

## ENERGY STUDIES PROGRAM AT STOCKTON STATE COLLEGE

Lynn F. Stiles  
Stockton State College

## BACKGROUND

A unique undergraduate program for arts, science and business students focusing on energy studies and the use of high technology equipment has been underway at Stockton State College since 1983. Energy topics courses have been offered since 1975, with an Energy Studies Certificate Program being established in 1983. Through a judicious choice of elective courses, a science or planning major can complete both the requirements of his/her major and also those of the Energy Certificate. In the last two years, twelve students have received this certificate. The certificate program only accounts for a small fraction of student enrollments in courses entirely dedicated to an energy topic. In addition, the introductory physics courses directly address energy related applications. Energy studies at Stockton includes the Energy Studies Certificate Program as a focus of many energy-related courses.

As a result of this Energy Studies program, two New Jersey Department of Higher Education Engineering/Technology equipment grants have been awarded to Stockton to purchase \$163,000 of state-of-the-art energy related equipment. This has further enhanced the project-oriented approach in several of the energy courses offered at Stockton. We have used some of this equipment in laboratory experiments in a large introductory physics course, further exposing students to energy conservation issues.

There are three basic aspects of the energy studies initiative at Stockton which form the structure of this discussion:

1. Over 100 students (representing half of all science majors) each year are exposed to air infiltration and thermography measurement techniques in introductory physics. In addition several applied energy topics are integrated into the courses.
2. Approximately twenty students each year enroll in project-oriented energy courses utilizing both simple and sophisticated equipment. And approximately five students each year complete a senior research project related to energy.
3. Between fifty to one hundred students from outside the sciences enroll in specially designed general education courses with an energy theme.

## INTRODUCTORY PHYSICS

There are several opportunities in the introductory physics course - Physics for Life Sciences - to apply basic physics to energy use. The obvious topics include: ideal efficiency in heat engines and heat pumps, storage of energy in reservoirs and flywheels, the new technologies of solar, wind and OTEC, and heat conduction losses in buildings. Beyond inclusion of these topics, an entire lecture is devoted to the use of thermography with

application to detecting energy leaks in buildings. Also during the last two years we have introduced a laboratory experiment where teams of students measure infiltration rates of buildings on campus using a sulfurhexafluoride tracer gas technique and a gas chromatograph. This experiment generates a great deal of enthusiasm, but requires a bit more refinement. The students are genuinely enthusiastic about these experiences.

#### INTERMEDIATE LEVEL ENERGY COURSES/SENIOR RESEARCH

Student interest in the intermediate energy courses, Energy Management, Energy Planning, Energy Physics, and Alternate Energy Technologies, is based on several factors. Those pursuing a certificate are required to select three of these four courses as part of the requirement. Some students see these courses as alternatives to "straight" physics courses for certain types of teacher certification, and others see an association between energy background and job prospects. Still others use these courses as alternatives to fulfill a general education requirement. There is no predominant major represented in these classes which include students from biology, business studies, chemistry, economics, environmental studies, geology, marine sciences, mathematics, philosophy, physics, and psychology.

I have been teaching the Energy Management and Energy Planning classes in both a lecture and seminar format. I lecture on topics related to energy conservation in the former course, and energy plans and ordinances in the latter for the first half of the semester in each course. During the second half of the term each student is required to give two oral presentations to the class and also write two research papers based on two research projects performed individually or in a group. I have a library of papers written in earlier classes which becomes an additional resource. Thus students build on others' research. This is particularly valuable when the topic of study is related to Stockton's physical plant.

Students do not always choose projects requiring infrared thermography or tracer gas techniques, and in fact, I taught the Energy Management course with none of this advanced equipment in 1983-4. Topics of study in the Energy Management class are typically centered on the buildings on campus, but I also encourage students to study their own apartments and homes. Finally students also study buildings of interest to municipalities near Stockton. Examples of projects include a study of the use of lighting, a study of the effectiveness of vestibule retrofits on doorways, and infiltration rate in academic buildings; a determination of conduction and infiltration loss mechanisms in a home for retarded citizens; a measurement of heat loss mechanisms in Victorian homes in an historic district; a determination of the potential of solar DHW for a new dormitory; a measurement of hot water use in showers in student housing; determination of indoor air quality in several off-campus houses; and a survey of energy conservation attitudes of students living in off-campus housing compared with those on-campus. The list continues. There have been some practical outcomes of these studies which have served as a strong motivating force for the students. Three examples are: A retrofit plan of lighting renovations for the academic buildings has been designed and grant money applied for; a retrofit plan to reduce infiltration in Victorian houses

in Bridgeton, NJ (without destroying their historic nature) is now underway; and a consideration of clustering of common-use space on campus (so that heating/cooling can be shutdown in parts of the campus during vacation times) is being implemented.

Likewise the students in the Energy Planning course are encouraged to develop plans for a real community. By necessity these plans are small scale, narrow in scope, and less likely to influence the communities than the ones in the Energy Management class. However, the results have also been interesting with studies of curbside recycling, and community education programs. Other studies include: critiques of several local energy ordinances and county transportation plans; a proposal for vanpooling; an analysis of resource recovery plans; and several proposals for energy retrofits of Stockton buildings (based on the research done by students in the Energy Management class).

#### GENERAL EDUCATION

Stockton has a general education requirement which requires students choose from a distribution of courses from groupings of courses specially intended for nonmajors. Over the last five years several courses have been taught in this general studies category including: Energy Conservation Strategies, Alternative Energies, Nuclear Power, International Energy Politics, Energy (An Intergration and Synthesis course for Jr/Sr), Solar Energy, and Energy Physics. These courses can be used as an energy elective course in partial fulfillment of the certificate requirements. The beauty of these courses is that non-science majors can be "turned-on" to applied science from the obvious application to their lives. This then becomes a lever to teach science and the scientific method. The spinoff benefit is that students who are nontechnical become (at least partially) technically literate in the field of energy studies.

#### CONCLUSION

Energy studies (including the Energy Studies Certificate program) at Stockton remains vital even with the decline of worldwide oil prices. Students continue to view energy as an interesting and relevant topic. Those students interested in careers related to energy continue to believe that it will again become a hot topic in the near future. Stockton has been responding to this interest in three ways. First, the introductory physics course for life science students has numerous energy applications as part of the lecture component and has integrated the equipment used in building studies both in the lecture and laboratory. Second, an Energy Studies program culminating in a certificate at graduation has focused demand on several project-oriented intermediate-level energy courses. And third, several general education courses for non-science majors use energy as a topic to develop an understanding of the scientific method. Although several of the aspects of the program are specific to Stockton, there are several experiences that could be transplanted at other institutions. Thus, developing similar courses at other arts and sciences colleges should be possible and would likely result in a healthy student demand.