

Tennessee Tech Internal Cover Form for Letters of Notification

Please refer to the TTU Office of the Provost website for New Programs and Program Modifications before developing a proposal. <https://www.tntech.edu/provost/new-programs>.

Name of New Academic Program and Degree Designation:

Nuclear Engineering, Bachelor of Science

Proposed Implementation Date: August 2024

Information Contact: Joseph C. Slater / 931-372-3172
Printed Name Telephone

APPROVED: *mohan d Rao* / 2/14/2023
Department Chairperson's Signature Date

APPROVED: *[Signature]* / 2/14/23
College Dean's Signature Date

APPROVED: *[Signature]* / 02/21/23
Provost's Signature Date

Tennessee Tech Board of Trustees Approval: N/A
Date



Office of the President

TENNESSEE TECH

February 17, 2023

Dr. Robert Smith
Interim Executive Director
Tennessee Higher Education Commission
312 Rosa Parks Ave, 9th Floor
Nashville, TN 37243

Dear Interim Executive Director Smith:

In accordance with THEC policy A 1.6 Expedited Academic Programs: Approval Process, Tennessee Tech University (TTU) submits an expedited letter of notification (ELON) for a new program in the Department of Mechanical Engineering in the College of Engineering. This proposed Bachelor of Science in Nuclear Engineering program will address the severe workforce shortage in nuclear engineering.

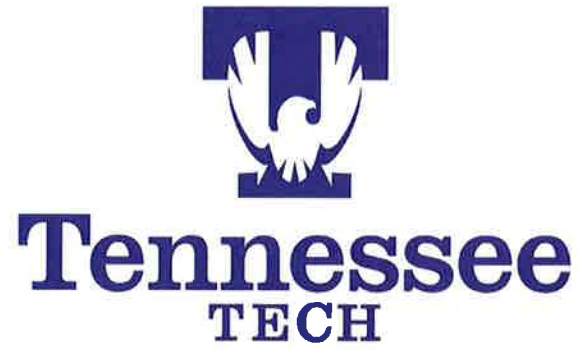
In Tennessee, there are four nuclear reactors that power homes and anchor local communities. Currently, across the United States, there are a total of 92 nuclear reactors. In 2022, the primary source of electricity was nuclear at a rate of 43.4%. In Tennessee, only 35 new nuclear engineering graduates entered the workforce in 2022. The average age of nuclear reactor engineers in the workforce is just over 50 years old. According to the U.S. Bureau of Labor Statistics, there are "about 700 openings for nuclear engineers each year, on average, over the decade." Many of these openings are projected to result from replacement workers who are expected to retire. These statistics demonstrate a clear need for a higher number of nuclear engineers in Tennessee and beyond.

In the 2023 State of the State Address, Governor Lee stated, "No other state in the country comes close to Tennessee's legacy, resources, and potential to be a leader in nuclear energy. And there is no long-term national strategy that doesn't include nuclear energy." Addressing this limitation, the Governor is investing extensively in establishing a nuclear development and manufacturing ecosystem built for the future of Tennessee. This endorsement from the Governor demonstrates that we need to develop new programs to facilitate workforce development in nuclear engineering. In addition, Congressman John Rose secured \$3,000,000 in federal funding in the current budget for startup costs for this program.

Please consider this letter a formal request for the expedited approval process.

Sincerely,

Philip B. Oldham
President



Expedited Letter of Notification

For the
Bachelor of Science
in
Nuclear Engineering Program

Submitted by
Tennessee Tech University

OVERVIEW

INSTITUTION NAME:	Tennessee Technological University
PROPOSED ACADEMIC PROGRAM:	Bachelor of Science in Nuclear Engineering
DEGREE DESIGNATION:	BSNE
CIP CODES:	14.2301
CIP CODE TITLES:	Nuclear Engineering
ACADEMIC PROGRAM LIAISON:	Dr. Joseph C. Slater, Dean College of Engineering 931-372-3172 j Slater@tntech.edu
IMPLEMENTATION TIMELINE:	
▪ Proposed date for the external site visit:	April 2023
▪ Estimated date of submission of ENAPP	August 2023
▪ Estimated date of submission of the external review report to THEC:	September 2023
▪ Estimated date of institution's response to external review:	October 2023
▪ Estimated timeline for proposed programs that will seek programmatic accreditation:	June 2029
▪ Proposed date of the institutional governing board's meeting to consider the proposed academic program for approval:	December 2023
▪ Proposed date of the THEC meeting to consider the proposed academic program for approval:	January 2024
▪ Proposed implementation date when students will enroll in the proposed academic program:	August 2024

Background

Provide a short narrative describing the circumstances that initiated the need and development of the proposed academic program.

The current production status of nuclear engineers in the United States is insufficient. In 2021 ASEE reports only 384 students graduated across the country in Nuclear Engineering, which is less than eight per state¹. Many Nuclear Engineering programs graduate in the single digits per year. So, while the U.S. produces a minimal number of nuclear engineers each year, a shortage is looming. According to the Nuclear Energy Institute, approximately 38% of nuclear energy industry workers are expected to retire in the next few years². National Labs, such as Oak Ridge National Lab, have great difficulty finding students with the requisite knowledge to fill roles in nuclear engineering positions.

Further, indications are that nuclear energy is on the cusp of another heyday, contrary to public sentiment. The former president of Green Peace, Patrick Moore, has stated that using nuclear power is critical to addressing fossil fuel dependence driving greenhouse gasses and climate change. He said: "I see it as a long-term technology that will continue to be perfected."³

Provide a general overview of the program, including a description of the academic program, total credit hours, target audience, purpose, program outcomes, delivery method (on-ground, online, hybrid, etc.), and any other pertinent information.

Tennessee Tech University proposes to initiate a Bachelor of Science in Nuclear Engineering (BSNE) program. Students in this program will apply the principles of physics, chemistry, and mathematics to study engineering topics, including statics, materials mechanics, machines, thermodynamics, and metallurgy. The knowledge gained in these areas is applied to understanding nuclear engineering topics, including reactor fluid mechanics and heat transfer, reactor physics, nuclear radiation measurement, radioactive waste management, and nuclear systems design. A B.S. in Nuclear Engineering will provide students with the foundational knowledge necessary to contribute to the nation's workforce.

In total, the BSNE program will consist of 128 hours of coursework and will be offered on-ground. Of these, 41 hours are assigned to general education, 21 hours are assigned to math and science, and the remaining 66 are assigned to programming core and electives.

Program Educational Objectives:

Graduates of the BSNE program will ...

- excel in diverse career paths, using their engineering knowledge and professional skills to address complex problems and make positive impacts on society.
- serve their profession and the public as ethical team members and leaders with awareness of modern issues, commitment to inclusive collaboration, and effective communication.

¹ <https://ira.asee.org/wp-content/uploads/2022/11/Engineering-and-Engineering-Technology-by-the-Numbers-2021.pdf>

² <https://www.power-eng.com/nuclear/addressing-the-age-gap-in-nuclear-power-generation/>

³ <https://www.wired.com/2007/11/co-founder-of-greenpeace-envisions-a-nuclear-future/>

- practice adaptive learning, expanding and enhancing their knowledge, creativity, and skills through professional development, continuing education, and/or earning advanced degrees.

Student Outcomes:

Students are expected to have the following skills upon completing the undergraduate degree program.

- The ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- The ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline.
- The ability to communicate effectively with a range of audiences.
- The 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.
- The 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.
- The ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- The ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Justification for Consideration of Expedited Policy

Provide clear evidence that the proposed program is in high demand in the region and in the state.

One of the goals of the THEC's State Master Plan is to "increase enrollment in majors leading to high-demand jobs." The proposed BSNE program supports this goal in several ways. There is a severe workforce shortage in Nuclear Engineering. Currently, 92 nuclear reactors in the United States power tens of millions of homes and anchor local communities, including the four in Tennessee⁴. In 2022, the primary source of electricity at 43.4% was nuclear⁵. Yet, in Tennessee, only 35 new nuclear engineering graduates entered the workforce in 2022⁶. The average age of nuclear reactor engineers in the workforce is just over 50 years. The U.S. Nuclear Regulatory Commission recently announced its approval of the designs for a first-of-its-kind small modular reactor (SMR)⁷. This could signal a potential shift in developing and integrating next-generation power plants in the U.S. These statistics demonstrate a clear need for a higher number of Nuclear Engineers in Tennessee and beyond.

⁴ <https://www.nei.org/resources/us-nuclear-plants>

⁵ <https://www.nei.org/CorporateSite/media/filefolder/resources/fact-sheets/state-fact-sheets/Tennessee-State-Fact-Sheet.pdf>

⁶ <https://registrar.utk.edu/commencement-overview/spring-2022-confirmed-degrees/tickle-college-of-engineering-2022-spring/>

⁷ <https://www.energy.gov/ne/articles/nrc-certifies-first-us-small-modular-reactor-design>

In the 2023 State of the State Address, Governor Lee stated, "No other state in the country comes close to Tennessee's legacy, resources, and potential to be a leader in nuclear energy. And there is no long-term national strategy that doesn't include nuclear energy."⁸ Addressing this limitation, the Governor is investing extensively in establishing a nuclear development and manufacturing ecosystem built for the future of Tennessee. This endorsement from the Governor demonstrates that we need to develop new programs to facilitate workforce development in Nuclear Engineering.

Existing Programs of Study at the Institution

If the proposed program is emerging from an existing minor or certificate program, provide the previous three years of enrollment and graduation data for the existing program.

The Tennessee Tech University College of Engineering offers eight programs with curricula leading to Bachelor of Science degrees in Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, General Engineering, Mechanical Engineering, Computer Science, and Engineering Technology. The undergraduate programs in Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, and Mechanical Engineering are accredited by the ABET Engineering Accreditation Commission. The Computer Science program is accredited by the ABET Computing Accreditation Commission. The Engineering Technology program is accredited by the ABET Engineering Technology Accreditation Commission. 2449 undergraduate students are currently in these programs across the college.

There are no existing minor or certificate programs in Nuclear Engineering at Tennessee Tech University. The only programs related to this area are B.S. in Chemical Engineering and B.S. in Mechanical Engineering, with a steady annual enrollment of approximately 200 and 700, respectively.

Community and Industry Partnerships

Provide a minimum of two letters of support from regional, community, and/or workforce partners in the ELON appendix. Letters should be dated and appear on letterhead.

Two letters of support from the industry are submitted in Appendix A of this letter of notification. These letters show support for the degree program from the regional workforce partners in Tennessee and beyond.

- Spectra Tech Inc, Oak Ridge, TN
- Teledyne Brown Engineering, Huntsville, AL

Accreditation

⁸ <https://www.tn.gov/governor/sots/2023-state-of-the-state-address.html>

If the proposed program has a programmatic accrediting agency, please describe plans, timeline, and associated costs to obtain accreditation.

The primary accrediting agency for all engineering programs is ABET. All undergraduate engineering, engineering technology, and computer science programs offered at Tennessee Tech University are accredited by ABET. This B.S. in Nuclear Engineering program will seek ABET accreditation in alignment with these programs.

Per ABET guidelines, the university must graduate at least one cohort from the program before seeking accreditation⁹. Considering that THEC approves the starting of this program in January 2024, a first-year class will be accepted in fall 2024, with anticipated graduation in spring 2028. An ABET Readiness Review document will be submitted in October 2028, following a self-study report in June 2029 and an on-site visit in September 2029. The current fee for initial program accreditation is \$8,000¹⁰.

Administrative Structure

Provide an organizational chart that includes the college, department, administrative unit, and program director for the proposed academic program.

The proposed B.S. in Nuclear Engineering program is intended to be housed in the Department of Mechanical Engineering within the College of Engineering, as presented in Figure 1. The administrative structure within the college is as follows: The Dean for the College of Engineering administers activities within the college, and the Chair of the Department of Mechanical Engineering administers activities within the department. The Department Chair will report to the College Dean. To aid in administrating the B.S. in Nuclear Engineering program, the Department of Mechanical Engineering will appoint a faculty member as a coordinator and allow release time from teaching to compensate for those responsibilities.

If a new academic department will be required for the proposed program, the THEC Academic Policy A1.3: New Academic Units must be followed and should be noted in this section. The request for a New Academic Unit must be submitted concurrently with the Expedited Letter of Notification.

A new academic department is not required to establish the B.S. in Nuclear Engineering. This program is intended to be housed in the existing Department of Mechanical Engineering within the College of Engineering at Tennessee Tech University.

⁹ <https://www.abet.org/accreditation/get-accredited/>

¹⁰ <https://www.abet.org/accreditation/cost-of-accreditation/>

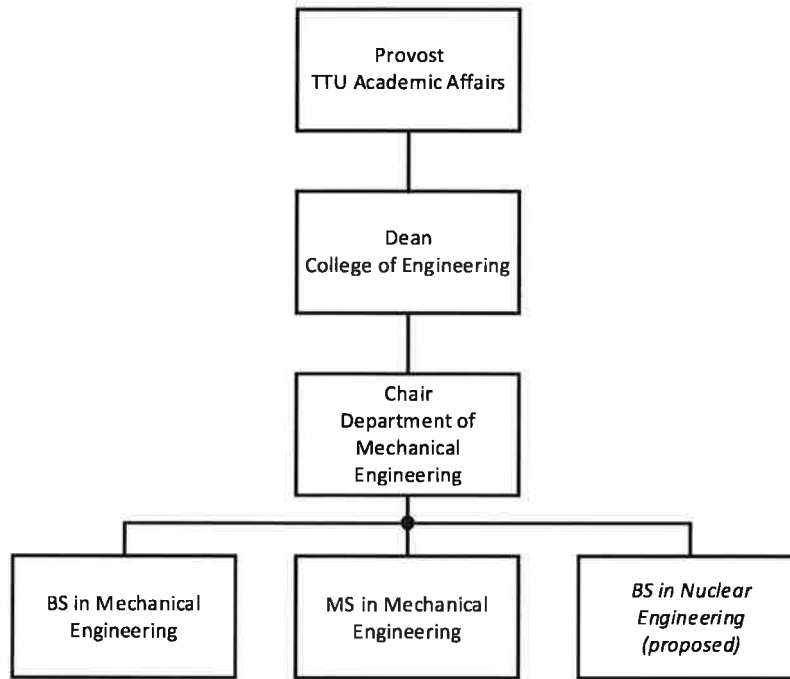


Figure 1: Administrative structure for the Nuclear Engineering program

Enrollment and Graduation Projections

Provide initial projections for the first five years of enrollment and graduates. Enrollment projections should be realistic and based on demonstrable student demand. Attrition calculations should be based on the average rates of similar programs or overall institutional attrition rates.

Before determining the projections required, the enrollment and graduation rates of similar programs, such as the B.S. in Mechanical Engineering, B.S. in Electrical Engineering, and B.S. in Chemical Engineering at Tennessee Tech University, were examined. The projected enrollment and graduation rates are presented in Table 1.

Table 1: Projected Enrollment and Graduation Rates

Year	Academic Year	Projected New Freshman	Projected Attrition	Projected Continuing Students	Projected Graduates
1	2024-25	10	2	8	-
2	2025-26	10	3	15	-
3	2026-27	12	3	24	-
4	2027-28	12	3	33	6
5	2028-29	14	4	37	8
6	2029-30	15	4	40	12

Institutional Alignment and Demand

Alignment with State Master Plan and Institutional Mission

Explain how the proposed program aligns with the THEC Master Plan and Institutional Mission State or Profile.

The program will address the following strategic initiatives:

- T.N. Reconnect – Drive to 55
- 2023 State of the State Address – Governor Lee
- Tennessee Technological University Institutional Mission

A 2017 T.N. Reconnect report indicated that over 900,000 Tennesseans have some college credit but no college degree. For the state of Tennessee to meet the Drive to 55 initiative, we must take every reasonable step to keep students progressing toward the degree. The BSNE Program will provide new program options for students while embracing TTU's Strategic Plan to be responsive to the needs of stakeholders.

In the 2023 State of the State Address, Governor Lee stated, "No other state in the country comes close to Tennessee's legacy, resources, and potential to be a leader in nuclear energy. And there is no long-term national strategy that doesn't include nuclear energy." Addressing this limitation, Governor Lee is investing extensively in establishing a nuclear development and manufacturing ecosystem built for the future of Tennessee. This endorsement from the Governor demonstrates that we need to develop new programs to facilitate workforce development in Nuclear Engineering. The BSNE program will address workforce initiatives by creating partnerships that engage industry leaders, workplace managers, and business executives. These partnerships will identify gaps in the workforce and shape the BSNE curriculum to provide innovative solutions to address the shortcomings.

Alignment with Tennessee Tech's Institutional Mission. The proposed BSNE program strongly supports Tennessee Tech University's mission: "Tennessee's technological university creates, advances, and applies knowledge to expand opportunity and economic competitiveness. As a STEM-infused, comprehensive institution, Tennessee Tech delivers enduring education, impactful research, and collaborative service." Aligning with the mission, the BSNE is a STEM degree with strength in nuclear and reactor physics, nuclear fuel cycles, nuclear system design, which supports Tennessee Tech's mission "as a STEM-infused" institution and a technological university.

Student Interest

Provide compelling evidence of student interest in the proposed program. Types of evidence vary and may include enrollment in related concentrations or minors; representative student and alumni surveys; and national, statewide, and professional employment forecasts and surveys.

Student Interest: Student interest and feedback were solicited from all undergraduate engineering students in the College of Engineering in the form of a survey. An overwhelming response was received from over 250 students with strong support for this program. The survey included vital questions to

ascertain if they would enroll in this program if offered and the significance of providing it at Tennessee Tech University.

1. If Nuclear Engineering had been available as a major when you started at TTU, how likely is it you would have considered it as a major?
Extremely Likely: 73 (29%)
Very Likely: 91 (36%)
2. If Nuclear Engineering is available as a major now, how likely is it you would have considered it as a major?
Extremely Likely: 44 (43%)
Very Likely: 82 (33%)
3. Considering that the majority of electricity generated in T.N. is from Nuclear sources, and there is only one undergraduate Nuclear Engineering program in the state, how important is it to have a B.S. degree in Nuclear Engineering at TTU?
Extremely Important: 140 (55%)
Very Important: 75 (30%)
4. Please include any feedback you like to provide on this program. *(only a few responses were included for brevity).*
 - I'd love to see this program!
 - I think this is an excellent idea. As the world is coming to terms with the costs of continuing to use massive amounts of fossil fuels, we are feverishly trying to find new ways to satisfy our energy demands. One of the best ways is nuclear. We need more people with the knowledge to design and create new and better reactors.
 - Coming from the Oak Ridge area, Nuclear Engineering would be sought after by many places out that way.
 - Always been my dream! Add this!!

Existing Programs Offered at Public and Private Tennessee Universities

List all academic programs with the same or similar CIP code offered at public and private universities in Tennessee along with the number of degrees awarded for the last three years of available data.

Per THEC Academic Program Inventory¹¹, only the University of Tennessee Knoxville (UTK) offers a B.S. in Nuclear Engineering program. The enrollment and degrees awarded for the last three years are presented in Table 2.

¹¹ <https://thec.ppr.tn.gov/THECSIS/Research/Research.aspx>

Table 2: Enrollment and Graduation Rates at other Universities

CIP Code	Degree	Major	University	2018-2019	2019-20	2020-21	2021-22
14.2301	B.S.	Nuclear Engineering	UTK				
Enrollment				205	194	195	198
Degrees Awarded				38	43	32	42

If there are current programs in Tennessee, provide a short narrative on how the proposed program will substantially differ from existing programs.

The proposed B.S. in Nuclear Engineering degree program at Tennessee Tech University will be housed and supported by the excellent faculty in the Department of Mechanical Engineering and the Center of Excellence in Energy Systems Research. The degree program will stress engineering science fundamentals and mathematics. The core curriculum will cover the basic principles of nuclear energy production, reactor systems design, and management of radioactive materials. Elective courses will be developed to permit students to broaden their education as desired.

All students in this program will be required to participate in appropriate experiential learning activities. These activities require students to go beyond mastering basic skills and knowledge in applying that material to problem-solving challenges. These activities involve collaboration and reflective learning and allow students to learn in an environment that aligns with their aptitudes. Examples of these activities that fulfill experiential learning include, but are not limited to, co-ops or internships, undergraduate research or design projects, participation in a design competition, study abroad programs, service learning projects, etc. The core curriculum and the experiential learning model distinguish the TTU Nuclear Engineering Program from the UTK Nuclear Engineering Program. Further, the course delivery will be accomplished through active learning strategies that lead to higher student engagement and promote better knowledge retention.

Articulation and Transfer

For proposed bachelor's programs, indicate all Tennessee Transfer Pathways (TTP) that may be acceptable for entry into the proposed program.

One primary Tennessee Transfer Pathway currently exist that would align with the proposed B.S. in Nuclear Engineering: A.S. in Mechanical Engineering

The A.S. in Mechanical Engineering is available at the following community colleges:

- Chattanooga State Community College
- Cleveland State Community College
- Columbia State Community College
- Jackson State Community College
- Motlow State Community College
- Nashville State Community College
- Northeast State Community College
- Roane State Community College
- Volunteer State Community College
- Walters State Community College

Indicate any additional community college or technical college programs that may be articulated for transfer into the proposed bachelor's program.

Tennessee Tech University does not anticipate articulating other transfer programs into the proposed bachelor's program. As the program grows, it would be an interest to explore further.



April 26, 2022

To Whom It May Concern:

This letter is being written in support of the establishment of a nuclear engineering program at Tennessee Technological University (Tennessee Tech). The resurgence and current interest in nuclear power and technology, coupled with the wave of retirements from the industry, has resulted in a dire need for well-trained nuclear engineers. Nuclear engineers work in a myriad of areas such as nuclear power, environmental cleanup, national security (weapons programs), engineering and design companies, equipment vendors, radiation sterilization, regulatory agencies, universities, research laboratories, and nuclear medicine. There is a shortage of nuclear engineers in every one of these areas, as evidenced by the many job openings and high salaries.

Tennessee Tech has a reputation for graduating engineers who are ready to go to work. The university provides their graduates with not only a strong academic foundation, but also practical training and a "can-do" attitude. No doubt they put out a great product!

As the President and owner of an engineering and environmental company that focuses on nuclear work, I believe that a nuclear engineering program at Tennessee Tech would be a great resource to our state and nation. I heartily support the effort to establish the nuclear engineering program and look forward to hiring some of the graduates.

Sincerely,

A handwritten signature in blue ink, appearing to read "Loong Yong", is written over a light blue horizontal line.

Loong Yong, Ph.D. (Nuclear Engineering)
President
Spectra Tech, Inc.
Oak Ridge, TN 37830



**TELEDYNE
BROWN ENGINEERING**
Everywhere you look™

Cummings Research Park
300 Sparkman Drive, NW
P.O. Box 070007
Huntsville, Alabama 35807-7007
256.726.1000

April 26, 2022

Dr. Terry Saltsman
Tennessee Tech
1 William L Jones Dr
Cookeville, TN 38505

Dear Dr. Terry Saltsman:

As a member of the Tennessee Valley Corridor Leadership Council, we have discussed the increasing need for educational opportunities in nuclear engineering.

Establishment of a nuclear engineering program at Tennessee Tech is consistent with that need and very timely for our region as numerous opportunities in new nuclear reactor development and deployment exist. TVA has recently announced its support of new nuclear development as well as other reactor developers connected with the Tennessee Valley Corridor. Especially with these opportunities growing related to the need for carbon free power, increasing numbers of new nuclear engineers will continue to be in demand for the foreseeable future.

Best wishes to Tennessee Tech in establishment of the nuclear engineering program.

Sincerely,

Gard Clark
Senior Vice President
Energy and Environment
Teledyne Brown Engineering, Inc.