Key Goals and Innovations Needed for a U.S. Fusion Pilot Plant

Committee

Richard J. Hawryluk

Chair

Dr. Hawryluk is Associate Director for Fusion at the Princeton Plasma Physics Laboratory. Among other responsibilities, he was Interim Deputy Director for Operations from October 2018 to January 2019 and Interim Project Director of the NSTX-U Recovery Project from March 2018 to present. From August 2017 to July 2018, he was interim director of the Princeton Plasma Physics Laboratory in August 2017. Hawryluk came to the lab in 1974 after receiving a Ph.D. in physics from MIT. He headed the Tokamak Fusion Test Reactor at PPPL, then the largest magnetic confinement fusion facility in the United States, from 1991 to 1997 and led the deuterium-tritium experiments. Hawryluk oversaw all research and technical operations as deputy director of the laboratory for 11 years from 1997 to 2008. He then spent several years working on research and management topics associated with ITER, as head of the ITER and Tokamaks Department from 2009 to 2011 and from 2013 to 2016, and as Deputy Director General for the Administration Department of ITER from 2011 to 2013. He also chairs the board of editors of Nuclear Fusion, a monthly journal devoted to controlled fusion energy. He has chaired and participated in numerous national and international program reviews and advisory committees.

Brenda L. Garcia-Diaz

Member

Dr. Garcia-Diaz is the Manager for the Energy Materials Group at Savannah River National Laboratories (SRNL). She leads a strategic initiative project to develop electrochemical fluorination for used nuclear fuel reprocessing and was recently the program manager on nuclear material storage programs looking at corrosion and degradation in nuclear material storage containers before her current position at SRNL.

Prior to that, Brenda was a co-founder and CEO of Greenway Energy, a company focused on Clean Energy Research that has received multiple commercial and DOE funded projects. A Puerto Rico native, she received her Master degree in Chemical Engineering from the University of Puerto Rico – Mayagüez and Ph.D. in Chemical Engineering from the University of South Carolina. Brenda is the co-author on over 10 patent disclosures and applications. She has never served on an NASEM study.

Gerald L. Kulcinski

Member

Dr. Kulcinski is the Grainger Professor of Nuclear Engineering-Emeritus. He was the Director of the Fusion Technology Institute at the University of Wisconsin-Madison. Dr. Kulcinski was the Associate Dean of Research for the College of Engineering from 2001 to 2014. He was elected to the National Academy of Engineering in 1993 and was awarded the NASA Public Service Medal in 1993 and the NASA Exceptional Public Service Medal in 2010. He served on the NASA Advisory Council from 2005 to 2009 and on the Advisory Committee for the Department of Commerce on Emerging Technology from 2008-2018. He has been a fellow in the American Nuclear Society since 1978. He has served as a chair, co-chair, or member of six study committees.

Kathryn A. McCarthy

Member

Dr. McCarthy is Director of the U.S. ITER Project at Oak Ridge National Laboratory. From January 2017 to February 2020, she was VP, R&D and Laboratory Director at the Canadian Nuclear Laboratories. She was the National Technical Director for Systems Analysis for the DOE-NE Fuel Cycle R&D Program, preceded by involvement in various other nuclear fission and fusion programs. Dr. McCarthy was a guest scientist at the Kernforschungszentrum in Germany, March-September 1989, and participated in the DOE U.S./U.S.S.R. Young Scientist Program at the Efremov and Kurchatov Institutes in Russia, and the Latvian Academy of Science in Latvia, September 1989-August 1990. She received her B.S. in nuclear engineering at the University of Arizona in 1983; M.S., 1986 and Ph.D., 1989, in Nuclear Engineering at UCLA. She is a member of the National Academy of Engineering and served on the Committee on the Prospects for Intertial Fusion Energy in 2013. She has served on NASEM studies at various capacities.

Per F. Peterson

Member

Dr. Peterson holds the William and Jean McCallum Floyd Chair in the Department of Nuclear Engineering at the University of California, Berkeley. He is also Chief Nuclear Officer for Kairos Power, where he guides nuclear technology review and advises on scientific and technical topics for KP-FHR technology development and licensing. At UC Berkeley he performs research related to high-temperature fission energy systems, as well as studying topics related to fusion energy technologies and the safety and security of nuclear materials and waste management. He has served as a member or chair of numerous advisory committees for the national laboratories and National Research Council. His research in the 1990's contributed to the development of the passive safety systems used in the GE ESBWR and Westinghouse AP-1000 reactor designs. His 2003 Nuclear Technology article with Charles Forsberg and Paul Pickard identified salt cooled, solid fuel reactors as a promising technology, today called fluoride salt cooled, high temperature reactors (FHRs). His current work and research focuses on enabling and accelerating advanced nuclear energy technologies.

Jeffrey P. Quintenz

Member

Dr. Quintenz recently retired from General Atomics (GA) where he was Senior VP of the Energy Group and is now a part-time employee of TechSource, Inc. with the title of Senior Nuclear Subject Matter Expert. At GA, Dr. Quintenz led research and development divisions encompassing all GA activities in magnetic fusion energy, inertial confinement fusion (ICF), and nuclear technologies and materials (fission). His research interests include fusion (both inertial and magnetic confinement), nuclear power, and nuclear weapons deterrence. Previously Dr. Quintenz was Director of Pulsed Power Sciences and ICF program manager at Sandia National Laboratories. After joining Sandia, he developed and applied computational tools to the study of plasmas and particle beams. He has also served as director of the ICF Office within NNSA, and president of Lockheed Martin Nevada Technologies with responsibility for the stockpile stewardship program activities at the Nevada Test Site. He is a fellow of the IEEE and recipient of the NNSA Excellence Medal. He earned his Ph.D. in electrical engineering from the University of Arizona. He is currently a member of the Defense Programs Advisory Committee (DPAC) serving the senior leadership in the National Nuclear Security Administration (NNSA).

Wanda K. Reder

Member

Wanda Reder is currently the President and CEO if Grid-X Partners based in Chicago. Prior to that, she was the Chief Strategy Officer at S&C Electric Company. Her pioneering work has led to smart grid deployments and wind, solar energy, and utility-scale battery storage integration into traditional utility systems. An IEEE Fellow, Reder was recognized with the 2014 IEEE Richard M. Emerson Award for her leadership in the IEEE Smart Grid program and in the continued growth of the Power and Energy Society (PES), including the creation of its Scholarship Fund program. Reder was the first woman president of PES and is responsible for the launch of the IEEE Smart Grid, positioning IEEE as the leading source for information on smart-grid technology. Wanda is a member of the U.S. Department of Energy's Electricity Advisory Committee. She is also a member of the National Academy of Engineering and a candidate for 2017 IEEE President-Elect. She has participated in various NASEM committees.

David W. Roop

Member

Mr. Roop is the Principle Consultant at DWR Associates. He has a 43-year career in the electric utility industry focused on electric transmission and substation operations and management. He previously chaired Dominion Energy Virginia's resiliency strategy team resulting in industry leading initiatives. These initiatives include the development and implementation of large power transformers hardened against geomagnetically induced currents (GIC), implementation of substation security initiatives, electromagnetic pulse (EMP) hardening of substations, and the development of transmission mobile equipment such as Static Synchronous Compensators (STATCOMs). In addition, Mr. Roop has managed the rapid deployment of eight Flexible AC Transmission Systems (FACTS)" across Dominion Energy Virginia's system which includes Static Var Compensators (SVCs) and Static Synchronous Compensators (STATCOMs). His duties included technical support and engineering resources for electrical equipment, protective relays and operations including research activities to support Transmission System development. His organization also provided technical support for Dominion Generation substations, including protective relaying, for both regulated and merchant plants. He holds one patent for grounding of electrical systems. Currently, he is a registered Professional Engineer in the Commonwealth of Virginia and is an active member of CIGRE presently serving as the President of the CIGRE U.S. National Committee. He was elected to the National Academy of Engineering in 2018 and currently serves on the Board of Directors of the Virginia Academy of Science, Engineering, and Medicine (VASEM). Mr. Roop is a life member of the IEEE and member of Eta Kappa Nu. Mr. Roop is also an Adjunct Professor of Practice at Virginia Tech in the Bradley Department of Electrical and Computer Engineering.

Philip Snyder

Member

PHIL SNYDER is the director of the Theory and Computational Science group for General Atomics' Energy And Advanced Concepts Group. He joined the General Atomics Theory and Computational Science Division in 1999, and became manager of the Turbulence and Transport group in 2010. His recent research has focused on the edge region of fusion plasmas, particularly the physics of the edge transport in tokamaks. Dr. Snyder has served as chair of the Sherwood Executive Committee and the Edge Coordinating Committee, and is currently Principal Investigator of the Edge Simulation Laboratory project. He is a fellow of the APS and a recipient of the 2004 Rosenbluth Award for Fusion Theory, the 2013 John Dawson Award for Excellence in Plasma Physics Research, and the 2014 International Atomic Energy Agency Nuclear Fusion Prize. Dr. Snyder recently served on the NAS Committee on a Strategic Plan for U.S. Burning Plasma Research. Dr. Philip Snyder holds a B.S. in computational physics from Yale University and a Ph.D. in Plasma Physics from Princeton University.

Jennifer L. Uhle

Member

JENNIFER UHLE is NEI's vice president of generation and suppliers. Prior to joining NEI, Dr. Uhle served as the director of reactor safety programs at Jensen Hughes, a consulting company to the nuclear industry. Dr. Uhle joined Jensen Hughes in 2016, working in advanced reactors, thermal-hydraulics and regulatory affairs. Previously, she served at the U.S. Nuclear Regulatory Commission for 23 years in several positions including the deputy director of the offices of Nuclear Regulatory Research and Nuclear Reactor Regulation and the director of the Office of New Reactors. Dr. Uhle obtained her bachelor's and doctorate degrees in nuclear engineering from the Massachusetts Institute of Technology (MIT) in 1991 and 1996, respectively, with a specialization in reactor systems and design. She served as the U.S. representative to the International Atomic Energy Agency's first fact-finding mission to Fukushima in 2011. She serves on the advisory committee to MIT's Department of Nuclear Engineering.

Dennis G. Whyte

Member

Dr. Whyte is the Hitachi America Professor of Engineering at MIT, a professor in the MIT Department of Nuclear Science and Engineering, and the Director of the MIT Plasma Science & Fusion Center. Dr. Whyte's research interests focus on accelerating the development of magnetic fusion energy systems. He has led teams and published over 300 papers across the multi-disciplinary fields of magnetic fusion including plasma confinement, plasma-surface interactions, blanket technology, plasma diagnostics, superconducting magnets and ion beam surface analysis. Dr. Whyte leads the overall MIT research team on SPARC, a private-sector funded compact high-field tokamak presently under development to demonstrate net fusion plasma energy gain. He also leads the Laboratory for Innovations in Fusion Technology at PSFC, which has energy company sponsorship to explore early-stage, disruptive fusion technologies. As an educator, Prof. Whyte has been deeply involved in student design courses for fusion energy systems. Dr. Whyte was educated in Canada gaining his Ph.D. from the U. Quebec working on the Tokamak de Varennes, Canada's national fusion facility. He previously worked at the DIII-D National Fusion facility for a decade and served as a senior lecturer at UCSD. He was an assistant professor in the Nuclear Engineering department at the University of Wisconsin - Madison from 2002-2006. Prof. Whyte previously served as MIT Nuclear Science and Engineering Department Head. He has served as leader of the Boundary-Plasma Interface Topical Group of the U.S. Burning Plasma Organization and is a Fellow of the American Physical Society Division of Plasma Physics. Professor Whyte was awarded the Department of Energy's Plasma Physics Junior Faculty Award in 2003. In 2013 he won the IAEA Nuclear Fusion Prize and was presented the Fusion Power Associates Leadership Award in 2018. He is a two-time winner of the Ruth and Joel Spira Award for Distinguished Teaching from the School of Engineering at MIT. Dr. Whyte has been a committee member on two previous NAS studies: "A Review of the DOE Plan for U.S. Fusion Community Participation in the ITER Program" (2009). and "An Assessment of the Prospects for Inertial Fusion Energy" (2013).

Brian D. Wirth

Member

Dr. Wirth is Governor’s Chair Professor of Computational Nuclear Engineering in the Department of Nuclear Engineering at the University of Tennessee, Knoxville and Oak Ridge National Laboratory. Professor Wirth’s research investigates the performance of nuclear fuels, structural materials and plasma facing components in nuclear environments, utilizing computational materials modeling complemented by experimental investigation. Brian received a B.S. in nuclear engineering from the Georgia Institute of Technology in 1992 and a Ph.D. in mechanical engineering from the University of California, Santa Barbara in 1998. Dr. Wirth spent four years in the High Performance Computational Materials Science Group at Lawrence Livermore National Laboratory. In 2002 he joined the faculty at the University of California, Berkeley as an Assistant Professor of Nuclear Engineering and was promoted to Associate Professor in 2006. He has received a number of awards, including the 2014 U.S. Department of Energy Ernest O. Lawrence Award in Energy Science and Innovation, the 2016 Mishima Award from the American Nuclear Society for outstanding work in nuclear fuels and materials research and the 2003 Presidential Early Career Award for Scientists and Engineers (PECASE). Dr. Wirth is a fellow of the American Association for the Advancement of Science (AAAS, 2016 Fellow, Physics Section) and the American Nuclear Society (ANS, 2017 Fellow).

Christopher Jones

Staff Officer