



UNC CHARLOTTE

Office of the Chancellor

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February 5, 2013

Dr. Chris Brown
Vice President for Research and Graduate Education
General Administration
University of North Carolina
Post Office Box 2688
Chapel Hill, North Carolina 27515-2688

Dear Dr. Brown:

Enclosed is UNC Charlotte's Request for Authorization to Establish a M.S. in Applied Energy and Electromechanical Systems. This exciting program closely aligns with the opening of our new Energy Production and Infrastructure Center (EPIC) building and will prepare graduates to meet technology needs in the energy and power industries.

Thank you for your consideration of this request. Provost Joan Lorden or I would be pleased to respond to any questions that you may have.

Cordially,

A handwritten signature in black ink that reads "Phil".

Philip L. Dubois
Chancellor

cc: Provost Joan F. Lorden
Dean Robert Johnson
Cody Thompson, UNC General Administration

APPENDIX C
UNIVERSITY OF NORTH CAROLINA
REQUEST FOR AUTHORIZATION TO ESTABLISH
A NEW DEGREE PROGRAM

***INSTRUCTIONS:** Each proposal should include a 2-3 page executive summary. The signature of the Chancellor is required. Please submit one hard copy and an electronic copy of the proposal to the Office of the Senior Vice President of Academic Affairs at UNC General Administration.*

Date: January 29, 2013

Constituent Institution: The University of North Carolina at Charlotte

CIP Discipline Specialty Title: Energy Management and Systems Technology

CIP Discipline Specialty Number: 15.0503 Level: B _____ M X 1st Prof _____ D _____

Exact Title of the Proposed Degree: Applied Energy and Electromechanical Systems

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): M.S.

Does the proposed program constitute a substantive change as defined by SACS? Yes X No _____

The current SACS Substantive Change Policy Statement may be viewed at:
<http://www.sacscoc.org/pdf/081705/Substantive%20Change%20policy.pdf>

If yes, please briefly explain.

As required by the Policy Statement on Substantive Change for Accredited Institutions of the Commission on Colleges, the University of North Carolina at Charlotte (UNC Charlotte) is required to submit a letter of notification prior to implementation for new degree programs. Notification of this new degree program will be provided to SACS after approval by the University of North Carolina Board of Governors and prior to implementation.

Proposed date to establish degree program: Month August Year 2013

Are there plans to offer all or a portion of this program to students off-campus or online? Yes _____ No X

If yes, complete the form to be used to request establishment of a distance education program and submit it along with this request.

Note: If a degree program has not been approved by the Board of Governors, its approval for alternative, online, or distance delivery must wait until BOG program approval is received. (400.1.1[R], page 3)

¹This Appendix C supersedes the preceding Appendix C entitled, "Request for Authorization to Establish a New Degree Program," adopted May 6, 2009.

I. DESCRIPTION OF THE PROGRAM

- A. Describe the proposed degree program (i.e., its nature, scope, and intended audience).

The Department of Engineering Technology and Construction Management (ETCM) proposes the creation of an Applied Energy and Electromechanical Systems (MSEEM) master's degree program to prepare graduates to work in the energy and power industries. Students will be given a solid background in energy production and generation, power transmission and conversion, systems dynamics, and mechatronics. These interdisciplinary subjects are well-suited to be delivered by the interdisciplinary ETCM faculty. Upon completion of a common core, students will choose a focus of either energy systems or electromechanical systems.

UNC Charlotte provides educational opportunities to residents of the largest metropolitan area in North Carolina and is located in one of the fastest growing energy hubs in the country. Charlotte is home to 240 companies that employ about 25,000 workers in Charlotte's energy sector. A number of large energy-based companies have major facilities located in the Charlotte area including: Duke Energy, the nation's largest electric utility; The Shaw Group; Areva; Siemens; Westinghouse; Fluor; Toshiba; Babcock & Wilcox; Saertex USA; and Celegard. According to Jeff Merrifield, Senior Vice President of The Shaw Power Group, "A lot of companies are coming from around the country and around the world, placing facilities here and creating a network..." [Charlotte Chamber of Commerce, News 14]

Growth in Charlotte's energy sector has accelerated recently, and the program in Applied Energy and Electromechanical Systems will help to meet increasing needs for specially trained technical employees. "Merrifield states, "In the case of The Shaw Group, 5 years ago we had 40 people here in town and today we have about 1110." According to Mark Pringle of Siemens Energy, "We just announced we're adding gas turbine to our manufacturing and service capabilities here and we're going to build a 450,000 sq. ft. addition to the factory and hire over 1,000 people in the next 4 years." He adds, "I think it started with Duke Energy and they brought in some of their suppliers who came here and then Siemens, who was here, decided to make our hub in North America and we just keep building off each other." [News 14]

The Charlotte area is also home to nearly 100 renewable energy and energy efficiency businesses, and this portion of the energy sector is expected to grow as well. Since 2004, the North Carolina General Assembly has passed about 70 renewable energy and energy efficiency bills, resulting in more than 1,130 sustainable energy business employing 10,250 people. [*Charlotte Business Journal*]

According to the 2012 Charlotte Major Employers Directory, "Charlotte was recently dubbed 'The New Energy Capital' by Duke Energy and peer *Fortune 500* firms because of significant investment in recent years by energy environmental sector companies." (http://charlottechamber.com/clientuploads/Economic_pdfs/MajorEmployers2012.pdf)

This robust climate of growth for energy and power-based industry in the Charlotte region make UNC Charlotte an ideal fit for a Master of Science in Applied Energy and Electromechanical Systems degree program. UNC Charlotte's Department of Engineering Technology and Construction Management has provided quality technical education for over 30 years. Our programs have met rigorous standards for specialized accreditation, and we have a long history of supplying graduates for the greater Charlotte region and throughout North Carolina. A large number of the departmental faculty has significant industrial and research expertise that will ensure the delivery of a technically robust and industrially relevant program. This proposed program will enhance the Department's

outreach and integration with the community, enlarge its scholarly research capacity, and produce much needed graduates for Charlotte's growing energy sector.

The program will consist of a 15-credit hour common core and a 15-credit capstone experience; the capstone experience will be comprised of either a sequence of 15-credit hours of major electives or a sequence which includes 6-credit hours of major elective courses, a 3-hour Research and Analytical Methods course and a formal 6-credit hour graduate research thesis. The 30-credit hour degree program is outlined below:

Common Core Courses (15-credit hours)

ENER 6120	Energy Generation and Conversion	3 credit hours
ENER 6135	Energy Transmission and Distribution	3 credit hours
ENER 6150	System Dynamics	3 credit hours
ENER 6170	Applied Mechatronics	3 credit hours
*ETGR 5272	Engineering Analysis IV	3 credit hours

Students then choose either the Research & Thesis Option or the Non-Thesis/Coursework Option as follows:

Master's Research & Thesis Option (15-credit hours)

Major Electives (2)		6 credit hours
*CMET6160	Research and Analytical Methods	3 credit hours
ENER 6900	Master's Research and Thesis	6 credit hours

OR

Non-Thesis Coursework Sequence (15-credit hours)

Major Electives (5)		15 credit hours
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Students select major elective courses from the following list:

*CMET 5270	Operation of Constructed Facilities	3 credit hours
*CMET 6130	Building Information Modeling	3 credit hours
*CMET 6140	Building Energy Management	3 credit hours
*CMET 6155	Facility Instrumentation and Controls	3 credit hours
*ENER 5250	Analysis of Renewable Systems	3 credit hours
*ENER 5260	Hydrogen Production and Storage	3 credit hours
*ENER 5275	Air Conditioning Systems	3 credit hours
*ENER 5280	Fuel Cell Technologies	3 credit hours
*ENER 5285	Applied Noise and Vibration Control	3 credit hours
ENER 5290	Advanced Instrumentation	3 credit hours
ENER 6000	Special Topics in Applied Energy or Electromechanical Systems	1-3 credit hours
ENER 6220	High Voltage Technology	3 credit hours
ENER 6235	Advanced Transmission	3 credit hours
ENER 6260	Computation Fluid Dynamics for Energy Applications	3 credit hours
ENER 6270	Dynamic Systems Control and Design	3 credit hours
ENER 6800	Independent Study	1-3 credit hours

*Denotes existing courses in the Department

Additional new major elective courses will be created based on faculty research interest and industry feedback. Other appropriate existing graduate level courses will be identified from other programs such as Mechanical Engineering (ME), Electrical Engineering (EE),

Computer Engineering (CpE), Systems Engineering (SE) and Engineering Management (EM) for inclusion as possible electives.

The proposed program will serve students graduating from the Department's existing baccalaureate programs in Electrical Engineering Technology (ELET) and Mechanical Engineering Technology (MET). This graduate program will also accommodate students graduating from the College of Engineering's Mechanical Engineering (ME), Computer Engineering (CpE), and Electrical Engineering (EE) programs. It is anticipated that working professionals from local and regional industries seeking to maintain or upgrade their job skills will also avail themselves of the program as will graduates of other MET, ELET, ME, CpE, and EE programs throughout the Southeast. The MSEEM will be the only applied interdisciplinary masters-level program in energy in the UNC system and, as such, it is anticipated this program will be attractive to local professionals and undergraduates as a means of continuing their education with an energy or electromechanical emphasis.

Graduates will be prepared to enter the workforce with an understanding of the interface between mechanical work, electrical/electronic control systems, and electrical energy. They will have the understanding of the mechanisms for coupling these domains and the competencies necessary to design and implement appropriate systems. Graduates will be prepared to work in a growing number and variety of technical positions which require knowledge of both electrical and mechanical systems and devices, such as energy product design and development, system integration, field installation and commissioning.

B. List the educational objectives of the program.

Program Educational Objectives: These are statements that describe the expected accomplishments of MSEEM graduates during the first few years after graduation.

The Department of Engineering Technology and Construction Management is committed to providing the environment and expertise to ensure that its graduates make substantive contributions in their professional endeavors after graduation, both in the areas of technical proficiency and community involvement. Accordingly, the MSEEM program alumni will contribute to society as productive technical professionals and engaged citizens by:

1. Applying general and discipline-specific concepts and methodologies to identify, analyze, and solve technical problems.
2. Articulating technical material in a professional manner to potentially diverse audiences and in a variety of circumstances.
3. Contributing within team environments, demonstrating ethical, respectful and professional behavior in all associations.
4. Recognizing and appreciating the environmental, societal and fiscal impact of the technical professions in a local, national and global context.
5. Demonstrating an individual desire and commitment to pursue continuous self-improvement and lifelong learning.

C. Describe the relationship of the program to other programs currently offered at the proposing institution, including the common use of:

1. Courses:

The proposed MSEEM is a new program which includes development of four new courses (12 credits) in the core curriculum, as well as additional electives. Currently, 33 credit hours of courses already exist to serve the program. Other elective courses will be developed to meet student and industry needs. The proposed program will be administered by the Department of Engineering Technology and Construction Management, and will serve students graduating from the Department's existing BSET in Electrical Engineering Technology (ELET) and Mechanical Engineering Technology (MET) programs.

This graduate program will also accommodate students graduating from the College of Engineering's Mechanical (ME), Computer Engineering (CpE), and Electrical Engineering (EE) programs. It is anticipated that working professionals from local and regional industries seeking to maintain or upgrade their job skills will also avail themselves of the program as will graduates of other MET, ELET, ME, CpE, and EE programs throughout the Southeast.

2. Faculty:

This program will share faculty resources with the existing BSET in Electrical Engineering Technology and existing BSET in Mechanical Engineering Technology programs. Currently, fifteen (15) full-time faculty members deliver the Electrical and Mechanical ET programs with another twenty faculty members in related, supporting fields such as construction, civil, environmental, and fire protection. Members of the Graduate School Faculty currently teaching in those programs will deliver courses in the proposed MSEEM program. The majority of the program coursework and thesis direction will be delivered by faculty from the Electrical and Mechanical Engineering Technology programs. As such, the program has the potential to produce graduate level research and external funding opportunities for faculty in both these academic programs.

3. Facilities:

Ample space is available in the Smith Building to move forward with this program. Office space for new faculty members is available, as is project space for graduate student projects and research activity. Existing laboratories and offices in Smith which now support the ELET and MET program will be utilized by the MSEEM program and are adequate to deliver the programs. The new Energy Production and Infrastructure Center (EPIC)'s power and infrastructure laboratories are also available to support the program.

4. Other resources:

Other resources such as engineering computing facilities and library resources are available for use by the MSEEM program. Computing applications are in place for the existing undergraduate programs and will be utilized by the MSEEM program. Library resources for the existing BS programs will also be utilized by the MSEEM program.

- D. Identify opportunities for collaboration with institutions offering related degrees and discuss what steps have or will be taken to actively pursue those opportunities where appropriate and advantageous.

Currently, there are no programs like this one in North Carolina (none in this CIP code designation) so the opportunity for collaborative efforts does not currently exist. However, in the future, such collaborations will be explored as other institutions bring programs forward.

II. JUSTIFICATION FOR THE PROGRAM - NARRATIVE STATEMENT

- A. Describe the proposed program as it relates to:
1. Institutional mission

The proposed graduate program meshes nicely with the institutional mission and strategic plan. It fits well with the mission of the new Energy Production and Infrastructure Center (EPIC) building. As the third graduate level program to be housed in the Department of Engineering Technology and Construction Management (ETCM), the program will increase the ability of the ETCM Department and its faculty to become active participants in the institutional goal of raising the University's graduate research and scholarly profile.

The UNC Charlotte mission statement reads, "UNC Charlotte is North Carolina's urban research university. It leverages its location in the state's largest city to offer internationally competitive programs of research and creative activity, exemplary undergraduate, graduate, and professional programs..."

In their mission statement, the William States Lee College of Engineering "provides quality educational experiences and discovers and disseminates knowledge that serves the citizens and industries of local, national and international communities."

The Department mission statement indicates that our "programs exist to serve the citizens of North Carolina and the industries in this region and beyond by supplying highly competent" graduates. The proposed program is positioned to support the Department, College and University missions by providing intellectual capital and by educating North Carolina citizens to meet the challenges of the region, state and nation.

The UNC Charlotte William States Lee College of Engineering is home to the Energy Production and Infrastructure Center (EPIC) which has as its mission to "enhance the available technical workforce, advance technology, and facilitate strategic industry-university collaboration for the global energy industry while supporting the Carolinas' economic and energy security development." The proposed MS program in Applied Energy and Electromechanical Systems aligns with and supports the mission of EPIC by providing a program to prepare students to enter the energy sector workforce and a graduate program to support energy-related research. UNC Charlotte would be the only institution in the UNC system with an energy-focused graduate degree program.

2. Strategic plan

The proposed MSEEM program contributes to all goals of the Department's 2010-2015 Strategic Plan as listed below. In particular, the proposed program contributes to Goal 1 of the Department's strategic plan, which is to add/develop graduate level programs in niche areas. Opportunities for substantive contributions in student leadership and professional development, along with increased faculty participation in centers as additional research is initiated may also be realized through the proposed program. Additionally, the MSEEM program will be a major contribution to Goal 5 of the Department's strategic plan, which is the planned development of a School of Technology with graduate level programs.

GOAL #1: Add/Develop graduate level programs in niche areas to develop and extend the research capacity of the School. (as funding support is provided)

- A. Implement and grow MS in Construction & Facilities Management program (2011-15).
- B. Implement and grow Master of Fire Protection & Administration program (2011-15).
- C. Plan/Add MS in Energy & Electromechanical Systems (2011-13).
- D. Plan/Add PhD in Interdisciplinary Integrated Technologies or similar title (2014-15).

GOAL #2: Foster and further develop culture of excellence for our programs, students, faculty and staff.

- A. Obtain a successful ABET reaccreditation during 2010-2011.
- B. Enhance student leadership, professional development and community service opportunities within the School.
- C. Promote staff excellence through training and communication of expectations.
- D. Promote faculty excellence through incentives and expectations for excellence.
- E. Increase faculty participation in Centers in the COE and University.
- F. Partner with other entities in COE to enlarge the Industrial Solutions Laboratory to promote and facilitate further faculty and industry collaboration.
- G. Provide adequate facilities to support expanding program offerings and facilitate applied research and outreach missions of the School.
 - 1. Modify/Renovate Smith Building to provide adequate support for current and planned programs for short term (2010-2015)
 - 2. Plan new facilities to support growing School as part of CRI Campus (2015)

GOAL #3: Continuing with sustainable infrastructure theme, add new and/or restructure existing undergraduate programs, tracks and/or options in specific niche areas of Applied Design & Integrated Technologies to 1) foster economic growth and development in the greater Charlotte region and the State of North Carolina, and 2) provide our students with the education and skills necessary for success in a global workplace. (as funding support is provided)

GOAL #4: Increase the quantity, quality, and diversity of students studying in the School.

GOAL #5: Establish School to house existing programs and proposed programs outlined in the strategic plan. Preliminary name for the School is Applied Design & Integrated Technologies.

This plan has been reviewed at various stages of development and endorsed by our stakeholders, including department and program Industrial Advisory Boards, alumni and employers.

3. Responsiveness to local, regional, or statewide needs

Graduates of the proposed program, which is inherently multidisciplinary in nature, will fill the types of positions that will benefit the surrounding industrial community and the economy of the entire country. The energy generation/distribution industry, with large companies such as Duke Energy, Siemens, General Electric, Shaw and Areva, relies on graduates that understand the link between mechanical work and electrical energy production. Graduates of the program will understand the

mechanisms for coupling those two domains and with the energy production and distribution methodologies. Technical positions in energy product design and development, system integration, field installation and commissioning will need graduates who understand the interface between the electrical and mechanical domains, as well as the hands on, applied type of research experience our graduates will have the opportunity to complete as a part of their studies. Additionally, the aerospace economy, increasingly prevalent in the Carolinas, will employ these graduates. Complex aviation systems used in aircraft production, deployment of aircraft, fleet operations and repair/maintenance operations will require graduates with a multidisciplinary approach to solving problems presented by complex systems. Graduates of the program will also be employed in numerous industrial capacities that require a multidisciplinary approach to solving problems and implementing solutions presented by complex electromechanical and mechatronic systems.

4. Student demand. Discuss the extent to which students will be drawn from a pool of students not previously served by the institution

In addition to providing a seamless transition to graduate studies for the Department's existing BSET in Electrical Engineering Technology (ELET) and Mechanical Engineering Technology (MET) students, this graduate program could also accommodate students graduating from the College of Engineering's Mechanical (ME), Computer Engineering (CpE), and Electrical Engineering (EE) programs. It is anticipated that working professionals from local and regional industries seeking to maintain or upgrade their job skills will also avail themselves of the program as will graduates of other MET, ELET, ME, CpE, and EE programs throughout the Southeast. The MSEEM will be the only applied interdisciplinary masters-level program in energy in the UNC system and, as such, it is anticipated this program will be attractive to local professionals and undergraduates as a means of continuing their education with an energy or electromechanical emphasis.

It is estimated that initial enrollments will range from 5 to 15 students depending upon timing of approval and subsequent recruiting efforts. With reasonable marketing and brand development, enrollments are expected to increase to 20 to 30 full-time students and another 5 to 15 part-time students within a few years. These estimates are considered conservative given the high demand for technical energy specialists and the expected popularity of this program. The size of the Charlotte metropolitan area, coupled with the large energy hub located here provides unique opportunities for a Master of Science in Applied Energy and Electromechanical Systems. As such, the program could potentially enroll 40 to 60 students as the opportunities and challenges in the energy sector become better recognized by the public.

5. Employment opportunities. Document need for proposed degree recipients in the region, the state, or nationally

Effective 2012, the U.S. Bureau of Labor Statistics (BLS) will report on "green" jobs, which will include all occupations related to natural resources, energy efficiency and generation/distribution of energy from alternative sources such as wind, solar and biomass (<http://www.bls.gov/green/#definition>). The BLS does not currently provide individual statistics on energy and power related occupations, with these positions incorporated into traditional electrical and mechanical engineering or the generic engineering, other, category. Although the electrical and mechanical engineering fields are projected to have a modest growth of 2-6% through 2018, a substantial number of positions will be created through the graying of the current workforce. As indicated in Figure 1, data from 2006 indicated that over 50% of the workforce employed in the generation, transmission and distribution of electric power was aged 45 and older.

Natural attrition from these demographics, in conjunction with the push towards more renewable energy, will result in jobs related to the current grid and power generation/distribution paradigm as well as those encompassed in the BLS Green Power definition.

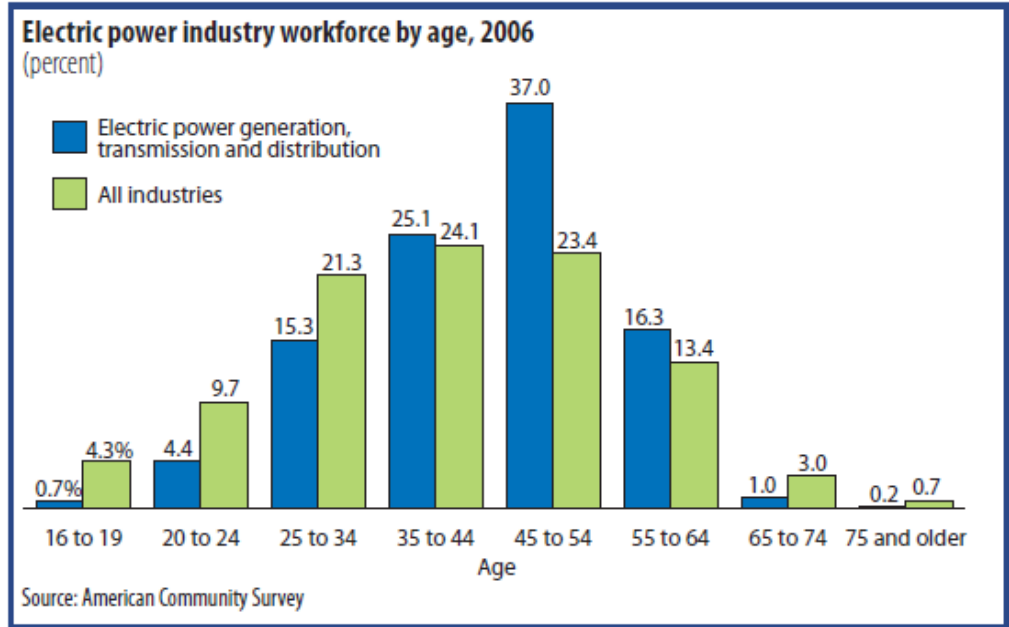


Figure 1: Source - Occupational Outlook Quarterly, Fall 2008

The U.S. Department of Energy August 2006 report to the U.S. Congress, *Workforce Trends in the Electric Utility Industry* (http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/Workforce_Trends_Report_090706_FINAL.pdf), reiterated the necessity of power engineering education as well as expressing concern of the availability of educators to meet future demands. This fact, in conjunction with the focus of engineering education to satisfy the short-term application focus of industry, yielded the conclusion “To foster innovation to keep the United States on the forefront of technological advancement and to maintain our leadership position amidst international competition, strong support of strategic research at universities is critical.” Figure 2 presents the qualitative summary of this report in terms of major professions of the power industry workforce.

<i>Similarities</i>	<i>Differences</i>	
	<i>Lineworkers</i>	<i>Power Engineers</i>
Demographics – dominated by “Baby Boomers”	Industry very aware of retirement situation	Industry not completely aware of pending retirement impact
Loss of institutional knowledge as more retire	Short-term impact to utility operation	Long-term impact to national competitiveness
Mergers, cutbacks, and downsizing over the past two decades	Interest in field is growing	Interest in field is declining
In-house training programs being developed by industry to fill perceived voids	Training programs nearly doubled in last 10 years	University programs have declined over the past decade
Potential lack of qualified interested replacements	High pay, especially for limited post-secondary education	Low pay, compared to other concentrations within electrical engineering

Figure 2: Lineworkers vs Power Engineers (Table 4 of DOE report)

The Department of Energy report concludes “Despite industry’s apparent ability to meet short-term workforce demand on the applications side, the decline in support for basic power systems research and education is of concern. It is an engine for innovation, exploration and ingenuity, and is necessary for sustaining scientific advancement to maintain our competitive position in the world. In addition, due to the reticence in the electric industry, incremental decisions usually last 30-40 years, requiring a broader, long-term perspective. Thus the public-private partnerships should be considered to keep America’s power research capabilities strong and secure.” The unique combination of the status of Charlotte as an energy hub, the existence of EPIC on the UNC Charlotte campus and the proposed MSEEM program will provide this critical public-private partnership for both educational and research endeavors.

- B. Discuss potential program duplication, program competitiveness, and opportunities for collaboration in the delivery of the program.
1. Identify similar programs offered by public and private universities elsewhere in North Carolina. Indicate how the proposed new degree program differs from other programs like it within UNC. If the program duplicates other UNC programs, explain:
 - a. Why the proposed program is necessary or justified, and
 - b. How all or portions of the curriculum might be offered collaboratively with another UNC institution.

Currently, there are no institutions in the UNC system offering graduate degree programs in Applied Energy Systems or Electromechanical Systems.

2. If the program is a graduate or first professional degree, compare it with other similar programs in public and private universities in North Carolina, in the region, and in the nation. Where appropriate, describe how all licensure or professional accreditation standards will be met, including required practica, internships, and supervised clinical experiences.

The proposed new degree program is unique in that it will be the first graduate degree program in applied energy or electromechanical systems in the University of North Carolina system. Currently, there are no programs like this one in North Carolina (none in this CIP code designation) so the opportunity for collaborative efforts does not readily exist. Other programs contain portions of the content of this program in

either energy management or renewable energy (NYIT, Northeastern, University of Colorado Denver, Oregon Institute of Technology) or electromechanical systems (Southern Pacific) or as a small concentration in a traditional program. The proposed MSEEM program differs from the programs referenced above through its multi-disciplinary nature and solid energy/electromechanical core to tailor a program of study that emphasizes applications in the energy management and electromechanical systems technology discipline. In addition, a search through the National Center for Education Statistics, Institute of Education Sciences (<http://nces.ed.gov/ipeds/>) yielded no degrees containing the keywords energy or power at the master's level offered by four-year institutions in the United States.

Graduates of the MSEEM program will not be required to obtain licensure to practice. Completion of the MSEEM will be considered one year of practical experience towards the Professional Engineer (PE) license, should the student choose to seek licensure.

- C. Enrollment (baccalaureate programs should include only upper division majors, that is, juniors and seniors).

Headcount enrollment

Show a four-year history of enrollments and degrees awarded in similar programs offered at other UNC institutions (using the format below for each institution with a similar program); indicate which of these institutions you consulted regarding their experience with student demand and job placement. Indicate how their experiences influenced your enrollment projections.

No other existing masters programs in energy and electromechanical systems exist in the UNC system.

Institution: N/A

Program Title: N / A

	(year)	(year)	(year)	(year)
Enrollment	N / A	N / A	N / A	N / A
Degrees-awarded	N / A	N / A	N / A	N / A

Please indicate the anticipated first year and fourth year steady-state enrollment (head count) for the proposed program.

Year 1: Full Time 12 Part-time 6 Total 18
 Year 4: Full-time 24 Part-time 10 Total 34

Estimates provided above are considered conservative and represent lower-bound values. Enrollments could actually approach 40 to 60 full-time students as an upper bound estimate once this program reaches steady state. Those higher enrollments could be readily absorbed and served without increase in estimated resources identified in this proposal.

III. PROGRAM REQUIREMENTS AND CURRICULUM

A. Program Planning

1. List the names of institutions with similar offerings regarded as high quality programs by the developers of the proposed program.

Currently, no other applied energy and electromechanical program is offered in this CIP code designation in North Carolina. Other programs contain portions of the content of this program in either energy management or renewable energy (NYIT, Northeastern, Colorado Denver, Oregon Institute of Technology) or electromechanical systems (Southern Pacific) or as a small concentration in a traditional program. The proposed MSEEM program differs from the programs referenced above through its multi-disciplinary nature and solid energy/electromechanical core to tailor a program of study that emphasizes applications in the energy management and electromechanical systems technology discipline. There are other internal opportunities for students in the COE to access these courses as part of concentrations in other MS programs at UNC Charlotte.

2. List institutions visited or consulted in developing this proposal. Also discuss or append any consultants' reports or committee findings generated in planning the proposed program.

No institutions were visited while developing this proposal. The Lee College of Engineering houses a Department of Electrical and Computer Engineering (ECE) and a Department of Mechanical Engineering and Engineering Science (MEES), among others. Several ETCM faculty members currently hold adjunct graduate appointments in these departments, and faculty and leadership of both departments have expressed an interest in expanded synergistic opportunities that would be afforded by the MSEEM program. In addition, a search through the National Center for Education Statistics, Institute of Education Sciences (<http://nces.ed.gov/ipeds/>) yielded no degrees containing the keywords energy or power at the master's level offered by four-year institutions in the United States.

B. Admission. List the following:

1. Admissions requirements for proposed program (indicate minimum requirements and general requirements).

The minimum admission requirements for the program are:

- a. An earned undergraduate degree in engineering technology, engineering, energy or a closely related field
- b. An undergraduate GPA of 3.0 or better
- c. Acceptable scores on the verbal, quantitative, and analytical sections of the GRE
- d. Positive recommendations
- e. Acceptable TOEFL score is required if the previous degree was from a country where English is not the common language.
- f. Integral and differential calculus (MATH 1121 or MATH 1241 or ETGR 2171, and ETGR 2272 or MATH 1242 at UNC Charlotte or equivalent from other institution)
- g. Statistics (STAT 1220 or STAT 3128 at UNC Charlotte or equivalent from other institution)
- h. Other credentials as required by the Graduate School

2. Documents to be submitted for admission (listing or attach sample).
 - a. Official transcripts from all colleges and universities attended
 - b. Official GRE scores
 - c. Official TOEFL scores
 - d. The UNC Charlotte application for graduate admission online
 - e. Three professional recommendations
 - f. Others as required by the Graduate School

C. Degree requirements. List the following:

1. Total hours required. State requirements for Major, Minor, General Education, etc.

The program leading to the Master of Science degree in Applied Energy and Electromechanical Systems is a 30 semester-hour program. The program consists of a 15-credit hour common core, a 6-credit hour elective core in either applied energy or electromechanical systems, and a capstone experience including either a sequence of 9-credit hours of major electives or a specified 3-hour research and analytical methods course in conjunction with a formal 6-credit hour graduate research thesis.

2. Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, "second major," etc.).

Students pursuing a master's degree in applied energy and electromechanical systems have two options to complete the 30-credit hour program.

- a. 24 hours of course work plus 6 hours of thesis project, or
- b. 30 hours of course work and a comprehensive examination.

Both options require the formation of a program committee. The thesis option is reserved for students who are attending the on-campus program and are performing research under formal graduate research or teaching assistantships. Students receiving such assistantships may be required to pursue the thesis option. The thesis option requires students to submit a written thesis and orally defend their work before their program committee.

All non-thesis students must complete 30 credits of coursework and successfully complete a formal comprehensive examination. The comprehensive examination is a written exam. A student's exam will be scheduled when he/she has at least 24 hours of course credit completed or in progress. The student's graduate advisor and the examining committee will coordinate the examination (to be offered once in the fall and once in the spring semesters), preparing the exam with the assistance of members of the student's program committee. The exam will measure the student's mastery of theories and applications in the selected area of specialization within the discipline. Students will have only two opportunities to receive passing marks on the examination.

For graduate programs only, please also list the following:

3. Proportion of courses open only to graduate students to be required in program.

At least 15 semester hours of the 30 required semester hours must be in courses numbered 6000 or above. Courses numbered 6000 and above are only open to graduate students.

4. Grades required

All candidates must earn an overall 3.0 to graduate. Accumulation of one Unsatisfactory (U) grade will result in the suspension of the student's enrollment in the program.

5. Amount of transfer credit accepted

The Department, at its discretion, may accept transfer of graduate courses (6 credits maximum) taken at another institution or from another program prior to admission to the master's program in applied energy and electromechanical systems. Only courses in which the student earned a grade of B or better may be transferred.

6. Language and/or research requirements

The program has both a thesis and non-thesis track. After admission to candidacy, thesis students will complete a comprehensive oral exam and thesis defense while non-thesis students will complete a comprehensive written exam. Residence will be per Graduate School rules. There is no language requirement.

7. Any time limits for completion

Subject to Graduate School rules, currently a maximum of six years to complete a masters level program.

- D. For all programs, list existing courses by title and number and indicate (*) those that are required. Include an explanation of numbering system. List (under a heading marked "new") and describe new courses proposed.

Course numbers have been established that correspond with Graduate School catalog guidelines and with the Office of the Provost's published academic policy on course numbering located at <http://provost.uncc.edu/policies/course-numbering>.

Significant coursework for the degree currently exists at UNC Charlotte. Thirty-three credit hours of core and elective courses exist to support this program. The degree leverages existing coursework within the MS Construction & Facilities Management program and other existing energy-related courses in the Department.

Existing Courses

CMET 5270:	Operation of Constructed Facilities
CMET 6130:	Building Information Modeling
CMET 6140:	Building Energy Management
CMET 6155:	Facility Instrumentation and Controls
*CMET 6160:	Research and Analytical Methods (Required for thesis option only)
ENER 5250:	Analysis of Renewable Energy Systems (Cross list with ENER 4250)
ENER 5260:	Hydrogen Production and Storage (Cross list with ENER 4260)
ENER 5275:	Air Conditioning Systems (Cross list with ENER 4275)
ENER 5280:	Fuel Cell Technologies (Cross list with ENER 4280)
ENER 5285:	Applied Noise and Vibration Control (Cross list with ENER 4285)
*ETGR 5272:	Engineering Analysis IV (Cross list with ETGR 4272)

The following new graduate level courses (12 credits) will be created and developed as part of the core requirements:

*ENER 6120: Energy Generation and Conversion	3 credit hours
*ENER 6135: Energy Transmission and Distribution	3 credit hours
*ENER 6150: System Dynamics	3 credit hours
*ENER 6170: Applied Mechatronics	3 credit hours

In addition, the following new elective courses are planned for development to supplement existing core and elective courses in the Department and meet the needs of our students, industry partners and curriculum objectives:

ENER 5290: Advanced Instrumentation	3 credit hours
ENER 6220: High Voltage Technology	3 credit hours
ENER 6235: Advanced Transmission	3 credit hours
ENER 6260: Computational Fluid Dynamics for Energy Applications	3 credit hours
ENER 6270: Dynamic Systems Control and Design	3 credit hours

New Courses

ENER 5290: Advanced Instrumentation (3) Prerequisite: ELET 2241 or ETME 3163. This course provides methodologies for measurement, analysis and control of physical components of conventional and renewable energy conversion and storage systems.

ENER 6000: Special Topics in Applied Energy or Electromechanical Systems. (1-3) Study of specific new areas emerging in the various fields of energy and electromechanical systems. May be repeated for credit.

*ENER 6120: Energy Generation and Conversion (3) Prerequisite: ETGR 3171. Overview of energy use. Fossil fuel resources and energy conversion. Solar energy principles, solar collector, photovoltaic cells and applications. Wind energy and wind turbines. Nuclear energy principles, nuclear reactors and power generation. Geothermal and Hydraulic energy conversion. Hydrogen energy, storage and transportation, Overview of fuel cell, fuel cell types and application.

*ENER 6135: Energy Transmission and Distribution (3) Prerequisite: ETGR 3171. Power transmission and distribution network architectures. Transmission line models, parameters, and equivalent circuits. Symmetrical components. Power flow studies. Symmetrical and unsymmetrical faults. Transient operation and power system protection. Power system stability. Distribution optimization.

*ENER 6150: System Dynamics (3) Pre or co-requisite: ETGR 5272. Energy-based modeling of dynamic mechanical, electrical, thermal, and fluid systems to formulate linear state equations, including system stability, time domain response, and frequency domain techniques.

*ENER 6170: Applied Mechatronics (3) Prerequisite: ENER 6150. Analog electronic design for purposes of controlling electromechanical systems, including electromechanical sensors and actuators, analog electronic design of filters, state-space and classical controllers, and transistor-based servoamplifiers and high voltage amplifiers. Significant laboratory component with design and fabrication of circuits to control electromechanical systems. Implementation of digital controllers.

ENER 6220: High Voltage Technology (3) Prerequisite: ETGR 3171. Covers concepts of high voltage generation, measurements, protection and safety. Students will study high

electric fields theory, breakdown mechanisms in gases, liquids, and solid dielectrics. The high voltage insulation, including insulation coordination, will also be discussed. The course will also provide instructions on high voltage applications and safety.

ENER 6235: Advanced Transmission (3) Prerequisite: ENER 6135. This course provides instruction on network steady-state analysis; faults; protection systems; switching equipment; voltage and power static control; surge voltages and protection, transient operation and stability, "smart grid" enabling technologies.

ENER 6260: Computational Fluid Dynamics for Energy Applications (3) Prerequisites: ETME 3133 and ETGR 3171. Introduction to the use of commercial CFD codes to analyze flow and heat transfer in energy related problems. Finite difference and finite volume methods, SIMPLE model for incompressible flow, models of simple geometries are developed and studied, post processing and visualization. Overview of turbulence and turbulence modeling.

ENER 6270: Dynamic Systems Control and Design (3) Prerequisite: ELET 4242 or ENER 6150. This course covers dynamic systems control, its analysis and design. Analysis of linear feedback systems, deterministic and stochastic dynamic systems, their characteristics, robust stability and robust performance. Robust control, Kalman filter, and its design and compensation of deterministic and stochastic dynamic systems, including wind turbines system control and piezo (mechatronics) systems.

ENER 6800: Independent Study. (1-3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in energy and electromechanical systems. May be repeated for credit.

ENER 6900: Master's Research and Thesis. (1-6) Prerequisite: Consent of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. May be repeated for credit.

IV. FACULTY

- A. (For undergraduate and Master's programs) List the names, ranks and home department of faculty members who will be directly involved in the proposed program. The official roster forms approved by SACS may be submitted. For Master's programs, state or attach the criteria that faculty must meet in order to be eligible to teach graduate level courses at your institution.

Initially, all faculty members directly involved in the program will be from the Department of Engineering Technology & Construction Management (ETCM) in the Lee College of Engineering. This group of faculty is an interdisciplinary group of graduate faculty consisting of members with education and expertise spanning the following disciplines: mechanical, electrical, power, construction, civil, chemical, environmental, and fire protection.

Anthony L. Brizendine, PhD, PE, Professor & Chair, ETCM
Aidan Browne, PhD, Assistant Professor, ETCM
Nan Byars, PE, Professor, ETCM
Tara Cavalline, PhD, PE, Assistant Professor, ETCM
Don Chen, PhD, PE, LEED, Assistant Professor, ETCM
Chung-Suk Cho, PhD, Assistant Professor, ETCM
G. Bruce Gehrig, PhD, PE, Associate Professor, ETCM
Rodney Handy, PhD, CIH, Professor, ETCM
John Hildreth, PhD, PE, Assistant Professor, ETCM

Hyunjoo Kim, PhD, LEED A.P., Assistant Professor, ETCM
Jeffrey Kimble, Associate Professor, ETCM
Steve Kuyath, PhD, Associate Professor, ETCM
Na Lu, EdD, Assistant Professor, ETCM
David Murphy, Associate Professor, ETCM
Thomas Nicholas, PhD, PE, Assistant Professor, ETCM
Maciej Noras, PhD, Assistant Professor, ETCM
Carlos Orozco, PhD, Associate Professor, ETCM
Ron Priebe, PE, Associate Professor, ETCM
Peter Schmidt, PhD, PE, Assistant Professor, ETCM
Deborah Sharer, PhD, Associate Professor, ETCM
Barry Sherlock, PhD, Professor, ETCM
Ahmad Sleiti, PhD, PE, Associate Professor, ETCM
Patricia Tolley, PhD, PE, Associate Professor, ETCM
Jozef Urbas, PhD, Associate Professor, ETCM
Sheng-Guo Wang, PhD, Professor, ETCM
Wesley Williams, PhD, PE, Assistant Professor, ETCM
Aixi Zhou, PhD, Assistant Professor, ETCM

Per the current Graduate Catalog (<https://catalog.uncc.edu/graduate-catalogs/current/graduate-school>): In accordance with criteria developed by each graduate program or unit and approved by the Graduate Council, the Dean of the Graduate School appoints members of the Graduate Faculty for renewable terms. Members of the Graduate Faculty offer courses and seminars, mentor graduate students, and supervise research at an advanced level of scholarship.

- B. (For doctoral programs) List the names, ranks, and home department of each faculty member who will be directly involved in the proposed program. The official roster forms approved by SACS may be submitted. Provide complete information on each faculty member's education, teaching and research experience, research funding, publications, and experience directing student research including the number of theses and dissertations directed.

n/a

- C. Estimate the need for new faculty for the proposed program over the first four years. If the teaching responsibilities for the proposed program will be absorbed in part or in whole by the present faculty, explain how this will be done without weakening existing programs.

It is anticipated that this new enrollment stream will warrant the addition of four new faculty members over the next several years to adequately deliver the program. Faculty in the Electrical and Mechanical Engineering Technology programs will be added through the campus' faculty line allocation process. These positions will be justified through enrollment growth and/ or student credit hour production targets being met. Academic Affairs carefully reviews program requirements, new programming and program productivity annually to allocate resources for program delivery and growth. This process will provide resources for new faculty and staff positions to support the proposed program. In addition, the College of Engineering performs internal assessments for resource allocation for new and/or growing programs. Both the Provost and Dean of Engineering are committed to providing adequate resources from existing revenue streams to deliver and grow the program.

Additionally, research capability and production will increase as new faculty and graduate students are added.

- D. Explain how the program will affect faculty activity, including course load, public service activity, and scholarly research.

No adverse effect is anticipated on current faculty loads. In fact, the addition of new faculty hires will provide additional catalyst for energy and electromechanical research, scholarly publication, and community outreach activity.

V. LIBRARY

- A. Provide a statement as to the adequacy of present library holdings for the proposed program to support the instructional and research needs of this program.

Current monograph and journal holdings are adequate to support a portion of the proposed program. Library holdings related to energy infrastructure and production are currently being purchased to support graduate level research and with the addition of resources added through the allocation of funds for EPIC research, sufficient resources will be available by the time that the program begins. Available databases include: IEEE Xplore, ACM DigitalLibrary, and Compendex.

- B. State how the library will be improved to meet new program requirements for the next four years. The explanation should discuss the need for books, periodicals, reference material, primary source material, etc. What additional library support must be added to areas supporting the proposed program?

Program faculty will work with the EPIC director and the Engineering Librarian to identify the books, periodicals, publications, databases and electronic resources appropriate for support of the program. Funding already in place will be used to bolster holdings to a level deemed appropriate by the library and faculty. Ongoing support for the resources described will be provided via normal operating procedure.

- C. Discuss the use of other institutional libraries.

The library's participation in an interlibrary loan consortium provides another means of effectively supporting research and instructional needs.

VI. FACILITIES AND EQUIPMENT

- A. Describe facilities available for the proposed program.

The proposed MSEEM program will share facilities with the existing Construction Management, Civil, Electrical and Mechanical Engineering Technology programs in the Smith Building. Laboratories currently exist to support fluid mechanics, stress analysis, thermodynamics, electronics, power (generation, transmission and distribution), programmable logic control, and instrumentation and controls experimentation. In addition, the program will have access to the EPIC laboratory facilities.

- B. Describe the effect of this new program on existing facilities and indicate whether they will be adequate, both at the commencement of the program and during the next decade.

Existing facilities are adequate to support the on-campus program at commencement and during the next decade.

- C. Describe information technology and services available for the proposed program

UNC Charlotte Information Technology Services (ITS) provides the backbone for all email and internet access. The Lee College of Engineering (COE) MOSAIC computing service administers and maintains software utilized by COE students, faculty and staff.

- D. Describe the effect of this new program on existing information technology and services and indicate whether they will be adequate, both at the commencement of the program and during the next decade.

No significant impact will occur on information technology and services from the MSEEM program. Existing information technology services and MOSAIC engineering computing capabilities are adequate to support the program now and for the next decade.

VII. ADMINISTRATION

Describe how the proposed program will be administered, giving the responsibilities of each department, division, school, or college. Explain any inter-departmental or inter-unit administrative plans. Include an organizational chart showing the "location" of the proposed new program.

The proposed program will be administered within the Department of Engineering Technology and Construction Management. The Department Chair has ultimate responsibility for the program within the Department, reporting to the Dean of the Lee College of Engineering, who in turn reports to the Provost. Each graduate program has a Program Director who administers the program and reports to the Department Chair.

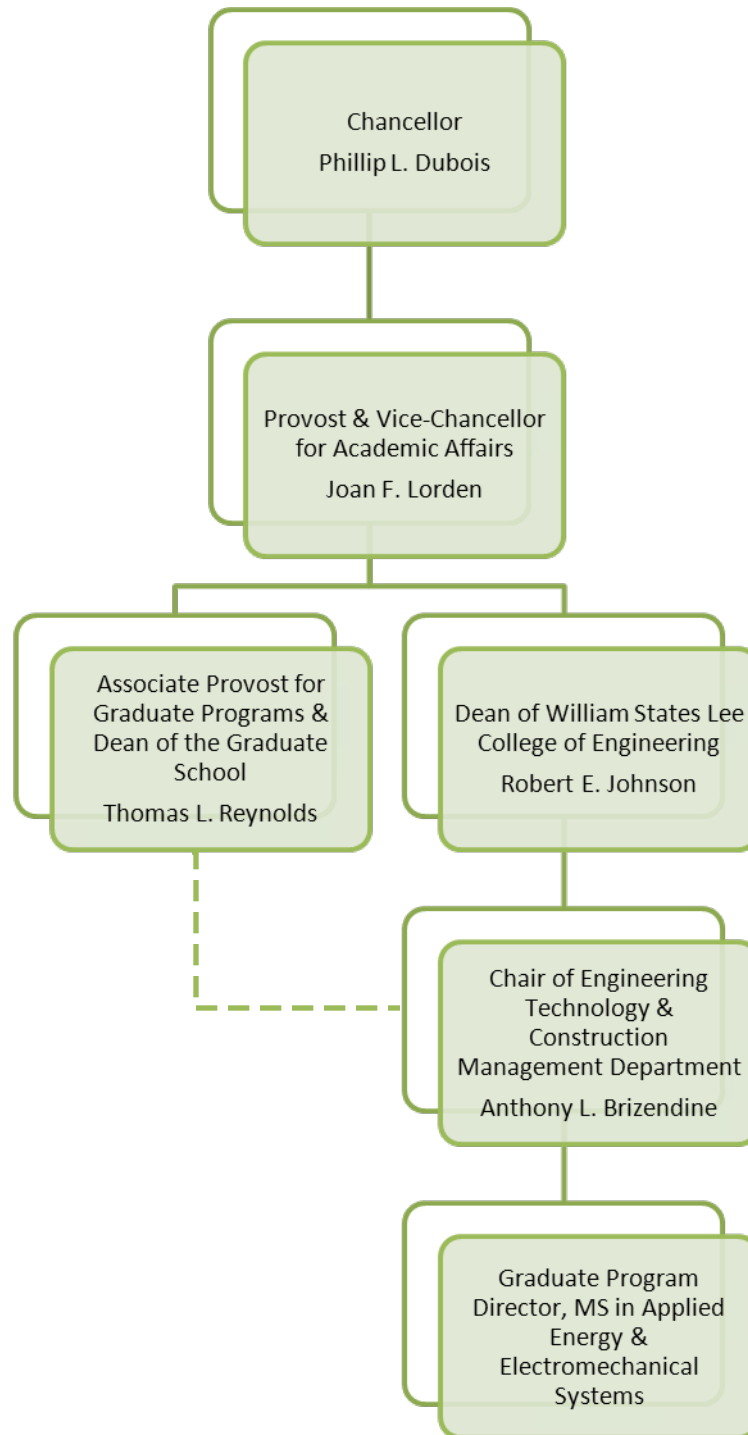
At the University of North Carolina at Charlotte, the Dean of the Graduate School is the administrative officer with primary responsibility for the supervision of graduate programs. The Dean is responsible for the executive and administrative affairs of the Graduate School in accordance with policies determined by the UNC Charlotte Graduate Council, the Graduate faculty, and the Faculty Council. The Graduate School is responsible for monitoring the quality of graduate programs, the final admission of graduate students, appointments to the Graduate faculty, and the enhancement of research activities essential to the conduct of graduate programs.

The Graduate Dean's main duties include the following:

- Admission of students
- Appointment of dissertation and thesis committees
- Approval of programs of study
- Admission of students to candidacy
- Final approval of dissertations

Upon admission to the MSEEM Program, the student will be assigned an appropriate Faculty Advisor from among the Electrical Engineering Technology, Mechanical Engineering Technology, or other appropriate ETCM Faculty, based on the student's prior training and stated interests. The Faculty Advisor will recommend a Plan of Study for the student's first year of enrollment in the program.

If the thesis option is selected, the Faculty Advisor will assist the student in identification of an appropriate research project. Before the beginning of the third semester following admission to the program, the student must form a three-member Program Committee. The assigned Faculty Advisor may chair this committee or the student may select a new Faculty Advisor at the time the committee is formed.



Subject to the approval of the Dean of the Graduate School, the functions of the Program Committee are to:

- Approve the student's plan of study
- Evaluate the student's academic progress each semester

- Evaluate the internship project or research project plan
- Certify the candidate's qualifications for the degree subject to the approval of the Dean of the Graduate School

VIII. ACCREDITATION AND LICENSURE

- A. Indicate the names of all accrediting agencies normally concerned with programs similar to the one proposed. Describe plans to request professional accreditation.

The proposed MSEEM program will be evaluated as part of the routine SACS evaluation of UNC Charlotte. The Accreditation Board of Engineering and Technology (ABET) also accredits master's level programs; however, there is no plan to request accreditation from ABET for the proposed MSEEM program since the Civil Engineering Technology, Electrical Engineering Technology, Mechanical Engineering Technology, Civil Engineering, Electrical Engineering, Mechanical Engineering and Systems Engineering undergraduate programs are ABET accredited. It is common practice, both at UNC Charlotte and at other engineering schools, to only seek ABET accreditation at the undergraduate level.

- B. If the new degree program meets the SACS definition for a substantive change, what campus actions need to be completed by what date in order to ensure that the substantive change is reported to SACS on time?

As required by the Policy Statement on Substantive Change for Accredited Institutions of the Commission on Colleges, the University of North Carolina at Charlotte (UNC Charlotte) is required to submit a letter of notification prior to implementation for new degree programs. Notification of this new degree program will be provided to SACS after approval by the University of North Carolina Board of Governors and prior to implementation.

- C. If recipients of the proposed degree will require licensure to practice, explain how program curricula and title are aligned with requirements to "sit" for the licensure exam.

Graduates of the MSEEM program will not be required to obtain licensure to practice. Completion of the MSEEM will be considered one year of practical experience towards the Professional Engineer (PE) license, should the student choose to seek licensure.

IX. SUPPORTING FIELDS

Are other subject-matter fields at the proposing institution necessary or valuable in support of the proposed program? Is there needed improvement or expansion of these fields? To what extent will such improvement or expansion be necessary for the proposed program?

The MSEEM program has been designed to be self-contained within the Department of Engineering Technology and Construction Management and support from other subject matter fields outside the department is not necessary. As an inter-disciplinary program, the MSEEM program will rely on support from all disciplines within the department including construction management, civil engineering technology, electrical engineering technology, fire protection and mechanical engineering technology. Although not necessary to initiate or deliver the program, collaboration opportunities within the Lee College of Engineering and with other colleges at UNC Charlotte may evolve in the future.

Students in the program may take courses in related areas from other COE programs, sciences, mathematics, and business as part of their program electives. There is no needed improvement or expansion of any potential external field of study.

X. ADDITIONAL INFORMATION

Include any additional information deemed pertinent to the review of this new degree program proposal.

No additional information is submitted.

XI. BUDGET

Based upon your responses in previous sections, provide estimates of the incremental continuing and one-time costs required to implement the proposed program.

A. Estimates should be provided for the first and fourth years of the program in the following broad categories and be inclusive of applicable employee fringe benefit costs:

1. New Faculty and Instructional Support Staff (including Library)

	Year 1	Year 4
New Faculty (One each in years one, two and three)	\$ 90,000	\$ 267,000
Technical Services Support Staff/Laboratory Manager (position added in year two)	\$ 0	\$ 51,000
Part-time instructional	\$ 20,700	\$ 26,000
benefits	\$ 26,100	\$ 92,220
totals	\$ 136,800	\$ 436,220

Estimates above include one new faculty position in year one and part-time instructional funds of \$20.7K. One additional faculty member is added in each of years two and three, as well as, a laboratory support position in year two. Year four funding includes three faculty members, a laboratory support position, part-time instructional funds of \$26K, and associated benefits for faculty and staff.

2. New Non-Academic Administrative Support Positions

None are requested. Current administrative support staff levels in the Department are adequate to support the program. In addition, non-academic administrative support for the program in the graduate school, computing, and business support functions can be absorbed with current staffing.

3. Recurring Operational Expenses (e.g., supplies, materials, telephone, travel, insurance, library or software subscriptions, equipment maintenance, etc.)

Recurring Operating Funds	Year 1	Year 4
Graduate Stipends [number = 3 FTE in year 1 (one funded by new grants/contracts); 7.5 in year 4 (2.5 funded by new grants/contracts)]	\$ 45,000	\$ 112,500
Supplies and Materials	\$ 12,100	\$ 28,500
Current Services	\$ 1,750	\$ 2,250
Travel	\$ 4,700	\$ 9,900
Communications	\$ 1,350	\$ 2,625
Printing and Binding	\$ 450	\$ 925
Advertising	\$ 2,200	\$ 2,900
Fixed Charges	\$ 2,250	\$ 2,500
Totals	\$ 69,800	\$ 162,100

4. One-time expenses for facilities renovations or additions, equipment purchases, library materials, etc.

No facility renovations are required to deliver this program. Funding for equipment necessary to deliver the program has been expended and equipment is in place to deliver the program. Library resources have been budgeted / expended in advance of program initiation as part of our Energy Production & Infrastructure Center initiative. Incremental continuing costs are expected to be minimal and are summarized above in section XI.A.3. No other one-time expenses are expected.

- B. Based on the campus' estimate of available existing resources or expected non-state financial resources that will support the proposed program (e.g., federal support, private sources, tuition revenue, etc), will the campus:
 1. Seek enrollment increase funds or other additional state appropriations (both one-time and recurring) to implement and sustain the proposed program? If so, please elaborate.

Yes, the campus will seek enrollment increase funds to implement the program.

2. Require differential tuition supplements or program-specific fees? If so, please elaborate.
 - a. State the amount of tuition differential or program-specific fees that will be requested.

This proposal requests the same differential tuition as other graduate programs in the Lee College of Engineering at UNC Charlotte. Those amounts (\$900 per semester for full time students) are shown in the table in section c. below.

- b. Describe specifically how the campus will spend the revenues generated.

Revenues generated from this pool will be used to support continuing expenses, including laboratory equipment purchase and maintenance, computing equipment, and consumable supplies for the program.

- c. Does the campus request the tuition differential or program-specific fees be approved by the Board of Governors prior to the next Tuition and Fee cycle?

Yes. The College of Engineering (COE) at UNC Charlotte has graduate student tuition differential in place for all COE graduate programs as shown in the tuition and fee schedule below. We will request same structure for this program. The tuition increment for a full-time graduate student is \$900 per semester and is incremented for part-time students based on number of credit hours as shown in the following table:

UNC CHARLOTTE – LEE COLLEGE OF ENGINEERING				
	0 - 2 Credit Hour	3 - 5 Credit Hour	6 - 8 Credit Hour	9+ Credit Hour
Tuition NC Resident	\$491.25	\$982.25	\$1,473.50	\$1,964.50
Tuition Non-Resident	\$2,027.00	\$4,054.00	\$6,081.00	\$8,108.00
Tuition Increment	\$225.00	\$450.00	\$675.00	\$900.00
Ed & Tech Fee	\$53.25	\$53.25	\$100.25	\$200.50
General Fee	\$311.75	\$311.75	\$601.75	\$988.00
ID Fee	\$6.00	\$6.00	\$6.00	\$6.00
UNC System Assoc Fee	\$0.15	\$0.15	\$0.25	\$0.50
Transportation Fee	\$15.00	\$15.00	\$15.00	\$15.00
Total Cost –NC Resident	\$1,102.40	\$1,818.40	\$2,871.75	\$4,074.50
Total Cost – Non-Resident	\$2,638.15	\$4,890.15	\$7,479.25	\$10,218.00

- C. If additional enrollment increase funding or other state appropriations elaborated above are not forthcoming, can the program still be implemented and sustained and, if so, how will that be accomplished? Please elaborate.

Yes, the program can be implemented and sustained without enrollment increase funding. UNC Charlotte has prioritized this program among our top three curriculum initiatives and will prioritize the program for funding due to the critical importance of this program to our students, the EPIC initiative and our industry energy constituents.

XII. EVALUATION PLANS

All new degree program proposals must include an evaluation plan which includes:

- A. Criteria to be used to evaluate the quality and effectiveness of the program, including academic program student learning outcomes.

Program Educational Objectives: These are statements that describe the expected accomplishments of MSEEM graduates during the first few years after graduation.

The Department of Engineering Technology and Construction Management is committed to providing the environment and expertise to ensure that its graduates make substantive

contributions in their professional endeavors after graduation, both in the areas of technical proficiency and community involvement. Accordingly, the MSEEM program alumni will contribute to society as productive technical professionals and engaged citizens by:

1. Applying general and discipline-specific concepts and methodologies to identify, analyze, and solve technical problems.
2. Articulating technical material in a professional manner to potentially diverse audiences and in a variety of circumstances.
3. Contributing within team environments, demonstrating ethical, respectful and professional behavior in all associations.
4. Recognizing and appreciating the environmental, societal and fiscal impact of the technical professions in a local, national and global context.
5. Demonstrating an individual desire and commitment to pursue continuous self-improvement and lifelong learning.

Other external criteria which will be utilized to evaluate the program include, but are not limited to, the following:

1. ability to attract students
2. quality of instruction
3. quality of program faculty
4. ability to produce graduates
5. quality and competence of graduates
6. career mobility and success
7. satisfaction of energy and manufacturing sector employers
8. quality of research and scholarly activity

- B. Measures (metrics) to be used to evaluate the program (include enrollments, number of graduates, and student success).

Various measures, both direct and indirect, are currently utilized to evaluate our existing programs. Those same measures will be applied to the proposed MSEEM program. Those measures include, but are not limited to:

1. student enrollments
2. scores on student course evaluations
3. annual and post tenure reviews of faculty
4. number of graduates produced
5. graduate grade point averages and results of nationally-normed tests where applicable
6. satisfaction of alumni on surveys
7. satisfaction of employers on surveys
8. level of research and scholarly activities

- C. The plan and schedule to evaluate the proposed new degree program prior to the completion of its fourth year of operation.

The Department will employ its existing robust continuous improvement assessment process to this proposed program. The existing programs are assessed by an integrated

program and course assessment process which external consultants have described as outstanding based upon their evaluation of our programs and processes. For the MSEEM program, the process will begin by establishing assessment measures and tools (i.e. primarily student work activities) that are directly tied to the established program educational objectives. The assessment tools will be administered as part of the Department's Individual Course Assessment Process (ICAP) each semester a course is taught. Data collected through the ICAP process will be evaluated by a Focus Area Improvement Team (FAIT) that will be established for the MSEEM program and will work in conjunction with the other master's level FAIT in the Department. The FAIT team will then, based on the student performance data, make any recommendations for course and curricular improvement that may be deemed necessary to ensure continued program quality and improvement. Master's level FAIT will also communicate and coordinate with existing undergraduate FAIT in the Department to facilitate skills and competencies required for graduate level studies.

Maturation of the proposed program is expected to take 6 to 8 years. The measures for evaluating program success, as described above in XII.B, are not likely to be fully realized in four years. Evaluation of the program must therefore assess progress toward the steady-state goals. From the inception of the program, we will maintain a database of enrollment and student outcome data for students entering the MSEEM program. Application, admission, graduation, and post-graduate placement data will be collected. Lee College of Engineering and Department of Engineering Technology and Construction Management staff will track the progress of alumni and their satisfaction with their employment outcomes for up to five years after graduation, when possible, by using mailed or e-mailed surveys. Staff will encourage self-reporting for alumni over longer periods by creating a self-service alumni website that encourages graduates to submit their contact information and current employment information, network via online discussion, and contact other alumni.

Based on employment data supplied by graduates, staff will make contact with frequent employers of our graduates and initiate formal or informal surveys of employer satisfaction. Feedback from the ELET and MET Industrial Advisory Boards (IAB), as well as the ETCM combined IAB, concerning the program and its educational outcomes will be solicited.

Fourth year milestones are listed below.

1. During the fourth year of the proposed program, enrollment will be assessed to determine whether it is meeting projections. Equivalent full-time enrollment in the program should approach 27 to 33 by the fourth year.
2. The program should have produced 18 to 30 graduates by the fourth year of operation.
3. Educational program outcomes should be satisfactorily met for 85 percent of graduates.
4. A panel of external evaluators will visit the UNC Charlotte campus to assess the overall success of the program. The evaluation report prepared by the evaluators will be reviewed by the Department of Engineering Technology and Construction Management Chair, by the Dean of the College of Engineering, and by the Provost.
5. Necessary changes in the program will be implemented based on the review to ensure that program goals are achieved.

XIII. REPORTING REQUIREMENTS

Institutions will be expected to report on new program productivity as a part of the biennial low productivity program review process.

This proposal to establish a new degree program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor: Philip J. Dubson Date: 2/6/13

Attachments

A: Budget projections for the first four years of program operation (4 pages)

B: Representative supporting letters from industry partners (8 pages)

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM

INSTITUTION	UNC Charlotte	DATE	29-Jan-13
Program (CIP, Name, Level)	15.0503, Energy Management and Systems Technology, M		
Degree(s) to be Granted	Master of Science Applied Energy and Electromechanical Systems	Program Year	Year 1
Differential tuition requested per student per academic year	\$1,800		
Projected annual FTE students	15		27000
Projected annual differential tuition	\$27,000		

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Projected Differential Tuition	Enrollment Increase Funds	Other New Allocations (Grants/Contracts)	Total
EPA/SPA Regular Salaries					
Associate Professor (pos#xxx1)	\$ 90,000.00	\$ -	\$ -	\$ -	\$ 90,000.00
Technical Support Staff (Laboratory- pos#xxx2)		\$ -	\$ -	\$ -	\$ -
PT Staff	\$ 15,000.00	\$ 5,700.00	\$ -	\$ -	\$ 20,700.00
EPA Academic Salaries					
[title/number of position]	\$ -	\$ -	\$ -	\$ -	\$ -
Benefits (Social security, Retirement, Medical Insurance)	\$ 26,100.00	\$ -	\$ -	\$ -	\$ 26,100.00
Graduate Stipends	\$ -	\$ -	\$ -	\$ -	\$ -
[number of stipends - 2 FTE]	\$ 30,000.00		\$ -	\$ -	\$ 30,000.00
[stipends from grants/contracts -1 FTE]				\$ 15,000.00	\$ 15,000.00
Supplies and Materials		\$ 12,100.00	\$ -	\$ -	\$ 12,100.00
Current Services		\$ 1,750.00	\$ -	\$ -	\$ 1,750.00
Travel	\$ 1,300.00	\$ 3,400.00	\$ -	\$ -	\$ 4,700.00
Communications		\$ 1,350.00	\$ -	\$ -	\$ 1,350.00
Printing and Binding		\$ 450.00	\$ -	\$ -	\$ 450.00
Advertising	\$ 2,200.00		\$ -	\$ -	\$ 2,200.00
Space Rental/Building Lease	\$ -	\$ -	\$ -	\$ -	\$ -
Fixed Charges		\$ 2,250.00	\$ -	\$ -	\$ 2,250.00
Software	\$ -	\$ -	\$ -	\$ -	\$ -
Libraries*(Costs covered by EPIC budget allocation)		\$ -	\$ -	\$ -	\$ -
TOTAL ADDITIONAL COSTS	\$ 164,600.00	\$ 27,000.00	\$ -	\$ 15,000.00	\$ 206,600.00

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM

INSTITUTION	UNC Charlotte	DATE	29-Jan-13
Program (CIP, Name, Level)	15.0503, Energy Management and Systems Technology, M		
Degree(s) to be Granted	Master of Science Applied Energy and Electromechanical Systems	Program Year	Year 2
Differential tuition requested per student per academic year	\$1,800		
Projected annual FTE students	22		
Projected annual differential tuition	\$39,600		

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Projected Differential Tuition	Enrollment Increase Funds	Other New Allocations (Grants/Contracts)	Total
EPA/SPA Regular Salaries					
Associate Professor (pos#xxx1)	\$ 90,000.00	\$ -	\$ -	\$ -	\$ 90,000.00
Assistant Professor (pos#xxx3)	\$ 85,000.00	\$ -	\$ -	\$ -	\$ 85,000.00
Technical Support Staff (Laboratory- pos#xxx2)	\$ 51,000.00		\$ -	\$ -	\$ 51,000.00
PT Staff		\$ 8,300.00	\$ -	\$ -	\$ 8,300.00
EPA Academic Salaries					
[title/number of position]	\$ -	\$ -	\$ -	\$ -	\$ -
Benefits (Social security, Retirement, Medical Insurance)	\$ 65,540.00	\$ -	\$ -	\$ -	\$ 65,540.00
Graduate Stipends	\$ -	\$ -	\$ -	\$ -	\$ -
[number of stipends - 2.5 FTE]	\$ 37,500.00		\$ -	\$ -	\$ 37,500.00
[stipends from grants/contracts - 1 FTE]				\$ 15,000.00	\$ 15,000.00
Supplies and Materials		\$ 15,000.00	\$ -	\$ -	\$ 15,000.00
Current Services		\$ 1,800.00	\$ -	\$ -	\$ 1,800.00
Travel		\$ 6,600.00	\$ -	\$ -	\$ 6,600.00
Communications		\$ 2,050.00	\$ -	\$ -	\$ 2,050.00
Printing and Binding		\$ 850.00	\$ -	\$ -	\$ 850.00
Advertising		\$ 2,650.00	\$ -	\$ -	\$ 2,650.00
Space Rental/Building Lease	\$ -	\$ -	\$ -	\$ -	\$ -
Fixed Charges		\$ 2,350.00	\$ -	\$ -	\$ 2,350.00
Software	\$ -	\$ -	\$ -	\$ -	\$ -
Libraries*(Costs covered by EPIC budget allocation)		\$ -	\$ -	\$ -	\$ -
TOTAL ADDITIONAL COSTS	\$ 329,040.00	\$ 39,600.00	\$ -	\$ 15,000.00	\$ 383,640.00

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM

INSTITUTION	UNC Charlotte	DATE	29-Jan-13
Program (CIP, Name, Level)	15.0503, Energy Management and Systems Technology, M		
Degree(s) to be Granted	Master of Science Applied Energy and Electromechanical Systems	Program Year	Year 3
Differential tuition requested per student per academic year	\$1,800		
Projected annual FTE students	25		
Projected annual differential tuition	\$45,000		

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Projected Differential Tuition	Enrollment Increase Funds	Other New Allocations (Grants/Contracts)	Total
EPA/SPA Regular Salaries					
Associate Professor (pos#xxx1)	\$ 90,000.00	\$ -	\$ -	\$ -	\$ 90,000.00
Assistant Professor (pos#xxx3)	\$ 85,000.00	\$ -	\$ -	\$ -	\$ 85,000.00
Associate Professor (pos#xxx4)	\$ 91,000.00	\$ -	\$ -	\$ -	\$ 91,000.00
Technical Support Staff (Laboratory- pos#xxx2)	\$ 51,000.00		\$ -	\$ -	\$ 51,000.00
PT Staff		\$ 9,500.00	\$ -	\$ -	\$ 9,500.00
EPA Academic Salaries					
[title/number of position]	\$ -	\$ -	\$ -	\$ -	\$ -
Benefits (Social security, Retirement, Medical Insurance)	\$ 91,930.00	\$ -	\$ -	\$ -	\$ 91,930.00
Graduate Stipends	\$ -	\$ -	\$ -	\$ -	\$ -
[number of stipends - 2.5 FTE]	\$ 37,500.00		\$ -	\$ -	\$ 37,500.00
[stipends from grants/contracts- 1 FTE]				\$ 15,000.00	\$ 15,000.00
Supplies and Materials		\$ 17,250.00	\$ -	\$ -	\$ 17,250.00
Current Services		\$ 2,200.00	\$ -	\$ -	\$ 2,200.00
Travel		\$ 7,500.00	\$ -	\$ -	\$ 7,500.00
Communications		\$ 2,625.00	\$ -	\$ -	\$ 2,625.00
Printing and Binding		\$ 925.00	\$ -	\$ -	\$ 925.00
Advertising		\$ 2,650.00	\$ -	\$ -	\$ 2,650.00
Space Rental/Building Lease	\$ -	\$ -	\$ -	\$ -	\$ -
Fixed Charges		\$ 2,350.00	\$ -	\$ -	\$ 2,350.00
Software	\$ -	\$ -	\$ -	\$ -	\$ -
Libraries*(Costs covered by EPIC budget allocation)		\$ -	\$ -	\$ -	\$ -
TOTAL ADDITIONAL COSTS	\$ 446,430.00	\$ 45,000.00	\$ -	\$ 15,000.00	\$ 506,430.00

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM

INSTITUTION	UNC Charlotte	DATE	29-Jan-13
Program (CIP, Name, Level)	15.0503, Energy Management and Systems Technology, M		
Degree(s) to be Granted	Master of Science Applied Energy and Electromechanical Systems	Program Year	Year 4
Differential tuition requested per student per academic year	\$1,800		
Projected annual FTE students	29		
Projected annual differential tuition	\$52,200		

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Projected Differential Tuition	Enrollment Increase Funds	Other New Allocations (Grants/Contracts)	Total
EPA/SPA Regular Salaries					
Associate Professor (pos#xxx1)	\$ 90,000.00	\$ -	\$ -	\$ -	\$ 90,000.00
Assistant Professor (pos#xxx3)	\$ 85,000.00	\$ -	\$ -	\$ -	\$ 85,000.00
Associate Professor (pos#xxx4)	\$ 92,000.00	\$ -	\$ -	\$ -	\$ 92,000.00
Technical Support Staff (Laboratory- pos#xxx2)	\$ 51,000.00		\$ -	\$ -	\$ 51,000.00
PT Staff	\$ 13,000.00	\$ 13,000.00	\$ -	\$ -	\$ 26,000.00
EPA Academic Salaries		\$ -			
[title/number of position]	\$ -	\$ -	\$ -	\$ -	\$ -
Benefits (Social security, Retirement, Medical Insurance)	\$ 92,220.00	\$ -	\$ -	\$ -	\$ 92,220.00
Graduate Stipends	\$ -		\$ -	\$ -	\$ -
[number of stipends - 5 FTE]	\$ 75,000.00		\$ -	\$ -	\$ 75,000.00
[stipends from grants/contracts-2.5FTE]				\$ 37,500.00	\$ 37,500.00
Supplies and Materials	\$ 6,000.00	\$ 22,500.00	\$ -	\$ -	\$ 28,500.00
Current Services		\$ 2,250.00	\$ -	\$ -	\$ 2,250.00
Travel	\$ 1,500.00	\$ 8,400.00	\$ -	\$ -	\$ 9,900.00
Communications		\$ 2,625.00	\$ -	\$ -	\$ 2,625.00
Printing and Binding		\$ 925.00	\$ -	\$ -	\$ 925.00
Advertising	\$ 2,900.00		\$ -	\$ -	\$ 2,900.00
Space Rental/Building Lease	\$ -	\$ -	\$ -	\$ -	\$ -
Fixed Charges		\$ 2,500.00	\$ -	\$ -	\$ 2,500.00
Software	\$ -	\$ -	\$ -	\$ -	\$ -
Libraries*(Costs covered by EPIC budget		\$ -	\$ -	\$ -	\$ -
TOTAL ADDITIONAL COSTS	\$ 508,620.00	\$ 52,200.00	\$ -	\$ 37,500.00	\$ 598,320.00



January 11, 2013

Anthony L. Brizendine, PhD, PE
308 Duke Centennial Hall
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

On behalf of Shaw's Power Group, I would like to express support for your proposal to develop the Master of Science in Applied Energy & Electro-mechanical Systems (MSEEM) degree program in The William States Lee College of Engineering at UNC Charlotte. This interdisciplinary program will provide a valuable educational choice for many energy professionals in the region and state.

Shaw recognizes the value of the proposed MSEEM program. The Energy Production and Infrastructure Center (EPIC) at UNC Charlotte was formed in response to the need from industry to supply highly trained engineers qualified to meet the demands of the energy industry through traditional and continuing education. EPIC is a highly collaborative industry/education partnership that produces a technical workforce, and advancements in technology for the global energy industry while supporting North Carolina's economic development and energy security. Shaw is one of the founding members of the industry group that worked to develop the EPIC program, and we believe that the MSEEM program is an important component of this initiative.

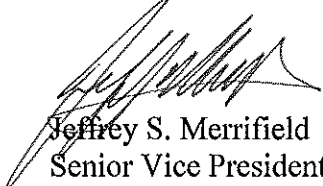
We and our counterparts in the energy industry recognize that the industry faces a workforce crisis just as there is a need to build new energy facilities. UNC Charlotte has a history of supplying professional talent to energy and engineering firms. An ample supply of well-trained energy professionals is important for the continued economic development of this industry sector. To date, UNC Charlotte has established concentrations in the undergraduate programs in several engineering degree programs as part of the EPIC initiative. The proposed MSEEM degree takes these efforts to the next level by providing a technical education path at the Masters level for both graduating seniors and working professionals looking to upgrade their credentials and expertise.

Currently, Shaw has over 1,100 employees at our headquarters in Charlotte, and due to our projected growth, retirements, and replacements to our workforce we will have a continued and meaningful need for qualified graduates from the EPIC program. Additionally, we would expect to hire graduates of the proposed MSEEM program if it were to be approved. Furthermore, we also anticipate (and likely

encourage) that our current employees will access this program for continuing professional growth and career advancement.

Shaw's Power Group has benefited from the employment of graduates of The William States Lee College of Engineering for many years. On behalf of our entire team here in Charlotte, I thank you for your progressive planning to prepare future energy professionals for North Carolina and our nation.

Sincerely yours,



Jeffrey S. Merrifield
Senior Vice President
Shaw's Power Group



Thomas G. Franch
Senior Vice President
Reactors & Services
North America

January 2, 2013
UNC/TGF/010213

Anthony L. Brizendine, PhD, PE
308 Duke Centennial Hall
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

I would like to express support for your proposal to develop the Master of Science in Applied Energy & Electro-mechanical Systems (MSEEM) degree program in The William States Lee College of Engineering at UNC Charlotte. This interdisciplinary program will provide a valuable educational choice for many energy professionals in the region and state.

AREVA Inc. recognizes the value of the proposed MSEEM program. The Energy Production and Infrastructure Center (EPIC) at UNC Charlotte was formed in response to the need from industry to supply highly trained engineers qualified to meet the demands of the energy industry through traditional and continuing education. EPIC is a highly collaborative industry/education partnership that produces a technical workforce, and advancements in technology for the global energy industry. The MSEEM program is an important component of the EPIC initiative.

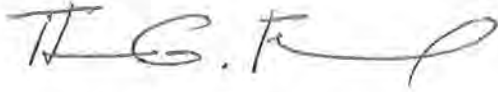
The energy industry recognizes that the industry faces a workforce crisis just as there is a need to build new energy facilities. UNC Charlotte has a history of supplying professional talent to energy and engineering firms. An ample supply of well-trained energy professionals is important for the continued economic development of this industry sector. To date, UNC Charlotte has established concentrations in the undergraduate programs in several engineering degree programs as part of the EPIC initiative. The proposed MSEEM degree takes these efforts to the next level by providing a technical education path at the Masters level for both graduating seniors and working professionals looking to upgrade their credentials and expertise.

Our company will likely hire an additional 250 engineers over the next 5 years at all of our locations, and the MSEEM program can contribute to our ability to meet our needs. This program will also likely provide an important lateral entry to the energy industry for other engineering professionals and it will benefit our current employees by providing continuing professional development.

AREVA INC.

AREVA Inc. has benefited from the employment of graduates of The William States Lee College of Engineering for many years. On behalf of AREVA Inc., I thank you for your progressive planning to prepare future energy professionals for North Carolina and our nation.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'T.G. Franch'. The signature is fluid and cursive, with a large, sweeping flourish at the end.

Thomas G. Franch
Senior Vice President
Reactors & Services – North America



January 28, 2013

Anthony L. Brizendine
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

On behalf of Siemens Energy, I am writing to commend your proposal to develop a new degree program at the Master's level in Applied Energy & Electro-mechanical Systems at UNC Charlotte. This program will provide an excellent addition and alternative to more traditional programming at UNC Charlotte. Siemens' experience with your interdisciplinary Senior Design program gives us great confidence in your team's ability to delivery this unique, interdisciplinary curriculum.

We certainly recognize that The William States Lee College of Engineering produces outstanding engineers, and we believe this program meets another key need in the profession by extending the undergraduate energy concentrations and interdisciplinary work in senior design at UNC Charlotte to the graduate level. These innovative and advanced education options with leading edge interdisciplinary knowledge are key to the global competitiveness and economic development of the state.

Again, I thank you for your progressive planning to provide both future and current engineering professionals with interdisciplinary education options. This program will improve the workforce for North Carolina and our nation by producing graduates with state-of-the-art knowledge and skills.

Sincerely yours,

Joseph S. Zabrecky
Manager
Steam Turbine Engineering

John L. Hall
Manager
Steam Turbine Technical Services Manufacturing



101 Siemens Avenue
Charlotte, NC 28273



MACLEAN POWER SYSTEMS

A MacLean-Fogg Company

January 22, 2013

Anthony L. Brizendine
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

I am writing to express support for UNC Charlotte's proposal to develop a Master of Science in Applied Energy and Electro-mechanical Systems (MSEEM) degree. This program will serve as an important source of energy professionals for MacLean Power Systems and other energy sector companies in the Charlotte region.

MacLean Power Systems has worked with the College of Engineering for the last two years by sponsoring Senior Capstone design projects for students. Throughout this successful collaboration, I and my colleagues at MacLean Power Systems have been very impressed with the quality of students graduating from UNC Charlotte's College of Engineering. We have hired exceptional students from UNC Charlotte's College of Engineering. We look forward to continued collaborations in the future.

The energy sector is a large and growing component of North Carolina's economy, and a steady supply of current and knowledgeable energy professionals is essential to keep the energy workforce healthy and growing. MacLean Power Systems looks forward to taking advantage of a new supply of more highly trained energy professionals from the proposed MSEES program.

MacLean Power Systems supports the UNC Charlotte College of Engineering, and appreciates your efforts to provide high quality energy professionals for the workforce of today and, with the proposed MSEES program, the workforce of tomorrow.

Sincerely,

Shane Nazworth
Engineering Director - Insulation & Protection
MacLean Power Systems

January 22, 2013

Anthony L. Brizendine
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

On behalf of CoaLogix, I want to express support for UNC Charlotte's proposal to develop a Master of Science in Applied Energy and Electro-mechanical Systems (MSEEM) degree. I expect this program will serve as a valuable source of energy professionals for CoaLogix and other energy sector companies in the southeast.

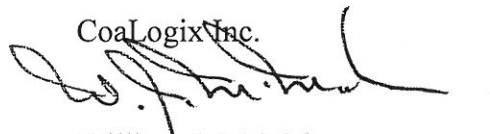
CoaLogix has sponsored senior design projects for students in the College of Engineering for several years. The Senior Design Expo presents an outstanding display of student work, and we at CoaLogix have been pleased and impressed with the quality of the instruction and the level of design work being done by the students in UNC Charlotte's College of Engineering.

Charlotte has grown into a vital energy sector hub which serves as an important component of North Carolina's economy. A steady supply of current and knowledgeable energy professionals is essential to keep the energy workforce healthy and growing. For decades, UNC Charlotte has provided well-trained graduates to energy and engineering firms throughout the region. CoaLogix looks forward to taking advantage of a new supply of more highly trained energy professionals from the proposed MSEES program.

CoaLogix supports the UNC Charlotte College of Engineering, and in particular, the proposed Master of Science in Applied Energy and Electro-mechanical Systems degree. We appreciate your efforts to provide high quality energy professionals for CoaLogix and Charlotte's growing energy sector.

Sincerely,

CoaLogix Inc.



William J. McMahon
President & CEO

WJM/jas



United Mechanical Corporation

The Leader in Comfort and Process Mechanical Solutions

January 23, 2013

Dr. Anthony L. Brizendine, PhD, PE
William States Lee College of Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Subject: MS Applied Energy and Electromechanical Systems

Dear Tony:

It is with enthusiasm that we learn more details about the proposed Master's program in Applied Energy and Electromechanical Systems. United Mechanical has found that both commercial and industrial facilities are continuing to increase their emphasis on the efficient utilization of energy in their facilities and their processes. The LEED certification process is playing an important part in the development of new facilities and the continuing operation of existing facilities.

Professionals with expertise in the fundamental engineering sciences will play an ever increasing role in the design and management of facilities and processes. This program will provide the needed additional training that will allow the graduates to support commercial developers as they strive to achieve additional energy conservation measures.

Additionally, our region includes industrial plants with a wide variety of unique manufacturing processes. The engineers involved with these plants continue to face many challenges as they implement additional innovative energy solutions. The graduates of the Master's program in Applied Energy and Electromechanical Systems will be uniquely qualified to address many of these challenges.

The graduates of all programs in the College of Engineering at UNCC continue to make significant contributions to the economic development of our region and state. The entire workforce in our region benefits from these contributions.

In conclusion, we look forward to the initiation of the college's new program and the contributions it will make.

Very truly yours,

David A. Brown. P.E.
Chairman

DESIGN/INSTALL

*Comfort Htg & Cooling
Process Htg & Cooling
Chillers & Boilers
Evaporative Cooling
Precise Temp Control
Humidity Control
Dust Collection
Air Purification
Ventilation Systems
Pneumatic Conveyance
Compressed Air
Piping Systems
Data Centers
Clean Rooms*

SERVICE

*Planned Maintenance
Emergency Repair
System Renovation
Air Balancing
Water Balancing
Equipment Start Up
Water Treatment
Building Commissioning*

ENGINEERING

*Professional Engineering
Preliminary Designs
Project Budgets
Energy Studies
Design Drawings*

CONTROLS

*Building Automation
Controls Retrofits
Pneumatic Controls*



AUTHORIZED CONTROLS INTEGRATOR

Appendix C: MS Applied Energy & Electromechanical Systems

2811 Central Avenue
Charlotte, NC 28205
704/374-1857
FAX 704/358-0747