

CONNECTING OHIO'S BUSINESSES AND UNIVERSITIES:

ASSETS IN OHIO'S ENERGY FUTURE



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UCEAO

UNIVERSITY CLEAN ENERGY
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**Connecting Ohio's Businesses And Universities:
Assets In Ohio's Energy Future**

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on behalf of the University Clean Energy Alliance of Ohio

Authors: Robin Lindquist-Grantz LISW-S, Elissa Welch, MPA, and Scott Miller, MS

Graphic Design and Layout: Lindsey Siegrist

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The University Clean Energy Alliance of Ohio (UCEAO) is comprised of 15 Ohio institutions of higher education whose mission is to advocate for research and education, as well as share expertise, in clean energy generation; to inform energy policy decision makers; and to provide a single collective message about energy issues for university, government and industrial partners in Ohio.

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EXECUTIVE SUMMARY

The importance of energy to the future of the state of Ohio and to our nation cannot be overstated. Our economic prosperity, our national security, and our future well-being are tied to developing and deploying clean, affordable and reliable energy for everyone. In Ohio, Governor Strickland has made energy development a cornerstone of the state's economic development plan and a part of the administration's plan for higher education. To meet these challenges, the University Clean Energy Alliance of Ohio (UCEAO) is working to promote and coordinate energy education, research and technology deployment. UCEAO, a group of 15 Ohio universities, is working with statewide partners in government, education and industry to turn discovery and development into positive economic outcomes for Ohio. With generous funding from the Ohio Air Quality Development Authority (OAQDA), UCEAO hosted five regional focus groups in March 2009 on the subject of building a better energy business-university relationship. The results of those focus groups are analyzed and presented here in an attempt to inform our understanding of how Ohio's universities can facilitate positive collaborations with the private sector to achieve successful outcomes for our energy future.

With assistance from other UCEAO member institutions, Ohio University's Voinovich School of Leadership and Public Affairs coordinated and facilitated focus groups with industry representatives in the five regions of Ohio: Northeast, Northwest, Southeast, Southwest and Central. Forty-one individuals participated statewide, representing 36 companies and organizations of various sizes, research interests and stages of development. Based upon the questions asked during the focus groups, four key findings were identified that provide an understanding of the current status of business-university partnerships and possible improvements:

1. Capitalize on existing resources and competencies;
2. Provide access to university knowledge, technology and resources;
3. Clarify and augment the university role in Ohio's economic development plans; and
4. Align higher education curriculum and workforce training with business needs.

These findings, in conjunction with the best practice suggestions offered by private sector attendees, build a strong body of knowledge from which UCEAO can strategically grow and work with state partners to target energy economic development statewide. Specific elements suggested that could facilitate successful collaborations include:

1. Establishing connectors or liaisons within the universities to look for and encourage potential partnerships;
2. Clearly articulating expectations and hesitations prior to project and contract development;
3. Developing a shared vision and goals;
4. Aligning university research and industry timeframes; and
5. Utilizing a joint approach to the research design.

Next steps to be considered by UCEAO include expanded membership, increased business involvement, publicizing resources and outreach to all interested parties. A robust network of UCEAO faculty, staff, researchers and students will strengthen UCEAO's marketing efforts to better connect with potential members and partners as well as existing partners at the state including the Ohio Board of Regents, the Ohio Department of Development and the Ohio Air Quality Development Authority. Similarly, a continued dialogue with businesses from entrepreneurs to larger players will reinforce UCEAO's understanding of how to effectively meet business needs. UCEAO's ability to act as a convener of partners is evident in its annual spring energy conference and will be further highlighted in an upcoming project with the Ohio Board of Regents to develop an online database of energy-related capabilities at UCEAO member institutions and affiliated governmental labs.

Based on the findings presented here, UCEAO will continue to identify ways to involve members of Ohio's advanced energy business community in its ongoing strategic planning. These relationships are too valuable to let languish, especially in a climate favorable to energy education as well as business and technology deployment.



INTRODUCTION

The University Clean Energy Alliance of Ohio (UCEAO) is comprised of 15 Ohio universities committed to advancing energy education, research and technology. Furthermore, UCEAO is dedicated to turning discovery and development into positive economic outcomes for Ohio. To follow up on a successful workshop organized by UCEAO and led by industry representatives in April 2008, UCEAO received an award from the Ohio Air Quality Development Authority (OAQDA) to host and assess the results of regional meetings focused on enhancing the interface between Ohio's universities and energy businesses in the private sector. The information obtained in these groups is considered crucial to improving UCEAO's understanding of how Ohio's students, scientists, engineers and technologists can contribute to addressing the challenges in this sector.

As a founding and active member of UCEAO, Ohio University's Voinovich School of Leadership and Public Affairs coordinated and facilitated five regional focus groups of industry representatives in March 2009 to gather information on the current and desired partnerships with Ohio's universities. UCEAO member institutions assisted in organizing the groups and recruiting industry participants, and research staff and students at the Voinovich School analyzed the results to prepare this report. UCEAO intends to use the findings to contribute to the organization's overarching long-term goals and the development of near-term plans to assist and support Ohio energy companies in their efforts to comply with recent state energy legislation (SB 221).

METHODOLOGY

The purpose of the regional focus groups was to initiate communication with energy-related companies about their technical challenges and needs. A focus group research design was chosen as the best method for obtaining in-depth information about private sector needs, current university/industry interactions, student preparation, and identifying best practices for future collaborative relationships. Focus groups were conducted in the five regions of Ohio: Northeast, Northwest, Southeast, Southwest and Central. UCEAO member institutions in these regions assisted in securing locations for the groups and recruiting participants.

Participation was purposefully limited to businesses in the energy sector and to approximately 10 participants per group to allow ample time for productive discussion. Energy businesses of different sizes (less than 10 to more than 500 employees), various stages of development and diverse energy sectors were

included; however, some sectors are represented more than others in certain regions because of industry clusters in that area (e.g., solar in Northwest Ohio; see Appendix A for a list of energy sectors represented in each regional focus group). The same set of questions, developed by the Voinovich School with input from UCEAO members, was asked at each of the focus groups, and each conversation was transcribed in its entirety for analysis; see Appendix B for the list of questions used by the professional facilitators.

The findings and viewpoints discussed in this report cannot be generalized to the state's entire energy sector. However, given the overall similarity of comments shared by the participating companies and employee representatives, the recommendations made in this report will be useful to UCEAO as it moves forward in developing a plan to improve partnerships with Ohio's private sector.



KEY FINDINGS

This section of the report highlights the major themes identified across the five focus groups with the specific opportunities, barriers and recommendations discussed within them as sub-themes. A summary of the themes and sub-themes is displayed in Table 1.

TABLE 1. THEMES AND SUB-THEMES FROM THE ANALYSIS

THEMES	SUB-THEMES
Businesses and universities should capitalize on Ohio’s existing resources and competencies	Utilize existing facilities to build emerging technologies Take advantage of Ohio’s highly trained manufacturing workforce
Universities should provide information and access to knowledge, technology and available resources	Identify and market a university liaison for research and assistance Attempt to align the perceived goals of the university with those of the private sector Find ways to make university resources available to and affordable for Ohio businesses Clearly address and resolve issues related to intellectual property when entering into a collaborative relationship
The university’s role in Ohio’s economic development plans should be clarified and augmented	Increase opportunities for accelerating technology readiness Provide assistance with technology commercialization
Businesses and universities should work together to align higher education curriculum and workforce training to business needs	Prepare students with skills needed in the “real world” work environment Utilize co-op and internship programs to assign students to business projects Bolster Ohio’s economy by attracting Ohio graduates into Ohio businesses and careers

I. Capitalize on Existing Resources and Competencies

When asked about Ohio's core competencies and major advanced energy growth areas in each region of the state, participants stressed that Ohio should build upon its ample and available resources. More specifically, every group discussed the need to utilize Ohio's extensive manufacturing history and capabilities in all parts of the state. This includes capitalizing upon:

- + the existing physical facilities in which emerging technologies can be developed and commercialized, and
- + a workforce that is highly trained in manufacturing.

One participant stated, *"I think we have to think beyond the specific technologies and go out and recognize the [manufacturing] legacy we have here that's enormously powerful."* Another pointed out, *"We have a large manufacturing base but it's underutilized right now, so that's why emerging technologies is [sic] going to offer a transition period for those companies who want to get out from underneath the automotive industries."*

Regarding the utilization of a trained workforce, another participant commented:

I think of one differentiating factor being that you are able to make things here, and you have a lot of talent and a lot of people who can start with very rough drawings and can actually render a machine.

Connecting the state's legacy with advanced energy growth opportunities, one participant said:

Clearly, materials manufacturing is a big one, because any new technologies tend to be materials limited, in terms of how you can design a solution, and so people working in advanced materials are always on the cutting edge.

Many other participants further noted a need to build on Ohio's competency in components manufacturing:

Probably our biggest single strength in this state is we're a state not dominated by any one big company. We're a state of component manufacturers and that component manufacturing allows us to adapt to various technologies much more rapidly.

...obviously Ohio has probably right now a somewhat underutilized, relatively trained work force. You know, with other things, I'd say that's kind of Ohio's selling point, is we have companies that make parts and pieces of many of these technologies.

Some participants were concerned about resources and products being harvested or made in the state, but then exported to other producers or buyers. *"The value is added elsewhere."* Other participants believed Ohio is uniquely positioned due to its competency in components manufacturing to build complete systems here, for sale around the nation or globe.

...you can design it. You can come up with new technology. You can actually build a prototype. You have people here who can make things, which is somewhat unique. And if you are distributing in a

region of the U.S., you are at a very good location to reach the Northeast and the Midwest and maybe even the South like Atlanta. So you are afforded some advantages from the standpoint of the location.

...there aren't any major systems companies in Central Ohio that I know of...but there are a whole lot of companies in the area that could be parts of the supply chain. When you ask a question like region or the state, I don't even think that way truthfully, because our customers are all over the world. We ship less than 10 percent in-state, and we're a tiny little company. You have to think of it differently.

2. Access to University Knowledge, Technology and Resources

Issues related to knowledge, technology and resources available at Ohio's universities occupied much of the conversation in all of the groups. The most important message stemming from this topic is that industry has difficulty knowing 1) what university resources are available to them, 2) how to find them, or 3) how to form a successful relationship with the appropriate contacts. Some of the specific barriers identified by participants included:

- + not knowing who to connect with for research and assistance;
- + a perception that the publishing and education goals of universities are at odds with industry's goal of technology deployment and profit;
- + a perception that partnering with universities is too costly, albeit beneficial for product testing; and
- + many issues related to intellectual property.

These barriers are discussed in more detail in the sections below.

Finding the Front Door

Whether reflecting on the beginning of collaborative relationships or having an interest in forming partnerships, many participants reported not knowing how to access university expertise and resources. They did not know how to "enter the front door."

I think one of the big challenges has always been trying to find the right people within the university. What we have found is that there's no easy way to make the determination about who are the right people and who should be facilitating those discussions within the university; who knows where all the technical resources are hidden away.

Sometimes companies are connected by mutual contacts, but oftentimes they have had to initiate contact. "...[W]e dug them out. We found people with the expertise through the internet that were here or through references locally." Another participant stated, "I would say in our experience it [initiating contact] is a little bit more from our side."

Basically, it was usually we had a particular issue that we were interested in so we would go to the relevant department or whatever and call them up and start talking to them, ask them, 'Hey, do you have anyone in the department who's working on this?'

SUGANIT SYSTEMS, INC.:

GROWING RELATIONSHIPS IN TOLEDO

Suganit Systems, Inc. works in the renewable energy and chemicals fields with a primary focus of producing fuels from biomass and commercializing their process. Suganit has had a positive relationship with the University of Toledo (UT) since its beginning in 2006. Suganit's president, Praveen Paripati, portrays the company's long-term association with UT as mutually supportive of one another's advanced energy initiatives.

While Suganit is a Virginia-based company, their relationship with UT has spawned the opening of a development center at the Clean and Alternative Energy Incubation Center in Toledo. Additionally, they intend not only to continue collaborative research with UT and other universities, but to expand operations in Toledo and to continue hiring UT graduates at their Ohio location. In their work with the university, Suganit sponsors research, collaborates with university researchers and also applies for relevant state and federal funding requests. One successful venture was an award by the Third Frontier Advanced Energy Program in 2009. Suganit Systems, Inc. has also been awarded grants by the U.S. Departments of Energy and Agriculture.

Mr. Paripati recommends that companies seeking partnerships with universities understand how academic research is conducted and begin "bridging the gap and being able to work across these two domains." He continues, "There's a lot of realization now in the universities about the value of doing viable research—research that is viable in the sense that it can lead to near-and medium-term commercialization. At this stage we are on the cusp of a revolution in the nature of energy production and chemical and fuels production. So I think it presents a very good opportunity for the universities, as well as companies, to be looking to collaborate and be a part of this change.

"Right now I think Ohio is doing an extremely good job of trying to keep at the forefront of the advanced energy technologies."



Others reported approaching faculty members after finding out what they were working on via a conference presentation or a published article. “You might read a paper and find out that also somebody down the road is doing work that you’re interested in and then we go contact them.” Sometimes companies also initiate contact because of a specific grant proposal.

...a catalyst for collaboration too is...if you have an externally funded project the requirements for that project are that it includes a collaboration between different businesses or between business and the university. So then you know if you get one of those you start seeking out who can provide the capabilities that I need from the university now.

A couple of participants reported that neither their company nor universities have initiated contact for various reasons. As one participant noted in particular, “We haven’t reached out as a company. And the schools haven’t reached out to us because of the relationship or the connection back to [our] industry.”

Perceived Lack of Common Vision and Goals



Although there are examples of successful collaboration around the state, in all five regions focus group participants indicated a perception that the publishing goals of universities are at odds with industry’s goal of timely technology deployment and profit. They believe this is one reason why it is difficult to get academic researchers involved in industry research. One participant stated, “There’s the wealth of knowledge in the information institutions. But what sometimes happens is they have their own goals in mind.” Another said:

A university is a sports team. It’s the Yankees. But, you look at all these individual players interested in their individual statistics [publishing for tenure] and, like sports players...that’s the measure of success as a researcher. That’s a fundamental barrier to bring in private equity and private compan[ies].

Furthermore, some participants believe universities are not clear on their own mission and wondered if the primary university focus is to educate or to do research. Others thought it was a dual mission, which is equally as challenging because it does not inherently promote nor encourage the creation of partnerships between the university and industry.

There is a dual purpose here for the university, one of education and the second one of research. And if you try to do both, that is where, without regard to the collaborators, then it can be a series of problems, from the industry’s point of view. At least from my own company’s point of view.

And my questions is...is the interest of the university to say, ‘How can we direct our research to support this [industry innovation]?’ or ‘How do we direct our curriculum to support this [industry innovation]?’ There’s two different arms of the university, and they have different goals and they have different methodologies, really.

... they're not an outreach of our companies and we can't treat them that way. And yes, they want to publish. The reason that these universities get lots of money from the state and elsewhere... isn't for development. It's... their mission, and that's to teach these kids... The reason they take money from grants, post docs etc., is for them to advance the knowledge base...

Several participants expanded on the concept of university structure as creating barriers to industry-university partnerships by discussing how university operations inhibit collaboration. In particular, how university "bureaucracy" can get in the way of a collaborative relationship.

Usually that's why we take it outside and try to come back in the back door and use their [faculty] analytical tools and use the expertise as a consulting service. It's not really the university, they just happen to be employed by the university.

We have found it very difficult to get additional resources through academia and through the resources being done in isolation or in silos, that there's really not collaboration between universities.

Business Principles

Related to comments about access, mission and the structure of universities, participants commented on the need for universities to better market themselves as a way to improve all of these issues. Many of the industry representatives participating in the focus groups thought that if universities are interested in working with businesses, they should market that interest and their expertise.

It's amazing. It's like the best-kept secret, and they don't want the secret out. So it's very difficult to determine what capacity and what technologies are even resident, because the universities don't do a good job in being able to facilitate that information to local businesses that could take advantage of it.

...you need to promote yourselves to the people who didn't know about it unless he heard about it through a friend... I think you guys need to identify what it is. Just think of yourselves as a business... If your product is intellectual innovation and capacity building, then how do you sell your product?

Participants wanted universities to operate like a business when it comes to having a clear mission or marketing expertise, but many, especially the smaller companies, find it difficult to afford what is charged by universities for providing technology research. These participants seemed to struggle with needing help with testing and developing a commercialization plan and paying for that service from a university researcher. One participant representing a small start-up stated, "I'm looking at it as I want to go to the university and I need the university, but I don't have the money to go to it." Others commented:

But from a small company, we don't have a lot of the very expensive analytical equipment, so you look for laboratories to help you. There's the assumption that a public university would be willing to help and/or be cost-effective. We find that when we go to [the university] they are more expensive than a lot of private companies.

What we do is we adapt technology to commercialize product that has a market, that's number one. Number two is we continue to innovate those products, continue to innovate those processes and those

business processes, to be able to improve, to continue to get more efficient, to make the commercialized product better. But what we don't do is, we don't do primary research because nobody can afford to do it.

One participant described an agreement they had made with a local university to afford the necessary research.

...as a start up, the university has resources in regards to validation and equipment. And for those things we don't yet have the monies for that are made available to us on a for fee basis which is helpful to our building efforts, pretty much for validation on our concepts and such.

Across the board, all participants expressed a desire for university researchers to adhere to industry project timeframes when working together. They stated industry often requires quicker turn around than pure academic research. One participant said, "Because one of the hesitations is just around the speed issue; sort of the speed of business versus the speed of the university." Another participant noted, "You guys operate at such a slow pace. ...everything happens in school periods, school times." They stressed that for a university-industry partnership to be successful, the researcher must be willing to meet tight deadlines. Two examples include:

The timing can be [everything] to industry, so if we can't get something by this day it can stop the whole product line. It's really critical for us sometimes.

So when we go to the universities and say, we want to be able to work in collaboration, the first thing that we establish with them is this sense of urgency that we have for the information that we're looking to accomplish.

The Elephant in the Room



One of the biggest barriers to businesses accessing university resources and expertise is intellectual properties (IP). "Sort of the elephant in the room for us is confidentiality around IP and developing it and who has rights to it and the collaboration." Concerns about intellectual property rights were reported from both participants who have had negative experiences and those who have not worked with a university but make a negative assumption about the IP process or legal parameters. One person summed up what was said in many of the conversations, "Universities in Ohio have different interpretations of public contract research. They say, 'If we've developed it on your dime, we own it.' That's crazy." Another participant spoke of personal experience:

We've spent a lot of time working with universities to get them on a team and they insist that if we pay them and they develop IP they own it. And that's unacceptable to us, as well as our customer. That's a big stumbling block.

Several participants noted that expectations and hesitations should be discussed upfront so all parties know what to expect. Examples of this include:

That is where I was going to go with expectations...because we don't yet know what the balance is. We know what we want, we know what we need...but not at all yet had the conversations to understand what's a fair exchange, if you will, in a relationship that would be beneficial to a faculty member or a student.

My perceived barrier is that you guys are going to want the intellectual property or you're going to want licensing and royalties. And I'm a selfish businessman that wants my sweat to stay on my side of the relationship. I might be projecting and guessing, because I've never had this conversation... [universities should put it out there] for all to know: [For example]'Here's what we typically would like in a collaborative relationship as far as intellectual property. If we're going to use our labs and our professors...it's going to be all on our side and you guys are going to lose the technology. Or, it's going to be a win-win.' You guys I think could do a better job promoting that kind of relationship...

3. University Role in Ohio's Economic Development Plans

Participants were asked how universities can best support the challenges and needs of the private sector. Throughout the groups, participants discussed opportunities for universities to be a major force in the state's economic development plans. More specifically, they saw partnerships between universities and industry as an opportunity to build up Ohio's advanced energy technology resources. This includes university assistance with:

- + increasing and accelerating technology readiness; and
- + technology commercialization.

Regarding actual collaborative relationships that promote economic growth for everyone, one participant commented, "I think the short statement is strategic alignment between the technology needs of the region and the universities' staffing and organization." Making a similar point, a participant in a different group stated, "The hurdle, I think, is the university itself recognizing the regional market potentials for the development of resources into a viable industry."

Other participants offered the following statements that tie into themes identified in previous sections of this report.

I think the question is how do you make that synergy between the academic community and the business community and take [that expertise] and knowledge, and skills and innovations and move them across, because that's really what's important.

The goal is community-based technology development. It's finding jobs for our graduates and it's not about publication, really, although there are certain aspects of the academic process that can't be ignored. But what we're about right now, in this day and age, the perfect storm; having billions of dollars identified to advanced energy. Universities have to be collaborative.

University assistance with increasing technology readiness was seen as both an opportunity for industry, especially smaller companies, and economic development for Ohio. Participants stressed the importance of having a concept tested by researchers before taking it to market. Furthermore, once a technology is proven, companies need help with creating a commercialization plan for the product. As stated by one participant, “I want to go and I want to have an independent person test it. I want to be able to make some improvements...” Another said, “I need them to test my ideas and model them for us, not a lot, but I need some testing. And then I need to work with a university on a commercialization plan.” According to another:

I think the main effort of what we need to do with the economy now is to get these technology readiness level 3-4-5 projects...to the technology levels 6-7-8-9. So we've got to get them off of the bench and out into the field working, and that's where I think the emphasis needs to be.

Some participants expanded on comments about testing and commercialization by noting the need to take what is being developed by faculty and creating a commercial value for it. They saw this as an opportunity for industry to add value to research conducted at universities.

... there's got to be a connection between the research that's being conducted and supervised by those professors in the university system and still measure whether or not there's commercial application for that research still. You still got to pass that research on to private enterprise to develop the commercial value. And there's still got to be some accountability between the research side and the commercial application side to bridge that.

Citing a successful collaboration, in light of some of the barriers mentioned previously, one participant said:

We're working with the university now, where they have the technology. The professors have spun off the company, and we've included them as a collaborator or subcontractor on various efforts. But they also recognize that our production company is a conduit to their production of their intellectual materials and their intellectual property. That's a potential remit. They understand we have access to the market; we have access to manufacturing scale-up. They are flexible. They recognize they live in a bureaucratic contracting environment, but they still accommodate us.

4. Align Curricula and Workforce Training with Business Needs

The participants understood student education is a major mission of the universities. They also had an interest in seeing that students graduating from Ohio's universities are well-educated and prepared to enter the workforce. Some of the participating companies currently utilize student interns and co-op placements, whereas others would be interested in doing more with students. All agreed that the alignment of curricula and workforce training with business needs should be a priority. In particular, they would like to see:

- + students being better prepared for working in the “real world” work environment;
- + interns or co-op students placed on specific company projects; and,
- + Ohio's economy being built up by keeping graduates in our state's workforce.

MYERS MOTORS: CO-OPS AND CARS OF THE FUTURE

Drawing on a shared love of electric cars, Professor Tom Hartley and eight University of Akron students recently teamed up with Myers Motors, to develop a low-cost lithium battery management system that will revolutionize the economic accessibility of electric vehicles.

Located in Tallmadge, Ohio, Myers Motors is one of the foremost manufacturers of all-electric vehicles in the United States, currently producing a one-passenger gasless vehicle priced at \$29,995 that is capable of driving at highway speeds. Classified as a three-wheeled motorcycle, it is the cheapest all-electric vehicle currently available. The company hopes that, in time, they will be able to sell their “NmG,” or “no more gas,” vehicles for less than \$20,000. The battery management system Hartley’s students helped develop is an important step towards affordability, and is currently proceeding towards a joint patent. It will be part of Myers Motors’ concept for a two-passenger gasless vehicle, their prospective entry for the Progressive Automotive X Prize competition.

Funded by the X Prize Foundation and Progressive Insurance, the Progressive Automotive X Prize’s mission is to promote the development of efficient, eco-friendly vehicles. The prize, to be awarded in 2010, is \$10 million and will go to the team that develops a vehicle capable of 100 mpg, or its energy equivalent.

The University of Akron and Myers Motors have developed a mutually-beneficial partnership, unlike similar, but prohibitively expensive, cooperative programs. Cooperative education programs like these fulfill the needs of both students and small businesses. Small businesses receive assistance from new workforce talent, and students get the real world experience and hands-on learning opportunities that are a valuable part of a college education. Many opportunities such as these are sponsored by the University of Akron’s student chapter of the Institute of Electrical and Electronics Engineers, Inc.



Dana Myers, president of Myers Motors, hopes to work with students again in the future by incorporating their projects at Myers Motors into curriculum at University of Akron. He imagines the development of a suspension system and 3D CAD drawings as particular projects students could help with as part of their classes.

The development of programs such as these that promote research and opportunities for talented students may well be the key to Ohio’s economic future, making Ohio businesses the leaders in the field and promoting in-state job opportunities.

Most groups discussed a need for students to have core, not necessarily degree-related, skills to work in the private sector. These included good communication skills, critical thinking skills, the ability to conduct complex problem solving and an interest in lifelong learning. According to participants, these fundamentals would serve both the students and the energy sector well. As one participant put it, *“I think that’s something that an educational institution could really look at doing and become exemplary in how they educate people to think about the future, and future problems.”* Another said universities need to offer:

...training to give people a holistic, life cycle, cost-analysis skill, so when they’re out contributing to a decision-making process, they don’t look at only the first costs. They can make the arguments and have that seed planted about lifetime operating costs being part of the decision-making. Because that’s really what we’re talking about here, as far as clean energy and sustainability...a longer-term framework.

Those working with students reported that having them work on specific projects adds value to their education experience and to the company. Despite the additional training and supervision, they mostly see the arrangements as a positive for everyone.

It’s been a good thing for us; it brings bright young people into the company. And for them, because cooperatives have generally run fairly lean, people are put immediately into useful and productive projects, so they’re doing work that probably someplace else they wouldn’t do.

Additionally, working on a specific project can provide experience managing complex projects, which was seen as a skill needed immediately upon entering the workforce.

So coming out of the university with some idea of how you manage complex projects and how you actually work with people that don’t work for you, but you’ve got to influence. Universities for the most part don’t touch this, but it’s a critical skill set that I think industry relies on. And in some cases, some have figured out they actually have to build that up in their organizations. But if you look at what would make students successful it would be huge.

Retaining graduates educated by Ohio universities was viewed as important to the economic growth of the state. Participants believed the private sector and universities could build economic momentum by utilizing what each has to offer, including keeping graduates in Ohio’s workforce. One participant stated, *“It’s industry that is going to create the wealth in the economy, not the universities. From that standpoint [they] are only going to be supportive and make sure we have an educated workforce.”* Another noted, *“Ohio’s community colleges, technical colleges, and Edison centers are positioned to produce skilled workers and to support the needs of the advanced energy industrial sector.”*

In addition to opportunities for engineering student research, participants also discussed the potential for business students to assist with commercialization and marketing plans for specific technologies. Some have already worked with professors and students in business programs, whereas others are interested in doing so.

TECHNOLOGY MANAGEMENT, INC.:

FUELING ENERGY AND PARTNERSHIPS

Technology Management, Inc. (TMI) and The Ohio State University's Ohio Agricultural Research and Development Center (OARDC) are currently working together to create new clean energy systems. Since 1990, Cleveland-based Technology Management, Inc. has been developing compact solid-oxide fuel cells which are capable of generating much cleaner energy than traditional fuels.

Though agriculture and fuel cells don't seem an obvious fit, the OARDC determined that the combination of anaerobic digesters and fuel cells could potentially store and use renewable energy. "Biomass to Electricity," OARDC's name for the project, focuses on research, development, and the eventual commercialization of the solid-oxide fuel cell technology developed by Technology Management, Inc.

The Biomass to Electricity program uses large anaerobic digesters made by NewBio E-Systems of Minnesota to convert biomass—a product in which Ohio is rich—to biogas. This biogas can be used by fuel cells to generate energy. These solid-oxide fuel cells can use a variety of fuels, giving this technology a great potential for widespread use due to its flexibility. With the help of federal funds and a Third Frontier Project award, OARDC hopes to transform this technology and other similar biomass conversion systems into scalable energy systems.

The hub-and-spoke arrangement between OSU, Technology Management, Inc., and its other partners in the project is almost as innovative as the project itself. With the university as the hub and the businesses as the spokes, this approach uses the technology and commercialization of the business and the knowledge and facilitation of the university. Therefore, OSU and its partners were able to collaborate on different aspects of the project without being weighed down with ongoing legal and commercial issues. It also allows for the addition of other partners, or "spokes," with fewer conflicts over expertise and technology.

Biomass to Electricity's innovative approach was awarded one of seven NorTech Innovation Awards in 2005. These awards focus on individuals, companies and organizations that have developed systems that could impact Ohio's economic and technological future. The award led to the receipt of a USDA Bioawareness Days II Award for the approach's innovative method of technology integration for renewable energy.

In a time when fuel cells and renewable energy are scaling up, such programs may be the way of the future. Fuel cells, like those of Technology Management, Inc., could make it possible for agricultural producers across Ohio to turn their biomass production into affordable and reliable energy.





COLLABORATION BEST PRACTICES

One objective of this project was to identify the “best practices” for university-industry collaborations. Although previous sections in this report mostly focus on barriers and areas needing improvement as identified by participants, it should be noted that examples of positive experiences and partnerships were also discussed in each group. Based on this information and the case studies highlighted in this report, common elements that facilitate successful collaboration include:

1. Establishing connectors or liaisons within the universities to look for and encourage potential partnerships;
2. Clearly articulating expectations and hesitations prior to project and contract development;
3. Developing shared vision and goals;
4. Aligning university research and industry timeframes; and
5. Utilizing a joint approach to the research design.

By far, the most important component of current successful collaborations is the usage of a “connector,” someone who can bridge the needs of industry and the work of university researchers. Businesses who have had successful interactions—and those who have not yet collaborated—with universities stressed that working with a university liaison provided entrée to the university and/or could facilitate such relationships. According to two different participants:

You know, if someone came to the table and said, ‘Okay, here’s a problem that we have. How can we put this group of different subject matter experts in the room to resolve this?’ Those type of connections, that type of teeing up, is what we would like to see.

...I think it’s a matter of matching a researcher or a scientist or somebody who has, you know, a specific expertise and a company who needs that expertise and [is] saying ‘we can fund this guy [the researcher] and accelerate what we’re doing on the private side.’

A participant who is in the position of connecting clients to the university summed up his role:

It’s that linkage, forming that relationship, with someone who doesn’t know about what the university

could do in a particular area of research. And then on the other hand, probing into the university and finding out what can you do, 'what resources do you have?', then matching them up. It's almost like a dating service.

In many ways, this person could act as a project manager, assisting with networking, and making sure the other recommended best practices are implemented, such as discussing expectations and hesitations, and ensuring that all parties identify a common vision, goals and timeframes. One person commented from their experience, “[We have n]o hesitations working with universities once the project is defined and expectations are addressed and well-defined.” Of particular note is the need to discuss expectations related to the development, protection and transfer of intellectual property.

In the context of having a liaison, some participants discussed how the motivation level of individual faculty members determines whether or not a successful collaboration takes place once a connection has been made. Based on experience, one participant stated, “...in instances where relationships have not worked as well, it has been more of an individual academic researcher issue, e.g., failure to live up to commitments.” It was noted, however, that the connector can assist in determining who would be a good match with content, research skills and a desire to work with industry.

And the executive director...introduced me to one of the chemistry professors on campus that was very ambitious, a very ambitious professor. And within two weeks, he had an office set up at my plant, and we just started to collaborate on the process from that point on and got a deep relationship into the university.

Some participants suggested that Centers of Excellence provide a framework for utilizing connectors, implementing other best practices identified in this report and addressing some of the concerns discussed in previous sections. Successful examples of centers, institutions, or other organizations were identified around the state.

...[Examples include] institutes or centers of excellence or other organizations whose primary goal is not education. The same faculty work there, but it's the center whose goal is slightly different. There it is mostly research focused, and you can have the confidentiality and all those other types of relationships...a framework of that kind can be extremely helpful, especially if there is going to be a lot more accreditation.



NEXT STEPS

As UCEAO moves forward to develop a plan to advance energy education, research and new technologies, the results of this project should be carefully considered. Some of the information discussed in this report lends itself to short-term goals, whereas other findings will require longer-term efforts. Below are some initial steps that UCEAO is currently considering or could consider implementing to build upon these findings.

Expanded Membership

Based on the outcomes characterized in this report, UCEAO will continue with its existing membership initiative to include community and technical colleges and four-year liberal arts schools as members. Community and technical colleges play a significant role in workforce development and skills acquisition, and liberal arts colleges are educating the next generation of community leaders and policy makers. Together with major research institutions, this level of outreach and inclusion could foster stronger ties within Ohio's robust higher education system and lead the way for future multi-institution collaboration and more partnerships between higher education and the private sector. A strong network of faculty, staff, researchers and students strengthens UCEAO in its efforts to market itself and to meet the needs of the Ohio Board of Regents, the Ohio Department of Development and the Ohio Air Quality Development Authority.

Business Involvement

Given the importance of continued dialogue with the private sector, UCEAO will work to establish guidelines for soliciting and including businesses as UCEAO affiliate members. Of specific interest to UCEAO would be start-up companies who could advise on the development of the business-university relationship from early in the life of the enterprise. Incubation centers and companies with a specific, innovative approach to clean energy would also be valuable partners. Finally, trade associations could be considered as a way to include the business perspective in UCEAO activities. Such an approach would alleviate potential conflicts of interest between specific companies and UCEAO university members on specific issues, including patents, projects and student placement.

Publicizing Resources

UCEAO is currently in discussions with the Ohio Board of Regents to develop an online database of energy-related capabilities at the UCEAO member institutions and affiliated governmental labs. Information would include faculty research interests and competencies, institutional facilities and equipment available for public use, energy-related academic programs offered at each institution, and research centers and institutes with an energy component. This database addresses a major point raised in the focus groups regarding the lack of adequate information about whom to contact or the resources that might be available at a potential partner institution. A primary contact person could also be identified as that institution's liaison for business—the go-to person to help facilitate communication and partnership. Expanded meetings of the UCEAO Board of Governors would be another way to connect businesses with universities. These could involve facility tours, such as last year's Board meeting at Univenture in Marysville, or university visits to showcase research projects and resources to area businesses. This opportunity for networking is beneficial for the institution, the business and UCEAO as a strategy for convening mutual interests as well as sharing information and best practices.

Outreach

To further build on the idea of connecting businesses and universities by increasing the flow of information between them, UCEAO will continue to host its annual conference and poster session to highlight energy research at Ohio's institutions and to build networks across sectors. Regional forums could also supplement the annual conference through periodic business-oriented discussions on relevant energy issues. UCEAO is also redesigning its web site to make it more user-friendly. The new version will be more easily navigable and complete, including more current, relevant information such as upcoming conferences of interest to business and academia. In addition, it is essential to include a wider scope of faculty and staff at the member institutions who are aware of and involved in UCEAO projects to serve as advocates of the partnership. This includes areas such as technology transfer and facilities management, as well as colleges and departments beyond engineering and the sciences, such as business, education, agriculture, and communication. These individuals have an existing network of business contacts that could be tapped for new projects and collaborations.



CONCLUSION

Regardless of the specific mechanism implemented, UCEAO will continue to consider ways to involve more private sector members in its ongoing strategic planning. Balancing the interests of individual UCEAO members with those of the whole will be key to encouraging strong relationships within our university system and in presenting a unified front as our universities reach out to Ohio businesses. The need is too great and these relationships are too valuable to let languish, especially given the tremendous opportunities facing our state and our nation. Today's favorable environment for energy education, business development and technology deployment requires new and innovative partnerships, and the University Clean Energy Alliance of Ohio plans to become a national model for integrated business and university collaboration.

APPENDIX A: UCEAO REGIONAL FOCUS GROUP ATTENDEES

NORTHEAST OHIO (CLEVELAND): OHIO AEROSPACE INSTITUTE, MARCH 17, 2009

ADI WIND	Sheffield	Energy generation
Energizer (3 attendees)	Westlake	Manufacturing
GrafTech International	Parma	Manufacturing
M-7 Technologies	Youngstown	Manufacturing
Orbital Research	Cleveland	Research
Rolls-Royce Fuel Cell Systems (US) Inc.	North Canton	Energy generation
The University of Akron Research Foundation	Akron	Energy storage

SOUTHWEST OHIO (WEST CHESTER): VOICE OF AMERICA LEARNING CENTER, MARCH 17, 2009

Duke Energy	Cincinnati	Energy generation
Jatrodiesel, Inc	Miamisburg	Manufacturing
Melink Corporation	Milford	Energy efficiency
TFC Energy	Fairborn	Manufacturing
The Dayton Power and Light Company	Dayton	Energy generation
University of Cincinnati	Cincinnati	Business development
Webcore Technologies	Miamisburg	Manufacturing

NORTHWEST OHIO (TOLEDO): UNIVERSITY OF TOLEDO ENERGY INCUBATOR, MARCH 18, 2009

American Ag Fuels	Defiance	Manufacturing
IAMS	Findlay	Manufacturing
Ohio Gas Company	Bryan	Energy generation
Owens Corning	Toledo	Manufacturing
Regional Growth Partnership (3 attendees)	Toledo	Business development
ShadePlex	Toledo	Manufacturing
Solargytics, Ltd.	Sylvania	Research
SuGanit Systems Inc	Toledo	Research and development

CENTRAL OHIO (COLUMBUS): THE OHIO STATE UNIVERSITY PAGE HALL, MARCH 18, 2009

AEP	Columbus	Energy generation
Ameresco	Columbus	Energy solutions
Applied Sciences, Inc.	Cedarville	Research
Buckeye Power	Columbus	Energy generation
Energent Solutions	Columbus	Research
Hexion Specialty Chemicals	Columbus	Manufacturing
Replex Plastics	Mount Vernon	Manufacturing
Resource100 LTD	Canal Winchester	Research and development
Zyvex Performance Materials	Columbus	Research and development

SOUTHEAST OHIO (ATHENS): OHIO UNIVERSITY VOINOVICH SCHOOL, MARCH 20, 2009

Carbon Cycle Engineering	Athens	Research and development
Independent/unaffiliated	Athens	Sustainable design
Michael Bradley & Co., Inc.	Marietta	Service electrical apparatus
Panich + Noel Architects	Athens	Architect
Sun Coke Energy	Franklin Furnace	Manufacturing
Third Sun Solar	Athens	Energy generation

APPENDIX B: UCEAO FOCUS GROUP QUESTIONS

UCEAO is an organization that is comprised of 15 Ohio universities committed to advancing energy education, research and technology. UCEAO is dedicated to turning discovery and development into positive economic outcomes for Ohio by developing working relationships with industry and Ohio-based government laboratories. To further this goal UCEAO is conducting a series of meetings around the state aimed at enhancing the interface between UCEAO's member institutions and energy businesses in the private sector. The information collected in these meetings will be compiled into a report and key findings will be presented at the UCEAO annual meeting in April to aide in the development of a strategic plan. Copies of the report will be made available to focus group participants.

1. What are the core competencies in Ohio related to the advanced energy sector?
2. What are the major advanced energy growth areas in this region of the state? How are they different than other parts of the state?
3. In general, how has your company interfaced with Ohio's universities and colleges?
4. If you have worked with universities or colleges, how did your relationship initially begin?
[Query: How did you find and get in the front door? What were your expectations? What were your hesitations?]
5. What are the biggest challenges to working with universities?
[Query: If you have not worked with universities, what has kept you from working with them? What are the institutional hurdles that need to be surmounted to pull technology out of the university and into industry?]
6. What capacities/technologies do universities need to develop to help you capitalize on advanced energy opportunities? [Probes: Research and development, technology transfer, incubator and economic development, proof of concept] [Query: What are the needs for different market sectors?]
7. How can universities best support the challenges you face in your business and other needs of the private sector? [Query: How can industry utilize university technical knowledge? What would help take you to the next level?]
8. How does your industry utilize interns and co-op placements? How can universities best prepare students for working in the advanced energy sector?
9. How can the private sector benefit universities?
10. Please provide successful examples of private sector/university collaborations. What made these collaborations successful?
11. Is there anything we should have discussed today but didn't?

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