

# EES Report

ENGINEERING EXPERIMENT STATION • GEORGIA TECH

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the Nation*

## Tech-Designed Combustion Device Produces Clean, Cheaper Energy

A combustion device that can produce clean energy from wood two and a half times cheaper than with fuel oil is being built by the Engineering Experiment Station.

It is part of Georgia Tech's effort to help the Department of Energy find alternate energy sources for U.S. industry.

A new design on an old idea, the device is called a gasifier. It is the first to be built at Tech, and it is one of the few in existence in the country, says its designer, Tom McGowan, of the EES Energy Research Laboratory.

The gasifier, which is well under construction, is a 10-foot tall cylindrical metal vessel in which wood or other forms of biomass are burned with very little air. The end product is a gas that can be used as a fuel for industrial boilers or for direct heating and drying applications. The ash by-product can be used as a soil conditioner and fertilizer.

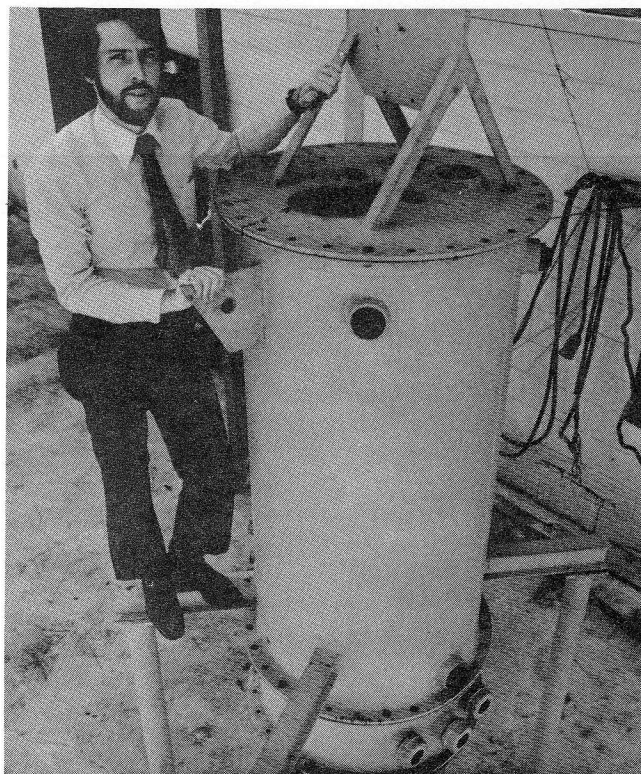
McGowan says that gasifiers have been around since the early 1800's but have been plagued with problems that have made them previously undesirable for industry. The main problems have been with impurities in the gas, such as tars and acids, which tend to condense in pipes and burners. Other problems have been with ash melting and plugging the grates with a substance called slag, and with the grates overheating and burning out.

The Tech-designed gasifier eliminates some of these problems, says the engineer. For instance, putting the gasifier's burner very close to the unit avoids condensation of tars and acids, and a tubular, air-cooled grate avoids ash slagging and grate burnout.

The economical nature of the gasifier, however, is its main attraction. "This gasifier will be able to produce around half a million Btu's per hour from wood at a cost two and a half times cheaper than with fuel oil," says McGowan.

These figures are based on using three and a half gallons of number two fuel oil per hour versus 80 pounds of wood per hour.

McGowan sees excellent prospects for industry retrofitting present coal or oil boilers with wood



*Tom McGowan of the EES Energy Research Laboratory stands on Georgia Tech's gasifier, a combustion device that can produce clean, cheaper fuel with wood.*

gasifiers as the technology becomes available to users and to suppliers of retrofitting equipment.

The advantages are that retrofitting is cheaper than buying a new wood-fired boiler, and the gasifier can be located away from the boiler. That second advantage is important for industrial operations which do not have room adjacent to the boiler to install a gasifier, and for industries which don't want to disrupt existing plant layout.

In addition to the gasifier, Georgia Tech has recently begun a number of research projects regarding the use of wood for energy. As part of this research they have found that the state of Georgia produces woody biomass at a rate greater than any other state.

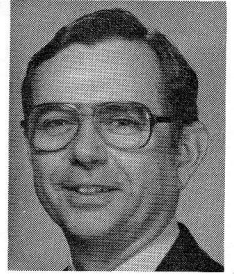
McGowan says that the waste from forest operations alone could provide the primary source of the wood needed for industrial purposes.



*EES researchers are making an air survey of the Savannah River Nuclear Plant near Augusta, Ga., to determine where to locate sensor systems to detect and track air traffic approaching sensitive areas of the plant. The project, "Airborn Intrusion Detection System Design," is sponsored by Sandia Laboratories, the Department of Energy and the Savannah River Plant. Pictured R to L are: Newt Seebeck, DOE director, Safeguards and Security, Savannah River Plant; Ken Carmichael, pilot from Dooley Aviation; Eugene Grenaker, project director, EES Radar Instrumentation Lab; and Roger Johnson, associate project director, also Radar Instrumentation Lab.*

## Millimeter Wave Research Increased at Ga. Tech

Research at EES is increasingly involved with various applications of millimeter and sub-millimeter wavelengths, a field that has grown extensively during the '70's. Millimeter and submillimeter waves are higher in frequency than microwaves and lower in frequency than infrared waves. They are particularly useful for sensors capable of operating in adverse environments—smoke, dust, fog, and rain—or for making remote measurements.



During the past two to three years, EES has received some 45 contracts totaling several million dollars, covering activities in passive remote sensing, radar measurements, guidance systems, component and techniques development, and other areas relating to millimeter wave technology. These programs draw upon the resources of several laboratories within EES.

The general growth of applications of millimeter wave technology is attributable to two major factors—recent technical advances and new requirements for special systems. The technical advances in the field include better signal sources, such as all solid state devices of small size; new high-power tubes, such as "gyrotrons"; and more sensitive detectors and receivers.

These growth factors have also spawned the additional activity of obtaining information about environmental effects on millimeter wave systems. This includes absorption and reflection of millimeter waves due to rain, fog, snow, smoke and dust, as well as the reflectivity of the terrain, the sea, vehicles, buildings and other objects.

In general, millimeter waves do very well at penetrating fog, smoke, haze and dust, and are superior in this respect to optical systems that are used for such things as missile homing or target identification. Several of the EES contracts have been involved with measuring how smoke and dust attenuate and reflect millimeter waves.

An example of a system application being developed by the EES Electromagnetics Laboratory is a two-frequency radiometer which has been used as a passive atmospheric sensor in NASA aircraft. Sensitive wideband receivers (radiometers) centered at frequencies near 94 and 183 GHz have been flight tested.

At 183 GHz, which is the frequency of an atmospheric water vapor transition, the radiometer provides atmospheric temperature data related to water content. A 93 GHz channel obtains surface or lower atmosphere temperature information, serving as a reference. This dual-channel system is now installed in an RB-57 aircraft.

—Dr. James Wiltse  
Associate Director  
Electronics Laboratories

## Passafiume Awarded Legion of Merit

John Passafiume, associate director of the EES Computer Science and Technology Laboratory, received the Legion of Merit Award this summer upon his retirement as a full Colonel from the U.S. Army. This is the second Legion of Merit Award for Passafiume.

Passafiume received the award for his meritorious service while assigned to the U.S. Army Electronics Command and the Communications and Research and Development Command from August 1977 to June 1979. He was cited specifically for his pioneering efforts in software support planning and for establishing the first initiatives to integrate two of the army's electronic warfare programs.

His skill in managing the planning, budgeting and procurement efforts of a \$200 million research, development and acquisition program for satellite communication systems and equipment was also mentioned.

Passafiume graduated from the United States Military Academy in 1955 and served in several assignments before returning to the Academy as an instructor. He received his Master's in Electrical Engineering from Purdue University.

He has served as Chief of Plans and Projects Branch of the Communications-Electronics Division in the NATO Central Europe Command Headquarters; as Deputy Assistant Chief of Staff, Communications-Electronics, also in NATO; as Deputy Director of Electronics Warfare Laboratory; and as Director of the U.S. Army Center for Tactical Computer Systems.



President Jimmy Carter, White House Science Advisor Dr. Frank Press (center), and Georgia Tech President Dr. Joseph Pettit listen attentively as Dr. Thomas Stelson, Tech vice president for research, speaks on energy from biomass.



## President Carter Attends Energy Briefing at Tech

President Jimmy Carter was on the Tech campus August 30 to attend a briefing on how American science and technology can alleviate energy problems.

The object of the briefing, which was requested by Carter, was to give the president the opportunity to hear from ten top experts on what is happening in different areas of new energy technologies.

Dr. Frank Press, science advisor to the White House, said the briefing was a report on what the dividends of industry and university research and development investments are likely to be.

Tech's Vice President for Research, Dr. Thomas Stelson, was among the featured speakers and briefed Carter on Tech's role in biomass research. In his talk, Stelson said that biomass is renewable and is small-scale in its opportunities. He also said it can be very labor-intensive and can contribute more than any other energy area, except possibly conservation, to job opportunities and employment.

Stelson told the president that the best near-term possibility for biomass is forest residue. He said that agricultural residues, particularly damaged or spoiled material, are also very good possibilities.

The Engineering Experiment Station is currently involved in several projects for promoting the use of wood wastes for use as an alternate energy source. It is also investigating the production of alcohol from agricultural residues. And this past summer the Biomass Research Facility, one of the largest facilities in the country for the study of biomass for energy, was dedicated on the Tech campus.

At the conclusion of Stelson's address, President Carter asked him what he thought the holdup was in getting more people to use wood. Stelson answered that people want to be certain that they can get an adequate supply of wood, and they also want to be assured that the technology for better wood burning equipment is going to be there.

In his remarks following the presentations, Carter said that he thought all of the areas pre-

sented were "exciting and extremely interesting possibilities for solving energy problems." He also said that the best and cheapest way to meet the country's goals of reduced dependence on imported oil is through conservation. The president did not feel that this area has been adequately explored.

## Industrial Safety and Health Consultation Service Commended

Georgia Tech's On-Site Safety and Health Consultation Service received a commendation of outstanding achievement in a semi-annual review by the regional administrator of the U.S. Department of Labor's Occupational Safety and Health Administration in Atlanta.

In a letter to Dr. Donald Grace, director of EES, R. A. Wendell said that he made no recommendation for changes in the program because there were no program deficiencies found by monitors.

Wendell also congratulated the program staff for "an excellent accomplishment both in the initial implementation of the . . . On-Site Consultation Program and in the outstanding delivery of professional safety and health services to Georgia business and industry."

The Georgia Tech On-Site Safety and Health Consultation Service is designed to give qualified firms which desire assistance an understanding of applicable federal occupational safety and health regulations. Assistance is also available for identifying and eliminating or controlling safety and health hazards in the workplace. This service is independent of any governmental safety and health compliance and enforcement activity and is strictly confidential.

The service is sponsored jointly by the federal government and by Georgia Tech. It is administered through the Economic Development Laboratory of EES.

## Tech Opens Office In Philippines

Dr. Gerald Hein, head of the Engineering Extension Laboratory, announced that as of Sept. 17 Georgia Tech has an office located at the University of the Philippines in Manila.

Hein says that this move makes it easier for Tech to supervise the programs it conducts in a number of Asian countries. The move also anticipates Tech doing much more work in Asia.

Tech is now involved in more than a million dollars worth of research work in Asian countries. This includes a pyrolysis project in the Philippines where rice hulls are used to produce gas and charcoal, various pump projects in Indonesia and the Philippines that involve the manufacture and installation of low-cost, manually operated water pumps, and an industrial extension project in Korea.

Most of the funding for these projects comes from the U.S. Agency for International Development, the United Nations Industrial Development Organization and the Korea Credit Guarantee Fund.

Georgia Tech has been participating in international programs since the early 1960's in South and Central America and Africa, and since 1973 in Asian countries. Programs are set up so that Tech professionals travel to foreign countries and foreign nationals come to Atlanta to visit the Tech campus for instruction. Assistance covers such things as applied research, economic development, education and training, industrial development, and technology transfer, particularly energy technology transfer.

Most of the work Tech does is based on a country's level of development. Countries in the Asian area range from well-developed ones like Australia and Hong Kong, to medium-developed ones like Taiwan and Korea, to those that are less developed like Indonesia and Sri Lanka.



*Ross Hammond of the EES International Programs Division will head the new Asia Office of Georgia Tech.*

Ross Hammond, who will head the Asia Office of Georgia Tech, says that most countries are interested in practical or appropriate technology. This is technology that is adapted to the needs and capabilities of individual countries and includes such things as adequate water pumps for drinking and irrigation and simplified applications of solar energy.

It will be Hammond's job to find out what the countries want and how Tech can help them. Although he will be the only Tech representative on a full-time basis in the islands, he will call for help from within the entire Tech community when it's needed.

The stateside job of coordinating Tech's efforts will be managed by Nelson Wall, chief of the International Programs Division of the Engineering Extension Laboratory.

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