



## New Jobs–Cleaner Air Part II: An investment in American Businesses and American Jobs

Stories from the Air Pollution Control Supply Chain



A Ceres Report

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Prepared in collaboration with



## Foreword

In February 2011, Ceres issued a study demonstrating how new air pollution rules proposed for the electric power sector by the Environmental Protection Agency (EPA) will provide long-term economic benefits across much of the United States in the form of highly skilled, well-paying jobs created through infrastructure investment in the nation's fleet of power plants.

The analysis, prepared by the Political Economic Research Institute (PERI) based at the University of Massachusetts at Amherst, estimated that investments driven by EPA's two new air quality rules will create nearly 1.5 million jobs, or nearly 300,000 jobs per year on average over the next five years.

Meeting new standards that limit sulfur dioxide, nitrogen oxides, mercury and other pollutants will create, as stated in the report, "a wide array of skilled construction and professional jobs" – from the electricians, plumbers, laborers and engineers who will build and retrofit power plants, to operations and maintenance (O&M) employees who will keep the modernized facilities running.

Others have similarly concluded that EPA rules will have a net positive effect on our nation's workforce. The Economic Policy Institute (EPI), for example, prepared an analysis focusing specifically on EPA's proposed "mercury and air toxics rule". EPI concluded that the toxics rule will lead to jobs being created around the country, and at the same time will produce significant health and environmental benefits.

This report supplements these broad economic studies by highlighting specific case examples of the companies involved in building a modern generating fleet. It breaks the supply chain into its component pieces and shows the vital role that American workers play in installing and maintaining sophisticated emission control systems.

The pollution control industry in the United States is served by an extensive supply chain. Companies located throughout the country provide engineering, design, construction, and maintenance services, and manufacture the many different parts and components needed in air pollution control systems.

Reducing emissions from our most polluting power plants is an integral step toward America's clean energy future, along with the efficient and responsible use of conventional energy, and greater reliance on renewable sources like wind and solar. In highlighting these case studies, we hope to "put a face" to the individuals and companies that can help transform existing assets into part of a cleaner and more efficient electric power system.

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## Executive Summary<sup>1</sup>

As Congress continues to debate influential legislation about the Environmental Protection Agency's (EPA's) proposed utility-sector air quality regulations, a parallel debate continues about America's unemployment problem. President Obama and Congress have placed job creation at the center of their domestic policy agenda, and the questions resonate from rural America to Capitol Hill:

- What are the right policies to stimulate the U.S. economy, spur investment, and give companies the "regulatory certainty" they are looking for?
- What are the wrong policies that will stifle investment and give companies the incentive to reduce the size of their workforces?
- And how can we tell the difference?

The primary public health threats identified from the country's electric sector come from coal-fired power plants that would be regulated under EPA rules. Over one-half of the nearly 300 gigawatts (GW) of coal-fired power plants in the U.S. already have advanced controls for sulfur dioxide emissions, but many other plants are left uncontrolled and allowed to emit damaging pollutants and toxic substances into the air.

"Once you begin to put capital ...to work, jobs are created."

– Michael Morris, president and CEO,  
American Electric Power Company

Regulations would fix this by setting new standards to require wider use of air pollution control (APC) devices and techniques. Estimates have projected that the total amount of investment needed to comply with the new rules is around \$94 billion.<sup>2</sup> This investment would flow directly to American companies, creating the construction and manufacturing jobs that our economy needs.

Unprecedented amounts of capital sit on the sidelines in the American economy. This has been cited as one reason why the unemployment rate remains so high: with uncertainty in the business climate and the economic outlook, corporate investment is scarce. America's electric power generators are no exception. Cash on their balance sheets is at historic levels, ready to be invested.

A robust American supply chain stands ready to deliver. It includes companies from small businesses up to multi-national corporations: businesses with the proven, specialized expertise to meet the electric sector's need for state-of-the-art APC equipment. It includes the companies that quarry limestone for lime injection systems, the steelmakers and concrete pourers, and the software engineers who design sophisticated monitoring and control systems to keep plants functioning at peak efficiency.

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<sup>1</sup> Information for this report was collected and compiled through interviews with company representatives, company financial filings, company websites, and public news articles. Some company data were drawn from Hoovers.

<sup>2</sup> "New Jobs – Cleaner Air Employment Effects Under Planned Changes to the EPA's Air Pollution Rules," Ceres Report, February 2011.

Construction activity has slowed down along with the economy, but construction projects at our nation's power plants can modernize our nation's electric generating fleet, clean up our air, and spark much-needed investment in just what America needs now: jobs. Research from the Bureau of Labor Statistics has shown that one million dollars' worth of investment in a

During peak construction, Alabama Power's \$1.7 billion scrubber initiative was responsible for creating more than 2,300 jobs. "This investment is not only good for the environment, it's also good for Alabama's economy."

- Charles McCrary, Alabama Power  
president and CEO

construction project leads directly and indirectly to 11 new jobs. For a coal power plant requiring \$200 million worth of APC equipment, this equates to 2,200 jobs. This addition to the workforce would have ripple effects when people spend their wages. Multiply this by dozens of projects around the country, and soon an investment in air quality becomes a truly meaningful step toward economic recovery and growth.

New regulations will – by design – create incentives for companies to rationalize their asset base by retiring existing generating plants that are beyond their useful life. Any capacity taken offline will be replaced by generation from

other nearby plants along with output from new plants that may be constructed. Newer plants have the added advantage of incorporating today's most efficient technologies, which will help reduce greenhouse gas emissions from the electric sector.

In addition to leading the retrofit of our existing plants, many of the firms described in this report would also play a role in new power plant construction – designing advanced turbine blades, pouring the foundations for new generator halls, and erecting the ductwork and transmission infrastructure. Currently 18 GW of natural gas-fired generating capacity is planned for construction in the U.S. from Mississippi to Colorado, and California to New York. These projects will soon materialize from blueprints into buildings at the hands of thousands of workers.

In the pages that follow, we will show how this investment is already having a positive impact on the quality of our electric generating infrastructure by modernizing our nation's fleet of power plants – and putting people to work in the process, up and down the supply chain.

## What is the Supply Chain?

The supply chain for air pollution control comprises the companies that design, build, and maintain the pre- and post-combustion equipment and systems that reduce harmful emissions from power plants. Figure 1 shows where the equipment would be found. For control of nitrogen oxides, **separated over-fire air (SOFA)** systems and **low NO<sub>x</sub> burners** may be used during coal combustion (1). Following combustion, the resulting emissions need to be conveyed through **ductwork**; fans, wiring, ducts, and duct coatings play an important role here (2).

Further removal of sulfur dioxide, nitrogen oxides, and toxic pollutants is taken care of by an **injection system** (3) that is designed to apply a reagent to the flue gas. Common types of injection systems include: **selective catalytic reduction (SCR)**, **flue gas desulfurization (FGD)**, **activated carbon injection (ACI)**, and **dry sorbent injection (DSI)**. This is a technology- and equipment-intensive process, requiring mixers, conveyors, storage tanks, and spray nozzles. Whenever the injection system is operating, **reagents** such as trona and ammonia need to be present. The chemical reactions that take place lead to the formation of solid particles. Some of these can be removed by gravity, while others need to be filtered out of the flue gas using particulate controls (4), often consisting of **fabric filters** and fans. Finally, the cleaned flue gas is **monitored** (5) and vented to the atmosphere.

Most companies in the supply chain perform multiple **services** (6), from designing and drawing up engineering plans, to fabrication, installation, operation, and maintenance of components and systems. Numerous local companies often perform demolition and site work and facilitate the integration systems into an existing plant.



Figure 1: Segments of the Supply Chain

## Mapping the Impact – Measuring the Potential

Constructing power plants and APC systems takes resources, equipment, and expertise from around the country. From demolition to re-commissioning, a single construction project could involve companies from a neighboring town working alongside teams from across the country. Each project is unique, but plant owners tend to source parts, equipment, and materials from nearby locations to minimize the costs of shipping heavy cargo. Services, meanwhile, may come from farther afield, especially if a project requires specialized skills or knowledge. Figure 2 shows how supply chain firms are often located in relation to a given project.

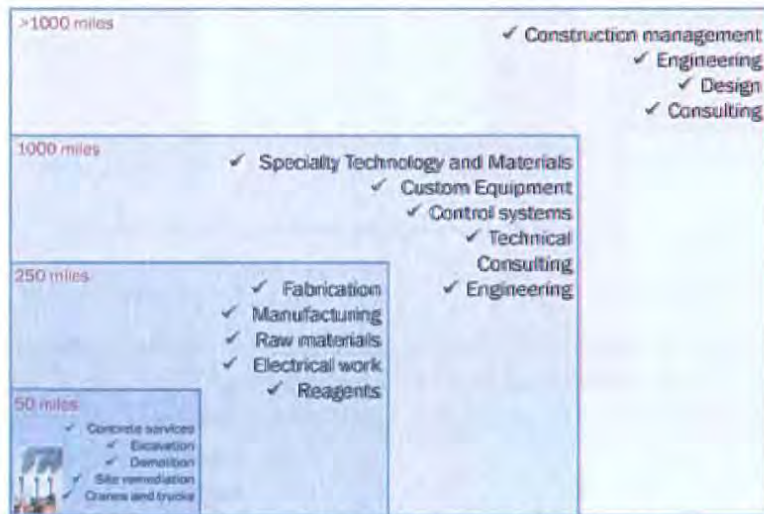


Figure 2: Regions of impact for a typical power plant construction project.

The presence of firms in the supply chain maps to the location of their customers as well as the availability of key inputs of natural resources and skilled workers. But one thing is clear: American businesses across the country provide the products, expertise, and services necessary to update our fleet of older coal-fired power plants. These businesses provide engineering design, construction, and maintenance services, and manufacture the many different types of equipment needed in APC systems. Figure 3 shows the locations of major operations for 175 supply chain companies that were identified for this report.



Figure 3: U.S. locations of key supply chain companies.

Supply chain companies provide products and services from the early stages of design through installation to ongoing monitoring and maintenance. Figure 4 shows how these functions are clustered in certain U.S. states. The economic benefits of APC industry growth are likely to be strongest in these states.

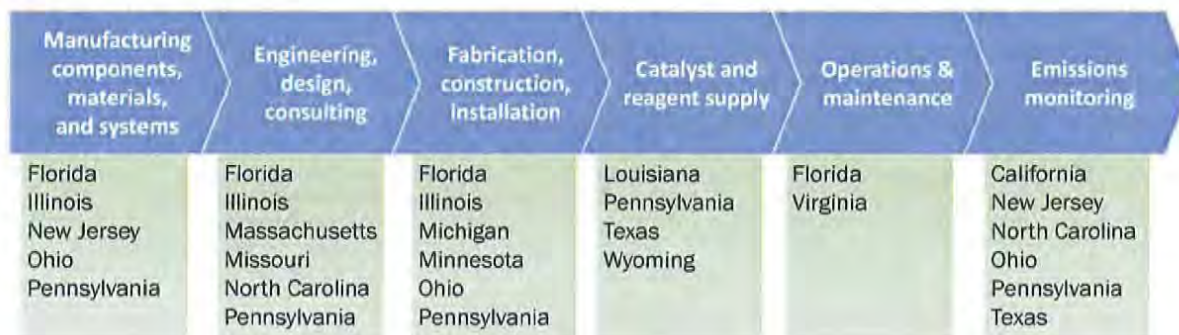


Figure 4: Supply chain functions and their presence in selected U.S. states.

The means to fund investments in APC projects will come from different sources, depending on the financing strategy and regulatory status of the plant owner. Some plant owners will pass through the costs of construction to ratepayers, while others will cover them using capital

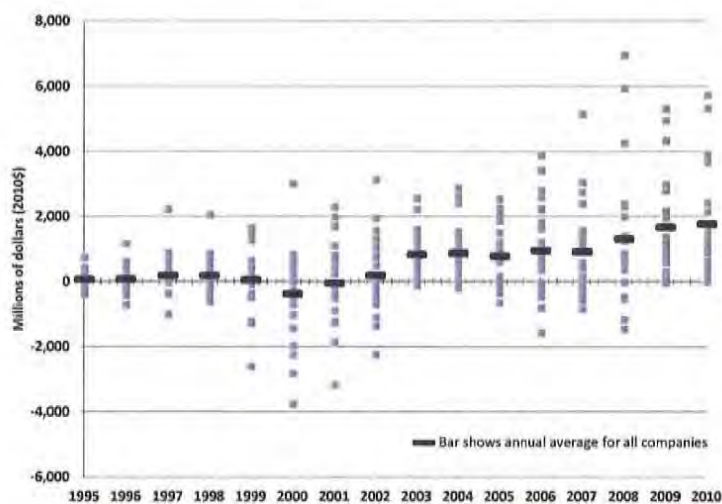


Figure 5: Year-end cash reserves for top 20 U.S. electric generators, 1995-2010. (Source: Company financials)

reserves. In both cases, air regulations provide a catalyst for getting new investment flowing in the economy – far beyond the amount that is happening today. As shown in Figure 5, total cash reserves on the balance sheets of the top 20 electric generators in the U.S. topped \$35 billion in 2010 – the highest level ever – with an average of nearly \$2 billion per company. This cash is collected through company profits, and companies have chosen to hold on to it, rather than reinvest it in hiring people to build new infrastructure or improve operational efficiency.

As we will see in the following pages, air quality regulations have already done much to reverse this pattern and get investment flowing back into the economy.



## Project Spotlight: Merrimack Station Wet Scrubber

Public Service Company of New Hampshire (PSNH) is nearly finished installing a wet scrubber at their 460 megawatt (MW) Merrimack Station coal-fired power plant in Bow, New Hampshire. The completed emission control equipment will cut nearly all emissions of sulfur dioxide and 80% of mercury emissions, significantly improving air quality in the Northeast.

PSNH obtained regulatory approval to invest **\$457 million** in the scrubber project, which is providing **300 on-site construction jobs** for the three-year construction period – in addition to hundreds of other jobs further upstream in the supply chain.

The project includes construction of a 450-foot-tall emission stack, which is a large concrete structure with a metal flue lining. The base and the walls of the stack (shown in the photograph) required approximately 10,000 tons of concrete – over 500 trucks' worth.



Companies involved in constructing the new stack have included:

- Aggregate Industries (Saugus, MA): A global company that provides aggregate, asphalt, and ready-mixed concrete
- Independent Concrete Pumping (Wakefield, MA): A local company that provides concrete pumping services
- Hallamore Corporation (Holbrook, MA), a local company that provides hauling and crane rental services

The project is being managed by URS Corporation of San Francisco, California. Siemens provided the equipment for the FGD system, and the project required the services and expertise of numerous other American businesses.

## Project Spotlight: Dunkirk-Huntley Injection System

NRG Energy recently installed an innovative injection system to cut emissions at its Dunkirk and Huntley plants in upstate New York. The coal-fired plants have a combined generating capacity of 910 MW.

The system combines two newer technologies for pollutant reduction: dry sorbent injection (DSI) and activated carbon injection (ACI) to remove sulfur dioxide, mercury, nitrogen oxide, and particulate matter from flue gases.

- Pinto Construction Services (Buffalo, NY), a local company, installed the underground utilities and performed excavation and backfill for the foundations needed by the new equipment. They also graded the site and performed re-vegetation on the property.

- AECOM (New York City) served as project and construction manager for the **\$275 million** project, managing design, procurement, and installation. AECOM is a global engineering firm that serves multiple sectors with a focus on transportation, energy, and water infrastructure.
- Clyde Bergemann EEC (Hanover, MD) provided additional engineering and fabricating work for equipment and supporting systems, including modifications to ductwork, wiring, and insulation. CBEEC was recently formed when Clyde Bergemann, a multi-national engineering services firm, acquired Environmental Elements Corporation. The company designs and supplies large-scale air pollution control system.
- The trona substrate for the injection system is produced by Solvay Chemicals in Green River, Wyoming, which mines the world's largest trona deposit. Trona is a naturally-occurring mineral used in a variety of industrial applications, including glass manufacturing. It is being used increasingly in injection systems for acid gas removal because the equipment costs are lower than those of the more familiar alternative, a wet scrubber, or flue gas desulfurization (FGD) system.



### **Project Spotlight: Brunner Island Wet Scrubber**

PPL's Brunner Island Power Station, located in York Haven, PA, began constructing a new FGD system on units 1, 2 and 3 (a total of 1,540 MW) in 2007. The scrubber is able to remove up to 97 percent of the sulfur dioxide emissions from the plant's flue gas. The total project investment was **\$800 million**, which directly and indirectly created employment opportunities for thousands of people over the three years it took to complete the project, and added **30 permanent jobs** at the plant to operate the scrubber.



The two companies with the largest hand in the project were The Shaw Group (a global company with offices in Pennsylvania) and Siemens Environmental Systems & Services (a division of Siemens headquartered in Pittsburgh, Pennsylvania). Shaw handled the engineering, procurement, and construction of the project, while the FGD equipment itself was designed by Siemens.

Other companies involved in carrying out the project included:

- APi Construction (New Brighton, MN) installed the insulation for the FGD ductwork
- Brayman Construction Corporation (Saxonburg, PA) constructed cofferdams to allow the limestone holding structures to be built in a dry environment.
- Degremont Technologies (a global company) provided the FGD wastewater treatment system
- FMC Technologies (Houston, TX) designed, supplied, and installed the limestone and gypsum handling systems
- Grout Systems Inc. (Wadsworth, OH) constructed the auger piles, a component of the FGD structure's foundation
- McCarl's, Inc. (Beaver Falls, PA) served as the mechanical system contractor
- M.J. Electric (Iron Mountain, MI), which installed the electrical systems necessary for the project
- Stebbins Engineering (Watertown, NY) manufactured the absorber vessel shell, an FGD system component
- Sterling Boiler & Mechanical (Evansville, IN) provided mechanical installation services
- 3L&T (Mountain View, CA) supplied the corrosion-protective coating for the FGD ducts

### **Project Spotlight: Allen S. King Air Quality Control System (AQCS) and Selective Catalytic Reduction (SCR)**

As part of its Metropolitan Emissions Reduction Project in the state of Minnesota, Xcel Energy constructed multiple emissions controls at its 620 MW Allen S. King plant between 2003 and 2007. The project involved extensive modernization work at the plant including boiler overhauls, construction of an SCR, and a combination spray dryer/fabric filter system for reducing particulates and SO<sub>2</sub>.

The investments at the King plant totaled **\$380 million**, and once completed, reduced SO<sub>2</sub> emissions by 91 percent, NO<sub>x</sub> emissions by 89 percent, and particulate and mercury emissions by 20 percent each.

Key players in the multi-pollutant reduction effort included:

- Alstom Environmental Controls (a global company) provided the dry scrubber and baghouse systems
- AMEC (a global company with offices in Minneapolis, MN) performed additional detail engineering for the AQCS
- Babcock & Wilcox (Charlotte, NC) performed boiler rehabilitation services
- Black & Veatch (Overland Park, KS), which performed the engineering and design of the emissions control equipment
- Danny's Construction Co., Inc. (Shakopee, MN) performed steel construction services
- Emerson Process Management (a global company) provided the distributed control system for the AQCS



- Graycor Inc. (Oakbrook Terrace, IL) performed the installation of the equipment and supporting structures
- Mitsubishi (a global company with offices in Washington, D.C.) supplied the SCR system
- Harris Mechanical (St. Paul, MN) installed the process piping for the AQCS and SCR systems

### Company Spotlight: M.J. Electric, LLC

Michigan-based M.J. Electric has evolved from a small electrical services company to a national engineering firm over the course of its 87-year history. It provides construction services, process controls, project management, and storm recovery assistance to electric utilities, power companies, and other industrial customers.

The company works on all aspects of building and maintaining electric infrastructure, from substations to transmission lines. Increasingly their work is extending to wind farm construction and interconnections. M.J. Electric serves as a prime contractor for the electrical work in new power plant construction, which includes installation and retrofits of APC systems. Their project list spans the United States and includes scrubbers, baghouses, cooling towers, and air blowers, as well as



boiler, turbine, and generator buildings.

“Through these projects, we have not only offered continued permanent employment to hundreds of Illinoisans, but we have also provided jobs to contract employees who call Illinois home. Clearly these projects have had a positive impact on the economies of central and southern Illinois – areas hard-hit by tough economic conditions.”

*-Chuck Naslund, Ameren Energy Resources president, CEO, and chairman*

M.J. Electric has \$300 million in revenues and nine offices around the country. They have recently completed electric power plant projects in New Mexico, Ohio, Utah, Pennsylvania, and Kansas, in addition to other states. They are owned by Houston-based Quanta Services, which provides infrastructure contracting services for natural gas and oil, telecommunications, and heavy industrial companies, in addition to the electric power sector. Quanta Services employs 13,700 people, including both salaried and hourly workers.

Air regulations to spur investment in new pollution control infrastructure and generating capacity would benefit M.J. Electric directly by creating demand for their electrical construction services. Their workforce would play an important role in helping power plant owners carry out retrofits, improve efficiency by upgrading their process management systems, and build new generating capacity.

### **Company Spotlight: United Conveyor Corporation**

United Conveyor Corporation (UCC) is a specialized designer and manufacturer of material handling systems for the electric power industry. The company has a 90-year track record in the business and has grown from providing coal transport systems to a wide array of handling systems.

UCC performs its own steel fabrication so as to have greater control over the performance of its final products. The company is based in Illinois and also has manufacturing operations in Indiana and Colorado, with sales offices in other states and around the world. It distributes equipment around the U.S. through 15 regional partners. UCC's U.S. workforce is roughly 300 people.

Materials handling systems have historically been used for coal transport and management of fly ash and bottom ash, which are airborne waste byproducts of coal combustion. Waste products are collected and either sent back for secondary combustion, or recycled. The advent of injection systems for reducing air emissions has increased the need for materials handling. Dry sorbent injection (DSI) and flue gas desulfurization (FGD) systems require reagents to be stored and fed into the combustion process. UCC provides conveyors for such systems, in addition to crushers, mixers, pipes and fittings, gates and valves, separating equipment, and tanks.

UCC has been moving to capitalize on growing demand for DSI technology, which has significant cost advantages over FGD systems. DSI removes SO<sub>x</sub>, mercury, and acid gases, which would be controlled under the Cross-State Air Pollution Rule and the Mercury and Air Toxics Rule. UCC announced recently that they had completed 25,000 hours of system testing on a DSI system specifically designed for simultaneous removal of SO<sub>2</sub>, HCl, and mercury. The passage of these rules would create new market opportunities for UCC by driving demand for materials handling systems.

"The \$600 million project will create 900 jobs and be one of the largest construction projects in Michigan over the next few years."

*- DTE Energy press release regarding construction of two new scrubbers at its Monroe plant, units 1 and 2.*

### **Company Spotlight: Midwesco Filter Resources, Inc.**

Headquartered in Winchester, VA, Midwesco Filter Resources manufactures filters for a range of industrial and OEM applications, from asphalt to food products. Their filters are designed to remove contaminants during processing and treat waste products, including air emissions. Midwesco's utility and industrial boiler line of business provides baghouses, which are large fabric filters that capture particulate matter from flue gas. Emissions from a boiler are blown into a baghouse where heavy metals and particles accumulate in a series of long cylinders. This is an important step in controlling soot and capturing the airborne byproducts that result from injection systems such as DSI and ACI.

Electric generating plant owners aim to minimize operating costs of baghouses by installing durable filters that are easy to service. In addition to providing the filters themselves, Midwesco provides maintenance and diagnostic services to reduce corrosion, filter failure, and other risks.

Midwesco has manufacturing operations in Illinois, Virginia, Kentucky, and Oklahoma. The company is a subsidiary of publicly-traded MFRI, Inc., which provides piping and cooling equipment, in addition to filter products. MFRI had \$218 million of revenues in 2010 and employed roughly 1,500 people.

Tighter air rules would boost demand for Midwesco's products and services since baghouses are an essential part of the equipment that removes SO<sub>x</sub>, NO<sub>x</sub>, heavy metals, and toxins from a plant's flue gas.

## **Conclusion**

From coast to coast, investments aimed at improving our nation's power plants are already benefiting hundreds of supply chain companies and creating employment opportunities for tens of thousands of skilled Americans. From patents to production, the supply chain for air pollution control equipment has the capacity to modernize aging infrastructure and cut air emissions.

Regulations to control toxic air releases, as well as sulfur dioxide and nitrogen oxides, will do more than just reduce the public health costs of our electricity generation. They will create a strong incentive for companies to move money from the sidelines into the economy, channeling capital to construction projects and boosting demand for workers.

As the record has shown, the diverse APC supply chain touches every corner of the nation. For every one of the companies featured in this report, dozens of others are poised to step in and lead America's transition to a cleaner electric sector and its return to full employment and strong economic health.

## Exhibit 1: Representative List of APC Supply Chain Companies

Company	Main Location	APC Products and Services	Primary Industry Function
ACDC Inc.	OH	Dampers for scrubbers and SCR	Component, materials, and/or system manufacture
ADA Environmental Solutions	CO	ACI, DSI	Component, materials, and/or system manufacture
Advanced Polymer Coatings, Inc.	OH	Scrubber coatings	Component, materials, and/or system manufacture
Air Control Techniques, PC	NC	APC optimization and testing	Engineering, design, consulting
Air Liquide America Specialty Gases	TX	Specialty gases	Emissions monitoring
Airgas, Inc.	PA	Specialty gases	Emissions monitoring
AirTek, Inc.	AL	ESPs	Fabrication, construction, and installation
Albemarle	LA	Activated carbon	Catalyst and reagent suppliers
Alden	MA	Air flow modeling for SCRs and ESPs	Engineering, design, consulting
Altech Environment USA	IL	Emission monitoring systems	Emissions monitoring
AMEC	DC	SCR, FGD, baghouse	Engineering, design, consulting
American Pipe Supports	GA	Piping for SCR and FGD	Component, materials, and/or system manufacture
Ametek Process Instruments	PA	Emission monitoring systems	Emissions monitoring
Andover Technology Partners	MA	Technology consulting	Engineering, design, consulting
APC Technologies Inc.	PA	Activated carbon and dry sorbent injection systems	Engineering, design, consulting
Apex Instruments	NC	Emission monitoring and analysis	Emissions monitoring
API Construction Company	MN	Insulation and lagging for APC equipment	Fabrication, construction, and installation
Astralloy Steel Products	AL	Steel for baghouses	Component, materials, and/or system manufacture
Austin White Lime	TX	Lime	Catalyst and reagent suppliers
Avogadro Environmental Corporation	PA	Emission monitoring systems	Emissions monitoring
AZCO Inc.	WI	Piping and ductwork for SCR and FGD	Fabrication, construction, and installation
B3 Systems	NC	Emission monitoring and analysis	Emissions monitoring
Babcock + Wilcox	NC	Multi-pollutant controls	Fabrication, construction, and installation
Babcock Power Inc.	MA	Multi-pollutant controls	Fabrication, construction, and installation
Bachmann Industries	ME	Components for FGD and SCR	Component, materials, and/or system manufacture
BACT Process Systems Inc.	IL	Scrubbers and baghouses	Fabrication, construction, and installation
Baldwin Environmental, Inc.	NV	Emissions monitoring and analysis	Emissions monitoring
Barton Malow	MI	Multi-pollutant controls	Fabrication, construction, and installation
BASF Corporation	LA	SCR catalyst	Catalyst and reagent suppliers
Bedford Technologies Inc	VA	ESP services	Operations & maintenance
Belco Technologies Corporation	NJ	Scrubbers, ESPs, SCRs	Component, materials, and/or system manufacture
BENTLEY OFFICES	PA	Software systems for FGD operations	Engineering, design, consulting
BETE	MA	Spraying nozzles for FGD	Component, materials, and/or system manufacture
Black & Veatch	FL	Consulting for AQCS projects and compliance	Engineering, design, consulting
BoldEco Environment	NJ	Fabric filters	Engineering, design, consulting
Branch Environmental Corporation	NJ	SCR	Component, materials, and/or system manufacture
Brown Electric	WV	Scrubbers, mercury CEMs	Fabrication, construction, and installation
Burns & McDonnell	MO	Consulting for compliance and AQCS	Engineering, design, consulting
Calgon Carbon Corporation	PA	Activated carbon	Catalyst and reagent suppliers
California Analytical Instruments	CA	Emissions monitoring and analysis	Emissions monitoring
Carmeuse North America	PA	Lime	Catalyst and reagent suppliers
Casey Industrial, Inc.	CO	Steel, construction services	Fabrication, construction, and installation
CECO Environmental	OH	Scrubbers, ESPs, SCRs	Component, materials, and/or system manufacture
CEM Service Group, Inc.	PA	Emission monitoring systems	Emissions monitoring
Cemtek Environmental	NJ	Emission monitoring systems	Emissions monitoring

Company	Main Location	APC Products and Services	Primary Industry Function
Certified Constructors Services Inc	FL	Precipitator and SCR services	Fabrication, construction, and installation
Chemco Systems, LP	PA	SCR, limestone grinding and ash systems	Component, materials, and/or system manufacture
Cherne Contracting Corporation	MN	Scrubbers, baghouses	Fabrication, construction, and installation
Church and Dwight Company, Inc.	NJ	Sodium bicarbonate for DSI	Catalyst and reagent suppliers
CMC Solutions Inc	MI	Emission monitoring systems	Emissions monitoring
Combustion Components Associates	CT	Low-NOx burners, ROFA, SCR, SNCR	Component, materials, and/or system manufacture
Composites USA	MD	Lining for scrubbers	Component, materials, and/or system manufacture
Conley Corporation	OK	FRP piping for FGD	Component, materials, and/or system manufacture
Control Analytics, Inc.	PA	Emission monitoring systems	Emissions monitoring
Cormetech Inc.	NC	SCR catalyst	Catalyst and reagent suppliers
Corning, Incorporated	NY	Substrates for APC systems	Catalyst and reagent suppliers
CRI Catalyst Company	TX	Catalysts for reducing NOx and air toxics	Catalyst and reagent suppliers
Custom Instrumentation Services Corporation	CO	Emissions monitoring systems	Emissions monitoring
Custom Stack Analysis	OH	Emission monitoring and analysis	Emissions monitoring
Dekoron/Unitherm, Inc.	FL	Tubing for CEMs	Component, materials, and/or system manufacture
Dixie-Southern	FL	Steel fabrication	Fabrication, construction, and installation
Ducon	MO	Multi-pollutant controls	Fabrication, construction, and installation
Duromar	MA	Linings and coatings for FGD	Component, materials, and/or system manufacture
Dustex	GA	Fabric filters, DSI systems, mechanical collectors/cyclones	Component, materials, and/or system manufacture
ECOM America Ltd.	GA	Emission monitoring systems	Emissions monitoring
Effox-Flextor	OH	SCR, scrubbers, ESP, baghouse components	Component, materials, and/or system manufacture
Enerfab, Inc.	OH	Multi-pollutant controls	Fabrication, construction, and installation
Environmental Systems Corporation	TX	Emissions monitoring systems	Emissions monitoring
EPSCO International	MA	ESP + FF consulting services	Engineering, design, consulting
ETSI Inc.	VA	Baghouse services	Operations & maintenance
EvenAire Systems, Inc.	MN	Scrubber	Fabrication, construction, and installation
Evonik Energy Services LLC	NC	Design, engineering for scrubbers, SCR	Engineering, design, consulting
Exothermic Engineering Corporation	MO	Design and engineering for NOx reduction	Engineering, design, consulting
FLSmith	PA	Injection systems, SCR, baghouses, scrubbers	Engineering, design, consulting
FMC Corporation	PA	Trona and other sorbents	Catalyst and reagent suppliers
Foster Wheeler	NJ	SCRs, low-NOx burners	Fabrication, construction, and installation
Fox Equipment	FL	SCR and FGD components	Component, materials, and/or system manufacture
Fuel Tech, Inc.	IL	Low-NOx burners, ROFA, SCR, SNCR	Component, materials, and/or system manufacture
Graycor Industrial	IL	FGD, ACI, SCR	Fabrication, construction, and installation
Graymont Ltd	PA	Lime	Catalyst and reagent suppliers
Greer Lime	WV	Lime	Catalyst and reagent suppliers
Hadek Protective Systems	PA	Linings and coatings for FGD	Component, materials, and/or system manufacture
Haldor Topsoe, Inc.	TX	Catalysts and processes for NOx removal	Catalyst and reagent suppliers
HDR, Inc.	NE	Engineering for emissions projects	Engineering, design, consulting
Hitachi Power Systems America, Ltd.	NJ	Multi-pollutant control systems	Component, materials, and/or system manufacture
Holz Rubber Company	CA	Pumps and conveyor products	Component, materials, and/or system manufacture
Horiba Instruments, Inc.	CA	Emission and process analyzers	Emissions monitoring
Independence Demolition	OH	Demolition and salvage	Fabrication, construction, and installation
Industrial Accessories Company	KS	FGD, DSI, baghouses	Component, materials, and/or system manufacture
Industrial Contractors, Inc.	ND	Scrubbers	Fabrication, construction, and installation
Integrated Flow Solutions	TX	SCR components	Component, materials, and/or system manufacture
Inter-Mountain Labs	WY	Emissions testing and monitoring	Emissions monitoring



Company	Main Location	APC Products and Services	Primary Industry Function
IRONHEAD Fabricating Inc	OH	Baghouses, precipitators, ductwork	Fabrication, construction, and installation
J Carpenter Environmental	MI	Activated carbon	Catalyst and reagent suppliers
Johnson Matthey	PA	SCR, catalysts	Engineering, design, consulting
Kiewit Power	KS	Multi-pollutant control systems	Fabrication, construction, and installation
L-Con Constructors Company	TX	SCR, FGD, baghouse	Fabrication, construction, and installation
Lechler, Inc.	IL	Spray nozzles for FGD	Component, materials, and/or system manufacture
Lhoist North America	VA	Lime and lime products	Catalyst and reagent suppliers
Linde Gas North America, LLC	NJ	Industrial gas supply	Emissions monitoring
Lutz, Daily & Brain, LLC	KS	AQCS engineering	Engineering, design, consulting
M.J. Electric	MI	Electric systems for FGD, ESP, SCR, baghouses	Fabrication, construction, and installation
Marsulex Environmental Technologies	PA	Multi-pollutant controls	Engineering, design, consulting
Martin Marietta Aggregates	NC	Limestone for FGD, magnesium for SCR	Catalyst and reagent suppliers
MC Industrial	MO	Multi-pollutant controls	Fabrication, construction, and installation
McGill AirClean	OH	ESPs, fabric filters	Component, materials, and/or system manufacture
MECS	MO	Wet scrubbers	Engineering, design, consulting
Merrick Environmental Technology	FL	Fabric filter + ESP	Engineering, design, consulting
Met-Pro Corporation	PA	Fabric filters	Component, materials, and/or system manufacture
Midwasco Filter Resources	VA	Baghouse components	Component, materials, and/or system manufacture
Mississippi Lime	MO	Lime	Catalyst and reagent suppliers
Mitsubishi Power Systems, Inc.	FL	SCR, turbines	Component, materials, and/or system manufacture
MKS Instruments	MA	Sensors and fittings	Emissions monitoring
Motor City Electric Co.	MI	Electric systems for ESPs	Fabrication, construction, and installation
MSI/Mechanical Systems Inc	WI	Emission monitoring systems	Emissions monitoring
Nalco Mobotec	PA	Sorbent injection, ROFA, SNCR	Engineering, design, consulting
Neumann Systems Group, Inc.	CO	Injection systems	Engineering, design, consulting
Neundorfer	OH	ESP, baghouses	Engineering, design, consulting
Nol-Tec Systems Inc.	MN	Dry sorbent injection	Component, materials, and/or system manufacture
NoNOx Components LLC	VA	SCR system components	Component, materials, and/or system manufacture
Norit Americas	TX	Activated carbon; injection systems	Catalyst and reagent suppliers
Northern Metal Fab, Inc.	WI	Steel and coatings	Fabrication, construction, and installation
Novinda Corp.	CO	Reagents for mercury control	Catalyst and reagent suppliers
NWL Transformers	NC	ESP power supplies and controls	Fabrication, construction, and installation
O'Brien & Gere	NY	Engineering and technical consulting	Engineering, design, consulting
OCI Wyoming, L.P.	WY	Soda ash	Catalyst and reagent suppliers
Parker Hannifin, Parflex Division	OH	SCR hoses	Component, materials, and/or system manufacture
Perma Pure	NJ	Emission monitoring systems	Emissions monitoring
Pete Lien & Sons	SD	Lime	Catalyst and reagent suppliers
Philadelphia Mixing Solutions	PA	Scrubber mixing systems	Component, materials, and/or system manufacture
Pocono Fabricators	PA	Linings and coatings for scrubbers	Fabrication, construction, and installation
Pollution Control Services, Inc.	FL	Technical services for ESPs	Operations & maintenance
Powerspan Corporation	NH	Multi pollutant control systems	Engineering, design, consulting
Prospect Steel Company	AR	Steel for baghouses, FGD	Component, materials, and/or system manufacture
Protective Coatings, Inc.	IN	Pipe coatings for FGD	Component, materials, and/or system manufacture
PSP Industries	MS	Steel fabrication	Fabrication, construction, and installation
RMB Consulting & Research, Inc.	NC	Air pollution control consulting	Engineering, design, consulting
Roberts & Schaefer	IL	Limestone + gypsum handling for FGD	Fabrication, construction, and installation
Rolled Alloys Inc.	MI	Alloys for FGD ductwork	Component, materials, and/or system manufacture
Sargent & Lundy, LLC	IL	SO <sub>2</sub> , PM, NO <sub>x</sub> , HAP control technologies	Engineering, design, consulting
SCRTech (CoaLogix)	NC	NO <sub>x</sub> catalyst	Catalyst and reagent suppliers
Shaw Group	LA	NO <sub>x</sub> and SO <sub>x</sub> control	Fabrication, construction, and installation
SICK MAHAIK	MN	Emission monitoring systems	Emissions monitoring

Company	Main Location	APC Products and Services	Primary Industry Function
Solvay and SOLVAir Solutions	TX	Dry sorbent injection	Catalyst and reagent suppliers
Southern Environmental	FL	ESP upgrades	Fabrication, construction, and installation
SPE-AMEREX	IL	DSI, fabric filters, spray dryer absorber	Fabrication, construction, and installation
Spectrum Systems	FL	Emission monitoring systems	Emissions monitoring
Spraying Systems Co	IL	Spray nozzles for FGD	Component, materials, and/or system manufacture
Stanley Consultants	IA	Engineering for pollution control projects	Engineering, design, consulting
St. George Steel	UT	Ductwork fabrication for FGD	Fabrication, construction, and installation
STI CEMS	AR	CEMS integrator and service provider	Emissions monitoring
Sud-Chemie Inc	MA	SCR catalyst	Catalyst and reagent suppliers
SWF Industrial	PA	Steel ductwork	Fabrication, construction, and installation
Tanner Industries Inc.	PA	Chemicals and systems for SCR	Catalyst and reagent suppliers
Teledyne Monitor Labs	PA	Emission monitoring systems	Emissions monitoring
Tempest Company	NE	Consulting for pollution control projects	Engineering, design, consulting
Testo, Inc.	NJ	Emission monitoring systems	Emissions monitoring
Thermon Manufacturing Co.	TX	Emission monitoring and heat tracing	Emissions monitoring
TIC Holdings, Inc.	CO	FGD, SCR, ESP	Fabrication, construction, and installation
Turner EnviroLogic	FL	SCR, CEMS, dampers and expansion joints	Component, materials, and/or system manufacture
Tyco Environmental Systems	OH	Particulate & air flow monitors	Emissions monitoring
Uhde Corporation	PA	Plant construction	Fabrication, construction, and installation
Ulticor Corrosion Control Inc	MI	FGD coatings	Component, materials, and/or system manufacture
United Conveyor Corp.	IL	DSI, lime handling for scrubbers	Fabrication, construction, and installation
United States Lime & Minerals	AR	Lime	Catalyst and reagent suppliers
Universal Analyzers, Inc.	NV	Emission monitoring systems	Emissions monitoring
URS Corporation	CA	FGD, Sodium Bisulphite injection systems (for SO <sub>3</sub> )	Fabrication, construction, and installation
VIM Technologies, Inc.	MD	Emission monitoring systems	Emissions monitoring
Viron International Corporation	TX	Dampers and louvers for scrubbers	Component, materials, and/or system manufacture
Wahlco Metroflex	ME	Ductwork and components for SCR and FGD	Component, materials, and/or system manufacture
Williamstown Fabricators	WV	Scrubbers	Fabrication, construction, and installation
WINBCO Tank Company	IA	Scrubbers	Component, materials, and/or system manufacture
WorleyParsons	IL	Multi pollutant control systems	Engineering, design, consulting
WPS Industries Group	LA	Environmental control fabrication	Fabrication, construction, and installation
Zachry Holdings Inc	TX	FGD, SCR, ESP, baghouses	Fabrication, construction, and installation

## Exhibit 2: Illinois State Profile for the APC Supply Chain

### *Company Spotlight:*

#### *The Roberts & Schaefer Company*

Headquartered in Chicago, Roberts & Schaefer specializes in the design, engineering, procurement and construction of bulk material handling and processing systems for the power and mining industries. Roberts & Schaefer employs project managers, engineers, construction managers and support staff, and has offices in the U.S. (Chicago, Salt Lake City and Pittsburgh), Australia, India, Indonesia, Poland, South Africa and Chile.

The company was founded in 1903 and provides systems that convey materials for electric power plants: coal, limestone, gypsum, bituminous waste, biomass and woodchips. A crucial piece of emission control equipment, the "wet scrubber," relies on equipment from Roberts and Schaefer to deliver, sort and mill limestone, which is injected into the emissions to remove sulfur dioxide, which causes acid rain, along with other pollutants. Roberts & Schaefer also designs systems to handle gypsum, a waste product from wet FGD technologies that is often recycled into wallboard or roadways.

The company's services would help power plant owners comply with air regulations in Illinois and many other states. Roberts & Schaefer expects this to boost their revenues and, in turn, the size of their workforce.

Illinois has 57 coal-fired electricity-generating units totaling 15.5 GW of capacity, or five percent of the U.S. total. Ninety-five percent of these units are expected to continue operating, but 75 percent lack controls for sulfur dioxide and acid gas emissions. Most of them will require **investment in pollution control retrofits** in order to comply with forthcoming rules including the Mercury and Air Toxics Rule and the Cross-State Air Pollution Rule.

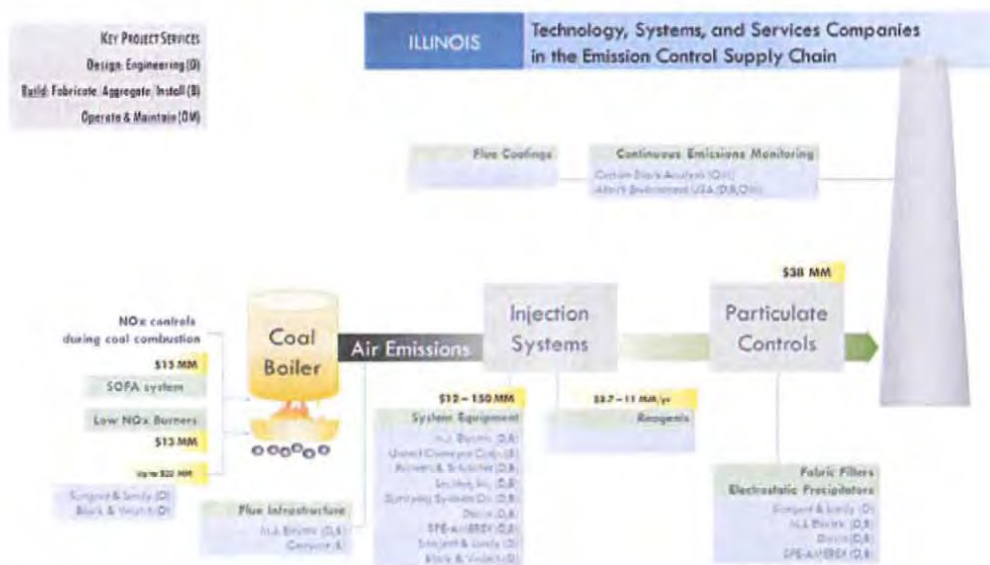
As a result, approximately **\$7.6 billion** will be invested in pollution control equipment by 2015 in Illinois to meet EPA's air quality standards, directly and indirectly creating over **65,600 jobs in the state**. Such a large investment requires the services and labor of numerous companies, from fabricators to engineers to technology providers. Construction of new generating capacity could create **an additional 57,000 jobs**.<sup>3</sup>

A small sample of Illinois' companies in the environmental equipment supply chain, listed below, have over **4,000 employees** and cover multiple industries. They have combined annual revenues of more than **\$3.6 billion** worldwide.<sup>4</sup>

<sup>3</sup> Data on existing units and pollution controls are calculated using data from the U.S. Energy Information Administration. Projections of investment and job creation are taken from the Ceres report *New Jobs – Cleaner Air: Employment Effects Under Planned Changes to the EPA's Air Pollution Rules*, February 2011.

<sup>4</sup> Company employment and revenue figures presented in the Exhibits are drawn from public sources. Due to lack of access to comprehensive company data, these estimates likely understate the actual numbers.

Figure 6: Companies in the Supply Chain in Illinois



NOTE: Names include representative set of companies with operations in Illinois. Cost figures are for a typical 300 MW coal plant and reflect capital costs or annual operating expenses.

Company Name	Industry	Illinois presence
Altech Environment USA	Emissions monitoring	Geneva (HQ)
Black & Veatch	Engineering consulting	Chicago, Burr Ridge (Branch)
Custom Stack Analysis	Emissions testing	Chicago (Branch)
Ducon	Engineering & construction	Palatine (Midwest HQ)
Fuel Tech, Inc.	Engineering & construction	Warrenville (HQ)
Graycor Industrial	Construction	Oakbrook Terrace (HQ)
Lechler, Inc.	Design & manufacturing	St. Charles (HQ)
Mellvaine Company	Consulting & software	Northfield (HQ)
M.J. Electric	Electrical systems	Glen Ellyn (Branch)
Roberts & Schaefer	Engineering & construction	Chicago (HQ)
Sargent & Lundy, LLC	Engineering & construction	Chicago (HQ)
SPE-AMEREX	Manufacturing	Batavia (HQ)
Spraying Systems Co	Component manufacturer	Wheaton (HQ)
United Conveyor Corp.	Construction	Waukegan (HQ)

### Exhibit 3: Massachusetts State Profile for the APC Supply Chain

*Company Spotlight:  
Alden Labs*

Alden Labs, located in Holden, MA, employs over 40 environmental engineers, scientists and technicians who provide engineering and technical services to optimize power plant emission systems. They apply fluid dynamic modeling techniques to flue gases, and use the results to design new pollution control systems and improve existing ones.

Alden Labs has experience with virtually every type of pollutant and system, including: wet and dry stacks; particle-reducing Electrostatic Precipitators and baghouses; selective catalytic reduction (SCR) systems for reducing nitrogen oxide emissions; flue gas desulfurization (FGD) systems for capturing sulfur dioxide; and mercury control systems.

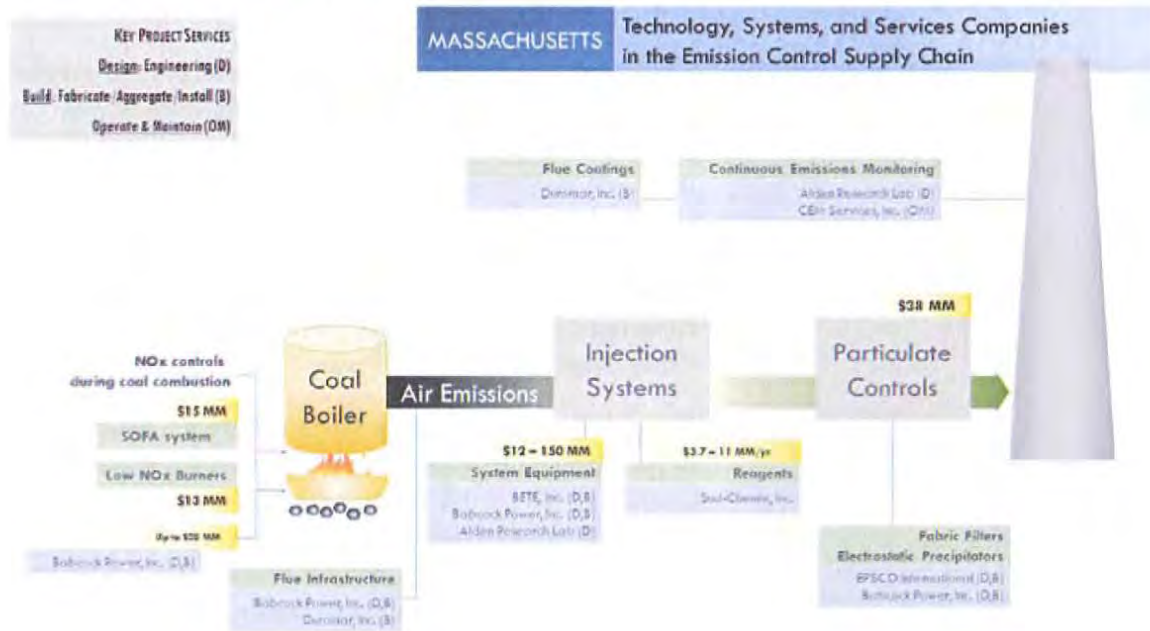
Alden believes that EPA regulations would enable them to invest in growing their Massachusetts-based workforce to meet the anticipated increase in workload that would result when electric power plants come under new emission limits under the EPA's Mercury and Air Toxics Rule and Cross-State Air Pollution Rule.

Massachusetts has seven coal-fired electricity generating units totaling 1.6 GW of capacity, or one-half of one percent of the U.S. total. Eighty-three percent of these units are expected to continue operating, but 29 percent lack controls for sulfur dioxide and acid gas emissions. Most of them will require **investment in pollution control retrofits** in order to comply with forthcoming rules including the Mercury and Air Toxics Rule and the Cross-State Air Pollution Rule.

As a result, approximately **\$504 million** will be invested in pollution control equipment by 2015 in Massachusetts to meet EPA's air quality standards, directly and indirectly creating over **3,600 jobs in the state**. Such a large investment requires the services and labor of numerous companies, from fabricators to engineers to technology providers. Construction of new generating capacity could create **an additional 5,800 jobs**.

A small sample of Massachusetts' companies in the environmental equipment supply chain, listed below, have over **700 employees** and cover multiple industries. They have combined annual revenues of more than **\$9.2 billion** worldwide.

Figure 7: Companies in the Supply Chain in Massachusetts



NOTE: Names include representative set of companies with operations in Massachusetts. Cost figures are for a typical 300 MW coal plant and reflect capital cost or annual operating expenses.

Company Name	Industry	Massachusetts presence
Alden Research Laboratory	Consulting & engineering	Holden (HQ)
Babcock Power Inc.	Design & fabrication	Danvers (HQ), Worcester
BETE	Component manufacturer	Greenfield (HQ)
Duomar	Component manufacturer	Pembroke (HQ)
EPSCO International	Consulting & engineering	Carlisle (HQ)
Shaw Group	Engineering & construction	Cambridge, Randolph, Stoughton, Weymouth (branches)
Sud-Chemie Prototech	Catalyst supply	Needham (division HQ)

## Exhibit 4: Michigan State Profile for the APC Supply Chain

### *Company Spotlight:*

#### *M.J. Electric*

M.J. Electric is a subsidiary of Houston-based Quanta Services. With origins in a Michigan-based company founded in 1924, M.J. Electric provides construction and instrumentation services to the electric power and industrial sectors.

Their project list spans the United States and includes scrubbers, baghouses, and other pollution control equipment in addition to wiring and transmission and a growing number of wind energy projects.

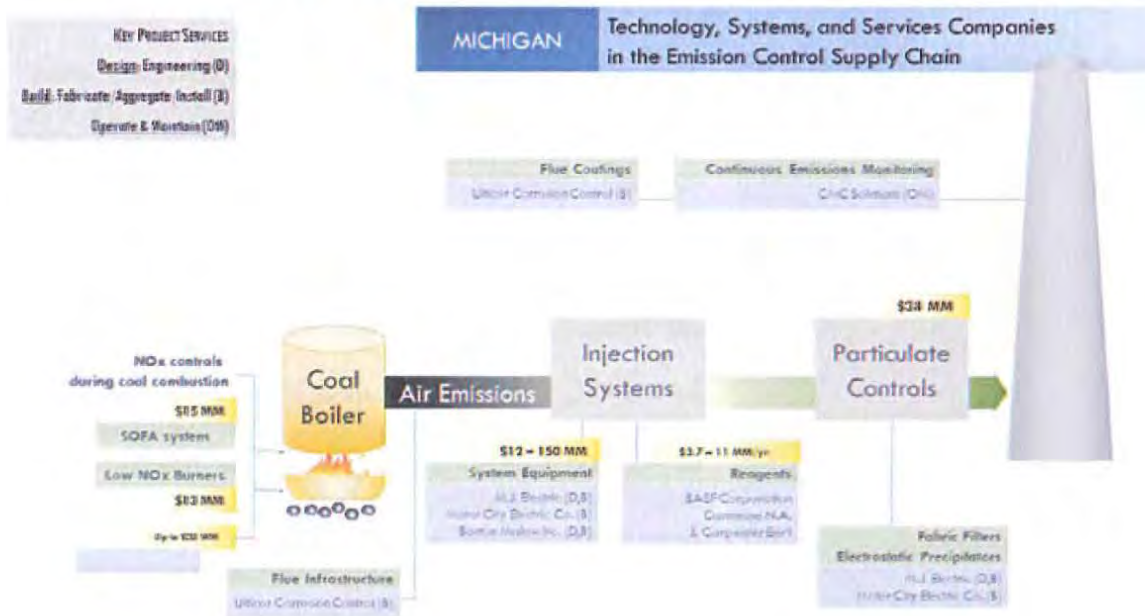
M.J. Electric has \$300 million in revenues and nine offices around the country. They have recently completed electric power plant projects in New Mexico, Ohio, Utah, Pennsylvania, and Kansas, in addition to other states.

Michigan has 52 coal-fired electricity-generating units totaling 11.5 GW of capacity, or four percent of the U.S. total. Eighty-three percent of these units are expected to continue operating, but 85 percent lack controls for sulfur dioxide and acid gas emissions. Most of them will require **investment in pollution control retrofits** in order to comply with forthcoming rules including the Mercury and Air Toxics Rule and the Cross-State Air Pollution Rule.

As a result, approximately **\$6.3 billion** will be invested in pollution control equipment by 2015 in Michigan to meet EPA's air quality standards, directly and indirectly creating over **48,000 jobs in the state**. Such a large investment requires the services and labor of numerous companies, from fabricators to engineers to technology providers. Construction of new generating capacity could create **an additional 14,200 jobs**.

A small sample of Michigan's companies in the environmental equipment supply chain, listed below, have over **1,500 employees** and cover multiple industries. They have combined annual revenues of more than **\$86 billion** worldwide.

Figure 8: Companies in the Supply Chain in Michigan



NOTE: Names include representative set of companies with operations in Michigan. Cost figures are for a typical 300 MW coal plant and reflect capital costs or annual operating expenses.

Company Name	Industry	Michigan presence
Barton Malow	Construction	Southfield (HQ)
BASF Corporation	Catalyst supplier	Wyandotte (branch)
Carmeuse North America	Catalyst supplier	Cedarville, River Rouge, Detroit, Rogers City (branches)
CMC Solutions Inc	Emissions monitoring	Wixom (HQ)
J Carpenter Environmental	Catalyst supplier	Muskegon (HQ)
M.J. Electric	Electric systems installer	Iron Mountain (HQ)
Motor City Electric Co.	Electric contractor	Detroit (HQ)
Ulticor Corrosion Control Inc	Component manufacturer	Clarkston (HQ)



## Exhibit 5: Ohio State Profile for the APC Supply Chain

### *Company Spotlight:*

#### *Enerfab, Inc.*

With a headquarters in Cincinnati and offices around the U.S., Enerfab provides engineering, fabrication, materials handling, and maintenance services to the energy sector, as well as to the chemical and food/beverage industries.

As a fabricator, Enerfab is hired to turn raw materials and parts into an integrated and functioning system. They construct the main vessels for slurry systems as well as piping, electrical, fans, pumps, and other equipment for dry and wet scrubbers and SCR systems. They also install low-NOx burners. They leverage state-of-the-art technologies by incorporating equipment from other vendors but hiring their own employees for project management and construction jobs.

Enerfab is one of a few companies that has experience with newer technologies such as DSI and AGI systems, as well as older technologies such as fabric filters and baghouses.

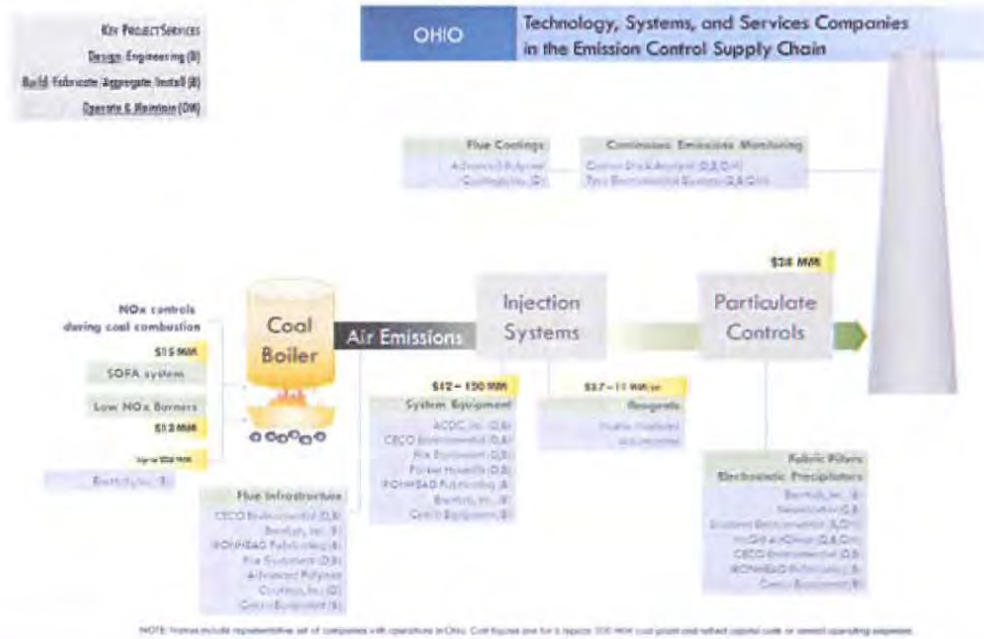
The company is privately owned and has operated for over 30 years.

Ohio has 69 coal-fired electricity-generating units totaling 21.4 GW of capacity, or seven percent of the U.S. total. Eighty-two percent of these units are expected to continue operating, but 31 percent lack controls for sulfur dioxide and acid gas emissions. Most of them will require **investment in pollution control retrofits** in order to comply with forthcoming rules including the Mercury and Air Toxics Rule and the Cross-State Air Pollution Rule.

As a result, approximately **\$7.1 billion** will be invested in pollution control equipment by 2015 in Ohio to meet EPA's air quality standards, directly and indirectly creating over **58,000 jobs in the state**. Such a large investment requires the services and labor of numerous companies, from fabricators to engineers to technology providers. Construction of new generating capacity could create **an additional 18,000 jobs**.

A small sample of Ohio's companies in the environmental equipment supply chain, listed below, have over **1,100 employees** and cover multiple industries. They have combined annual revenues of more than **\$14.3 billion** worldwide.

Figure 9: Companies in the Supply Chain in Ohio



Company Name	Industry	Ohio presence
ACDC Inc.	Component manufacturer	Milford (HQ)
Advanced Polymer Coatings, Inc.	Component manufacturer	Avon (HQ)
CECO Environmental	Manufacturing, design & installation	Cincinnati (HQ)
Ceeco Equipment	Supplier	West Chester, Dayton, Akron (branches)
Custom Stack Analysis	Emissions monitoring	Alliance (HQ)
Enerfab, Inc.	Engineering & fabrication	Cincinnati (HQ)
Fox Equipment	Fabrication & installation	Cincinnati (branch)
IRONHEAD Fabricating Inc	Fabrication	Toledo (HQ)
Martin Marietta Aggregates	Catalyst supplier	Woodville (branch)
McGill AirClean	Engineering, manufacturing & construction	Columbus (HQ)
Neundorfer	Engineering & consulting	Willoughby (HQ)
Parker Hannifin, Parflex Division	Component manufacturer	Ravenna (division HQ)
Southern Environmental	Engineering & construction	Westerville (branch)
Tyco Environmental Systems	Manufacturer & supplier	Milford (branch)

## Exhibit 6: Pennsylvania State Profile for the APC Supply Chain

### *Company Spotlight:*

#### *Calgon Carbon Corporation*

Calgon Carbon Corporation, based in Pittsburgh, provides carbon for industrial purification processes. Since its founding during World War II, the company has identified hundreds of market applications for activated carbon.

Recently Calgon has seen its power plant market segment undergo rapid growth as an increasing number of plant owners install activated carbon injection systems. These systems inject a solution of activated carbon into the flue gas (emissions) stream. This removes mercury and other toxics before they are emitted into the air.

Whereas some supply chain companies are most actively involved during the retrofit and upgrade portion of an APC project, Calgon has an ongoing role in the operations of an ACI system as the supplier of an important reagent that makes mercury removal possible.

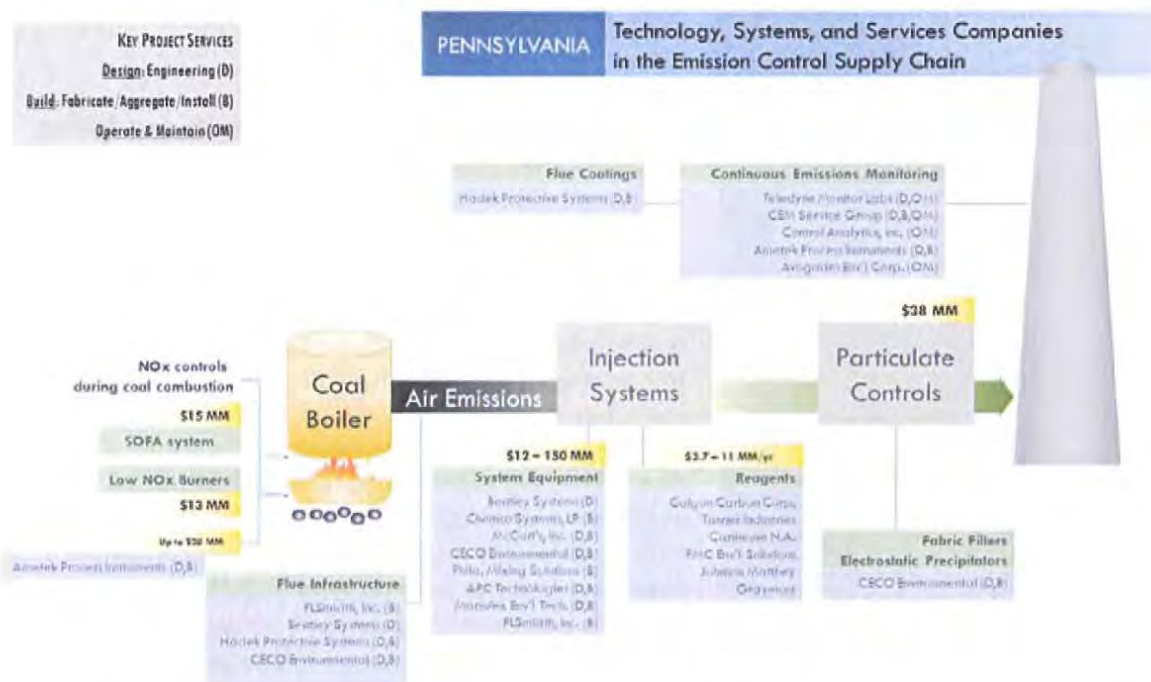
Calgon has about \$500 million of annual revenues and employs over 1,000 people who perform a range of manufacturing, processing, operational, and marketing roles.

Pennsylvania has 53 coal-fired electricity-generating units totaling 17.4 GW of capacity, or six percent of the U.S. total. Eighty-eight percent of these units are expected to continue operating, but 20% lack controls for sulfur dioxide and acid gas emissions. Most of them will require **investment in pollution control retrofits** in order to comply with forthcoming rules including the Mercury and Air Toxics Rule and the Cross-State Air Pollution Rule.

As a result, approximately **\$4.7 billion** will be invested in pollution control equipment by 2015 in Pennsylvania to meet EPA's air quality standards, directly and indirectly creating over **33,800 jobs in the state**. Such a large investment requires the services and labor of numerous companies, from fabricators to engineers to technology providers. Construction of new generating capacity could create **an additional 25,400 jobs**.

A small sample of Pennsylvania's companies in the environmental equipment supply chain, listed below, have over **5,000 employees** and cover multiple industries. They have combined annual revenues of more than **\$28 billion** worldwide.

Figure 10: Companies in the Supply Chain in Pennsylvania



NOTE: Names include representative set of companies with operations in Pennsylvania. Cost figures are for a typical 300 MW coal plant and reflect capital costs or annual operating expenses.

Company Name	Industry	Pennsylvania presence
Ametek Process Instruments	Component manufacturer	Berwyn (HQ), Pittsburgh (division HQ)
APC Technologies Inc.	Manufacturing & supplier	Pittsburgh (HQ)
Avogadro Environmental Corp.	Technical services	Easton (HQ)
Bentley Systems	Technical software	Exton (HQ)
Calgon Carbon Corporation	Catalyst supply	Pittsburgh (HQ)
Carmeuse North America	Catalyst supply	Pittsburgh (HQ)
CECO Environmental	Engineering, manufacturing & construction	Wexford, Conshohocken, Lebanon
CEM Service Group, Inc.	Manufacturing & service	Ottsville (HQ)
Chemco Systems, LP	Component installation	Monongahela (HQ)
Control Analytics, Inc.	Manufacturing	Export (HQ)
FLSmidth	Engineering & supplier	Bethlehem (US HQ)
FMC Environmental Solutions	Catalyst supply	Philadelphia (division HQ)

Company Name	Industry	Pennsylvania presence
Graymont Ltd	Catalyst supply	Bellefonte (regional office), Pleasant Gap (plant)
Hadek Protective Systems	Component manufacturer	Pittsburgh (US HQ)
Johnson Matthey Emission Control Technologies	Catalyst supply	Malvern, Wayne, Smithfield (branches)
Marsulex Environmental Technologies	Engineering & construction	Lebanon (HQ)
McCarl's Inc.	Construction	Beaver Falls (HQ)
Philadelphia Mixing Solutions	Engineering & construction	Palmyra (US HQ)
Pocono Fabricators	Component manufacturing & installation	Pittsburgh (HQ)
Tanner Industries Inc.	Catalyst supply	Southampton (HQ)
Teledyne Monitor Labs	Manufacturing & supplier	Gibsonia (branch)