# Energy Training Handbook

## *Training Recommendations*

## *for*

## *California*

## *and*

## *the Community College System*

**Presented by the Statewide Energy Management Program (SEMP)**
**a partnership with the California Energy Commission and the**
**Chancellor's Office of the California Community Colleges**

# Energy Training Handbook

**The purpose of this handbook is:**

- **To share recommendations on Energy training (targeting technicians and other college personnel) within the California Community College system**
- **To encourage your District to institute energy efficiency and resource conservation as core values**

**Developed through a partnership between the California Energy Commission and the California Community Colleges**

# W E L C O M E

Congratulations on developing a district energy policy. This **Energy Training Handbook** will assist you in implementing long–term energy efficiency training for all college personnel particularly energy technicians. This training should become part of the required annual in-service training.

The California Energy Commission (CEC) has long understood that the California Community College (CCC) System is the largest institution of higher learning in the world and has a significant impact on energy consumption in the State. Some of the key statistics of our system:

- **Size** - the CCC system consists of 72 semi-autonomous districts made up of 108 full service campuses, 54 approved off-campus centers and 20 district offices.
- **Facility Assets** - include approximately 20,489 acres of land, 4,699 buildings and 52.2 million gross square feet of space that includes 40 million assignable square feet of space.
- **Alternate Sites** - the system has over 2,000 off-campus outreach centers at various facilities
- **Funding** - the system is funded annually by the State of California in excess of $6 billion
- **Enrollment** - the system serves over 2.6 million students annually and was expected to increase by 6% by Fall 2001; it is projected that a total of 46.7 million assignable square feet is needed to accommodate the enrollment projected over the next five years
- **Projected Growth** - according to the California Postsecondary Education Commission (CPEC), the CCC is projected to experience enrollment growth of 528,918 students in years 1998-2010

With this in mind, based on the past 10 years of work on promoting energy savings through training and policy, the Statewide Energy Management Program (SEMP) Team is convinced that the CCC system can become a model for the entire country. The CCC system has potential influence on and the ability to move in a sustainable direction in support of other state efforts.

SEMP is also convinced that the CCC currently has the expertise within each district to make this happen! Resources are available, including college administrators, faculty, staff and energy technicians, to begin the process of long term energy planning. The leadership exists among the Board members throughout the State to adopt energy policy which promotes energy efficiency, resource conservation and sustainability and realize savings.

The contribution to this Handbook by the California Energy Commission staff, De Anza College (DAC) staff, faculty, administrators and students, CCC Chancellor's Office staff, personnel from various community colleges throughout California and the many consultants to the project has been an essential part of this initiative. Each person brought his or her expertise and knowledge to this effort and that commitment is very much appreciated.

In an effort to keep the focus on energy efficiency, resource conservation and training, any input by the readers of this document is important. Continuing to build more partnerships is essential. We hope this is the foundation for realizing this long-term vision.

**Realize the value of your technicians and college personnel and commit to long-term Energy training!**

If energy efficiency and resource conservation are to become "core values" within the CCC system, adopting an energy policy and a long-term training program for energy technicians, as well as all college personnel, are essential. These two efforts must occur simultaneously to address the various barriers to energy efficiency.

The objectives developed by the Task Force were to provide low cost, accessible and relevant technician-level training, which addresses the barriers to training determined under the needs assessment, market survey and the previous pilot training programs.

The findings over the 10 years of work are summarized below and profile the CCC technicians who work with energy systems and equipment:

- 36-55 years old, technician-level with 10+ years experience, high school graduates
- Technical training gaps: controls, Energy Management Systems (EMS), building design and retrofit, energy efficiency concepts, new technologies, life cycle cost, whole building approach
- Foundation skills needed: content–based math, computers, English, business communication, work and study skills
- Program design should incorporate Associate degree level, traditional classroom methods, hands-on instruction, distance learning to broaden accessibility to work force, computer access, experienced and qualified instructors
- Program configuration should be easily accessible, low cost, short-term modules in an accelerated format to address barriers of time and expense
- Marketing and outreach: internet and hard copy newsletter/communications for both managers and employees

Training strategies which target these technicians must consider the following:

- Most technicians are not able to travel to training sites due to costs, time off work or unwillingness to give up personal time
- Cost must be minimal as the target group is not accustomed to paying for training or will not participate currently if too expensive
- Possibility of receiving training at the work site (on the job training)
- Enhancing the skills of the technician workforce and promoting an environment which fosters life-long learning
- Short term rather than full credit courses
- Maximum of 12 hours per module
- Availability of videotapes or other mediated learning for some participants
- Opportunities to share resources and develop a "training network"
- Modules provide course content and resources applicable to technician-level skills
- Incorporate some basic skills development including math
- Provide "mentor" instructors who build the current skill level of technicians but also provide "peer" trainers that understand the challenges in this occupation in a CCC setting

Other strategies that could be explored included:

- Regional approach to training – possibly create "training centers"
- Work with existing Energy Management Programs within the CCC system to utilize expertise of CCC faculty
- Build upon natural "links" between CCCs and 4 year colleges, industry, public utilities and other community resources

To assist you in developing your long-term training the Task Force developed a core of energy training modules listed as follows:

**Statewide Energy Management Program**
**9 course modules - objectives**

**ES 69 Energy Reliability and Your Organization** 1.0 Unit

An overview of strategies to assist in preparing an energy management action plan for your organization and staff. The strategies include model board policy, administrative guidelines, assembling an energy management action team, assessing the impact of energy policy on society, and an overview of key stakeholders in the energy field.

Course Objectives:

The student will
1. Review and discuss energy management and energy reliability issues.
2. Identify and understand the value of managing energy within an organization including its impacts on the environment.
3. Assess strategies for development and implementation of an energy management action plan.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and changes in Operations and Maintenance.

Review Model Board Policy document to see what strategies might be applicable to that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 70 Intro to Energy Management Technology** 1.0 Unit

An overview of the field of Energy Management and its importance in today's society, including future implications, and discussion of careers and impact on modern culture and society. This model introduces the whole building concept and related energy efficiency and conservation issues including the building envelope, Heating, Ventilation & Air Conditioning (HVAC) systems, lighting, energy management and controls and renewable energy technologies.

Course Objectives:

The student will
1. Evaluate and analyze energy management and energy conservation issues.
2. Identify and understand the value of energy management.
3. Identify and understand the principles of energy management.
4. Explore the career opportunities in the energy field.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review Model Board Policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 71 The Building Envelope** 1.0 Unit

An introduction to the building shell as the primary physical component of any facility, which controls energy flow between the interior and exterior of the building. The goal is to develop a qualitative and analytical understanding of the thermal performance of major building envelope components. Topics include wall, doors, glazing (windows), roofing and building skin as well as climatic responsive building design.

Course Objectives:

The student will

1. Develop a qualitative and analytical understanding of the thermal performance of major building envelope components.
2. Examine the role of a building's walls and roofs in reducing overall building energy loads.
3. Examine the comfort benefits and energy savings potential of windows.
4. Analyze building insulation, moisture barriers and vapor barriers as the means to control the passage of heat and prevent condensation at the building envelope.
5. Explore the benefits and barriers of a climatic responsive design and approach that takes maximum use of nature and integrates building components.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review Model Board Policy document to see what strategies might be applicable to equipment for that organization. . (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 72 Heating, Ventilating and Air Conditioning (HVAC) Systems** 1.0 Unit

An introduction to HVAC systems, the systems that provide heating, cooling, humidity control, filtration, and comfort control to facilities. The course will examine various HVAC systems and their interrelationship with other building systems. Students will consider HVAC technologies that can help facilities managers achieve the goals of lowering energy costs, becoming more environmentally friendly, and enhancing indoor air quality.

Course Objectives:

The student will

1. Examine various HVAC systems and analyze their relationship with other building system components.
2. Explore the importance of, and methods for, reducing HVAC loads.
3. Assess the potential of incorporating building automation/control systems.
4. Evaluate the benefits of optimizing for part-load conditions.
5. Examine the use and benefits of economizers.
6. Assess the impacts of building ventilation systems.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of HVAC equipment and systems within the CCC system or organization. Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review Model Board Policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 73 Electric Motors and Drives** 1.0 Unit

The course examines the opportunities for lowering energy consumption through energy-efficient motors and motor controls, including an introduction to the technology of high efficiency motors and variable frequency drives. Techniques to increase current carrying capacity, improve voltage to equipment, reduce power losses, and lower electric bills will be discussed.

Course Objectives:

The student will

1. Assess the importance of a facility-wide inventory of motors.
2. Examine various strategies to reduce energy usage in motors.
3. Assess the importance of sizing motors appropriately.
4. Examine the technology and benefits of high efficiency motors.
5. Examine the potential benefits and pitfalls of variable frequency drives.
6. Assess the impacts and benefits of power factor correction.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operation and Maintenance for current systems and equipment.

Review Model Board Policy document to see what strategies might be applicable to equipment for that organization. . (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 74 Lighting Distribution Systems** 1.0 Unit

The course provides an introduction to the fundamentals of lighting and energy management lighting techniques. It discusses the different types of lighting and daylighting applications used in commercial and institutional buildings, while describing the quality and quantity of lighting needed for certain applications, measuring efficiency, color rendering, ballasts, etc. Lighting design that provides visual comfort at lower energy costs will be emphasized.

Course Objectives:

The student will

1. Explore how light is produced and delivered by examining various lighting technologies and the efficiency associated with each technology.
2. Examine the benefits and applications of compact fluorescent lighting.
3. Examine the benefits and applications of fluorescent.
4. Assess the essential role of ballast in lighting.
5. Explore the various types of occupancy sensors and the benefits of their use.
6. Examine principles, applications and technologies for exterior lighting.
7. Explore the theory and benefits of daylighting as an alternative to electric lighting.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operation and Maintenance for current systems and equipment.

Review Model Board Policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 75 Electric Power Systems** 1.0 Unit

An introduction to electric power systems, focusing on distribution components such as transformers, switchgear, distribution panels, and wiring. Power systems analysis, preventive maintenance, and record keeping techniques will be discussed. Emphasis will be placed on opportunities within a facility's distribution system to save energy, increase equipment life, and reduce unscheduled outages.

Course Objectives:

The student will

1. Explore the distribution components of electrical power systems.
2. Assess the opportunities for improving efficiencies of electric power systems.
3. Examine the importance and benefits of power systems analysis.
4. Examine the importance of customer-owned transformers in electric power systems.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review model board policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 78 Energy Management Systems and Controls** 1.0 Unit

This course describes the most commonly used controls and energy management systems in commercial and institutional applications. Topics will include complex automatic systems for major energy-consuming equipment, as well as simple controls, including time clocks, occupancy sensors, photocells, and programmable thermostats. Computer-based energy management systems, as well as control systems to reduce peak electrical demand will be discussed.

Course Objectives:

The student will

1. Explore the common controls available to help reduce energy consumption.
2. Examine the various functions of energy management systems.
3. Explore the benefits and justification of energy management systems and controls.
4. Analyze the ways that facilities are charged for power and energy.
5. Evaluate techniques to reduce electrical peak demand (peak shaving).

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review model board policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

**ES 79 Renewable and Alternative Energy Systems** 1.0 Unit

An introduction to the potential for renewable and alternative energy systems when adding power generation capacity for a site or large facility. Life-cycle cost comparisons between renewable energy systems and conventional power generation and the added potential of reducing peak power demand will be emphasized. Topics include photovoltaic power systems, wind energy systems and fuel cells.

Course Objectives:

The student will

1. Explore the technology and applications of renewable and alternative energy systems.
2. Examine existing and potential applications of photovoltaic (PV) power systems.
3. Examine existing and potential applications of wind power.
4. Examine potential applications and types of fuel cells.
5. Analyze opportunities for buying green power.

Strategies:

Conduct survey of energy knowledge, use and operations/maintenance of equipment and systems within CCC system or organization (Use previous market survey model). Interview leadership/administration to determine level of support for energy efficiency policy, training and Operations and Maintenance for current systems and equipment.

Review model board policy document to see what strategies might be applicable to equipment for that organization. (Refer to the Energy Policy Handbook pages 8-20)

Develop a prioritized list of possible strategies to reduce energy use related to systems and equipment within the organization. (Energy audit/Utility or Energy Service provider type)

For more information contact the **Statewide Energy Management Program**

**Long-Term Energy Training**

Throughout 5 years of training the Statewide Energy Management Program (SEMP) found an increasing acceptance of Technology Based instruction by the technicians in our targeted population. The response to these efforts has been exemplary, with over 70% of the 108 CCCs participating in the training and/or Energy Reliability Summit broadcast.

The most economical means to deliver instruction throughout the state or your district is through technology and distance education. Bringing the client to a site for training, travel time, time away from work, hotel charges, etc. is very costly to the community colleges. Sending an instructor to the different locations is also costly for the same reasons. Providing flexible training opportunities will maximize enrollment and resources.

The technology used for energy training should be driven by the training objectives, subject content, location of the audience and the expert. The instructor must be comfortable with whatever technology (ies) is chosen. The instruction drives the technology not the technology driving the instruction.

The technology to be used is decided not only by the subject matter but the resources available on each campus. The CCC has many qualified personnel to assist when deciding on what technology to use. Listed below will be the Pros and Cons of some of the technologies that were used in the pilot. The following information provides a matrix for instructors and support personnel to assess the various distance learning technologies, balance their advantages and limitations, and align instructional goals and objectives with the optimum media mix.

**Technology-Based Training Options**

**Satellite:** two way audio, one way video

Pros:

- All CCCs have the capability of receiving a satellite signal
- Quality transmission
- Covers a broad geographic area
- Large audience capability
- All CCCs could use this technology
- Use a website for all material
- Fax or e-mail assignments
- Can be taped for later viewing

Cons:

- Send and/or receive equipment necessary (Most CCCs, CSUs and UCs have receive equipment)
- Costly if using a private network for up-link and transponder time
- Must have access to a production studio and up-link equipment
- Technical staff support
- One-way video, two-way audio using telephone for talkback, fax or email
- Advertising costly
- Inter-district registration policy presently does not exist, students must apply for admission to the college offering the program

Technical Support:

- Producer/Director
- Technical Director
- Audio Technician
- Video Technician
- 3 Camera Operator depending on how many camera are used
- Floor Director wears the headset and tells the talent what to do
- Set Designer
- Graphic Artist

- Scriptwriter
- Teleprompter
- Lighting
- Unlink Engineer and staff – usually handled by the satellite company
- Conference Coordinator

Cost:

- Cost varies depending on your college resources including technical support. Plan on at least $10,000 - $20,000 for a satellite up-link per hour.

**CCCSat:** California Community College Satellite Network

Pros:

- All 108 CCCs have the capability of receiving this satellite signal
- No cost involved for use at this time
- Quality transmission
- Large audience capability
- Use a website for all material
- Fax or e-mail assignments
- Can be taped for later viewing

Cons:

- Presently must send signal to Palomar College for up-linking
- Must have access to a production studio or distance education classroom
- Technical staff support
- One-way video, two-way audio using telephone for talkback
- Advertising costly
- Inter-district registration policy presently does not exist Students must apply for admission at college offering program

Technical Support: Depending on how elaborate you want your broadcast, you could use the same support that is needed for a regular satellite broadcast, as mentioned above, or you could make it as simple as broadcasting out of your distance education classroom where you would have:

- Television engineer or technician
- Camera person – usually a student is capable of operating all the cameras remotely as well as video taping

Cost:

- Presently Palomar has a grant to cover the cost, but in the future the campus using CCCSat will need to secure the funds to cover the cost of operation.

**DISH Network:** (Teleconference, one-way video and audio, Commercial network which Palomar is presently operating for the CCCs)

Pros:

- Covers the entire United States
- Can be video taped for later viewing

Cons:

- Presently must send signal to Palomar College for up-linking
- Cost involved when the present grant ends
- Must have access to a production studio or distance education classroom
- Technical staff support
- One-way video, two-way audio using telephone for talkback
- Advertising costly
- Out-of-state as well as inter-district on-line registration policy presently does not exist. Students must apply for admission at college offering program

Technical Support: Can be a combination of the satellite and/or CCCSat technical staff. Video tape of 4CNet used to get programming to Palomar.

Cost:

- Presently Palomar is operating the DISH network with grant money, but additional grants are needed to keep the operation going.

**4CNet:** Video conferencing

Pros:

- All CCCs, CSUs and UCs have the capability of participating
- Cost for transmission is already paid for by the Chancellor's Office
- Two-way audio and video
- Multiple sites can participate
- Can be videotaped for later viewing
- Can be used to send broadcast to Palomar College for up-linking to satellite

Cons:

- Trained technical staff support
- Must be present to participate
- Must have conference room where the videoconferencing equipment, telephone and fax lines are available
- Advertising costly
- Inter-district registration policy presently does not exist, students must apply for admission to the college offering the program

Technical Support:

- Video conference coordinator – the person who is responsible for setting up the conference and talking with the other sites that will receive the conference. Responsible for seeing that course material is available at each of the sites whether mailed or on the web. Each site will have a person responsible for this function. Sometimes it is the responsibility of those attending the conference.
- Video conference scheduler – the person that schedules the dates and times on the 4CNet schedule and with the participating sites
- Trained technician with the videoconference unit and the network. It is their responsibility to turn the unit on and make sure it is connected to the network. He/she must monitor the broadcast and let the host site know if there is a problem. This is very important and can not be stressed enough.
- Usually the video conference equipment is user friendly and very easy to operate with a touch screen so that a camera operator is not necessary.

Cost

- There is no additional charge if your site is connected directly to 4CNet. Presently the cost is covered under the Telecommunications Budget of each campus. Costs are involved if a T1 line is used and may start as low as $35.00 an hour or more. If connecting with a facility like a Kinko's that usually change a flat fee of $150.00 for the use of their facility or $250.00 including line charges for an hour.

**Mediated Learning** (Video tapes, Computer Based Training/On-line Learning and Video streaming)

Pros:

- Self-paced learning
- Anytime, anywhere access
- Large student participation possible
- Course material available on-line
- Feedback by e-mail
- Improves access and equity
- Flexible; easy to use
- Time spent up-front in the instructional design pays off in the end

Cons:

- Cost of technical support and equipment; varies as to the choice of medium
- Instructor training and involvement possibly for a longer time
- Cost of videotape/mailings, etc.
- Must have access to a computer that is able to handle video streaming, or CDs

Technical Support: - Depending on the technology used.

- On-line teaching – the instructor can learn to put his/her course information on the web, but usually there is a web technician to organize and manage the course material and student activity e.g. class listserv.
- Tech support to maintain mediated classroom, computer, DVD or VCR, video projector, screen
- Web access is necessary
- Production crew/camera operator needed for video taping or video streaming

Cost: will vary greatly depending on the medium that is used.

- Videotape could cost anywhere from $20,000 - $60,000 for a 30 hour course or as little as $100.00 depending on the number of students and using a Distance Education (DE) classroom
- Online Learning - depending on the instructor and his/her knowledge of using the web. Usually there is a stipend for an instructor developing an online course of at least $1,500 or more. If technical support is required throughout the course it could be costly.

Video Streaming – Like online learning the cost will vary depending on how elaborate the design and video are. Production crew and computer/ web technician are required, a video editor may also be needed adding up to $20,000 or more, If a DE classroom is used and no editing is done, video streaming can be very inexpensive.

**Technical Staff requirements for Technology-Based Training:**

- Distance Learning Coordinator
- Media Coordinator
- Technicians
- Faculty Liaison
- Faculty

**Technician training required:**

- 4CNet protocol and monitoring
- 4CNet equipment installation and updates

**Other Factors required:**

- Upgrades of existing equipment/systems
- Re-established priorities for technology-based training
- Support from statewide network (4CNet)
- How to support CCC technicians for technology-based training?

**What are we talking about? How do we achieve this?**

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- Energy planning involves a commitment to long term training of college personnel including administrators, faculty, staff and energy technicians
- Long term investment in a well trained technicians pool capable of realizing energy savings for CCC districts
- Development of a district "energy team" which utilizes the variety of skills, talents and knowledge necessary for long term planning

**Why should we offer energy management training to the technicians, administrators, faculty, staff and students?**

- The California Community College System is the largest institution of higher learning in the world and is a significant energy consumer in the State
- The energy required to power CCC real estate is a large investment of resources and the System has an obligation to manage energy wisely and to save energy, money, and future resources
- Long term uncertainty of energy sources, costs and reliability of service
- Relatively easy to accomplish
- Addresses energy reliability issues of the present and future
- Saves money
- Increases comfort level in classrooms and office space
- Utilizes expertise within CCC districts while continuing to build their knowledge base and skills (technicians long term value to the district)
- Best practices and knowledge gained can be incorporated into long-term energy savings plan (energy management plan)
- Assures movement toward energy independence and security
- Builds confidence and good will in the public's trust of community colleges

**What has SEMP learned that will assist us with training?**

The criteria established for the EMT training program are:

- Make training accessible to technicians who work with energy systems and equipment
- Be sure training is low cost and accessible
- Teach principles of energy management
- Curriculum must be flexible, modular and provide recognition or verification of completed training
- Develop EMT job description
- Provide additional skills including math, communications, report writing etc.
- Can be applied to all college personnel to realize further energy savings potential

**Why use technology to deliver Energy Training?**

- Audience/students/personnel are spread throughout the State at 108 locations
- 24 CCCs have an existing energy program with expertise on their campuses; partnerships need to be formed
- Appropriate technology is available on all the CC campuses whether it be video conferencing, computer based training or a combination of a number of technologies

**What should we keep in mind for successful training?**

- 80% of the technicians especially wanted hands-on training with live instructor (30% identified videotape/computer based courses as desirable) like traditional classroom delivery method
- Technicians want CEU credit

- They want to receive training information from supervisors (70%)
- 30 – 40% of the technicians like short-term training, 1-5 days with full-day sessions
- 30% wanted 1-12 hours per course
- 18% want free courses
- expect significant benefits from training
- 80% of managers are interested in newsletter
- biggest obstacles to training
    - **time off work (65%)**
    - **cost (60%)**
    - **no time (55%)**

To take the Energy Management one more step and ensure that long-term training continues within the California Community College system, colleges must link their policy efforts with their training efforts.

To realize a long-term energy management training effort, we must tap into the talent and expertise currently available in our sister colleges. SEMP suggests that the next level of work be a training effort among at least four colleges to develop a statewide training consortium, with each of the four colleges providing at least one course from their current energy management programs. SEMP views the current EM programs in the California Community College system as a strong foundation for future growth.

SEMP suggests the use of mediated learning (video streaming, on-line instruction, etc.) in the next phase of work. A statewide energy consortium could utilize video streaming technology. 4CNet will be a key to delivering long-term training in the foreseeable future

SEMP looks forward to each district's innovative solutions for energy training and anticipates the CCC system moving toward greater energy efficiency and resource conservation.

## NEXT PHASE

# APPENDIX

For further information contact:

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Technology-Based Training was an integral part of the initial SEMP training. The following table is an overview of the technologies presently available to deliver training.

**Technology Usage Table**

| Technology | Usage | Expense | Technical Support | CCC Access | Student Access |
|---|---|---|---|---|---|
| **Satellite** | Low | Highest | Requires the most | Very few have capability | On campus |
| **CCCSat** | Low | Medium | Significant | Only One Location | On campus |
| **Dish Network** | Low | Medium | Significant | Only One Location | Home |
| **Local Cable** | Low | * High/Low | * High/Low | Very few have capability | Home |
| **4CNet** | Low/High | Low | Low | All have capability | On campus |
| **Mediated Learning** | High | Low | * High/Low | All have capability | On/Off campus |

Key: * "High" if production crew is used. "Low" if using Distance Education classroom.

September 9, 2002

**Technology-Based Training**

**Satellite Transmission** – usually one-way video and audio using a telephone, fax and/or e-mail to interact. Satellite is an electronic retransmission device serving as the repeater normally placed in orbit around the earth for the purpose of retransmitting electromagnetic signals (programming). It normally receives signals for a single source and retransmits them over a wide geographic area. Domestic communication satellites such as CCCSat (California Community College Satellite network), the DISH Network and other commercial satellite companies were used for the energy management training.

**De Anza College's** up-link facility was used for the Energy Reliability Summit in February 2001. This facility is known as a satellite earth terminal which sends the programming to that portion of a satellite which receives processes and retransmits communication between Earth and the satellite. Most of the colleges in the CCC, CSU and UC systems have a satellite receiver and can receive the broadcast. Over seventy locations participated in the Summit. Cost can be anywhere from $10,000 - $20,000 depending on length of the broadcast, time of day and staff and equipment available on the campus.

**CCCSat** (California Community College Satellite network) and the DISH Network were used for the energy management training, CCCSat used channel 80, and the DISH network used the community college channel 9405. Both are one-way video and audio using telephone, fax or e-mail for interaction.

Some of the community colleges were interested in receiving the Energy Management Technology Program (EMTP) courses and presently did not have the capability to videoconference so CCCSat was chosen as an alternative distribution technology. Compressed video, using 4CNet, was used to carry the program live from De Anza College to Palomar College where it was up-linked to all the State's community colleges that had working reception capability.

CCCSat provides the highest quality digital telecommunications delivery for distance education in the State. CCCSat supports the academic mission of the California Community College System and the Chancellor's Office, which funds the CCCSat grant. For addition information check the web site www.cccsat.org CCCSat is a statewide initiative established by the CCC Chancellor's Office to advance distance education. CCCSat

up-link facilities are physically located on the Palomar campus and funded with a five-year budget of 8.5 million dollars.

**DISH Network** – The Community College Network, channel 9405 on the DISH Network is also on the Palomar Campus and available to all the CCCs through a special grant funded by the Chancellor's Office of the CCC system. Some of the EMTP classes were broadcast nationwide on DISH and calls were received from Arizona requesting to receive all the courses.

**Cable Television Network** – like satellite transmission, it is one-way video, audio, and data distribution system carried on coaxial cable or fiber optics to single or multiple specified locations. De Anza College is connected to the local ATT Cable network and programs two channels, Sunday through Thursday, CCN1 and CCN2. The service area covers the great Bay Area from Menlo Park to South San Jose. Early in the grant programs were broadcast on the local cable network from the distance learning classroom located on the De Anza campus. EMTP will be using the network in the fall 2002 to reach all the local school districts and homes in the area.

**4CNet** – is two-way video and audio known as video conferencing or compressed video. Compressed video is the processing of video images, transmitting changes from one frame to the next which reduces the bandwidth to send them over a telecommunication channel, reducing the cost. 4CNet formally known as "CSUnet" is a dedicated data network linking each of the campuses of the California State University (CSU) system and was established in 1984. This effort was to help meet the increasing information technology needs of the University system throughout the State. CSUnet continually modified and expanded its function and technical resources to keep current with the state-of-the-art services and applications. CSUnet's purpose has been to serve the University's academic and administrative mission, goals and objectives.

The State of California authorized auxiliary funding in the 1996-97 fiscal year to the California Community Colleges (CCC) "to assure that each of the 125 (campus and district office) sites have established necessary infrastructure capability for teleconferencing, connections to CSUnet and satellite downlink" capabilities.

In response to this funding allocation, the CSU and CCC have implemented a working relationship to create the California State University and Community College Network, 4CNet. (There is also a connection to the University of California for video conferencing, thus the 4CNet). The role of 4CNet expands the role of CSUnet to the community college environment. It is the purpose of the 4CNet to serve the academic and administrative mission, goals and objectives in ways that exploit centralized and distributed information resources for the separate and combined California State Universities and Community Colleges.

4CNet is managed and operated by the Telecommunications Infrastructure Support services (TISS) team, a part of the Technology Infrastructure Initiatives (TII) Division of the California State University Chancellor's Office. The California Community Colleges Chancellor's Office provides consultative leadership in the management and development of the network. The TISS organization has been developed to effectively fulfill this management function.

In using the 4CNet for EMTP it was very evident that many of the community college technicians were not trained to use their video conference equipment or the network. It was also evident that proper technical support to oversee the video conference unit for an academic program that used the evening hours was not present. There was no one available to assist after hours if there was a technical problem. These issues need to be solved if other programs are to be successful in using 4CNet.

**Mediated Learning** – In addition to the technology mentioned above there are other mediums to assist the student and instructor with the course content. A few are listed below:

Videotape – Many of the distance education classes are videotaped. They are usually placed in the Media Center for review or sent to the distance students who are registered and can not receive the class any other way. There is the cost of mailing the tape which usually costs about $5.00 per tape (envelope and postage) plus the cost of the videotape which can vary depending on the length of the tape and the quality used. Course material is sent with the tape or can be printed off of the class web site. If course is being held in the distance education classroom there is no additional technical staff required. A regular production crew would

be necessary if developing a telecourse which would be offered on the local cable company. This could cost anywhere from $20,000 - $60,000 for a 30 hour course if the college does not have a production crew available.

Online Learning – Computer Mediated Learning, where the students receive the entire course content and resources on the Internet. Interaction with the instructor and other students is done with e-mail and a class listserv where a student may ask a question of the instructor or other classmates and post statements for discussion. Usually all homework is submitted via e-mail. A stipend is given to the instructor for developing an on-line course. This can be any where from $1500 on up. Often there is a web technician to assist the faculty.

Video streaming – Broadcasting video and audio to audiences over standard networks, especially the Internet and organizations' intranets. Network streaming video, combining the impact of video with the ease of web browsing, has already revolutionized corporate communications, training, education, entertainment and security applications. If a course is being taught in a distance education classroom where it is being videotaped at the same time, it can be digitized and placed on a server where students have access anytime anywhere. As with online learning, the course should be designed for maximum student participation/interaction. Time spent on the design on the front end will make a difference! Developing instruction is time consuming but very powerful and rewarding if designed well. Cost will vary depending on how elaborate the instructional design, what hardware and software are available, as well as how much technical support is required.

Other mediated learning – using a web page for a course, a class listserv for interaction, using a compact disc (CD) with a textbook, and selecting resources from different web sites. All of these and more are part of mediated learning.

# CALIFORNIA COMMUNITY COLLEGE DISTRICTS

1 Allan Hancock Joint
2 Antelope Valley
3 Barstow
4 Butte
5 Cabrillo
6 Cerritos
7 Chabot-Las Positas
8 Chaffey
9 Citrus
10 Coast
11 Compton
12 Contra Costa
13 Desert
14 El Camino
15 Feather River
16 Foothill-De Anza
17 Fremont-Newark
18 Gavilan
19 Glendale
20 Grossmont-Cuyamaca
21 Hartnell
22 Imperial
23 Kern
24 Lake Tahoe
25 Lassen
26. Long Beach
27. Los Angeles
28. Los Rios
29. Marin
30. Mendocino-Lake
31. Merced
32. MiraCosta
33. Monterey-Peninsula
34. Mt. San Antonio
35. Mt. San Jacinto
36. Napa Valley
37. North Orange County
38. Palo Verde
39. Palomar
40. Pasadena Area
41. Peralta
42. Rancho Santiago
43. Redwoods
44. Rio Hondo
45. Riverside
46. South Orange County
47. San Bernardino
48. San Diego
49. San Francisco
50. San Joaquin-Delta
51. San Jose-Evergreen
52. San Louis Obispo County
53. San Mateo
54. Santa Barbara
55. Santa Clarita
56. Santa Monica
57. Sequoias
58. Shasta-Tehama-Trinity
59. Sierra Joint
60. Siskiyous
61. Solano
62. Sonoma
63. Southwestern
64. State Center
65. Ventura County
66. Victor Valley
67. West Kern
68. West Valley-Mission
69. West Hills
70. Yosemite
71. Yuba
72. Copper Mountain