2016 Nuclear Engineering Student Delegation

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Policy Statement

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2016 NESD Policy Statement

Investing in Education - The Delegation recommends that funding for Integrated University Programs (IUP) be maintained at or above the FY16 levels instead of being cut from the FY17 budget.

Federal funding to support nuclear education and research is paramount to maintaining a primary leadership role in the development and implementation of nuclear technologies. The federal government is the largest employer of students who benefit from the IUP, namely nuclear engineering graduates. As 38% of the current workforce retires within the next few years, the federal government has a vested interest in maintaining a highly educated workforce in order to ensure that crucial expertise is not lost.

Nuclear Innovation - The Delegation recommends enhancing federal support for the development of advanced nuclear technologies by passing S.2795, H.R.4979 and supporting portions of S.2012*. This will enable the evolution of the nuclear regulatory framework, expedite the commercialization of advanced reactor technologies, and promote U.S. leadership in nuclear technology exports.

Innovative nuclear reactor technologies offer improvements in security, safety, used fuel disposition, industrial applications, and economics. Collaboration between private, public, and academic partners enables these technologies to realize their full potential. American innovation is key to ensuring our continued leadership in international nuclear safety and maintaining competitiveness of U.S. nuclear technology. Breakthrough technologies require access to unique testing facilities only available at national laboratories. Enabling affordable access to national lab facilities to private companies, particularly small businesses and start-ups, significantly reduces development times and costs of critical nuclear technology.

Maintenance of the U.S. Nuclear Fleet - In order to protect jobs created by reliable and carbon-free nuclear energy, federal action must be taken to ensure fair market treatment of nuclear power plants by supporting S.854 and introducing tax credits that fairly account for their value.

Thirteen nuclear reactors have prematurely closed or are scheduled to retire early in the coming years, with fifteen to twenty at risk of closure in the near future. Premature closures are primarily driven by market conditions and short-sighted economic policies, which contradict the goal of a reliable, low-carbon, and diverse electrical grid. Lack of federal support for the domestic nuclear fleet stagnates the U.S. nuclear industry, in large part because of no interim or permanent storage of used fuel.

Alternative Nuclear Technology - The Delegation recommends federal funding for research and development in alternative nuclear technologies. Applications of nuclear technologies in medical treatments, space exploration, and nonproliferation are vital to U.S. interests, domestic and abroad.

Nuclear medicine utilizes radioisotopes to diagnose and treat diseases such as cancer. H.R.35 should be supported to advance our understanding of human biology and radiation to further aid nuclear medicine and diagnostics. Space exploration benefits from nuclear technology and has powered space-crafts to locations within and beyond our solar system. We support the portions of S.2012* that facilitate space nuclear technology development by American companies. In the interest of global nonproliferation, we recommend passing H.R.5370, as well as continued investment in radiation detection capabilities.

About the NESD

The Delegation comprises a diverse group of students from the nation's nuclear engineering programs, representing various disciplines within the nuclear sciences. The students independently organize and run this trip to Washington, D.C. The Delegation does not represent any organization or university; the views expressed in this policy document are strictly those of the delegates.

2016 NESD Additional Information

Investing in Education - According to Energy Secretary Ernest Moniz, “Nuclear power is our nation’s largest source of low-carbon electricity and is a vital component in our efforts to both provide affordable and reliable electricity and to combat climate change. These [IUP] awards will help scientists and engineers as they continue to innovate with advanced nuclear technologies,” [1]. Despite its continued success, the proposed budget for FY17 cuts all funding for the IUP.

As the need for educated nuclear scientists and engineers continues to rise, 38% of the current nuclear workforce will be eligible for retirement by 2018 [2]. It is important to support the development of well-trained professionals to sustain and augment employment in both federal and private sectors.

In FY16, the IUP awarded over $20 million in nuclear science and engineering student scholarships and fellowships. It awarded over $35.5 million to support 48 university-led nuclear energy R&D projects to develop innovative technologies and solutions [3][4].

The United States no longer leads other countries for total R&D funding as percentage of national GDP. In terms of science and engineering degrees, the U.S. has contributed the least annual growth to R&D funding in comparison to other countries such as China [5]. Academic institutions rely on federal contributions for science and engineering R&D. Without federal support making nuclear science education affordable, the U.S. risks students seeking education and employment abroad.

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[1] "Energy Department Invests $82 Million to Advanced Nuclear Technology." *Energy.gov*. Department of Energy, 14 June 2016. Web. 11 July 2016. http://www.energy.gov/articles/energy-department-invests-82-million-advanced-nuclear-technology

[2] McAndrew-Benavides, Elizabeth. "NEI's Nuclear Workforce Survey." *Nuclear Energy Institute* (2016): n. pag. Oct. 2016. Web. 11 July 2016. http://www.nei.org/CorporateSite/media/filefolder/Backgrounders/Presentations/NEI-s-2015-Nuclear-Workforce-Survey-Presentation-to-the-NRC-October-2015.pdf?ext=.pdf

[3] "S&E Indicators 2016. Ch. 4 Research and Development: National Trends and International Comparison." *S&E Indicators 2016 | NSF - National Science Foundation*. National Science Board, 2016. Web. 11 July 2016. http://www.nsf.gov/statistics/2016/nsb20161/#/report

[4] "FY 2016 Research and Development Awards." *Neup.inl.gov*. NEUP, 2016. Web. 11 July 2016. https://neup.inl.gov/SitePages/FY16%20RandD%20Awards.aspx

[5] "DOE Announces Over $5 Million in Student Scholarship and Fellowship Awards." *Neup.inl.gov*. NEUP, 16 Apr. 2016. Web. 11 July 2016. https://neup.inl.gov/SitePages/Scholarship.aspx

Nuclear Innovation - Advanced nuclear reactor technologies offer continued improvements in safe, reliable methods of meeting domestic energy demand while enhancing economic viability, improving fuel cycle flexibility, and addressing security and nonproliferation concerns. Foreign countries are aggressively pursuing the development and commercialization of advanced nuclear systems. For the United States to maintain global leadership in the nuclear industry, it is important to foster the commercial development of advanced reactor technology by companies both big and small. There are currently more than 45 new companies backed with over $1 billion in private funding throughout the U.S. [6]. These companies must be able to demonstrate and test their technology to address any regulatory and feasibility concerns in an affordable manner. This requires increased federal support and collaboration with the national laboratories. The current regulatory environment must also adapt in order to affordably and efficiently license advanced nuclear reactor designs.

Innovative designs, along with high standards for performance and safety, have previously established the U.S. as the world leader in nuclear technology. Advanced reactor technologies are already being developed and deployed internationally, largely supported by foreign governments or public-private partnerships. If U.S. companies are unable to develop competitive nuclear technologies, the U.S. risks losing both potential export markets for domestically designed and manufactured technologies and its influence as a leader in nuclear technology and safety.

Nuclear technology often requires expensive research and test facilities to develop, validate, and prove designs. The U.S. is unique in that it already has existing world-class facilities available at its national laboratories. Affordable and practical access to these facilities for private companies is critical toward enabling private development of advanced nuclear technologies. This access is crucial for small-businesses and start-ups lacking expensive research facilities and will enable them to demonstrate proof-of-concept technologies at an early stage. This would reduce economic burden and risk to ratepayers and provide U.S. companies with a significant advantage when competing with companies abroad. While the Gateway for Accelerated Innovation in Nuclear (GAIN) program seeks to address this, additional federal support is required to enable effective access to these facilities.

If the Nuclear Regulatory Commission is to remain the gold standard in nuclear safety, it must provide an efficient and economical path for licensing advanced reactor technologies. Commercializing advanced reactor technologies will require an affordable and predictable licensing pathway for first-of-a-kind reactor designs from small pre-revenue companies. At present, there is no efficient, cost-effective way for companies to obtain federal approval for pre-commercial, small modular and non-light water reactor designs [7]. H.R.4979 and S.2795 provide a practical framework for revising the regulatory process for these new designs by restructuring licensing fee collection and introducing a phased regulatory process, as well as supporting public-private partnerships.

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[6] Fehrenbacher, Katie. "How Startups Can save Nuclear Tech." *Fortune.com*. Fortune, 05 July 2015. Web. 11 July 2016. http://fortune.com/2015/07/06/how-startups-can-save-nuclear-tech/

[7] Goldberg, Matthew . "Unleashing Innovation: A Comparison of Regulatory Approval Processes." Third Way 13 April 2016. Web. http://www.thirdway.org/report/unleashing-innovation-a-comparison-of-regulatory-approval-processes.

Maintenance of the U.S. Nuclear Fleet - Certain regional electricity markets in the United States have undervalued nuclear energy facilities, leading to their premature retirement [8]. Conditions in these markets favor short term profits and do not take into account long-term planning and societal benefits provided by nuclear energy such as reliability, grid stability, fuel security, and zero-carbon generation. The premature retirement of commercial nuclear facilities is counterproductive to the development of a stable, diverse, emission-free energy portfolio.

The U.S. economy currently benefits from 99 commercial nuclear reactors, generating $40-$50 billion in direct revenue [9]. An average nuclear reactor generates approximately $600 million annually and 500 permanent jobs for the local community [10]. Over 100,000 people are employed in nuclear energy production, with an additional 25,000 new industry jobs expected in the next several years [9]. Additionally, nuclear power accounts for more than half of America's carbon-free energy [10].

Wind and solar generators are financially compensated for carbon-free electricity production while nuclear power, which also produces carbon-free electricity, is not compensated. The Delegation recommends equivalent benefits for nuclear energy facilities. Additionally, nuclear energy facilities' market struggle is exacerbated by intermittently low natural gas prices, excessive costs for on-site storage of used fuel, and a lack of long-term planning in deregulated energy markets. Closure of nuclear plants will also have a significant negative impact on energy market diversity, long-term electricity stability, and U.S. carbon emissions targets.

Solar and wind alone cannot realistically replace clean energy production lost by closing nuclear plants because they are intermittent generators and energy storage is neither an effective nor economical technology. This leads to replacing prematurely closed nuclear facilities with natural gas plants, which ultimately increases the U.S. carbon emissions and makes it difficult to meet the emission goals of the Paris Accords, North American Climate, Clean Energy, and Environment Partnership, and mandated by the Environmental Protection Agency (EPA) Clean Power Plan (CPP).

Premature closure of nuclear facilities also leads to less diversity in the energy markets and overreliance on natural gas. This leads to rising consumer electricity prices when natural gas prices rise or when fuel supply is impeded.

China, Russia, France, and other countries are aggressively pursuing advanced nuclear technologies. To maintain leadership and influence safety standards around the world, the U.S. needs to support its nuclear industry in R&D, especially in fuel storage capability. We ask that Congress support the Nuclear Waste Administration Act of 2015 (S.854) and determine a solution for used fuel storage. Without federal action, used nuclear fuel will remain stored at facilities across the country, making the federal government and utilities liable for billions of dollars in temporary storage costs.

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[8] "Market Failure & Nuclear Power | Nuclear Economics." *Nucleareconomics.com*. NECG, 24 June 2016. Web. 11 July 2016. http://nuclear-economics.com/14-market-failure/

[9] "Economic Growth & Job Creation." *Nei.org*. Nuclear Energy Institute, 2016. Web. 11 July 2016. http://www.nei.org/Why-Nuclear-Energy/Economic-Growth-Job-Creation

[10] "Nuclear Energy: America's Low-Carbon Electricity Leader." *Nei.org*. Nuclear Energy Institute, Nov. 2015. Web. 11 July 2016. http://www.nei.org/Master-Document-Folder/Backgrounders/Fact-Sheets/Nuclear-Energy-America-s-Low-Carbon-Electricity-Le

Alternative Nuclear Technology - Nuclear isotopes play a key role in the medical field. Over 40 million procedures use nuclear medicine each year, and the demand for radioisotopes is increasing at an annual rate of up to 5% [11]. Because of recent closures at facilities vital for their production, there exists a need to produce radioisotopes to prevent a worldwide shortage. Furthermore, isotopes are being identified for new procedures and will have to be produced [12]. The delegation recommends U.S. particle accelerator and nuclear reactor funding for the production of medical isotopes to accommodate domestic needs and to act as a supplier in the international market.

In recent years, research on the effects of radiation on human biology has gone unfunded [13]. Low-dose radiation research will yield greater regulatory confidence in the usage of novel nuclear technologies. It is recommended that the Low-Dose Radiation Research Act of 2015 (H.R.35) be passed into law to establish a research plan for low-dose radiation within U.S. universities and national laboratories.

Space exploration requires a variety of technologies in which nuclear energy plays a vital role. Recent developments in the American private industry are lowering the cost of access to space. Lower costs enable unprecedented capability for exploration deeper into our solar system and beyond. Recognizing the importance of nuclear technology to space exploration, work should continue on developing mission-enabling technology, including domestic supply of the radioisotope Pu-238 for low power robotic missions, fission power, and propulsion for manned missions into the solar system. For this reason, we recommend support for portions of S.2012*.

Nuclear science and technology provides solutions to many of the problems the U.S. faces, but the potential for misuse cannot be ignored. A culture of responsibility is necessary to continue pursuing these solutions while ensuring the health and safety of the public. There is no better way to maintain and improve upon this than by promoting and incentivizing domestic and international nonproliferation practices. Research and development of radiological detection technologies is necessary to improve America's verification capabilities. Strengthening these capabilities will allow for America to lead global cooperation in nonproliferation efforts. In the interest of reinforcing diplomatic obligations, the Delegations recommends that the U.S.-China Nuclear Cooperation and Nonproliferation Act of 2016 (H.R.5370) be passed into law.

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[11] "Radioisotopes in Medicine." *World Nuclear Association*. N.p., June 2016. Web. 10 July 2016. http://www.world-nuclear.org/information-library/non-power-nuclear-applications/radioisotopes-research/radioisotopes-in-medicine.aspx

[12] J. Elggvist. "The Potential and Hurdles of Targeted Alpha Therapy – Clinical Trials and Beyond." Journal of Frontiers in Oncology. Jan 2014. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3890691/

[13] "House Approves Bipartisan Low-Dose Radiation Research Bill." Committee on Science, Space, and Technology. N.p., 17 Nov. 2014. Web. 10 July 2016

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*Selected sections of S.2012 which the delegation fully supports:

- Division D - Science
  - Sections 501-511, Title V - Department of Energy Science
  - Sections 621-628, Title VI, Subtitle C - Nuclear Energy Research And Development
  - Section 714, Title VII - Nuclear Energy Innovation
  - Section 9001, Title IX - Energy and Manufacturing Workforce Development (A-1-D)
  - Sections 3301-3311, Title XXXIII - Nuclear Innovation Capabilities