PENN STATE INSTITUTES OF ENERGY AND THE ENVIRONMENT

2014-2019 STRATEGIC PLAN

JULY 2014

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I. Introduction

The Penn State Institutes of Energy and the Environment (PSIEE) has crafted its strategic plan for 2014 to 2019 as part of the overall Penn State strategic planning process. In June 2014, Provost Nick Jones defined five pillars of scholarship for Penn State as a whole. Each of these five have a direct relationship with "energy and the environment": for example, Pillar 1 is "Promoting Our Health" and includes disease, environmental health, and other issues such as climate change and pollution; Pillar 2, "Stewarding our Resources", lists water, energy, land use, ecology, food, global connections, sustainability, cyber science, and organizational, political, and social sciences; Pillar 3, "Transforming Education", includes Science, Technology, Engineering, and Mathematics (STEM) leadership and education; and Pillar 4, "Building our Digital Future", identifies big data, simulations, analytics, risk and privacy, natural sciences, and other tools that are necessary to research and address critical energy and environmental topics. Finally, "Valuing and Exploring Our Cultures" (Pillar 5) includes civic engagement, crossing disciplinary boundaries, communication, and integration with the arts. Each of these will play an important role if we as a society are to achieve our energy and environmental goals.

In addition to drawing on the Penn State-wide strategic planning process, input for the PSIEE strategic plan came from several sources. First, PSIEE hosted 4 town hall meetings in late 2013 and early 2014; 62 faculty from 7 different colleges and 31 different departments participated in these very productive discussions. Second, PSIEE consulted with its Coordinating Council, consisting of faculty representatives from affiliated Colleges, Institutes and Centers, and its Executive Committee of deans from its affiliated Colleges and several Vice Presidents. Third, PSIEE worked with its staff to identify critical areas for strategic planning, implementation and action. Finally, PSIEE consulted with members of the University Research Council, including associate deans of research and other institute directors. PSIEE circulated the draft strategic plan for comments and feedback in April and June 2014; these comments have been addressed in this version of the strategic plan.

This PSIEE Strategic Plan[1] for 2014 to 2019 includes the following sections: the 2008-2013 PSIEE strategic goals and associated action plans, along with accomplishments for this time period are examined in Section II; updated PSIEE mission and values statements are provided Section III; PSIEE's five research themes and broad initiatives for 2014-2019 and beyond are described in Section IV; and specific strategies identified to support these initiatives, including the areas identified for further exploration during the implementation phase of this Strategic Plan, are outlined in Section V. These strategies include creating an annual work plan and an ongoing system of evaluation.

[1] Note: if a list is included in the strategic plan, listed items are in alphabetical order.

II. 2008-2013 Strategic Plan

During the last strategic planning cycle from 2008 to 2013, PSIEE identified several goals and action plans. These historical goals and action plans are quoted below for reference, followed (B) by a short summary of PSIEE's accomplishments during this period.

A. 2008 to 2013 Goals and Summary of Associated Actions Plans

1. **Strategically hire faculty in energy and the environment:**
    - 24 new energy hires during the next 4-6 years; 8 new searches during 2008 with a focus on bioenergy and clean coal.
    - Plan and coordinate replacement hires in the environmental area.
    - Continue to leverage funds for collaborative hires with other institutes.

2. **Instigate excellence in research, teaching and outreach in environment & energy:**
    - Promote and assist big grant and interdisciplinary submissions.
    - Utilize Keystone Innovation Zone (KIZ)/Keystone Innovation Starter Kit (KISK)[2] and other commonwealth opportunities.
    - Strengthen energy centers and institutes in participating academic units, emphasizing coordination with other college-level and university-level institutes.
    - Seed new interdisciplinary efforts in emerging areas of strategic interest, including water and energy, wind, energy efficiency, and outreach. Public policy was identified as an important area to strengthen.
    - Investigate interdisciplinary graduate school programs, including the potential for an energy and environmental studies program.
    - Establish a general education course in energy and environment for all undergraduate students.

3. **Provide infrastructure support that facilitates excellence in research:**
    - Increase support of campus-wide facilities (including the Water Quality Laboratory in the Land & Water Building and the Fermentation Pilot Plant in Fenske).
    - Collaborate with the Office of Vice President for Research (OVPR) to provide information and training to all affiliate faculty and graduate students on responsible conduct in research training.

[2] Governor Ed Rendell announced funding for these programs in 2009. The goal of the Keystone Innovation Zone program was to create community and university partnerships to transfer technology from development to encourage commercialization and entrepreneurship. The goal of the Keystone Innovation Starter Kit initiative was to help recruit top faculty researchers by providing lab equipment, funding for lab build out, and licensing of new technology; *see, e.g.*, http://www.acheinc.org/region/MidAtlantic/2009_conference/Penn_State_Dubois.pdf.

B. 2008 to 2013 Accomplishments in Meeting Goals and Research Outcomes

PSIEE accomplished or made progress on the goals identified above during the 2008-2013 period. These are addressed below, along with a number of research accomplishments.

Goal 1: Strategically hire faculty in energy and the environment

During the past five years, PSIEE has been involved in hiring thirty-five new faculty in the energy and environmental fields (four of these faculty have since left Penn State, leaving a net of thirty-one new faculty positions). The strategic co-hires were made based on the needs of the University in key areas of environmental and energy research. At Penn State, co-funded faculty are housed in departments to maintain disciplinary strength while building broader inter-disciplinary collaborations across the University. Three of these faculty were hired in collaboration with two of PSIEE's sister institutes, HUCK and MRI. These co-funded faculty are each identified with the 2014-2019 strategic themes; these strategic themes will be described later in this plan with additional detail in Appendix 1.

Table 1. PSIEE's new Co-funded Faculty during 2008-2013 Strategic Planning Period

Energy Co-Funds		Energy & Environment Co-Funds	
Charles Anderson	Future Energy Supply	Matthew Hurteau	Future Energy Supply/ Climate and Ecosystem Change
Kirby Calvert	Smart Energy Systems	Manish Kumar	Future Energy Supply/ Water Science & Biogeochemical Cycles
Xun Cao	Future Energy Supply	Armen Kemanian	Future Energy Supply/ Water Science & Biogeochemical Cycles
Ismael Dado	Future Energy Supply	Li Li	Future Energy Supply/ Water Science & Biogeochemical Cycles
Roman Engel-Herbert	Future Energy Supply	Jeff Yanosky	Future Energy Supply/ Health and the Environment
Noel Chris Giebink	Future Energy Supply	Brian McDonald	Future Energy Supply/ Health and the Environment
Ying Gu	Future Energy Supply	**Environment Co-Funds**	
Ben Lear	Future Energy Supply	Jennifer Balch	Climate & Ecosystem Change
Robert Rioux	Future Energy Supply	Elizabeth W. Boyer	Water Science & Biogeochemical Cycles
Howard Salis	Future Energy Supply	Miriam Freedman	Health and the Environment
Sven Schmitz	Future Energy Supply	Christopher Gorski	Climate & Ecosystem Change
Mort Webster	Future Energy Supply/ Smart Energy Systems	Douglas Kennett	Climate & Ecosystem Change
Stephen Treado	Smart Energy Systems	Todd LaJeunesse	Water Science & Biogeochemical Cycles
Adri van Duin	Future Energy Supply	Jason Rasgon	Climate & Ecosystem Change
Randy L. Vander Wal	Future Energy Supply		
Donghai Wang	Future Energy Supply		

Goal 2: Instigate excellence in research, teaching, outreach in environment & energy

Promote/assist with big grant and interdisciplinary submissions:

In 2010, PSIEE joined with the Materials Research Institute (MRI) and the Office of the Vice President of Research to support the creation of the Strategic Interdisciplinary Research Office (SIRO). The goal of this new office is to better support the research activities of MRI and PSIEE and the broader Penn State research community. SIRO supports proposal preparation, accounting, and integrating of large-scale multi-disciplinary research proposals. The formation of SIRO was a strategic decision to reduce redundancies between MRI and PSIEE as well as create a resource for complex multi-million dollar proposals.

Through SIRO, PSIEE was the submitting unit on approximately $82M in awarded grant activity during the past 5 year strategic plan period; awards came from federal and state agencies, foundations and industry. The largest award was from the Department of Energy to support the establishment of the $21M Department of Energy (DOE) Center for Lignocellulose Structure and Formation headed by Dr. Daniel Cosgrove; this award was recently renewed. International awards included a $10M KAUST award to Dr. Bruce Logan for research on Energy for a Sustainable Water Infrastructure and Agriculture. PSIEE also worked closely with colleges to support several other large interdisciplinary teams. Some of those that received funding include the National Science Foundation (NSF) Critical Zone Observatory, the NSF Sustainable Climate Risk Network (SCRiM), the U.S. Department of Agriculture Northeast Woody/ Warmseason Bioenergy Consortium, the DOE Consortium for Building Energy Innovation, the Environmental Protection Agency (EPA) Center for Nutrient Solutions, and the DOE National Energy Technology Laboratory's Regional University Alliance. An industry-supported research alliance was also developed with Chevron for coal conversion research at Penn State.

Utilize KIZ/KISK and other commonwealth opportunities.
To support the new co-funded energy faculty positions above, PSIEE worked with the Pennsylvania Department of Community and Economic Development and several Penn State departments to attract $2.6 million of external start-up funding from the Commonwealth. Matching support was also provided for start-up packages for 2 new nuclear engineering faculty and 2 new Huck co-funded faculty not listed above. The funding allowed faculty to set up and equip their labs. Also included in the $82M above is $11M in grants from various state agencies, including the Department of Environmental Protection, the Fish and Boat Commission, and the Department of Conservation and Natural Resources.

Strengthen energy centers and institutes in participating academic units, emphasizing coordination with other college-level and university-level institutes.
PSIEE has supported the following entities and collaborations during the past five years through financial contributions, staffing assistance, participation and collaboration:

1. *University-Wide Institutes*
    a. Arts & Humanities Institute
    b. Huck Institutes of the Life Sciences
    c. Institute for CyberScience
    d. Materials Research Institute
    e. Social Science Research Institute
2. *Penn State Institutes of Energy and the Environment Core Research Institutes*
    a. Earth and Environmental Systems Institute
    b. Earth and Mineral Science (EMS) Energy Institute
    c. Engineering Energy and Environmental Institute
    d. Environment and Natural Resources Institute
    e. Rock Ethics Institute
3. *Other Penn State Entities (in alphabetical order)*
    a. Africa Array
    b. Agricultural Law Research and Education Center
    c. Agriculture and Environment Center
    d. Alliance for Earth Sciences, Engineering, Development in Africa (AESEDA)
    e. Biomass Energy Center

f. Center for Advanced Power Generation
g. Center for Chemical Ecology
h. Center for Environmental Informatics
i. Center for Geo Chemistry and Genomics (CECG)
j. Center for Infectious Disease Dynamics
k. Center for Molecular Toxicology and Carcinogenesis
l. Global Engagement Network (Dalian Univ. of Technology, Univ. of Freiburg, Peking Univ., Penn State-Dalian Joint Center for Energy Research (JCER))
m. Pennsylvania Sea Grant
n. Pennsylvania Spatial Data Access (PASDA)
o. Pennsylvania Water Resources Research Center
p. Riparia
q. Susquehanna Shale Hills Critical Zone Observatory
r. Thomas D. Larson Transportation Institute
s. University Health Sciences Council

Seed new interdisciplinary efforts in emerging areas of strategic interest (including water and energy, wind, energy efficiency, and outreach). Public policy was identified as an important area to strengthen.

PSIEE has supported the following interdisciplinary initiatives through staffing, funding, mentoring, and other kinds of support; these are listed below in alphabetical order:

1. Battery & Energy Storage Technology (BEST) Center
2. Center for Climate Risk Management (CLIMA)
3. Center for High Performance Building Systems (CHiPBS)
4. Center for Lignocellulose Structure and Formation
5. Center for Solutions to Weather and Climate Risk
6. Climate Change Impacts Downscaling (CCID) Initiative
7. COMPASS Science Communication Workshop (joint with EESI)
8. Consortium for Building Energy Innovation (CBEI)
9. DataCommons
10. Energy and Environmental Economics and Policy (EEEP) Initiative
11. Institute for Natural Gas Research (INGaR)
12. Marcellus Center for Outreach and Research
13. North East Woody-Warmseason Biomass Consortium (NEWBio)
14. Penn State/ConocoPhillips Energy Prize (co-sponsored national innovation award)
15. Polar Center
16. Research/Outreach Dialogue series
17. Solar Energy Network: Transdisciplinary Environmental Research (SENTER)
18. Sustainable Climate Risk Management (SCRiM) Research Network
19. Sustainability Institute
20. University Energy Partnership (National Energy Technology Laboratory)
21. Water Blues, Green Solutions Film
22. Water Task Force
23. Wind Strategic Initiative

In addition, PSIEE hired a research fellow in 2013 with a background in environmental and natural resource law and public policy. This has allowed for additional exploration of how to connect PSIEE's technical research areas with broader public concerns.

Investigate interdisciplinary graduate school programs, including the potential for an energy and environmental studies program.
PSIEE provides limited graduate student support for the Intercollege Graduate Degree Program in *Ecology* as well as the dual title program in *Biogeochemistry*. Some organizational support was provided for the launch of the dual title program in *Human Dimensions of Environment and Natural Resources* and the Masters of Professional Studies (iMPS) in *Renewable Energy and Sustainability Systems*. Discussions are currently underway for the creation of new dual title graduate programs related to climate and water.

Establish a general education course in energy and environment for all undergraduate students.
A task force was established to look at the creation of a general education course. That effort evolved into the Sustainability Coursework Initiative, which is now under the direction of the Sustainability Institute.

3. Provide infra-structure support that facilitates excellence in research

Increase support of campus-wide facilities (including the Water Quality Laboratory in the Land & Water Building and the Fermentation Pilot Plant in Fenske).
The Water Quality Lab and Fermentation Facility are both supported by PSIEE. During the previous 5 year strategic planning cycle, over $400,000 was spent to upgrade the Water Quality Laboratory with remodeled facilities and new instrumentation. PSIEE also supported the creation and continued funding of LIME (Laboratory for Isotopes and Metals in the Environment). Most recently, Penn State made a $7-10 million commitment to purchase a significant amount of equipment and expand these core facilities to support energy and environmental research. In association with the Earth and Environmental Systems Institute, the LIME lab will be transformed into the Energy and Environment Sustainability Laboratory (EESL), while additional instrumentation will be co-managed with the Materials Characterization Laboratory in the Materials Research Institute.

Collaborate with OVPR to provide information and training to all affiliate faculty and graduate students on responsible conduct in research training.
PSIEE collaborated with the Rock Ethics Institute on the NSF proposal titled "Graduate Pedagogy for Ethical Dimensions of Coupled Natural and Human Systems Research" to develop methods for teaching graduate research ethics in science and engineering, with four on-line modules on energy and environmental topics and a new 2 credit course for the iMPS Program in *Renewable Energy and Sustainability Systems.*

Research Accomplishments During 2008-2013

During the previous strategic planning cycle, PSIEE contributed to Penn State's ongoing success in energy and environmental research. Penn State started this cycle from a position of great strength. An analysis by Elsevier Press of over 7.5 million research publications between 2003 and 2007 ranked Penn State as the leading university in the world for multidisciplinary alternative energy research, while Thomson Reuters reported that Penn State had the most citations of any university in the world in energy and fuels for the period 1998 to 2008. In the NSF classification of environmental research expenditures,

Penn State ranked between 11th and 13th during the period from 2008 to 2012,[3] maintaining a well distributed portfolio across earth, atmospheric, and ocean sciences. Penn State faculty, students and staff make tremendous contributions to this research enterprise as individuals, and are increasingly working together as very effective teams.

The most dramatic advance during the 2008 to 2013 strategic planning cycle was in Penn State's success with major interdisciplinary research awards; examples include:

- ARPA-E (seven major awards in this program) (DOE)
- Center for Green Infrastructure and Stormwater Management (EPA)
- Center for Lignocellulose Structure and Formation (DOE)
- Center for Nutrient Solutions (EPA)
- Consortium for Building Energy Innovation (DOE)
- Energy Sustainability for Water Infrastructure and Agriculture (KAUST)
- Grid Smart Training and Application Resource (GridStar) Center (DOE)
- Mid-Atlantic Clean Energy Applications Center (DOE)
- National Energy Technology Laboratory Regional University Alliance (DOE)
- NorthEast Woody/Warmseason Biomass Energy Consortium (USDA)
- Penn State-Chevron Alliance for Coal Conversion Technology (Chevron)
- Susquehanna Shale Hills Critical Zone Observatory (NSF)
- Sustainable Climate Risk Management (NSF)

Each of these multi-million dollar awards was highly competitive, and in several cases only one or two projects were funded nationally. For example, Penn State is one of only two universities to lead a DOE Energy Innovation Hub (CBEI) and is second only to MIT in the number of awards in the DOE's prestigious Advanced Research Projects – Energy (ARPA-E) program. NSF program managers have recognized Penn State as a model for their Critical Zone Observatory and Sustainable Research Network programs.

Penn State is highly competitive worldwide, particularly in the energy field. For example, Thomson Reuters examined publications between 1998 to 2008 related to "energy and fuels" in its Science Citation Index; Penn State was sixth overall for worldwide institutions, and the top U.S. university.[4] In a different study released in 2009 that examined more than 3,000 universities and research institutions worldwide, Elsevier listed Penn State in the top five institutions globally, and again as the top U.S. university, for publications on alternative energy.[5] In addition, groups like the National Council on Science and the Environment have recognized Penn State for its effective leadership of innovative interdisciplinary research.[6] In reviewing publications in relevant Thomson Reuters Web of Science database categories during this strategic planning cycle (2008 to 2013), Penn State ranked first in energy and fuels and is very strong in other energy and environmental fields, ranking 10th in water resources publications, 11th in multidisciplinary geosciences, 17th in ecology, and 22nd in

[3] 2012 is the most recent year for which data are available.
[4] Thomson Reuters, "Energy Gauge: Who Exactly is in Power?" ScienceWatch.com (Nov./Dec. 2008).
[5] Press Release, Elsevier Releases Results of Alternative Energy Research Leadership Study Identifying Top 25 Institutions Worldwide (25 June 2009), available online at http://www.elsevier.com/about/press-releases/corporate/elsevier-releases-results-of-alternative-energy-research-leadership-study-identifying-top-25-institutions-worldwide.
[6] NCSE, Interdisciplinary Environmental and Sustainability Education and Research: Institutes and Centers at Research Universities (March 2014) (listing PSIEE first in its case studies of broad institutes addressing environmental issues).

environmental science publications (see Appendix 1). In several of these fields Penn State has very high numbers of citations per publication, indicating the impact of our scholarship. In the water resources field Penn State had 10% more citations per publication than any of the other top 20 universities.

These successes were achieved in part with modest investments by PSIEE, including co-funded faculty salaries, PSIEE matching funds on grants, and other investments. The leverage ratio of PSIEE internal expenditures to external awards was more than 1:20. In other words, for every dollar spent by PSIEE, more than twenty dollars returned to Penn State as research funding during the three year period from July 2010 to June 2013; based on this metric, energy efficiency (smart energy systems) and alternative energy strategies (future energy supplies) have been particularly productive in recent years. Table 2 provides data for each of the strategic initiatives PSIEE identified as targets for global leadership in 2010.

Table 2. PSIEE Investments and Awards for Strategic Themes and Initiatives

Spending and Awards Categorized by Strategic Initiative
2010/2011-2012/2013

		3 Year Annual Average, 2010/2011 to 2012/2013			
		Cofund Faculty	PSIEE Commitments	External Awards	Leverage
Future Energy Supply		**420,454**	**467,947**	**40,149,425.33**	**45**
Biomass Energy		142,419	209,070	11,125,745.67	32
Coal Utilization for Fossil and Renewable Energy		162,566	44,104	2,400,300.67	12
Global Unconventional Gas Shales		35,911	105,117	2,509,850.33	18
Solar Photoconversion		79,557	100,945	10,675,546.67	59
Wind Energy			8,711	581,440.33	67
Climate & Ecosystem Change		**458,509**	**314,863**	**21,451,977.67**	**28**
Biodiversity		73,670	79,048	11,186,415.67	73
Climate Science		303,877	215,815	8,003,497.00	15
Polar Science		80,962	20,000	2,262,065.00	22
Health and the Environment		**325,164**	**145,880**	**7,418,879.00**	**16**
Health and the Environment		325,164	145,880	7,418,879.00	16
Smart Energy Systems		**382,562**	**455,313**	**39,505,004.33**	**161**
CO2 Capture, Sequestration & Utilization		71,342	124,726	2,499,989.33	13
Energy Storage		219,349	207,972	10,356,552.33	24
Smart Infrastructure Development		91,872	122,615	26,648,462.67	124
Water Science and Biogeochemical Cycles		**722,583**	**694,558**	**16,251,074.33**	**11**
Coupled Biogeochemical Cycles		298,127	311,774.26	10,465,155.00	17
Water Science		424,456	382,783.41	5,785,919.33	7
TOTAL		**2,309,272**	**2,078,561.23**	**111,919,819.00**	**26**

Moving forward, PSIEE is focused on continuing to build on this success.

III. PSIEE Mission Statement, Values, Vision, and Goals for 2014-2019

The Penn State Institutes of Energy and the Environment's previous mission statement has been updated as part of the latest strategic planning cycle and the PSIEE core values have been identified.

A. Updated Mission Statement for 2014-2019

The mission of the Penn State Institutes of Energy and the Environment is to foster and facilitate interdisciplinary scholarship and collaboration to positively impact important energy and environmental challenges.

B. PSIEE Values for 2014-2019

In providing support to Penn State, the Penn State Institutes of Energy and the Environment value:

1. Creative research that builds on disciplinary strengths and finds interdisciplinary opportunities across colleges and campuses to address critical questions related to energy and environmental challenges at local to global scales.
2. A diverse cohort of faculty, students, and staff who innovate, lead, serve and celebrate a community focused on critical energy and environmental challenges.
3. Generation of innovative technologies and adaptation/implementation strategies that have positive impacts on society, while working to ensure these are affordable and accessible to diverse populations.
4. The translation of research into actionable knowledge to advance sustainability and improve the human condition.

To accomplish this mission and help achieve these values, PSIEE has outlined the following vision and goals for the 2014-2019 Strategic Plan.

C. PSIEE Vision & Goals for 2014-2019

During the 2014-2019 strategic planning period, PSIEE will help support Penn State by:

1. Promoting worldwide recognition for Penn State's creative and cutting-edge interdisciplinary scholarship and Penn State's positive effect on energy and environmental challenges.
2. Helping Penn State researchers become sought after and emulated for their ability to lead interdisciplinary teams, develop effective partnerships to address local and global concerns, and communicate their successes to society.
3. Providing innovative state-of-the-art research infrastructure and organizational support that empowers and supports faculty and adds value to Penn State.

PSIEE will support this vision and these goals in two ways. First, PSIEE has identified targeted themes and initiatives on which to focus; the supporting strategies listed below flow from these. Second, PSIEE has developed a list of specific action items to be achieved during the 2014-2019 strategic planning period. These are discussed in turn below.

IV. PSIEE Themes and Initiatives for Energy and the Environment

Beginning in 2010, PSIEE organized itself around 12 strategic initiatives each with a critical number of Penn State researchers working on energy or environment-related issues. In the current planning cycle, PSIEE has added biodiversity as an initiative and these 12 initiatives have been aggregated into 5 working research themes. These broad themes are represented below in the graphic and discussed in greater detail in Appendix 1. In addition, PSIEE has worked to develop an overall unifying initiative for the 2014-2019 strategic plan.

A. Strategic Themes & Initiatives

A unifying theme and five initiatives for 2014-2019 are represented in the schematic to the left and explored in detail below.

Unifying Initiative of Knowledge Systems: Data, Knowledge, Impact

Penn State is a global research leader in many areas of profound importance to society. However, between Penn State's innovative science and real world impact lies the challenge of translation: translation of data into knowledge and technical innovations, and translation of new knowledge and technologies into effective policies, programs, products, and practices, including by government, business and industry, communities, and individuals. "Big data" efforts and their corresponding hardware and software development for computation and visualization are beginning to address the gaps between data and the creation of knowledge that is meaningful, timely and usable. For example, Penn State hosts both the Data Commons and ScholarSphere as platforms for making data accessible. The launch of the Institute for CyberScience has been, and will be, an enabling force at Penn State toward this Data→Knowledge step.

Now is the time for Penn State to direct attention to the Knowledge→Impact step. Emerging research paradigms (e.g., clinical translational science, dissemination and implementation sciences, community participatory research) are aimed at discovering effective and sustainable approaches to putting research-based knowledge to work toward solving human, social and technical problems. To date, research on the "translation process" highlights the importance of engagement with constituents such that local values, attitudes, resources and constraints become part of the equation for effecting and sustaining measureable impacts.

To maximize our contribution to society, Penn State needs to deliberately build knowledge systems that connect data, models and theory to knowledge dissemination for decision-making, uptake of new technologies, and implementation of evidence-based policies and practices. Penn State has the scholarly expertise needed to make a positive difference. The University also has tremendous outreach capacity through outlets such as Cooperative

Extension, WPSU, industry partners, clinical practices, educational activities and the alumni network. Lacking, however, is a concerted university-wide effort to build 21st century knowledge systems that will translate scholarship and innovation in ways that have a sustained and measureable impact on critical challenges in a variety of areas, including energy and the environment. PSIEE have framed our 2014-2019 research themes around important energy and environment challenges in which Penn State can take leadership roles in developing Data→Knowledge→Impact pathways from information and analysis through to relevant societal action.

Five Research Themes

PSIEE believes that Penn State is uniquely equipped to address five major research themes, all requiring interdisciplinary problem solving and solution innovation.

1. Smart Energy Systems

The International Energy Outlook 2013 projects that world energy consumption will grow by 56% between 2010 and 2040. The importance of energy efficiency and smart energy systems to help meet growing energy demand without contributing to greenhouse gas emissions – in the built environment, for transportation, and elsewhere – has never been greater. In addition to work on energy systems and their supporting infrastructure, Penn State has world class research on clean and efficient energy utilization strategies for engines, turbines, fuel cells, refrigeration, and many other devices. Implementation of new solutions has the potential to revolutionize the energy industry, but significant technical, social and systems-level analysis is required for such solutions to fulfill their promises. PSIEE will foster and build knowledge in smart energy systems by focusing on topics such as:

- CO_2 capture, sequestration, and utilization.
- Energy storage.
- Smart infrastructure development (energy grid, transportation, buildings, etc.)

Example: Smart Energy Systems in Buildings

Dramatic improvements in energy efficiency are achievable with current technologies, but are thwarted by three levels of failed decision processes: 1) the financing structure for new construction does not appropriately weight building life cycle energy costs; 2) incentives for the team of architects, engineers, and contractors building the building are not aligned to unveil system level energy savings; and 3) the occupants of the building do not understand how the building system operates and lack the ability to maximize comfort at minimum cost.

Coupling of data, models and decision tools, business and contracting models, and new social practices for building occupants can be used to design a 21st century building knowledge system. Penn State's DOE Energy Efficient Buildings Hub is exploring many of these themes, in partnership with key stakeholders in the building sector.

2. Future Energy Supply

New sources of power generation will undoubtedly be needed to meet skyrocketing world energy demand. Penn State researchers are positioned to lead efforts to support a scalable, innovative, and clean energy portfolio that meets the world's need for reliable energy sources while considering the economic, environmental, health and climate effects of energy generation. These technologies include, but are not limited to:

- Biomass energy.
- Coal utilization for fossil & renewable energy.
- Global unconventional shales.
- Solar photoconversion and Wind energy.

3. Water and Biogeochemical Cycles

Population growth, development, and environmental changes put increasing stresses on water resources throughout the world. Water is at the nexus of the energy-environment relationship, and water scarcity involves the inherent trade-offs between production of food, goods, and services and the maintenance of natural ecosystems. Nutrients and carbon are circulated through water, terrestrial ecosystems and the atmosphere in biogeochemical cycles that have both local and global impacts. With humans already impacting well over 50% of the Earth's biosphere, understanding and managing these coupled earth systems is essential for a sustainable future.

4. Climate and Ecosystem Change

Managing the risks of anthropogenic climate change poses significant challenges at the nexus of natural and social sciences, ethics, engineering, and mathematics. Penn State has the critical mass to become a world leader in this area. Realizing this potential, however, requires integrated assessment of system interactions leading to societal change. This will in turn require investments in mission-oriented basic research across the involved disciplines.

Major initiatives within this theme include, but are not limited to:

- Climate variability and change.
- Ecosystem productivity and biodiversity; stressors and resilience.
- Food and water security.
- Polar science.

Example:: Water Quality

Farmers throughout the Chesapeake Bay Watershed are encouraged to conserve nutrients by a host of individual "best management practices", many of which are subsidized at considerable cost by states and the federal government. These incentives are available across an entire county, so best management practices next to a stream (where they will do maximum good) are subsidized at the same rate as practices far from water, which will have very little impact. None of the incentive programs consider the synergies or conflicts between the multiple practices that occur on a working farm.

To improve our approach to building these incentives, state-of-the-art agroecosystem, hydrologic, and economic models can be integrated into an agriculture-environment knowledge system. This knowledge system can be employed to optimize placement of practices on the landscape, rationalize incentives and investment, and interface with decision tools that provide farmers and policymakers with clear practical choices. Penn State's New EPA Center for Nutrient Solutions is providing a testbed for many of these ideas.

5. Health and the Environment

The National Academy of Sciences lists climate change, emerging infections and pollutant impacts as 3 of the 6 most important environmental challenges of this century. Dynamics of disease, environmental change, and gene-environment interactions have been affecting human, animal, and plant health for decades, but we are only now beginning to address these interactions in ways that can disrupt infectious disease vectors, enable precautionary design of chemicals and materials, and develop medical treatments to minimize negative impacts. Scientists are also identifying an increasing number of beneficial human/ environment interactions, including the micro biomes in our digestive systems and on our skin.

Penn State researchers are beginning to gather around these important questions. PSIEE has already hosted a number of workshops, and plan to continue these and other activities, to facilitate team development and knowledge sharing in this emerging area.

B. Strategies for Supporting PSIEE Themes & Initiatives

The following strategies are designed to support PSIEE's strategic themes and initiatives to realize the vision and goals of the organization.

Strategy 1: Develop Research Leadership.

PSIEE will promote interdisciplinary research and education by hiring, mentoring, and working to foster and facilitate an organization where faculty are focused on important energy and environmental challenges.

1. Hire:
    - Invest targeted funding for strategic co-funded faculty positions.
    - Provide baseline funding for 60 existing co-funded tenure line faculty positions within departments.
        - Identify key initiatives to target for new hires, starting with water.
        - Refill positions vacated through attrition with consideration of these initiatives.
        - Expand potential co-hires to new colleges or departments.
        - Support strategic co-hires to strengthen diversity.
2. Participate in the job development and hiring process:
    - Assist with job advertisements for interdisciplinary positions, cluster hires.
    - Develop targeted recruiting strategies to increase diversity.
    - Participate in the interview process.
3. Help new faculty successfully integrate into the Penn State research community:
    - Engage new hires with orientation activities:
        - Develop a comprehensive welcome packet that includes PSIEE resources, including information related to diversity on campus.
        - Invite new faculty to structured events.
        - Encourage new faculty to consider PSIEE affiliation.
        - Secure a PSIEE senior mentor for each new affiliate (*see also* Strategy 4).
    - Collect information (bios, research interests, diversity information) about new hires. Disseminate new co-hire research interests to current faculty and affiliates; encourage existing faculty to reach out and potentially include new co-hires in grant proposals, collaborations, etc.
4. Mentor:
    - Review co-funded faculty on a regular basis to provide constructive feedback on their relationship to PSIEE goals and strategies (*see also* Strategy 5).
    - Develop formal interdisciplinary mentorship programs for new and existing faculty (assistant, associate and full professors) that complement existing programs.

- Create and support periodic training opportunities. Examples include:
    - Faculty leadership development programs.
    - Science communication and policy outreach training.
    - Project management.
    - Research ethics.
    - Engaged scholarship, stakeholder involvement, conflict management (including working across cultural differences).

- Support research/policy fellowships and sabbaticals.
    - Organize and clarify an internal sabbatical program, which could include office or working space, opportunities to work on related projects and/or other support.
    - Promote and support existing programs (e.g. leaves for NSF and other agency program directorships, Congressional Science Fellows, Jefferson Science Fellows).

5. Foster and Facilitate Leadership:
    - Support faculty seeking interdisciplinary grants and research funding.
        - Organize informal teams around funding opportunities or research challenges.
        - Assist potential PIs in identifying and applying for large inter-college or inter-campus grants.
        - Work with faculty to identify and provide matching funds for grants.
        - Use seed or small grant programs to catalyze new collaborations and interdisciplinary research.

    - Support and collaborate with Penn State institutes, colleges and other units to strengthen Penn State's interdisciplinary community of scholars and to identify strategic gaps in expertise.

    - Facilitate informal opportunities for collaboration such as PSIEE networking events.

    - Develop funding to support faculty organizing symposia and speaking at international meetings.

    - Work with the Penn State Development Office to identify opportunities and raise funds for targeted areas and programs (e.g., the Water Institute).

    - Celebrate accomplishments.
        - Periodic or as-needed recognition of achievements.
        - Work toward developing an annual award program. Topics or awards could recognize achievements in the areas of:
            - "Team science" and achievements in collaboration.
            - Communication of science.
            - Civic engagement and outreach.
            - Teaching and mentoring.

Strategy 2: Engage External and Research Communities.

PSIEE will support education, communication and outreach, and engagement opportunities for faculty and students working on energy and environmental challenges.

1. Educate:
   - Develop, promote, and support seminars, events, workshops, colloquia, or other educational programs that support interdisciplinary research, education, and outreach. Work to encourage diverse audiences at events.
     - Signature annual outreach events, e.g., the Environmental Colloquium.
     - Targeted topics, e.g., water, climate change.
     - Targeted audiences, e.g., the Chesapeake Bay Commission.

   - Work towards developing an in-residence research/policy fellowship program.

   - Support interdisciplinary initiatives focused on targeted energy and/or environmental issues.
     - Host Environmental Inquiry minor.
     - Facilitate existing interdepartmental graduate programs (Ecology; Biogeochemistry, Human Dimensions of Environment and Natural Resources; Renewable Energy and Sustainability Systems).
     - Develop and facilitate new interdepartmental graduate programs (e.g., water, climate science).
     - Develop recruiting and retention programs to increase the diversity of undergraduate and graduate students in relevant majors.
     - Support new and emerging interdisciplinary centers across Penn State in areas such as integrated assessment, marine science, ethics, conflict assessment, dissemination science, and communication.
     - Expand relationships with partners in the arts, humanities, and media.

   - Support university network efforts in energy and environmental areas.
     - Support global initiatives such as the existing Penn State/Dalian Joint Center for Energy Research and the Penn State/Freiburg/Fraunhofer Institute's Solar Energy Network: Transdisciplinary Environmental Research (SENTER).
     - Develop collaborative partnerships with other evolving strategic partner institutions, including those serving underrepresented groups.

   - Explore ways to further integrate undergraduates into research at Penn State, including the potential for creating a formal undergraduate research program.

2. Communicate:
   - Disseminate information:
     - Identify and share news about upcoming events, grant opportunities, other information relevant to energy and environmental issues.
     - Provide easily accessible information about interdisciplinary work on energy and the environment at Penn State.
       - News announcements and articles.
       - Website: faculty expertise database, portal, successful grants.

        - Explore use of social media and other innovative modes of communication and outreach for energy and environmental science.
        - Share and ensure transparency of information about how to access PSIEE resources.

- Collect and aggregate information:
    - Work to improve PSIEE's relationships with opportunity- and news-making organizations outside Penn State.
    - Work to improve inbound communication and relationships with Penn State organizations, colleges, institutes, faculty, staff and researchers.

- Develop a science communications training framework:
    - Work with other Penn State units (e.g., EESI) and external partners to develop faculty training programs for effective science communication in the media and policy arenas.
    - Institute an annual lecture/panel discussion focused on effective science communication.
    - Engage stakeholders in these events.
    - Explore other avenues for faculty engagement in external communication of their science.

3. Engage:
    - Work with internal and external stakeholders to strengthen current engagement and identify new opportunities for engagement regarding contributions to the local to global community including:
        - Research outcomes.
        - Innovation or economic contributions.
        - Policy impact.
        - Community impact.

    - Work with colleges, departments and other units to host outside visitors and guests collaborating with Penn State researchers.

Strategy 3: Identify and Evaluate Emerging Research Trends

PSIEE will work to ensure that faculty and affiliates of PSIEE and Penn State are informed (and inform others) of emerging or trending energy and environmental topics. PSIEE will also support the research and development of strategies and research tools for addressing these topics. The following strategies are intended to keep Penn State ahead of the curve on emerging topics and at the forefront of new research areas.

1. Identify:
    - Potential areas of new research or pilot programs that could be scaled up University-wide or beyond.

    - Ways to inspire teams or collaborations to address strategic research themes, identifying opportunities such as environmental interactions with human health.

- Opportunities to work with the Sustainability Institute to develop research related to grand challenges in global sustainability.

- Opportunities to work with the Rock Ethics Institute on ethical considerations around energy and the environment.

- Ways to strengthen incentives and opportunities for interdisciplinary projects.

- How to reduce barriers to interdisciplinary research at Penn State.
  - This may include identification of new areas of need such as data management or visualization, or identifying issues that make interdisciplinary work a challenge to accomplish within Penn State.

- Opportunities to work with the Strategic Interdisciplinary Research Office (SIRO) and other Penn State units to communicate research priorities for key funding agencies or granting entities, including new topics or areas of focus and what broader impacts might help Penn State researchers be as competitive as possible. Potential broader impacts could include:
  - Human dimensions integrated with the natural sciences.
  - Scalable projects ranging from local to global.
  - A focus on key regional issues.

2. Develop:
   - Methods for helping faculty communicate how research translates into action, articulating the broader impacts that emerging research topics address.

   - Knowledge systems that incorporate the natural and social sciences with law, policy, and human decision making.

   - Methods to address "complex systems" at the interface of energy, environment, climate and health through coordination and leveraging among institutes, colleges, the Office of Vice President for Research, Outreach and Online Education, Office of Physical Plant, Information Technology Services, and other Penn State units.

3. Engage stakeholders:
   - Work with University Research Council on interdisciplinary opportunities that relate to energy and the environment.

   - Work with outside partners such as government, non-governmental organizations, or industry stakeholders to listen, learn and translate discussions, problems and needs into research opportunities.

Strategy 4: Support Research Infrastructure

PSIEE will continue to manage and maintain staff and infrastructure to support interdisciplinary energy and environmental research.

1. Manage and maintain:
   - Buildings and supporting systems (computers, etc.):
     - Land & Water Building.
     - Materials Research Laboratory.
   - Building renovations and upgrades:
     - Materials Research Laboratory.

   - Existing and new instrumentation and laboratories:
     - Existing facilities:
       - Water Quality Lab.
       - Laboratory on Isotopes and Metals in the Environment (LIME).
       - Stopped Core Facility.
       - Solar Measurement Facility.
     - Other facilities:
       - Cooperate with other co-funded facilities, including the Materials Characterization Laboratory and Huck core facilities.
       - Acquire and house $7-$10 million of new equipment; strategic acquisitions related to paleochronology, field environmental measurement, and energy materials.
     - Organize all PSIEE facilities under the umbrella of Energy & Environmental Sustainability Laboratories.

2. Support, Integrate, and Leverage:
   - PSIEE leadership and governance through close coordination of the Director, Associate/Assistant Directors; Executive/Coordinating Councils; other Institute directors; and University Research Council.

   - PSIEE staff expertise in laboratories/instrumentation, information technology, communication, events, facilities management, administration, and facilitation.
     - Communicate actionable information on user facilities, instruments, and internal expertise resources.
     - Host periodic seminars, tours of facilities, instruments or other resources.
     - Hire (or co-hire) laboratory director, additional staff as needed.
     - Develop best practices for operation/maintenance of equipment/facilities.

   - Staff support for PSIEE managed centers and institutes, including:
     - Pennsylvania Water Resources Research Center.
     - Biomass Energy Center.
     - Batteries and Energy Storage Technology (BEST) Center.
     - Emerging PSIEE institutes such as new Water and Ecology Institutes.

   - PSIEE-related multi-user facilities, equipment, and field research stations, and identify key contacts throughout Penn State.

- Center, institute and related data management expertise, e.g.:
  - Pennsylvania Spatial Data Access (PASDA).
  - Penn State Data Commons.[7]
  - Center for Environmental Informatics.
  - Cyberscience Institute.
  - ScholarSphere and related initiatives.

- Information resources and on-demand, grant-application-ready materials.

Strategy 5: Evaluate Activities.

The following strategies are designed to help PSIEE continuously identify, evaluate, measure and communicate our efforts, outcomes, and success.

1. Identify:
   - Metrics for measuring PSIEE staff activities and services.
   - Metrics for measuring activities, effort, success, and outcomes by co-funded faculty in the energy and environmental science. These metrics may include interdisciplinary research, collaboration, impact, funding levels, scholarship, and outreach.
   - Parallel metrics for measuring Penn State wide research, education, and impacts in energy and the environment.
   - Metrics for assessing progress towards building a more diverse community.

2. Evaluate:
   - Co-hired faculty through periodic reviews (including tracking of diversity metrics); *see also* Strategy 1 above for mentoring of faculty.
   - Internal metrics to evaluate the effectiveness of PSIEE-related services.
   - PSIEE goals, objectives and values, updating these as needed.
   - Topical themes and initiatives.
   - Use outside reviews for key initiatives or potential themes.
   - Priorities for maximizing long-term investment by re-allocating positions or refilling co-funded faculty lost through attrition.
   - Opportunities for managing PSIEE resources as effectively as possible, especially if there is potential duplication; convene discussions to look for opportunities for collaboration and synergy.

[7] Through the Penn State Data Commons, faculty can archive datasets and generate a publication or DOI number that can be included in journal articles, providing direct access to publically funded research results.

3. Provide Annual Deliverables, including:
    - An annual report including selected metrics to monitor and provide a benchmark for assessing activities related to achieving Strategic Plan goals
        - Review budget; goals, tasks, activities & events; staffing.
        - May include reporting of co-fund and internal PSIEE performance metrics, adjustments to the current strategy, values, goals or objectives, links to staff performance, planning and performance evaluations.

    - An annual Work Plan to serve as an internal staff document that outlines goals, initiatives, and planned activities.

4. Communicate and Adapt:
    - Circulate prior year's annual report to selected internal stakeholders.
    - Circulate annual PSIEE work plan to internal staff and selected stakeholders.
    - Provide feedback to the Penn State Office of the Vice President of Research.
    - Collect, incorporate and act on feedback.

V. Conclusion

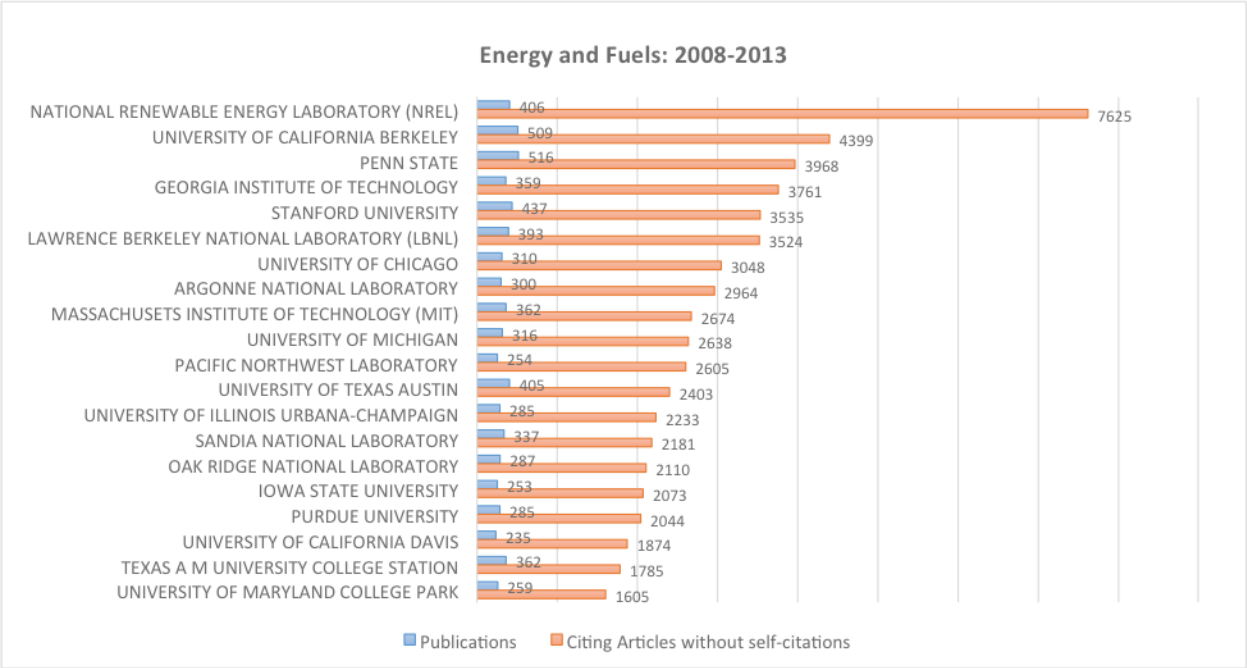
The Penn State Institutes of Energy and the Environment plays a vital role in recruiting leading scholars, mentoring faculty, and facilitating research in areas of strategic interest and strength. This document provides the PSIEE vision, values, goals and roadmap for how PSIEE will expand upon prior success to continue to advance energy and environmental research in the coming years. This is an aspirational plan that will take the collaborative effort of faculty, students, staff and administration working together to leverage our many areas of strength to keep Penn State on a trajectory of excellence in energy and environmental science.

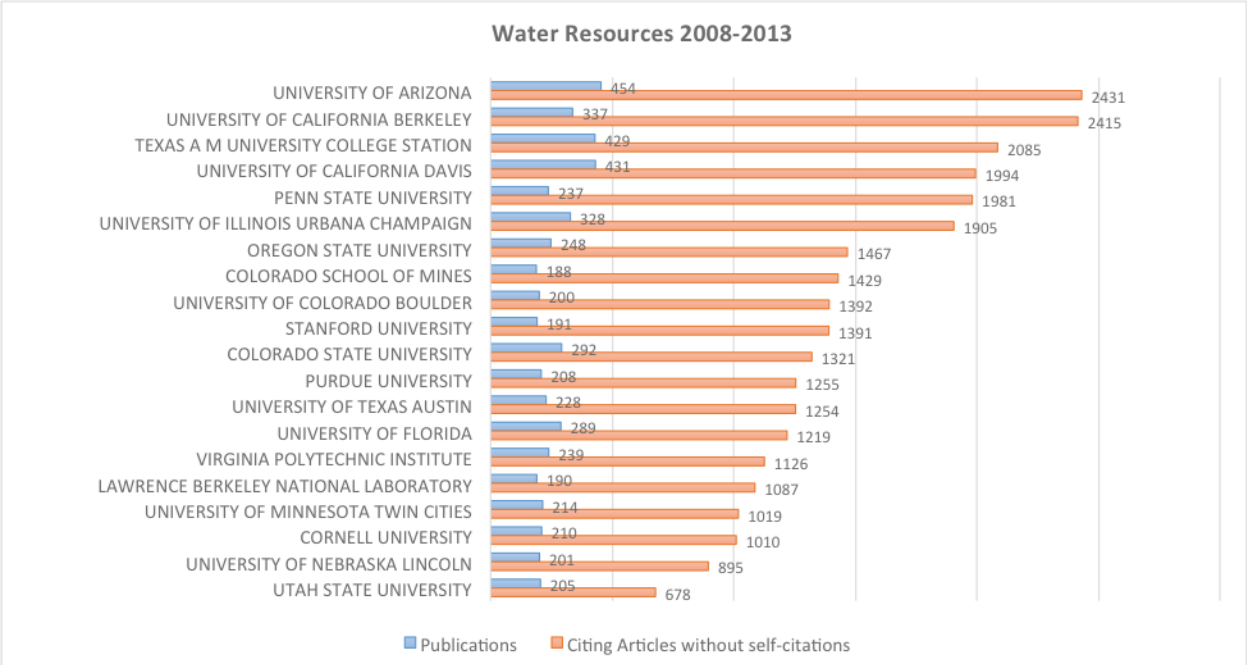
While this document provides a strategy for the next five years, our planned annual reviews, continued input from stakeholders, or emerging research trends may lead to adjustments in this strategy. Any updates to this plan will be included and posted online, and shared through our newsletter, annual reports and other communications.

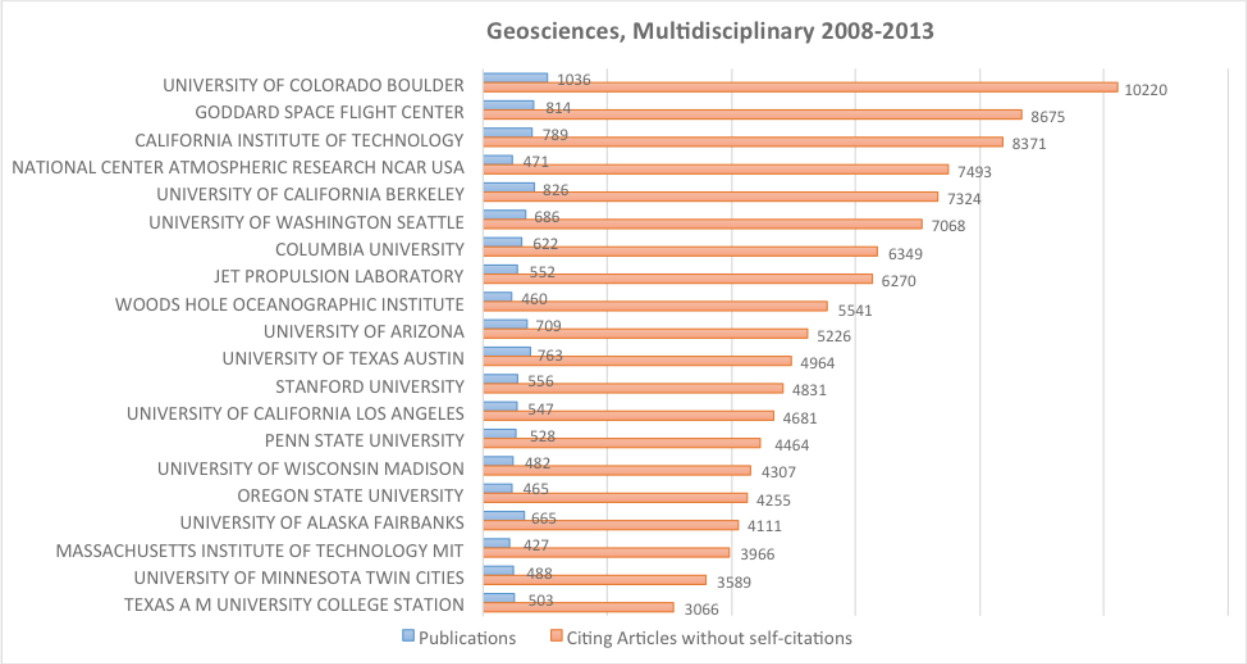
Input on this plan or comments and questions regarding PSIEE are always welcome and can be emailed to psiee@psu.edu.

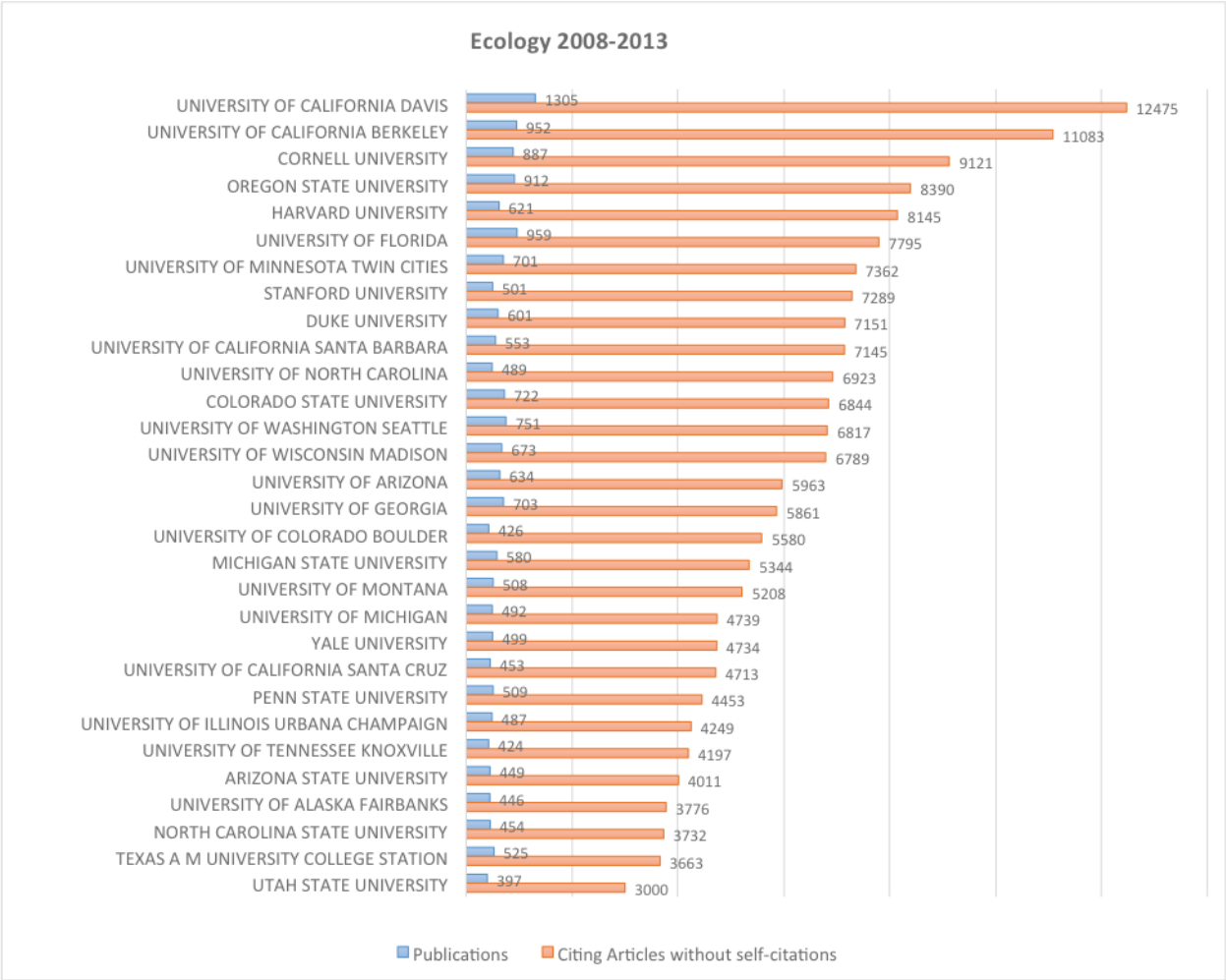
Appendix 1: PSIEE Related Research Areas, by the Numbers

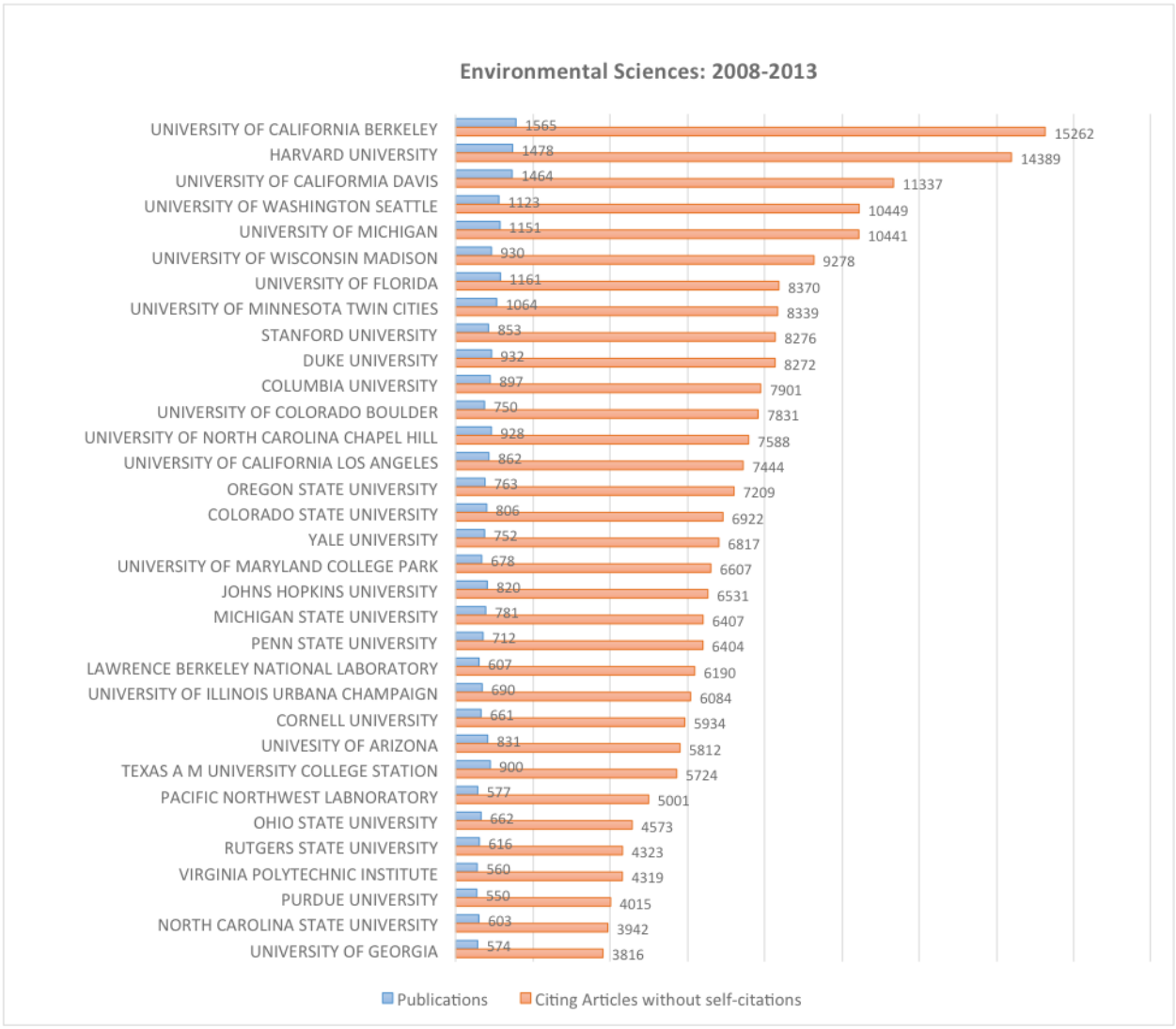
In reviewing activities during the most recent strategic planning cycle, PSIEE collated publication and citation information for peer U.S. institutions among selected multidisciplinary energy and environmental topic areas in the Thomson Reuters Web of Science database categories, ranked by citations. The results of this analysis are below. Rankings by publication numbers were provided on page 9 of this Strategic Plan.






Geosciences, Multidisciplinary 2008-2013
UNIVERSITY OF COLORADO BOULDER 1036 10220
GODDARD SPACE FLIGHT CENTER 814 8675
CALIFORNIA INSTITUTE OF TECHNOLOGY 789 8371
NATIONAL CENTER ATMOSPHERIC RESEARCH NCAR USA 471 7493
UNIVERSITY OF CALIFORNIA BERKELEY 826 7324
UNIVERSITY OF WASHINGTON SEATTLE 686 7068
COLUMBIA UNIVERSITY 622 6349
JET PROPULSION LABORATORY 552 6270
WOODS HOLE OCEANOGRAPHIC INSTITUTE 460 5541
UNIVERSITY OF ARIZONA 709 5226
UNIVERSITY OF TEXAS AUSTIN 763 4964
STANFORD UNIVERSITY 556 4831
UNIVERSITY OF CALIFORNIA LOS ANGELES 547 4681
PENN STATE UNIVERSITY 528 4464
UNIVERSITY OF WISCONSIN MADISON 482 4307
OREGON STATE UNIVERSITY 465 4255
UNIVERSITY OF ALASKA FAIRBANKS 665 4111
MASSACHUSETTS INSTITUTE OF TECHNOLOGY MIT 427 3966
UNIVERSITY OF MINNESOTA TWIN CITIES 488 3589
TEXAS A M UNIVERSITY COLLEGE STATION 503 3066
Publications
Citing Articles without self-citations


Ecology 2008-2013
UNIVERSITY OF CALIFORNIA DAVIS 1305 12475
UNIVERSITY OF CALIFORNIA BERKELEY 952 11083
CORNELL UNIVERSITY 887 9121
OREGON STATE UNIVERSITY 912 8390
HARVARD UNIVERSITY 621 8145
UNIVERSITY OF FLORIDA 959 7795
UNIVERSITY OF MINNESOTA TWIN CITIES 701 7362
STANFORD UNIVERSITY 501 7289
DUKE UNIVERSITY 601 7151
UNIVERSITY OF CALIFORNIA SANTA BARBARA 553 7145
UNIVERSITY OF NORTH CAROLINA 489 6923
COLORADO STATE UNIVERSITY 722 6844
UNIVERSITY OF WASHINGTON SEATTLE 751 6817
UNIVERSITY OF WISCONSIN MADISON 673 6789
UNIVERSITY OF ARIZONA 634 5963
UNIVERSITY OF GEORGIA 703 5861
UNIVERSITY OF COLORADO BOULDER 426 5580
MICHIGAN STATE UNIVERSITY 580 5344
UNIVERSITY OF MONTANA 508 5208
UNIVERSITY OF MICHIGAN 492 4739
YALE UNIVERSITY 499 4734
UNIVERSITY OF CALIFORNIA SANTA CRUZ 453 4713
PENN STATE UNIVERSITY 509 4453
UNIVERSITY OF ILLINOIS URBANA CHAMPAIGN 487 4249
UNIVERSITY OF TENNESSEE KNOXVILLE 424 4197
ARIZONA STATE UNIVERSITY 449 4011
UNIVERSITY OF ALASKA FAIRBANKS 446 3776
NORTH CAROLINA STATE UNIVERSITY 454 3732
TEXAS A M UNIVERSITY COLLEGE STATION 525 3663
UTAH STATE UNIVERSITY 397 3000
Publications
Citing Articles without self-citations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UNIVERSITY OF CALIFORNIA BERKELEY 1565 15262
HARVARD UNIVERSITY 1478 14389
UNIVERSITY OF CALIFORMIA DAVIS 1464 11337
UNIVERSITY OF WASHINGTON SEATTLE 1123 10449
UNIVERSITY OF MICHIGAN 1151 10441
UNIVERSITY OF WISCONSIN MADISON 930 9278
UNIVERSITY OF FLORIDA 1161 8370
UNIVERSITY OF MINNESOTA TWIN CITIES 1064 8339
STANFORD UNIVERSITY 853 8276
DUKE UNIVERSITY 932 8272
COLUMBIA UNIVERSITY 897 7901
UNIVERSITY OF COLORADO BOULDER 750 7831
UNIVERSITY OF NORTH CAROLINA CHAPEL HILL 928 7588
UNIVERSITY OF CALIFORNIA LOS ANGELES 862 7444
OREGON STATE UNIVERSITY 763 7209
COLORADO STATE UNIVERSITY 806 6922
YALE UNIVERSITY 752 6817
UNIVERSITY OF MARYLAND COLLEGE PARK 678 6607
JOHNS HOPKINS UNIVERSITY 820 6531
MICHIGAN STATE UNIVERSITY 781 6407
PENN STATE UNIVERSITY 712 6404
LAWRENCE BERKELEY NATIONAL LABORATORY 607 6190
UNIVERSITY OF ILLINOIS URBANA CHAMPAIGN 690 6084
CORNELL UNIVERSITY 661 5934
UNIVESITY OF ARIZONA 831 5812
TEXAS A M UNIVERSITY COLLEGE STATION 900 5724
PACIFIC NORTHWEST LABNORATORY 577 5001
OHIO STATE UNIVERSITY 662 4573
RUTGERS STATE UNIVERSITY 616 4323
VIRGINIA POLYTECHNIC INSTITUTE 560 4319
PURDUE UNIVERSITY 550 4015
NORTH CAROLINA STATE UNIVERSITY 603 3942
UNIVERSITY OF GEORGIA 574 3816
Publications
Citing Articles without self-citations

Appendix 2: Diversity, Ethics, and Sustainability

In his June 2013 letter, Interim Provost Robert Pangborn listed diversity, ethics, and sustainability as three key items to address in strategic planning. Each of these topics is embedded in the 2014-2019 PSIEE Strategic Plan laid out above, and summarized here.

Diversity

The challenge of increasing diversity in the energy and environment fields, among others, is under discussion at the Office of Vice President for Research. Within PSIEE, we have committed to tracking diversity statistics for PSIEE co-hired faculty, working to recruit diverse candidates to advertised positions, exploring how to recruit a diverse student body into these fields, developing methods for recruiting diverse audiences to events, and finding ways to work with other institutions who work with disadvantaged populations. Over time, we hope to help improve the level of diversity in the energy and environment fields and will begin tracking this metric during this strategic planning cycle.

Ethics

Since 2008, PSIEE has worked closely with the Rock Ethics Institute on a variety of subjects, including the development of a course for teaching graduate research ethics in science and engineering. Going forward, PSIEE has committed to teaching a workshop on research ethics and will continue to work with researchers on this important subject. Future collaboration with the Rock Ethics Institute on issues such as climate change, scientific research, and other areas are also in process.

In addition, PSIEE is working to ensure that faculty and students better understand how to access PSIEE resources, including both general information and specific information related to programs like PSIEE seed grants.

Sustainability

PSIEE is focused on issues related to sustainability as part of its research portfolio. In identifying "grand challenges", PSIEE's goal is to inspire researchers to work together to solve our society's pressing energy and environmental issues; these issues have a direct bearing on questions associated with sustainability. In addition, PSIEE affiliated faculty are working directly on many Sustainability Institute projects with Penn State as a living laboratory; PSIEE is hoping to continue and expand this cooperative work during this strategic planning cycle.

On a day-to-day basis, PSIEE also manages two buildings and several user facilities. It is PSIEE's goal to continue to maintain these as efficiently as possible, and to minimize negative impacts on the environment. We are fortunate in that the Land & Water Building also hosts the Sustainability Institute, with considerable expertise in campus sustainability.