPCN (p. III-11):

> The Agreement with SES contemplates the purchase by SDG&E of up to 900 MW of new solar related energy from SES in three phases. Phase 1 consists of 300 MW scheduled for delivery in the 2008 to 2010 timeframe. While the first phase will provide 300 MW when all construction is completed, the capacity will be added in increments over the 2008 through 2010 period. Phase 2 project consists of an additional 300 MW in the 2011 to 2012 timeframe. SDG&E also has a right of first refusal for a third phase for another 300 MW phase.

According to the SDG&E, commercial production is expected to begin in 2008. The economic terms of the contract, specifically the $/kwh price that SDG&E will pay SES for the power, is unknown.

There are currently six prototype 25 kW Stirling dishes in operation at Sandia National Laboratory. I have been asked to opine on the reliability and cost of SES dish technology and whether it is feasible or realistic to expect that SES can meet the contract schedule defined by SDG&E.

3. DEVELOPMENT HISTORY OF DISH STIRLING TECHNOLOGY

I co-authored a 2003 paper that includes a brief history of the development of dish Stirling technology.[1] I have excerpted the following summary of dish Stirling technology from that paper.

> Over the last 20 years, eight different Dish-Stirling systems ranging in size from 2 to 50 kW have been built by companies in the United States, Germany, Japan, and Russia. The first of the historical systems, the 25-kW Vanguard system built by ADVANCO in Southern California, achieved a reported world record net solar-to-electric conversion efficiency of 29.4%. In 1984, two 50-kW Dish-

[1] T. Mancini, P. Heller, B. Butler, B. Osborn, W. Schiel, V. Goldberg, R. Buck, R. Diver, C. Andraka, J. Moreno, *Dish-Stirling Systems: An Overview of Development and Status*, Journal of Solar Energy Engineering, Vol. 125, pp. 135-151, May 2003.

> Stirling systems were built, installed, and operated in Riyadh, Saudi Arabia, by Schlaich-Bergermann und Partner of Stuttgart, Germany.
>
> A third Dish-Stirling system was built by McDonnell Douglas Aerospace Corporation (MDAC) in the mid 1980s and, when MDAC discontinued development of the technology, the rights to the system were acquired by the Southern California Edison Company (SCE). SCE operated the system from 1985 to 1988. Stirling Energy Systems (SES) of Phoenix, Arizona, acquired the technology rights and system hardware in 1996 and have continued development of the system. In 1991, Cummins Power Generation, working under costshared agreements with the U.S. Department of Energy and Sandia National Laboratories, started development of two Dish-Stirling systems: a 7-kW system for remote applications and a 25-kW system for grid-connected power generation. Cummins was innovative in its Dish-Stirling systems, incorporating advanced technologies into the designs. . . The two Cummins programs made progress, but were terminated in 1996 when Cummins' parent company, Cummins Engine Company, realigned business along its core area of diesel engine development.
>
> Dish-Stirling systems have demonstrated that they are capable of producing electricity for the grid and for remote power applications. Technology development needs are for low-cost components and systems that can operate unattended at very high levels of reliability.
>
> SES acquired the intellectual and technology rights to the McDonnell Douglas concentrator and the license to manufacture the USAB (now Kockums) 4-95 Stirling engine based power conversion unit (PCU) in 1996.
>
> The (SES) systems are continuously monitored and repaired whenever a problem occurs. Consequently, they have demonstrated excellent availability, greater than 98%, during the most recent 1,000 hr of operation.

I was the SAIC project manager for a dish/Stirling design that was in competition with the SES design. By 2002, SAIC had also demonstrated relatively high availability of the system for periods of time. However, the "mean time between failure" was approximately 40 hours. Major reliability problems with the SAIC Stirling engine included hydrogen leakage through joints and seals, internal engine seal leakage, swashplate actuator stalls, and heater head braze joint hydrogen leaks. That means that on average once every 40 hours a problem of some type required shut down and maintenance. Nearly continuous maintenance was necessary to keep the system "available" to generate electricity. SES has also demonstrated very high availability, though this has been achieved by a program of continuous maintenance. In 2002, SES and SAIC both had dish/Stirling units operating at the University of Nevada – Las Vegas. Power output was greater for SES than SAIC. Both SAIC and SES conducted maintenance on a nearly continuous basis to keep the units available for electricity production.

Dish/Stirling is not cost-competitive with conventional power generation, or other forms of renewable power generation such as wind and solar, at this time. Wind and geothermal are fully commercial renewable energy technologies with a cost of energy of approximately 5¢ US/kWhr each.[2] As noted in the 2003 Journal of Solar Energy Engineering paper I co-authored:[3]

> In the U.S., niche markets for Dish-Stirling power generation depend on federal or state government subsidies, required to close the gap between the current cost of power from these systems (~30¢ US/kWhr) and the price that the market is willing to pay (~6¢ US/kWhr), a difference of 24¢ US/kWhr.
>
> Even at the relatively low production rate of 50 MW/yr (~2,000 25-kW systems or 5,000 10-kW systems) and at an O&M cost of 1–2¢/kWhr, the cost of electricity from Dish-Stirling systems will be 15–20¢/kWhr enabling entry into some village and remote-power markets. As system costs fall and reliability improves, it is reasonable to expect levelized energy costs of less than 10¢

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[2] R. Caputo, B. Butler, *Solar 2007: The Use of "Energy Parks" to Balance Renewable Energy in the San Diego Regio*n, accepted for publication, American Solar Energy Society, 2007 Annual Conference, Cleveland, July 2007.

[3] T. Mancini, P. Heller, B. Butler, B. Osborn, W. Schiel, V. Goldberg, R. Buck, R. Diver, C. Andraka, J. Moreno, *Dish-Stirling Systems: An Overview of Development and Status*, Journal of Solar Energy Engineering, Vol. 125, pp. 135-151, May 2003., p. 139.

US/kWhr, which will expand the markets to distributed generation and demand-side applications.

A "mean time between failure" between 2,000 and 10,000 hours must be proven before dish/Stirling can be incorporated into utility-scale installations.[4] The current "mean time between failure" is a few hundred hours. This means a great deal of time, effort, and money must be spent on maintenance. This drives up the cost of operating a dish/Stirling unit. The commercial viability of the Stirling system is unproven at this time.

4. PILOT INSTALLATION IS NEXT LOGICAL STEP IN DISH/STIRLING DEVELOPMENTAL PROGRESSION

The 1 MW pilot project being developed by SES for SCE is a good example of a necessary and prudent incremental step to ensure all the technical deficiencies in the first generation production model are worked-out before scaling-up to arrays involving many 1,000s of individual dishes. It is also instructive that SCE, a company with extensive experience with dish/Stirling technology and the company that sold the technology to SES, is requiring the successful deployment of a 1 MW pilot project before scaling-up to a utility-scale installation.

SDG&E has no experience with the operation of dish/Stirling technology, and is proposing to go straight from the prototype to a utility-scale installation. Few or none of the benefits of the 1 MW pilot test will be available to SES as it moves to full commercial scale production to satisfy the SDG&E contract(s), as the 1 MW pilot has not yet begun operation and full commercial production must begin in a matter of months if SES hopes

[4] R. Caputo, B. Butler, *Solar 2007: The Use of "Energy Parks" to Balance Renewable Energy in the San Diego Regio*n, accepted for publication, American Solar Energy Society, 2007 Annual Conference, Cleveland, July 2007.

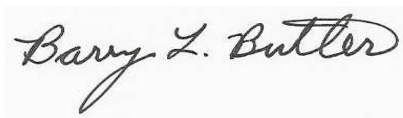
to meet the 2010 deadline established in the SDG&E contract. This is neither prudent nor possible unless the technical risks of the operation and maintenance are quantified and then apportioned between the federal government, investors, SES and SDG&E. The SCE 1MW project is the way to quantify the risks, before moving to 10MW then on to 100MW. Without these risks quantified and apportioned, investors who are willing to shoulder all of the risks for a meager reward must be found.

5. DISH/STIRLING IS A PRE-COMMERCIAL TECHNOLOGY

The San Diego Regional Renewable Energy Study Group addressed dish/Stirling in its August 2005 *Potential for Renewable Energy in the San Diego Region*.[5] Several of the co-authors of this report are SDG&E staff. Dish/Stirling is identified as pre-commercial in this study, based primarily on analyses conducted by the National Renewable Energy Laboratory and Black & Veatch.

I concur with this assessment in the *Potential for Renewable Energy in the San Diego Region*. My opinion is that dish/Stirling technology holds much promise. By 2020, the technology could be a significant player on a commercial scale in the concentrated solar power category. However, there is no possible way that dish/Stirling solar can move from high cost prototype models with substantive reliability concerns to large-scale production of high reliability low-cost commercial models by 2008 and full operation of a 12,000 dish, 300 MW array by the end of 2010. An entire step wise development 1MW, 10MW, 100MW with installed cost, reliability and operation & maintenance costs assessed over a year of operation at each step is necessary to move from current prototypes to the large-scale commercial plants contemplated in the power purchase agreements between SDG&E and SES.

I declare under penalty of perjury this testimony and attachment are, to the best of my knowledge, true and correct.

Signed:  Date: 5/31/2007

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[5] San Diego Regional Renewable Energy Study Group, *Potential for Renewable Energy in the San Diego Region*, August 2005 (www.renewablesg.org).

APPENDIX A

BARRY L. BUTLER, Ph. D.

EDUCATION

B.S. Ceramic Engineering, 1965, Alfred University
M.S. Materials Science, 1967, Rensselaer Polytechnic Institute
Ph.D. Materials Science, 1969, Rensselaer Polytechnic Institute

MANAGEMENT TRAINING

1980 Experience Compression Lab/Interpersonal skills training
1981 Technical Writing, short course, University of Denver
1982 Management Action Program/Management Methods
1983 Personal Management Skills, University of Denver

PROFESSIONAL SUMMARY

Dr. Butler has lead nationally recognized teams in solar materials technology for US/DOE, and solid rocket motor propellant to case bonding for NASA. In addition to guiding the national teams and managing the work, he also represented the teams' work to the legislature and Executive branches of government to illustrate their importance.

Dr. Butler is a material scientist with training in the structure property relationships of metals, ceramics and polymers. Dr. Butler has contributed to the basic understanding of carbon/carbon and carbon/polymer composite materials. His research on the optical properties of low cost, lightweight optical structures has helped to relate material properties to system performance. Dr. Butler developed the laser ray trace optical evaluation technique for determining the slope errors of new and available solar concentrators. He guided the development of the solar thermal technology at Solar Energy Research Institute (SERI) which included major advances in stressed membrane heliostats and direct absorption thermal receivers.

As manager of SAIC's Energy Products Division he has managed the design, fabrication and deployment of five 25 kWe dish/engine power systems. Each 114m^2 reflector weighs 18,000 lbs., and are capable of self-deployment. Dr. Butler holds nine patents and has one pending patent application for the self-deploying advanced drive.

As the manager of the NASA Solid Propulsion Integrity Program (SPIP) Bondline work package of Science Applications International Corporation (SAIC), he was responsible for evaluation of materials and processes to improve the reliability of space shuttle solid rocket motors. Large composite glass/graphite epoxy solid rocket motor cases were health monitored and verified during manufacture, cure and pressure test. He was responsible for managing research and development and enhancing innovation and engineering applications of activities. The NASA SPIP program's $70M effort was documented on a CD-ROM database a first for NASA. He is active in both the Solar Energy Industries Association (SEIA) and congressional liaison work for solar and aerospace activities.

As the manager of the Energy Projects Division at SAIC, he has played a major role in the development of electro-chemical battery systems and membrane heliostat technology. He has planned and expanded SAIC's battery systems development to include sodium sulfur cells for utility load-leveling and electric vehicle applications and other advanced cells and systems for aerospace applications. He planned and expanded SAIC's advanced solar concentrator area to include design, fabrication and testing of advanced heliostat and dish systems to meet customer needs. He has moved to extend both heliostat and dish technology into small, lightweight modular systems capable of acquisition by a broader range of customers. As Vice President of the Solar Energy Industries Association (SEIA) during 1995 and President during 1996, he drafted the SEIA Strategic Plan and prepared congressional testimony on solar thermal technology representing the industry to congressional committees. He supported the Department of Energy (DOE) solar Thermal Five Year Plan and represented industry to the Office of Management and Budget (OMB) on solar funding issues.

As a research manager at SERI, he guided the research of 90 scientists ($15 million annually) on solar materials, heat and mass transfer, and thermal systems. Building heating and cooling, ocean thermal energy conversion, solar thermal electric and industrial process heat programs have also been under his direction. Dr. Butler has set the pace in advanced lightweight solar collectors with two patentable concepts. He has also recognized and supported significant advancements in materials and designs from his research staff. He has defined, packaged and sold research programs based on these concepts. Several programs have resulted in commercial products.

He has developed research management skills which allow creativity and technical freedom, while maintaining tight cost and schedule control to ensure quality and timely technical outputs. He is multilingual, has traveled internationally for the Fulbright Foundation, and has lectured on solar materials.

EXPERIENCE

Started Butler Sun Solutions-2002-Present

He runs the solar manufacturing operation for patented solar assisted hot water system. They also perform contracted services to support large 160 m^2 advanced tracker drives for commercial solar companies. They also are doing engineering management and configuration control for the 250,000 gallon per day desalination plant for the City of Avalon, on Catalina Island, CA, in conjunction with Southern California Edison.

Manager, Energy Products Division for SAIC, 1996- 2002

Dr. Butler ran the United States Department of Energy Dish/Stirling Joint Venture Program. A $36 million 50/50 government industry cost share program to develop and deploy dish/engine systems. To date, three systems have been deployed and are operating at design levels.

Manager, NASA Solid Propulsion Integrity Program Bondline Division for SAIC, 1989-1996

He was a major contributor to the SAIC proposal and designated as the program manager for the $40 million, seven year effort. He staffed and set up the Bondline Program offices in San Diego, California, and Huntsville, Alabama. He managed ten SAIC staff and $5 million annually. He managed the Bondline team consisting of six major subcontractors; Thiokol, Hercules, United Technologies (CSD), ARC, Lockheed Martin, and Aerojet. His division managed the cost, schedule, and technical content of the program. He was responsible for overall customer (NASA) satisfaction.

Manager, Energy Projects Division, Science Applications International Corporation, 1984 – 1988
He started the energy Projects Division which has grown to include 10 staff members and $1.2 million in annual sales while meeting both growth and profit objectives. The division performs research on point and line focus solar collectors, advanced electrochemical storage batteries and chemical conversion of phosphogypsum to sulfur. He managed systems research and simulations as well as hardware development and testing. He has motivated his division staff to be creative and achievement-oriented, which has enabled business growth.

Manager, Solar Thermal and Materials Research Division, Solar Energy Research Institute, 1982 – 1984
As the manager of the Solar Thermal and Materials Research Division, he directed the activities of the division and developed new technical initiatives, management policies, and operating procedures. He was responsible for managing the Solar Thermal, Passive, Active, Buildings, Conservation and Ocean Programs. Specifically, he managed four research branches: Thermal Research, Materials Research, Thermal Systems and Engineering Research, and Buildings System Research. The division totaled 90 people and $15 million in research funds annually.

Manager, General Research Division, Solar Energy Research Institute, 1980 – 1982
Dr. Butler managed the General Research Program ($10 million and 60 staff) which included basic research tasks in photochemistry, photoelectrochemistry, remote sensing of solar resources, university grants (26), sabbatical and summer intern programs, nondestructive evaluation, optical materials and containment materials research. He instituted research reporting of technical progress and cost control on a monthly basis

Chief, Materials Branch, Solar Energy Research Institute, 1978 – 1980
Dr. Butler built and managed the Materials Branch from a staff of four to thirty people supported by a budget of $3 million annually. He developed the facilities and equipment needs of the branch. He conceived and implemented the Solar Optical Materials Planning Committee composed of representatives of Sandia Lab Albuquerque, Sandia Lab Livermore, Jet Propulsion Lab, Los Alamos National Lab, Battelle Pacific Northwest Lab, Lawrence Berkeley Lab, National Bureau of Standards, and SERI. The committee publishes a set of National Solar Materials Planning Recommendations in five reports which have been followed by the DOE research program.

Solar Materials Coordinator, Sandia National Laboratory, 1975 – 1978
Dr. Butler coordinated the materials and process support of Solar Total Energy, Central Receiver and Photovoltaic projects. This included development of advanced collector testing based on laser ray tracing, materials research on the outdoor durability of wood and composites and life testing of this glass, wood, and composites. Large-scale materials field testing and hail damage test facilities were also part of his responsibility.

Member, Technical Staff, Sandia National Laboratory, 1969 – 1975
He conducted research and published work on advanced carbon/carbon structure property relationships. This research formed the basis for process changes which supported five successful test flights of

carbon/carbon heat shields. Thermally induced strains and stresses up to 2800°C were studied and modeled to determine composite behavior under transient thermal loading. Carbon fiber felts and filament would performs were densified by chemical vapor deposition and carbonized pitch matrix methods. Nose tips heat shields and thermal insulation systems were fabricated and studied. Dr. Butler taught the bell Lab Composite Materials course and was the lab expert on glass carbon and aramid fiber interfaces with epoxy, polyester, metals and ceramics.

TECHNICAL EXPERTISE INCLUDES:

Business management to meet profit and revenue goals
Technical management of large research groups and projects $10 - $15 million and 100 staff members
Structural design, analysis, and fabrication of fiber/matrix composites
Composite materials design, fabrication technology, and tooling expertise

PROFESSIONAL ACTIVITIES

American Ceramic Society (ACS), 1962 – present
American Society of Metals (ASM), 1975 – present
American Carbon Society (ACS), 1965 – 1977
Keramos, Ceramic Engineering Honorary
Alpha Sigma Mu, Metallurgical Honorary
Society for the advancement of Materials and Process Engineering (SAMPE), 1978 – present
American Solar Energy Society (ASES), 1975 – present, Chairman of Solar Thermal Division
Solar Energy Industries Association 1984- Present, Board Chairman 1990-1994
Solar Energy Industries Association, Concentrating Solar Power Division Chairman 1998-2002
Member of SANDAG renewable energy working group 2005-present.
Supporting the California Solar Initiative at the California Center For Sustainable Development 2006-Present

HONORS/AWARDS

American Men and women in Science
Who's Who in America
Materials Associate Editor, *ASME Journal of Solar Energy Engineering*,1979 – 1981
Fulbright Lectureship, Yugoslavia, 1983
International Energy Agency, Solar Design Team for Alberia, Spain, 1978
NASA Distinguished Service Award for Solid Rocket Motor Integrity Imporvement.

PATENTS (9 Issued)

January 17, 1984	#4,425, 904	Tracking System for Solar Collector
April 16, 1985	#4,511,215	Lightweight Diaphragm Mirror Module System for Solar Collectors
December 24, 1985	#4, 559, 926	Centerless Drive Solar Collector System

February 17, 1987	#4,643,168	Liquid Cooled Fiber Thermal Radiation Receiver
October 3, 1989	#4,870,949	Wind Resistant Two-Axis Tracker for Energy or Radiation Concentrators
May 10, 1991	#5,016,998	Focus Control System for Stretched Membrane Mirror Module
April 6, 1993	#5,199,499	Oil Well Fire Capper/Snuffer
April 24, 1995	#8,393,472	Long-life Self Renewing Solar Reflector Stack
January 4, 2005	#6,837,303 B2	Internal, Water Tank Solar Heat Exchanger

SECURITY CLEARANCE: DISCO/Secret/SAIC Terminated in 2002 on retirement from SAIC

PUBLICATIONS

Thomas Mancini, Peter Heller, Plus Barry Butler, Bruce Osborn, Wolfgang Schiel, Richard Diver, Vernon Goldberg, Reiner Buck, Charles Andraka, James Moreno, *Dish-Stirling Systems: An Overview of Development and Status*, Journal of Solar Energy Engineering, Copyright © 2003 by ASME MAY 2003, Vol. 125.

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Butler, B.L. and K.J. Beninga. *Design of a 100 MWH Sodium – Sulfur Battery Load – Leveling Facility*, May 21, 1987.

Butler, B.L. and K. Ramohalli. *Composite Membrane Dish Concentrators*, Solar Thermal Research Symposium, February 6, 1987.

Butler, B.L. and M. Featherby. *Internally Metallized Ceramic Vacuum Pipe for Particle Beams*, 1987 Particle Accelerator Conference (CEBAF), February 27, 1987.

Beninga, K.J., Butler, B.L. and P.J. Royval. *Stressed Membrane Research – SAIC*, Proceedings of the Solar Thermal Technology Conference, Albuquerque, N.M., June 17 – 19, 1986, SAND86-0536, June, 1986.

Butler, B.L. *Encyclopedia of Materials Science and Engineering*, Pergamon Press, May, 1986.

Beninga, K.J. and B.L. Butler. Sodium – Sulfur Battery Systems Development. American Chemical Society, 8412-0986-3/86/0869-222, March, 1986.

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CERTIFICATE OF SERVICE

I hereby certify that, pursuant to the Assigned Commissioner and Administrative Law Judge's Scoping Memo and Ruling, I have served a true copy of "Phase I Direct Testimony of Dr. Barry Butler" to all parties on the most recently updated service list for Application No. 06-08-010.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this 1st day of June, 2007, at San Francisco, California.

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