

THE KIRSCH CENTER FOR ENVIRONMENTAL STUDIES—A 17-YEAR ODYSSEY FROM CAMPUS VISION TO ARCHITECTURAL FULFILLMENT

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ABSTRACT

The Kirsch Center for Environmental Studies (KCES), a 22,000 square foot (2044 square meter) building of classrooms, offices and laboratories on the campus of De Anza Community College in Cupertino, California, is now in its first year of occupancy, but the project is in its 17th year. Preliminary observations of this LEED¹ Gold design show a winter daytime electrical power demand of less than 1.2kW per square foot (12.9kW per square meter) for all electrical energy uses, with the rooftop PV system able to meet over 100% of that demand during the central four hours of the day already in February. The real story at this stage is how this all came to be. An historical chronicle of all that had to happen and did happen is presented. The final building is described and the preliminary performance deduced. Conclusions are drawn regarding the value of the project.



Fig. 1: Digital rendering of the Kirsch Center for Environmental Studies (source: VBN Architects)

1. INTRODUCTION: THE STORIES THAT BUILDINGS COULD TELL

If only buildings could speak! Imagine the stories that they could tell about their conception, design, construction, and

operation—stories of which the building users are almost always unaware. Even more interesting would be those stories of “Green”, or “Sustainable” buildings, in other words “High Performance” buildings by whatever name we choose to give to them. Those stories usually go back many years before construction—sometimes even decades—to when and how the idea first came to an architect, or builder, or client, or institution. They would reveal why and how these higher goals were set, how they were retained or how and why they were modified during the design process, and how well the building actually met those goals. They would encompass the entire process and all of the people involved. And they would explain how the necessary “Whole Building” design approach defined the integral working relationships and coordination of architects, engineers, clients and users throughout, from concept to commissioning.²

The Kirsch Center for Environmental Studies (KCES) story began in 1989, and continues today as the newly occupied building is still being commissioned. But the heart of the story is the way in which students, faculty, leadership, staff and community members bought early into the vision of what could be, the way in which the student government used their own funds to launch it, and how these important constituents played a dominant role over a 17 year period to assure the apparently successful result.

2. THE STORY OF THE KIRSCH CENTER FOR ENVIRONMENTAL STUDIES

2.1 The Setting

The setting for the KCES is De Anza Community College, a partner in the two-campus Foothill-De Anza (FHDA) Community College District, with dual campuses located in adjacent cities [Cupertino (DA) and Los Altos Hills (FH)] along the western side of the San Francisco Bay

metropolitan region. Located about 45 miles south of San Francisco, both campuses cater to the heart of what is commonly known (worldwide) as “Silicon Valley”, a region of amazing modern high-tech accomplishments and contributions to the world.

California’s Community College System is the largest system of higher education in the world— an assemblage of 109 two-year public Colleges statewide, organized into 72 districts, and serving more than 2.5 million students. The 112-acre De Anza campus, named after Spanish explorer Juan Bautista de Anza, is one of the largest single-campus community colleges in the country, with a fall enrollment averaging 25,000 students.³ Five thousand of those students enroll each year in Biology and Environmental Studies classes, and thousands of Bay Area schoolchildren have visited the 1.5-acre Cheeseman Environmental Study Area that is adjacent to the newly constructed KCES.

2.2. How it all Started—1989-1996

The germ of the idea for the new building began in 1989, with one of the authors of this paper (Julie Phillips—then a part-time instructor in Biology, subsequently hired full-time to develop the Environmental Studies Program), along with Jim Anderson, a Biology instructor, and Al Guevara, De Anza energy management leader. The original idea was actually to create a program in Environmental Studies at the College, supported by a building that could teach students about the environment, recycling and energy use. The founding College President (Dr. A. Robert DeHart) gave the go-ahead in 1990, and concept drawings for a 2,200 square foot (204 square meter) facility were drafted and submitted to the College.

College leadership was transferred to Dr. Martha Kanter, in 1993. During the 1990-1996 years the development of ES courses and programs was occurring simultaneously with the advancement of the building concept. Those years were critical to develop the project within the shared governance structure of the College.

An Environmental Studies Building Task Force was formed, with the charge to develop a proposal for a new E.S. building, to work with the decision-making structure at De Anza, and to begin to solicit possible outside funding. In addition, the fledgling Environmental Studies Program received large contracts (nearly \$1 million over 8 years) from the California Energy Commission and from the Pacific Gas and Electric Company to develop programs in energy efficiency for Community College energy management technicians and facilities personnel.

While almost everything about the design and concept of the building changed over the next nine years, the original

Mission Statement endured, only modified to the current building name in honor of the most prominent donors, Steve and Michele Kirsch, acting through their Foundation:⁴

“The Kirsch Center for Environmental Studies commits to environmental protection as a fundamental objective and integral part of educating our students and the public. Through an interdisciplinary approach we will partner with industry, government, utilities and academic institutions.”

As the design evolved, the Mission Statement was embodied in a shorter goal-statement:

“A building that teaches about energy, resources and stewardship.”

The concept of the building as “a building that teaches” *animated* the goal, giving the building *itself* stature as an integral part of the mission and of its own function (and, perhaps, legitimizing the notion here that the building is really telling its own story).

2.3 The Formative Years—1997-2000.

In June of 1997 the E.S. building was approved in concept by the Campus Facilities Team, but with no agreement on location and design. In October of 1997 one of the author’s of this paper (D. Aitken) was contracted to serve as the project consultant, based upon invited educational presentations he had previously made that year to the campus community and to the Building Task Force.

The building project was formally launched in 1998 through a series of campus actions. In particular, a proposal was presented to the De Anza College Associated Student Body (DASB) to use student funds to develop the project through the conceptual architectural design. That proposal was supported one month later by a recommendation from the President’s office that the DASB allocate \$180,000 for this purpose. On December 11, 1998, Dr. Aitken supported the proposal with a presentation to the DASB Board on the concepts of green building design and the potential value such a building would have for the campus. The DASB then approved the awarding of the \$180,000 of student funds, subject to approval by the College’ Board of Trustees. That approval came on January 4, 1999.

The DASB students felt that funding for this project *was of urgent concern*. The DASB President (Nicholas Pisca) supported this by stating that “With the E.S. Building, this is a project that can be used by the entire student body.”

Interviews of a highly selected list of potentially qualified architects took place in early February, 1999. The firm of

Van der Ryn Associates of Sausalito, California, was selected to be the Design Architects. David Deppen of that firm was identified as the design architect. The Engineering firm of Ove ARUP of San Francisco was selected for the all-important compatible mechanical and electrical engineering designs, with the KCES effort headed first by Tom Watson, and later by Cole Roberts. Architectural documentation support was provided by VBN Architects of Oakland, who served as the Architects of Record, with their KCES effort headed by Franz Steiner.

Van der Ryn Associates led four open workshops with the De Anza Community during the spring of 1999, to develop the community's input to the design. During that time members of the Building Task Force, along with De Anza College staff and administrators, also toured a number of exemplary buildings in the San Francisco Bay area and in Sacramento. By April the program for rooms and spaces had become clear, and the building goals and various site and energy-design ideas had been firmed up. In June a flier was prepared and distributed, "What would you suggest for the Environmental Studies facility?", with invited input directed to a dedicated web page.

By August of 1999 the design was taking form. Although an exploration had been made about the possibility of building it entirely without mechanical HVAC systems, but prudence won out. The target then became a building that would beat the stringent California energy standards by at least 30%.⁵ The goal for the integrated rooftop photovoltaic (PV) system was to supply 50% of the building's electrical energy needs from solar energy on an annual average basis.

The building's educational goal to have it be "more than a teaching facility—an instructional tool for students and the local community" was also being translated into unique interior design and function features. Furthermore, the decision was made to register the building for LEED certification. That registration was filed with the U.S. Green Building Council on September 30, 2002 by the project's LEED coordinator, Kathleen Smith, with the declared design target to meet the LEED Gold level.

On November 2, 1999, a very important bond issue—Bond Measure E—was passed by the area's communities, providing to the FHDA District USD 248 million over 11 years for replacing, refurbishing, constructing and upgrading buildings. Funds from Measure E were committed to the construction of the KCES. By then all had settled on the building's design goals: recycled steel, fly-ash concrete, passive solar heating, natural daylighting, integrated rooftop PV, natural ventilation, rainwater collection for irrigation, and all nontoxic components for interior and exterior.

Colin Underwood, a De Anza student, released a professional-looking brochure that he had designed, "Dare to Open the Doors to our Future", about the E.S. building, suggesting ways in which people might become involved in the project. He developed, printed and distributed 1,000 copies—with *his own money*.

The final opening of the door to building construction came in May, 2000, with the donation by the Steven and Michele Kirsch Foundation of USD 2 million for the building. Steve Kirsch had been particularly impressed with the initiative that the De Anza College Energy Management Program had shown in developing the "Guidelines to the Statewide Energy Management Program", for he was interested in having this good work influence statewide energy policy.⁶ So the decision was made to name the building after them. The condition that came with their contribution, however, was that *the project would have to break ground within one year of the gift*.

2.4 Design and Construction—2000-2005.

The design of the KCES proceeded from 2000 through 2004, ultimately settling on a 22,000 square foot (204 square meter) two-story configuration, with a 30kW (AC rated) roof-mounted photovoltaic array. In December, 2001, an early design concept of the KCES was featured by the California Governor on the cover of the State document "Building Better Buildings, A Blueprint for Sustainable State Facilities".⁷

Design details were completed, always by consensus, construction drawings made, the project was put out to bid, and a construction company was selected. The actual construction commenced with a ground-breaking ceremony on January 28, 2004. Construction proceeded through the next eighteen months. The KCES was ready for occupancy by the start of the school year in September, 2005.



Fig. 2: Grand opening, October 14, 2005. (Photograph by D. W. Aitken)

3. A STATE-OF-THE-ART BUILDING EMERGES

3.1 Description of the KCES

The Kirsch Center for Environmental Studies (KCES) has an extended E-W rectangular configuration, with the south wall virtually due south. The larger volume east portion of the building contains classrooms, faculty offices with adjacent outdoor student study area, the Dean's office and conference room, and the Stewardship Resource Center, a large open area for community-based learning. The west wing contains classrooms and a large laboratory that spans from wall to wall. A special feature of both floors of this portion of the building is the "MAX". The MAX learning spaces are technology-based interactive areas, serving both for circulation to and from classrooms and offices and for individual or small group learning.



Fig. 2: Students studying in the "MAX", the circulation corridor opened up for technology-based interactive self and group learning. (Photograph by D. W. Aitken.)

Comfort conditioning throughout the building is primarily provided by natural means. Excellent energy efficiency in the envelope, supplemented by some passive solar gain in the south-side entryway and adjacent hallway, along with interior gains, lead to little required mechanical heating. For cooling, each classroom is first to be naturally ventilated, with manually operable windows, opened or closed by classroom instructors as part of the "teaching by doing" features of the building. Fresh-air provision to the room is assured by supplementary fan-forced ventilation controlled by CO₂ monitoring of the classroom exhaust air.

Mechanical comfort conditioning in the east section of the building is facilitated by a raised floor plenum, with supply air entering at floor level through circular registers that can be moved to any location to provide direct occupant comfort, and manually adjusted for desired air flow.

Auxiliary heating and cooling energy is provided to this portion of the building by very energy-efficient mechanical systems,⁸ with the end-use comfort provided by fan-forced air-handling systems.

The classrooms are primarily daylit through large windows with spectrally selective low-e glazings. The largest classroom is on the northside, for glare-free illumination.⁹ Two smaller classrooms on the south side are protected by external shading overhangs, and external and interior shading lightshelves.¹⁰ Auxiliary lighting is by suspended up/down luminaries,¹¹ ganged in parallel to the windows, with the first, second and combined inner rows each separately controlled by daylight controlled dimmers.¹² Faculty offices are also each daylit, with occupancy-sensor controlled wall switches.¹³ All natural and artificial office and classroom lighting is designed to provide for an illumination range between 30 and 50 footcandles (320-540 LUX).

Glare control is provided by the new PCB-free "EcoVeil" shades from MechoShade, with a 5% openness factor. This leads to over 90% darkening of the room for A/V use or southside glare control while still giving a satisfactory rendering of the trees and views outside the window.



Fig. 3: The south shading overhangs and light shelves. In the distance shading of the west-facing faculty offices. (Photograph by D. W. Aitken.)

The western portion of the building features two north-facing laboratories, the John Muir Institute of Natural Sciences, and the Statewide Energy Management Program (SEMP) that spans the full width of the building. The SEMP laboratory opens out to an adjacent outside study area through a large garage-type door to facilitate outdoor learning activities. Heating and cooling of this portion of the building are assisted by a radiant floor slab. In the winter, the water for the slab is heated by the high efficiency

(92%-99%) condensing gas-fired boiler. The cool water for summer radiant cooling, however, is not separately created, but rather is the return water to the chillers operating in support of the East wing, simply first routed through the west-wing slab floor to pick up some more heat.

Rainwater is collected from the roof of the building and returned to the local aquifer through a percolation pond. Waterless urinals are used in the men's restrooms. The modest requirements of the building for heated water are met by a four-panel solar water heating system on the roof.¹⁴

A roof-mounted PV system, rated at 36.5kW DC (allowing for a California Energy Commission AC rating of just under 30kW, the point of departure for the CEC rebate) was constructed from 192 KC190 PV modules from Kyocera, each with a CEC power rating of 167.7 Watts. The entire array covers a surface area of 2,922.2 square feet (270.7 square meters).

The DC PV output is converted to AC by a net-metering qualified single Xantrex PV30208 inverter with a CEC efficiency rating of 92%, allowing power to flow from the PV either to the building when needed or to the grid when the PV power is available in excess amount. The PV system also provides shading to almost 25% of the roof, with the dominant shading over the west wing, helping to facilitate the reliance in that wing on just natural ventilation and radiant cooling. The rest of the roof is painted white, with an officially-acceptable "cool roof" coating.

The building features 70% recycled steel, 40% fly-ash concrete, and sustainable and non-toxic building materials, low VOC paints, recycled carpeting and FSC certified lumber. Energy saving LCD computer screens are used throughout (there are over 50 computers in the building).

3.2 First Occupancy—September, 2005

The building was first occupied for the opening of classes on September 21, 2005, although the faculty had been setting up their offices since mid-August. When the building was first occupied, problems with the lighting installation caused classrooms and faculty offices to be used initially without electric light assist. All functions of the building were still able to be carried on under this 100% daylight condition, showing that the building will be able to function well during anticipated future blackout periods.

The weather was hot at the time of first building occupancy. The chiller was also not operating yet, but generally the building maintained reasonable thermal comfort levels on its own, even though the shading PV had not yet been installed.

The most important feature of the first occupancy was the great enthusiasm for the building and the quality of its interior spaces shown by faculty and students!

3.3 PV Turned on, and First Performance Data

For a variety of reasons, the rooftop PV system could not be installed until early 2006. Data on the building's electrical performance, the performance of the PV system, and the contribution of the PV output toward meeting the building's electrical needs, were obtained for the first time on February 23, 2006. These data were recorded by a Fat Spaniel Technologies monitoring system,¹⁵ which also features a very descriptive pictorial presentation of the hour-by-hour electrical performance of the building and the PV system.¹⁶

Preliminary observations have produced very satisfactory initial conclusions about the building's performance. Peak electrical energy demand during the day, including lights, ventilation fans, the electrical components of the boiler, and plug-loads, is 26kW, with 23kW more usual. For this 22,000 square foot (2044 square meter) building, this amounts to a power demand during the day of less than 1.2 watts/square foot (12.9 watts/square meter), suggesting a very satisfactory energy-efficient performance for the building.

The maximum PV output seen so far is about 30kW. Correcting for the geometric relationship of the noon sun altitude this early in the year and the 13° slope of the PV array shows that the system is apparently operating with an inverter efficiency in the high 90-percent range.

The most significant observation to date, however, is that the PV system output *exceeds* the hourly demand for the building for *at least* the central four hours of the day, a period during which, in fact, power is being returned by the PV system to the grid. And this is at the end of February. It would appear that the goal of PV power production meeting 50% of the building's electrical demands for the year is in reach.

3.4 Commissioning—2005-2006

The commissioning of the building's energy and lighting systems has not been easy. Daylight sensors had to be moved to proper placements, defective daylight controls had to be replaced, and the electrical controls for the mechanical systems have been producing erratic results. Monitoring equipment apparently was not installed properly (exclusive of the Fat Spaniel system, which was properly installed and is working very well), and some of the metering equipment was apparently broken in installation. This confirms what is well known, however, and that is that *no* assumptions about

building performance can be made with confidence until the building has been fully commissioned.

4. IMPACT ON THE REST OF THE CAMPUS

It was not long before the enthusiasm surrounding the KCES project positively influenced operations for the rest of the campus. For example, the LEED Gold goal standard set for the KCES caused the campus administration to determine that, henceforth, all new campus buildings will be designed to meet at least LEED certification standards.

In addition, under the leadership of the Director of Facilities, John Schulze, a 201kW single-axis tracking PV system was installed as a shading canopy on top of the parking garage near the KCES. An additional 100kW fixed PV array canopy was installed over the parking lot on the sister campus, Foothill College.

5. CONCLUSIONS—LESSONS LEARNED

The KCES building is in its first year of occupancy, but the process that led to it is now entering its 17th year. This paper has revealed the great responsibilities placed upon the many in the College Community, and the tenacity of all involved in holding on to the highest standards for the building. Sheer determination frequently kept the building project on track against frustrating obstacles. It has underscored the concept of “shared governance” as the *key* to the project’s success. The shared victory will now live on the campus for 100 years, every day teaching the students within it, and the community around it, how environmentally responsible architecture can be practically accomplished, and how beautiful and satisfactory the results can be. It is the sincere hope of the De Anza College campus that this is just a beginning.

REFERENCES

¹ Leadership in Energy and Environmental Design (LEED) Green Building Rating System® by the U.S. Green Building Council. The KCES building was registered with LEED on September 30, 2002. The paperwork for final LEED Certification at the Gold level is currently (March, 2006) still in process. All indications are that the building has met or exceeded these standards. Information on the LEED requirements and procedures for certification can be obtained from the U.S. Green Building Council home page, <http://www.usgbc.org/>

² Aitken, D.W., “Putting it Together: Whole Buildings and a Whole Building Policy”, REPP Research Report,

Renewable Energy Policy Project, No. 5, September, 1998. A PDF version can be downloaded from http://repp.org/repp_pubs/pdf/aitken.pdf. Hard copy can be ordered from REPP, (202) 293-2833.

³ This information extracted from the De Anza web page, <http://www.deanza.edu/about/>

⁴ <http://www.kirschfoundation.org/who/about.html>

⁵ One of the authors of this article (D. Aitken) did indeed co-design such a building in the mid 1970’s, and at a site very close to the KCES. The Clark Library at San Jose State University in San Jose, California, was the first State building allowed to be constructed with no mechanical heating or cooling systems. Heating was provided by 5,000 square feet (465 square meters) of solar thermal collectors cascading in rows down the building’s vertical south side--the State’s first building-integrated solar system. Cooling was accomplished entirely by the local diurnal demand and the selection of building materials, conductivities and thicknesses. More information can be found at

http://donaldaitkenassociates.com/projects_library.html

⁶ <http://Energymanagement.deanza.edu/>

⁷ “A Blueprint for Sustainable State Facilities”, The [California] Sustainable Building Task Force, the State and Consumer Service Agency, Governor’s Executive Order D-16-00, December, 2001. Electronic versions should be downloadable from

<http://www.ciwmb.ca.gov/GreenBuilding/TaskForce>

⁸ Heating by a Patterson Kelly Mach series high efficiency (92%-99%) condensing hot water boiler; cooling by a TSI packaged evaporatively cooled water chiller (Nominal 42 Tons, Design 30 Tons).

⁹ North side view glazing is Viracon VE-2-55; shading coefficient (SC) 0.29, visible transmittance 40%; total solar heat gain coefficient (SHGC) 18%.

¹⁰ South side view glazing below the light shelf is Viracon VE-2-40; SC 0.25; visible transmittance 32%; SHGC 14%. Above the light shelf is Viracon VE-2-85; SC 0.44; visible transmittance 65%; SHGC 31%.

¹¹ Minuet 1T8 Direct/Indirect luminaries; 76% Up, 24% down.

¹² Watt Stopper LCD-103 three-circuit controls.

¹³ Watt Stopper WA-200 occupancy sensors.

¹⁴ The collectors, storage tanks and controls are by Heliodyne, Inc., of Richmond, CA.

¹⁵ <http://www.fatspaniel.com/datapage.html>

¹⁶ The reader of this paper can view the electrical performance of the Kirsch Center for Environmental Studies and its rooftop PV performance and contribution live on <http://view2.fatspaniel.net/FST/Portal/EcoEnergies/KirschBuilding/HostedEndUserView.html?>