

**DATE:** November 18, 2010

**SUBJECT:** The University of Tennessee, Knoxville: Ph.D. in Energy Science and Engineering

**ACTION RECOMMENDED:** Approval

**BACKGROUND INFORMATION:** In January 2010 the General Assembly of the State of Tennessee passed legislation authorizing the University of Tennessee to establish an academic unit of the University of Tennessee, Knoxville (UTK) for interdisciplinary research and graduate education in collaboration with the Oak Ridge National Laboratory (ORNL). The university and ORNL have signed a memorandum of understanding governing the new partnership in the establishment of the academic and research unit, known as the Center for Interdisciplinary Research and Graduate Education (CIRE). CIRE will bring together extensive and complementary resources at UTK and ORNL to increase science, technology, engineering, and mathematics (STEM) academic and research activities of national significance focused on energy-related science and engineering. CIRE will enhance collaborations between UTK and ORNL, increase the number of STEM doctoral graduates, advance multi-disciplinary research in energy-related science and engineering, and accelerate the translation of research results into beneficial technologies.

CIRE has developed and proposes to offer a new model for interdisciplinary Ph.D. programs in energy science and engineering. The new degree will provide breadth while preserving the depth and rigor of a research doctorate. Topical areas have been chosen to align with unique ORNL capabilities and programs. The Energy Science and Engineering (ESE) Ph.D. will be complemented by a concentration in ESE for students who prefer pursuing doctoral studies through existing UTK Ph.D. programs in engineering and the sciences. Both the ESE degree and its six specialty areas will include an emphasis on entrepreneurship and innovation, including opportunities for interested students to develop and implement business plans with the UTK business school.

Two external consultants in the field have conducted proposal evaluation and site visits. The first consultant, Dr. Phillip A. Parrish, Associate Vice President for Research, University of Virginia, completed a review November 1-2, 2010. Dr. Parrish found the interdisciplinary Ph.D. in ESE program initiative between UTK and ORNL “well conceived and planned and . . . on the path towards successful start-up. The investment by the State of Tennessee in this program highly leverages existing resources and programs at both UTK and at ORNL, and is a significant value to the State’s taxpayers.”

The second consultant, Dr. Marilyn Brown, Professor of Public Policy, Georgia Tech, will conduct a proposal evaluation and site visit November 15-16, 2010.

Depending on the outcome of Dr. Brown's evaluation and UTK's proposal revision as a result of it, the final Ph.D. in ESE proposal may be distributed to the Commission at the November 18, 2010 meeting for its consideration. Should a delay be necessary, Dr. Richard Rhoda will consider program approval by interim action on behalf of the Commission at which time the proposal has met all THEC policy review requirements for establishing new academic degree programs. The UT Board of Trustees approved the Ph.D. in ESE at its October 21, 2010 meeting, with the understanding that THEC would entertain the proposal only after positive evaluation by consultants and necessary program revision.

#### **PROGRAM PROPOSAL SUMMARY:**

**Program Need.** The purpose of the proposed program is to advance interdisciplinary research in energy science and engineering, capitalize on university and ORNL research collaboration, produce graduates equipped for scholarship and innovation, and contribute to state economic development in the energy sciences. The CIRE Task Force conducted interviews with energy-related industries and university energy research and education centers to determine expectations for industry hires in energy science and engineering. Industry corporate leaders from Chevron, DuPont, Exxon Mobil, GE Global Research, and Siemens Energy were interviewed. Stanford, MIT, and the University of Southern California energy-related research and education centers sponsoring traditional Ph.D. programs were contacted as CIRE developed the proposed program. These interviews underscored the industry need for graduates prepared in an interdisciplinary, research-based energy science program. Graduates are expected to work in transformative energy research and development in government, national laboratories, universities, and to pursue entrepreneurial energy supply and management initiatives. There are no comparable energy science and engineering interdisciplinary doctorates in the U.S. delivered jointly with a national laboratory.

**Curriculum.** The 72 semester-hour post-baccalaureate doctoral program will require completion of a core curriculum, a knowledge breadth requirement, and a specialized concentration in one of the following six areas:

- Nuclear Energy
- Energy Conversion and Storage
- Bioenergy and Biofuels
- Renewable Energy – Solar, Wind, Hydro, Geothermal
- Environmental and Climate Sciences related to Energy
- Distributed Energy/Grid Management

**Faculty.** The program will not require new dedicated lines and will instead draw for joint appointments from the ranks of existing UTK faculty in the Colleges of Arts and Sciences, Engineering, and Agriculture and Natural Resources. Additionally, ORNL research personnel who meet UTK Graduate School and ESE faculty criteria will be affiliated with the program.

**Administrative Organization.** The Ph.D. in ESE will be administered by CIRE, with the support of an interdisciplinary CIRE Board of Directors and an External Advisory

Committee. The CIRE Executive Director will have responsibility for a program curriculum committee, a graduate coordinating committee, and a credentials committee.

**Program Size:** Highly prepared graduate students will be nationally recruited to compete for the twenty research assistantships available in year one. Students pursuing the ESE major and those pursuing ESE concentrations in other Ph.D. research programs will be eligible. The ESE program itself and ESE concentration areas in other affiliated Ph.D. degree majors is projected to generate 30 graduates per year by year six of program operation.

**Implementation.** The proposed start date for the program is August 2011.

**Cost.** The proposed ESE doctoral program has been developed as a close partnership between UTK and ORNL. Both institutions have committed resources to make this program a success, and in addition the Tennessee Legislature has appropriated \$6.2 million in one-time funds for program implementation. The university has provided existing faculty and space for program administration, students, and jointly-appointed faculty. The ORNL and UTK have assigned space in the Joint Institution for Computational Sciences for the administrative functions of CIRA at the national laboratory. First-year costs total \$1,155,900, with \$806,000 of this total in graduate student stipends and tuition and fees. Recurring administrative costs are projected at \$180,000 annually for partial salary and benefits to a program director and assistant director. The \$6.2 million start-up is projected to run through the first five years of program start-up and operation.

**Post-Approval Program Evaluation.** An annual performance review of the proposed program will be conducted for the first five years following approval. The review will be based on benchmarks established in the approved program proposal. At the end of this period, campus, governing board, and Commission staff will perform a summative evaluation. The benchmarks include, but are not limited to, enrollment and graduation, program cost, progress toward accreditation, library acquisitions, student performance, and others set by the institution and agreed upon by governing board and Commission staff. As a result of this evaluation, if benchmarks are not met during the monitoring period, the Commission may recommend that the governing board terminate the program. The Commission may choose to extend the period, if additional time is needed and requested by the governing board.