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American Energy & Manufacturing Competitiveness Partnership

Driving Regional Transformation

A Primer for the AEMC Partnership Dialogue 2

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June 20, 2013
The University of Toledo

Executive Summary

On June 20, 2013, the Council on Competitiveness and the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy (EERE) will hold the second in a series of important leadership dialogues on the campus of The University of Toledo (UT). The dialogues are being held across the country as part of the American Energy and Manufacturing Competitiveness (AEMC) Partnership—a three-year effort to bring together national leaders to address a rapidly shifting national and global energy landscape. The second dialogue continues the conversation started during the foundational AEMC Partnership Inaugural Dialogue in Washington, D.C., on April 11-12, 2013.

The Council and EERE have partnered with UT for the AEMC Dialogue 2 due to critical lessons being learned from the materials and silicon-based industries in Northwest Ohio, which have historically played an important role in the region's glass-making industry. Today, these lessons are informing the acceleration of Toledo's evolution from the "glass city" to a thriving cluster of solar energy research and manufacturing.

AEMC Dialogue 2 will bring together leaders from industry, academia, labor, the national laboratories, government and the non-profit community. The Honorable David Danielson, Assistant Secretary of EERE will lead the discussion, alongside Council President & CEO Deborah L. Wince-Smith and UT President and dialogue host, Lloyd Jacobs.

The AEMC Partnership will convene two additional regional dialogues this year—the next of which will take place in August at the GE Global Research Center in Niskayuna, NY, and a fourth in Fall 2013. The AEMC Partnership with culminate in a major, annual, Washington D.C.-based, energy and manufacturing summit in December.

Driving Regional Transformation
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The American Energy and Manufacturing Competitiveness (AEMC) Partnership

The AEMC Partnership is a three-year effort by the Council on Competitiveness (Council) and the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy (EERE) to bring together national leaders to address a rapidly shifting national and global energy landscape. In a series of progressive dialogues over Spring-Fall 2013, participants are uncovering actions that can be taken now to enable America to bolster dramatically its energy, manufacturing and economic competitiveness for the coming decades and beyond. This is a new partnership formed under the EERE's Clean Energy Manufacturing Initiative (http://www1.eere.energy.gov/energymanufacturing/index.html), a strategic integration and commitment of manufacturing efforts focusing on American competitiveness in clean energy manufacturing. The goals of the AEMC Partnership are to:

Increase U.S. competitiveness in the production of clean energy products: Strategically investing in technologies that leverage American competitive advantages and overcome competitive disadvantages.

Increase U.S. manufacturing competitiveness across the board by increasing energy productivity: Strategically investing in technologies and practices to enable U.S. manufacturers to increase their competitiveness through energy efficiency, combined heat and power, and taking advantage of low-cost, domestic energy sources.

The purpose of the AEMC Partnership dialogue is to create a platform for the generation and potential deployment of models for public-private partnerships (PPP) to advance the AEMC Partnership goals.

The AEMC Partnership is broadly divided into two phases, the first of which has been completed.

AEMC Partnership: Phase One—Mapping the Landscape

To inform cultivating topics for the progressive dialogue series, and provide a foundation the larger goals of the AEMC Partnership, the Council performed an extensive literature review and "mapping" of 184 past and current research efforts across the United States and internationally on three topics:

- Linkages between energy efficiency (EE) efforts of manufacturers, renewable energy (RE) efforts and manufacturing competitiveness;
- Energy-related barriers to manufacturing competitiveness as they relate to energy; and
- Models for PPPs for fostering competitive industries.

This work also identified links, barriers and public-private partnership models that have not been studied or on which studies are out of date.

The literature review is documented in the Council publication *The Power of Partnerships*, and its companion piece, *A Summary of Public-Private Partnerships*. (Both of these documents are available at http://www.compete.org/about-us/initiatives/aemcp/). These reports provide the foundation for this effort and address the following questions:

- What prevents the United States from leading in the manufacturing of clean energy and energy efficient products, as well as energy productivity throughout the manufacturing sector?
  - High capital requirements;
  - Lack of Innovation infrastructure;
  - Low investment in advanced manufacturing technology;

Foundation of AEMC Partnership

REPORTS

184 reviewed

↓

28 selected for in-depth analysis

↓

180 **recommendations**

26 **policy categories analyzed**

PUBLIC-PRIVATE PARTNERSHIPS

30+ reviewed

↓

19 selected for in-depth analysis

↓

4 **PPP models developed**

- Structural costs;
- Public and cyber infrastructure;
- Trade policy; and
- Clean energy market risks.

- What are the essential ideas and strategies necessary to co-create a successful clean energy manufacturing PPP?
  - Strong leadership;
  - Clear, compelling mission;
  - Early funding stream to establish a PPP, usually from the public sector; and
  - Flexible intellectual property practices that draw corporate participation.

As the AEMC Partnership dialogue series progresses, participants will discuss and expand on the findings in these reports.

AEMC Partnership: Phase Two—Inaugural Dialogue and Beyond

The Council and EERE initiated Phase Two of the AEMC Partnership with an inaugural dialogue in Washington, DC, on April 11-12, 2013. This phase includes a total of four progressive dialogues generating new insights pertaining to the overall goals of the Partnership—as well as informing the creation of a public-private partnership model to further advance the initiative's goals. The inaugural dialogue laid out the objectives of the AEMC Partnership and began examining a range of PPPs. The second dialogue hosted by The University of Toledo continues the discussions sparked during the inaugural dialogue—including the examination of a regional experience in scaling expertise in materials science and technology into advanced manufacturing. The third dialogue on August 13, 2013 hosted by Mark Little, Senior Vice President and CTO of GE at the GE Global Research Center in Niskayuna, NY, will continue the process of homing in on potential PPP models with a focus on specific technology areas and barriers/opportunities for their deployment and scaling in the United States. A fourth dialogue on the west coast will follow in Fall 2013, focusing squarely on designing the attributes of a clean energy manufacturing public-private partnership that may be presented and announced at the first, annual American Energy and Manufacturing Summit on December 12, 2013 in Washington, D.C. Future dialogues to vet and evaluate proposed PPP models, and to elaborate upon success metrics will continue this conversation in 2014 and 2015—along with future, annual summits.

Summary of the AEMC Partnership Inaugural Dialogue

The inaugural dialogue convened and engaged more than 100 senior leaders from industry, government, academia, labor and the national laboratory system. Co-hosted by the Honorable Deborah L. Wince Smith, President & CEO of the Council on Competitiveness; and the Honorable David T. Danielson, Assistant Secretary of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy (EERE), the dialogue laid the foundation for future discussions by gathering input on fields in the clean energy manufacturing sector that could enhance U.S. competitiveness by creating a public-private partnership and discussing the benefits and detriments of different methods in structuring a public-private partnership.

Participants in the inaugural dialogue included: Mr. Jason Miller, Special Assistant to the President for Manufacturing Policy; Dr. Pradeep Khosla, Chancellor, University of California-San Diego; Dr. Dan Arvizu, Director, National Renewable Energy Laboratory; Dr. Thom Mason, Director, Oak Ridge National Laboratory; Mr. Sean McGarvey, President, Building and Construction Trades Department of AFL-CIO; Dr. Om Nalamasu, Chief Technology Officer, Applied Materials, Inc.; Dr. J. Michael McQuade, Senior Vice President for Science and Technology, United Technologies Corporation; and, Dr. Monty Alger, Senior Vice President, Research and Development, Myriant.

An important function of the inaugural dialogue was to identify, understand, and discuss the opportunities around clean energy manufacturing. Much of this exploration was intended to highlight the convergence of market forces, public interest and private sector strategies around clean energy manufacturing.

The Honorable David Danielson, Assistant Secretary, U.S. Department of Energy Office of Energy Efficiency and Renewable Energy; The Honorable Deborah L. Wince-Smith, President & CEO, Council on Competitiveness; Jason Miller, TITLE, National Economic Council; Libby Wayman, TITLE, U.S. Department of Energy Office of Energy Efficiency and Renewable Energy; and Chad Evans, Executive Vice President, Council on Competitiveness

In her opening remarks, Wince-Smith noted:

> *"Half of the new electricity-generating capacity installed to meet the growing global energy demand during the next 25 years is expected to come from clean energy. Furthermore, businesses, governments, and communities are embracing energy saving behaviors and technologies. These market and political forces are converging to create the national will to invest in developing, manufacturing, and deploying clean energy technologies, as well as ensuring that all industrial sectors of our economy are using energy efficiently to, in turn, drive industrial productivity."*

Her quotation conveys the sense of urgency at the dialogue and around the country as to the importance of having a clean energy manufacturing strategy. With this common understanding of the current clean energy manufacturing landscape, the AEMC Partnership tasked dialogue participants to generate ideas around two main themes:

- Leverage points in national investment in the clean energy manufacturing landscape—e.g. foundational technologies, road mapping, standards, policy tools, supplier relationships, domestic production barriers, etc.—with the potential to produce exponential impact and competitive advantage for all manufacturing sectors; and,
- Public-private partnership models that would best use these leverage points and launch the United States ahead of international competitors.

The exceptional cross-section of industry, academic, labor, national laboratory and public sector leaders in attendance produced a robust discourse. Some key insights regarding potential leverage points and public-private partnership models from the inaugural dialogue include the following:

Insights on Potential Leverage Points

- Scaling technologies from prototypes to mass-manufactured products;
- Building a workforce that understands the challenges of scaling the production of newly created technologies in the United States;
- Developing and deploying advanced materials;
- Diffusing tools including modeling and simulation, robotics, automation, sensor technologies, and additive manufacturing into the manufacturing sector; and
- Leveraging "big data."

The Honorable Deborah L. Wince-Smith, President & CEO, Council on Competitiveness; Dr. Pradeep Khosla, Chancellor, University of California, San Diego; and Dr. J. Michael McQuade, Senior Vice President for Science and Technology, United Technologies Corporation.

Insights on Public-Private Partnership Models

- Designing the project with input from all stakeholders and with the outcome in mind greatly increases the likelihood of success;
- Shouldering the indirect cost of research facilities and equipment is a barrier to industry participation in a PPP;
- Facilitating the progress and success of a PPP is contingent on strong and singular leadership; and
- Creating a boundary of trust through intellectual property agreements is essential to create an environment attractive for broad stakeholder participation.

Materials: Foundations for the Clean Energy Economy

Each subsequent dialogue is intended to follow the trajectory set forth by the previous dialogue and to narrow the focus of the discussion. While participants presented several ideas during the inaugural dialogue, the technology platform of materials science and engineering surfaced as a strong field of interest across multiple stakeholders primarily because of the relevance of advanced materials to both, overarching goals of the AEMC Partnership. A recent report funded by the DOE's Advanced Manufacturing Office makes a similar case:

> *"…the nations that assume leadership in producing materials for this next era of human progress—the Clean Energy Age—will have access to unprecedented opportunities for economic development by unleashing manufacturing innovations and efficiencies that are limited by current materials capabilities."* [1]

The crosscutting nature of materials through all technologies is reflected in the research and development (R&D) portfolio of EERE. In fact, all EERE Technology Offices currently make investments in materials technologies. The Next Generation Materials program, an R&D portfolio within the Advanced Manufacturing Office, also contributes to the Materials Genome Initiative,[2] a federal interagency program supporting integrated materials computational engineering (a tool to speed the materials development cycle).

Advanced materials can drive significant enhancements in energy products including more efficient solar cells; larger, lighter and stronger wind turbines; and longer-range car batteries. Moreover, material technologies have the ability to increase the competitiveness of all manufacturing sectors, for example through broadly applicable advances in heat recovery processes, lubricants that reduce wear and on process equipment, and shaping processes that reduce material waste. As such, materials science and engineering have the potential to be a major vehicle for meeting the goals of the AEMC Partnership.

The AEMC Partnership is interested in exploring how to leverage investments in materials science and engineering being made at universities, national laboratories and businesses across the country. One of the common themes of the AEMC Partnership inaugural dialogue was the idea of "aligning vectors" to promote U.S. competitiveness. Each effort of organizations affecting materials science and engineering can be considered a "vector," and these could be aligned to increase U.S. competitiveness in the production of clean energy products and increase U.S. manufacturing competitiveness across the board by increasing energy productivity. Public-private partnerships can play important roles in this process for maximum market impact.

UT is a natural platform for the second dialogue of the AEMC Partnership given its role in the transformation of much of Ohio's industrial base into high-tech, high value-added manufacturing. This type of evolution is an example of what the AEMC Partnership hopes to achieve on a national scale. This follow-on dialogue will build off the momentum from the first, foundational conversation of the inaugural dialogue—to move decisively and strategically to create the conditions for a better, more competitive America.

Spotlight

Photo Source: General Electric

Composites for Wind Energy

Advanced composites have the potential to reduce the cost of wind power and drive down the production cost of wind turbines. According to a 2008 Department of Energy study, the potential energy captured by a wind turbine—rotor power—grows with the square of the diameter of the turbine blades.[3] However, increasing the size of the blades increases the production cost as well imposes a weight penalty on energy efficiency. Layered composite materials offer significant performance increases for both blades and tower structures,[4] increasing efficiency and reducing costs—potentially providing a competitive advantage for manufacturers adopting this technology.

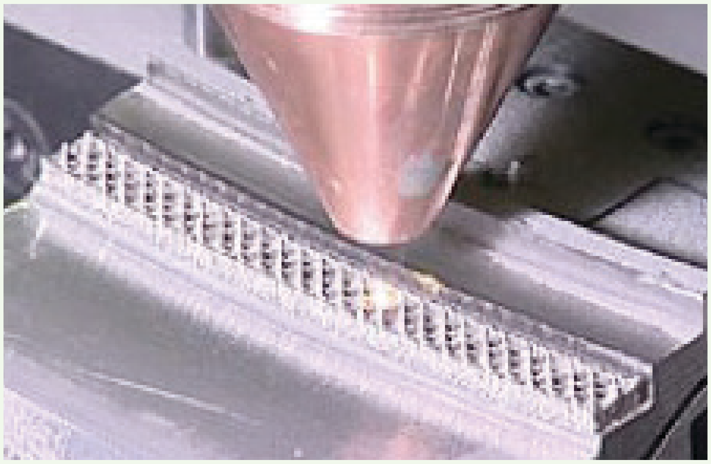

Photo Source: Rolls Royce

Net-Shape Processing

Producing a component as close as possible to its final shape—often combining energy-intensive processing steps—can reduce material waste, and often eliminate the need for costly secondary processing and finish machining. Net-shape processing, any manufacturing method that applies this methodology, offers an avenue for tremendous energy savings across a wide swath of the industrial sector.[5]

Photo Source: Ford Motor Company

Thermoelectric Materials

Manufacturers can apply thermoelectric materials to multiple technology platforms and can, thereby convert waste heat into useful electricity, and conserve energy—reducing the need for more power generation. According to research funded through the U.S. Department of Energy's Vehicle Technology Program, approximately 40 percent of an automobile's energy is lost to waste heat in the exhaust gas.[6] Thermal electric material can convert energy lost in through exhaust gas into useful energy for such functions as lights, pumps, etc.—reducing overall energy use and improving vehicle fuel economy.

Toledo: Transforming the Glass City into a Solar Energy Cluster

A global leader in glass throughout the 20th century, with thriving industrial laboratories connected to university research capabilities in glass technology, Northwestern Ohio endured a period of time where it lost its manufacturing competitive advantage.[7] This is a familiar story in the industrial Midwest. However, by forming public-private partnerships in the late 1980s and mid-2000s, stakeholders from the private sector, Ohio's universities, and local government have successfully leveraged the region's deep manufacturing history and the technical expertise embodied in both The University of Toledo (UT) and local businesses to make the region a global competitor in the energy space. This Dialogue primer highlights two public-private partnerships pivotal to the emergence of Toledo's solar energy cluster.

Observers can trace the vision of Toledo and the local region as a world-leader in solar energy back to Toledo entrepreneurs Harold A. McMaster and Norm Nitschke, along with their business partner, Frank Larimar. A business leader and inventor with more than 30 years of experience in automotive, architectural, and other glass products, McMaster formed Glasstech Solar, Inc. in 1984. Glasstech Solar, Inc. was a spinoff from the parent company Glasstech, a leader in the manufacturing of furnaces for tempered glass McMaster co-founded with Nitschke.[8] Glasstech Solar, Inc. initially worked on thin-film solar technology at its Wheatridge Colorado location. In 1987, however, Glasstech Solar, Inc. funded and built the $13.5 million solar cells production plant, Solar Cells, Inc., located on the UT campus in Toledo, Ohio.[9]

As McMaster and Nitschke advanced their technology, they sought the assistance of UT to address processing issues in thin film solar development. Driven by university researcher Dr. Alvin Compaan, UT secured two State of Ohio grants that brought sophisticated thin-film deposition systems to the region—systems that Solar Cells Inc. leveraged. Due in part to this public-private collaboration, Solar Cells became a global leader in thin film solar technology, winning additional grants with Compaan from the Department of Energy. In 1996, Michael Cicak took over the role of President of Solar Cells, Inc. The company was eventually acquired by True North Partners, LLC in 1999 and renamed First Solar, Inc.[10]

In the era of fierce global competition, accelerated product cycles, and constantly shifting competitive advantage, looking for external sources of innovation can become a mandate for some firms and some industries. McMaster, Nitschke and Compaan understood this reality and engaged in a public-private partnership that began the evolution of Toledo's manufacturing base centered around glass to one focused on solar energy.

A more recent and formal public-private partnership is the university-driven Center for Photovoltaics, Innovation, and Commercialization (PVIC) created at UT in 2007. PVIC launched with a $18.6 million grant from Ohio Department of Development's Third Frontier Project, and $30 million in matching contributions from federal agencies, universities, and industrial partners.[11] The PVIC has its origins in a strategic analysis performed in 2001 by UT that identified thin-film materials as a premier area of research with the university.[12] The PVIC, in a sense, is the codified and institutionalized version of the partnership between McMaster, Nitschke and Compaan that, today, is carrying on the work these three visionaries began. More broadly, PVIC's role in driving the regional transformation displayed by Solar Cells, Inc. and UT suggests the value of public-private partnerships.

Side-by-side with industrial partners, PVIC addresses numerous aspects of thin-film photovoltaic research including improvements to materials and technologies, and ways to lower production costs and improve the efficiency of solar technologies.[13] Though the solar power sector is on shaky footing the United States, PVIC has achieved success in its mission of accelerating the photovoltaic industry. At the present time, PVIC has generated 130 new jobs statewide with an average salary of $71,473 and is directly responsible for the establishment of two new companies and the relocation of three other businesses into Northwestern Ohio. Moreover, six new patents are currently pending.[14]

The Council and EERE have partnered with UT for this second dialogue to tap into the experiences of the people at the center of this evolution and to capture insights that will inform the mission, goals, and organization of the AEMC Partnership. Both the collaboration between Solar Cells, UT and PVIC are examples of the power of partnerships to drive regional transformation. They are also models that the AEMC Partnership was built to explore and, to some degree, emulate to realize a new era of sustainable and clean energy manufacturing. Lastly, the Toledo narrative highlights the ability of advanced materials to act as a technology platform to advance multiple industrial sectors—as glass has done across the automotive, architectural, and now solar sectors in Toledo.

Solar Cluster Success Factors[15, 16, 17, 18, 19, 20]

- Deep history in the research, development, and production of glass.
- Active support of local congressional representative.
- Involvement of exceptional entrepreneurs (industry leadership).
- Local center of knowledge and talent creation (University of Toledo).
- Solar Cluster is vertically integrated.
- Expertise gained through a long history of university-industry partnership related to automotive sectors eased the launch of PVIC.
- Commodities-based nature of Northwestern Ohio's automotive parts supply chain created an environment of collaboration.

TRANSFORMING THE GLASS CITY INTO THE SOLAR CITY

Toledo's Tradition of Innovation and Entrepreneurship Continutes

1880

1887

✷ Edward Libbey visits Toledo and decides to move his glass company here. He is attracted to Toledo because of its:

- Major transportation hub and access to the west
- Aggressive local business community
- Available gas supplies
- High-quality sand

1903

✷ Michael J. Owens invents the automatic bottle-making machines. It proves to be the most significant development in glass making since the invention of the blowpipe around 50 B.C. The machine produces a phenomenal 13,000 bottles a day, compared to the 600 a day that could be produced by a skilled glassblower. Today's machines can produce more than 1 million bottles in a day.

1940s

✷ Harold A. McMaster and Norman Nitschke, both inventors and entrepreneurs, begin their careers in glass. At Libbey Owens Ford, McMaster is hired as the first research physicist in the company working with Nitschke. McMaster departs in 1948 to form a new company, Permaglass, to work on various molded and treated glass. He later forms Glasstech in 1971 and works on the glass tempering processes (80 percent of the world's automotive glass and 50 percent of its architectural glass is manufactured using machines developed by the work at Glasstech).

1984–1990

✷ Nitschke and McMaster form Glasstech Solar to start working on amorphous silicon thin-film solar cells. In 1987, they form Solar Cells Inc. and locate the plant on UT's campus. They stop work on amorphous silicon and focus on cadmium telluride thin films.

✷ Arizona investors, True North Partners, jointly venture with Solar Cells to form First Solar in 1999, and McMaster forms a new company, McMaster Energy Enterprises in 2001 (at age 84), using machines developed by the work at Glasstech.

1987

✷ Dr. Al Compaan, a scientist, is hired and helps McMaster and Nitschke develop thin-film PV technology.

2001

✷ UT identifies renewable energy as an area of strategic research focus and dedicates new faculty positions, including an endowed chair position (now occupied by Professor Robert Collins) in this area.

"Our plan is to develop Northwest Ohio into a nationally recognized center for alternative energy technologies in which the knowledge from our universities is transformed locally into innovations and wealth creation."

PFI proposal, May 2, 2002

2003

✷ UT receives PFI grant from the National Science Foundation, which formalizes northwest Ohio's solar energy cluster through the funding of the Northwest Ohio Partnership on Alternative Energy Systems with Frank Calzonetti as the PI, including a plan to establish the UT Clean and Alternative Energy Incubator.

"This center will work to overcome barriers to the commercialization of solar energy technology, and includes support to advance public support and understating of solar energy technology options."

Dr. Robert Collins, PI, NEG Endowed Chair and Professor, 2006

2008

✷ UT receives $8.5 million from the Ohio Research Scholars Program designate as endowed chairs. The Harold and Helen McMaster Foundation awards UT with $2 million for a new endowed chair as part of the match for this state award.

✷ With the assistance of Representative Marcy Kapfur, the NASA Solar Cell Testing Facility is established at UT in August. The facility provides testing and certification of solar cells and solar cell materials.

✷ The University of Toledo, following the invitation of the National Science Foundation, sponsors an NSF Partnership for Innovation Conference in Arlington, VA, to showcase best practices in creating innovation partnerships.

2009

✷ The Ohio Board of Regents announces that UT's Center of Excellence in Advanced Renewable Energy and the Environment is an OBOR Center of Excellence.

✷ UT's School of Solar and Advanced Renewable Energy is established. Building on UT's strengths in solar energy, fuel cells, biomass, electricity management energy storage and wind research, this new school provides national leadership in education and research in solar and other forms of advanced renewable energy.

✷ The UT Scott Park Campus of Energy and Innovation is dedicated in September, featuring an 8-acre solar field installed by a Clean and Alternative Energy Incubator client, ADG; a massive wind turbine installed by incubation client EPS; alternative and sustainable energy demonstration sites; and plans for an accelerator, which will assist companies that have graduated from the incubator.

2020

2010

✷ UT begins accepting students for its new Professional Masters in Photovoltaics.

✷ UT Vice President of Research, Dr. Frank Calzonetti, testifies at the White House Clean Energy Manufacturing Forum.

2006

✷ UT opens its Clean and Alternative Energy Incubator. Companies who will graduate from the incubator in following years include: Xunlight (MWOE), Calyxo (Solar Fields), Advanced Distributed Generation, and Innovative Thin Films.

✷ Founded at UT in 2006, Write Center for Photovoltaics Innovation and Commercialization (PVIC) is supported by a $18.6 million Third Frontier Grant with The University of Toledo, serving as lead institution and working with The Ohio State University and Bowling Green State University.

2007

✷ UT is involved in two of the 11 projects nationwide to receive U.S. Department of Energy Solar Energy America awards.

✷ UT is selected to host the University Clean Energy Alliance of Ohio at its Clean and Alternative Energy Incubator.

2012

✷ ISOFOTON announces R&D and economic development partnership with The University of Toledo and the opening of a new factory in Northwest Ohio

✷ UT is awarded the NSF SEP: Earth-Abundant Solar Cells As A Sustainable Energy Pathway grant for nearly $2 million.

WORKING LUNCH

Exploring Innovation Network PPPs, Mature Market PPPs, and Test Bed/ Demonstration PPPs

The Toledo narrative provides three pillars to the framework for the second dialogue of the AEMC Partnership:

- The crosscutting nature of advanced materials—in this case, advanced glass—and their abilities to act as foundational technologies for multiple industrial sectors;
- The power of public-private partnerships to drive regional change; and
- A platform for the deep analysis of potential PPP models for the AEMC Partnership.

The third pillar—a thorough analysis of potential PPP models—is the focus of the working lunch at the AEMC Partnership Dialogue 2.

Two PPPs instrumental to Toledo's transformation from the Glass City to a robust solar energy cluster—Ohio Third Frontier and PVIC—fit into two PPP models defined by the Council in the Power of Partnerships: the Ohio Third Frontier project falls under the Innovation Network model characterization and PVIC the Mature Market model:

- **Innovation Network PPPs** are generally national or international networks of applied research and demonstration organizations, often focused on a particular technology or set of technologies at each node in the network. The network nodes sometimes are linked by a broad theme.
- **Mature Market PPPs** seek to advance the objectives of more mature industries. These PPPs tend to be industry-led and focus on pre-competitive research, cooperative research on advanced manufacturing technologies, or standards. The technologies addressed by these PPPs can be early-stage or more mature, but there are enough mature companies in the market that the private sector engages heavily in the leadership.

In addition to exploring these model types, the working lunch will include an analysis of the Test Bed / Demonstration model using the Detroit-based PPP, NextEnergy.

- **Test Bed / Demonstration PPPs:** Although the other PPP models in this study may include testing and demonstration components, the Test Bed / Demonstration PPPs have testing and demonstration as their primary function. These PPPs often work to establish the market for emerging technologies and are local by nature, even if their user community is national or global in scope.

Spotlight

Ohio Third Frontier

Created in 2002 within the Ohio Development Services Agency, the Ohio Third Frontier (OTF) is $2.3 billion internationally recognized technology-based economic development initiative. An example of an Innovation Network public-private partnership, the OTF provides funding through 13 different program areas to Ohio technology-based companies, universities, non-profit research institutions, and other organizations to create new technology-based products, companies, industries, and jobs.[21]

A particular program area of interest to the AEMC Partnership is the Technology Commercialization Center (TCC) Program, which is designed to support accelerated commercialization of technologies and capitalization and expansion of Ohio companies in existing core technology focus areas.[22] This program is the successor to OTF's 2003 Wright Centers of Innovation program that launched The University of Toledo Wright Center for Photovoltaics, Innovation, and Commercialization (PVIC). The TCC program embodies a decade of experience in launching public-private partnerships aimed at bringing technologies to market in Ohio's technology-based industrial sectors. This experience is codified in the guidelines set forth in the 2013-2014 TCC Request for Programs. These guidelines represent factors that drive success in public-private partnerships, including:

- 2:1 Cash Cost Share requirement (no in-kind contributions) with at least half the cost share from industry and private investment capital;
- Center must build on already world-renowned work in Ohio and show clear path to manufacturing, production, and distribution in Ohio within 2-6 years;
- Focuses only on late-stage emerging technologies; and
- Business-driven in the authority over direction, resource allocation, and project and technology investments.

Wright Center for Photovoltaics Innovation and Commercialization

An example of a Mature Market public-private partnership, the Wright Center for Photovoltaics Innovation and Commercialization (PVIC) is a collaborative thin-film photovoltaic directed-basic research, applied research, development, and commercialization center. Working side-by-side at The University of Toledo Research Technology Complex, university and private sector researchers address numerous aspects of photovoltaic research, including improvements to materials and technology, and ways to lower production costs and improve the efficiency of thin-film solar technologies.[23] Members include three large research universities (University of Toledo, Ohio State University, and Bowling Green State University) and large and small firms from across the thin-film solar supply chain—including PPG Industries Inc. and the Willard & Kelsey Solar Group.[24] The Center has two broad membership levels—Industry Member and Research Partner—that vary based on company size, type, and location. Three prevalent project models are offered for partner organizations:[25]

- **University Research**—Intellectual Property (IP) owned by universities and accessible partners
- **Collaborative Research**—Joint ownership of IP
- **Service Research**—IP owned by industry

The PVIC, established in 2007 with an $18.6 million award from the State of Ohio's Third Frontier program, intends to secure self-sustaining funding by the end of the grant (which occurred in late 2012). The Third Frontier grant required funding to be matched—which PVIC was able to secure through $30 million from federal agencies and universities and industrial partners.[26]

NextEnergy[27]

An example of a Test Bed / Demonstration public-private partnership, NextEnergy's mission is to accelerate energy security, economic competitiveness, and environmental responsibility through the growth of advanced energy technologies, businesses, and industries. In order to accomplish this mission, NextEnergy provides its partners with services such as demonstration and commercialization strategies for newly-development technologies, market analysis, venture development and program management in the areas of vehicle electrification, energy efficiency, and advanced grid technologies.

NextEnergy also provides an authoritative voice in the public sector by partnering with local government, the State of Michigan and federal agencies to design future energy strategies, advise on funding priorities, and administer and evaluate programs. NextEnergy also develops curriculum and workforce development programs.

A nonprofit organization, NextEnergy was established in 2002 through a grant from the State of Michigan and the Michigan Economic Development Corporation. This PPP continues to receive an annual appropriation from the State as well as additional funding streams from federal grants, philanthropic donors, and industry fee-for-service.

Of the many insights generated from the inaugural dialogue and the subsequent content analysis of this two-day conversation, a notable conclusion was the diminishing relevance of the Early Market PPP model to the goals of the AEMC Partnership. Simply stated, the AEMC Partnership is squarely aimed at making a positive impact in the marketplace. While Early Market PPPs are valuable to the creation of knowledge that informs the development of disruptive technologies, the AEMC Partnership is targeting activities closer to commercialization in the technology development cycle. As such, the working lunch will focus on the Innovation Network, Mature Market, and Test Bed/Demonstration Facility PPPs.

Regardless of the model type chosen, there are common themes that have emerged as being essential elements of the PPP independent of the model type. Two such elements from the Inaugural Dialogue include:

- Scaling the production of prototype technologies to mass-manufactured products in the United States, and
- Personnel exchange/employee turnover as a central vehicle for knowledge transfer

The importance of scaling production in the United States and the barriers to achieving scale will be further explored in the dialogue panel session "R&D and Manufacturing: Attacking the Problem of Scaling" and is discussed in more detail in the subsequent section of this primer.

The concept and mechanism of information exchange is an important facet of any public-private partnership. Innovation scholars have identified the most common form of knowledge spillover occurs with the movement of workers between complementary firms.[28] In recognition of this avenue for information exchange, another PPP examined in *The Power of Partnerships*, the Industrial Technology Research Institute (ITRI), instituted a built-in quota for annual employee turnover to promote the diffusion of public and private co-development knowledge into the external market, in addition to helping ensure innovation does not stagnate within the Institute.[29]

Another example of knowledge transfer is the Los Alamos National Laboratory (LANL) Industrial Fellows Program created in 1995. This program assigns LANL staff members to a partnering company to help solve unique technical problems on a one or two-year term basis. The companies benefit from the exposure to new technologies, joint product development ventures, and access to world-class R&D facilities. Likewise, LANL has the opportunity to gain assistance from private industry in solving unusual applied research problems, commercialize Los Alamos technologies, and understand industry best practices.[30]

These two aspects—scaling production in the United States and knowledge transfer through personnel exchange—are encouraged to be woven through each of the working group conversations. These elements show promise for inclusion into any PPP model recommendation.

Reconnecting R&D and Production to Promote Domestic Manufacturing and Innovation

In the context of R&D and manufacturing, "scale" is the process of expanding production beyond a pilot facility or process into mass-manufacturing. Scale, however, can also be thought of as the ability for the United States to capture value from the technologies that American scientists and engineers imagine, create, and incubate inside industry, universities, and government laboratories. Whichever country or region produces these new technologies—or applies them to an existing manufacturing process—benefits from the jobs created and increased economic activity that will result. Simply stated, America's ability to scale is directly linked to its ability to provide opportunities for Americans to prosper.

A perennial challenge of the science and technology community—dating back to the emergence of the U.S. innovation system after WWII—is that of technology commercialization. The innovation literature has coined the institutional and behavioral barriers between invention and a viable business as the valley of death. At the early stages of technology development, efficient markets do not exist for allocating risk capital. Early-stage technologies and new markets carry higher levels of risk and uncertainty, creating a market failure where the private sector foregoes investment.[31]

More recently, a second valley of death has emerged. Often referred to as the scale-up valley of death, it is made up of the challenges of growing to large scale a viable business built around innovations. In the past, vertically integrated firms housed basic and applied R&D as well as production within the same company. When innovation grew from the efforts of these large firms, they had the resources to scale the production of new technologies or processes.[32] The 1980's, however, witnessed the beginning of the transformation of the global industrial landscape—vertically integrated corporations off-loaded production processes to focus on their core competencies and shifted R&D to focus on the near-term needs of the business units.[33] This began the era of globally distributed manufacturing as well as a shift in the innovation landscape. Foundational technological breakthroughs in the United States are now more likely to come from universities, national laboratories, and small start-up companies.[34] This broken linkage of R&D to manufacturing—a linkage that was once a mainstay of the U.S. industrial sector—has created the scale-up valley of death in the United States.

The desire to scale production in the United States comes from several fronts. Large multinationals will capture value regardless of where production is performed. The question that is increasingly asked is: how much? Recently history has highlighted the many ills of manufacturing abroad, such as quality control challenges, protection of intellectual property rights, and high shipping and logistical costs[35]—not to mention rising labor costs. Each of these factors is chipping away at profits margins and the benefits of manufacturing offshore. Additionally, speed-to-market has become more important than any other time in history. With product development cycles accelerating and competitive advantages shifting overnight, the pace at which new technologies reach the market is more important than ever. In many cases co-locating manufacturing and R&D can accelerate the transition from lab to market.[36]

After the scale-up valley of death, another challenge resulting from the separation of the R&D and manufacturing is the potential impact on innovation. The value of the proximity and linkage of manufacturing to research, development, and deployment (RD&D) is still largely unanswered. However, many scholars and business leaders suspect that the severe loss of manufacturing over the last 10 years is a serious threat to America's innovative capacity.[37]

Can Public-Private Partnerships Address Scale-up?

Recent research is beginning to highlight the possibility that a region's ability to support businesses that successfully scale depends on complementary capabilities and assets (including financial) available in-house or within a regional industrial ecosystem. Since the decline of patient, vertically integrated firms conducting extensive fundamental research, these capabilities are rarely found "in-house" in multinational corporations. These capabilities could be provided by a region's complementary resources and assets—i.e. the industrial commons.

Early evidence has revealed that public-private partnerships—and the industrial commons that they create—are a differentiating factor between places where many firms start-up but fail to scale, such as the United States, and places where scale-up occurs, such as Germany.[38] As described in the Report of the MIT Taskforce on Innovation and Production, "It's impossible to understand the different fates of manufacturing in the U.S. and Germany without comparing the density and richness of the resources available in the industrial ecosystem across much of Germany to the thin and shrinking resources available to U.S. manufacturers across much of our country."[34] A differentiating resource in the German system—at least relative to the United States—are the Fraunhofer Institutes (a network of 80 research units and 60 institutes that partner with industry to provide a wide variety of services for businesses of all sizes with a particular emphasis on small and medium-sized enterprises [SMEs] that do not maintain their own R&D departments.) German firms able to tap into the Fraunhofer network—among other publicly-supported shared assets—often find themselves competitively positioned against U.S. and other global manufacturers.

Metrics: Measuring the Success of Public-Private Partnerships

With the understanding that PPPs can promote a rich industrial ecosystem—understanding what PPP models are most effective and best suited to achieve the goals of the AEMC Partnership is essential. Success metrics are critical to this process.

The Power of Partnerships—the intellectual underpinning for the AEMC Partnership—revealed quantitative success metrics from PPPs described in the report are lacking and qualitative success factors are not well understood across the public-private partnership landscape. This is a challenge the AEMC Partnership must address and, as such, will be a common thread throughout the second dialogue at The University of Toledo and the entire series of dialogues. Without knowing if a PPP is succeeding, it will be hard to improve it, to decide to continue it, etc.

Today's need to measure success and provide accountability for government investments in science and technology is not only a mandate driven by fiscal austerity, but also a necessity in the U.S. innovation-driven economy. This is especially true for PPPs since they are a tool in the effort to bridge the gap between funded research and commercial markets.

After proving their worth in both World War II and the Cold War, public investments in R&D became practically unimpeachable. The current U.S. budget debates have shifted the attitude of policymakers and the general public regarding federal science and technology investments—what was once at times either an era of excitement or agnosticism is now one of skepticism.[35]

Constrained budgets are not the only driving force behind the call for better metrics. Economic competitiveness and, in turn, national prosperity in the United States are more dependent than ever on the ability to leverage the scientific and technological advancements achieved in public and private sector laboratories across the country. Rising worker compensation—a positive development—and other wealthy nation developments have made it difficult for American business to compete in any other way.

Success Metrics: Power of Partnerships Insight

Each PPP stakeholder will measure success differently—metrics tend to be aligned with the origination's mission. Economic development agencies, such as Ohio Third Frontier, measure economic impact:[36]

- Direct and indirect job creation;
- New companies established; and
- Follow-on investments.

Higher education institutions, such as University of Toledo, will align success metrics with the mission of education and knowledge creation:[37]

- Publications;
- Citations;
- Presentations;
- Invention Disclosures;
- Patent Applications;
- Start-ups; and
- Proposals Funded.

Key Questions for the Toledo Dialogue

How can advanced materials drive innovation across numerous manufacturing sectors?

What can we learn and replicate from the experience of Toledo's glass manufacturing sector to support the transition of existing national and regional assets into the next level of value-added, high-tech manufacturing?

How can public-private partnerships facilitate the scaling of technologies from prototypes to mass-manufactured products in the United States?

What are some ways PPPs could catalyze information exchanges to promote knowledge spillover (e.g. a research personnel exchange program)?

How does linking R&D teams and manufacturing teams accelerate innovation?

How can technologists and researchers—in both private and public laboratories—be encouraged to include manufacturing design implications from the earliest stages of technology development?

How should the success of PPPs created to meet the goals of the AEMC Partnership be measured? What are the critical leading and lagging indicators of success (i.e. job creation, spinoffs, exports, tax revenue, productivity, etc.)?

What are the critical areas within the materials supply chain that—if targeted for investment—have the potential to create an outsized impact on U.S. manufacturing competitiveness?

What is the best level of involvement of federal/state/local governments, academia, national laboratories and industry?

Looking Forward

The outpouring of support for the AEMC Partnership Inaugural Dialogue and the deep engagement and enthusiasm displayed during this national conversation validates the premise of the AEMC Partnership—leveraging the benefits of energy efficiency and the U.S. position as world leaders in clean energy innovation is essential to revitalizing the U.S. industrial base, which remains a core driver of U.S. competitiveness and prosperity,

The Inaugural Dialogue, though largely foundational, began the processes of narrowing the field of clean energy manufacturing to a subset of platforms that have the potential to advance the goals of the AEMC Partnership. Private and public sector leaders highlighted at the Inaugural Dialogue the unique ability of materials science and engineering to act as renewable energy product as well as drive energy efficiency across a multitude of industrial sectors.

The AEMC Partnership follows this trajectory to The University of Toledo—an institution at the center of a materials-enabled regional manufacturing transformation driven by public-private collaboration. Using the development of Toledo's solar energy cluster as case study to inform the AEMC Partnership, this second dialogue will continue the search for leverage points in national investment in the clean energy manufacturing landscape—e.g. foundational technologies, road mapping, standards, policy tools, supplier relationships, domestic production barriers, etc.—with the potential to produce exponential impact and competitive advantage for all manufacturing sectors, and public-private partnership models that would best use these leverage points and launch the United States ahead of international competitors.

End Notes

1. TMS Energy, "Materials: Foundation for the Clean Energy Age", February 2012.
2. Executive Office of the President of the United States, "Materials Genome Initiative for Global Competitiveness", June 2011.
3. U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, "20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply", July 2008
4. Ole Thybo Thomsen, "Sandwich Materials for Wind Turbine Blades— Present and Future", *Journal of Sandwich Structures and Materials*, 11, No. 1 (2009): 7–26
5. TMS Energy, "Materials: Foundation for the Clean Energy Age", February 2012.
6. John W. Fairbanks, "U.S. Department of Energy (DOE) - Vehicular Thermoelectric Generator (TEG) Project Objectives" Presentation. *Vehicular Thermoelectrics: A New Green Technology, DOE Thermoelectric Applications Workshop*, Coronado, CA, January 3–8, 2011.
7. Frank J. Calzonetti, "The Role of an Antecedent, Academic R&D and Entrepreneurship in the Development of Toledo's Solar Energy Cluster", March 2007.
8. Ibid.
9. Ibid.
10. Ibid.
11. Wright Center for Photovoltaics, Innovation, and Commercialization, Homepage - Accessed June 7, 2013 http://pvic.org/Default.aspx.
12. Frank J. Calzonetti, *The Role of an Antecedent, Academic R&D and Entrepreneurship in the Development of Toledo's Solar Energy Cluster*, March 2007.
13. Jim Winkler, "Harnessing the Power of the Sun", Web. Accessed June 7, 2013 www.greenenergyohio.org.
14. The University of Toledo, "The University of Toledo Solar Research Update", March 2013.
15. Frank J. Calzonetti, *The Role of an Antecedent, Academic R&D and Entrepreneurship in the Development of Toledo's Solar Energy Cluster*, March 2007.
16. Dr. Alvin Compaan, President and CTO - Lucintech, Inc., Interview. May 15, 2013.
17. Mr. Norm Nitschke, Co-Foudner & Executive Vice-President (Retired), Glasstech Inc. Interview May 15, 2013.
18. Frank Calzonetti, Professor of Geography & Vice President for Government Relations - University of Toledo, Interview. May 24, 2013.
19. Mr. Richard Stansley Jr., Co-Director, Wright Center for Photovoltaic Innovation and Commercialization, Interview. May 28, 2013.
20. Mr. Anthony Howard, Interview. May 30, 2013.
21. Ohio Development Services Agency, "Ohio Third Frontier Homepage", Accessed June 10, 2013.
22. Ohio Third Frontier, "Technology Commercialization Center Program—2013 and 2014 Request for Proposals" May 24, 2013.
23. Jim Winkler, *Harnessing the Power of the Sun*, www.greenenergyohio.org
24. The Wright Center for Photovoltaic Innovation and Commercialization (PVIC) official website, http://pvic.org/Default.aspx
25. Robert W. Collins, "Overview of PVIC", *Catalyzing Innovation in PV Manufacturing: An NSF Workshop*, May 6-7, 2010.
26. The Wright Center for Photovoltaic Innovation and Commercialization (PVIC) official website, http://pvic.org/Default.aspx
27. The Council on Competitiveness, *The Power of Partnership*, March 2013.
28. Marshall, Alfred, Principles of Economics, MacMillan, 1980.
29. The Council on Competitiveness, The Power of Partnership, March 2013.
30. Los Almos National Laboratories, http://www.lanl.gov/orgs/tt/partnering/industrial_fellows/. Industrial Fellows Program.
31. Auerswald and Branscomb, Valleys of Death, 2003.

32. Massachusetts Institute of Technology, “Report of the MIT Taskforce on Innovation and Production in the Innovation Economy Report”, Editors: Richard M. Locke and Rachel Wellhausen, February 2013.

33. Ibid. pg. 20.

34. Ibid. pg. 21.

35. Rahel Rekhi and Neal Lane, “Qualitative Metrics in Science Policy: What Can’t Be Counted, Counts”, Issues in Science and Technology, Fall 2012

36. Ohio Third Frontier, “Technology Commercialization Center Program - 2013 and 2014 Request for Proposals” May 24, 2013.

37. The University of Toledo, “The University of Toledo Solar Research Update”, March 2013.

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