

Planning Meeting to Create a Strategic Roadmap for Regional Energy Innovation Ecosystem Development for the Tri-State Techbelt Region

Discussion Summary¹

On May 23, 2018, Carnegie Mellon University's (CMU) [Wilton E. Scott Institute for Energy Innovation](#) hosted a day-long planning meeting to develop a strategic roadmap for regional energy innovation ecosystem development for the Tri-state Techbelt region.

The planning meeting was hosted in partnership with the West Virginia University [Energy Institute](#) (co-lead), the University of Pittsburgh [Center for Energy](#), and Case Western Reserve University's [Great Lakes Energy Institute](#). These universities are part of the [Tri-State University Energy Alliance](#) (TrUE). The purpose of the alliance is to accelerate innovations to address challenges and opportunities facing the energy sector in the tri-state area. The universities have formally agreed to work more closely to align their individual and collective expertise for research, technology commercialization, partnerships with industry and more.

Over 30 experts attended the meeting, bringing together perspectives from academia, energy innovation and entrepreneurship, business and industry, and public policy. Attached to this summary are the agenda and [List of Participants](#) at the meeting.

¹ This report summarizes the content, conclusions, and recommendations from a cross-sector, collaborative workshop organized by Carnegie Mellon University. Built on the robust and constructive dialogue of workshop participants, the recommendations put forth in this report merit consideration. This report represents general agreement achieved during the workshop but does not necessarily reflect the opinions and ideas of each individual participant or the views of their affiliated organizations or Carnegie Mellon University. Focused on summarizing workshop discussions, this report also does not purport to describe all complexities associated with each topic.

Planning Meeting Goals

The planning meeting's goals were to:

- Discuss the current status of energy-focused innovations in the region.
- Consider the region's strengths, weaknesses, opportunities, and threats in relation to its energy innovation ecosystem.
- Evaluate the models that other US regions use to advance their ecosystems.
- Think about whether (and if so, how) the region should formulate a strategic vision for a stronger energy innovation ecosystem.
- Propose qualitative and quantitative measures for the region to assess the status quo and alternative models.
- Identify next steps, if deemed appropriate, to create a strategic roadmap for regional energy innovation ecosystem development for the Tri-State Techbelt region.

Overview of Energy Innovation Ecosystem

Joseph Hezir, Professor of the Practice at CMU's Scott Institute, began the meeting by discussing the core components essential for a flourishing regional energy innovation ecosystem.

These components include:

- Energy resources: the rich and diverse energy resource base in the tri-state region.
- Enabling policy environment: regulatory and financial energy innovation policies at the federal, state, regional, and local level that affect market formation.
- Innovation concepts: the flow of ideas from sources such as universities, government labs, startups, and/or industry.
- Finance: the availability of risk capital from equity investors including angel investors, VCs, and credit facilities.
- Customers: small and large corporations that serve as early markets.
- Business models: institutional frameworks and processes, as well as informal networks for the flow of ideas and human capital within the ecosystem.
- Supply chain: skilled workforce, manufacturing base, and support services.

Each component in the ecosystem is linked, and together they drive economic growth, which is at the center of the regional energy innovation ecosystem, as shown in Figure 1.

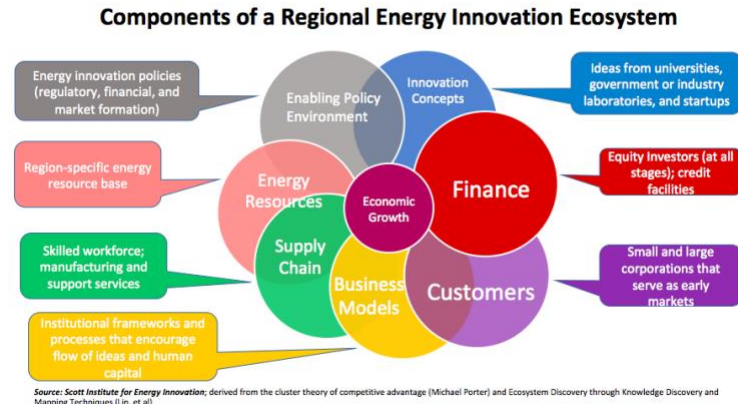


Figure 1: Components of a Regional Energy Innovation Ecosystem

Source: Carnegie Mellon Scott Institute for Energy Innovation, 2018

Note: Derived from Michael Porter's Cluster Theory of Competitive Advantage and Lin et al.'s Ecosystem Discovery through Knowledge Discovery and Mapping Techniques

This leads to the following questions for roundtable participants:

1. Are there actions the tri-state region can take to make the regional energy ecosystem work better?
2. Can the region strengthen each ecosystem component as well as the links among them?
3. Would joint policies among the three states make the system work better?

History of Past Tri-State Energy Ecosystem Activities

In 2017, the TrUE Alliance, led by Brian Anderson of WVU's Energy Institute, prepared a proposal to the DOE that would develop an analysis of the tri-state region's energy ecosystem (TREEC). The proposed analysis would have:

- quantified the existing regional energy ecosystem (e.g., intellectual property, investment level, industrial base);
- assessed challenges and opportunities associated with potential regional ecosystem development paths;
- conducted a sector-specific SWOT (strengths, weaknesses, external opportunities, threats) assessment focused on clean fossil, grid modernization, efficiency, nuclear, and advanced manufacturing; and
- developed a strategic roadmap integrating resources, capabilities, regional interests, natural comparative advantages and next steps.

Dr. Anderson explained that the proposed sectors (clean fossil, grid modernization, efficiency, nuclear, and advanced manufacturing) for the analysis were not meant to cover all the possibilities for the tri-state region. Rather, the proposal team identified them as potential areas of strength that the region could address with limited resources. Many energy technologies were

not included in the analysis such as wind, solar, and thermal energy. In this discussion, Dr. Anderson encouraged participants to consider other potential energy sectors for inclusion in the SWOT analysis.

Anderson suggested that the existing energy innovation ecosystem can be viewed as a web of all things related to energy (industry, national labs, etc.) as well as focusing on how technologies are managed within that ecosystem for different technology readiness levels (TRL). This includes TRL level 1 where the technology is still being researched to TRL level 9 where the technology is in the marketplace. The overall aim of an analysis in this case is to understand how stakeholders perceive the current situation and their vision for building the region into an energy innovation powerhouse in the future.

Question 1: What's happening now?

How does the region currently support the advancement of energy-focused innovations into the marketplace and the related regional economic development?

Denise Brinley, Energy Advisor at the Pennsylvania Department of Community and Economic Development (DCED), began the discussion by encouraging the group to think of economic growth as the largest circle [in the [Components of a Regional Energy Innovation System](#)]. She said she believes that this perspective of the energy innovation ecosystem may be able to initiate more action.

The DCED has been exploring how the region can grow its energy economy, and conducted a scenario planning session, according to Ms. Brinley. The participants in the scenario planning, a diverse group of 40 people from across the Commonwealth, came up with two possible scenarios: Rivers and Roots. Rivers is a scenario in which Pennsylvania utilizes all its energy and innovation resources. The Roots scenario begins with innovation at the local level. The City of Pittsburgh could have a role in either scenario as it influences the energy ecosystem for the entire state.

Roundtable participants then began to discuss the general question of the status of regional support for energy-supported innovation. Several issues were identified:

- Lack of funding to grow energy innovations;
- Insufficient customers with an early-adoption mentality;
- Lack of appreciation by existing, particularly publicly-owned, utility infrastructure for the benefits of new technologies and services;
- Need for more state government policies to influence demand through policy such as providing incentives for companies to buy, for example, wind energy in-state instead of out-of-state;
- More action is needed by the four universities (CMU, Pitt, WVU, CWRU), as combined, they cover all energy issues, to incorporate the perspectives of industry and policymakers.

Participants discussed the need for a clear strategic effort, that:

- Incorporates large companies in the region;
- Attracts internal and external investment;
- Recognizes the potential of inexpensive cleantech to attract businesses to states;
- Provides an opportunity for exporting that technology to other countries;
- Incorporates regional vulnerabilities, like infrastructure and poor air quality, rather than focusing exclusively on the potential for investment;
- Leverages legacy systems rather than seeing them as an impediment to innovation;
- Builds fossil energy infrastructure that can later be used for renewable energy (e.g., Denmark);
- Modifies state regulatory structure so that it encourages investment in new business models. For example, New York compensates utilities that support alternative energy solutions such as forming partnerships for local storage solutions;
- Provides a clear narrative to make it clear that the fossil fuel workers do not think they are being put out of business, and renewable energy workers don't think they are overlooked in favor of fossil workers;
- Improves communication by utilities to make their strategic goals clearer to investors and university innovation partners; and
- Welcomes all forms of industry to the table for strategic planning discussions including innovators, small businesses, and large corporations.

Later in the day, Jerry Paytas, Vice President, Research & Analytics, Fourth Economy gave a presentation on “Energy and the Economy: The Good, the Bad, and the Ugly.” In his presentation, he summarized a number of interesting facts and figures of the “[Energy for the Power of 32](#)” region, which includes a 32-county region in four states where the energy economy is linked. These include:

- The Power of 32 region uses 39% of its energy on transportation, 29% on industry, 20% on residential buildings, and 11% on commercial buildings.
- Energy has a role as a job generator. In the US, there were 6.2 million workers in the energy efficiency sector in 2016. That means 4 out of every 100 jobs in the US are energy related. It produced 300,000 net new jobs in 2015-2016 and these jobs offer better than the average pay.
- Energy is also a very important input for production. However, as production efficiency increases, the link between energy demand and supply weakens. Between 1998-2014, manufacturing gross output has been steady (slightly increasing) while fuel consumption has decreased. People are able to produce more with less. The only industries whose output growth does not exceed energy use are chemical, petroleum, and computers & electronics.
- There is also a weak link between the development and growth of energy and economic growth (the state's GDP growth). For example, the growth in mining of natural resources exceeds the GDP growth. In our region, the growth in natural resource mining was 2 to

12 times the overall GDP growth. The only exception is North Dakota, which was an outlier.

- In the Power of 32 area, we export the equivalent of enough coal for 8.8 million homes, enough natural gas for 4.4 million homes, and enough electricity for 3.5 homes. This is a significant portion of our natural resources. With the detrimental effect to our health and the environment and employing few people in the region, we need to consider whether this is a fair trade that we want to continue.
- The area exports \$24 billion of energy (gas, coal, nuclear), with a huge gap in renewables. Less than 2% of our source energy is from renewables, compared to the US average of 11%. The cited data is from 2011, so these numbers have probably changed. It is likely that there has been an increase in natural gas and a decrease in coal.
- In addition, in its role as a job generator, the energy sector employs women in 22-34% of its workforce compared to the 47% of women in the overall U.S. workforce.
- As many as 73% of employers have expressed that they face difficulty in hiring qualified workers.

Question 2: What works? What doesn't work?

How might the region conduct a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the region's current energy innovation ecosystem?

Ellen Williams, Distinguished University Professor at the University of Maryland and Director Emeritus of the Advanced Research Projects Agency-Energy (ARPA-E) discussed her work on assessing regional innovation characteristics. In her presentation, Dr. Williams emphasized the importance of measurements and documenting impact in making the case for continued investment in clean energy innovation. Regional cleantech development, she said, creates economic opportunities that are important for sustained public commitment for transitions to a low-carbon energy system. Further, attention to local needs plays a significant role in early market demand for new technologies and for larger-scale deployment. Data that could be incorporated into a regional innovation energy ecosystem analysis includes:

- Practical, detailed data that is not too complex;
- Identification of, and the ability to use, existing public and proprietary data sources;
- Use of surrogate data such as the number of clean tech companies in a region;
- Relationship of state funding, advanced engineering degrees, manufacturing program intensity, university patents, tech transfer revenue and spinouts, to the development of clean energy firms, jobs created, and indirect revenue;
- Energy ecosystem policies and activities in other states and internationally that could serve as a model.

Roundtable participants then began to discuss possible issues that could be included in a SWOT analysis. Concerns regarding the existing energy ecosystem that could be incorporated in a strategic analysis include:

- Insufficient pathways for commercialization of new technologies;
- Lack of a concrete strategy around state funding deployment;

- Need for a first market for new technologies within the states;
- Lack of a regulatory model that allows for spending, and then recovery, for research and development activities by utilities as is the case in other states;
- Unclear goals (e.g., resilience, emission reduction, energy poverty, etc.) for the region’s energy ecosystem, and how energy fits as a priority among other societal issues (e.g., access to food and medicine);
- Determination of the appropriate balance between “top-down” vs. “bottom-up” (i.e., community-based such as “Reenergize Johnstown”) energy projects.

These results need to be presented in a clear way to stakeholders – policymakers, industry, academia, interest groups, and the general public.

Question 3: What’s happening elsewhere?

What models are other regions in the US using to advance their energy ecosystems? Are there elements of these models that should be considered in the tri-state region?

Jetta Wong, Senior Advisor, Northern California Operations, Los Angeles Cleantech Incubator (LACI) provided an overview of this program as a possible model for the tri-state region. LACI’s mission is to commercialize cleantech and ensure an inclusive green economy. Much of its work is focused on developing and networking portfolio company entrepreneurs with experts.

LACI’s three core pillars are unlocking innovation, transforming markets, and enhancing community. For example, LACI partnered with the [California State University, Northridge](#) to set up an incubator within the university, similar to what LACI does for the region as a whole. The university organized the “Bullring,” an annual competition to pitch to investors, and received the iCorps grant for an entrepreneurship training program. The [Energize California](#) initiative, funded by the California Energy Commission with a \$5 million, 6-year grant fosters cluster activity and market transformation through networking events focused on emerging trends, adoption opportunities and demonstration opportunities for specific technologies. Another LACI program focuses on workforce training through two pilot programs: the [LA Youth Policy Institute](#) (YPI) for electronics technicians and the [STEM Portfolio-Building](#) program for community college students.

Some challenges LACI has faced is that its grant-based program requires a level of specificity for both activities and measurement that can be challenging for incubators and more flexible funding would be useful. As LACI expands to other regions (e.g., Fremont in Northern California), they are finding that each region has its own unique situation so discussions with key stakeholders are needed to identify the best strategy. This process includes an ecosystem scan, gap analysis, programming, executive roundtable, and a programming phasing plan. So, while LACI determined that the Los Angeles needed a central campus for cleantech’s hardware activities as other regional programs focused on software, Fremont’s challenge is in connecting people to enhance understanding and discuss possible policy changes. The Fremont situation might be a more appropriate model for the tri-state region than Los Angeles itself.

Questions Four and Five: How should we develop a strategy? How will we know if it works?

- *How should the region formulate a strategic vision for a more vibrant energy innovation ecosystem and how could it be more effectively coordinated?*
- *What qualitative and quantitative measures might the region use to assess the effectiveness, efficiency, equity, and ease of political acceptability of the status quo and alternative models?*

Jerry Thompson, Executive Vice President of MARC USA, provided an overview of the [Forge the Future](#) study that proposed a strategy for development of downstream economy for natural gas resources. There will be an energy-enabled economy in the region, but when and how big? It has the potential to bring 6-9% growth in annual state GDP over 10 years and create 100,000 jobs. The focus areas were petrochemicals, heat and power generation and cooling, advanced materials, advanced manufacturing, and export and the infrastructure to support it.

Grant Goodrich, Director of the Great Lakes Energy Institute at Case Western Reserve University discussed the development of an [energy roadmap for Ohio](#). There's a sentiment that opportunities for clean energy aren't being developed in Ohio that should be. The roadmap focuses on renewable energy, energy efficiency, electrified transportation, and advanced manufacturing. The year-long discussion resulted in a number of insights:

- A dollar is like an electron in that it follows the path of least resistance, so investment can go elsewhere if there is somewhere easier to invest.
- The Fortune 500s in Ohio have a role in shaping the future for the state and the opinions of lawmakers in what they should value. An example is their statement that they would buy wind power elsewhere because they cannot get it in Ohio.
- In terms of a skilled workforce, the region has an advantage with the pool of quality workers from the legacy manufacturing industries that can be retrained and connected to energy jobs. The workers are here that can be trained up and connected to the right jobs.
- The focus of the roadmap should not be clean energy vs. natural gas, rather it is "AND," not an "OR."

Question Six: What should be the next steps for this analysis?

The roundtable participants identified a number of overarching ideas that would benefit from additional analysis.

1. **The tri-state region needs more of an early-adopter mentality.** Innovators and entrepreneurs have new ideas, but lack a customer base that is willing to be an early adopter and act as a proving ground for new technologies and business models. Regional policymakers willing to support innovation can help by providing more opportunities for pilot programs. Universities can also play a role as a testing ground.
2. **The tri-state region needs a [green bank](#).** Currently, developers of solar, wind, and hydro are working with the residential market because the financial structure makes it

cheaper. However, solar farms would make much more sense than individual residential rooftops. The green bank could be a first step in figuring out the financial structure for these solar developers. Similarly, energy storage could move the tension away from renewable and fossil to provide flexibility. Looking at existing models in other regions might provide guidance as to how the tri-state region should move forward.

3. **Collaboration among all stakeholders is key in developing a successful roadmap.** For example, today's roundtable discussion would have been enhanced if a director of facilities and operations and regional companies with sustainability plans were part of the discussion.
4. **Research activities should be public-private partnerships where academia and the private sector work together supported by government funding.** The private sector should influence the priority with which technology is developed by academic institutions.
5. **Other possible topics include out-of-the-box business models, carbon capture, transportation, industry, and advanced manufacturing.**

In summarizing the key takeaways from the discussion, Joe Hezir identified the following five words to guide the next steps for developing a tri-state regional energy ecosystem roadmap:

1. Baseline
2. Strategy
3. Portfolio
4. Networking
5. Money

Planning Meeting to Create a Strategic Roadmap for Regional Energy Innovation Ecosystem Development for the Tri-State Techbelt Region

**Wednesday, May 23, 2018
10 am - 4 pm**

**Carnegie Mellon University, Scott Hall, Marquis Room, 5th Floor
5000 Forbes Avenue Pittsburgh, PA**

- 10:00 am** **Welcome and Roundtable Participant Introductions**
Professor Jay Whitacre, Director, CMU's Wilton E. Scott Institute for Energy Innovation
- 10:15 am** **Charge to Roundtable**
Brian Anderson, Director, West Virginia University Energy Institute
Joe Hezir, Professor of the Practice, CMU's Wilton E. Scott Institute for Energy Innovation
- 10:30 am** **Roundtable Discussion Question 1: What's happening now?**
How does the region currently support the advancement of energy-focused innovations into the marketplace and the related regional economic development?

Startup Speaker (15 minutes): **Denise Brinley**, Senior Energy Advisor, Pennsylvania Department of Community & Economic Development
- 11:30 am** **Roundtable Discussion Question 2: What works? What doesn't work?**
How might the region conduct a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the region's current energy innovation ecosystem?

Startup Speaker: **Ellen Williams**, University of Maryland, Director Emeritus, Advanced Research Projects Agency-Energy (ARPA-E) on “Assessing Regional Innovation Characteristics”

12:30 pm **Lunch Break: Jobs, Energy Innovation, and Economic Development**
Startup Speaker: **Jerry Paytas**, Vice President, Research & Analytics, Fourth Economy

1:00 pm **Roundtable Discussion Question 3: What’s happening elsewhere?**
What models are other regions in the US using to advance their energy ecosystems? Are there elements of these models that should be considered in the tri-state region?

Startup Speaker: **Jetta Wong**, Senior Advisor, Northern California Operations, Los Angeles Cleantech Incubator

2:00 pm **Roundtable Discussion Questions 4 and 5: How should we develop a strategy? How will we know if it works?**

- How should the region formulate a strategic vision for a more vibrant energy innovation ecosystem and how could it be more effectively coordinated?
- What qualitative and quantitative measures might the region use to assess the effectiveness, efficiency, equity, and ease of political acceptability of the status quo and alternative models?

Startup Speakers:
Jerry Thompson, EVP, Public Relations Director; MARC USA on the “Forge the Future” report

Grant Goodrich, Director, Great Lakes Energy Institute, Case Western Reserve University on the forthcoming Ohio Energy Roadmap

3:00 pm **Roundtable Question 6: What should be the next steps for this analysis?**
Final Thoughts from Roundtable Participants

4:00 pm **Adjourn**

Planning Meeting Participant List*

<p>John Adams Asst. Director, Business Operations, Energy Institute West Virginia University</p>	<p>Brian Anderson Director, Energy Institute West Virginia University</p>
<p>Denise Brinley Energy Advisor PA Department of Community and Economic Development</p>	<p>Mike Broeker Chief Executive Officer Epiphany Water Solutions</p>
<p>Joe DeMatteo Director, Business Development Duquesne Light Company</p>	<p>Cory Dennison President Vision Shared</p>
<p>Nathan Failla Business Analyst Idea Foundry</p>	<p>Michael Fisher Project Developer The Efficiency Network</p>
<p>William Getty President Benedum Foundation</p>	<p>Grant Goodrich Director, Great Lakes Energy Institute Case Western Reserve University</p>
<p>Joe Hezir Professor of the Practice CMU Scott Institute for Energy Innovation</p>	<p>Katrina Kelly Manager, Strategy and Business Development University of Pittsburgh Center for Energy</p>
<p>Krycia Kubiak Director, State Regulatory Strategy & Government Affairs Duquesne Light Company</p>	<p>Jeff McDaniel Entrepreneur in Residence Innovation Works</p>
<p>Petra Mitchell Chief Executive Officer Catalyst Connection</p>	<p>Trip Oliver Manager, Policy, Government & Public Affairs Chevron</p>
<p>Jerry Paytas Vice President, Research & Analytics Fourth Economy</p>	<p>Greg Puschnigg Chief Executive Officer BOSS Controls</p>
<p>Geo Richards Lead, Energy Systems Dynamics National Energy Technology Laboratory</p>	<p>Anna J. Siefken Associate Director for Innovation and Strategic Partnerships CMU Scott Institute for Energy Innovation</p>
<p>Lauren Stephens Regional Account Manager Daikin Applied</p>	<p>Deborah Stine Associate Director for Policy Outreach CMU Scott Institute for Energy Innovation</p>
<p>Cynthia Sweet Associate Vice Chancellor for Economic Partnerships</p>	<p>Thomas Tarka Sr. Engineer, Research & Innovation Center National Energy Technology Laboratory</p>

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Andy Thomas Director, Energy Policy Center Cleveland State University	Jerry Thompson EVP, Public Relations Director MARC USA
Ellen Williams Professor University of Maryland	Davitt Woodwell President Pennsylvania Environmental Council
Jason Zapka Assistant Professor, Electrical & Computer Engineering Youngstown State University	

**Titles as of May 2018*