

ENERGY INSTITUTE  
AT  
HISTORICAL  
BARBER-SCOTIA COLLEGE  
Concord, North Carolina



**Mable Parker McLean College Union**

## Energy Institute at Barber-Scotia College

The fate of the nation rises and falls with the state of its economy. The local, state and federal governments work cooperatively to ensure the fiduciary needs for the common good of the people are fulfilled. However, the responsibilities for providing services to constituents remain through good times and bad alike, along with associated cost.

In May of 2007, 522 Mayors, representing over 65 million Americans accepted a non-binding challenge, now known as the United States Mayors' Climate Protection Agreement, to reduce global pollution at the local level. By December 2007, 780 mayors from the 50 states, the District of Columbia and Puerto Rico, representing a population over 77 million citizens have joined the effort. The Mayors' activity is in response to what was declared to be a lack of action at the Federal level. New options promise land use alternatives that in many jurisdiction, particularly densely populated centers, would have high real values, post-clean-up. Such new options would aid local government in their long-term planning activities as well.

Topics on Climate Change, Energy Security and Global Warming have recently grabbed substantial headlines and media attention. The underlying implications of the headlines are far reaching and pervasive in nature. As these phrases and others have entered the lexicology of the general public, institutions of all types have been moved to responding. Subsequent reactions could be defined as opportunity but should be translated into the search for solutions to meet institutional and societal concerns, mandates and individual desires.

Multiple and new energy options influence environment degradation choices, as environment solution options are likely to presage energy system implementation and usage patterns. At the same time, energy demand is growing at unprecedented rates, making planning for future requirements an arduous endeavor that may lead to heightened risk analysis behavior among investors and other stakeholders. Implementation of new options requires adjustments to and/or changes in workforce preparedness strategies. This challenge is further exasperated by the current and future retirement schedule among "baby boomers" in energy and related industries.

Charlotte-based Duke Energy has expressed strong interest in leading in the development of the Energy Institute at Barber-Scotia College, Concord, NC. The Energy Institute with curricula and resources will provide immediate benefits to the concerns of the major energy industry, worker training and re-training and further provide leadership to the aggressive response to the energy challenge. Gas and Electric Energy providers, the Agriculture Industry and the Transportation Industry, among others, all face a new competitive energy environment.

### Brief Overview

In 2004, in response to the energy crisis, Enviro-Tech/M & M Technologies Inc. presented a proposal to Barber-Scotia College for it to participate in the envisioned structures of Public/Private Partnership to energy alternatives. At that time, a major focus was upon the viable culmination of the conversion of Peanut Shell-to-Hydrogen.

The Public/Private Partnership deployment model is centered on the issues and concerns of the National Association of Counties (NACo) and their Center for Sustainable Communities (CSC) relative to waste management responsibilities. A key component of the Enviro-Tech/M & M Technologies Inc. model is education and training in Science, Technology, Engineering and Mathematics–related areas, critical for the growth and development of the newly emerged Renewable Energy Industry. Crafted carefully and appropriately, Barber-Scotia’s inclusion in the deployment strategy would provide a needed platform to stabilize the College and offer broader growth opportunities through a targeted degree program related to Energy. Success at Barber-Scotia College could lead to inclusion of other Historically Black Colleges and Universities (HBCUS), and Tier I Research Intensive Minority-serving institutions, including North Carolina’s Elizabeth City State University and North Carolina Agricultural and Technical State University.

Enviro-Tech /M & M Technologies Inc. Founder and President Dennis McGee was recommended to the Barber-Scotia College Board of Trustees to serve as an advisor to President Carl Flamer’s Committee for Planning. The invitation was accepted in 2006. In May of 2008, representatives of the University of North Carolina at Charlotte (UNCC), Research Center expressed desire to support the partnership.

### Curricula Development Collaborative Participants

Barber-Scotia College  
Enviro-Tech /M & M Technologies Inc.  
University of North Carolina at Charlotte, Research Center  
University of California at Davis  
Georgia Institute of Technology  
National Renewable Energy Laboratory

### Objectives of the Collaborative Participants

1. To establish a Certificated Training Program in operations and maintenance (Operator in Training) for City/County facility personnel as keyed to the requirements of the Public/Private Partnership with NACo, and
2. To establish an appropriate interdisciplinary degree program in Energy Options, targeting entrepreneurship, engineering and research elements.

The Enviro-Tech /M & M Technologies Inc. plan includes a written agreement with NACo to deploy Biomass-to-Hydrogen (B2H2) Power Parks in a Bi-Coastal, North Carolina / California National Pilot structure. An integrated platform characterized as a “Renewable Energy Technology Suite” for cities and counties, targets two (2) North Carolina sites, Concord (small town environment) and Rich Square (rural environment), and three (3) California sites.

Sites: Los Angeles (large urban center), Fresno (agriculture environment) and Roseville (suburban environment). Collectively, the selected sites will serve as a “template” for other NACo constituencies which might mirror issues and concerns. End-use Deployment Feasibility Studies with a third party independent validation of results of the 4-6 month studies will be conducted in partnership with the Enviro-Tech /M & M Technologies Inc. team.

The current Study Team includes:

1. Matthew, NC based Enviro-Tech /M & M Technologies Inc. (Project Management);
2. National Renewable Energy Laboratory (Science, Technology and Engineering Advisor);
3. Montreal, Canada based Enerkem Technologies (Core Conversion Technology Developer)
4. City College of New York (Carbon Filtration Technology developer)
5. University of North Carolina at Charlotte (Continuous Emissions Monitoring Technology Developer);
6. Green Now Global of Atlanta, WRJ Operations
7. Georgia Institute of Technology (Economic and Logistics modeling);
8. Ventura, CA based Atmospheric Analysis and Consulting (Air Quality Laboratory);
9. Lakewood, CO based MicroChem Tech (Project Administration).

Under the formalization of the NACo partnership agreement, initial Training Sites will be established in Concord, NC (Southeast Region) and Los Angeles, CA (Western Region). Other regional training sites will be developed as results of the Bi-Coastal B2H2 National Pilot viable.

Tasks and Timeline\*

Feasibility Studies 4-6 Months	Funding completion targeted April/May 2009
Third Party Validation Study	September / October 2009
Power Park Design & Construction Outlook	November / December 2009 20-24 Month Schedule
Power Park Operation & Training Startup	Collateral w/Design & Construction Schedule

- Representatives from Enviro-Tech /M & M Technologies Inc.; Barber-Scotia College; UNCC Research Center; and the City of Concord agreed to begin feasibility study November 2008 with a targeted completion date April / May 2009.

Funding

Funding for the partnership activities are being developed by Enviro-Tech /M & M Technologies Inc., Eva Clayton Associates International Inc., the North Carolina Community Development Initiative and Private Investment in two (2) phases:

Phase 1 – The Feasibility Studies for Biomass-to-Hydrogen National Pilot Program at

- a. Concord, NC Site
- b. Rich Square, NC Site
- c. Los Angeles, CA Site
- d. Fresno, CA Site
- e. Roseville/Lincoln, CA Site

\$1.5 Million total for the North Carolina activities

\$500 Thousand total for the California activities

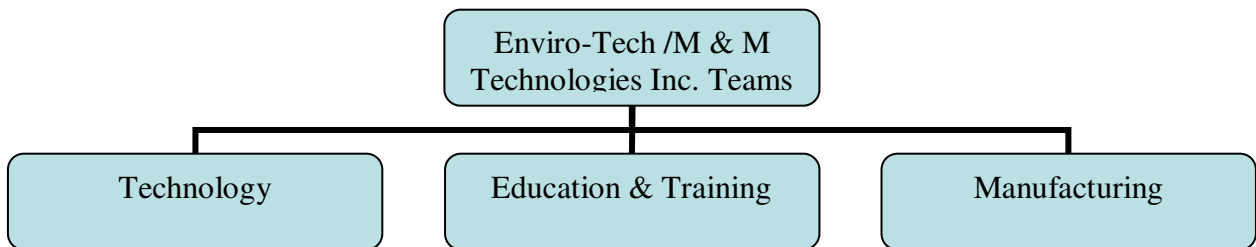
Phase 2 – Design/ Construction and Operations

- a. Private Activity Tax-Exempt Bond Financing
- b. Potential: Public Stock Offering

The NACo-based Public/Private Partnership for Cabarrus County will include Barber-Scotia College and the City of Concord, NC. The estimated capital investment is \$100 Million per county in North Carolina. Final share apportionment will be detailed through the end-use feasibility study(s) business plan and Third Party economic validation of the results.

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CENTER FOR SUSTAINABLE COMMUNITIES



## CITY AND COUNTY DEPLOYMENT SITES

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### Public/Private Partnership Strategy

Operation and management strategy is based upon establishing the partnerships with and through the National Association of Counties (NACo) and their Center for Sustainable Communities (CSC). The relationship allows for direct access to City and County sites, personnel and the feedstock resources required for constructing and operating Biomass-to-Hydrogen Power Park facilities. There are >31,000 Counties and County Equivalent administrative unites, and an estimated 87,000+ extant political entities in the Federal Administrative System.

Public Partner Role	Private Partner Role
Site Provision: 1. Wastewater Treatment Facilities 2. Material Recovery Facilities 3. Landfills	Technology Provision 1. Conversion 2. Energy Efficiency
Personnel	Education & Training College & University Connected
Permit Management	Capital Acquisition

### Vision

The Energy Institute at Barber-Scotia College offers students the exploration of the multiple areas of alternative energy and environmental responsibility through academic study and interdisciplinary research. Collaboration opportunities with local and state governmental agencies, private and public agencies provide students first-hand experience in the rapid growing energy industry markets. Expected outcomes of research collaborations will lead to improved human and environmental health through sustainable and environmentally friendly agricultural and industrial practices.

The transfer of academic knowledge and practical application will reduce environmental pollution, improve air and water quality, and promote clean renewable energy which will benefit the nation and the world.

### Specific objectives for Barber-Scotia Bio-Energy program

1. To provide sustainable technology-based solutions for the management of waste materials by cities and counties.
2. To provide trained labor force to increase productivity and efficiency of waste management tasks; leading to a direct and ancillary benefit for the public/private partners and the communities that they serve.

## Benefits

- \*Reduce land and capital requirements for local utility providers
- \*Provide trained personnel for operations and maintenance
- \*Provide consistent and sustained academic growth and development for the Bio-Energy industry
- \*Create highly skilled workers for jobs in the 21<sup>st</sup> Century and
- \*Provide support for the local economy and its stimulus.

## **Suggestive Course of Study B.S. Degree with a Major in Bio-Energy**

### **Freshman Year**

<u>Fall</u>		<u>Spring</u>	
GS ENG100 English Comp. I	(3)	GS ENG 102 English Comp. II	(3)
GS MAT135 Algebra & Probability	(3)	MAT 142 Pre Calculus for Bio Energy	(3)
GS HIST100 United States History I	(3)	GS HIST 102 World Civilization I	(3)
GS HPE111 Physical Activity	(2)	GS HPE 211 Wellness and Fitness	(1)
GS REL100 Intro. Biblical Studies	(3)	GS ENV 230 Environmental Science/Lab	(4)
GS SEM110 Freshman Seminar	(1)	BS200 Bible Survey I	(3)

### **Sophomore Year**

<u>Fall</u>		<u>Spring</u>	
GS ENG230 World Literature	(3)	GS COM232 Oral Communication	(3)
MAT 241 Calculus	(3)	PHY142 Physics	(3)
BE 201 Principles of Alternative / Renewable Energy Technologies	(3)	BE202 Intro. Environmental Energy Tech.	(3)
CHE141 Chemistry I (w/lab)	(4)	BS202 Bible Survey II	(3)
PHY141 Introduction to Physics	(3)	CHE 142 Chemistry II (w/lab)	(4)
GS ETH100 Introduction to Ethics	(3)	BE205 Engineering Computers	(3)

### **Junior Year**

<u>Fall</u>		<u>Spring</u>	
BE203 Special Topics in Alternative Energy	(3)	GS ECO 130 Economics	(3)
BE301 Water and Waste Water Systems I	(3)	BE 302 Water and Waste Water Systems II	(3)
BE303 Biomass / Bio Gas	(3)	BE 305 Safety/Codes/Regulation Standards	(3)
BE304 Soils and Soil Composites	(3)	BE 308 Energy Site Evaluation	(3)
BE306 Alternative Energy Planning /Design /Analysis	(3)	BE 307 Alternative Energy Inventory	(3)
		BE204 Fuel and Hydrogen	(3)

### Senior Year

<u>Fall</u>		<u>Spring</u>	
BS PT412 Theo. Research Methods	(3)	BE403 Global Connections	(3)
BE406 Capstone Project I	(3)	BE408 Capstone Project II	(3)
BE401 Alternative Energy Implementation and Maintenance	(3)	BE 402 Energy Efficiency & Management	(3)
GS SEM410 Senior Seminar	(1)	Elective	(3)
Elective	(3)	Elective	(3)

### Bio-Energy Course Descriptions

*BE 201 Principles of Alternative / Renewable Energy* - (3 hrs.) -This course provides an overview of alternative (new and traditional) / renewable energy options. The class will include hands on projects, conferences, and field trips.

*BE 202 Introduction to Environmental Energy Technology* – (3 hrs.) - This course introduces the student to the atmospheric sciences linking research on climate, air quality technologies as fuel cells and batteries.

*BE 203 Special Topics in Alternative Energy* - (3 hrs.) -This course introduces the student to the multiple facets of alternative energy including but not limited to Water, Solar, Wind, Fossils Fuels, and Atomic.

*BE 204 - Fuel and Hydrogen Technologies* – (3 hrs.) -This course explores a variety of analysis methodologies which are used in combination to provide a sound understanding of hydrogen and fuel cell systems and markets.

*BE 205 Engineering Computers* – (3 hrs.) -This course is designed to introduce the student to the computer engineering technology field by providing a classroom experience that includes hands-on practice. The student will be introduced to the fundamentals of computer programming, computer architecture, printed circuit board design and fabrication, electrical and electronic components

*BE 301 Water and Waste Water Systems I* – (3 hrs.) -The student will be introduced to the range of programs contributing to the well-being of the nation’s waters and watersheds and compliance with the requirements of the Federal Water Pollution Control Act. Effective baseline management systems of water and waste systems are explored.

*BE 302 Water and Waste Water Systems II* – (3 hrs.) -This course equips the student with the knowledge and provides the basis for decisions necessary to manage technical Water and Waste Water Systems. Field trips and on-site visitations require the student to travel to local water and waste water facilities. Prerequisite: BE301 Waste Water Systems I

*BE 303 Biomass / Bio Gas* – (3 hrs.) -This course will examine the biological material that can be used as fuel or for industrial production. Special attention will be directed toward the Biogas generated from the anaerobic digestion of organic matter.

Prerequisite: CHE141 Chemistry I (w/lab)

*BE 304 Soils and Soil Composites* - (3 hrs.) -This course examines the complex nature of soil and soil compositions and effects upon the regions.

*BE 305 Safety, Codes and Regulations Standards* – (3 hrs.) -The student is introduced to practices and procedures that help ensure safety in operating, handling, and using hydrogen and hydrogen systems. Local codes and regulations for operations provide guidelines for class structure and study.

*BE 306 Alternative Energy Planning and Design* – (3 hrs.) -This course will explore the essentials to planning and designing effective and efficient means for the development and use of the basic alternative energy sources: Solar, wind, geothermal, water/tide, water/hydroelectric

*BE 307 Alternative Energy Inventory and Analysis* – (3 hrs.) -This course explores the securing, storing, inventorying, and analyzing facilities for the basic alternative energy sources: Solar, wind, geothermal, water/tide, water/hydroelectric

*BE 308 Energy Site Evaluation* - (3 hrs.) -This course will explore the essentials for the evaluation of energy facilities and the effective and efficient operation of energy sites.

*BE 401 Alternative Energy Implementation and Maintenance* - (3 hrs.) - This course explores the multiple methods of implementation and maintenance of the basic alternative energy sources: Solar, wind, geothermal, water/tide, water/hydroelectric

*BE 402 Energy Efficiency and Management* – (3 hrs.) -This course introduces the student to the variety of responsibilities associated with Energy Efficiency and Management: equipment procurement; new construction and retrofits; effective operations and maintenance; and utility management; transportation and disposition.

*BE 403 Global Connections* - (3 hrs.) – This course will examine alternative global perspectives in issues of business economics and the environment. It offers an exploration in the conflicting visions that frequently express and suggest elements of an institutional framework that can align the benefits of globalization with the objectives of enhanced environmental protection.

*BE 406 Capstone Project I* – (3 hrs.) -This course is the first part of the student's Capstone Project. The student is required to write a formal proposal for a one-year Bio Energy project; the project must be approved and conducted (with documented log) under the supervision of the Bio Energy advisor / teacher. The proposal will include objectives, activities, timeline and projected evaluations for the culmination of the project.

*BE 408 Capstone Project II* - (3 hrs.) -This course is the second part of the student's Capstone Project conducted under the supervisor of the Bio Energy advisor / teacher. The student will be required to give a formal presentation of the project and how the student has benefited from the project at least two (2) weeks before graduation.

Prerequisite: BE406 Capstone Project I

See Next Page – Additional required courses for Bio-Energy Degrees

### Other Required Courses for Bio-Energy Degree

*MAT 135 - College Algebra and Probability* – (3 hrs.) - This course includes systemic concepts in integers, groups, rings, integral domains and fields as well as, the analysis and interpretation of statistical data, central tendency and dispersion, basic probability concepts and laws, random sampling and statistical inferences.

*MAT 141-142 - Pre Calculus for Science / Mathematics Majors* – (3 hrs.) -These two course deal with real numbers and graphs, functions, polynomial and rational functions, exponential and logarithmic functions as well as a review of trigonometric functions.

Prerequisite: Math Assessment Test

*MAT 241 – Calculus* – (3 hrs.) -This course includes analytic geometry, graphs, functions, limits and continuity, differentiation and logarithmic functions as it is applied with other applications to physics, material and motion.

*PHY 141 – Introduction to Physics (w/lab)* – (4 hrs.) -The student is introduced to the science of the material world, matter and motion. Among the many divisions of physics explored will include: Light, heat (energy) sound and kinetics. The laboratory experience provides opportunity for the student to apply basic principles, understanding and knowledge to simulated projects.

*PHY 142 - Physics (w/lab)* – (4 hrs.) -The student is continues the study of the science of the material world, matter and motion. Among the many divisions of physics explored will include: Atomic energy, hydraulics, pneumatics, engineering and bio-technologies. The laboratory experience provides opportunity for the student to apply basic principles, understanding and knowledge to simulated projects.

Prerequisite: PHY141 Introduction to Physics (w/lab)

*ECO 130 – Economics* – (3 hrs.) -This course is designed to acquaint the student with basic functions and responsibilities of economics and economic systems and how they relate to fiscal policy.

*CHE 141 – 142 Chemistry I and II (w/lab)* – (4 hrs.) -The fundamental chemical and physical principles of inorganic chemistry are studied. A basic foundation of atomic theory, gas laws, electrochemistry and thermodynamics are utilized in the writing of chemical formulas, predicting reactions, and solving problems. The laboratory experience provides opportunity for the student to apply basic principles, understanding and knowledge to simulated projects.

GS ETH 100 – Introduction to Ethics – (3 hrs.) - This course is an introduction to traditional theories and problems in the field of moral philosophy. Students examine the meaningfulness of ethical discourse and explore what makes an action right or wrong, good or evil. Contemporary ethical issues are explored.