



OHIO AIR QUALITY DEVELOPMENT AUTHORITY

2010 Annual Report

Clean air and clean energy are good business.



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The Ohio Air Quality Development Authority

November 2011



CLEAN AIR & CLEAN ENERGY
ARE GOOD BUSINESS

Letter to our Stakeholders:

Just like historians and married couples who enjoy observing “round-numbered” anniversaries, OAQDA celebrated its 40th anniversary in June 2010 – exactly 40 years since its 1970 creation by the Ohio General Assembly. We hope you found useful the materials we prepared to chronicle the Authority’s legacy of helping keep Ohio’s air clean and supporting ever-emerging advanced energy technologies.

Even more importantly, though, OAQDA embarked on its fifth decade last year by adding to that legacy. Seven new non-coal projects were authorized for funding from the \$150 million Ohio Advanced Energy Job Stimulus Program. The funding supported a wide array of cutting-edge advanced technologies, ranging from lithium ion cells for use in battery packs for electric vehicles, to energy efficient refrigeration systems, to thin-film solar panels. In addition, five coal projects were approved for funding from the stimulus program.

With respect to its oversight of the Ohio Coal Development Office program, OAQDA engaged in a priority shift to better align the program’s focus with that of the Fossil Energy Program of the U.S. Department of Energy. Accordingly, in July, the focus of the annual granting of Ohio Coal Research Consortium funds shifted to an emphasis on projects that address the capture and storage of carbon dioxide. These actions reflect mounting anticipation of future carbon constraints by the federal government.

In September, OAQDA voted to create a small business loan program within its Clean Air Resource Center (CARC). Previously, since its creation in 1996, CARC was authorized only to provide grant funding to small businesses seeking to comply with the requirements of the Clean Air Act. Subsequently, the first-ever CARC loan was approved by OAQDA in March of this year.

All in all, 2010 was a year when OAQDA continued its forward movement across a variety of fronts, from supporting advanced energy to re-targeting clean coal technology to assisting local governments and universities with energy efficiency and conservation. Not a bad way to mark 40 years of service to Ohio.

In closing, we observe that OAQDA’s long-standing Executive Director, Mark R. Shanahan, retired from his post effective April 30, 2011. On behalf of all Authority members and staff, we thank Mark for his 21-plus years of service to OAQDA and to the State of Ohio.

Respectfully,

Gayle Channing Tenenbaum
Chair

Todd Nein
Interim Executive Director

2010 OAQDA Highlights

A month-by-month review of investment and leadership in advanced energy technology and development

January

At its January meeting, OAQDA members approved the first of what would be several air revenue bond financings in 2010 to help local governments and state universities across Ohio invest in energy efficiency and conservation measures. The January action was for a \$9.5 million bond to assist the Orient corrections facility in Pickaway County with upgrades and retrofits at the Correctional Institution, the Correctional Reception Center and the Training Academy. The improvements included a decentralized power house, direct digital control system, water conservation installations, lighting retrofits and an ozone laundry system.

The Authority also awarded a \$3.2 million Ohio Coal Development Office (OCDO) grant to The Ohio State University for a pilot project to demonstrate a method for producing hydrogen from coal syngas, along with a stream of carbon dioxide (CO₂) suitable for sequestration. The award was approved as part of the \$150 million Ohio Advanced Energy Job Stimulus Program. It served as matching funds for a \$5 million grant from the American Recovery and Reinvestment Act.

February

Owens Community College became Ohio's first recipient of funding from the American Recovery and Reinvestment Act's Qualified Energy Conservation Bond program (QECB) as part of a financing package approved by the Authority in February. Under terms of the financing, which was completed the following month, two air quality

development bonds, each in the principal amount of \$3,125,000, were simultaneously approved as Series A federally tax-exempt bonds and Series B QECB federal tax-credit bonds. Owens will use the funds for wide-ranging energy efficiency and conservation measures at its campuses in Hancock and Lucas Counties. The measures included lighting and water conservation upgrades, vending machine controllers, computer power management systems and direct digital control upgrades at both campuses. Additionally, the Findlay campus in Hancock County targeted a new summer reheat boiler at its education center, while the Toledo campus in Lucas County planned to acquire a heating water system upgrade and a roof replacement for its Heritage Hall.

In addition, the Authority authorized an OCDO grant award of \$108,698 to Touchstone Research Laboratory of Wheeling, West Virginia for a pilot project to study the capture of flue gas CO₂ by passing the gas through an algae pond at Cedar Lane Farms in Wooster, Ohio. The award was authorized as part of the \$150 million Ohio Advanced Energy Job Stimulus Program. It served as matching funds for \$538,574 in additional funding from the U.S. Department of Energy National Energy Technology Laboratory (NETL).

March

OAQDA's March meeting saw the approval of two more OCDO grants for clean coal technology projects at The Ohio State University and Battelle. The awards were authorized as part of the Ohio Advanced Energy Job Stimulus Program.

Ohio State received a grant of \$273,106 for a pilot

project to demonstrate a method for enhanced capture of carbon dioxide and sulfur dioxide at Ohio's coal-based power plants. Battelle received \$500,000 for the development of an improved computer model to refine current estimates of CO₂ storage capacity in western Ohio.

April

Kent State University's Stark and Tuscarawas regional campuses were approved for \$2.5 million in financing at the April Authority meeting for a wide-ranging energy efficiency and conservation project. The project is the latest step in the adoption of the university's institution-wide Energy Conservation Master Plan to meet the energy consumption and greenhouse gas emission reduction goals of 20 percent, as targeted by House Bill 251. Planned retrofits included lighting upgrades, new vending machine controls, HVAC upgrades, solar fountain and waterfall pumps, building automation enhancements and others. The energy conservation measures are expected to cut energy consumption by 25 percent, triggering annual savings of \$312,905, or 35 percent. Reductions in greenhouse gas emission were expected to be the equivalent of removing 532 cars from the road.

May

In anticipation of likely federal regulation of CO₂ emissions, OAQDA authorized two OCDO grants at its May meeting to further the state's understanding of the suitability of its deep geology for CO₂ sequestration. A grant of \$2,209,409 was awarded to Battelle for its participation in the 18-month project, "Conducting Research to Better Define the Sequestration Options in Eastern Ohio and the Appalachian Basin." The grant is a continuation of OCDO's support for the Midwest

Regional Carbon Sequestration Project. Total project cost is \$28,668,433, with most of the remaining funds being provided by the U.S. Department of Energy. A second grant of \$790,591 was approved to help support participation in the same project by the Ohio Department of Natural Resources, Division of Geological Survey.

In addition, long-time OAQDA employee Janis Ivory retired on June 30 after 25 years of dedicated state service.

June

Authority members marked the 40th anniversary of the agency's creation in June 1970 with the publication of a retrospective piece that presented in detail the highlights of four decades' worth of service in cleaning Ohio's air, safeguarding the overall environment and supporting clean and advanced energy technologies and programs.

September

Pickaway County will retrofit its government buildings with a variety of energy efficiency and conservation systems and measures thanks to the first-ever funding to an Ohio county from the American Recovery and Reinvestment Act's QECB program. The project was made possible thanks to \$3,115,000 in bonds issued by OAQDA, which administers the QECB program, at its September meeting. Most of the retrofits will involve the county courthouse, jail and service center and will include lighting system upgrades, building automation and controls, water conservation measures and retro-commissioning of mechanical and electrical infrastructure. The new measures are expected to help the county cut annual utility bills by nearly 24 percent and to reduce greenhouse gas emissions by 15 percent.

November

OAQDA authorized five new awards from the \$150 million Advanced Energy Job Stimulus Program, four of which were in the “non-coal” category and the other being an OCDO-funded clean coal technology project. The four non-coal projects received loan awards as follows:

- \$10,000,000 to CODA Automotive, Inc. of Columbus to retrofit an existing manufacturing facility for the production of automotive-grade lithium ion cells. The cells will make 34kWH battery packs with advanced thermal management and battery management electronics for use in electric vehicles. The project will generate 1,000 new jobs in its first phase and up to 2,100 at full production. Total project investment will be \$711,000,000.
- \$1,365,780 to SCI Engineered Technologies, Inc. of Columbus to help expand manufacturing capacity for the production of high-temperature superconductivity material. SCI will use the funds to purchase machinery and equipment to meet the growing demand for its thin-film solar panels. The project will create 50 new full-time jobs and retain another 26 jobs. Total project investment is \$3,003,780.
- \$1,530,000 to the Stark County Port Authority, working in collaboration with Stark State College of Technology and The Timken Company, to establish the Wind Energy Research and Development Center on property owned by the college. The Center will conduct wind energy testing of ultra-large main-shaft bearing systems over 10 feet in outer diameter. The project will create eight new full-time jobs and 57 temporary construction jobs. Total project investment is \$11,847,864.
- \$7,612,500 to Turning Point Solar LLC to assist in the construction of a 49.9 megawatt solar-powered electric generation station on land within 500 acres of reclaimed strip mine lands outside of Cumberland (Muskingum and Noble Counties). The land is owned by American Electric Power. When built, the facility will be the largest photovoltaic array east of the Mississippi River. The project will create 20 new full-time jobs and 312 full- and part-time construction jobs. Total project investment is \$220,112,500.
- \$385,570 in the form of an OCDO grant to The Ohio State University for the project “Geophysical and Geochemical Properties of Reservoir and Cap Rock for Carbon Sequestration in Ohio.” The grant supports earlier OCDO grants aimed at better characterizing the potential for Ohio’s deep geologic formations to serve as permanent storage for CO₂. Case Western Reserve University will participate as a partner in the project, which will take place in Belmont, Scioto, Tuscarawas and Warren Counties. Total project investment is \$470,396.

December

An OAQDA loan of \$10,000,000 from the Advanced Energy Job Stimulus Program was approved to help establish Ohio’s first-ever public capital fund focused on stimulating investment in micro-infrastructure energy opportunities. The Ohio Energy Gateway Fund was created to match private investment with advantageous public dollars to stimulate investment in local power generation, energy efficiency and growth opportunities. (As of August 2011, OAQDA funds have been redirected to other projects due to the Ohio Department of Development fully funding The Ohio Energy Gateway Fund).

Clean Coal Technology Support

Responding to anticipated, future federal carbon restraints, OAQDA oversaw a priority shift in the management of Ohio's coal program toward projects that address more advanced methods for capturing and storing carbon dioxide, as well as enhanced oil recovery. The shift further aligns work of the Ohio Coal Development Office (OCDO) with that of the Fossil Energy Program of the U.S. Department of Energy. Newly sharpened program objectives also included greater emphasis on projects that address oxygen separation from air and the conversion of coal to other fuels.

At its July meeting, OAQDA approved 12 new clean coal grants to four Ohio universities – the University of Akron, Case Western Reserve University, the University of Cincinnati and The Ohio State University. The Authority authorized \$2,034,728 in OCDO grant funding, which was matched by \$469,505 in additional funding by the universities, bringing the total overall investment to \$2,504,233.

The 12 OCDO grants are listed below, according to the category of research being undertaken:

Carbon dioxide capture and sequestration

- \$159,786 for a continuation project at **Case Western Reserve University** that evaluates the potential for leakage of CO₂ contaminated with sulfur dioxide, oxygen and other flue gas components after injection into Ohio's deep saline aquifers. The two-year project will measure the solubility of CO₂ in brine and the rates of reaction of this solution with minerals found in possible CO₂ storage reservoirs in Ohio and also develop computer models to estimate the risk of CO₂ migration. University share: \$46,044.
- \$160,000 for a continuation of support for a project of **The Ohio State University** involving the iron-based chemical looping process, which directly converts coal into hydrogen with an off-stream of sequestration-ready CO₂. To date, the system has been demonstrated at the bench scale of 2.5 KWth (kilowatt thermal). The goal of this two-year project is to develop a prototype coal handling and feeding system that can be suitable to the 25 KWth to 1 MWth sub-pilot range. University share: \$40,034.
- \$160,000 for a two-year project at **The Ohio State University** to address optimization of reactor conditions in a CO₂ capture system

demonstrated in prior OCDO-funded projects. The process uses calcium oxide to capture CO₂ at elevated temperatures so that the heat can be used for electricity generation. It also renders a pure stream of CO₂ ready for sequestration. University share: \$45,013.

Oxygen separation

- \$160,000 for a two-year project at the **University of Cincinnati** to continue research into the development of membranes that can reduce the cost for separation of oxygen from air in oxy-fired coal combustion. This project will support past work by fine-tuning membrane pore size through use of zeolite membranes. University share: \$40,284.
- \$160,000 for a two-year project at the **University of Cincinnati** for the development of a membrane for use in the separation of oxygen from air. This proposal differs from the above project at the university in the form of zeolite to be evaluated. Also, this proposal will emphasize reducing the thickness of the membrane to enhance the oxygen flow rate. Researchers will address separation issues, including the extended time required for membrane synthesis that leads to higher costs as well as the large membrane thickness and existence of

inter-crystalline pores that lower separation performance. University share: \$57,175.

- \$160,000 for a two-year project at **The Ohio State University** to reduce the cost of separation of oxygen from air in oxy-fired coal combustion. The proposed approach is to place a nano layer of dense membranes between two porous support layers made of materials easily fabricated into shapes required for oxygen separation processes. The project's goal is to fabricate these membranes in tubular shapes to facilitate the building of bench-scale test set-ups for demonstration to potential commercialization partners. University share: \$40,000.

Conversion of coal to hydrogen

- \$80,000 for a one-year continuation of a project at the **University of Cincinnati** to demonstrate high-temperature water-gas shift reactors that do not require catalysts for conversion of syngas to hydrogen. The basis of the concept is development of a zeolite membrane for separation of CO₂ and hydrogen, thus driving the desired reaction to completion. The reactor has performed well to date, although membrane performance has dropped 18 percent. The goal of the remaining year is to work to stabilize the membrane and improve reactivity. University share: \$20,000.

Coal fuel cells

These three projects comprise the new coal-based fuel cell collaborative program between the **University of Akron** and **The Ohio State University**. The first task will be to work out intellectual property issues and a common statement of work. The primary problems holding up progress on the coal fuel cell have been fabrication of the cell button and elimination of pinhole air leaks where the reactive button is attached to the cylinder that completes the cell assembly. The goal of the collaboration is to use the unique expertise of the principal researchers at each university to resolve techniques for fabrication of cells with reproducible performance and greater reactivity.

- \$160,000 for the two-year “coal-based fuel cell efficiency and overall concept” project at the University of Akron. University share: \$40,000.
- \$159,993 for the two-year “coal-based fuel cell catalysts” project at The Ohio State University. University share: \$40,920.
- \$160,000 for the two-year “coal-based fuel cell supports” project at The Ohio State University. University share: \$40,000.

Other projects

- \$160,000 for continuation of an iron-based chemical looping project at The Ohio State University aimed at increasing the reactivity of the iron oxide particles in the chemical looping process so that the size of the reactors may be reduced. This two-year project will be a fundamental study involving quantum theory to try to understand how oxygen moves into and out of iron particles and to increase the rate at which it does. The Consortium directed that a consultant who specializes in this field be added to the project team, and the principal researcher has agreed to this redirection. University share: \$40,034.
- \$80,000 for the one-year continuation of a prior two-year project at The Ohio State University to develop reduced-temperature cathodes for syngas fuel cells. The project's goal is developing stable cathode catalyst formulations that have improved oxygen-activation and –reduction properties at lower temperatures, enabling lower operating temperatures and, thus, more flexibility in terms of materials and costs. This one-year extension is a “redirection” by the Consortium to reflect a priority shift away from processes dependent on the production of syngas. University share: \$20,000.

Of the total \$2,034,728 authorized by OAQDA for clean coal research, \$1,759,792 will co-fund the above projects. The remaining \$274,936 was authorized to cover Ohio University's administrative and technical assistance budget to oversee the research projects and for outside consultants as needed and investigator travel costs.

2010 OAQDA Projects

2010 OAQDA Projects

Month	Company	Amount	Program
January	Noresco LLC	\$9,500,000	Financing
	The Ohio State University	\$3,200,000	OCDO
February	Owens Community College	\$6,500,000	Financing
	Touchstone Research Laboratory	\$108,698	OCDO
March	The Ohio State University	\$237,107	OCDO
	Battelle	\$300,000	OCDO
April	Kent State University	\$2,500,000	Financing
	Cool Containers, LLC	\$235,870	Stimulus
	Buckeye Silicon	\$1,428,000	Stimulus
	Ohio Power Company	\$79,450,000	Financing
May	Touchstone Research Laboratory	\$391,302	OCDO
	Battelle	\$2,209,409	OCDO
	Ohio Dept. of Natural Resources	\$790,591	OCDO
July	Ohio Power Company	\$257,130,000	Financing
	Ohio Coal Research Consortium	\$2,034,728	OCDO
September	Pickaway County	\$3,115,000	Financing
October	Buckeye Power	\$100,000,000	Financing
November	CODA Automotive, Inc.	\$10,000,000	Stimulus
	SCI Engineered Technologies, Inc.	\$1,365,780	Stimulus
	Stark County Port Authority	\$1,530,000	Stimulus
	Turning Point Solar, LLC	\$7,612,500	Stimulus
	The Ohio State University	\$385,570	OCDO
December	EnerTech Ohio I Feeder	\$10,000,000	Stimulus

2010 Financial Statement

Ohio Air Quality Development Authority Management's Discussion and Analysis for the Year Ending December 31, 2010

TABLE 1
NET ASSETS (in 000s)

	Governmental Activities		Business-Type Activities		Total	
	2010	2009	2010	2009	2010	2009
<i>Assets:</i>						
• Cash and cash equivalents	\$ 5,577	\$ 41,459	\$ 67,613	\$ 39,260	\$ 73,190	\$ 80,719
• Accounts receivable	—	—	17	21	17	21
Total Assets	\$ 5,577	\$ 41,459	\$ 67,630	\$ 39,281	\$ 73,207	\$ 80,740
<i>Liabilities:</i>						
Current and Other Liabilities	237	14	81	172	318	186
Total Liabilities	237	14	81	172	318	186
<i>Net Assets:</i>						
Invested in Capital Assets	—	—	17	21	17	21
<i>Restricted:</i>						
• Coal Research & Development	\$ 5,340	\$ 41,445	—	—	\$ 5,340	\$ 41,445
• Advanced Energy Projects	—	—	\$ 55,679	\$ 27,738	\$ 55,679	\$ 27,738
<i>Unrestricted:</i>						
	—	—	\$ 11,853	\$ 11,350	\$ 11,853	\$ 11,350
Net Assets	\$ 5,340	\$ 41,445	\$ 67,549	\$ 39,109	\$ 72,889	\$ 80,554

The figures are from the report of the 2010 audit conducted by the Auditor of State.
The notes to the financial statement are an integral part of the statement.
A full copy can be requested from the OAQDA.

2010 Financial Statement, cont.

Ohio Air Quality Development Authority

Management's Discussion and Analysis
for the Year Ending December 31, 2010

TABLE 2
CHANGE IN NET ASSETS (in 000s)

	Governmental Activities		Business-Type Activities		Total	
	2010	2009	2010	2009	2010	2009
<i>Program Revenue:</i>						
• Charges for Services	\$ —	\$ —	\$ 1,134	\$ 2,200	\$ 1,134	\$ 2,200
• Operating Grants	271	42,586	704	773	975	43,359
<i>General Revenue:</i>						
• General State Assistance	\$ 239	\$ 40	\$ 147	\$ 1	\$ 386	\$ 41
• Investment Earnings	—	3	5	1	5	4
• Micellaneous	237	14	81	172	318	186
Total Revenue	510	42,629	29,806	30,713	30,316	73,342
<i>Program Expenses:</i>						
• Community and Economic Develop.	\$ 36,638	\$ 3,665	\$ —	\$ —	\$ 36,638	\$ 3,665
• Air Quality Development	—	—	1,146	1,088	1,146	1,088
• Clean Air Development	—	—	198	271	198	271
Total Proram Expenses	36,638	\$ 3,665	\$ 1,344	1,359	37,982	5,024
Transfers	23	40	(23)	(40)	—	—
Increase	\$(36,105)	\$39,004	\$28,439	\$29,314	\$ (7,666)	\$68,318

The figures are from the report of the 2010 audit conducted by the Auditor of State.
The notes to the financial statement are an integral part of the statement.
A full copy can be requested from the OAQDA.

2010 Ohio Air Quality Development Authority Members

Gayle Channing-Tenenbaum, *Chair*, Columbus

David M. Benjamin, *Vice Chair*, Aurora

Clifford R. Cloud, *Secretary-Treasurer*, Columbus

Vincent A. Russo, Highland Heights

Jeffrey M. Jacobson, Columbus

Ex Officio members:

Alvin D. Jackson, M.D., *Director*, Ohio Department of Health

Christopher Korleski, *Director*, Ohio Environmental Protection Agency Ohio



Todd Nein, *Interim Executive Director*

Ohio Air Quality Development Authority

50 West Broad St., Suite 1718

Columbus, Ohio 43215

Phone: (614) 224-3383

Fax: (614) 752-9188

www.ohioairquality.org