APPENDIX A

UNIVERSITY OF NORTH CAROLINA

NOTIFICATION OF INTENT TO PLAN
A NEW BACCALAUREATE OR MASTER'S PROGRAM

THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for an institution to make the case for need and demand and for its ability to offer a quality program. This notification and planning activity to follow do not guarantee that authorization to establish will be granted.

Date: ___Nov. 5, 2010_________

Constituent Institution: _____North Carolina State University_________________________

CIP Discipline Specialty Title: _______________________________ Engineering, Other_____

CIP Discipline Specialty Number: ________14.99.99____ Level: B _______ M ___X___ I _______

Exact Title of the Proposed Program ______MS in Electric Power Systems Engineering____________________________________________

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S.): _________M.S. EPSE_____________

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

a. Is it at a more advanced level than those previously authorized?   Yes _____  No _____

b. Is the proposed program in a new discipline division?   Yes _____  No __x___

Approximate date for submitting the Request to Establish proposal (must be within one year of the date of submission of notification of intent to plan):

Cuncurrent____________________

Proposed date to establish degree: month _____July______ year _______ 2011_______ (Date can be no sooner than six months after the date of notification of intent to plan and must allow at least three months for review of the request to establish, once submitted.)

1. Describe the proposed new degree program. The description should include:
   a. a brief description of the program and a statement of educational objectives
   b. the relationship of the proposed new program to the institutional mission and how the program fits into the institution's strategic plan and its response to UNC Tomorrow
   c. the relationship of the proposed new program to other existing programs at the institution
   d. special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program.

   a. A brief description of the program and a statement of educational objectives.
The proposed program is a Master of Science in Electric Power Systems Engineering (MS-EPSE) to be offered through Electrical and Computer Engineering department. The program consists of 9 courses (27 credit hours) and a Capstone research project (3 credit hours – non-thesis).

The MS-EPSE program at NC State University will be the flagship electric power sector career preparatory academic degree program. The degree will be suitable for a new or recent graduate, as well as experienced professionals who want to receive the necessary retraining to change careers. The Department of Energy (DOE) has identified a need for this academic degree program, as the program addresses two of the urgent workforce development needs DOE has identified for the electric power sector: (i) to train power engineers who can replace a large population of seasoned engineers who will likely retire over the next five years, and (ii) to provide the new skills that the new power engineers will need in order to transform the current electric grid to a “smart grid”. In April 2010, DOE awarded NC State University a three year grant to facilitate the development and delivery of this program.

The MS-EPSE is an innovative program which will provide students with a thorough understanding of the tools, methods, and practice of electric power engineering. It will be both focused and practical in its orientation, with the goal of providing an education that is directly applicable to a career in the power industry. The program will provide a comprehensive coverage of engineering skills on electric power engineering as well as professional skills. Table 1 shows the proposed curriculum. As the table indicates, the MS-EPSE program will:

- Be comprehensive, covering both the core power engineering topics as well as the new cross-disciplinary courses for smart grid applications.
- Provide the requisite professional training through an interdisciplinary curriculum that will include modules on risk management, communication skills, project management, engineering economics, and technical writing.
- Provide hands-on training on both power systems and smart grid technologies.
- Be an intensive program, designed for training a population with a diverse background in a short time of 10 months.

The proposed MS-EPSE program has been approved by the Council of Graduate Schools to satisfy the Professional Science Master (PSM) requirements. Encompassing the PSM scope, MS-EPSE will offer students the opportunity to earn a unique professional degree that is grounded in science and also develops professional skills through activities / coursework that are highly valued by employers and fully prepare them to progress towards leadership roles.

Table 1: MS - Electric Power Systems Engineering Curriculum
### Summer Semester

**ECE 592-x1: Fundamentals of Electric Power Systems – Lukic (lead faculty)**
- M1: AC circuit analysis, real and reactive power
- M2: Magnetic fields and Faraday’s law, transformers
- M3: Electromechanical energy conversion and electric machines
- M4: Power transmission lines
Lab: Energy conversion lab

### Fall Semester

**ECE 550: Power System Operation and Control - Baran**
- M1: Power system modeling & power flow analysis
- M2: Automatic generation control and economic dispatch
- M3: Voltage regulation
- M4: System stability
Lab: System Operation and Control – Baran/Roberts (Progress Energy)

**ECE 534: Power Electronics & Utility Applications - Bhattacharya**
- M1: Power electronics fundamentals - Huang
- M2: Three-phase converters - Bhattacharya
- M3: Utility applications: FACTS - Bhattacharya
Proj: Power Electronics Applications - Huang/Bhattacharya

**ECE 592-07: Electric Power Generation: Conventional and Renewable - Baran**
- M1: Thermal & hydro power plants – Corson (MAE)
- M2: Wind and photovoltaic systems – Enslin (Quanta)
- M3: Environmental impacts – DeCarolis (CCEE)

**ECE 592-x2: Power Engineering Practicum - TF**
- M1: Project management – Bergey (CM)
- M2: Communication skills – Covington (CHASS)
- M3: Technical writing - Covington (CHASS)
- M4: Project plan development - TF/Bergey

**ECE 592-16: The Business of the Electric Utility Industry - TF**
- M1: History, structure, and business models
- M2: Regulations and standards
- M3: Engineering economics – Brown (Quanta)
- M4: Utility ratemaking
- M5: Policy and emerging issues
In the MS-EPSE program, each course will include a structured set of modules that will be taught primarily by faculty, but some of the modules will be taught by industry professionals who have expertise on the modules. A direct benefit associated with utilizing this curriculum model is the close interaction students will have with industry professionals. Graduates will learn about current and emerging technologies and how they are implemented within the power industry by hearing firsthand from professionals within the power field.
The *educational objectives* are as follows:

- Provide the knowledge and training that future electric power system engineers will need for creating the next generation of smart grid systems.
- Identify and fill key gaps in electric power engineering education.
- Develop a comprehensive accelerated 10 month MS-EPSE program that will cover core power engineering topics and also include new cross-disciplinary courses for smart grid applications.
- Structure a curriculum around having a systems focus, by emphasizing how a system component is related to the overall power system operation and management, rather than an in-depth focus on a component / subject.
- Provide professional training through an interdisciplinary curriculum that will include modules on risk management, communication skills, project management, engineering economics, and technical writing.
- Provide industry exposure and experience to students by getting experts from industry involved in teaching as well as the capstone project activities.
- During the first three years of operation train and graduate three cohorts of students; 20 the first year, 30 the second year, and 30 the third year.

b. The relationship of the proposed new program to the institutional mission and how the program fits into the institution’s strategic plan and its response to UNC Tomorrow

The MS-EPSE program will support recommendations 4.1.1, 4.1.2, 4.1.3 and 4.4.1 of the UNC Tomorrow Commission. It is also strategically in line with the following elements of NC State’s mission statement: “Innovative learning environment;” emphasis on “mastery of fundamentals, intellectual discipline, creativity and responsibility;” enhancement of NC State’s “historic strengths in science and engineering;” and providing “leadership for intellectual, cultural, social, economic, and technological development within the state, the nation, and the world.” The MS-EPSE program fits into the institutions strategic plan by “building research and graduate and professional programs aggressively in proven and emerging areas;” “strengthening our commitment to a broader, more comprehensive range of discipline, creativity, problem-solving, and responsibility;” “fostering innovation-driven economic development;” and “integrating global perspectives into our programs and functions.”

c. The relationship of the proposed new program to other existing programs at the institution

The new MS-EPSE program is fundamentally different from the current MS-EE program. This program is designed to provide comprehensive training for a career in a targeted sector – electric power sector. Hence, the curriculum consists of courses targeted for this specialization and all the courses will be mandatory. The program is different from MS-EE in three important ways. First, there will be seven technical courses providing a comprehensive coverage of engineering knowledge related to the electric power engineering (ECE 550, ECE 534, ECE 592-07, ECE 592-14,
The current MS-EE program on the other hand provides a broader education by encouraging both depth and breadth. Second, the new program being a PSM program will also provide professional skills training though another set of mandatory courses specifically developed for this degree (ECE592-16, ECE592-x2). The courses for professional skills will be developed by faculty from College of Management and the College of Humanities Arts and Social Sciences to provide knowledge and skills on engineering economics, project management, technical writing and risk management. Finally, all the courses will include several modules that will be taught by both faculty and industry professionals. This approach will provide students with a unique experience, since they will have the opportunity to interact with professionals from companies such as ABB, Progress Energy, Quanta Technologies, etc.

d) Special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program

An integral part of the recently established FREEDM Systems Center’s mission is to recruit and train the next generation of engineers for electric power industry. The Center provides support for a new faculty member and administrative support for the development of college education programs related to electric power and energy systems engineering. Within the last two years, the Center has facilitated expanding the course offerings in the ECE department related to electric power and energy systems, and helped to establish a certificate program focusing on renewable electric energy systems. The Center has also provided a unique environment to attract faculty and industry expertise needed for undertaking such a program. Currently, there are five core faculty members in the ECE department with a primary focus on electric power and power electronics systems. There are also five other engineering faculty who work closely with the center and have agreed to contribute to this program to develop the interdisciplinary components. Furthermore, faculty support from College of Management and CHASS has been obtained to provide the courses on professional skills.

The MS-EPSE program will also draw heavily upon the close power industry ties that currently exist within the FREEDM Systems Center. At the present time the Center has 41 industry members who are each actively engaged in the research initiatives outlined within the Center’s strategic plan. Finally, the Center will provide facilities related to smart grid which will be unique in the nation. In June of 2010, the Center has moved into a new 20,000-square-foot space on the Centennial Campus inside the Keystone Science Center. The new building includes space for the following: offices, computer laboratory, library, and power electronics, energy storage, and motor drive laboratories, as well as a Real Time Digital Simulator lab and the 1MW FREEDM System demonstration hub, a modern distribution system with a large percentage of distributed generation and energy storage devices. This will provide students with a unique experience to work on real issues related to smart grid, solar, wind generation, energy storage, solid state transformer and other advanced energy technologies.
2. List all other public and private institutions of higher education in North Carolina currently operating programs similar to the proposed new degree program.

None

3. Estimate the number of students that would be enrolled in the program during the first year of operation: Full-Time _____20______ Part-Time _____0____

4. If there are plans to offer the program away from campus during the first year of operation:
   a. briefly describe these plans, including potential sites and possible method(s) of delivering instruction.

   No off campus sites are planned.

   b. indicate any similar programs being offered off-campus in North Carolina by other institutions (public or private)

   N/A

   c. estimate the number of students that would be enrolled in the program during the first year of operation: Full-Time _________ Part-Time __________

5. List the names, titles, e-mail addresses and telephone numbers of the person(s) responsible for planning the proposed program.

   Dr. Mesut Baran, FREEDM Systems Center College Education Program Director, Professor of Electrical Engineering, (919) 515-5081, baran@ncsu.edu.

   Lisbeth Borbye, Assistant Dean for Professional Education, Graduate School, Director UNC Professional Science Masters Initiative (919) 515-0322, lborbye@ncsu.edu

   Dr. Alex Huang, FREEDM Systems Center Director, Distinguished Professor of Electrical Engineering, (919) 513-7387, aqhuang@ncsu.edu

   Rogelio Sullivan, Associate Director of FREEDM, (919) 513-3330, rasulliv@ncsu.edu

This intent to plan a new program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor ________________________________

(Rev. 8/10)