

# AN INTERNATIONAL COLLABORATION IN EDUCATION, COMMUNITY DEVELOPMENT AND ENERGY TECHNOLOGIES

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**Abstract** ---- An international collaboration in educational reform, energy technologies and community and economic development exists between the Eastern Cape Technikon (ECT), Eastern Cape Providence, South Africa and Texas Southern University (TSU), Houston Texas, U.S.A. The overall objective of this program is to improve the livelihood of the disadvantaged inhabitants of the Eastern Cape Providence of South Africa and to establish long-term collaborative relations between students and faculty of ECT and TSU. The energy technology program assists in South Africa's Rural Electrification program by installing solar systems in rural communities implementing sustainable solutions to their infrastructure and developmental needs in conjunction with local technikons, universities, governments, and utilities. The community and economic development trains the community populace in electronic commerce (e-commerce) and Internet technologies.

**Index Terms** ---- Photovoltaic batteries, Renewable Energies, Solar power, South Africa, SMET, E-commerce

## INTRODUCTION

This paper describes programs between the Eastern Cape Technikon (ECT) of South Africa and Texas Southern University (TSU), Houston Texas on energy technology, economic and community development, and institutional enhancement and sustainability. The overall objective of these activities is to improve the livelihood of the disadvantaged peoples of the Eastern Cape Providence of South Africa and to establish long-term collaborative relations between students and faculties of ECT and TSU.

The program assists the Eastern Cape Technikons in curriculum reform in all areas, including science and engineering, and professional development of their faculties. Thermal solar and photovoltaic energy systems are installed in homes and rural community centers of the Eastern Cape. Training and education on installation and maintenance of these systems are provided on-site and through international exchanges of students and faculty that receive technical training at the TSU Photovoltaic Laboratory. The program introduces inhabitants of the rural communities of the Eastern Cape to e-commerce and establishes Internet websites for international sales of regional community products.

The program works with ECT to enhance the curriculum and research capacities in the science, mathematics,

engineering, and technology (SMET) areas. The academic area foci are electronic engineering, manufacturing engineering and product development. On-site workshops have been conducted to instruct ECT faculty and staff on grant proposal writing to enhance sponsored research and development on the campus. ECT faculties and staff received extended training on curriculum development including assessment and evaluation. International video teleconferencing will link SMET student organization leaders, such as in the National Society of Black Engineers (NSBE) and the TSU Solar Club, with ECT students to establish similar organizations at ECT.

Economic and community development for the Eastern Cape is accomplished through workshops (in-country and via video conference) on basic business development and entrepreneurial skills through assistance from the TSU School of Business faculty. Software development training is provided through the TSU Quality Software Developers Institute (QSDI). E-commerce and web site construction is provided such that Eastern Cape regional products can be marketed to the greater world market.

## INSTITUTIONS

Texas Southern University is located near the central core of the City of Houston in a low to middle socio-economic community. The university's student enrollment of nearly 8,500 is overwhelmingly African American, and the university is one of the Historically Black Colleges and Universities (HBCUs) in the United States. The university was established in 1947 and offers undergraduate and graduate degrees through 7 colleges and schools. These are the School of Business, College of Education, College of Continuing Education, College of Pharmacy and Health Science, College of Liberal Arts and Behavior Sciences, the Graduate School and the College of Science and Technology through which this program is administered. The College of Science and Technology offers undergraduate and graduate degrees through its 7 department: Biology, Chemistry, Computer Science and Physics, Engineering Technologies, Industrial Technologies, Mathematics, and Transportation Studies. Also housed in this college are the Renewable Energy and Photovoltaic Batteries Laboratory, and the Quality Software Developers Institute (QSDI) in which this program is associated.

The Eastern Cape Technikon is classified as a Historically Disadvantaged Institution (HDI). ECT is

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classified as such because it was established as a homeland institution of the University of Transkei under the pre-1994 government. The current Eastern Cape Technikon (ECT) operates as an autonomous South African institution of over 4,000 students. The Technikon was founded for the purpose of preparing students, particularly those from disadvantaged backgrounds, for careers in middle sector organizations in South Africa. To-date this remains the central purpose of the Technikon. The ECT has three faculties: Applied Science (Design and Technology, Food Services and Management, Commercial and Technical Education), Business Sciences (Accounting, Secretarial Studies, Management Studies, Law, Communication Languages), and Engineering (Civil, Construction Management and Surveying, Information Technology, Mechanical and Mathematics). The mission of ECT committed itself to: 1. Co-operate with commerce industry, the Government and the community in pursuing one of its goals, which is producing graduates with good work ethics and responsible leadership, 2. Provide teaching, research, development, and community services sensitive to current needs and trends. The Technikon has a main campus in Butterworth with satellite campuses in Umtata, Queenstown and East London in the Eastern Cape Providence of South Africa.

ECT has an institutional goal to build an infrastructure that will support continuous program improvement to raise the retention and graduation rate of its students and to increase their marketability in the South African economy. This paper describes several activities between Texas Southern University (TSU) located in Houston Texas, U.S.A. and the Eastern Cape Technikon (ECT) designed to achieve this goal. A grant from the United State Agency for International Development (USAID) and several other organizations sponsor this program.

### PROGRAMMATIC ACTIVITIES

The programmatic activities focus on the programs and outcomes of institutional capacity building, energy technology education, and economic and community development in operation between ECT and TSU.

#### Institutional Capacity Building Effort

Institutional capacity building efforts between TSU and ECT has been led by Professor Claudette M. Ligons, College of Education at Texas Southern University. Partners at ECT include Ms. Irene Harvey and a team of the faculty at the institution. A primary task in this activity was to assess the quality of the education programs at ECT in conjunction with enhancing the professional development of the faculty at ECT. Under the post-Apartheid government educational reforms were initiated to change educational goals from being “content driven” to being “outcomes driven”. Updating and improving the curriculums would be undertaken in concert with faculty professional

development. Dr. Ligons, et. al [1] introduced the “Critical Friends Groups” as a way of providing a sustainable dialogue on professional development with groups of faculty of several departments at ECT. “The Critical Friends Group is a way to spread the human capital across departments through loosely-structured peer coaches who can support the work of colleagues in teams” [1].

TABLE I  
THE OLD AND THE NEW CURRICULUM APPROACH IN SOUTH AFRICA. [2]

<b>The Old Curriculum</b>	<b>The New Curriculum</b>
Passive learning	Active learning
Examination driven	Learners assessed on an on-going basis
Role-learning	Critical thinking, reasoning, reflection and action
Content placed in rigid time-frames	Flexible time-frames, learners work at own pace
Emphasis on what the teacher hopes to achieve	Emphasis on outcomes – what the learner becomes
Syllabus seen rigid and non-negotiable	Learning programs seen as guides that allow for teacher innovation and creativity
Teachers responsible for learning; motivation depend on the personality of the teacher	Learners take responsibility for their learning; pupils motivated by feedback and affirmation.

TABLE II  
PAST INFORMAL WORKSHOPS SESSIONS PROVIDED AT ECT FACULTIES [2]

<b>Date</b>	<b>Workshop Activity and Location</b>
12/99	Competency and Outcomes-Based Instructional Strategies (3 days), ECT
2/00	Designing Websites to Improve Instruction (3 days), ECT
6/00	Development of Learner Guides (2 days), ECT
9/02	Outcomes-Based Educational Assessment (3-days), ECT
11/00	Outcomes-based Education – in preparation for the accreditation visit in the engineering departments (2 days), TSU
10/00	Graduate Course in Individualized Instruction (5 persons for 27 days), TSU

Initially, workshops at ECT “supported a core of the faculties at ECT in developing a knowledge base and related skills to make the shift from traditional teacher-centered classrooms to an out-come-based approach that is more learner-centered” [2]. Currently, Dr. Ligons and TSU colleagues via video-conferencing with the ECT Group conduct these workshops. The intent of this effort is two-folded. First, faculties at ECT would develop “the knowledge to make a philosophical shift from traditional teacher-centered to an innovative learner-centered approach” [2] in teaching. Secondly, the faculties are to “restructure their courses around a competency-based model” [2]. An

additional challenge to this effort occurs because many of the ECT faculty members transferred from the private sector; therefore, their needs for effective teaching strategies are extreme.

### Energy Technologies

The Photovoltaic Research (PV) and Demonstration Laboratory at TSU is a designated training site for college students participating in the National Renewable Energy Laboratory (NREL) PV Research Associate Program. This facility was developed by the late Dr. Joshua Hill and recently managed by Mr. Oral LaFleur. During the summer NREL PV Research Associates, other college students and high school students participate in the Renewable Energy and Environmental Protection (REEP) Academy. The REEP Academy is a comprehensive educational outreach program developed by the late Dr. Joshua Hill in 1995. REEP seeks to create a lasting interest in mathematics, science, engineering and technology among youth from low and moderate-income households, and transform that interest into the pursuit of higher education.

For many years selected students participating in the REEP Academy, along with TSU Staff and other professionals, have traveled to South Africa. The purpose of the trip is to assist with developmental projects and participate in South Africa's Rural Electrification program by installing solar systems in rural communities. Through education and cultural awareness, REEP South Africa works with villages and rural communities to determine areas in need of improvement, and when feasible, implements sustainable solutions to their infrastructure and developmental needs in conjunction with local technicians and universities, governments, and utilities. During the REEP Academy's visit to South Africa, students have participated in installations of PV systems in villages with no source of electricity. One installation was a 100-watt DC system designed to supply electricity to four 18-watt fluorescent lights. Students tested their knowledge gained in the REEP Academy classrooms at TSU by connecting the two 50-watt panels in series to supply a 24-volt system [3].

Introducing a new technology to South Africa and the world, students in the REEP Academy installed a battery free solar refrigerator, which was part of a research project sponsored by NASA. This system is a project that will allow personnel at Texas Southern Photovoltaic Research and Demonstration Laboratory to measure the usage and performance of a refrigerator that runs directly from power generated by solar panels without the use of photovoltaic batteries. Students were divided into groups to install the refrigerator. A group worked on building the wooden frame, while another group wired the solar panels in parallel for a 12-volt system for solar refrigerator. In addition, a group was responsible for setting up the refrigerator in the home and bolting the panels to the roof.



FIGURE. 1  
REEP STUDENTS INSTALLING 100-WATT DC SYSTEM IN SOUTH AFRICAN RURAL VILLAGE [3]



FIGURE. 2  
INSTALLING SOLAR PANELS ON THE ROOF OF HOME [3]



FIGURE. 3  
SETTING UP SOLAR REFRIGERATOR IN HOME [3]

A data logger is connected to the solar refrigerator that will collect data to be analyzed at the Laboratory in the TSU College of Science and Technology to determine if this type of technology will work for homes in remote areas around the world without electricity. Additional solar refrigerators are in similar feasibility studies in the United States and in Mexico. FIGURE 4 illustrates some performance data of a solar refrigerator installed in western Texas in the U.S.A. The solar refrigerator design and insulation materials are such that an inside cooling temperature (red line) is maintain during the evening and night hours without the compressor operating (blue line). The compressor only operates during the daytime when the temperature (yellow line) rises.

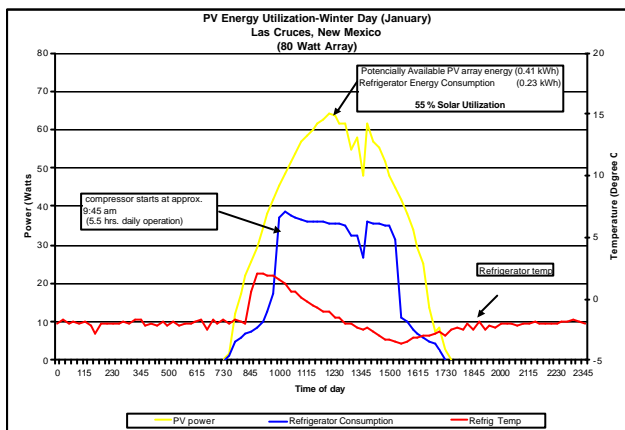


FIGURE 4  
SOLAR REFRIGERATOR PERFORMANCE DAILY DATA [4]

### Community Development

The community and economic development project between Eastern Cape Technikon and TSU is sponsored by the Academic Liaison Office (ALO) of the International Development Agency. Here under the direction of the TSU Quality Software Developers Institute (QSDI) persons in the fashion design trade in the Eastern Cape Providence will be trained in e-commerce, website development, and international sales of their goods and services. Local women's fashions will be the focused sales product. This project is directly aligned with the ALO mission and USAID objectives: "to meet critical needs in the development priorities of a rapidly transforming South Africa and in particular to the rural population of the Eastern Cape Province". This training, including modern technology via use of the World Wide Web (WWW), will enhance the results of the fashion and textiles training done prior and will empower participants with better knowledge of the computer and how using the WWW to sell their artisan goods could lead them into Entrepreneurship. This is one of the main goals of the project.

At both in-country (at the Eastern Cape Technikon of South Africa) and via video-conferencing (at TSU to ECT),

a series of workshops will be conducted to carry out this project. This schedule was developed by Ms. Jennifer R. Jolivet, an International Consultant on the Deans Staff of the College of Science and Technology and Mr. Felix Alexis a Consultant with QSDI.

A month-by-month outline of the training program between August 2002 and June 2003 is described below.

#### August, 2002 - In Country Workshop

1. Module 1 – Compare traditional store- front, mail order and e-commerce models to exhibit Internet advantages.
2. Module 2 – Computer/Internet Introductions:
  - 2.1 Basic Computer functions
  - 2.2 Web Overview
  - 2.3 Finding fashion items on the Web
  - 2.4 Ways to purchase items on the Web
3. Module 3 – Introduce Photography Technology:
  - 3.1 Using the digital camera.
  - 3.2 Scanning
  - 3.3 Sizing/Editing
  - 3.4 Uploading
4. Module 4 – Inventory Maintenance
  - 4.1 Add Items to Inventory (Images, Descriptions, Prices)
  - 4.2 Modify Items (Descriptions, prices)
  - 4.3 Delete Items
5. Module 5 – Business Operations
  - 5.1 Calculate Raw Cost, Mark up, Shipping, merchant account
  - 5.2 Tracking/Shipping Orders
  - 5.3 Returns

#### September, 2002 Follow Up /Distance Learning Seminar

1. Module – Introduce/Discuss Marketing strategies:
  - 1.1 Partner with Novelty Shops in the USA
  - 1.2 Partner with Churches/Community Based Organizations
  - 1.3 Introduce e-Commerce methods
  - 1.4 Address open Issues/Logistic Problems
  - 1.5 Show ways that vendor can add unique HTML store fronts
2. Prepare for seminar
3. Tweak Application as necessary
4. Help Recruit/Build Sales Network

#### October, 2002 Follow Up - Distance Learning Seminar Business Course I

1. Module – Discuss/Strengthen Marketing strategies:
  - 1.1 Partner with Novelty Shops in US Part II
  - 1.2 Partner with Churches/Community Based Organizations II
  - 1.3 Introduce e-Commerce methods II

- 1.4 Address open Issues/Logistic Problems II
- 1.5 Show ways that vendor can add multimedia to e-store fronts.
- 2. Prepare for seminar
- 3. Tweak Application as necessary
- 4. Continue to help recruit/Build Sales Network

**November, 2002** Follow Up - Distance Learning Seminar

- 1. Module – Strengthen Operations/Profits
  - 1.1 Introduce Customer Engaging Methods
  - 1.2 Introduce Permissive Marketing Techniques
  - 1.3 Address Ways to Manage Returns
- 2. Prepare for seminar
- 3. Tweak Application as necessary
- 4. Help Recruit/Build Sales Network

**January, 2003** Follow Up - Distance Learning Seminar  
Business Course II

- 1. Module – Audit Operations/Profits
  - 1.1 Continue to Introduce/strengthen Customer engaging Methods
  - 1.2 Continue to Introduce/strengthen Permissive Marketing Techniques
  - 1.3 Introduce What to Monitor In Web Traffic
- 2. Prepare for seminar
- 3. Tweak Application as necessary
- 4. Help Recruit/Build Sales Network

**February, 2003** In Country Workshop II

- 1. Module 1 – Audit Operations/Improve Profits
  - 1.1 Introduce Cookies Technology, ways to monitor visits
  - 1.2 Introduce Multimedia software Flash5/GoLive
  - 1.3 Introduce smart/permissive email campaigns
- 2. Module 2 – (Other Exchanges)
  - 2.1 Introduce ways to leverage Major Exchanged (eBay, MSN, Yahoo, Microsoft)
  - 2.2 Introduce Affiliate Programs
  - 2.3 Build/Market Multiple pages that drive Web Site
- 3. Preparation For Trip

**March – June, 2003** Follow Up - Distance Learning Seminar

- 1. Module – Audit Operations/Profits
- 2. Three Seminars As Necessary
- 3. Prepare for seminars
- 4. Tweak Application as necessary
- 5. Help Recruit/Build Sales Network

The expected outcomes of this training program are:

- South African workers in the clothing and artifact design (ARTISAN) trades and industries will benefit from developing basic business, marketing and entrepreneurial skills.
- These tradespersons will be empowered with new awareness of merchandising fashions and artifacts and profit potential by selling via WWW.
- These tradespersons will understand the advantages of deploying best business and logistical practices by use of the Internet.
- These tradespersons will be strengthen and encourage to look toward distance learning as a practical way of maintaining global awareness.
- These tradespersons will be empowered to become Entrepreneurs through sustainability.

**CONCLUSION**

This collaboration between Texas Southern University and the Eastern Cape Technikon has established an unbreakable international bond between the two institutions and its peoples. It has benefited the faculty, staff and students of TSU greatly because of the opportunity to travel abroad and experience different cultures. The hundreds of students who have participated in the REEP Academy have become aware of the advantages of renewable energies, and through participation in this program the students are more inclined to continue their studies in the sciences, mathematics, engineering and technology (SMET) fields.

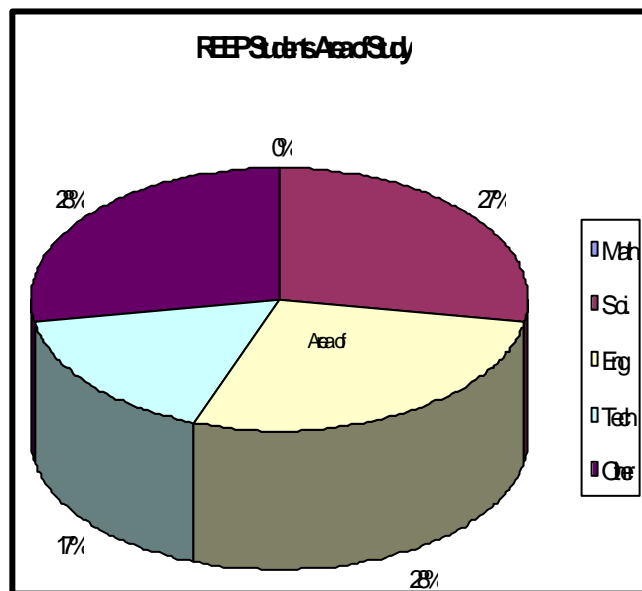


FIGURE. 5  
AREAS OF STUDY OF REEP STUDENTS [3]

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