

# FY17 Annual Report

## Institute for Sustainable Energy

Questrom School of Business  
Rafik B. Hariri Building  
595 Commonwealth Avenue, Suite 504B  
Boston, MA 02215

617.358.6248 | [www.bu.edu/ISE](http://www.bu.edu/ISE)

August 2017 | For Public Dissemination



# Letter from the Director

Dear Stakeholders and Colleagues:

The ISE is now finishing its first full year of operation. With your support, we have gotten off to a great start. As you will see in this report, we have an excellent research portfolio, expanding engagement with internal and external collaborators, and a good foundation for the coming years. I am particularly encouraged by two new developments. First, faculty members are starting to propose new multidisciplinary research projects, building on their established research but adding new dimensions. Second, outside collaborators are coming to us with new ideas and projects, including a growing cadre of distinguished senior fellows.

We could not have accomplished all this without the support of the Faculty Advisory Board, the Deans of our Cognate Schools at BU, and BU's entire Office of Research, and we want to take this opportunity to thank them. We also thank the more than fifty faculty members who have affiliated with the Institute and our wonderful administrative team at Questrom. We simply could not find a better administrative partner.

As we contemplate the growing threats of climate change alongside the many other economic, political, and environmental challenges facing the world today, it is painfully clear that the ISE's work is more important than ever. We intend to work as hard as we can on world-class research and policy engagement to address these challenges as we transition from start-up to full-scale operation.

Sincerely,

Dr. Peter Fox-Penner  
Director, Boston University Institute for Sustainable Energy  
Professor of Practice, Questrom School of Business  
595 Commonwealth Avenue  
Boston, MA 02215



## Faculty Advisory Board

**Michael Caramanis** | Professor & CEESI Co-Director, Mechanical Engineering | College of Engineering

**Dennis Carlberg** | Director of Sustainability at BU

**Cutler Cleveland** | Professor, Earth & Environment | College of Arts & Sciences

**Madhu Dutta-Koehler** | Associate Professor & Program Coordinator, City Planning and Urban Affairs | Metropolitan College

**Ken Freeman** | Dean & Allen Questrom Professor | Questrom School of Business

**Kevin Gallagher** | Professor of Global Development Policy/ Research Director, Center for Finance, Law & Policy | Frederick S. Pardee School of Global Studies

**Anthony Janetos** | Professor & Director, Earth & Environment | College of Arts & Sciences

**Nalin Kulatilaka** | Wing Tat Lee Family Professor in Management | Questrom School of Business

**Katharine Lusk** | Executive Director, Initiative on Cities

**Kenneth Lutchen** | Dean & Professor of Biomedical Engineering | College of Engineering

**James Rebitzer** | Professor & Chair of Markets, Public Policy, and Law Professor | Questrom School of Business

## Executive Committee

**Gloria Waters**, Vice President & Associate Provost of Research

**Ann Cudd**, Dean, College of Arts & Sciences

**Ken Freeman**, Dean, Questrom School of Business

**Ken Lutchen**, Dean, College of Engineering

## **Boston University Institute for Sustainable Energy Mission**

- Serves as an **interdisciplinary communications and collaboration hub** between the schools and colleges within BU who are doing research into sustainable energy and related areas to promote collaboration and synergies on new and existing projects
- **Incubates and promotes new sustainable energy research** across the University, and provides opportunities for students and faculty at all levels to participate in research projects to further their education as well as contribute to project research missions
- Serves as an **educational resource to BU students and faculty**, and to the BU community at large, through web and other information resources
- Helps **develop and deliver new course offerings** on sustainable energy and related topics for BU students as well as for specialized audiences
- Helps **develop communication products**, such as videos and podcasts, showcasing BU research
- **Hosts and promotes conferences**, symposia, and workshops on sustainable energy
- **Creates focused collaborations between outside experts, industry groups, and the University** through programs such as an Institute Affiliates program, visiting scholars, executives-in-residence, distinguished fellows and other university-community interactions

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PART I

# ACCOMPLISHMENTS

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## Research Portfolio Overview

Project	PI	Amount Awarded (year 1)	Expected Duration	Sponsor	Students/ Post-Docs
Carbon Free Boston Scoping Study	Cutler Cleveland	\$32,532	4 months	Barr Foundation	2
Carbon Free Boston	Cutler Cleveland Peter Fox-Penner	\$200,000 (\$750,000 fundraising commitment)	3 years	Barr Foundation Green Ribbon Commission Leventhal Foundation	2
Integrated Urban Water Management in Texas	Jacqueline Ashmore	\$126,546	3 years	George and Cynthia Mitchell Foundation	2
Electric Utilities Transition Strategies	Peter Fox-Penner	\$99,580	1 year	Energy Foundation	1
After Carbon Energy Policies	Peter Fox-Penner	\$30,000	1 year	William and Flora Hewlett Foundation	0
Electric Utility Transactive Platforms	Peter Fox-Penner	\$44,000	1 year	Commonwealth Edison	0
<b>Total</b>		<b>\$1,682,658</b>			

## Carbon Free Boston

### ISE Pioneers Cutting-Edge Models of City Climate Policies

Boston Mayor Martin Walsh has declared that the City of Boston will eliminate all net greenhouse gases by 2050. Cities are the leading source of greenhouse gas emissions and can coordinate mitigation efforts more effectively than national and international entities but lack the technical ability to do so.

#### Scope

The ISE is developing first-of-a-kind models to help city leaders choose policy packages that cut emissions with lowest cost and highest benefit. The sectors model transportation, buildings, waste and power.

#### Research Relevance

The policy models constructed will be the most advanced used by cities and will incorporate cutting-edge research on a wide span policies.

#### Engagement Relevance

City and State policy makers are the natural partners – large synergies with BU's Initiative on Cities.

#### Sponsors



#### Team

Cutler Cleveland, PhD (Co-PI) | Prof., CAS  
Peter Fox-Penner, PhD (Co-PI) | ISE  
Chris Meier, PhD (Program Manager) | ISE  
Michael Walsh, PhD (Sr. Research Scientist) | ISE  
Margaret Cherne-Hendrick, PhD | ISE

#### Terms

**\$200,000** | Awarded 2017-18  
(expected 3-yr total project)  
**\$750,000** fundraising  
commitment

## Integrated Urban Water Management in Texas Developing future solutions for the Lone Star State

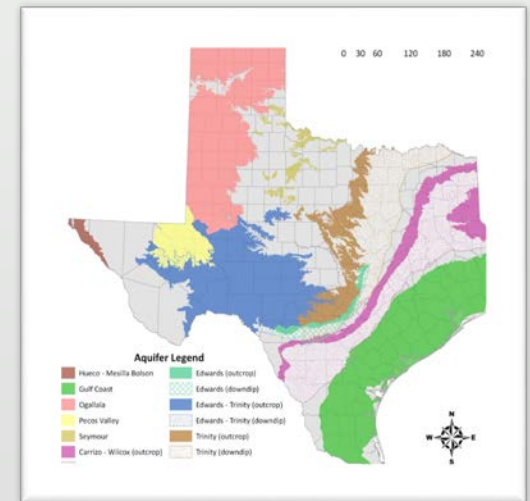
Texas faces water scarcity and aging water infrastructure today, plus high urban population growth rates and the effects of climate change. **Integrated urban water management** provides an opportunity to identify holistic solutions across different water streams (including gray and black water).\*

### Scope

ISE is analyzing the suitability of different business and revenue models and capital funding to support a transition to integrated water management

### Strategic Relevance

In the US today, we pay generally very little for our water, and typically take for granted both quality and consistent supply of water. However, water scarcity is a real and growing challenge in the US and across the world. Water is becoming an ever more precious resource as demand increases and climate change continues. Making sound choices around sustainable water use, management, and sourcing is a critical issue today that will continue to grow in importance as we establish the “water utility of the future” model.



### Team

Jacqueline Ashmore, PhD (PI) | ISE  
Margaret Cherne-Hendrick, PhD | ISE  
Victor Martin | QST MBA candidate

### Sponsor



### Terms

**\$126,546** | Awarded 2017-18  
(expected 3-yr total project)



# Electric Utilities Transition Strategies

## Helping Utilities' transition to sustainable business models

Energy Foundation has contracted the Institute to prepare a series of briefings on four US electric utilities. After each briefing is prepared, the ISE and Energy Foundation teams meet with each utility. The briefings and subsequent meetings serve to **advise and encourage US utilities to transition to cleaner, more sustainable business models.**

### Scope

In-depth analysis on four utilities resulting in individualized briefings on the asset profile, organizational structure, investor profile, clean energy exposure and positioning, and operative market structures and footprint of each utility.

### Strategic Relevance

This project keeps the ISE anchored in the policy community. We've met at the Edison Electric Institute and are now working with them.



### Team

Peter Fox-Penner, PhD (PI) | ISE  
Jennie Hatch | ISE Research Fellow  
Xuehui (Sophia) Xiong | M.A. Energy & Environment Candidate

### Sponsor



### Terms

**\$99,580** | Awarded 2016-17

## After Carbon Energy Policies The Role of the Grid on the Path to 2050 Decarbonization

Removing nearly all greenhouse gas emissions by 2050 is now an accepted imperative. The question is no longer whether we must do this, but rather how, and the implications of this transition for our energy systems, lifestyles, and the built environment.

### Scope

An examination of the choices for energy decarbonization from a perspective that integrates technology and economics with regulation and politics by focusing on production and use technologies that can create a carbon-free 2050

### Research Relevance

This project is about to produce publishable results on transportation and energy.

### Strategic Relevance

Interest continues to be very high among utilities, policymakers, and others on the future of the power sector. We have many more requests for advice than we can service and more are coming.



### Team

Peter Fox-Penner, PhD (PI) | ISE  
Jennie Hatch | ISE Research Fellow  
Bai (Webb) Li | M.S. in Electrical Engineering  
Candidate  
Will Gorman | Consultant The Brattle Group

### Sponsors



### Terms

**\$30,000** | Awarded 2016-17

## United Nations Least Developed Countries Funding Sub-national financing for the most vulnerable members of the global community

Massachusetts State Senator Barrett introduced bill to create voluntary checkoff on individual state tax returns to help most **vulnerable countries adapt to climate change**. More than **100 million people are expected to die by 2030** due to climate change.

The Least Developed Countries Fund exists to help those people survive, but remains grossly underfunded. Historically money flows to this fund from **national governments**, many of which **remain delinquent** on their commitments. This bill creates a way for **individual citizens to voluntarily donate directly to the fund**.

### Scope

Advocacy campaign and coordinating efforts to educate state officials, international leaders and interested organizations on the importance of helping to **create a subnational mechanism that enables voluntary donations from individuals to the Least Developed Countries who are most vulnerable to the effects of climate change**.

### Strategic Relevance

This is a completely new idea that is getting widespread attention in the global climate policy community, especially following the US withdrawal from the Paris Climate Accord.

### Team

Institute for Sustainable Energy  
Union of Concerned Scientists  
Oxfam America  
Oxford Climate Policy  
Barbara Kates-Garnick, Former Under Secretary of Energy for Massachusetts



# Electric Utility Transactive Platforms

## Realizing the utility of the future by constructing new markets

Despite the global nature of climate change, there is no global vision for how best to utilize the electric power system to cut emissions of heat-trapping gases. Too often solutions are developed in stovepipes, with minimal understanding of similar work underway elsewhere. Communication between China and the United States, which together produce almost half the world's heat-trapping gases, is often especially challenging due to mutual suspicions and cultural differences.

### Scope

Evaluation of ComEd's utility-of-the-future strategy

### Strategic Relevance

This will further expand BU's visibility and reputation in one of its core areas, utility-of-the-future

### Team

Peter Fox-Penner, PhD (PI) | ISE  
Jacqueline Ashmore, PhD | ISE  
Michael Caramanis, PhD | Prof., ENG  
Marshall Van Alstyne, PhD | Prof., QST

### Terms

\$44,000 | Awarded 2016



Sponsor

**ComEd**  
An Exelon Company

# Part 1 | Publications

## ISE Publications\*

*ISE staff, post-doctoral associates and affiliates frequently publish articles in news outlets and peer-reviewed journals. Here is a sampling of publications in FY 2017:*

Author	Outlet	Date	Link
Peter Fox-Penner, Courtney Guard (QST MBA '16), Rachel Eckles (CAS '17)	<i>US Bulk Power Markets: Challenges &amp; Recommendations. Quadrennial Review.</i> Report to US Department of Energy	6/10/2016	<a href="https://www.bu.edu/ise/files/2017/01/DOEWhitePaper_BU_I SE_June_10-redline-sent-WITH-DISCLAIMER.pdf">https://www.bu.edu/ise/files/2017/01/DOEWhitePaper_BU_I SE_June_10-redline-sent-WITH-DISCLAIMER.pdf</a>
Peter Fox-Penner, David Cash, Ann Berwick, Judy W. Chang, J. Michael Hagerty, Will Gorman	<i>Clean Energy Resource Options for Massachusetts to Meet GHG Reduction Goals under the Global Warming Solutions Act.</i> White paper funded by the Barr Foundation, written in collaboration with University of Massachusetts – Boston, Sustainable Solutions Lab and the Brattle Group	7/31/2016	<a href="http://www.bu.edu/ise/files/2017/06/ISE-Logo-Cover-page_Brattle-White-Paper.-Clean_Energy_Resource_Options_for_Massachusetts_to_Meet_GHG_Reduction_Goals_under_the_Global_Warming_Solutions_Act.pdf">http://www.bu.edu/ise/files/2017/06/ISE-Logo-Cover-page_Brattle-White-Paper.-Clean_Energy_Resource_Options_for_Massachusetts_to_Meet_GHG_Reduction_Goals_under_the_Global_Warming_Solutions_Act.pdf</a>
Peter Fox-Penner	Harvard Business Review	11/6/2016	<a href="http://www.bu.edu/ise/2016/11/28/why-apple-is-getting-into-the-energy-business/">http://www.bu.edu/ise/2016/11/28/why-apple-is-getting-into-the-energy-business/</a>
Phil Warburg (ISE Fellow)	New York Times, Letter to the Editor	1/23/2017	
Peter Fox-Penner, Benito Muller, Barbara Kates-Garnick	Oxford Climate Policy Blog	3/31/2017	<a href="http://oxfordclimatepolicy.com/blog/think-local-act-global/">http://oxfordclimatepolicy.com/blog/think-local-act-global/</a>
Peter Fox-Penner, Benito Muller, Barbara Kates-Garnick	CommonWealth, OpEd	4/8/2017	
Jurgen Weiss (ISE Fellow), Dean Murphy	<i>Hurry or Wait: Pacing the Rollout of Renewable Energy in the Face of Climate Change Risk.</i> The Brattle Group white paper	11/11/2016	<a href="http://www.bu.edu/ise/files/2017/02/Hurry-or-Wait-1.pdf">http://www.bu.edu/ise/files/2017/02/Hurry-or-Wait-1.pdf</a>
Peter Fox-Penner	Prepared Statement to the California Public Utilities Commission Banc Hearing	5/17/2017	
Dorothy Robyn (ISE Fellow), Jeffrey Marqusee, Craig Schultz	<i>Power Begins at Home; Assured Energy for US Military Bases.</i> Commissioned by Pew Charitable Trusts	1/12/2017	<a href="http://www.bu.edu/ise/files/2017/04/Power-Begins-at-Home-Noblis-Website-Version.pdf">http://www.bu.edu/ise/files/2017/04/Power-Begins-at-Home-Noblis-Website-Version.pdf</a>
Dorothy Robyn (ISE Fellow) as a member of the US Secretary of Energy's Advisory Board	Secretary of Energy Advisory Board <i>Report of the Task Force on Federal Energy Management</i>	9/22/2016	<a href="https://energy.gov/sites/prod/files/2016/11/f34/9-22-16_Report_of_SEAB_Federal_Energy_Management_TF_w_transmittal.pdf">https://energy.gov/sites/prod/files/2016/11/f34/9-22-16_Report_of_SEAB_Federal_Energy_Management_TF_w_transmittal.pdf</a>
John Helveston (ISE Post-Doc)	<i>To Save Our Roads We Must Reform the Gasoline Tax Now.</i> Submitted OpEd	2/1/2017	
John Helveston (ISE Post-Doc)	<i>Innovating Up, Down, and Sideways: The (Unlikely) Institutional Origins of Experimentation in China's Plug-In Electric Vehicle Industry.</i> Submitted for publication consideration to Research Policy	2/21/2017	
John Helveston (ISE Post-Doc)	<i>Pooling Stated and Revealed Preference Data in the Presence of Endogeneity.</i> Research paper prepared for peer review and publication.	2/1/2017	

\* Not including affiliated faculty

## Sustainable Energy Speaker Series Institute Sponsored Events

ISE's Spring 2017 Seminar Series featured ISE Non-Resident Senior Fellows and affiliates. This bi-weekly seminar series showcased the interesting and diverse work that is being done in the sustainable energy field. Though this was an on-campus event with Boston University students, faculty, and staff invited nearly 50% of those in attendance were from local industry.

The format for each talk was about a thirty minute presentation followed by a lively 30 minutes of question and answer based discussion. Each seminar was live streamed and drew up to 11 online participants that could engage in the discussion.

Date	Topic and Speaker	Audience	Audience Type
3/20/2017	The Economics and Competitive Landscape of Energy Storage, Brett Perlman (ISE Seminar Series)	15	(6 online) 50-50 external/internal
4/3/2017	Pricing Climate Risk, Gernot Wagner (ISE Seminar Series)	28	(11 online) 50-50 external/internal
4/13/2017	Hurry or Wait: Rolling our Renewable Energy, Jurgen Weiss & Dean Murphy (ISE Seminar Series)	20	(3 online) 50-50 external/internal
4/24/2017	Renewable Electricity in the Trump Era: The Role of Federal, State & Local Policies, Phil Warburg (ISE Seminar Series)	19	(5 online) 50-50 external/internal

**BU** Institute for Sustainable Energy

## Spring '17 Seminar Series

Hariri Building, Room 508  
595 Commonwealth Avenue  
Boston MA, 02215

**March 20**

Energy Storage Economics: The Impact on Renewables & Climate

*Brett Perlman*  
ISE Non-Resident Senior Fellow

**April 3**

Pricing Climate Risk

*Gernot Wagner*  
Research Associate & Lecturer, Harvard University School of Engineering and Applied Sciences

**April 13**

Hurry or Wait: Pacing the Roll-out of Renewable Energy in the face of Climate Change

*Jürgen Weiss & Dean Murphy*  
ISE Non-Resident Senior Fellow & The Brattle Group Principal

**April 24**

US State & Local Policies: Key Catalysts to Renewable Electricity's Ascent

*Philip Warburg*  
ISE Non-Resident Senior Fellow

## Industry Outreach

We have met with **over 50 companies and individuals** who are good targets for Industry Council or Advisory Board participation, including those where ISE staff have personal connections, and those where senior managers include BU alumni.

Altagas	Red Electrica	Comverge	Raytheon
Avangrid	Severn Trent	Air Liquide	Saint Gobain
Eversource	SSR	BP	Schlumberger
Bain	Southern Company	Covanta Energy	Schneider
Barclays	Vectren	CSE	Shell
Choate, Hall & Stewart	Veolia	Enel Green Power	Siemens
Citi	HGGC	Ericsson	Wilson Sonsini
El Paso Electric	Moody's	GE Current	Invenergy
Emera	San Jose Water	GE	Atlantis
Entergy	American Water	IBM	Altenex
Hawaiian Electric	Fortis	Johnson Controls	8point3
Morgan Stanley	Green Mountain Power	Lockheed Martin	EnerNOC
New Jersey Resources	National Grid	Microsoft	
NextEra	Oracle	Navigant	

This outreach has raised ISE's profile with key stakeholders. Many will send senior executives to participate in the ISE's Annual Briefing on October 19<sup>th</sup> - 20<sup>th</sup> 2017. Some have become involved in ISE projects, e.g., Covanta Energy has a representative on one of the Technical Advisory Boards for the Carbon Free Boston project.

We are also connecting with key executives who may be potential ISE Advisory Board members.

# Engaging with and Assisting Faculty & Centers Through Research, Events & Grant Proposals

## Highlights

The ISE helped Professor Michael Caramanis obtain a two-year **\$250,000 grant** from the prestigious Sloan Foundation.

ISE staff Dr. Jacqueline Ashmore, Dr. Margaret Cherne-Hendrick and Dr. Peter Fox-Penner are supporting the Initiative on Cities and faculty members Suchi Gopal and Nathan Phillips *Streets of the Future NSF grant* work through program development and strategic oversight.

ISE post-doctoral associate Dr. John Helveston submitted a **\$500,000 NSF grant** with Questrom Professor Justin Ren, who would be the PI.

ISE's Director, Dr. Peter Fox-Penner, assisted Mechanical Engineering Professor, Michael Gevelber, with his **submission to MIT's Climate CoLab contest** by giving feedback on his submission and through introductions to other relevant experts. ISE's Tess Kohanski promoted Professor Gevelber's submission by publicizing it through ISE's email listserv and social media networks.

ISE's post-doctoral associate Dr. Margaret Cherne-Hendrick assisted the Pardee Center by being part of it's **Graduate Summer Fellows Program selection committee**.

*Complete engagement metrics on following pages*



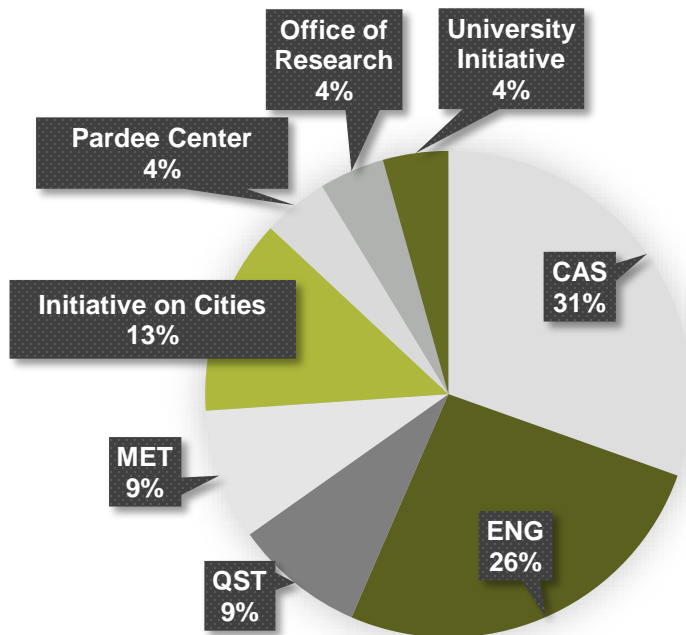
## Engaging BU Faculty and Initiatives

The **table to the right** indicates the number of faculty ISE has assisted. Often projects will include multiple faculty members. There are faculty members who have been assisted more than once, but they are only counted once in these metrics.

**Definition of “Faculty Engagement”** Individual faculty members that ISE Staff have supported by leveraging our technical expertise, contacts and/or networks to promote or strengthen faculty initiated activities.

<b>Total Number of BU Projects ISE engaged</b>	<b>21</b>	<b>Total Number of External partner projects</b>	<b>3</b>
<b>Departments/Centers Engaged</b>	<b>12</b>	<b>Schools Engaged</b>	<b>8</b>
# of Faculty Engaged by Department		# of Faculty Engaged by School	
Biology	1	CAS	7
Earth and Environment	5		
Chemistry	1		
Electrical and Computer Engineering	2	ENG	6
Mechanical Engineering	4		
Operations and Technology Management	1	QST	2
Strategy and Innovation	1		
City Planning	2	MET	2
Initiative on Cities	3	Initiative on Cities	3
Pardee Center	1	Pardee Center	1
Professional Development and Postdoctoral Affairs	1	Office of Research	1
BU Climate Action Plan	1	University Initiative	1
<b>Total Faculty Engaged</b>	<b>23</b>		

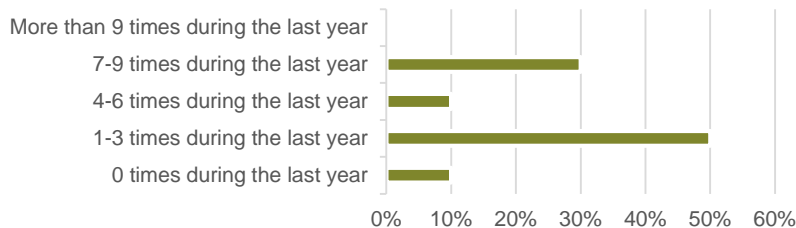
## Faculty Engaged by School



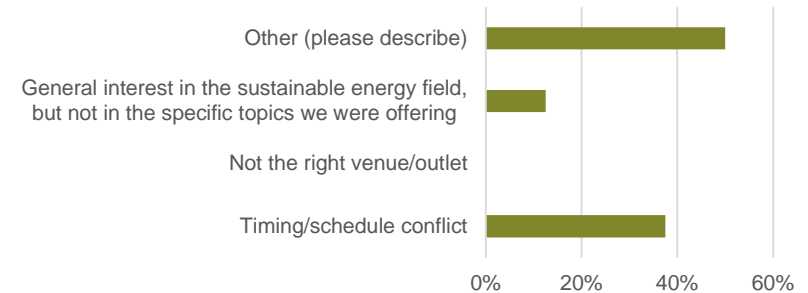
## Faculty Engagement Survey Highlights

We asked our more than 50 faculty affiliates to help us reflect on our first year. 12 of them responded and this is a snap shot of what they said:

Frequency of interactions with ISE



What's preventing more interaction with ISE?



*\*Other Free Text Responses:*

- Poor advertising of the events
- I just arrived at BU in January so haven't had time to engage much.
- Time availability on my part has limited my interactions to a few in depth encounters/meetings/trips
- Need longer time to avoid conflicts.

**Which of these areas are highest priority for you?**

- Identify new applied research opportunities to pursue (**60%**)
- Pursue research opportunities effectively (**50%**)
- Connect with others who share your interests within the BU community (i.e. through the November Mini-Retreat or through individual interactions with you) (**37.5%**)
- Connect with others who share your interests outside the BU community (i.e. through meetings with campus visitors or email introductions) (**25%**)
- Identify new external partners that you may work with (**16.7%**)
- Add new components to the student experience (coursework or research) (**0%**)

*Please share any comments on and suggestions for ISE's work. I.e., are there areas where you would like ISE to engage differently? Are there areas in which we are active where you view our value-add as limited? Do you have specific ideas of new ways for ISE to engage effectively?*

- Keep up the great work!
- ISE has been an excellent center for the university and continues to expand and excel! However, wider and more equitable dissipation/announcements of research grants and opportunities would be appreciated.
- Activities on pursuing applied research funding -- of the type Richard Stuebi and Brett Perlman are working on these days -- is ideal. The general outreach with seminars and meetings in Boston and elsewhere -- DOE etc -- are also great!
- ISE seems very focused on the market/business side of SE. As an engineer I do not always see topics or workshops of interest. It seems many of the BU faculty and outside community involved in the ISE are on the business end. While very important to the energy industry, the development of new technologies is really the critical aspect of creating sustainable energy.
- Keep up the good work :-)
- So glad to have the ISE on campus - it has brought vitality and energy to the school.

# Part 1 | Affiliated Faculty

## Over 50 Affiliated Faculty



**Michael Gevelber**  
Associate Professor,  
Mechanical Engineering  
energy efficiency and air  
flow of buildings



**Jillian Goldfarb**  
Research Assistant  
Professor, Mechanical  
Engineering  
renewable energy,  
thermodynamics



**Srikanth Gopalan**  
Associate Professor,  
Mechanical Engineering  
fuel cell technology, CO2  
sequestration, hydrogen  
storage



**Philip Hanser**  
Lecturer in Markets,  
Public Policy and Law  
Department, Questrom  
School of Business  
market regulation



**Lucy Hutrya**  
Associate Professor,  
Earth & Environment  
carbon fluxes and  
human impacts



**Malika Jeffries-EL**  
Associate Professor,  
Chemistry  
organic superconductors,  
solar cells, and diodes



**Nitin Joglekar**  
Professor, Operations  
and Technology  
Management  
technology comm-  
ercialization data



**Robert Kaufmann**  
Professor of Earth &  
Environment  
land use strategies, oil  
markets, climate change



**Patrick Kinney**  
Beverly Brown Professor  
of Urban Health, School  
of Public Health  
air pollution



**Laurence Kotlikoff**  
Professor of Economics  
financial planning, health  
care, insurance, financial  
reform



**Jonathan Levy**  
Professor,  
Environmental Health  
air pollution, urban  
environments, equity



**Stephen Leybourne**  
Assistant Professor,  
Administrative Sciences  
improvised work in project  
management



**Tom Little**  
Professor of Electrical  
and Computer  
Engineering, Director  
and Associate Dean



**David Marchant**  
Professor and  
Department Chair, Earth  
& Environment  
surface processes



**Malay Mazumder**  
Research Professor,  
College of Engineering  
particle technology, solar  
energy



**Gregory McDaniel**  
Associate Professor of  
Mechanical Engineering  
structural acoustics,  
vibrations



**Paul McManus**  
Senior Lecturer,  
Strategy and Innovation  
sustainability, executive  
management



**Uday Pal**  
Professor, Mechanical  
Engineering and Director  
of Materials Laboratory  
solid oxide fuel cells



**Nathan Phillips**  
Professor, Earth &  
Environment  
water, carbon, & energy  
exchange in plants



**Kenneth Pucker**  
Lecturer, Organizational  
Behavior  
opportunity and  
sustainable leadership



**Rick Reibstein**  
Lecturer, Earth &  
Environment  
toxics, environmental  
law and policy



**Justin Ren**  
Associate Professor  
of Operations and  
Technology  
Management



**Pablo Ruiz**  
Research Associate  
Professor, Mechanical  
Engineering  
electricity markets



**Emily Ryan**  
Assistant Professor,  
Mechanical Engineering  
alternative and advanced  
energy technologies



**Marc Rysman**  
Professor, Economics  
network effects,  
two-sided markets



**Henrik Selin**  
Director of Curricular  
Innovation & Initiatives,  
Associate Professor of  
International Relations  
development policy



**Ian Sue Wing**  
Professor, Earth &  
Environment  
environmental and  
economic analysis



**Pamela Templer**  
Associate Professor of  
Biology  
plant-microbial interactions  
and nutrient cycling



**Diane Thompson**  
Assistant Professor  
variability from coral and  
lake archives; proxy  
system modeling; tropical  
climate restructuring



**Marshall Van Alstyne**  
Professor/ Chair of IS Depart-  
ment/ Dean's Research Fellow,  
Information Systems



**Michael Caramanis**  
CEEESI Co-Director and Professor,  
College of Engineering  
smart grid enabled demand  
response, distributed renewable  
and other resource integration



**Cutler Cleveland**  
Professor, Earth & Environment  
interconnections among energy,  
society, and the environment



**Madhu Dutta-Koehler**  
Associate Professor of the Practice  
and Program Coordinator, City  
Planning and Urban Affairs  
sustainable urban planning, design,  
and architecture



**Ken Freeman**  
Allen Questrom Professor and Dean,  
Questrom School of Business  
health and life sciences, digital  
technology, sustainability and social  
enterprise



**Anthony Janetos**  
Professor and Director,  
Earth & Environment  
interaction of land systems  
with human needs and  
climate change



**Nalin Kulatilaka**  
Assistant Professor in  
Management, Questrom  
School of Business  
financing distributed energy  
investments, contract design



**Katharine Lusk**  
Executive Director,  
Initiative on Cities  
smart cities and local  
organization



**Ken Lutchen**  
Dean, College of  
Engineering  
interdisciplinary  
engineering  
research



**James Rebitzer**  
Professor and Everett W.  
Lord Distinguished Faculty  
Scholar, Chair, Questrom  
School of Business  
health care finance



**Arzum Akkas**  
Assistant Professor,  
Operations & Technology  
Management, Questrom  
School of Business  
global supply chain  
management, marketing,  
and econometric analysis



**Bruce Anderson**  
Professor of Earth &  
Environment  
atmospheric dynamics  
and hydrology, regional  
impacts of climate  
change and climate  
variability



**Michael Baram**  
Professor of Law and  
Health Law  
conservation and  
public health law



**Greg Blonder**  
Professor of the  
Practice, Engineering  
product design and  
manufacturing, green  
energy, medical  
devices



**Christos Cassandras**  
Professor, Electrical &  
Computer Engineering and  
Systems Engineering  
discrete event and hybrid  
systems, cooperative control,  
transportation and  
manufacturing systems



**Paul Cosway**  
Lecturer, Strategy and  
Innovation  
managing, strategizing  
and problem solving at  
the nexus of business  
and technology



**Ann Cudd**  
Dean of Arts & Sciences  
oppression, economic  
inequality, and gender



**J. Robb Dixon**  
Associate Professor,  
Operations and  
Technology Management  
teaching operations,  
technology management



**Sean Elliott**  
Professor, Chemistry  
chemistry and  
environmental  
microbiology



**Kira Fabrizio**  
Associate Professor,  
Strategy & Innovation  
strategy, intellectual  
property rights, and  
environmental policy



**Alan Feld**  
Professor of Law  
corporate, business &  
transactional law,  
energy law, tax law



**Kevin Gallagher**  
Professor of Global Development  
Policy, Research Director, Center  
for Finance, Law & Policy  
global development policy, trade,  
international economic analysis

## Recent Additions

Robert Metcalfe | Markets, Public Policy & Law  
Questrom School of Business

Mark Williams | Finance  
Questrom School of Business

## ISE Non-Resident Senior Fellows



### **Lawrence E. Goldenhersh, JD**

Lawrence is the founder, president, and CEO of Enviance, a 13-year-old cloud-based environmental software company. He specializes in environmental compliance and risk management, greenhouse gas accounting and finance, cloud computing, and supply chain environmentalism.



### **Henry Kelly, PhD**

Henry is an expert in technology policy and has worked extensively on energy, information, education technology, and nuclear weapons. He now serves as the chief scientist in the US Secretary of Energy's new Energy Policy and Systems Analysis organization.



### **Dorothy Robyn, PhD**

Dorothy is a public policy expert who writes and consults on policy issues related to energy, infrastructure, and telecommunications. She has 35 years of experience in government, academia, and consulting. She is currently doing foundation-funded research on how to make military bases more energy resilient.



### **Philip Warburg, JD**

Philip is an author and lawyer specializing in renewable energy. He has worked with governments and citizens groups on environmental initiatives in several Middle East nations and across Eastern Europe.



### **Jürgen Weiss, PhD**

Jürgen has 20 years of consulting experience in the energy area. He specializes in renewable energy, energy efficiency, energy storage, the interaction between electricity, gas, and transportation, and carbon market design and the impact these changes have on existing assets, market structures, and long-term planning needs for electric utilities in North America, Europe, and the Middle East.



### **Brett Perlman, JD, MPA**

Brett is the former Commissioner of the Public Utility Commission of Texas, appointed in 1999. More recently he founded Vector Advisors, a management consulting firm that serves telecommunications and energy clients.



### **Richard Stuebi**

Richard is the founder and president of Future Energy Advisors, a management consulting practice advising corporate clients on innovative growth strategies relating to energy. Previously he served as the Vice President of US Strategy & Group Technology at National Grid.



### **Jonathan Schrag**

Jonathan is currently the Deputy Administrator of the Rhode Island Public Utilities Commission. Previously he was Senior Director of the Clean Energy Idea Bank at the Environmental Defense Fund and a Senior Fellow at the Guarini Center on Environmental, Energy and Land Use Law at New York University.



### **Miquel Munoz Cabre, PhD**

Miquel is ISE's Senior Advisor on international climate. He specializes in sustainable energy policy and finance and climate change policies. His recent work includes quantification of Nationally determined Contributions in developing countries, renewable energy market and policy analysis in Latin America. He was formerly a program officer at the International Renewable Energy Agency (IRENA),

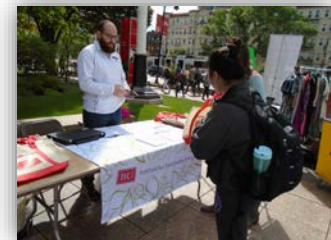


### **Pauliina Schwartz, CFA, MBA**

Pauliina Schwartz leverages her background in finance and her passion for clean tech to expand financing for renewable energy and other distributed energy resources. She has expertise in structured finance, fixed income markets, global banking operations, and experience with clients ranging from small specialty lenders to largest institutional investors in the world.

### Engaging students through research, outreach, advising & events

- ISE engages undergraduate and graduate students (PhD and masters) from across the university, primarily the College of Arts & Sciences, Questrom School of Business and the School of Engineering.
- 14 student research assistants have worked for ISE in FY17 across a variety of functions, including Institute sponsored research projects, course teaching assistance with Peter Fox-Penner, and communications and website functions.
- ISE regularly communicates with student club leadership from Net Impact and the Energy Club, inviting members to attend the ISE monthly staff meetings and coordinating events and guest speakers throughout the semester.
- ISE and *Sustainability@BU* piloted an internship program in fall 2016, where the two departments shared one intern in an effort to facilitate communication and identify opportunities for collaboration.
- Seed funding and sponsored research funds went to support two PhD and one masters students in the Questrom School of Business and the School of Engineering, totaling \$12,500.
- When programming events and organizing meetings with visiting guest, ISE rarely goes at it alone. When ISE hosts speakers or potential industry partners on campus, we will arrange private or small group lunches or meetings to foster connections between faculty and our guests.
- Events are almost always co-sponsored with other departments, including Mechanical Engineering, Initiative on Cities, Pardee Center, and Sustainability@BU to name a few.



*MBA/MA Student, Mark Arbonies, tables the sustainability fair to raise awareness with fellow students, September 2016*

### **Integrating ISE's expertise in curricula across Boston University**

- ISE Director and Professor of Practice, Peter Fox-Penner, teaches the MBA course PL851 Sustainable Business Models and Policy, which exposes MBA students concentrating in Energy and Environmental Sustainability to variety of external speakers hailing from industry and government.
- ISE works closely with Kira Fabrizio, head of the Energy and Environmental Sustainability (EES) MBA and part of the faculty team developing the joint degree between the MBA and the Earth and Environmental department in the College of Arts & Sciences. ISE advises on both of these efforts and coordinates closely with the EES concentration on curriculum development, event and speaker opportunities, including recently developing breakfast hour conversations with energy industry experts interested in coming to campus and talking to students.
- Because of our extensive network we are also assisting in the faculty recruitment process, both at the Questrom School of Business and the Metropolitan College. Our most recent placement is that of David Jermain who will be a critical part of MET's Master of City Planning sustainable energy concentration, teaching the cornerstone course.
- ISE Director, Peter Fox-Penner, also sits on the advisory board committee of the Initiative on Cities and the City Planning & Urban Affairs program, playing a critical role in the development of the sustainable energy concentration.
- ISE is actively exploring opportunities for executive education to provide open-enrollment and/or company-sponsored courses to mid-career and executive level professionals. Potential courses include "Clean Energy Business and Policy," "Electric Utilities of the Future: Disruption and Transformation," and "Clean Energy Financing in New England." Recent discussions with Questrom Senior Lecturer, Christopher Sprague, from the new initiative, Questrom Digital, is exploring executive education focused on scenario planning and leveraging the latest in digital learning platforms. As a recent startup institute, ISE is also advising Questrom Digital as it is starting up.
- In February 2017, David Bishop (Director of Mechanical Engineering) and Sarah Hokanson (Director of Professional Development & Post-Doctoral Affairs, Office of Research) submitted a proposal for the NSF Research and Training grant. If awarded, ISE would play a center role in hosting and training PhD students working in sustainable energy. As part of those discussions, a sustainable energy Boot Camp for new PhD students working in that field would help to provide multidisciplinary training exposing students to relevant issues in business, policy and science.

# FY17 Events

## FROM RISK TO RETURN INVESTING IN A CLEAN ENERGY ECONOMY

Dan Lachof, Chief Operating Officer of NextGen Climate America, will discuss the new Risky Business Project report, From Risk to Return: Investing in a Clean Energy Economy. The report goes beyond risk analysis to look at the many opportunities for American business to address climate change risks by building a clean energy economy. The best estimates suggest that we need to reduce greenhouse gas (GHG) emissions by 90% by 2050. To do so will mean transforming the way we produce and use energy. From Risk to Return examines the technological and economic feasibility of doing so, using commercial or near-commercial technology.



**DAN LASHOF**  
Chief Operating Officer,  
NextGen Climate America

### MODELING OF ALTERNATIVE ECONOMIC SCENARIOS, THIS REPORT:

- Analyzes different energy pathways, focusing on sources of energy that produce little to no carbon dioxide emissions.
- Details the level of investment needed for each pathway.
- Identifies areas of economic opportunity to be created by these energy transitions.

### EXAMINING OPPORTUNITIES FOR BOTH AMERICAN BUSINESSES AND INVESTORS TO THRIVE IN A CLEAN ENERGY ECONOMY. THIS REPORT FOCUSES ON:

- The major technological and infrastructure changes necessary to shift to clean energy economy.
- The size and timing of capital investments, including comparison with the costs of inaction and other major recent investments in technology and infrastructure.
- The effect of this transition on different sectors of the economy and regions of the country, including a focus on jobs.

**THURSDAY, DECEMBER 8, 4-6PM**

**BARRISTER'S HALL, BOSTON UNIVERSITY SCHOOL OF LAW  
765 COMMONWEALTH AVENUE  
BOSTON, MA 02215**

FREE • OPEN TO THE PUBLIC  
PLEASE RSVP:  
<http://bit.ly/2griHky>



WESTGEN CLIMATE AMERICA



Boston University Institute for Sustainable Energy



## DISRUPTIVE ENERGY FUTURES

A look at the future of the electricity industry and global oil market

The world's mightiest industries—oil and electricity—now face grave and potentially fatal disruption from many directions. Advanced energy efficiency and renewable supplies are taking over the world market so quickly, that more fossil fuel is becoming unaffordable for competitive reasons than unburnable for climate reasons. The pace of this transformation is set not by incumbents but by agile and uninhibited insurgents who leave the old industries no place to hide. For incumbents to survive and thrive in the new energy world, it will take fundamental and uncomfortable changes. This epochal shift and its relocation of capital have already begun and will only accelerate.



**AMORY LOVINS**  
Chief Scientist, Chairman & Co-Founder,  
Rocky Mountain Institute  
Amory, who has been called the "world's energy minimalist," is one of the true pioneers of green, decentralized power. He has published 31 books and 600 papers, holds 12 honorary doctorates and has received numerous prizes and awards, including a MacArthur prize.

**THURSDAY, SEPTEMBER 15  
4:30PM  
QUESTROM, HAR406**

HOSTED BY

Boston University Institute for Sustainable Energy

[sustainability@BU](mailto:sustainability@bu.edu)

Boston University Questrom School of Business  
Energy Management Center/University of Connecticut



## Science and Environment: A JOURNALIST'S PERSPECTIVE

Science and policy issues in energy and the environment have become a rich source of material for authors and journalists across the media spectrum. In particular, both the science of climate change and the reporting on that science have become heavily politicized, posing unique challenges for journalism.

This panel discussion explores the evolving role of authors and journalists who work in the energy and environment fields. Each panelist will discuss the evolution of their professional experience and their views on the challenges of writing and reporting in these fields, especially in the wake of the 2016 presidential election.

### Featured Panelists



**JOSEPH ROMM**  
Acclaimed author,  
Senior Fellow at Center  
for American Progress  
and science advisor to  
National Geographic



**MEERA SUBRAMANIAN**  
Award-winning journalist,  
author, and MIT Knight  
Science Journalism Fellow



**SETH BORENSTEIN**  
Award-winning national  
and international  
science writer for the  
Associated Press



**NAOMI ORESKES**  
Harvard Professor,  
award-winning and  
widely-cited science  
historian

### Moderator



**JOHN ROGERS**  
Senior Energy Analyst,  
Union of Concerned  
Scientists

**THURSDAY  
FEBRUARY 16  
4:00-5:30pm  
FREE AND OPEN-TO-ALL**

**WESTIN COPLEY  
PLACE HOTEL  
10 HUNTINGTON AVENUE  
BOSTON, MA 02116**

COCKTAIL RECEPTION TO FOLLOW  
DISCUSSION, <http://bit.ly/2iP23Eu>



Boston University Institute for Sustainable Energy



## Institute Sponsored & Co-Sponsored Events

### Engaging diverse audiences on multidisciplinary topics

Number of Events	16
Average Attendance	50
Smallest Event	8
Largest Event	146

Date	Event	Co-Sponsor?	Audience Size	Audience Type
9/15/2016	Amory Lovins Presents Disruptive Energy Futures	sustainability@bu, MBA EES	105	BU students, faculty, external
9/29/2016	Environmental Film Festival presents "The Age of Consequences"	ISE co-sponsored	100	external
11/3/2016	ISE Mini-Retreat	no	45	BU faculty, central administrators
11/8/2016	District Energy Keynote Lecture, City Planning, MET	ISE co-sponsored	43	internal, students
11/14/2016	DoE Regional Innovation Center Conference (Boston)	NECEC	45	External, potential regional partners - academic, nonprofits, entrepreneurs
11/29/2016	DoE Regional Innovation Center Conference (New York City)	NECEC	15	External, potential regional partners - academic, nonprofits, entrepreneurs
11/29/2016	Future of Buildings	sustainability@bu, IoC, Pardee Center (Paul McManus hosted)	30	internal students, 25% external (business, government, academic)
12/2/2016	BU Corporate Relations Lunch & Learn Series featuring Schlumberger	ISE co-sponsored	8	BU PhD/masters students
12/8/2016	Dan Lashof presents "From Risk to Return: Investing in a Clean Energy Economy"	NextGen Climate America	70	2/3 BU, 1/3 external (business, government, academic)
2/16/2017	Science & Environment: A Journalist's Perspective	Union of Concerned Scientists	146	79% external (business, government, academic)
2/22/2017	BU's Climate Research in Action	Pardee Center, IoC, sustainability@bu	48	BU 80%, 20% external
3/20/2017	The Economics and Competitive Landscape of Energy Storage, Brett Perlman (ISE Seminar Series)	no	15	(6 online) 50%-50% external/BU
4/3/2017	Pricing Climate Risk, Gernot Wagner (ISE Seminar Series)	no	28	(11 online) 50%-50% external/BU
4/13/2017	Hurry or Wait: Rolling our Renewable Energy, Jurgen Weiss & Dean Murphy (ISE Seminar Series)	no	20	(3 online) 50%-50% external/BU
4/24/2017	Renewable Electricity in the Trump Era: The Role of Federal, State & Local Policies, Phil Warburg (ISE Seminar Series)	no	19	(5 online) 50%-50% external/BU
4/25/2017	ISE Washington DC Launch	Federal Relations	65	90% external Washington DC



# Part 1 | Communications

## Social Media

**Facebook** <https://www.facebook.com/InstituteforSustainableEnergy/>

Followers **95**

Posts **19** top post reached 203 users

Pages Likes **95**

**Facebook Live**

~5,000 views

99 likes

93 shares

20 comments

**Twitter** @ISE\_BU

Followers **203**

Tweets **265**

Likes **133**

**Website** [www.bu.edu/ise](http://www.bu.edu/ise)

300 page views between

April 22 – May 22, 2017

## Communications & Outreach

**Twice-yearly Newsletter** (December & June)

Current listserv: **3,969 subscribers**

(872 are local or have opted-in to ISE listserv)

**Regular Outreach**

**2-4 monthly emails** specific to ~60 ISE BU affiliates  
i.e. info relating to project or job opportunities  
for students or PIs

**2-4 monthly emails** to extended local network  
(872 subscribers) primarily event announcements



*This 27 minute live conversation between Peter Fox-Penner and John Rogers, Energy Analyst, Union of Concerned Scientist was a precursor to ISE's Science & Journalism event on February 16, 2017, which John Rogers moderated.*

PART 2 | Self Assessment & the Look Ahead

# A LOOK OVER THE HORIZON

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### FY2018 Goals

2016

- Core team & systems established ✓
- \$2mm+ in projects underway or in negotiation ✓
- 40+ affiliated faculty ✓

2017

- Deliver on first major projects ✓
- Recruit additional PIs & staff ✓
- 50+ affiliated faculty ✓

2018

- Move to new space
- Maximize research output and faculty assists; broaden funding channels; confirm funding of \$3 million+
- Continue events, seminars, visibility events, student and curriculum involvement at about current or slightly trending up levels
- Launch major gifts campaign
- Improve communications function
- Increase BU core funding support a little and begin raising funds to replace current support with donated funds
- Form Advisory Board & Industry Council

2020

- Move to permanent space
- Expand to 10+ PIs, 15+ funded projects
- Grow to \$5mm+ annual run rate

### Research Opportunities In the Pipeline

- Launch Bloomberg Philanthropy/GEIDCO Global Grid Project
- \$100,000 gift for Haiti Clean Energy Project
- Professor Nalin Kulatilaka and Non-Resident Senior Fellows Pauliina Swartz, Richard Stuebi and Brett Perlman, are working to create a program in energy finance innovation
- Expansion of Hewlett Foundation “Grid of the Future” project
- Energy Futures Initiative – possible collaboration
- Sidewalks Lab (project of Google) – urban technology collaboration
- Expansion of Mitchell water project into full program
- NSF grant applications with Professor Templar; and Professor Ren and ISE Post-Doctoral Associate John Helveston

### Proposed Advisory Board

ISE has been fortunate to have the opportunity to engage with Sheldon Simon this year. Discussions with Sheldon led us to transition away from the Industry Council toward a more traditional Advisory Board.

ISE's proposed Advisory Board will comprise individuals who are knowledgeable about the sustainable energy sector and who want to support the Institute with some combination of time, talent, and treasure. Unlike many BU Advisory Boards, we do *not* propose that there be a firm expected annual contribution from AB members.

Instead, the expectation is that members will meet one of the following criteria:

- Distinguished Thought Leader or Former Government Official whose participation lends prestige and credibility
- Alum who commits to a moderate annual donation (\$5,000 - \$10,000) and wants to become involved in direction-setting and leadership
- Senior executive – current or former – in energy industry.

After the Annual Briefing, we will begin the process of forming the new Advisory Board.

### Annual Executive Briefing | October 19 & 20, 2017

On October 19th – 20th, the ISE will hold its first Annual Briefing, convening approximately 20 CEO-level experts at an event that will showcase BU's sustainable energy work. This is an important opportunity to connect with potential Advisory Board members and industry partners in person, on campus.

The invitation-only Briefing will bring together senior executives of select companies from industries at the forefront of advancing sustainable energy and government representatives also.

Presentations and discussions will focus on defining the opportunities for progress in decarbonization of the electric grid, emissions reductions in buildings and in transportation, and water. Participants will learn about the applied research projects that the Institute for Sustainable Energy is pursuing, with consideration of business, policy, and technology aspects, and will engage with thought leaders from industry and government.

#### Confirmed Participants Include

**Leah Bissonette** Principal, The Energy Bliss

**Lawrence Goldenhersch** Former CEO, Enviance

**R.F. Hemphill** Former President & CEO, AES Solar Energy

**Cheryl LaFleur** Chairman, Federal Energy Regulatory Commission

**Vice Admiral Dennis McGinn** Former Assistant Secretary of the Navy

**Anne Prammagiore** CEO, Commonwealth Edison

**Ken Pucker** Former CFO, Timberland

**Dorothy Robyn** Former Commissioner, General Services Administration

**Sheldon N. Simon** Partner & Equity Analyst, Adage Capital Management

# New Space for the Institute

- We are happy to announce that the ISE is moving in September 2017 to **650 Beacon St.**



*Watch for our grand opening and following events!*

## ISE Staff

### Leadership & Staff

**Peter Fox-Penner, PhD**

Institute Director & Professor of Practice

**Jacqueline Ashmore, PhD**

Director of Research & Outreach

**Tess Kohanski**

Assistant Director, Operations

**Ryan Hopping**

Senior Administrative Assistant

**Margaret Cherne-Hendrick, PhD**

Post-Doctoral Associate

**John Helveston, PhD**

Post-Doctoral Associate

**Chris Meier, PhD**

Program Manager, Carbon Free Boston

**Michael Walsh, PhD**

Senior Research Scientist, Carbon Free Boston

**Jennie Hatch**

Research Fellow

