Ohio Air Quality Development Authority

2008 Annual Report

Table of Contents

Letter to our Stakeholders:

Ohio's prominence in clean energy technology, research and development made significant strides in 2008 thanks, in part, to ground-breaking new projects supported with funding through the Ohio Air Quality Development Authority (OAQDA). As a result of these "firsts," Ohio's advanced energy programs show more promise than ever before to our state's economy, to our nation and to the world.

Perhaps the most significant accomplishment for OAQDA in 2008 was the unveiling of the Advanced Energy Job Stimulus Program. We joined with Lt. Governor Lee Fisher, who then was also the Director of the Ohio Department of Development, in October to launch the application process for businesses and technology organizations interested in competing for $150 million in funding available from this innovative program. The program includes $66 million for clean coal technology projects and $84 million for non-coal projects. It is part of the $1.57 billion bipartisan job stimulus package signed into law by Governor Ted Strickland in June 2008. Through November 2009, more than 204 profiles for advanced energy funding had been received by OAQDA.

Also in October 2008, OAQDA approved our first-ever authorization of Ohio Air Quality Revenue Bonds to support a geothermal heating system. The system will be installed at the Maumee Youth Center, operated by Lutheran Homes Society, in Henry County. The Center provides residential mental health care and treatment to youth from Henry and Lucas Counties.

In July 2008, OAQDA authorized funding in the amount of $1,900,473 for 10 two-year clean coal research projects at four Ohio universities – the University of Akron, Case Western Reserve University, the University of Cincinnati and The Ohio State University. For the first time, OAQDA authorized two-year projects *only*. This is a departure from earlier years when projects primarily of a one-year length were considered. The change was initiated to give our principal faculty researchers more stability and flexibility in their work, increasing the potential for findings that can positively affect all Ohioans.

Interestingly, because of rapid changes in the financial marketplace, 2008 also saw a number of refinancings of previously issued OAQDA bonds for the construction, acquisition and installation of air quality facilities at electric generating stations around the state. The stations affected by these actions are located in Adams, Ashtabula, Belmont, Brown, Clermont, Coshocton, Hamilton, Jefferson, Lorain and Trumbull Counties.

We greatly appreciate your interest in and support for our work, and we welcome any questions or suggestions you may have about this report or any of OAQDA's projects. We look forward to working with you to continue elevating Ohio's status as a leader in advanced energy programs and technologies.

Sincerely,

Gayle Channing Tenenbaum
Chair

Mark R. Shanahan
Executive Director and the Governor's Energy Advisor

2008 OAQDA Highlights

A month-by-month review of investment, research and leadership

Febuary

At its monthly meeting, OAQDA approved an Ohio Coal Development Office (OCDO) grant of up to $206,299 to The Ohio State University (OSU) for Phase 1 of a two-part project aimed at increasing the use of coal combustion by-products in the reclamation of Ohio coal mine sites. OSU will contribute $123,000 to the project, with another $83,000 coming from various partners, including the U. S. EPA, and Department of the Interior; the Ohio Department of Natural Resources and EPA; and electric utilities, industry trade groups and engineering consultants.

March

Two resolutions were authorized to issue tax-exempt bonds not to exceed $234 million and $109.3 million, respectively, for the refunding of outstanding bonds to Duke Energy Ohio. Those bonds had been authorized to assist in the construction, acquisition and installation of air quality facilities for its portion of several electric generating stations. The stations are located in Adams, Brown, Clermont, Coshocton and Hamilton Counties.

April

OAQDA authorized up to $26 million in bonds to refund a previous issuance on behalf of FirstEnergy Nuclear Generation Corporation. The project includes air quality facilities at the Perry Nuclear Power Plant in Lake County. The Authority also authorized a bond issuance of up to $100 million to refund previously issued bonds to Dayton Power & Light for its portion of air quality facilities at electric generating stations in Adams, Brown, Coshocton and Hamilton Counties.

May

The monthly OAQDA meeting featured the authorization of a grant of up to $228,066 for a study to determine whether Jarrod's Law, passed in 2005 and effective in 2007, is achieving its mission of protecting the health and safety of Ohio schoolchildren. Named for a first grade Lebanon, Ohio student who was killed in a tragic 2003 accident, the law requires every elementary and secondary school in Ohio to be inspected annually by local boards of health for safety, health and sanitation conditions. The Ohio Department of Health and The Ohio State University College of Public Health will conduct the study jointly at 20 elementary schools around the state.

June

OAQDA authorized up to $241,260,000 to refinance bonds previously issued to FirstEnergy Generation Corporation for the acquisition and construction of air quality facilities at its steam heating plant in Cuyahoga County and its electric generating plants in Ashtabula, Belmont, Jefferson, Lake, Lorain and Trumbull Counties.

August

Three resolutions were approved at the August OAQDA meeting aimed at finding solutions for different challenges involved in the mining and combustion of Ohio coal. OAQDA approved an OCDO grant of $118,436 to support a 12-month study of the feasibility of constructing industrial coal gasification parks that could provide fuel sources for clusters of industrial companies. The Authority also approved a $250,000 OCDO grant to partner with the U. S. Department of Energy's

National Energy Technology Laboratory (NETL) in the design of an industrial scale, polygeneration coal gasification facility. NETL will provide another $475,523 in funding. The first unit will be deployed at the University of Alaska. Finally, OAQDA approved another OCDO grant of $398,406 to support a three-year study to demonstrate management systems for mine lands that will result in terrestrial sequestration of carbon dioxide.

September

OAQDA entered into a grant agreement with OSU of up to $300,000 for a clean coal research project aimed at demonstrating a technology and method for retrofitting existing pulverized coal based power plants to allow capture of a CO_2 stream ready for sequestration. Other project partners include the U. S. Department of Energy, Babcock & Wilcox, Shell, Air Products, Consol Energy and Clear Skies.

October

In October, Ohio Lt. Governor and then-Ohio Department of Development Director Lee Fisher joined Mark R. Shanahan, the Governor's Energy Advisor, in unveiling the process that Ohio businesses and technology organizations must follow to apply for $150 million in funding from the Advanced Energy Job Stimulus Program. The Program includes $66 million for clean coal technology projects and an additional $84 million, to be allocated in three $28 million annual appropriations, for non-coal-related projects. It is part of the $1.57 billion bipartisan job stimulus package (HB 554) signed into law by Governor Ted Strickland in June 2008.

Also in October, achieving a first in its 38-year history, OAQDA authorized the issuance of up to $625,000 in Air Quality Revenue Bonds to assist in financing a geothermal heating system. The system will be installed at the Maumee Youth Center, operated by Lutheran Homes Society, in Henry County. The system will replace an inefficient oil-fired boiler unit built in 1963. The Center provides residential mental health care and treatment to children from Henry and Lucas Counties.

December

OAQDA approved a $77,000 grant to support a 2009 initiative of Clean Fuels Ohio that will promote transportation efficiency statewide through the use of cleaner energy sources and technologies. The "Green Fleets 2009" initiative will inform public agencies, school systems, businesses and other organizations that operate vehicle fleets on the benefits of using cleaner fuels. The initiative also will work to increase the availability of such fuels, including ethanol, biodiesel, compressed natural gas (including renewable bio-gas methane) and propane. Other project funding partners include the cities of Columbus and Cleveland and Gund Foundations; the Ohio Soybean Council; the Ohio Environmental Education Fund and others.

Clean Coal Technology Support

At its July meeting, OAQDA affirmed its continued support for clean coal technology research, development and deployment by approving OCDO funding in the amount of $1,900,473 for 10 research projects at four Ohio universities for the 2008-2009 academic years. The total approved includes $301,363 for Ohio University to administer the program over the two-year period. This amount includes up to $75,000 to be used for special mentoring of projects that are most likely to lead to commercialization.

As previously noted, OAQDA's action on this matter marked the first time in the coal program's history that only two-year projects were considered for funding. Again, this change reflects OAQDA's view that a two-year funding cycle gives principal faculty researchers more time, flexibility and potential for success in addressing their complex work.

The 10 projects approved in 2008 are consistent with the goals and objectives of OCDO's strategic plan. In addition, they are consistent with Governor Strickland's directive that we step-up efforts to boost production of Ohio coal, while employing state-of-the-art technology to do so in the most environmentally friendly manner possible. The projects are presented below, grouped according to subject matter:

Mercury Capture Project

- $159,804 to fund a **University of Cincinnati** project aimed at the development of a mercury sorbent for use at higher temperatures during coal combustion to capture elemental and oxidized mercury in a very small waste stream that can be easily disposed of in a secure landfill. A key goal of the project is to develop a sorbent that can reduce capture costs from U.S. Department of Energy estimates of $30,000 per pound to $1,000 per pound. University share: $51,755.

Geologic Sequestration Project

- $159,389 for a **Case Western Reserve University** project to assess chemical reactions between carbon dioxide (CO_2) and sulfur dioxide (SO_2) in Ohio's deep brine geologic formations. This project will consider whether SO_2 removal from the CO_2 gas stream is required for underground CO_2 sequestration. If not, the cost of sulfur capture by scrubbers would be eliminated. University share: $43,932.

Conversion of Coal to Power or Chemicals Projects

- $159,947 to fund a chemical looping combustion (CLC) project at **The Ohio State University**. CLC uses dual reactors to create pure streams of sequestration-ready CO_2 and hydrogen, which can be used in power production or as a reagent for chemical production. This project aims to enhance understanding of the rapid movement of oxygen during combustion, a key component of the CLC process. University share: $43,879.
- $159,996 to fund a second chemical looping project at **The Ohio State University.** This project involves the reaction of syn-gas (a mixture of carbon monoxide, CO_2, and hydrogen) and metal oxide composite particles. It differs from the first project in that the hydrogen produced is more ideal as a feedstock for a Fisher Tropsch reactor – a process used to produce a synthetic substitute for petroleum. University share: $43,884.

- $159,994 for a project at **The Ohio State University** aimed at developing electro-catalysts capable of reducing the temperature required to operate a solid oxide fuel cell (SOFC). SOFCs are highly efficient and produce low emissions. The greatest barrier to their use is the cost of materials required for operation at close to 1,000° C. This project seeks to develop catalysts that can reduce operating temperatures on the surface of the cathode layer of a SOFC by approximately 300°C. University share: $41,097.
- $159,994 for a related project at **The Ohio State University** intended to address issues with the anode layer of a solid oxide fuel cell. Under reduced temperatures, the anode can experience reduced resistance to sulfur poisoning and a loss of reactivity due to coking, or the accumulation of un-reacted carbon deposits on the surface. University share: $41,097
- $160,000 to fund a project at the **University of Cincinnati** to develop ceramic membranes that can separate oxygen from air in a more economical manner than is now possible. Oxygen, when used in oxy-fired pulverized coal power plants and in the "oxygen blow gasification" of coal, helps produce a sequestration-ready stream of CO_2. The current high cost of oxygen-from-air separation can be prohibitive for these applications. University share: $41,097.
- $160,000 for a second "oxygen-from-air" project at **The Ohio State University.** It differs from the project above in that it is not dependent on a sieving mechanism based on the molecular diameters and pore sizes of the membrane. In this case, the membrane is nearly free of pores, and separation occurs on the surface of the membrane. The two projects together present a well-balanced start in the investigation of this topic. University share: $50,310.
- $160,000 for a **University of Akron** project aimed at determining the design factors that would enable the scale-up of a direct coal fuel cell. Specific goals of the project include establishing the consistency of the coal fuel cell performance data, evaluating the material and energy balance, developing seals for the fuel cell and continuing to improve the mechanical strength of the overall fuel cell. This project is regarded as high-risk because of the challenges that must be overcome. If successful, however, it represents a concept that could change the world of power generation. Funding will be withheld if this summer's experiments do not go well. University share: $53,340.

Catalyst and Membrane Systems for Water Gas Shift of Syn-gas to Hydrogen

- $159,982 to fund a project at the **University of Cincinnati** aimed at building a reactor capable of achieving the water gas shift of raw syn-gas to hydrogen and CO_2 (water gas shift is a chemical reaction in which water and carbon monoxide react to form hydrogen and CO_2.). The work will conclude with a computer model that compares a comparably sized membrane reactor with the syn-gas reactor to determine the cost and commercial potential of the latter. University share: $49,865.

2008 OAQDA Projects

2008 OAQDA Projects

Month	Company	Amount	Program
February	The Ohio State University	$ 206,299	OCDO
March	Duke Energy Ohio, Inc.	$ 234,000,000	Financing
	Duke Energy Ohio, Inc.	$ 109,300,000	Financing
April	FirstEnergy Nuclear Generation Corp.	$ 26,000,000	Financing
	Dayton Power & Light Company Financing	$ 26,000,000	
May	JMG Funding Limited Partnership Financing	$ 218,000,000	
	The Ohio State University	$ 448,151	OCDO
June	FirstEnergy Generation Corp.	$ 241,260,000	Financing
July	Ohio Coal Research Consortium	$ 1,900,473	OCDO
August	Energy Industries of Ohio	$ 118,436	OCDO
	The Ohio State University	$ 398,406	OCDO
	US DOE-NETL	$ 250,000	OCDO
	FirstEnergy Generation Corp.	$ 210,000,000	Financing
September	The Ohio State University	$ 300,000	OCDO
October	Ohio Power Company	$ 85,000,000	Financing
	Ohio Valley Electric	$ 225,000,000	Financing
	LHS Family & Youth Services, Inc.	$ 625,000	Financing
December	Clean Fuels Ohio	$ 77,000	Financing
	TCB Properties Ltd.	$ 578,663.90	Financing

2008 Financial Statement

Ohio Air Quality Development Authority
Statement of Net Assests
December 31, 2008

	Government Activity	Business-Type Activity	Total
ASSETS			
Cash and cash equivalents	$ 2,422,009	$ 8,990,721	$ 11,412,730
Receivables:			
• Accounts	—	612,688	612,688
• Intergovernmental	249,382	—	249,382
Internal balances	(246,977)	246,977	—
Prepaid items	3,494	3,467	6,961
Capital assets, net of accumulated depreciation	_	27,250	27,250
Total Assets	**2,427,908**	**9,881,103**	**12,309,011**
LIABILITIES			
Accounts payable	18,511	13,377	31,888
Grants payable	13,069	—	13,069
Accrued wages and benefits	6,929	20,292	27,221
Total Liabilities	**38,509**	**33,669**	**72,178**
NET ASSETS			
Invested in capital assets	—	27,250	27,250
Restricted for:			
• Coal research and development programs	2,389,399	—	2,389,399
Unrestricted	—	9,820,184	9,820,184
Total Net Assets	**$ 2,389,399**	**$ 9,847,434**	**$ 12,236,833**

Contact the Ohio Air Quality Development Authority for notes to the basic financial statements.

Ohio Air Quality Development Authority
Statement of Activities
For the year ending December 31, 2008

	Program Revenues			Net (Expense) Revenue and Changes in Net Assets		
	Expenses	Charges for Services	Operating Grants	Governmental Activity	Business-Type Activity	Total
GOVERNMENTAL ACTIVITY						
Community and economic development	$ 5,363,139	$ —	$ 690,169	$ (4,672,970)		$ (4,672,970)
BUSINESS-TYPE ACTIVITY						
Air quality development	$ 811,934	1,425,976	521,415		1,135,457	1,135,457
Energy Strategy development	$ 268,340	—	231,000		(37,340)	(37,340)
Total business-type activities	$1,080,274	1,425,976	752,415		1,098,117	1,098,117
Total	**$6,443,413**	**1,425,976**	**1,442,584**	**(4,672,970)**	**1,098,117**	**(3,574,853)**
General Revenues:						
• Investment earnings				131,307	58,340	189,647
• Miscellaneous				2,550	6,022	8,572
Total general revenues				133,857	64,362	198,219
Changes in net assets				(4,539,113)	1,162,479	(3,376,634)
Net assets at beginning of year – Restated				6,928,512	8,684,955	15,613,467
Net assets at end of year				$ 2,389,399	$ 9,847,434	$ 12,2367,833

Contact the Ohio Air Quality Development Authority for notes to the basic financial statements.

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