Cooperative Development Energy Program

A Highly Successful Pre-collegiate and Collegiate STEM Workforce Program for Minorities and Women

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Abstract - As a result of a grant from the U. S. Department of Energy, Fort Valley State University (FVSU) started a technical STEM workforce development program for minorities and women in 1983. The program was named the Cooperative Developmental Energy Program (CDEP). CDEP is a multifaceted pre-collegiate/collegiate STEM program that consists of partnerships with corporations, federal and state agencies, six universities, and middle/high school counselors. Via collaboration with Georgia Institute of Technology, University of Oklahoma, University of Nevada-Las Vegas, Pennsylvania State University, University of Texas-Austin, and the University of Texas-Pan American, the program has graduated sixty one minority engineers, twenty geoscientists, and four health physicists since 1997. Fourteen of the graduates have earned MS degrees and three have earned the PhD. Approximately seventy students are currently enrolled in the dual degree collegiate part of the pipeline and one hundred and five are enrolled in the pre-collegiate part of the pipeline.

Keywords: pipeline, STEM, minorities, workforce, diversity

INTRODUCTION

Fort Valley State University was founded in 1895 and is one of 35 public institutions of the University System of Georgia with a student enrollment of approximately 3000 students. It is an 1890 Land Grant institution located in Central Georgia approximately 100 miles south of Atlanta, Georgia and 25 miles southwest of Macon, Georgia. FVSU is categorized as one of the Nation's Historically Black Colleges and Universities (HBCU). On July 1, 1983, FVSU received start-up funds from the Office of Minority Economic Impact (currently, the Office of Economic Impact and Diversity) of the U. S. Department of Energy to develop an energy workforce program that would increase the number of minorities and women pursuing careers in the private and governmental sectors of the energy industry. This innovative energy workforce program was named the Cooperative Developmental Energy Program (CDEP). CDEP developed in two phases. Phase I was the introductory phase for the program and functioned primarily as an internship program for academically-talented students at FVSU and Phase II of CDEP involved dual degree programs at FVSU and partnering universities.

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PHASE I: ENERGY INTERNSHIP PROGRAM

During Phase I, from 35 to 50 students participated annually in CDEP's Minority Student Summer Energy Internship Program (MSSEIP). Via MSSEIP, students were provided the option of having internships with governmental agencies or private sector energy companies. The following governmental agencies provided students with internships: Battelle Pacific Northwest Laboratory, Bonneville Power Administration, Bureau of Reclamation, Lawrence Livermore National Laboratory, Nevada Operations Office, Oakland Operations Office, Oak Ridge National Laboratory, and Pittsburgh Energy Technology Center. The private sector energy companies that provided students with internships consisted of Alabama Power Company, AMOCO, ARCO, Atlanta Gas Light Company, Cities Service Oil & Gas Corporation, Conoco, Electric Membership Corporations (Georgia), Georgia Power Company, Indiana-Michigan Power Company, Mobil, Nevada Power Company, Oglethorpe Power Corporation, and Phillips Petroleum Company.

Upon graduation several of the former interns were hired full-time at the following DOE facilities: Battelle Pacific Northwest Laboratory, Bonneville Power Administration, Jet Propulsion Laboratory, Lawrence Livermore National Laboratory, Nevada Operations Office, and Oakland Operations Office. In the private sector, CDEP graduates secured full-time employment with Alabama Power Company, Atlanta Gas Light Company, Cities Service Oil & Gas Corporation, Georgia Power Company, Indiana-Michigan Power Company, Nevada Power Company and Oglethorpe Power Corporation, to name a few. To participate in Phase I, FVSU students had to have accumulated 30 credit hours, a GPA of 3.0 or above, and majored in one of the following disciplines: Biology, Chemistry, Computer Science, Business, Mass Communications, or Mathematics. The track record of this program was impressive over a ten-year period. Minority students participated in approximately 450 internships, making it one of the largest specifically focused energy internship programs in the nation.

PHASE II: DUAL DEGREE PROGRAM IN ENGINEERING, GEOSCIENCES, AND HEALTH PHYSICS IN COLLABRATION WITH SELECTED UNIVERSITIES

As CDEP developed through Phase I during the 1980's, it became more and more apparent that FVSU needed a more energy-focused curriculum if CDEP was to ever reach its maximum effectiveness as a workforce development program for minorities and women in the energy industry. Research shows that there are certain academic disciplines that are germane for the production and managing of energy. Specifically, health physics is a discipline that is germane to the operations, monitoring, disposal of spent fissionable fuel, and clean-ups associated with nuclear power plants and other nuclear facilities. Geologists and geophysicists are needed for both fossil fuel exploration and environmental site restoration. Various fields of engineering including but not limited to civil engineering, environmental engineering, electrical engineering, mechanical engineering, nuclear engineering, and petroleum engineering are needed for all aspects of the energy industry ranging from exploration, production, processing, marketing, to environmental issues such as environmental assessment, environmental impact studies, and site remediation.

FVSU, like many other HBCU's, recognized in the 1980's that it was not practical or economically feasible to attempt to implement bachelor degree programs in engineering, geosciences, and health physics. Offering these disciplines as full degree programs would mean acquiring new buildings that are equipped with expensive labs along with highly paid faculty. This left FVSU-CDEP with only one option to attract minority students into the above disciplines and that was to implement these disciplines into the FVSU curriculum via dual degree programs

in collaboration with major universities.

In 1992, FVSU-CDEP and the College of Engineering of the University of Nevada-Las Vegas signed a cooperative agreement to offer 3+2 dual degree programs in mathematics/engineering, mathematics/health physics, and biology/health physics. Also, in 1992, FVSU-CDEP and the University of Oklahoma's (OU) College of Geosciences signed a cooperative agreement to offer dual degrees in chemistry/geology and mathematics/geophysics.

In 2000, FVSU-CDEP signed a Memorandum of Understanding (MOU) with Georgia Tech (GT) to offer 3+2 dual degrees in mathematics/engineering. FVSU-CDEP signed a cooperative agreement with the University of Texas-Austin (UTA) to offer dual degrees in mathematics/geophysics, chemistry/geology, and in mathematics/petroleum engineering in 2004. Also, in 2004, FVSU-CDEP signed a cooperative agreement with the University of Texas-Pan American (UTPA) to offer dual degrees in mathematics/engineering.

In 2005, FVSU-CDEP expanded its collaborative partnerships to include Penn State University (PSU) by signing a cooperative agreement to offer dual degrees in chemistry/geology, mathematics/geophysics, and mathematics/petroleum engineering.

All dual degree programs operate on a 3+2 format. Students begin the dual degree programs by matriculating at FVSU for the first three years and majoring in mathematics, biology, or chemistry. After attending FVSU for three years, students have the option of transferring to GT, UNLV, UTA, UTPA, OU, or PSU for years four and five to complete the requirements for their respective degrees in engineering, geosciences, or health physics. Upon the completion of the five-year dual degree program, students earn a BS degree in mathematics, biology, or chemistry from FVSU and a BS degree in engineering, geosciences, or health physics from one of CDEP's partnering universities.

Dual Degree Program Success

CDEP is a very successful STEM program for minorities and women. The five year dual degree STEM program was implemented in 1992 producing its first graduate in 1997. Since 1997, eighty-five students have graduated with a BS degree from one of CDEP's dual degree programs. The program graduated; 61 engineers, 20 geoscientists, and 4 health physicists. As of August 2007, three of CDEP's graduates have earned the PhDs and fourteen graduates have earned MS degrees. Currently, two CDEP graduates are enrolled in PhD programs.

To date, there are sixty-nine students enrolled in CDEP; forty are enrolled at FVSU, thirteen at GA Tech, six at UNLV, five at UT-Austin, and five at Penn State.

DIVERSITY PROGRAMS

CDEP has proven to be an effective diversity program for the energy industry. Over twenty-five percent of CDEP's dual degree graduates are working in the energy industry. Following is a list of energy companies that employ CDEP graduates: BP America, Chevron Texaco, Duke Power Company, Exxon Mobil Production Company, Georgia Power Company, Kerr McGee Oil and Gas Corporation, PSEG/Exelon Nuclear Company, Shell Oil Company, Southern Company, Southwest Gas Corporation, and Tennessee Valley Authority.

Many CDEP graduates have been employed by other high-tech employers outside of the energy industry such as Anteon Corporation, General Dynamics, General Motors, Intel, Inc., Northrop Grumman, Proctor and Gamble, Raytheon Corporation, and Sprint Nextel.

PARTNERSHIPS: UNIVERSITIES, INDUSTRY, GOVERMENTAL, MIDDLE SCHOOLS, AND HIGH SCHOOLS

During its twenty-five years of existence, FVSU-CDEP has formed over fifty partnerships with academic

institutions, industry, and federal and state agencies. CDEP defines a partnership as a cooperative agreement, a memorandum of understanding, internships, or financial support. University partnerships for dual degree STEM programs have been established with Georgia Tech, Pennsylvania State University, University of Oklahoma, University of Nevada-Las Vegas, University of Texas-Austin, and the University of Texas-Pan American.

CDEP has established a working relationship with high school counselors through a program called the National Educators Orientation Program (NEOP). Via NEOP, CDEP is able to recruit academically-talented students from across the nation. CDEP also works with middle school counselors to recruit students for its pre-college Mathematics, Science, and Engineering Academy

Since its inception, CDEP has formed partnerships with over thirty-five industries. Because many of the companies that CDEP formed partnerships with in the 1980s and 1990s have merged, it does not justify listing all former industry partners in this paper. However, the following is a current listing of industrial partnerships: AGL Resources (formerly Atlanta Gas Light Company), BP America, Conoco Phillips, Exxon Mobil, Georgia Power Company, Halliburton, Marathon Corporation, and Shell Oil Company.

Recent and current governmental partnerships consist of the Bureau of Reclamation, Environmental Protection Agency, Minerals Management Service, National Nuclear Security Administration, U. S. Department of Energy, and the U. S. Geological Survey.

All of the students enrolled in the dual degree programs are recruited with full academic scholarships. The funds used for scholarships are provided by industry and governmental agencies. Student internships are also provided by partnering companies and governmental agencies.

PRE-COLLEGE STEM PROGRAM (9th THROUGH 12th)

There is an acute under-representation of minorities and women in the fields of mathematics, science, and engineering. In 1993, the Cooperative Developmental Energy Program began addressing this under-representation through its pre-college outreach program, called the Mathematics, Science, and Engineering Academy (MSEA). The goal of CDEP's MSEA program is to provide a continuous pipeline for minority and female students from 9th grade through undergraduate and graduate levels of study majoring in mathematics, sciences, or engineering.

The students selected to participate in MSEA are academically conscientious and considered the crème-of-the-crop in their respective schools. These students are recruited from across the nation and are academically prepared to take on the challenging classroom and laboratory sessions taught by the staff of professors. MSEA is a learning experience that goes beyond what the students are taught at their middle schools and high schools. The professors expose the students to advanced mathematical concepts, hands-on laboratory experiments, and mentoring. Since 1993, CDEP has gathered demographic data on the students that have participated in MSEA in regards to gender, ethnicity, percent attrition and graduation, the percent that attended college, and the percent that majored in science and engineering.

MSEA consists of four different academies made up of four classifications, 9th, 10th, 11th, and 12th grade students. Sponsoring federal agencies, corporations, and partnering universities all participate in the MSEA program. The activities of each MSEA academy are described in the following paragraphs of this section.

The 9th grade academy is co-hosted by Fort Valley State University, Pennsylvania State University, Georgia Tech, and the U. S. Geological Survey (USGS). It is held the last two weeks in July and runs concurrently with the 12th grade academy. The two week academy exposes the students to instruction in mathematics, engineering and geology. In mathematics, the students study algebra and geometry; in engineering, each student works on a project that teaches him or her about the principles of electrical circuitry; and in the geology class, the students focus on the geological formation of Stone Mountain (Atlanta, GA) and study the geologic features of this massive granite rock. Additionally, the students go on a five-day geologic field trip to the Washington, D.C./Reston, VA area and Penn State University. They explore Harpers Ferry National Historic Park, Great Falls Park, and tour the U. S.

Geological Survey's headquarters where they hear speakers from National Aeronautical Space Administration, Environmental Protection Agency, the National Park Service, and USGS. Also, the 9th grade academy visit and tour the campus of Georgia Tech.

The 10th grade MSEA is hosted by the University of Nevada, Las Vegas (UNLV) and is held the second week of July. The students are introduced to one week of intense instruction in mathematics, geology, health physics, civil engineering, computer engineering, electrical engineering, environmental engineering, and mechanical engineering. The engineering exercises are taught by professors within the Howard Hughes College of Engineering at UNLV. In addition to classroom sessions, the students take fieldtrips to the Hoover Dam, the Grand Canyon, and the Yucca Mountain Science Center.

The 11th grade MSEA is hosted and sponsored by the Jackson School of Geosciences at the University of Texas-Austin and is held during the fourth week of June. This academy focuses on geology. The following topics are covered during the one week academy: The three rock families, Texas geology, plate tectonics, mapping, and petroleum engineering. The students take several field trips to see first hand the information covered in their classroom sessions. Field trips cover the Geology of the Llano Uplift, the Longhorn Cavern, Devil's Waterhole, and Enchanted Rock. The students also tour UT-Austin's campus, the State Capitol, the Jackson School of Geology, and the Petroleum Engineering Department.

The 12th grade MSEA is co-hosted by Fort Valley State University and partnering oil and gas companies in Houston Texas. The two week academy is held the last two weeks in July and runs concurrently with the 9th grade academy. The students engage in an intense one-week workshop on improving SAT scores with specific focus placed on improving mathematical and verbal skills. The SAT test is given to the students at the end of the first week period. To qualify for a CDEP scholarship, students must score a combine 1100 or above on the math and critical reading (verbal) sections.

During the second week of the 12th grade academy, Exxon Mobil, Shell, BP, Marathon, Chevron Texaco, and Halliburton sponsor a fieldtrip for the students to visit their facilities in Houston, TX. They are afforded the opportunity to visit various corporate offices and learn about the oil and gas industry. Students are exposed to the various career fields and job opportunities within the industry. One of the major highlights of the field trip to Houston is that the students of the 12th grade academy are greeted and hosted by CDEP graduates who are currently employed by the oil and gas companies that they are visiting.

MSEA Graduate Statistics (See Table 1): From 1993 through 2003, the MSEA program mentored a total of 373 students. Out of the 373 students, 187 of them completed the program for a 50% completion rate. During this eleven-year period of MSEA, 69 out of 157 males completed MSEA for a completion rate of 44%. Enrollment data show that 216 females began in MSEA and 118 completed the program for a 55% completion rate. Additional analysis of the data show that out of the 187 students who completed MSEA, 94 (50%) enrolled at FVSU. Further analysis show that 67 of the 94 students (71%) **enrolled in one of CDEP's dual degree** STEM programs in biology, chemistry engineering, health physics, geology, geophysics, or mathematics.

Students that enrolled in the MSEA program since 2004 are still in high school and are currently involved in the program. The total number of students mentored in MSEA from 1993 through 2007 is 510.

Table 1.Fort Valley State University Cooperative Developmental Energy Program/Mathematics, Science, & Engineering Academy (MSEA)

Profile of MSEA Graduates

MSEA Class	Initial Count Graduated MSEA	Enrolled FVSU	Dual Degree Geology	Dual Degree Engineering	Dual Degree Health Physics	FVSU Other Major	Graduated Dual Degree	Graduated FVSU Other Major	Attrition
1993*	36/13	9					3	4	2
1994*	40/14	5				2			3
1995*	43/25	16				1	5	2	8
1996*	49/31	10				4	2		4
1997*	33/24	9	1	1		3	1		3
1998*	39/18	5	2	1		1			1
1999*	38/15	16	3	4		4	1		4
2001**	29/15	7	1	2		3			1
2002**	36/18	5	2	1		1			1
2003**	30/14	12	2	3	5	2			
Total	373/187	94	11	12	5	21	12	6	27
Male	157/69	43	5	5	0	12	2	2	17
Female	216/118	51	6	7	5	9	10	4	10

***Denotes MSEA class that started with rising 8th grade students**

****Denotes MSEA class that started with rising 9th grade students**

From 1993 through 1999, the scholars involved in the program were selected as rising 8th graders and from 2001 through 2007, the participants were selected as rising 9th graders. Table 1 identifies the rising 8th grade classes by one asterisk and the rising 9th grade classes with two asterisks. CDEP did not host a freshman MSEA class in 2000 due to a lack of funding. Therefore, Table 1 will not have statistics listed for a class in the year 2000.

NATIONAL EDUCATORS ORIENTATION PROGRAM (NEOP):

In January 2006, CDEP invited 30 counselors from selected high schools in several states that have a significant minority student population to attend FVSU for one weekend to be oriented to FVSU and the CDEP dual degree programs. This event is called the National Educators Orientation Program or NEOP. The counselors returned to their respective campuses and served as ambassadors/recruiters for CDEP's dual degree programs. Contacts via NEOP counselors played an important part in CDEP being able to attract qualified students. As a result of the efforts of the 30 NEOP counselors, 6 students accepted CDEP scholarships and enrolled at FVSU as freshman during the 2006 Summer Semester and 2006 Fall Semester.

On the weekend of September 22-23, 2006, 45 counselors were invited to FVSU to attend a second NEOP Conference. The purpose of this conference was to identify qualified scholarship applicants for 2007. As a result of the NEOP Conference, 10 additional students were awarded scholarships (see Table 2)

Table 2. 2007 Scholars Recruited by MSEA & NEOP Counselors

No.	Name		Dual Degree	City
1	Armyia Bryant	MSEA	Biology/Health Physics	Vienna, GA
2	Cameron Crumsey	NEOP	Biology/Health Physics	Hephzibah, GA
3	Jonathan M. Davis	NEOP	Math or Chemistry/Geosciences	Atlanta, GA
4	Jessica Dawson	MSEA	Math/Petroleum Engineering	Columbus, GA
5	Johnne' Dawson	MSEA	Biology/Health Physics	Fort Valley, GA
6	Okema Gantt	NEOP	Chemistry/Geosciences	Rocky Mount, NC
7	Anthony L. Gardner, II	MSEA	Math/Geosciences	Anchorage, AK
8	Tiffany Harvey	NEOP	Math/Geosciences	College Park, GA
9	Monica Johnson	MSEA	Biology/Health Physics	Meansville, GA
10	LaKia McMillan	MSEA	Biology/Health Physics	Anchorage, AK
11	Jackie Monroe	NEOP	Math/Geosciences	Norcross, GA
12	Ashley V. Norris	NEOP	Math/Engineering	College Park, GA
13	Cayshia Piersaul	MSEA	Biology/Health Physics	Warner Robins, GA
14	Quartez R. Strickland	NEOP	Math/Engineering	LaGrange, GA
15	Dawit Tesfalem	NEOP	Math or Chemistry/Geosciences	Tucker, GA
16	Stephanie Troutman	MSEA	Math/Petroleum Engineering	Fort Valley, GA
17	Rickey Walker	NEOP	Math/Engineering	Atlanta, GA
18	Erica Wimberly	NEOP	Math/Geosciences	Jeffersonville, GA

ENERGY CAREER DAY CONFERENCE:

FVSU-CDEP operates an Annual Energy Career Day and Student Recruitment Conference to provide selected high school scholars an opportunity to interact with the FVSU faculty and staff, CDEP sponsors, partnering institutions, CDEP graduates, and current CDEP students. The conference is held the first week in March each year. In March of 2007, twenty-eight students were awarded scholarships in one of CDEP's dual degree programs and eighteen students accepted their scholarships.

The Annual Energy Career Day and Student Recruitment Conference serves as another important function for CDEP students who are enrolled at FVSU. Currently enrolled CDEP students are interviewed and recruited by representatives from sponsoring companies and governmental agencies for summer internships**.**

CONCLUSION

The Cooperative Developmental Energy Program is a multifaceted pre-collegiate/collegiate STEM workforce program that focuses on increasing women and minorities' participation in the energy industry. CDEP consists of multiple partnerships with corporations, governmental agencies, universities, and high school counselors.

CDEP has as a pre-collegiate component called the Mathematics, Science and Engineering Academy (MSEA) which starts in the ninth grade and continues through the twelfth grade. Sixty seven MSEA graduates have entered in one of CDEP's dual degree STEM programs.

Since 1997, CDEP and its six collaborating universities have graduated 61 engineers, 20 geoscientists, and 4 health physicists. Also, 14 of CDEP's graduates have earned M.S. degrees and 3 have earned the PhD. Approximately 70 students are currently enrolled in the dual degree programs and 105 students are participants in the pre-collegiate MSEA program.

BIOGRAPHICAL INFORMATION

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Isaac J. Crumbly is Vice President for Career and Collaborative Programs and Director/Founder of the Cooperative Developmental Energy Program at Fort Valley State University. He has a B.S. and M.S. in Horticulture from the University of Arkansas and the University of Illinois, and a PhD in Botany from North Dakota State University. He has held faculty research appointments with the Tennessee Valley Authority, Oak Ridge National Laboratory, and Lawrence Livermore National Laboratory. Dr. Crumbly developed and founded the Cooperative Developmental Energy Program in 1983. It is the only program of its kind. Address: Fort Valley State University, 1005 State University Drive, Fort Valley, Georgia 31030; telephone: 478-825-6243; fax: 478-825-6618; email: crumblyi@fvsu.edu.

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