

EES Report

ENGINEERING EXPERIMENT STATION • GEORGIA TECH

EES selected as major solar energy center

The federal government is consolidating many of its energy research programs and EES has been selected to operate a major R&D center in solar thermal energy on the Georgia Tech campus. The Department of Energy has awarded the Station's Energy and Materials Sciences Laboratory an initial contract for \$504,000 to start the Solar Thermal Advanced Research Center. EES has proposed a five year research program in advanced research in efficient conversion of solar energy, through high temperature processes, into storable chemicals and fuels, electrical power and industrial process heat. DOE has not committed funding to the center beyond the first year, but if its contract with the Station is fulfilled to its maximum extent, it would be the largest ever received at EES.

Solar thermal energy systems collect the heat from the sun and convert it into useful forms of energy. Examples are roof-top collectors or fields of parabolic mirrors which reflect and concentrate solar rays on a central focusing point. The new center will enable EES to expand its current experimental research program in solar thermal energy into new areas, using the 325-kW Advanced Components Test Facility on the Tech campus.

Advanced, high temperature solar systems will be emphasized which:

- Develop materials with greater resistance to high temperatures;
- Produce synthetic fuels and chemicals; and
- Provide viable sources of industrial electricity and high temperature

In the past, DOE has funded solar thermal R&D work on a project by project basis.



SUNLIGHT ILLUMINATES the focal point in the tower of the Department of Energy's 325 kW Advanced Components Test Facility at Georgia Tech. EES engineers will be using this receiver extensively in the operation of a major new solar energy R&D center at the Station.

Raytheon acquires marketing rights for Station energy control system

One of the nation's largest electronics manufacturers has acquired exclusive marketing rights to Georgia Tech's Facilities Management System, an innovative computer network which substantially lowers energy consumption in buildings under its control. Raytheon Service Company and Georgia Tech Research Institute announced an agreement recently which also covers modifications and improvements to the systems.

Georgia Tech's Physical Plant developed the system in collaboration with EES computer applications specialists and tested it in a group of Station buildings on the Tech campus. The result of the project has been a reduction in electrical energy consumption of approximately 35 percent. Another feature of the computer system has allowed fire and security

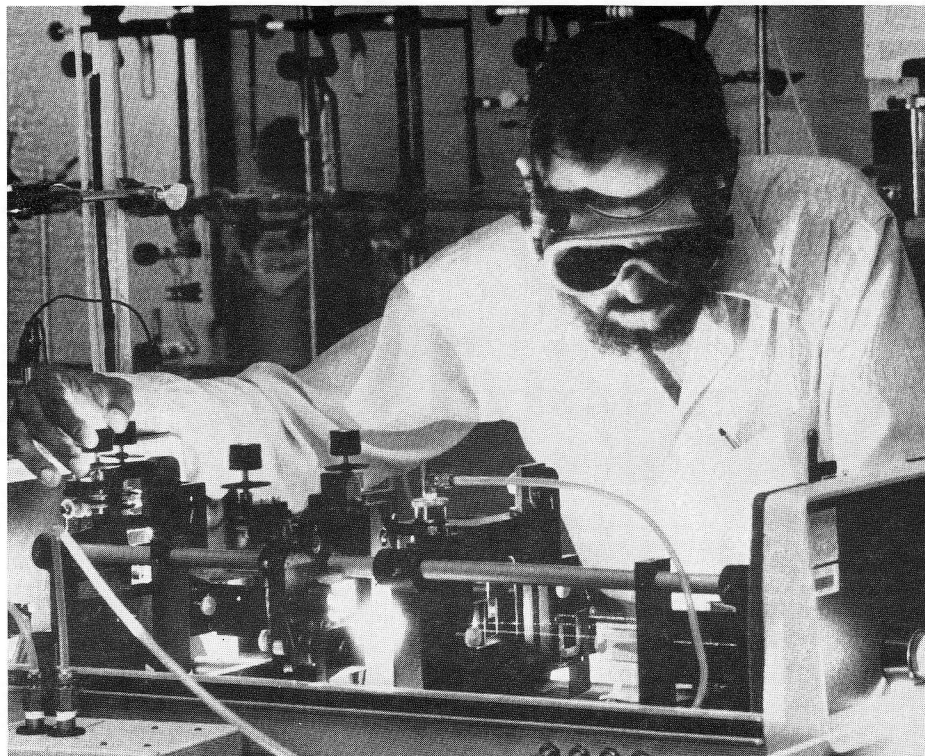
alarms in these buildings to be connected to the campus police station.

The computer system consists of a central minicomputer which serves a record keeping function. This "mother" computer displays the performance of each individual building, which is independently controlled by its own microprocessor. The advantages of the system are that it is a relatively low cost installation, provides a high degree of reliability and is easy to operate and maintain.

Under terms of the agreement with Georgia Tech, Raytheon and EES will work together to modify and improve the system so it will meet the specifications of the Army, Navy and Air Force for their energy management and control systems. Raytheon Service Company is headquartered in Burlington, Massachusetts.

January, 1982

STATION RESEARCHERS use laser technology to gather basic data on the complex chemical reactions governing the earth's stratosphere. This research is expected to be useful in helping scientists to assess the effects of manmade fluorocarbons on the stratospheric ozone layer. Ozone screens out harmful solar ultraviolet rays, and some researchers contend that fluorocarbons are depleting the ozone layer.



EES assists in ozone depletion research

Since the mid-Sixties, scientists have worked to understand the effects of aerosol sprays and other fluorocarbons on ozone, the layer of gases in the stratosphere which protects humans from overexposure to dangerous ultraviolet radiation. Some researchers believe that these fluorocarbons are removing ozone from the upper atmosphere at an alarming rate. As this theory goes, fluorocarbons are released into the air and rise slowly into the stratosphere, where sunlight converts them into highly reactive chlorine atoms. These chlorine atoms react easily with ozone (a compound comprised of three atoms of oxygen) to form other compounds which lead in turn to further ozone removal. The result, in theory, is a steady depletion of the amount of ozone available to absorb ultraviolet light.

Studies to validate this hypothesis have been handicapped by major gaps in current knowledge of stratospheric chemistry. It is difficult to overstate the complexity of the upper atmosphere's makeup. Researchers aren't even certain how much ozone the atmosphere contains from moment to moment, since these compounds are created and destroyed constantly by sunlight

and other natural forces. For this reason, researchers have had trouble distinguishing natural fluctuations from abnormal changes.

In this context, EES' work in atmospheric chemistry is highly significant. The Station's Molecular Sciences Branch is using sophisticated laser techniques to measure the rates at which a variety of gases react with each other in the stratosphere. One good example of the importance of this work was a recent study of the interaction between hydroxyl radicals and nitric acid. The reaction rates of these compounds are important to know in any study of the effect of fluorocarbons on ozone. Station researchers found that currently accepted measurements of the rate of reactions between these two compounds were inaccurate. Using the previous data, a group of scientists had devised a formula projecting a 14 percent depletion of the ozone layer by fluorocarbons between 1976 and the year 2000. Taking into account the EES-calculated reaction rate for hydroxyl radicals and nitric acid, the formula would have forecast only a nine percent reduction in the ozone layer by the turn of the century, according to Drs. A.R. Ravishankara and

P.H. Wine of EES' Molecular Sciences Branch. These scientists add that this level of depletion is closer to normal ozone fluctuations and therefore makes direct checks on ozone removal rates much more difficult.

Continuation of such studies is important, because the public debate over fluorocarbons and ozone involves decisions which are difficult to make without definite facts. Economically, fluorocarbons are growing tremendously in importance. Their inert nature makes them valuable to industry as degreasing agents, cleaners in the electrical industry, aerosol sprays and for food processing and refrigeration. On the other hand, firm evidence that fluorocarbons are destroying significant amounts of ozone would suggest a variety of environmental hazards: increased incidences of skin cancer, inhibited crop growth as well as harm to small organisms in the ocean which are important in the maintenance of the marine ecological balance.

"With interests as vital as these at stake," says Ravishankara, "researchers are going to have to do a lot more conclusive studies. Anything less than that will confuse this very critical issue."

Small minority firms helped by Station

Small, technology-based companies face major problems when they start to develop new products. Unlike major corporations, they do not have staffs qualified to undertake the technical aspects of the commercialization process. In addition, many are entering the manufacturing business for the first time and lack the experience necessary to market competitive products. These difficulties are particularly true of small, minority-owned enterprises, because their owners are typically newcomers to the world of industrial management. Often, they need assistance to get started on a solid foundation, and EES provides that help through its award-winning Technology Utilization and Commercialization Center (TUCC).

Georgia Tech's TUCC Center is sponsored by the U.S. Department of Commerce and serves two functions:

- It evaluates and oversees seven other federally-funded TUCC centers around the country; and
- It provides direct assistance to Southeastern inventors and entrepreneurs in getting new products to the marketplace.

The program has been in operation in EES' Economic Development Laboratory for four years under the direction of Ed Bethea. The Center has done its job so well that recently the National Business League awarded the Station one of its first four Berkeley G. Burrell Awards for minority enterprise development.

TUCC's principal role is to show inventors and entrepreneurs where help is for their specific needs. The Center coordinates technical assistance on the Georgia Tech campus and identifies sources of financing for entrepreneurs. The objective of the TUCC program is to stimulate and increase the capabilities of minority firms who want to expand and penetrate growth industries, particularly in the manufacturing sector.

TUCC provides free evaluations of new products and product ideas. If they are found promising for commercialization, the Center staff helps the inventor to formulate a commercialization plan which may include product development, field and

market testing as well as financial and manufacturing requirements. Several years may be required to obtain results. In the program's four years of operation, two product ideas have reached the commercialization stage. One is now being retailed; the other is ready for marketing in the next several months.

The product on the market today is called the Kibbie Capsule. Developed by a Louisiana businessman, this device detects and prevents oil leaks that sometimes develop from pinholes in the elbows, tees and joints of pipes of oil rigs. TUCC evaluated this invention, assisted with modification of the initial design, then helped the inventor to find financing. The Kibbie Capsule was installed on offshore oil rigs of Union and Mobil Oil companies. Mobil is one of 30 businesses, government agencies and universities which are represented on TUCC's Advisory Council, a group of leaders which takes an active interest in the program's clients. The recorded performance of the Kibbie Capsule greatly encouraged the involvement of Urban National Venture Corporation, another advisory council member

which invested \$150,000 in the product and extended a \$300,000 line of credit.

The other product near commercialization is an ornamental house plant guardian. This device uses a spring-loaded mechanism to hold hanging plants and to measure when they need to be watered. As water is poured into the plant's potting soil, the extra weight of the plant causes the spring to uncoil in a spiraling motion. When the moisture evaporates and the plant's weight lessens, the spring retracts in the same spiraling motion. This movement causes the plant to go through several 360 degree turns, a feature which exposes all of its leaves to sunlight.

Marketing for this device began last fall in the Atlanta area with nationwide marketing a possibility for this year. Sears Roebuck Co., also an advisory council member, is interested in retailing the plant guardian. TUCC's contribution to the product's commercialization began with design assistance. Suggestions by Tech engineers greatly reduced product costs for the plant manager's injection mold and made it much easier to assemble. TUCC staff members also helped with the development of the loan package which was recently approved by the Small Business Administration.

It is difficult to estimate how long the average commercialization period will be for most products which TUCC helps to develop, because this kind of program has never been tried before and there are no landmarks to guide it. Nevertheless, Bethea predicts that it will probably take a typical business around three or four years to go through the entire development and commercialization phases, but the accuracy of this projection depends on many factors. Once the program's approach has been refined, Bethea believes it will be usable on a broad scale.

The Reagan Administration apparently values TUCC's work. Despite substantial cuts in government spending for the current fiscal year, TUCC funding from the Department of Commerce has increased.

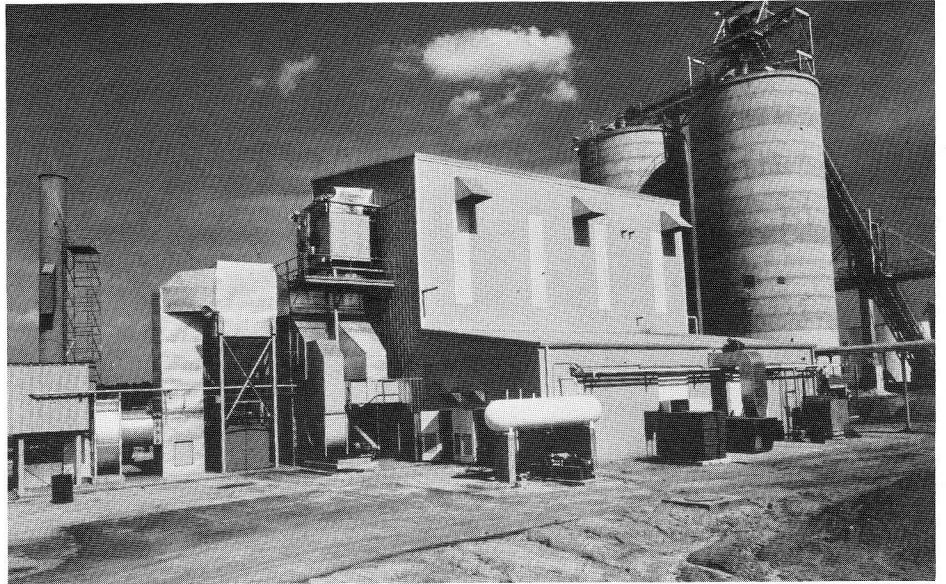


EES IS helping small minority companies and inventors who are trying to commercialize new products. This "plant guardian" is one prominent invention promoted through this program.

Innovative wood energy system featured on NBC

An EES demonstration of an innovative wood energy system recently received national exposure on NBC News. Network reporters filmed a program at a soy plant in Valdosta, Georgia, where Station engineers have helped Gold Kist Inc. install a wood-fueled boiler which can produce heat from wood waste, peanut hulls and pecan shells. The Department of Energy sponsored the demonstration to show non-forest products industries in the Southeast that wood is an economically feasible source of heat for some manufacturing processes. EES managed the project for DOE and selected Gold Kist's Valdosta plant as the demonstration site because of its good potential for energy savings, the technical competence of its engineering staff, the stability of Gold Kist and the easy availability and comparatively low cost of wood fuel in the Valdosta area.

Construction of the plant's boiler began in October 1980 and the system went into operation in May 1981, supplying steam for all plant requirements. Wellons Company of Sherwood, Oregon, designed and built the boiler with a unique firebox, consisting of three separate "cell" burners. The shape of each cell is cylindrical and the design allows for underfeed and tangential air supply. The cell circulates a turbulent mix of air and fuel which promotes complete



THIS SOY plant owned by Gold Kist Inc. in Valdosta, Georgia, was the site of a wood energy demonstration project sponsored by the Department of Energy. EES engineers assisted Gold Kist in installing an innovative wood-fueled boiler.

combustion of the fuel. The hot gases release the unburned and heavier particulates to the dropout chamber. At the same time, downstream collector devices remove the finer ash particles. Combustion temperatures in the cell range from 2000 degrees F. to 2500 degrees F.

EES conducted a study of wood residue supplies within a 50 mile radius of Valdosta and found that prices ranged from \$6 to 14 per ton — or 75 cents to \$1.75 per million Btu's delivered to the plant. In contrast, the company paid in excess of \$4 million per Btu for natural gas before converting to wood energy. The system's first year of operation will end in May 1982 and Station engineers estimate that the soy plant's boiler fuel bill will drop

from \$2.4 million annually to approximately \$1 million. Approximating the capital and operating costs of the new system at \$700,000 a year, the net energy savings should total around \$740,000 a year — or roughly 31 percent. EES projects that the system will have a simple payback period of 5.8 years and a discounted payback period of 3.9 years.

EES believes the Valdosta demonstration will establish a base of knowledge for other industries attempting to exploit biomass energy economically. The project will provide a system of methodologies which companies throughout the country can use as a model. Further information on this project is available from David Harris at the Station's Technology Applications Laboratory.

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