TENNESSEE HIGHER EDUCATION COMMISSION

REGULAR CALENDAR ITEM: II.D.

MEETING DATE: May 16, 2024

SUBJECT: New Academic Program
Tennessee Technological University
Nuclear Engineering, Bachelor of Science (BSNE)
CIP Code: 14.2301 (Nuclear Engineering

ITEM TYPE: Action

ACTION RECOMMENDATION: Approval

PROGRAM DESCRIPTION

Tennessee Technological University (TTU) proposes a 128-credit hour, Bachelor of Science (BSNE) in Nuclear Engineering. The proposed program was developed, in part, due to Governor Lee's commitment to the advancement of nuclear energy in Tennessee. The proposed program will teach students the principles of physics, chemistry, engineering-related mathematics, materials, mechanics, thermodynamics, and metallurgy. The program will also prepare students to contribute to the existing need for nuclear engineers trained at the baccalaureate level, and for an emerging need as Tennessee expands the nuclear development and manufacturing network.

The proposed program is designed to provide foundational knowledge to contribute to the nuclear energy industry and will focus on recruiting traditional high school students within Tennessee, alongside transfer students from regional community colleges and adult learners returning to school. Graduates will also excel in diverse career paths, using their engineering knowledge and professional skills to address complex problems and make positive impacts on society.

INSTITUTIONAL GOVERNING BOARD APPROVAL

The proposed Nuclear Engineering, BSNE program was approved by Tennessee Technological University Board of Trustees on March 7, 2024.

PROPOSED IMPLEMENTATION DATE

August 1, 2024

ALIGNMENT WITH STATE MASTER PLAN AND INSTITUTIONAL MISSION/STRATEGIC PLAN

The proposed program will assist in meeting Tennessee's Drive to 55 goals by providing a new degree program in an in-demand field that provides educational opportunities for students. The program will also provide graduates access to a high paying career, which will both increase family prosperity, and contribute to the Tennessee economy. Governor Lee's 2023 State of the State Address includes extensive investment in creating a nuclear development and manufacturing ecosystem. The proposed program will prepare graduates to enter this expanding field and provide access to high-paying jobs.

The proposed Nuclear Engineering, BSNE supports TTU's mission to "create, advance, and apply knowledge to expand opportunity and economic competitiveness." The proposed program is a STEM-infused curriculum, which will strengthen faculty and student research opportunities, advance state and regional

workforce development, enhance student success, foster community engagement, and promote sustainability. The program's learning outcomes each connect with TTU's mission and will be regularly reviewed by the Mechanical Engineering Department's External Advisory Board to ensure continued alignment.

CURRICULUM

The proposed program will consist of 128-credit hours of coursework and will be offered fully on-ground. The coursework will include 41-credit hours of general education requirements, 21-credit hours of math and science, and 66-credit hours of programming core and electives. Fifteen new courses will be developed for the proposed program.

Student learning outcomes follow the Accreditation Board for Engineering and Technology (ABET) guidelines, and point to several skills that graduates of the Nuclear Engineering program will possess by the time of their graduation, including:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PROGRAM PRODUCTIVITY

The Nuclear Engineering, BSNE program anticipates enrollment of 10 students in the first year and 47 students by year five. The proposed program anticipates graduating its first six (6) students in year four.

	2024-25	2025-6	2026-27	2027-28	2028-29
Enrollment	10	18	27	36	47
Graduates	--	--	--	6	8

PROGRAM DUPLICATION

The only other bachelor's degree in nuclear engineering offered in Tennessee is at the University of Tennessee, Knoxville.

STUDENT DEMAND

In February and March 2023, 265 students enrolled in TTU College of Engineering programs responded to a surveyed about their interest in the proposed program. Sixty-five percent of respondents (N=74) indicated

that they were extremely or very likely to have considered majoring in nuclear engineering if it had been available when they started at TTU. Furthermore, 43 percent indicated that they would consider nuclear engineering as a major now.

OPPORTUNITIES FOR PROGRAM GRADUATES

In 2021 the Center for Energy Workforce Development projected a need for 15,000 nuclear engineering employees by 2026. Further, small modular reactors have been recently approved by the United States Nuclear Regulatory Commission, which could signal a potential shift in developing and integrating next-generation power plants in the United States which will likely increase the demand for nuclear engineers. In addition, the United States Department of Energy has invested more than $600 million since 2014 to support small reactor concepts.

Letters of support for the Nuclear Engineering, BSNE were received from Spectra Tech Inc, Teledyne Brown Engineering, EchoWolf Solutions, Alex A. Beehler and Co., and General Atomics Electromagnetic Systems.

INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM

The Department of Mechanical Engineering at TTU currently has 17 faculty members, four (4) of which have transferable expertise in energy, thermal science, and fluid mechanics that will be utilized in teaching the curriculum of the proposed program. The program anticipates hiring a program director before the implementation of the program and plans to hire two (2) assistant professors and one (1) lecturer. Searches for tenure track faculty members will occur in the first and second year of program implementation, and a lecturer will be hired in the first year of program implementation.

Five (5) classroom spaces in Brown Hall will serve the program, in addition to faculty offices in the same building. Additional classroom space will be provided through the engineering building, slated for occupation in August 2024. Nine (9) existing labs, located in the Lab Science building, from the Department of Mechanical Engineering will be used for various aspects of the program.

The existing Mechanical Engineering External Advisory Board will be recruited to support the proposed program. Two (2) current members have expertise and background in Nuclear Engineering, and additional members from the nuclear industry will be added shortly.

EXTERNAL JUDGEMENT

An external review of the proposed program was conducted during a site visit on November 8, 2023 by Dr. Farzad Rahnema, Professor of Nuclear Engineering, Nuclear and Radiological Engineering, and Medical Physics Programs at Georgia Institute of Technology. The site visit included meetings with campus administrators and faculty from TTU, as well as current TTU students and industry partners.

Dr. Rahnema recommended approval of the proposed program, noting: "[t]he need for a new nuclear engineering program in Tennessee is motivated by several factors such as the positive public perception and employment opportunities in the State, Governor Lee's initiative for establishing a nuclear development and manufacturing ecosystem built for the future of Tennessee, the State's robust nuclear infrastructure (e.g., Oak Ridge National Laboratory, Tennessee Valley Authority, and the many other nuclear related companies in the State), and particularly the highly positive ME [mechanical engineering] students survey results indicating their interest in the nuclear engineering major."

ASSESSMENT AND POST-APPROVAL MONITORING

An annual performance review of the proposed program will be conducted for the first five (5) years following program approval. The review will be based on benchmarks established in the approved proposal.

At the end of this period, the campus, institutional governing board, and THEC staff will perform a summative evaluation. If benchmarks are not met during the monitoring period, the Commission may recommend that the institutional governing board terminate the program.

PROGRAM COSTS AND REVENUES

The proposed one-time and recurring expenditures for the Nuclear Engineering, BSNE program are listed in Table 1.

TABLE 1: ESTIMATED COSTS TO DELIVER THE PROPOSED PROGRAM

Estimated Costs to Deliver the Proposed Program						
One-Time Expenditures						
Category	**Planning**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Faculty & Instructional Staff (Faculty Lead)						
Accreditation						$9,700
Consultants	$8,000	$5,000	$5,000	$5,000	$5,000	$5,000
Equipment*****	$3,000,000					
Information Tech						
Library						
Marketing	$10,000	$2,000	$2,000	$2,000	$2,000	$2,000
Facilities						
Travel	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Other						
Total One-Time Expenditures	*$23,000*	*$12,000*	*$12,000*	*$12,000*	*$12,000*	*$21,700*
Recurring Expenditures						
Category	**Planning**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Faculty & Instructional Staff (Note 1)		$471,900	$629,057	$790,929	$814,657	$839,096
Non-instructional Staff (Note 2)						
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Tech						
Library						
Marketing						
Facilities						
Travel						
Other						
Total Recurring Expenditures	*$0*	*$471,900*	*$629,057*	*$790,929*	*$814,657*	*$839,096*

Grand Total (One-Time and Recurring)	**$23,000**	**$483,900**	**$641,057**	**$802,929**	**$826,657**	**$860,796**

***** Department of Education Congressional Direct one-time Grant obtained for this program. This covers cost for both equipment and IT (software). This is not included in the estimated cost.