

THE EVOLVING ROLES AND STRUCTURES OF UNIVERSITY-AFFILIATED ENERGY AND ENVIRONMENT INSTITUTES:

A REVIEW

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Abstract

The landscape of energy and environment-focused research institutions is varied and fragmented. It is not always clear what works for an institution and what doesn't. Rarely do these organizations communicate or coordinate on a long-term basis, with the exception of some specialized, donor-funded partnerships among two or three specific institutions. And yet these institutions, which are often anchored to academia, are some of the most important vectors of innovation in the global energy industry. They provide thought-leadership, feed students and fellows into industry and government, and drive the next generation of energy and environment development in the US and abroad. A closer look at 35 prominent energy, environment, and natural resources institutes offers valuable insight into the mission, visibility, and effectiveness of research-tied organizations. This paper provides a non-comprehensive attempt to classify and characterize these institutes by funding, governance structure, affiliates, and output. Output is a particularly important aspect of an institute's success: it defines how that institute is seen by the public, and whether it is able to attract notable fellows, funding, and staff. This paper does not seek to judge an institute on its operational effectiveness or influence—instead our intention is to map the space to offer a better understanding of which needs are being met and which are underserved. Finally, we propose a network initiative among these institutions, and to define what kind of coordination would have an acceptable cost-benefit ratio to most institute leaders.

1. Introduction

The U.S. and UK academic space has no shortage of energy, environment, and natural resources-related institutes. All of these organizations have slightly different missions and goals, although often similar-enough directives that comparison is possible (at least structurally). This paper provides fodder for the wider community, as well as the staff who are currently standing up a new policy institute at the Colorado School of Mines Payne Institute. The paper employs desktop research and offers a non-comprehensive review. It does not place judgment on the viability of any one institutional model, nor the relative success of any one institute, rather the goal is to identify where needs have been met and where gaps exist that could be filled by coordinated efforts among energy institutes.

Part of the motivation for such a mapping is self-serving—the recently-founded Payne Institute will be able to direct its work to offer new and innovative services and research, while also taking lessons from some other institutes that have been operating for several years longer. But the secondary motivation behind this paper is to offer other institutions a view of the current landscape as well. This is not trivial, as most of the institutions that we will include in this mapping were founded within the decade, and they may be forming their own strategies as much as Payne is currently.

Finally, we intend to expand the scope of this study to explore the possibility of creating a network among the relevant energy-focused institutes in the U.S. and the UK. How such a network would operate and whether coordination among these organizations would be well-received is a major objective of this work. We ask: could the creation of a network better leverage the strengths of the institutes?

The remainder of the paper is organized as follows: Section 2 presents a brief description of core literature that we considered for the review and gap-identification process. Section 3 provides a methodology, and a brief description of the method of analysis used. Section 4 contains four subsections which consider the common elements, key observations, and highlights unique ideas under the topics of: structure, funding, and outputs. Section 5 considers the role of a new network and possible coordination initiative, and Section 6 concludes.

2. Literature Review

This work on mapping the institutional space is preceded by other papers in both academic and gray literature. The most thorough and applicable paper to this work is a review conducted by the University of Texas at Austin.¹ Documentation on Think Tanks by the University of Pennsylvania

¹ “Energy Institute Benchmarking Profiles”. *University of Texas Energy Institute*. Ross Strategic. 17 November 2016.

also provides useful insights, informing our research.² Bazilian and Greer (2003)³ equally provides background for this study.

The background research conducted by the University of Texas, profiling several institutes is an invaluable resource for a study of this nature. The paper closely relates to Payne's vision for this study. The profiles offer a thorough guide to 13 different institutes, based mostly on interviews and website review. Many of the profiles are based on the self-reporting of institutions.

Similarly, the Think Tank Index, published by the University of Pennsylvania's Global Go To Think Tank, partially inspired our work to map energy and environment institutes. The index is an annual report on think tanks around the world, which results in a ranking by region and category. This ranking helps inform public policy makers of the value of the research that they use in the course of their work. Like the think tank index, we have compiled extensive information on energy institutes throughout the US and abroad, however, we do not attempt to rank these institutions as the University of Pennsylvania index does.

Greer et al. (2015) is another useful study that benchmarks a number of energy institutes in Europe and abroad that have directives and powers similar to Sustainable Energy Ireland (SEI). Like SEI's benchmarking study, the goal of the Payne Institute is to define a space for itself, without resorting to pure ranking. However, unlike the SEI study, Payne focuses on academic, energy-focused groups, rather than international, government-funded agencies.

Surveys of institutions in a specific academic space are a common thing, although the cross section of organizations studied here is generally unique⁴. The simplest of these surveys involves simply assembling a resume of a selection of institutions, without significant comparison or qualification.⁵ Our paper seeks to push this framework forward with some analysis of the characteristics of the institutions we are quantifying. Such analysis, we believe, will provide context for our higher goal: collaboration among institutions in the future.

Research for this paper included not only surveys of institutes but also studies of think-tanks and foundations, as the aims of these organizations are broadly similar: to build social or academic capital.⁶ This is achieved with the guidance of the organization's leadership, with the help of targeted or general funding, and in terms of output offered to the university or the community as a whole.

² McGann, James G., "2017 Global Go To Think Tank Index Report." TTCSP Global Go To Think Tank Index Reports. 2018. https://repository.upenn.edu/think_tanks/13.

³ Greer, Heather and Morgan Bazilian. "A Benchmarking Study of Selected National Energy Agencies." *Sustainable Energy Ireland*. December 2005.

⁴ Rush, Howard, Mike Hobday, John Bessant, Erik Arnold. "Strategies for best practice in research and technology institutes: an overview of a benchmarking exercise." *R&D Management*. 25(1): 17:31. January 1995.

⁵ Goto, Akira, and Patarapong Intarakumnerd. "Role of Public Research Institutes in National Innovation Systems in Industrialized Countries: The cases of Fraunhofer, NIST, CSIRO, AIST, and ITRI." The Research Institute of Economy, Trade, and Industry. March 2016. <https://www.rieti.go.jp/jp/publications/dp/16e041.pdf>.

⁶ Pautz, Hartwig. "Revisiting the think-tank phenomenon." *Public Policy and Administration*. 26(4):419-435 · October 2011.

Prior work has shown that funding and staffing choices are among the most important factors in an institution having high public engagement.⁷⁸ Philanthropic funding, for example, has shaped the direction and nature of climate-focused organizations.⁹ And the value of staffing choices are not exclusive to faculty: non-faculty staff members play a key role in bolstering the overall productivity of an academic institution.¹⁰

While we include research on think tanks to inform our study, it is worth mentioning that think tanks and academic institutes are often quite distinct, with institutes retaining ties to the parent university and generally attempting to offer neutral, scientific information, whereas think tanks are seen as “universities without students,” and often unencumbered by political affiliations.¹¹

Still, think tanks share the same imperative to build trust that academic institutes do. Finlay (2016) asserts that ensuring transparency thrives in the business model of think tanks is key to long term success of the industry. In fact, integrity is the biggest equity that think tanks hold; they must uphold it and avoid giving the impression of serving certain interests for selfish or other pecuniary gains.¹² This idea applies to all academic institutions as well, especially to those independent institutions that retain funding ties to industry and only loose ties to their host university.¹³

3. Methodology

In this paper, we identify key characteristics of energy and environment-focused research institutions. The goal of this is to aid in assessing these institutions based on such characteristics as: funding, governance structure, affiliates, and output. Further to this classification, we examine commonalities, uniqueness and key observations across the different institutions. This approach provides a way to evaluate without necessarily ranking the different institutions. As a result, this paper provides insightful information on underserved needs and insights on building a network initiative among these institutions.

There are several studies that have examined the structure and organizational behavior of public research institutions vis-à-vis problems of funding and quality of research output (Coccia, 2014; Laudel, 2006; Heitor et al., 2014)

⁷ Entradas, Marta and Martin W Bauer. “Mobilisation for Public Engagement: Benchmarking the Practices of Research Institutes.” Submitted to *Public Understanding of Science*, June 2015.

⁸ Etzkowitz, Henry. “Research groups as ‘quasi-firms’: the invention of the entrepreneurial university.” *Research Policy*. 32(1): 109-121. January 2003.

⁹ Nisbet, Matthew C. “Strategic philanthropy in the post-Cap-and-Trade years: Reviewing U.S. climate and energy foundation funding.” *WIREs Climate Change*. Wiley Periodicals, Inc. 2018.

¹⁰ Rhoades, Gary. “Managing Productivity in an Academic Institution: Rethinking the Whom, Which, What, and Whose of Productivity.” *Research in Higher Education*. (2001) 42: 619.

¹¹ Chance, Alek. *Think Tanks in the United States Activities, Agendas, and Influence*. Institute for China-American Studies. 2016.

¹² Finlay, Brian. “The Value of Transparency in 21st Century Think Tanks: the Stimson Center approach.” On Think Tanks. <https://onthinktanks.org/articles/the-value-of-transparency-in-21st-century-think-tanks-the-stimson-center-approach/>. 29 June 2016.

¹³ Sagar, A.D., J.P.Holdren. “Assessing the global energy innovation system: some key issues.” *Energy Policy*. 30(6):465-469. May 2002.

Weaver (1989) is one of the more cited studies to look at the dynamic landscape of think tanks. The study examined, predominantly, the funding, roles, and output of these institutions. Each of these features is further examined at a granular level, providing a detailed analysis of the characteristics of think tanks. While our study focuses on energy and environment-focused research institutions, we follow a similar approach in the characterization of the institutions referenced in this study.

Another instructive work, McGann (1992) looks at the historical evolution of public research institutes, and how old institutions gradually began to direct attention to domestic and environmental matters. The study highlights the founding period of most research institutions in the United States, and the economic and political environment that necessitated the birth of these institutes. Interestingly, too, the paper comments on the longstanding nexus between the independence of an institution and the objectivity and quality of research output.

Our study employed a qualitative method of analysis, similar to the above-mentioned studies. In gathering information, we resorted to surveys and interviews. However, we also relied on the background research conducted by the University of Texas, which provided results from surveys thirteen (13) of the institutions profiled in this study. The website of some of the institutes studied in this paper also provided additional information.

From the result of the survey emerged three key factors underlying all the institutes studied: governance structure, funding, and output. Under these factors, we then examine common factors, key observations, and unique ideas among the institutes. The results of the survey also enabled the construction of simple graphical analysis, detailing the strength of fellow-membership for the different institutes, and output types – symposia, colloquia, published research or white papers.

This study is first of its kind with respect to the goal of proposing the forging of a network of alliance among energy and environment-focused research institutions. It is imperative that we adopted a qualitative approach, which in this study involved assessing the key factors common to the different institutes. The upshot of this is that we learned of the similarities and disparities among the set of institutes studied. This finding, while not completely novel, is crucial to understanding the nitty-gritty of building either a loose network or a strong network of energy and environment institutes. Thus, this study contributes to the sparse literature on collaboration among energy and environment-focused institutes.

4. Mapping

Governance structure, funding, and output decisions are defining for any organization.¹⁴¹⁵ Whether the institute will take money and/or direction from its host university or another benefactor, how the institute will approach donation solicitation, and how the top-level executives hired by the

¹⁴ Pautz, Hartwig. “Scottish Think-Tanks and Policy Networks.” Scottish Think Tanks and Policy Networks.” *Scottish Affairs*. No. 58, Winter 2007.

¹⁵ Ostrower, Francie. “Nonprofit Governance in the United States: Findings on Performance and Accountability from the First National Representative Study.” The Urban Institute. <http://webarchive.urban.org/publications/411479.html>. June 25, 2007.

institute will execute its functions are all critical to the nature of the institute and to the way the institute is received by its intended audience¹⁶.

In the following sections we will use the information we gathered to give general context for governance, funding, and output among our studied energy institutes. Detailed spreadsheets can be found in the appendices.

4.1 Governance Structure

Common factors: Most institutes rely on a director whose responsibilities are tied exclusively to the functioning of the institute. Titles for this position include, Director, Chair, Executive Director, Institute Director, Faculty Executive Director, and at University College Cork and University College Dublin, Principal Investigator and Head of Energy Institute, respectively.

From there, most institutes have an assistant or associate director. Larger institutes tend to have directors of development, who build relationships with potential donors and solicit gifts. Institute web pages generally list administrative staff and fellows. The list of institute fellows ranges widely from a handful to more than 50 fellows (Fig. 1).

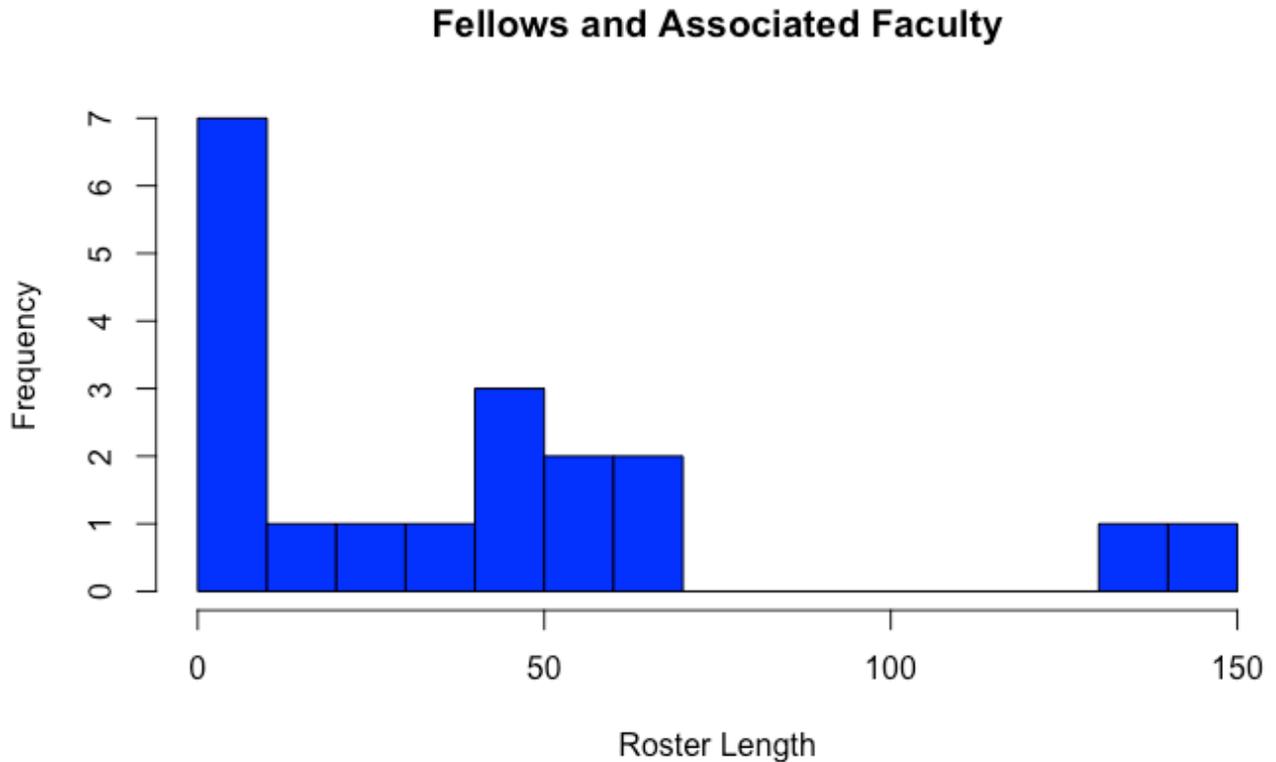


Figure 1: Roster numbers

¹⁶ Etzkowitz, Henry, Andrew Webster, Christiane Gebhardt, Branca Regina Cantisano Terra. "The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm." *Research Policy*. 29(2): 313-330. February 2000.

In terms of roster length, the University of Michigan Energy Institute and the Stanford Woods Institute for the Environment are clear outliers. High-end outlier results are not necessarily indicative of the true number of people that the institute employs, however. Many schools do not clearly distinguish between full fellows and associated faculty, many of which are likely on the University's payroll. Importantly, most institutes for which we have data have fewer than 50 fellows and associated faculty.

Most institutes also have an advisory board. The size of the advisory board varies somewhere between 5 and 16 members. But the advisory board takes on a very different role for different institutes. For some institutes, the advisory board is staffed exclusively with faculty, for others, it's staffed with executives from corporate energy firms and other industry groups. Faculty advisory groups tend to contribute in a tangible way to the academic direction of the institute, whereas several institutes, including the University of Michigan Energy Institute and Duke University Energy Initiative, appear to retain executive advisory boards to better connect research with industry-focused opportunities.

The function of the advisory board is also variable. Some of this variation is captured in the name of the advisory board. At times it is an "executive committee," other times a "governing board." Harvard Center for the Environment calls its board a "steering committee."

How much control an advisory board has over the host institution is also variable: At the Arthur L. Irving Institute for Energy at Dartmouth, the University Provost appoints the advisory board, but the institute specifies that "The advisers will serve in a solely advisory capacity, with no governing authority over the institute." At the Texas A&M Energy Institute, the Executive Committee and the Faculty Steering Committee are both staffed by faculty, and the External Advisory Board is staffed by people outside of academia, including business executives, a vice president from Sandia National Laboratories, and a Congressman from the US House of Representatives. At the MIT Energy Initiative, in addition to an executive committee and an external advisory board, a Governing Board is convened twice a year to oversee seed funding for research.

A strong and independent leadership staff, as well as a complementary advisory board, seems to be the rule for energy institutes. The influence of the host university tends to be more prominent the smaller the institute is. Large, well-funded institutes can afford to be independent of the universities they are tied to, while, for example, the smaller Wisconsin Energy Institute is wholly administered by UW's Research and Graduate Education office.¹⁷

Observations: Some Institutes appear to be quite concerned with limiting the influence of industry on the work that the institute does. For example, the Carnegie Mellon Energy Innovation Institute places limits on board membership, directing that every member of its board "is an actual research collaborator, usually through co-mentoring a postdoc or student." Carnegie Mellon also approaches bringing research out of the lab and into the real world by focusing primarily on Research and Innovation as well as Education and Outreach. This is appropriate given Carnegie's

¹⁷ Stahler, Gerald J., William R. Tash. "Centers and Institutes in the Research University: Issues, Problems, and Prospects." *Journal of Higher Education*. 65(5): 540-554. 1994.

focus on the science and engineering aspects of energy issues, which come with patent and commercialization concerns. Institutes that focus more on contextual policy analysis, such as Chicago's EPIC, may not have the same pronounced need to quickly publish energy policy papers.

Unique ideas: Among the standard structures and boards that most institutes have, a few governing mechanisms appear to be unique. The Energy Council at MIT's Energy Initiative is comprised of five professors as well as the initiative's executive director and a deputy director. It helps the initiative shape "research, education, and outreach directions," according to the organization's website.

At the Kleinman Center for Energy Policy at the University of Pennsylvania, a Center Coordinator position exists that appears to provide the functions of a top-level administrator, while a Faculty Director provides the expertise—essentially the function of an Executive Director split into two positions.

At Stanford's Precourt, institute staff provide support for many smaller centers at Stanford. This setup allows those smaller centers to be efficient, and it minimizes friction in creating more specifically-focused centers. Similarly, smaller offices share administrative staff in the case of CU Boulder's Renewable and Sustainable Energy Institute, which was developed to be a joint institute with the National Renewable Energy Laboratory.

4.2 Funding

Funding is key to the functioning of the institute. However, as funding is often a closely-guarded secret, only in rare cases do we have a full picture of an institute's income and outflow. In 10 of the 35 cases we included in this research, no funding information at all was available to the public. Often, the publicly available information on funding was incomplete.

Common Factors: There are two common factors in funding at energy institutes: a large "founding" gift, and continued philanthropic donations.¹⁸ Information on founding gifts is generally more transparent.

Other sources of funding are also found in grants, and in some instances the university itself contributes a small amount of money annually. "Corporate engagement" varies, but generally the powerhouse institutes like Stanford's Precourt seem to have substantial corporate engagement.¹⁹

In some cases, the state provides funding for the institute: University of Washington's clean energy test beds institute was initially funded by the state, and since then, the organization has been able to attract "more than \$30 million dollars of funding," including \$6 million from state funds, as well as "\$9 million in private gifts or industry grants, and \$15 million of new federal grant funding," according to the institute's website. In these instances, the state essentially offers a gift as "seed funding." The funding gives follow-on grant and gift money confidence that productive work can come out of the new institute, so the initial gift grows into more substantial gifts.

¹⁸ Drezner, Daniel W. "American think tanks in the twenty-first century." *International Journal*. 70(4): 637 – 644. 10 July 2015.

¹⁹ Slaughter, Sheila, Larry L. Leslie. "Academic Capitalism: Politics, Policies, and the Entrepreneurial University." Johns Hopkins University Press, Baltimore. 1997.

Cornell has a similar story, but perhaps on a grander scale. The Cornell Atkinson Institute for a Sustainable Future started with \$80 million gift from David & Patricia Atkinson. In Fiscal Year (FY) 2016, Atkinson’s expenses totaled \$5.6 million. Of that, research and program spending came to \$3.4 million, a year-over-year increase of 21 percent, due to “new collaborative research projects with external partners.” Revenues totaled \$6.1 million, with 60 percent of that coming from the institute’s endowment, 29 percent from current-use gifts, and 11 percent from the university itself and grants (See Table 1).

Table 1: Funding types

Funding Type	Institutes Reporting
Founding gift	6
Philanthropic donations	16
Grant funding	12
Corporate funding	11
University support	4

Most institutes had material on their websites, reporting philanthropic donations as sources of funding. Only four institutes mentioned any university support.

Key Observations: Leveraging a donor network seems to be one of the more efficient ways to expand the reach of an institute. Columbia’s Center on Global Energy Policy is a good example of this. The institute is tied to the SIPA (School of International and Public Affairs) donor network, and it does not need to solicit 100 percent of its donor gifts alone.

Some institutes have long lists of corporate sponsors and partners.²⁰ UC Davis is among these, with at least nine corporate sponsors, from Chevron to all of California’s biggest utilities, as well as nearly a dozen non-profit and state-sponsored partners.

Two of the 36 institutes we profile—University of Chicago’s EPIC and Harvard’s Belfer Center—appeared to have earned access to the MacArthur Grant fund. EPIC received one \$3 million grant, and Harvard has benefitted from MacArthur grants several times.

Grant funding is a major component of total institute funding across the Atlantic as well. University College Cork received €44 million in active grants for its Environmental Institute. Here, energy funding isn’t isolated from general environmental study funding, so comparing the €44 million gift to other energy-focused grants in the US is misleading. Still, the grant funding came predominately from European Union sources as well as SEAI (Sustainable Energy Authority of Ireland), and DCENR (the Irish Department of Communications, Climate Action and Environment). Again: all government sources, much like University of Washington.

²⁰ Fritsch, Micheal, Christian Schwirten. “Enterprise-University Co-operation and the Role of Public Research Institutions in Regional Innovation Systems.” *Industry and Innovation*. 6(1): 69-83, 1999.

In many cases, initial gifts that begin the institute continues to be the main source of sustenance for a long time. Payne is on the smaller side with a \$5 million gift, Andlinger is the largest gift we are aware of, at \$100 million.

Unique ideas: MIT's Center for Energy and Environmental Policy Research (CEEPR) seems to rely on connections with better-established schools within the university to bolster its finances (namely, the school of management, the department of economics, and the energy initiative). CEEPR also benefits from "continuous" partnerships with public and private entities to build "productive relationships that help faculty and research affiliates identify emerging policy challenges and sustain the relevance of their work." In return, these continuous benefactors receive "privileged access to research output, direct engagement with faculty and researchers, and participation in invitation-only events."

The Wisconsin Energy Institute also courts public and private partners. On its website it advertises, "Whether you'd like us to be a part of your research proposal or you need us to play an advisory role, we are open to collaborative funding efforts and have the breadth and depth of experience necessary to help develop competitive proposals."

Among the more unique partnership ideas there is the Julie Ann Wrigley Global Institute of Sustainability, which entered into a partnership with Major League Baseball in 2018 to develop a zero-waste program for the organization.

4.3 Output by category

Output is a catchall term to represent the work of an institute. Output is vitally important for proving the worth of an institute both to donors and the recipients of the institute's work (these recipients can be students, faculty, fellows, or other institutes). It forms the basis of casual networking by bringing experts and future experts into a similar circle.²¹ DeMuth (2007) argues that think-tanks "promote our output with an alacrity that would make many university administrators uncomfortable."²² Although our definition of output is broader than DeMuth's, including events as well as academic and white papers, many institutions also promote output much more nimbly than the universities they are tied to. A wide and expanding range of work and activities work helps an institute build and maintain visibility.²³

Here we will discuss three types of output that each institute contributes. The first are the "common features" that all institutes seem to offer: research, events (including talks, panels, and discussions), and symposia. The second type of output is discussed in "key observations" and are unique to the type of institution that offers that output. That is, if the institution is policy-focused, it will tend to offer policy digests, and if it's research-focused, it invariably offers short videos of current

²¹ Steelman, Aaron. "Book Reviews: Do Think Tanks Matter? Assessing the Impact of Public Policy Institutes by Donald E. Abelson." *Cato Journal*. <https://object.cato.org/sites/cato.org/files/serials/files/cato-journal/2003/5/cj23n1-19.pdf>. Accessed 10 June 2018.

²² DeMuth, Christopher. "Think Tank Confidential." *The Wall Street Journal*. <http://ccdemuth.com/wp-content/uploads/2015/03/Think-Tank-Confidential.pdf>. 11 October 2007.

²³ McNutt, Kathleen, Gregory Marchildon. "Think Tanks and the Web: Measuring Visibility and Influence." 35(2): 219-236. June 2009.

research, explainers, or hackathons—anything to showcase some of the more hands-on research that the institute funds.²⁴ The third type of output are highly-specific “unique ideas” which are not generally found at similar institutes.

Common Features: Every single institute we studied had some sort of obligation to contribute to research pertinent to that institute’s field.²⁵ For university-based institutes, this involved academic research or grant-funded engineering projects spearheaded by faculty or fellows. For umbrella institutions like the Siebel Energy Institute and the National Council for Science and the Environment, this takes the form of supporting academic research at other energy-related institutes by providing grants for research or supporting it in some other way.

Every institute we included in our study also provided an “events” calendar on its website with the exception of the Siebel Energy Institute.²⁶ Siebel is a philanthropic organization that awards grants to other energy institutes, and does not appear to interface with the public or with a particular academic community at a granular level as regularly. In most cases, however, “events” calendars are filled with talks given by experts, book discussions, panels, movie screenings, happy hours, and more. If these events are open to the public, they also confer on the institute and its host university an amount of authority over the subject matter at hand.

Symposia and colloquia are also common for institutes to host. These satisfy the two core aspects of an institute’s objective: contributing to collective knowledge and distributing that knowledge. In addition, symposia and colloquia bring together experts and non-experts with interests in similar topics, which allows the institute’s acolytes to network and creates the potential for collaboration (Fig. 2).

²⁴ Datta, Ajoy. “Getting better at influencing policy is a social process: lessons from work with an international agency.” On Think Tanks. 18 September 2018.

²⁵ Baird, Leonard L. “What characterizes a productive research department?” *Research in Higher Education*. 25(3): 211–225. September 1986.

²⁶ Neresini, Federico, Massimiano Bucchi. “Which indicators for the new public engagement activities? An exploratory study of European research institutions.” 20(1): 64-79. 13 December 2010.

Of the 36 institutes we researched:

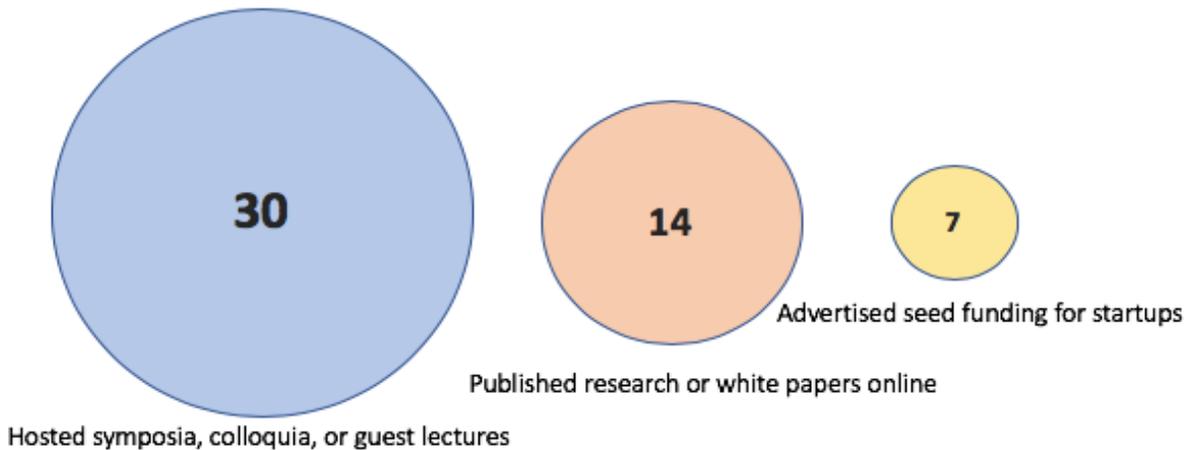


Figure 2: Output types

Key Observations: Economics-focused institutes tend to publish working papers online, perhaps to account for the long lead-time in getting economic research peer-reviewed. Sometimes, this willingness to publish working papers online can lead to the publication of non-economic papers, and policy-focused research working papers will also be posted.

Sometimes, rather than subsidize research programs or a specific fellow’s research, institutes will offer small grants in the form of “seed-funding” to get research on-track, perhaps to apply for bigger grants from a major funder like MacArthur or the Department of Energy. In some cases like at MIT or Carnegie Mellon, seed-funding appears to be an important part of the institute’s purpose. The institute is closest to the “seeds” of research that could grow into a bigger return for the host university.²⁷²⁸

Unique Ideas: Unique ideas are genres of output that aren’t common to more than a few different institutes. They’re plentiful among the academic research institute space and are a testament to the creativity of institute staff, as well as to the economic necessity of differentiating energy institutes in a clearly competitive market.

Some of the unique ideas that stood out included (Table 2):

1. Columbia’s institute-agnostic “Women in Energy” club: the club is focused on women in energy from Columbia, but a member need not be a woman or from Columbia to join the mailing list and attend club events. Columbia’s high-profile reputation attracts people across the country and its

²⁷ Trencher, Gregory, Masaru Yarime, Kes B. McCormick, Christopher N. H. Doll, Steven B. Kraines. “Beyond the third mission: Exploring the emerging university function of co-creation for sustainability.” *Science and Public Policy*. 41(2):151-179. 1 August 2013.

²⁸ Mazzoleni, Roberto, Richard R. Nelson. “Public research institutions and economic catch-up.” *Research Policy*. 36: 1512–1528. 27 August 2007.

semi-monthly newsletter of job opportunities and women-hosted and -focused events pertaining to energy help foster a new demographic in energy and connect people throughout the world.

2. The London School of Economics' Grantham Institute also has an active email list, and interested parties are reminded of recent and upcoming panels and talks, some of which allow for a virtual audience, on a variety of energy-related topics.
3. A few institutes offer regular podcasts. Podcasts can also be consumed throughout the world, irrespective of the bounds of geography or time, so this is a great way to develop a national or even global reach, as long as the podcast is interesting.
4. MIT's Center for Energy and Environment Policy Research uses its faculty to offer expert testimony for a variety of policy matters, specifically testifying before Congress on energy topics. This serves to bolster the institute's reputation among policy-focused professionals, which is CEEPR's target demographic.
5. Along the same lines, CEEPR also contributes to regulatory comment. In many cases, regulatory action at the federal level is high-profile and open to public comment, so an institute need not wait for an invitation to weigh in on a particular regulatory topic. Offering a public comment could help the institute gain notice among policy professionals and journalists who might be combing through public comment.

Table 2: Interesting ideas

Institute Name	Unique ideas
MIT Center for Energy and Environmental Policy Research	Expert testimony
Chicago EPIC (Energy Policy Institute Chicago)	Government portal
University of Pennsylvania Kleinman Center for Energy Policy	"Policy Digest" Carnot Prize
University of Wisconsin, Wisconsin Energy Institute	Grant writing support
Princeton Andlinger Center for Energy and Environment	"Energy Technology Distillates" (reports targeted at policy makers)
CSU Energy Institute	Science Fridays for K -12 Your Energy Colorado tools (variety of practical calculators) Workspace for startups
UC Davis Energy and Efficiency Institute	West Village "Living Laboratory" Honda Smart Home
Harvard Belfer	Policy briefs & testimony posted on site
University of Washington Clean Energy Institute	K-12 lesson plan Videos, guides, and lessons ("how to make a coin cell" etc)
The Earth Institute at Columbia University	Student Research Showcase Videos about research
Cornell Energy Institute + Atkinson Center for a Sustainable Future	Sends delegations to climate conferences
Arthur L. Irving Institute for Energy and Society at Dartmouth	Research guides Energy, Disaster, and Resilience 3-day workshop
Duke University Energy Initiative	Field trips to power stations
Energy Institute, University of Texas Austin	"Clean Energy Beers" mixer nights Energy Journalism workshop
Grantham Institute London School of Economics	Executive education courses
CSU Center for the New Energy Economy (School of Global Environmental Sustainability)	Advanced Energy Legislation Tracker State Policy Opportunity Tracker (SPOT Tracker) Clean Energy Policy e-Book for State Legislatures Clean Energy Legislative Academy for legislators
Tufts Institute of the Environment	Delegates to United Nations Framework Convention on Climate Change (UNFCCC) annual Conference of the Parties (COP)

5. Potential for Coordination

The Energy Institute space is relatively new. As recently as 2009, the future of institutional energy research was unclear.²⁹ Now, public and private funding for energy-related research clearly sustains almost three dozen institutes. However, given the dramatic increase in the number of energy institutes across the nation, the Payne Institute suggests that a network connecting these varied organizations might improve the reach of each. In short, a network could potentially make whole greater than the sum of its parts.³⁰

As highlighted in Anne-Marie Slaughter’s book “The Chessboard & The Web”, networks will play an increasingly important role in the future of policy discussions. The proliferation of energy-related research institutes, combined with rapid change in energy research, will make networks valuable in ensuring the greatest impact. As Slaughter (2017) argues, networks rely on a range of independent actors, where exchanges are mutually beneficial. More so, such networks are more flexible than markets, and can foster long-term relationships among said actors.³¹

As science and innovation related to energy continues to change rapidly, and political environments remain divided, networks can play a crucial role in maintaining continuity. Additionally, the network approach will allow actors to amplify their influence.³² However, finding the right balance between too much connectivity and not enough will be key to ensure the viability from the proposed network.³³

We suggest that network of energy institutes could take two different forms: it could be a “loose network” or a “strong network.” A loose network might be more decentralized, perhaps taking the form of a shared website and a mission statement for the institutes. A shared internal roster might be circulated among the administrative departments of the institutes, which could allow for greater communication and coordination between institutes with shared or complementary missions.

With a loose network, buy-in is low risk, but voluntary loose networks tend to suffer some entropy without a manager. Valencia and Cázares (2016) write that its easier than ever to maintain networks among university communities by digital means (via websites, digital repositories of journals and dissertations, etc.), but they also write that if a network is desired. They argue that these objectives can be attained if processes within academic networks are well managed, and a system to bolster development of research, innovation and education is put in place.³⁴

A strong network, on the other hand, would require a manager to facilitate communication between the institutes. This manager might keep lines between the institutes current, tend to a website that surfaces some of the most important work of the institutes daily, and organize events and an annual

²⁹ Falkowski, Paul G., and Robert M. Goodman. “Future Energy Institutes.” *Science*. 325(5941): 655. 07 Aug 2009.

³⁰ Thorelli, Hans B. “Networks: Between markets and hierarchies.” *Strategic Management Journal*. 7(1): 37-51. January/February 1986.

³¹ Slaughter, Anne-Marie. “The Chessboard and the Web: Strategies of Connection in a Networked World” (New Haven & London, Yale University Press, 2017), Page 49.

³² Ramo, Joshua Cooper. “The Seventh Sense: Power, Fortune and Survival in the Age of Networks” (New York, Little, Brown, 2016) Page 34.

³³ Gladwell, Malcolm. “The Tipping Point: How Little Things Can Make a Big Difference” ((New York, Little, Brown, 2000)

³⁴ Valencia, Adriana Valencia, and Maria del Carmen Trejo Cázares. “Academic and research networks management: Challenges for higher education institutions in Mexico.” *International Journal of Educational Technology in Higher Education*. 13:7. 2016

conference for members. Additionally, the manager would cultivate and tend to relationships between the various members of the network creating the seeds of trust that allow networks to be sustainable.

Since the network would be voluntary for an institute to join, buy-in would still have to be low enough that a significant number of institutes would participate, otherwise the network becomes a collaboration between 2 to 5 different institutes, which already exists among many institutes. Unlike a loose network, a managed network would have a slightly higher cost to join, in that all institutes would need to contribute to fund a conference and a manager. On the other hand, return on network membership could potentially be greater.

Regardless of how the network is structured, the advantages to membership in the network would be better communication, learning, and an enhanced ability to serve fellows and students. Nevertheless, if institutes view the space competitively, and seek to exclude others from grant funding or industry support creating a prisoner's dilemma within the space, it will be difficult to build an effective network.³⁵

With many international challenges confronting today's policy makers, the creation of a networked approach would give energy and environment institutes a comparative advantage over other policy-oriented institutes. The connections to diplomats, civil servants, and industry leaders among others created through the networked approach will give energy and environment issues center stage as important decisions are made about our global future.³⁶

6. Conclusions

Most institutions have a defined governance structure separate from that of the host university, including a director, an advisory board, and a network of fellows and faculty that produce original research for the institution. Most institutions also have a system of funding that is self-sustaining and generally only weakly tied to the host university. That is, many institutions are started with a founding gift and then work on donor networks and leverage grants to become operational and attract high-quality researchers, rather than accepting extensive support from the host university.

We suspect this setup is ubiquitous because it offers some obvious benefits for the institution in that it can fund and promote high-value work more nimbly than a university might. It can also host a variety of fellows and faculty who may not have or want formal ties to the university.

However, retaining some ties to the university offer the institute access to high-quality faculty, fellows, research, and facilities. In short, ties to the university offer gravitas to institutional output.

The nature of institutional organization in the energy and environment space in the US and UK bodes well for an opportunity to create a network of institutions. Institutions must work quickly and efficiently to produce relevant and timely information in a constantly-changing world. Being

³⁵ Slaughter, "The Chessboard and the Web" Page 113

³⁶ Ibid., Page 231.

able to share research, connect fellows, and organize cooperative events has the potential to make a siloed institute more productive and connected to other institutes with similar objectives.

Given this, we believe there is potential for either a loose network or a strong network of energy and environment institutes.

Appendix I

Columbia	http://energypolicy.columbia.edu/jason-bordoff				
	https://sipa.columbia.edu/sites/default/files/SIPA-Annual-2016-2017.pdf				
	http://energypolicy.columbia.edu/people/center-staff-and-fellows				
	http://energypolicy.columbia.edu/director-development				
Stanford	https://energy.stanford.edu/about/about-us				
	https://energy.stanford.edu/people/precourtinstitute-energy-advisory-council				
	https://energy.stanford.edu/people/staff				
	https://energy.stanford.edu/get-involved				
	https://energy.stanford.edu/education				
	https://energy.stanford.edu/research/research-areas				
MIT	http://ceepr.mit.edu/about				
	http://ceepr.mit.edu/about/people				
	http://ceepr.mit.edu/support				
	http://ceepr.mit.edu/research#projects				
	http://ceepr.mit.edu/about/history				
	http://ceepr.mit.edu/research				
	http://energy.mit.edu/about/#leadership				
	http://energy.mit.edu/about/#affiliations				
University of Chicago	https://www.macfound.org/grantees/9143/				
	https://epic.uchicago.edu/research				
	https://epic.uchicago.edu/news-events/news/opinions				
	https://epic.uchicago.edu/sites/default/files/EPIC_Brochure.pdf				
University of Pennsylvania	https://kleinmanenergy.upenn.edu/about				
	https://kleinmanenergy.upenn.edu/donors				
	https://kleinmanenergy.upenn.edu/				
	https://kleinmanenergy.upenn.edu/certificate-energy-management-and-policy				
	https://kleinmanenergy.upenn.edu/energy-centers				
Rice University	https://www.bakerinstitute.org/center-for-energy-studies/program-fccus/				
	https://www.bakerinstitute.org/other-ways-to-give/				
	https://www.bakerinstitute.org/center-for-energy-studies/center-for-energy-studiesanalysis/				
University of Wisconsin	https://www.bakerinstitute.org/center-for-energy-studies/about-energy-studies/				
	https://energy.wisc.edu/industry/how-to-partner				
	https://energy.wisc.edu/about				
	https://www.supportuw.org/how-to-give/school-college/engineering/wisconsin-energyinstitute/				

	https://energy.wisc.edu/industry/how-to-partner				
	https://energy.wisc.edu/research/uw-madison-energy-research-centers				
	https://energy.wisc.edu/sites/default/files/2016-12/WEI-About-Us_Two-Page_20160120.pdf				
	https://energy.wisc.edu/research/funding-opportunities				
	https://energy.wisc.edu/events				
	https://energy.wisc.edu/research				
Princeton	https://acee.princeton.edu/about/				
	https://acee.princeton.edu/about/related-programs/				
	https://acee.princeton.edu/about/directors-message/				
	https://acee.princeton.edu/events/ https://acee.princeton.edu/wp-content/uploads/2018/01/2017-Andlinger-AR_final-web.pdf				
Carnegie Mellon	https://www.cmu.edu/energy/about/factsheet.html				
	https://www.cmu.edu/energy/about/staff.html				
	https://www.cmu.edu/energy/research-innovation/research-centers.html				
CSU	https://energy.colostate.edu/about/history/				
	https://energy.colostate.edu/people/				
	https://energy.colostate.edu/entrepreneurship/industry-partnerships/				
	https://energy.colostate.edu/research/labs/				
	https://energy.colostate.edu/entrepreneurship/repz/				
	http://yourenergy.extension.colostate.edu/				
	https://energy.colostate.edu/getinvolved/powerhouse-internships/				
	https://energy.colostate.edu/getinvolved/				
Berkeley Haas	https://ei.haas.berkeley.edu/about/people.html				
	https://ei.haas.berkeley.edu/programs/				
	https://energyathaas.wordpress.com/				
	https://ei.haas.berkeley.edu/about/				
	https://vcresearch.berkeley.edu/research-unit/uc-energy-institute				
University College Dublin	https://www.ucd.ie/energy/members/				
	https://www.ucd.ie/energy/				
	https://www.ucd.ie/energy/collaborationandengagement/				
University College Cork	https://www.ucc.ie/en/eri/aboutus/				
	https://www.ucc.ie/en/eri/research/researchpillars/energy/energypolicyandclimatechange/				
	https://www.ucc.ie/en/eri/people/				
	https://www.ucc.ie/en/media/research/environmentalresearchinstitute/ERIAAnnualReport20_15.pdf				
	https://www.ucc.ie/en/media/research/environmentalresearchinstitute/ERIAAnnualReport20_15.pdf				

	https://www.ucc.ie/en/eri/research/researchpillars/energy/energypolicyandclimatechange/				
	https://www.ucc.ie/en/eri/outreach/				
UC Davis	https://energy.ucdavis.edu/history/				
	https://energy.ucdavis.edu/about/people/leadership/				
	https://energy.ucdavis.edu/about/people/staff/				
	https://energy.ucdavis.edu/about/people/faculty/				
	https://energy.ucdavis.edu/organizational-chart/				
	https://energy.ucdavis.edu/giving/past-funding-initiatives/				
	https://energy.ucdavis.edu/about/sponsors-partners/				
	https://energy.ucdavis.edu/outreach-documents/				
	https://energy.ucdavis.edu/about/				
Harvard Belfer	https://www.belfercenter.org/about/overview/history				
	https://www.belfercenter.org/about				
	https://www.belfercenter.org/about/staff				
	https://www.macfound.org/grantees/362/				
	https://www.belfercenter.org/research/topic/energy				
Harvard Future of Energy In	http://environment.harvard.edu/researchteaching/search?taxonomy_vocabulary_2%5B0%5D=10				
	http://environment.harvard.edu/steering-committee				
	http://energy.harvard.edu/about-foe				
University of Washington	http://www.cei.washington.edu/about/mission-vision/				
	http://depts.washington.edu/uwcei/wordpress/wp-content/uploads/2015/02/AnnualReport-2014-2015-final.compressed.pdf				
	http://www.cei.washington.edu/research/				
	http://www.cei.washington.edu/facilities/testbeds/				
	http://www.cei.washington.edu/education/				
	http://www.cei.washington.edu/about/				
University of Michigan	http://energy.umich.edu/				
	http://energy.umich.edu/about-us/director				
	http://energy.umich.edu/about-us/external-advisory-board				
	http://energy.umich.edu/news-events/media				
	http://energy.umich.edu/funding-partnerships				
	http://energy.umich.edu/faculty				
	http://energy.umich.edu/research				
	http://energy.umich.edu/news-events/past-events?category=All&page=1				
Columbia Earth Institute	http://www.earth.columbia.edu/articles/view/3341				

	http://www.earth.columbia.edu/articles/view/2256				
	http://www.earth.columbia.edu/articles/view/1793				
	http://www.earth.columbia.edu/articles/view/61				
	http://www.earth.columbia.edu/articles/view/1788				
	http://www.earth.columbia.edu/articles/view/2619				
	http://blogs.ei.columbia.edu/				
	http://www.earth.columbia.edu/videos				
	http://blogs.ei.columbia.edu/tag/research/				
	http://www.earth.columbia.edu				
	http://www.earth.columbia.edu/articles/view/1791				
Cornell	http://energyinstitute.engineering.cornell.edu/faculty				
	http://www.atkinson.cornell.edu/Assets/ACSF/docs/about/ACSF-Annual-2016_web.pdf				
	http://energyinstitute.engineering.cornell.edu/news ; http://www.atkinson.cornell.edu/news/cop.php				
	http://energyinstitute.engineering.cornell.edu/research				
Stanford Woods	https://woods.stanford.edu/about/woods-staff				
	https://woods.stanford.edu/annual-reports/2016/welcome				
	https://woods.stanford.edu/publications/directory				
University of Colorado Boulder	https://www.colorado.edu/rasei/about-us/rasei-directors				
	https://www.colorado.edu/rasei/icp-2019				
	https://www.colorado.edu/rasei/about-us				
	https://www.colorado.edu/rasei/				
Dartmouth	https://irving.dartmouth.edu/news/2017/06/director-named-lead-arthur-l-irving-institute				
	https://irving.dartmouth.edu/about-institute/frequently-asked-questions				
	https://irving.dartmouth.edu/news/2016/09/dartmouth-announces-creation-arthur-l-irving-institute-energy-and-society				
	https://researchguides.dartmouth.edu/energy				
Siebel Institute	http://www.siebelenergyinstitute.org/2015-siebel-energy-institute-launch-event/				
	http://www.siebelenergyinstitute.org/				
Arizona State University	https://sustainability.asu.edu/person/julie-wrigley/				
	https://sustainability.asu.edu/news/archive/asu-major-league-baseball-partnersustainability/				
	https://sustainability.asu.edu/events/				
Duke	https://energy.duke.edu/about/staff				
	https://energy.duke.edu/about/committees				
	https://energy.duke.edu/news/duke-university-energy-initiatives-annual-impact-report-fy2017				
	https://energy.duke.edu/education/extracurricular				

	https://energy.duke.edu/research						
	https://energy.duke.edu/about						
Texas A&M	http://energy.tamu.edu/external-partnerships/						
	http://energy.tamu.edu/research/publications/						
	http://energy.tamu.edu/find-faculty-experts/						
	http://energy.tamu.edu/about-us/						
	https://energy.utexas.edu/about/people						
University of Texas	https://energy.utexas.edu/research						
	https://energy.utexas.edu/about						
London School of Economics	http://www.lse.ac.uk/GranthamInstitute/profile-type/00-staff/						
	http://www.lse.ac.uk/GranthamInstitute/about/						
NCSE	https://www.ncseglobal.org/about						
Colorado State University	http://sustainability.colostate.edu/centers/center-new-energy-economy						
	http://cnee.colostate.edu/about-us/	http://cnee.colostate.edu/cnee-hires-new-assistant-director/					
	https://www.macfound.org/grantees/10356/						
	http://cnee.colostate.edu/projects/						
	http://cnee.colostate.edu/news/events/						
	http://cnee.colostate.edu/about-us/						
Tufts	http://environment.tufts.edu/about-us/						
	http://environment.tufts.edu/about-us/leadership/						

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