Appendix 2. Task Force Members Biographies

Cherry A. Murray *(SEAB Member and Task Force Chair)*

Cherry A. Murray is Dean of Harvard University's School of Engineering and Applied Sciences; John A. and Elizabeth S. Armstrong Professor of Engineering and Applied Sciences; and Professor of Physics. Previously, Murray served as principal associate director for science and technology at Lawrence Livermore National Laboratory from 2004-2009 and was president of the American Physical Society (APS) in 2009. Before joining Lawrence Livermore, Murray was Senior Vice President of Physical Sciences and Wireless Research after a 27 year long career at Bell Laboratories Research. Murray was elected to the National Academy of Sciences in 1999, to the American Academy of Arts and Sciences in 2001, and to the National Academy of Engineering in 2002. She has served on more than 100 national and international scientific advisory committees, governing boards and National Research Council panels and as a member of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. She also served as chair of the National Research Council Division of Engineering and Physical Science from 2008 to 2014.

As an experimentalist, Murray is known for her scientific accomplishments in light scattering, condensed matter and surface physics. She received her B.S. in 1973 and her Ph.D. in physics in 1978 from the Massachusetts Institute of Technology. She has published more than 70 papers in peer-reviewed journals and holds two patents in near-field optical data storage and optical display technology.

Rafael Bras *(SEAB Member)*

Rafael L. Bras is the provost and executive vice president for Academic Affairs at the Georgia Institute of Technology. He is a professor in the School of Civil and Environmental Engineering and School of Earth and Atmospheric Sciences. He holds the K. Harrison Brown Family Chair.

Prior to becoming provost, Dr. Bras was Distinguished Professor and Dean of the Henry Samueli School of Engineering of the University of California, Irvine (UCI). For 32 years prior to joining UCI he was a professor in the departments of Civil and Environmental Engineering and Earth, Atmospheric and Planetary Sciences at MIT. He is past Chair of the MIT Faculty, former head of the Civil and Environmental Engineering department and Director of the Ralph M. Parsons Laboratory at MIT. He has served as advisor to many government and private institutions.

Dr. Bras is a director of the American Geophysical Union. He is also in a member of the Board of Trustees of The University Corporation for Atmospheric Research and of the Foundation for Puerto Rico.

Dr. Bras has received many honors and awards, including: honorary degree for the University of Perugia, Italy; Hispanic Engineer National Achievement Award Hall of Fame member; NASA Public Service Medal; the Macelwane Medal of AGU; John Simon Guggenheim Fellowship; the Athalie Richardson Irvine Clarke Prize; Simon W. Freese Environmental Engineering Award; Honorary Diplomat of Water Resources Engineering of the American Academy of Water Resources Engineers; Horton Medal of AGU; AGU Hydrology Days Award; and Drexel University's 2010 Anthony J. Drexel Exceptional Achievement. He is an elected member of the U.S. National Academy of Engineering, the Academy of Arts and Sciences of Puerto Rico, and is a corresponding member of the Mexican National Academy of Engineering and the

Mexican National Academy of Sciences. He also is an elected Fellow of AGU, the American Society of Civil Engineers, the American Meteorological Society, and the American Association for the Advancement of Science.

Dr. Bras maintains an active international consulting practice. Dr. Bras has published two textbooks, over 200 refereed journal publications, and several hundred other publications and presentations.

Deborah Jin *(SEAB Member)*

Dr. Deborah S. Jin is a fellow of the National Institute of Standards and Technology (NIST) and an adjunct professor of physics at the University of Colorado Boulder. Dr. Jin is also a fellow of JILA, a joint research institute of NIST and the University of Colorado at Boulder. Dr. Jin leads an experimental research group working in the area of atomic, molecular, and optical physics. Her current research efforts include studies of ultracold Fermi gases, the creation and investigation of an ultracold gas of polar molecules, and studies of strongly interacting Bose-Einstein condensates and Bose-Fermi gas mixtures.

Dr. Jin received an A.B. in physics from Princeton University and a Ph.D. in condensed matter physics from the University of Chicago. She is a Fellow of the American Physical Society and a Fellow of the American Association for the Advancement of Science. Dr. Jin was elected to the National Academy of Sciences in 2005 and the American Academy of Arts and Sciences in 2007, and she received an additional honorary doctorate from the University of Chicago in 2009.

Dr. Jin's research accomplishments have been recognized through numerous awards, including a John D. and Catherine T. MacArthur Fellowship in 2003, the American Physical Society's I.I. Rabi Prize in 2005, the Benjamin Franklin Medal in Physics in 2008, Sigma Xi's William Proctor Prize for Scientific Achievement in 2009, a Department of Commerce Gold Medal 2011, and the L'Oreal-UNESCO Women in Science Award for North America in 2013.

Carmichael Roberts *(SEAB Member)*

Carmichael Roberts is a General Partner at North Bridge Venture Partners where he finances and builds companies that make new products using chemistry, materials science and/or materials engineering. He primarily focuses on very early stage ventures, including helping founders launch companies from initial formation.

Carmichael lead the North Bridge investment in 1366 technologies, a company in Bedford MA that makes high efficiency solar cells based on innovations in silicon engineering. He serves as the Chairman of 1366 technologies. Carmichael also helps start companies like Foro Energy which uses high powered lasers to access energy resources.

Prior to joining North Bridge, Carmichael co-founded several companies that were based on advanced materials engineering and/or chemistry. He has served in an executive and/or active board capacity for each of his companies.

Before starting his career as an entrepreneurial CEO, Carmichael worked in business development for a start-up polymer company called at GelTex Pharmaceuticals (acquired by Genzyme). Prior to GelTex,

Carmichael was responsible for new product and business development at Sentry Products, a life science venture wholly owned by Union Carbide Corporation (acquired by Dow Chemical).

Carmichael is also very dedicated to developing medical products for developing nations. Along with Harvard University, Carmichael co-founded Diagnostics For All, Inc., a non-profit organization funded by the Gates Foundation that is developing a materials platform to make low cost diagnostics for poor and rural populations in developing nations.

Carmichael serves on the advisory boards for MIT's Deshpande Center for Innovation, Harvard's Nanoscale Science and Engineering Center, Duke University and the New England Clean Energy Council. In 1999, he was named by MIT's Technology Review as one of the world's top 100 young entrepreneurs. Carmichael is also a trustee of Duke University, the Berklee College of Music, an overseer for the Boston Symphony Orchestra and the Museum of Science in Boston.

Carmichael received his B.S. and Ph.D. in organic chemistry from Duke University and was a National Science Foundation Fellow at Harvard University's Departments of Chemistry and Chemical Biology. He also earned his M.B.A. from the MIT Sloan School of Management.

Martha Schlicher *(SEAB Member)*

Martha leads Monsanto's bioenergy and sustainability efforts in the technology organization focused on utilizing Monsanto's scientific expertise and capabilities to support the existing renewables industry, to develop Monsanto's sweet sorghum and sugarcane product pipeline in Brazil and to identify and act upon new opportunities to create value for growers in the field of renewables. Martha has over 23 years of direct agricultural and bioenergy industry experience from previous roles at Monsanto, leadership of the National Corn to Ethanol Research Center and as the head of Technology and Business Development for a London based renewables company.

Martha has held roles within Monsanto leading the Environmental and Regulatory Sciences and Regulatory Policy Groups, the Ag Biotech Crop Teams and Strategy, and the US Western Corn Belt Commercial Business. Martha has a B.S. degree in Chemistry from Indiana University, a Ph.D. in Bio-organic Chemistry from the University of Illinois and an MBA from the Kellogg Graduate School of Management at Northwestern University.

Martha serves as a Trustee for the St. Louis Academy of Science, as a member of the United States Department of Energy Biological and Environmental Research Advisory Committee, and as an industry advisor to the International Center for Advanced Renewable Energy Research at Washington University in St. Louis, the Department of Agricultural Economics at University of Missouri - Columba, and the National Corn Grower Association.

Ram Shenoy *(SEAB Member)*

Ram Shenoy is the chief technology officer for ConocoPhillips. An electrical engineer by training, he has twenty years of oil and gas industry experience.

Before taking on his current role at ConocoPhillips, Shenoy was vice president of research for Schlumberger Limited, responsible for all Schlumberger's corporate scientific research laboratories. In prior years, he held a series of marketing and technology management positions with increasing responsibility, including managing director of Schlumberger-Doll Research Boston, and director and technology center manager of Schlumberger K.K. overseeing all the Engineering, Manufacturing and Sustaining activities of Schlumberger's R&D center in Tokyo, Japan.

Shenoy earned a B. A. and M.A. in Electrical Sciences from Cambridge University UK in 1986, a Ph. D. in Electrical Engineering from Cornell University, NY in 1991 and an MBA from the Stern School of Business, New York University in 2000. He is a member of the Institute of Electrical and Electronic Engineers, the Society for Industrial and Applied Mathematics and the Society of Petroleum Engineers.

John Deutch *(Ex Officio, as co-chair of SEAB)*

John M. Deutch is an Institute Professor at the Massachusetts Institute of Technology. Mr. Deutch has been a member of the MIT faculty since 1970, and has served as Chairman of the Department of Chemistry, and Dean of Science and Provost. Mr. Deutch has published over 140 technical publications in physical chemistry, as well as numerous publications on technology, energy, international security, and public policy issues.

John Deutch has served as director of the Central Intelligence Agency, the Deputy Secretary of Defense, the Under Secretary of Defense for Acquisitions and Technology, and in a number of positions for the U.S. Department of Energy: as Director of Energy Research, Acting Assistant Secretary for Energy Technology, and Undersecretary of the Department.

In addition John Deutch has served on many commissions during several presidential administrations including: the President's Nuclear Safety Oversight Committee; the President's Commission on Strategic Forces; the White House Science Council; the President's Committee of Advisors on Science and Technology; and the President's Intelligence Advisory Board.

John Deutch has received fellowships and honors from the American Academy of Arts and Sciences, the Alfred P. Sloan Foundation, and the John Simon Guggenheim Foundation. Public Service Medals have been awarded him from the Departments of Energy, State, Defense, Army, Navy, Air Force, and Coast Guard, including the Central Intelligence Distinguished Intelligence Medal and the Intelligence Community Distinguished Intelligence Medal. He received the Greater Boston Federal Executive Board's Speaker Thomas P. O'Neill Award for exemplary public service and the Aspen Strategy Group Leadership Award. He was elected to the American Philosophical Society and is a member of the National Petroleum Council and the Defense Science Board.

John Deutch earned a B.A. in history and economics from Amherst College, and both the B.S. in chemical engineering and Ph.D. in physical chemistry from M.I.T. He holds honorary degrees from Amherst College, University of Lowell, and Northeastern University. He serves as director for the following publicly held companies: Citigroup, Raytheon and Cheniere Energy. He is a trustee of the Center of American Progress, Resources for the Future, the Urban Institute, and the Museum of Fine Arts, Boston.

Persis S. Drell *(Ex Officio as co-chair of SEAB)*

Persis S. Drell is Professor of Physics at Stanford University and Professor and Director Emerita at SLAC National Accelerator Laboratory. She received her B.A. in mathematics and physics from Wellesley College in 1977. She received her Ph.D. in atomic physics from the University of California, Berkeley, in 1983. She then switched to high-energy experimental physics and worked as a postdoctoral scientist with Lawrence Berkeley National Laboratory. She joined the faculty of the Physics Department at Cornell University in 1988. In 2000, she became head of the Cornell high-energy group; in 2001, she was named deputy director of Cornell's Laboratory of Nuclear Studies. In 2002, Dr. Drell accepted a position as Professor and Director of Research at SLAC. She was the Deputy Project Manager for the Fermi Gamma Ray Space Telescope 2004-2005. In 2007 she was named Director at SLAC. She stepped down from the SLAC Directorship in 2012. Her current research activities are in Particle Astrophysics and Free Electron Laser science.

Dr. Drell has been the recipient of a Guggenheim Fellowship; a National Science Foundation Presidential Young Investigator Award; she is a fellow of the American Physical Society; a member of the American Academy of Arts and Sciences; and a member of the National Academy of Sciences. In 2012 she was the recipient of the 2012 Helmholtz International Fellow Award for outstanding scientific achievement.

Shirley Ann Jackson *(Ex Officio as Chair of the SEAB Science Subcommittee)*

The Honorable Shirley Ann Jackson, Ph.D., is the 18th president of Rensselaer Polytechnic Institute of Troy, New York, and Hartford, Connecticut, the oldest technological research university in the United States. She was elected to the Brookings Board of Trustees in 2000. Described by *Time Magazine* as "perhaps the ultimate role model for women in science," Dr. Jackson, a theoretical physicist, has held senior leadership positions in government, industry, research, and academe.

In 2009, President Barack Obama appointed Dr. Jackson to the President's Council of Advisors on Science and Technology (PCAST), which assists the White House in policy formulation in the many areas of science, technology, and innovation that are crucial to strengthening the economy. She is co-chair of the President's Innovation and Technology Advisory Committee (PITAC) within PCAST. In 2012, Dr. Jackson was elected as an international fellow of the British Royal Academy of Engineering. She is member of the National Academy of Engineering, the American Philosophical Society, and the American Association for the Advancement of Science (AAAS). She is a past president of the AAAS and former chairman of the AAAS board of directors. She is also a fellow of the American Academy of Arts and Sciences and the American Physical Society, as well as a regent of the Smithsonian Institution and a member of the board of the Council on Foreign Relations. She is a life member of the M.I.T. Corporation. Dr. Jackson is a director of several major corporations, including FedEx, IBM, Marathon Oil, Medtronic, and PSEG. She was chairman of the board of NYSE Regulation.

Before taking on the leadership of Rensselaer Polytechnic Institute, Dr. Jackson was appointed chairman of the United States Nuclear Regulatory Commission (NRC) by President William Jefferson Clinton in 1995 and served for four years, reorganizing the agency and revamping its regulatory approach. While at the NRC, she also spearheaded the formation of the International Nuclear Regulators Association and served as the group's first chairman. Before leading the NRC, she was a theoretical physicist at AT&T Bell Laboratories and a professor of theoretical physics at Rutgers University. Dr. Jackson holds an S.B. in

physics and a Ph.D. in theoretical elementary particle physics from M.I. T., as well as 52 honorary doctoral degrees.

Robert Karlicek *(External Advisor)*

Dr. Robert F. Karlicek, Jr. is currently the Director of the Smart Lighting Engineering Research Center at Rensselaer Polytechnic Institute, an NSF and industry funded program exploring advanced applications for next generation lighting. Prior to joining RPI, he spent over 30 years in industrial research and R&D management positions with corporations including AT&T Bell Labs, EMCORE, General Electric, Gore Photonics, Microsemi, Luminus Devices and SolidUV. His technical experience includes epitaxial growth of high performance LEDs and lasers, advanced device fabrication and high power LED packaging, thermal management, control systems design and applications in solid state lighting as well as other novel LED uses such as IR and UV LED applications.

Dr. Karlicek is well known globally as an LED industry expert, and is a frequent presenter at conferences and workshops. He obtained his Ph.D. in Physical Chemistry from the University of Pittsburgh and has over 40 published technical papers and 24 U.S. patents.

Mark Little (*External Advisor)*

Mark M. Little was named senior vice president and director of GE Global Research in October 2005, becoming only the ninth director in the organization's 105 year history.

At Global Research, approximately 2,600 people from virtually every major scientific and engineering discipline focus on the company's long-range technology needs. The organization has research facilities in the United States, India, China and Germany, working in collaboration with GE businesses around the world.

Prior to his current role, Mr. Little was vice president of GE Energy's power-generation segment headquartered in Schenectady, New York. GE Energy is a world-leading supplier of power generation equipment including gas, steam, wind and hydro-turbine generators, turnkey power plant services, gasification technologies and integrated gasification combined cycle.

Mr. Little joined GE in 1978, starting out in the company's Turbine business. After holding several management positions in engineering, he was named product general manager for generators in 1989. In 1991 he became general manager of business development for GE Energy, responsible for strategic planning and joint venture development. In 1992 he was appointed product general manager for gas turbines and in 1994 he was named vice president of Power Generation Engineering. He assumed responsibility for the large turbine generator segments of power generation in 1997, and in 2004 he was appointed to lead the combined thermal, wind and hydro power generation group.

Mr. Little holds bachelor's and master's degrees in mechanical engineering from Tufts and Northeastern Universities respectively, and he earned a Ph.D. in mechanical engineering from Rensselaer Polytechnic Institute.

Chad Mirkin *(External Advisor)*

Dr. Chad A. Mirkin is the Director of the International Institute for Nanotechnology, the George B. Rathmann Prof. of Chemistry, Prof. of Chemical and Biological Engineering, Prof. of Biomedical Engineering, Prof. of Materials Science & Engineering, and Prof. of Medicine at Northwestern University. He is a chemist and a world renowned nanoscience expert, who is known for his development of nanoparticle-based biodetection schemes, the invention of Dip-Pen Nanolithography, and contributions to supramolecular chemistry. He is the author of over 550 manuscripts and over 930 patents worldwide (241 issued), and the founder of four companies, Nanosphere, NanoInk, AuraSense, and AuraSense Therapeutics, which are commercializing nanotechnology applications in the life science and semiconductor industries.

Dr. Mirkin has been recognized for his accomplishments with over 80 national and international awards. These include the Linus Pauling Medal, an Honorary Degree from Nanyang Technological Univ. Singapore, an Honorary Professorship from Hunan Univ. China, the ACS Award for Creative Invention , an Einstein Professorship of the Chinese Academy of Sciences, the $500,000 Lemelson-MIT Prize, the Biomedical Eng. Society's Distinguished Achievement Award, the iCON Innovator of the Year Award, a NIH Director's Pioneer Award, the Collegiate Inventors Award, the National Inventors Hall of Fame, the Pennsylvania State Univ. Outstanding Science Alumni Award, the ACS Nobel Laureate Signature Award for Graduate Education in Chemistry, the 2003 Raymond and Beverly Sackler Prize in the Physical Sciences, the Feynman Prize in Nanotechnology, the Discover 2000 Award for Technological Innovation, the Materials Research Society Young Investigator Award, the ACS Award in Pure Chemistry, the Harvard University E. Bright Wilson Prize, the Camille Dreyfus Teacher-Scholar Award, the Alfred P. Sloan Foundation Award, the NSF Young Investigator Award, the Naval Young Investigator Award, the Beckman Young Investigator Award, and the Camille and Henry Dreyfus Foundation New Faculty Award.

He is a Member of the President's Council of Advisors on Science & Technology (PCAST, Obama Administration) and a member of the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine. He is also a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science and the Materials Research Society. Dr. Mirkin has served on the Editorial Advisory Boards of over twenty scholarly journals. At present, he is an Associate Editor of JACS. He is the founding editor of the journal Small, one of the premier international nanotechnology journals, and he has co-edited three bestselling books.

Dr. Mirkin holds a B.S. degree from Dickinson College (1986, elected into Phi Beta Kappa) and a Ph.D. degree in Chemistry from the Penn. State Univ. (1989). He was an NSF Postdoctoral Fellow at the MIT prior to becoming a professor at Northwestern Univ. in 1991.

Maxine Savitz *(External advisor)*

Maxine L. Savitz is a member and current vice president of the National Academy of Engineering. She is the retired general manager for Technology Partnerships at Honeywell, Inc., formerly AlliedSignal. Previously, she was the general manager of AlliedSignal Ceramics Components. Dr. Savitz was employed at the U.S. Department of Energy (DOE) and its predecessor agencies (1974-1983) and served as Deputy Assistant Secretary for Conservation.

Dr. Savitz serves on the National Research Council committee on Strengthening the U.S. EPA Laboratory Enterprise (chair) and Deployment of Clean Energy Technologies. She has served as a member of numerous other committees including, assessment of Solid State Lighting; America's Energy Future: Technology Opportunities, Risks and Tradeoff; Panel on Energy Efficiency (vice - chair); Review of the Quality of the Management and of the Science and Engineering Research at DOE's National Security Laboratories - Phase 1.

Dr. Savitz serves on the board of the American Council for an Energy Efficient Economy, and on advisory bodies for Pacific Northwest National Laboratory, Sandia National Laboratories, and Jet Propulsion Laboratory. She serves on the Massachusetts Institute of Technology visiting committee for sponsored research activities. In 2009, Dr. Savitz was appointed to the President's Council of Advisors for Science and Technology. She is a fellow of the California Council on Science and Technology. Past board memberships include the National Science Board, Secretary of Energy Advisory Board, Defense Science Board, Electric Power Research Institute (EPRI), Draper Laboratories, and the Energy Foundation.

Dr. Savitz's awards and honors include: C3E Lifetime Achievement Award (2013); Elected to the American Academy of Arts and Sciences (2013), the Orton Memorial Lecturer Award (American Ceramic Society) in 1998; the DOE Outstanding Service Medal in 1981; the President's Meritorious Rank Award in 1980; recognition by the Engineering News Record for Contribution to Construction Industry in 1979 and 1975; and the MERDC Commander Award for Scientific Excellence in 1967. She is the author of about 20 publications.

Chris Somerville *(External Advisor)*

Dr. Somerville is the Philomathia Professor of Alternative Energy at the University of California Berkeley and a professor in the Department of Plant and Microbial Biology. Since 2007 he has served as Director of the Energy Biosciences Institute, a 500-person research collaboration between UC Berkeley, Lawrence Berkeley National Laboratory, the University of Illinois at Urbana Champaign, and BP plc. From 1994-2007 he was a professor at Stanford University and Director of the Carnegie Institution for Science, and from 1982-1994 was a professor at Michigan State University. He received his Ph.D. from the University of Alberta for research in bacterial genetics and has subsequently been awarded five honorary doctorates. His research accomplishments have also been recognized through numerous awards including the Presidential Green Chemistry Award, the Balzan Prize, the Genetics Society Mendel Medal, the Biochemical Society Hopkins Medal, the ASPB Gibbs Medal and Schull Award, and a Humbolt Senior Research Award.

Dr Somerville has published more than 250 scientific papers in plant and microbial genetics, genomics, biochemistry and biotechnology. His research has been primarily focused on characterizing biochemical processes involved in polysaccharide and lipid synthesis and function. He was also a leader of the international consortia that sequenced the first plant genome.

Dr. Somerville has served on the scientific advisory boards of many academic institutions in Europe, Asia, and North America and has been an advisor to government agencies around the world and many corporations with business interests in energy, chemistry or biotechnology. He co-founded three

companies, and was Chairman of the board of one, Mendel Biotechnology, for ten years. He cofounded six scientific journals, a major database (TAIR) that has been accessed up to 30 million times per year, and an online book (The Arabidopsis Book) that has been downloaded approximately 100,000 times per year.

John Wall *(External Advisor)*

John has been Chief Technical Officer of Cummins since March 2000. In this role, he has responsibility for Cummins global research and engineering organizations and energy and environmental policy. Past responsibilities at Cummins include emission research, advanced engine engineering and technology planning.

John studied mechanical engineering in the Massachusetts Institute of Technology, where he received his SB and SM in 1975 and ScD in 1978. His doctoral research was in the area of internal combustion engine efficiency and emissions, and his professional research continued in the areas of combustion and emissions first at Chevron Research and then at Cummins. His interests today include advanced engine and fuel technologies for sustainable growth and engineering in a global work environment.

John serves on advisory councils for Purdue University, the Health Effects Institute, the MIT Energy Initiative and Indiana University Purdue University Columbus. He has served as an industry advisor to the California Air Resources Board and is currently a member of the US EPA Mobile Sources Technical Review Subcommittee.

John is a member of the National Academy of Engineering and a Fellow of the Society of Automotive Engineers. He has been awarded the SAE Horning Memorial Award and Arch T Colwell Merit Award for Research in the area of diesel fuel effects on emissions, and the ASME Soichiro Honda Medal for significant engineering contributions in the field of personal transportation.

In addition to industry activities, John serves on the Board of Directors of the Indianapolis Opera and is a member of the MIT Educational council.