Ohio: Securing America’s Energy Future

Options for Increasing Ohio’s Role in Our Nation’s Energy Independence

Consortium for Energy, Economics and the Environment
OHIO: SECURING AMERICA’S ENERGY FUTURE

OPTIONS FOR INCREASING OHIO’S ROLE IN OUR NATION’S ENERGY INDEPENDENCE
TABLE OF CONTENTS

Purpose Of This Report ................................................. 7
Acknowledgements ......................................................... 9
List Of Case Studies ....................................................... 11
Executive Summary ....................................................... 13

Introduction .............................................................. 19
  March 3 Summit ......................................................... 20
  Energy Production in Ohio ........................................... 21
  Ohio’s Petroleum and Fuels Industry ................................ 21
  Natural Gas Supply in Ohio .......................................... 22
  Ohio Coal ............................................................... 22
  Energy Consumption in Ohio ....................................... 22
  Ohio’s Electricity Generation And Transmission Landscape .. 23
  Ohio’s Energy Future ................................................ 24

Breakout Report: Fossil Fuels And Nuclear Power .................. 27
  Introduction .......................................................... 27
  Outlook: Coal–Ohio’s Most Abundant Energy Resource ........... 27
    Baseload Electric Power Production ............................... 27
      Need For Investment ............................................ 28
      Upgrades Are Essential ....................................... 28
      New Transportation Fuels: Coal to Liquid ..................... 29
      Gasification - Synthetic Gas For Industrial Processes ...... 29
      Coal a Raw Material Feedstock ................................ 30
  Outlook: Oil and Natural Gas- Independent Producers and “Small Oil” .... 30
    Local Supply = Fewer Disruptions = Less Volatility .......... 30
    Extending Ohio’s Oil and Gas Production ....................... 31
  Outlook: Nuclear Energy - Reliable Baseload Generation? ....... 31
  Priorities ............................................................. 31
    Maintain and Enhance Existing Fuel Resources .................. 31
    Distributed Energy ............................................... 32
    Carbon Dioxide Emissions ....................................... 33
    FutureGen .......................................................... 33
    Upgrading the Grid ............................................... 34
    Job Training ....................................................... 34
    New Plays Could Impact Oil and Gas Extraction ................ 34
    Reregulation ...................................................... 34
    Rail Issues ........................................................ 35
    Beginning a Dialogue About Nuclear Power in Ohio ............. 35
  Policy Options for Fossil Fuels and Nuclear Energy ............... 35

Breakout Report: Transportation ....................................... 39
  Introduction .......................................................... 40
  Outlook: New Technologies And a New Way Of Thinking .......... 41
  Priorities ............................................................. 41
    Renewable and Alternative Fuels .................................. 41
    Automotive Fuel Cells ........................................... 42
    Biogas .................................................................. 43
    Idle-Reduction Technologies ...................................... 43
    Transportation Planning .......................................... 46
Transportation Demand Management ........................................ 46
Increasing the Gas Tax ...................................................... 46
Use CMAQ Funds for Intended Purpose .................................. 47
Offer Business Incentives to Adopt New Technology .................. 47
Policy Options for the Transportation Sector: ........................... 47

Breakout Report: Sustainable Development .................................. 53
Introduction ........................................................................ 51
Outlook: Energy Efficient Businesses and
Buildings Development Density & Redevelopment ....................... 52
Priorities: ........................................................................... 55
Sustainable Businesses .......................................................... 55
Green Research Triangle Concept .............................................. 55
Human Health and Development .............................................. 56
Policy Options For Promoting Sustainable Development ............... 56

Breakout Report: Clean Alternative Energy Technologies .............. 59
Introduction ........................................................................ 59
Outlook: Technologies with the Most Potential for Ohio ................. 59
Fuel Cells ........................................................................... 59
Biomass/Waste Diversion ....................................................... 60
Wind .................................................................................... 62
Solar ..................................................................................... 64
Hydropower ........................................................................ 65
Priorities ............................................................................. 65
Development of an Alternative Energy Portfolio Standard .......... 65
Interconnection Benefits All Consumers .................................. 65
Externalities .......................................................................... 66
System Benefit Charge Increases ............................................ 66
Green Pricing Options ............................................................ 66
Policy Options for Clean Alternative Energy Technologies ............ 66

Breakout Report: Energy Education ........................................... 71
Introduction ........................................................................ 71
Outlook: Energy Literacy ................................................. 72
An Energy Literate Society .................................................... 73
Partnerships are the Key to Success ....................................... 73
Supply and Demand .............................................................. 73
Priorities ............................................................................. 74
Achieving Energy Literacy .................................................... 74
Education and Job Training .................................................. 74
Developing a Public Awareness Campaign .............................. 74
Policy Options for Energy Education ....................................... 75

Conclusions ........................................................................ 79

Bibliography ........................................................................ 81
Appendix A Welcome Letter from Senator George V. Voinovich .... 89
Appendix B Summit Agenda ................................................... 91
Appendix C Breakout Session White Papers .............................. 93
Appendix D List of Summit Participants and Focus Group Contributors .... 101
Appendix E Consortium for Energy, Economics, and the Environment Fact Sheet .... 111
Appendix F Glossary of Terms ................................................. 113
PURPOSE OF THIS REPORT

This report summarizes the thoughts and work of more than 100 energy experts representing the private, public and nonprofit sectors of Ohio. The participants gathered for a workshop cosponsored by Senator George V. Voinovich and Ohio University’s Consortium for Energy, Economics and the Environment (CE3) in Columbus, Ohio to identify opportunities for the state of Ohio to become a recognized leader in promoting energy independence. Attendees focused on four broad areas of interest: Fossil Fuels, Transportation, Sustainable Development and Clean Alternatives. A fifth group, Energy Education, convened separately and is included in the report.

This meeting and subsequent follow-up focus groups helped summit organizers gather many ideas into a list of state and federal policy proposals. The list represents the best critical thinking and analysis of those who participated.

This report contains information from a variety of organizations and viewpoints. There is widespread support for the concept of energy independence and urgency among all participants for addressing Ohio’s energy issues. Achieving this goal will take the combined efforts of all concerned parties.

Finally, it is important to note that Senator George V. Voinovich and the Consortium for Energy, Economics and the Environment (CE3) at Ohio University, as organizers of the summit and writers of these proceedings, believe the dialogue generated through this effort will play a vital role for the state of Ohio and the nation as we adjust to a new energy paradigm.

References to any specific product, process or service by a trade name, trademark, manufacturer or other identifier does not necessarily constitute or imply endorsement, recommendation or favoring by those involved but merely are meant to highlight options or recommendations.

The drafters of this report hope that the debate will continue and that many ideas presented herein will be discussed thoroughly and ultimately adopted as Ohio develops a comprehensive, forward-thinking energy strategy. The decision whether to adopt these recommendations lies with elected officials, the private and public sector, and the citizens of America as wise stewards of our resources. As Benjamin Franklin noted: Compromise will always be the hallmark of democracy.
ACKNOWLEDGEMENTS

The members of CE3 wish to thank those individuals who attended and contributed their thoughts to this effort, both at the March summit and the subsequent small group meetings. These people, who are working every day individually and with their organizations to meet our nation’s growing energy demands, made this effort possible. The organizations they represent, serving at the forefront of our energy systems, balance a multitude of factors including cost, reliability, and environmental and human health concerns to allow for our unprecedented standard of living.

In addition to those who contributed their thoughts on March 3, many others contributed more specific recommendations in a series of e-mails and phone calls. We are grateful for their efforts in strengthening this report.

Specifically, numerous staff and students helped in convening the March 3 energy summit and deserve to be singled out. Michael J. Zimmer, Thompson Hine LLP, and his deep knowledge of Ohio’s energy infrastructure provided a great balance to the meeting’s proceedings as he moderated the day’s events and participated substantially in the final editing of this report. Our joint keynote speakers, David Conover from the U.S. Department of Energy and Don McConnell from Battelle Labs in Columbus, provided a national and state perspective.

Our breakout group facilitators, Kimberly Gibson of the Mid Ohio Regional Planning Commission (MORPC) [transportation], Mike Long of the Solid Waste Authority of Central Ohio (SWACO) [Alternative Energy], Don McConnell (Fossil Fuels and Nuclear) and Geoff Buckley and Ted Bernard of Ohio University [Sustainable Development] managed the clock and their working groups to generate numerous positive ideas that made their way into this report.

On the planning committee, Staci Putney-McLennan from the Ohio Environmental Council, Kimberly Gibson and Laura Koprowski from MORPC, and Mark Shanahan from Ohio Air Quality Development Authority (OAQDA) were wonderful to work with in helping plan the event and in subsequent meetings. At Ohio University, Roxanne Male-Brune and Andrea Gibson in the Office of Research, Kevin Crist from the department of Chemical Engineering, and David Bayless from the department of Mechanical Engineering were extremely helpful in planning and following through with technical details.

Teri Geiger in Ohio University’s Office of the President was instrumental in identifying possible participants. Mark Weinberg, Director of the Voinovich Center for Leadership and Public Affairs at Ohio University, provided invaluable vision and strategic planning. Kate Leeman and Jared Vorkavich, also of the Voinovich Center, helped greatly with fact
checking and formatting as did Carole Womeldorf of Ohio University’s Department of Mechanical Engineering. Students who have assisted are almost too numerous to list but include Kyle Brown and Misak Avetisyan. Rachel Cook, Brooke Weberling, Meredith Heagney, Megan Cotton and Lindsey Siegrist—wonderful writers, researchers and editors who have been fabulous to work with on a tight deadline.

In Senator Voinovich’s Office, the tireless efforts of Cara Dingus Brook, Brian Mormino, Lauri Hettinger and Laurie Barton have aided this effort immensely.

Two people deserve to be singled out for their assistance: Cheryl Hanzel, who arranged and followed through on countless details that make a great event happen, and Beverly Jones, whose inspiration and vision led to this undertaking.
LIST OF CASE STUDIES

Powerspan ECO System - Bridging the Energy-Environment Divide .......................... 32
First Energy installs a multiemission air quality control unit to breathe new life into an aging power station.

SWACO Trash to Transit ................................................................. 43
The fifth largest publicly owned landfill in the United States is using methane and carbon dioxide from landfill gas for a variety of beneficial uses.

Truck Stop Electrification: Idle Work is the Hand of Innovation ............................ 44
The Ohio Department of Development is working with a private vendor to install and evaluate the effectiveness of one form of idle reduction technology.

The Cleveland EcoVillage Project: Urban Redevelopment with a Tinge of Green ...... 53
The largest urban redevelopment project of its kind, in inner city Cleveland, has created energy efficient affordable housing.

The University of Cincinnati Leads with LEED ...................................... 54
UC has become a statewide leader in promoting innovative building design by incorporating Leadership in Energy Efficient Design (LEED) principles in nine new and renovated buildings.

From Small Beginnings: Kurtz Brothers ............................................... 61
A family-owned landscaping company in northeast Ohio is becoming a pioneer in the conversion of multiple-source organic materials into commercial grade methane.

Fuel Cells Supply Tomorrow’s Technology Today ........................................ 61
Hocking College in southeast Ohio has installed the only operating fuel cell at a college or university in the state and has developed degrees in Alternative Energy and Fuel Cells and Vehicular Hybrids.

Winds of Change at AMP-Green Mountain Energy Wind Farm .......................... 62
American Municipal Power and Green Mountain Energy have installed Ohio’s largest operating municipal wind farm which generates up to 7.2 megawatts of green electricity.

The Timken Company Harnesses the Winds of Opportunity ............................ 63
As a manufacturer of bearings for wind turbines, The Timken Company represents a growing Ohio manufacturing base in renewable energy.

Solar Applications Expand Ohio’s Potential ............................................ 64
Bowling Green State University and Oberlin College have recently installed two of the largest solar arrays in the state.

Ohio’s Energy Educators ................................................................. 72
Numerous groups around the state including the Ohio Energy Project, Green Energy Ohio, Clean Fuels Ohio and the Ohio Environmental Council have been working for years to increase Ohio’s Energy Literacy.
EXECUTIVE SUMMARY

“Our dependence on foreign energy is like a foreign tax on the American people. It’s a tax our citizens pay every day in higher gasoline prices and higher costs to heat and cool their homes. It’s a tax on jobs and it’s a tax that is increasing every year.”

– President George W. Bush discussing energy at a national small-business conference, April 27, 2005

The United States is at a crossroads as it approaches a new energy future. As the world’s largest consumer of energy, our country must have access to safe, reliable, sustainable and affordable sources of energy to maintain our standard of living and our competitive advantage in the world’s economy. In order to feed the nation’s economy, we must continue to search for abundant sources of energy and offer global leadership for facing energy supply challenges. Increasingly, these energy sources are being found in portions of the world at odds with the culture and values of the United States. As a result, in this post-9/11 world, energy security has jumped toward the top of the nation’s priorities. Energy security is central to America’s economic growth, supply, sustainability and standing on the international stage.

Recent acts of terrorism around the world coupled with natural disasters such as Hurricanes Katrina and Rita in the fall of 2005 have demonstrated how thinly our supply chains are stretched. And recent price spikes in the wake of these disasters have demonstrated the volatility of worldwide energy markets. Sudden increases in cost for transportation fuels, natural gas and electric power in recent years have impacted virtually every American household and threaten to increase inflationary pressures as these costs are passed along to consumers.

In addition, recent projections by the U.S. Energy Information Administration estimate worldwide energy consumption will increase by more than 70 percent by 2030, further stretching an already-tight global energy market. Much of this growth will occur in Asia, particularly India and China where projected energy consumption will triple in this time span as their economies strive to emulate the success of the United States. To stem the tide of these natural and anthropogenic pressures, decision-makers increasingly are looking for innovative solutions to reduce our over-reliance on foreign sources of energy, and Ohio can play a part in this transformation.

Ohio is a net energy importer and the fifth largest consumer of overall energy resources in the nation. The state has a large stake in seeing that its supply of fuels and feedstocks (i.e. raw materials) are maintained. Ohio’s economy mirrors what is occurring in the United States, and

1 Energy Information Administration (EIA), International energy outlook 2006,
2 EIA, Energy consumption by sector, ranked by state, 2002
in many respects the state is an economic and political bellwether for the rest of the nation. Consider these facts:

**Coal:** More than 87 percent of the electricity generated in Ohio is derived from coal. In addition, critical components of the state’s economy, such as steel manufacturing, rely on coal for their production processes. As a result of this consumption Ohio is the fourth ranked coal consumer in the nation, on a per capita basis. At the same time Ohio is the 13th ranked coal producer in the nation.

**Oil:** Ohio is the fifth oldest crude oil producer in the nation, and even though its oil fields are quite mature, the state ranks 18th in annual domestic production. Even so, as the eighth largest oil consuming state in the nation (averaging 668,493 barrels per day in 2002), Ohio’s average daily production of 16,000 barrels per day meets only a fraction of its average daily need. As with the rest of the nation this deficit is filled by foreign oil.

**Natural gas:** Ohio is now the seventh largest consumer of natural gas in the nation with an annual consumption of 848,391 thousand cubic feet (mcf). In 2003, in-state production was just more than 93,640 mcf, making Ohio the 17th ranked producer. Much of this additional need is met via several large pipelines that transport gas mostly from the gulf coast region, and out-of-state supply is forecast to increase as liquefied natural gas terminals become more abundant.

These statistics shed light on several important points concerning Ohio’s energy. First, Ohio is a net energy importer. Many of Ohio’s energy-intensive manufacturers, such as the glass, casting, automotive and steel industries, are highly dependent on energy prices. Long Ohio’s greatest economic strength, these industries also rely heavily on feedstock sources from outside the state and, increasingly in the case of natural gas, outside of the United States.

Second, the infrastructure and logistics chains needed to supply these fuels provide affordable, abundant and reliable energy for the state’s residential and commercial customers. These complex logistics will become stretched as Ohio and the nation compete in a worldwide energy market that is increasing its demands for energy. Small disturbances in this system could have large ramifications on Ohio’s energy-reliant economy.

Third, conservation has a role to play in extending energy supply. The state of Ohio should undertake and promote extensive energy conservation measures. By taking a leadership role in conservation efforts, the state can serve as a role model for adopting energy efficient practices.

Fourth, balancing supply by diversifying sources will provide Ohio more options to meet its projected increase in energy demand. Increased reliance on renewable sources of energy

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1. Ohio Department of Natural Resources (ODNR), Division of Mineral Resources Management, 2005
2. EIA, *Energy consumption by source and total consumption per capita, ranked by state*, 2002
4. ODNR, Division of Mineral Resources Management, 2005
is an important step in increasing and diversifying supply. To make this a reality, Ohio should consider adopting a renewable energy portfolio standard (RPS) with a modest goal requiring 5 percent of all electricity be generated from renewable energy by 2020. Twenty-two other states, including Pennsylvania and the District of Columbia, have adopted just such a standard. 7

Finally, Ohio has many advantages in transforming its energy supply base. The state's manufacturing sector combined with its extensive college and university system provide it with ample opportunities to innovate and build the next generation of energy technologies. Innovative researchers and entrepreneurs capable of moving ideas to market are a powerful combination. Ohio should be working harder to facilitate these sorts of relationships.

These solutions will not occur quickly and will require innovation and financial resources. Ohio's heavy reliance on fossil fuels represents a substantial obstacle to the adoption of new energy technologies because infrastructure cannot quickly be repurposed. Until we begin a discussion on the future of energy in the state, and identify obstacles and opportunities for enhancement, Ohio will be particularly vulnerable to supply disruptions and their subsequent higher costs.

With this understanding, it is critical that Ohio become a source of innovative ideas for meeting the nation's need for more reliable sources of energy. Strategies for meeting increased energy needs fall into four broad categories: reducing consumption; increasing supply; developing new sources; and continuing technological innovation. Embracing this full spectrum of possibilities is the only way to meet our growing energy requirements. We must start now to keep pace with other states and to reduce global pressures facing Ohio's citizens.

The energy shortages of the 1970s and '80s brought tremendous advances in energy efficiency. However, lifting the OPEC oil embargo coupled with decreased consumption in the 1980s brought about a decrease in the cost of energy as market forces stabilized. The abundance of cheap energy in the late '80s and '90s led to relaxed efficiency standards. New advances in building construction, automotive design, and city and transportation planning could have substantial payoffs in energy efficiency. Ohio should embrace these opportunities to become a recognized leader in promoting energy efficiency because of its consumption patterns. These steps will produce net economic benefits rather than impose additional costs.

Increasing energy production will be essential to meeting Ohio's growing energy needs, and technological advances are going to help make the difference. Increasing the capacity of our existing fleet of coal burning power plants while upgrading emissions technologies through the deployment of new technologies - such as oxycombustion, ultrasupercritical generation, multipollutant control systems, carbon sequestration and integrated gasification combined cycle (IGCC) - will increase acceptance of this form of electricity generation. Enhancing recovery of existing oil and gas reserves will continue to help offset the need for external sources of energy. Finally, in adopting an alternative energy portfolio standard (AEPS), the state would increase the deployment of renewable sources such as wind, biomass and solar where appropriate and cost-effective.

7 Rabe, 2006
Even these increases are unlikely to meet Ohio’s growing energy needs. Therefore, the state should strive to become a national leader in biofuel production—both first- and second generation technologies. With much of the state’s row crops in corn and soybean production, Ohio is well-positioned for this to occur. Ohio is presently the only state in the top 10 states in corn and soybean production that does not have a commercial-grade ethanol production plant on line, although eight plants are currently under construction and at least four more are in the planning phases. With the production and transportation infrastructure for traditional “first generation” ethanol in place, the state would be well-positioned over the next decade for “second generation” technologies such as cellulosic ethanol and biodiesel production from unconventional sources.

Ohio is poised to become a leader in the coal-to-liquid fuels industry using Fischer-Tropsch reforming technology. By converting coal to liquid transportation fuels, manufacturers could provide more distributed, domestic production of critical infrastructure fuels. An additional benefit of Fischer-Tropsch reforming is its high efficiency in producing methane, which is widely used in Ohio for home heating and industrial production. Ohio could take a key role in Fischer-Tropsch fuel production by building upon the Air Force’s Assured Battlefield Fuels program research, led by Wright-Patterson Air Force Base.

Research should be conducted to enhance thin film photovoltaic (PV) production and advanced fuel-cell technology. With continual enhancements in these fields Ohio could become recognized worldwide in advanced energy technologies. Continuing or expanding incentives such as the recently enacted $103 million fuel-cells initiative, which is designed to attract economic development related to this technology, is a good start.

New advances in microturbines, that previously have been overlooked, are opening up new vistas in the deployment of small-scale wind generation. Ohio has better wind resources than other states, such as Pennsylvania, which have embraced this technology and are reaping the benefits with the recent announcement of a large-scale European turbine manufacturer locating in the state. Ohio could do the same or even better with its leadership in the metal fabrication and ball-bearing industries.

Ohio should be exploring unconventional sources for oil and gas such as Devonian-age shales, coal bed methane and tight gas sands which may exist in abundance. These indigenous resources may help open new opportunities for Ohio oil and gas producers, which all are independently owned and operated.

Finally, recent moves by the Bush Administration and Congress have decreased regulatory barriers for nuclear production. Policy makers and regulators should evaluate the future deployment of nuclear energy at existing sites, which has tremendous potential for meeting much of the state’s electrical generation needs—provided waste repository and secure storage of spent fuel are taken into account.

All these recommendations rely heavily upon an informed citizenry that fully understands the social, economic and quality-of-life implications surrounding energy supply and demand. An
Effective energy education program should include information on market forces and their effects on production and consumption; the impact that personal conservation efforts at home, work and school can have on energy costs; and strategies that meet America’s increasing need for safe, affordable, reliable and sustainable energy.

Specifically, Ohio should strive for an energy-literate society in which individuals can identify where their energy comes from, the environmental and economic consequences of energy utilization, and how they can reduce their consumption. Energy education and job training throughout the K-16 spectrum should be enhanced to meet the growing lack of qualified workers across all levels of the energy industry. Ohio should identify its critical knowledge needs and work to retain some of its best and brightest students in this critically important sector of the economy.

By using Ohio’s abundant resources, the state can transform itself from being overly reliant on externally produced energy sources to become more energy independent. To do this, Ohio will have to orient its knowledge creators and public policy-makers toward this goal; resources must be dedicated in proportion to the magnitude of the issues facing our nation; and leaders must call upon everyone to do their part.

Government need not be in the business of commanding or dictating to the private sector how to solve this current energy crisis. Government can get Ohio’s businesses and citizens orientated in the proper direction with data and information to validate choices made in the marketplace. Governments can also open markets for new technologies and services.

Nationally we have relied for too long on narrow or single approaches to meet our energy needs. We are better off with an array of alternatives and a portfolio of solutions to bridge the historical gaps to a road for energy independence in the 21st century. Other states are doing so, and it is Ohio’s time to assert that leadership with its resource, knowledge and skill base as the foundation of the state’s efforts as we work with our national leaders to become energy independent.
INTRODUCTION

America is on the threshold of a new energy paradigm. As the world’s largest consumer of energy, the nation must secure safe, reliable, affordable sources of energy. However, domestic production of many traditional fuel sources no longer keeps pace with our ever-growing consumption. The complex geopolitics of energy threatens America’s economic security, and nowhere is this more pronounced than in the oil markets. Since 1973, the United States has been steadily increasing its reliance on imported energy. In the past 30 years, foreign oil imports have doubled to comprise 60 percent of the oil we use. Imports of natural gas, uranium and refined petroleum are also escalating and are compounding the oil-import problem.\(^8\)

To meet this increasing need, the United States is looking abroad for oil resources at a time when Asia is becoming more industrialized and dependent on petroleum to fuel its growth.\(^5\) Europe is also forecasting a steady increase in its oil and natural gas imports through 2030.\(^9\) Global demand for oil is growing steadily yet domestic oil production capacity is at its lowest level in history. Oil prices have risen from nearly $10 per barrel in the late 1990s to consistently over $60 per barrel since late 2005, and it is possible that in the event of an economic or political crisis the price could climb even higher.\(^10\) Much of the world’s oil is located in politically unstable areas of the world, creating a growing energy, economic, trade and security threat to our nation.

Our reliance on uncertain supplies of oil is not our nation’s only energy challenge. If domestic natural gas resources were plentiful, we could consider so-called “gas-to-liquids” technologies for producing potential substitutes for oil. However, North American natural gas supplies are diminishing rapidly.

Reflecting tightened supplies, wholesale prices have risen from $2 per thousand cubic feet (mcf) in the late 1990s to consistently over $7/mcf, and occasionally more than $15/mcf in recent winters. This increase in natural gas prices is dramatically raising residential/commercial heating bills along with heavy industry and electric power generation that depend on natural gas or feedstock.

One option for expanding supply is liquefied natural gas (LNG) facilities for importing natural gas from other areas of the world. Although global natural-gas supplies have high potential for greater extraction, and some new facilities are now functioning, much of the world’s supply is located in areas increasingly at odds with America. Further expanding LNG capacity may serve only to perpetuate the security challenges we already face with oil. Additionally, LNG facilities have significant security issues that make siting very challenging.

Coal is an abundant enough resource in the United States to remain in wide use as a fuel source for electrical generation in

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\(^8\) EIA, *Energy trade by source*, 1949-2005, 2005
\(^5\) EIA, *International energy outlook* 2006
the foreseeable future. In addition, there is growing interest in technologies for processing coal into liquid fuels to replace oil. However, coal-source liquid fuels—as well as pulverized coal for electricity generation in central-station power plants—come with costs. Chief among these concerns are human and environmental health consequences.

Low- or zero-emission technologies such as solar and wind are increasingly being deployed around the world and in America as an alternative to traditional sources of electrical generation. However, they face significant barriers to industrial-level deployment. These technologies still are much more expensive than traditional coal generated base-load electricity, and they are heavily dependent upon weather and climatic conditions for peak efficiency. Though they are increasingly a larger piece of the world’s energy budget, they will not supplant traditional sources in the foreseeable future.

Finally, new developments in the nuclear power industry have the potential to increase capacity and reduce our reliance on foreign sources of energy. But, as with all energy alternatives, these developments come with some risks. Even though some are arguing that it is time for America to reconsider its relationship with nuclear energy, conducting the debate and implementing any significant policy change could take many years.

These trends show that no simple answer exists for solving America’s energy crisis. The conventional energy paradigm is becoming increasingly expensive due to concerns about future supplies of oil and natural gas. Even if oil and natural gas were abundant and expected to remain inexpensive, their continued use at increasing rates would put America at a strategic disadvantage and would expose consumers to increasing price volatility, as global demand outstrips supply.

For some observers, including those within the present administration, the future of energy lies in the “hydrogen economy.” This means creating hydrogen from a variety of feedstocks, using environmentally neutral conversion technologies and then consuming the hydrogen in fuel-cell power plants and automobiles that produce zero emissions. This is a very appealing vision, but the technological and economic challenges along such a value chain are large, and the enormous embedded energy infrastructure would have to be either radically repurposed or discarded and rebuilt again. In other words, the hydrogen economy is still many years away.

**March 3 Summit**


Senator Voinovich and CE3 invited professionals from across Ohio to look at the nation’s energy policy, explore methods for reducing the energy challenges we face as a nation, and identify the role Ohio might take in America’s energy future. During the meeting, the senator called upon summit participants to play a role in meeting the challenge to find more sustainable, economical, environmentally feasible solutions to support future energy consumption to benefit our state and nation.

At the summit, following several excellent presentations, participants were organized into breakout groups and charged with the task of identifying policies, technologies and strategies for reducing dependence on imported energy. The breakout groups were asked to identify issues and technologies important to the state and to propose viable solutions with the potential not only to ease our energy challenges but also to offer environmental and economic development benefits. They were asked to report back with suggestions about Ohio’s role in meeting the nation’s energy security challenge.

The breakout group focus areas were:

- transportation
- fossil fuels
- clean alternative energy technologies
- sustainable environment

Completely independent of one another, all four breakout groups highlighted the need for further education, at all levels of society, on the magnitude of the issues facing Ohioans as we move into a new energy paradigm. As a result, this report includes an additional section addressing the need for greater energy education and setting out the energy education comments of all four breakout groups.

This report also sets forth recommendations offered in the breakout groups. In some cases, comments offered in the general sessions of the summit are presented along with the relevant breakout report. These recommendations were intended as part of a dialogue and do not necessarily reflect a consensus of all summit participants.

Senator Voinovich has suggested that summit participants gather
again as needed to review the progress that Ohio has made in implementing these strategies and solutions for securing Ohio's energy future in the context of this global and national debate.

**Energy Production in Ohio**

Ohio has tremendous opportunities in development and clean utilization of its energy resources. For example, every drop of domestically produced oil and every molecule of locally generated natural gas contributes to reductions in energy imports while generating jobs in our domestic energy economy.

Although Ohio's hydrocarbon resources are some of the most mature in the world, these resources are not exhausted. Most of the remaining Ohio oil and gas reserves are found in unconventional settings - primarily coal seams, Devonian-age shales and low-permeability (tight) gas sands—that are particularly difficult or expensive to produce. In the longer term, as these technologies continue to develop, the basins could provide further hydrocarbon resources from oil sands and oil shales. There also are previously untapped deeper formations that need to be explored, according to a report by the Appalachian and Illinois Basin Directors of the Interstate Oil and Gas Compact Commission.12

Ohio’s electricity generation increased by 15.9 percent between 1990 and 2004, from 128,000 gigawatt hours (GWh) to 148,000 GWh. Coal remains the major source of electrical energy in Ohio, accounting for 86.4 percent of the electricity produced in the state. Even though the actual amount of electricity from coal has risen since 1990, it now accounts for a smaller proportion of electricity production, due to increased reliance on natural gas, nuclear power, petroleum and hydroelectric power.13

**Ohio’s Petroleum and Fuels Industry**

The oil industry in Ohio dates back to 1884, making Ohio the fifth oldest producer of oil in the country, behind Pennsylvania (1859), West Virginia (1859), New York (1865) and Kentucky (1865). However, in recent times Ohio’s oil industry has not had the national preeminence that it held at the turn of the 20th century. Today, Ohio produces only modest quantities of crude oil, ranking 18th among states in annual domestic production, contributing less than 1 percent of U.S. production.14 Ohio-produced oils are generally very high grade and are primarily used for lubricants and motor oils, rather than as liquid fuels. Production quantities in Ohio have generally been declining in recent years, even in the face of increasing prices, and the resource has been over-produced for most of the 20th century.

In 2005, producers drilled an estimated 711 oil and gas wells in 47 counties in Ohio. Of these, Monroe county drilled the most wells (66). Ohio produced 5,651,705 barrels of crude oil in 2005 with an estimated market value of $299,709,916, an increase of 36.23 percent ($79,851,452) from its 2004 value. The average price per barrel was $53.03, a 39.6 percent increase from 2004’s average price of $38.00 per barrel.15

There are four significant oil refineries in Ohio: two in Toledo (BP and Sunoco), one in Lima (Premcor) and one in Canton (Marathon). These refineries collectively process about 550,000 barrels of products per day, which is adequate capacity to supply about 80 percent of the petroleum fuels used by customers in Ohio through the 5,125 service stations across the state. With only approximately 16,000 barrels per day of in-state production in 2002, most of the crude oil supplied to these refineries is imported via petroleum pipelines. Even though Ohio is not a significant oil producer, it has an average daily consumption of 668,493 barrels per day, making it the eighth largest oil consuming state in the nation.16

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12 Appalachian and Illinois Basin Directors of the Interstate Oil and Gas Compact Commission, 2005
13 EIA, *Electric power annual data tables*, 2004/2005
15 ODNR, 2005
**Natural Gas Supply in Ohio**

In 2005, natural gas production in Ohio topped 84 billion cubic feet, at an average price of $9.03 per million cubic feet. The combined market value of Ohio crude oil and natural gas production in 2005 was $1,059,449,197. In 2005, ODNR’s Division of Mineral Resources Management issued 2,388 permits, which represents an increase of 470 (24.5 percent) from 2004 and the most permits issued since 1992 (2,481). This number includes permits issued to convert, deepen, drill, plug back, plug and abandon, reissue and reopen wells.17

Most of Ohio’s natural gas consumption is imported from out of state. Several major backbone gas transportation pipelines and storage facilities serve Ohio, relying on gas imported primarily from the Gulf Coast area.

Natural gas is distributed to customers via a number of local distribution companies, the largest of which is Dominion Energy. Most customers in the state have access to delivered natural gas, so that 69 percent of residences heat with natural gas. A minority of residential customers (mainly in rural areas) use electricity, propane or wood for heating.

In most cases, Ohio customers are able to choose the supplier of their natural gas. Several competitive suppliers or aggregators are in business, mainly serving larger commercial and industrial customers.

**Ohio Coal**

It is estimated that Ohio has 11.5 billion tons of economically recoverable coal reserves. According to the U.S. DOE, in 2004 Ohio was the nation’s 13th largest producer of coal. It produced 23.2 million tons, or about 2.1 percent of the U.S. total (note: all tonnages are in short tons.).

Coal was produced by 37 companies at 101 mines in 17 Ohio counties during 2003, the last available detailed reporting year. Production totaled 22.2 million tons, an increase of 6.2 percent from 2002. In 2003, 13.1 million tons were produced from seven underground mines, and 9.1 million tons were produced from 94 surface mines.

Ohio ranks second nationally in the consumption of coal, behind Texas. More than 86.4 percent of the electricity generated in Ohio is coal-derived. Ohio imported 59.4 percent of the 57.16 million tons of coal that were consumed in 2004. While most coal is used to generate electricity (96 percent), some is used to make steel.18

**Energy Consumption in Ohio**

As the fifth largest consumer of total energy resources in the nation (as of 2002), Ohio has a huge stake in the effort to solve the current energy crisis. Ohio’s total energy consumption increased by 4 percent between 1990 and 2001, from 3,840 trillion BTU to 4,363 trillion BTU but has declined slightly since 2000 to 3,959 trillion BTU in 2002.19

One-third of the energy consumed in Ohio comes from coal, which is the main source of energy for electricity production in the state. Petroleum, used little in the production of electricity, still accounted for almost one-third of energy consumption in the state, mostly for transportation purposes. Natural gas is not used heavily in electricity production in Ohio, but still accounts for more than one-fifth of energy consumption, mostly for heating purposes.20

Natural gas prices in Ohio have nearly quadrupled since 1990.21 Since natural gas accounts for 69 percent of the state’s home heating market, these increases have put a squeeze on many families.22 And although electricity prices have not yet risen substantially, some observers predict significant increases in electricity prices to cover increased fuel prices, particularly natural gas, once rate caps imposed by the Public Utilities Commission of Ohio (PUCO) expire in 2009.

Increases in energy prices not only are putting many families at risk but also are threatening the competitive position of numerous businesses. Many of Ohio’s industries are energy-intensive. The success of the state’s glass, casting, automotive and steel companies is highly dependent on energy prices, and these industries represent a substantial employment base in Ohio.

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17 ODNR, 2005  
18 ODNR, 2006  
21 EIA, Natural gas navigator, 2006  
22 EIA, Petroleum profile: Ohio, 2006
On the transportation front, Ohio faces similar challenges. Approximately 80 percent of the petroleum used in Ohio is for transportation fuels. Skyrocketing gasoline and diesel prices hurt families and almost every kind of business in the state.

More than 55 percent of the land in Ohio is devoted to agricultural production, and agricultural producers are heavily affected by energy prices. In the nation today, most food sources still require more energy to produce, process, transport and distribute than they yield in caloric content when consumed, meaning that food prices will rise with energy prices.

**Ohio’s Generation and Transmission Landscape**

In examining Ohio’s electricity generation infrastructure, two important factors must be considered: the structure of the utility industry and the state of the transmission system.

Three types of electric utilities serve most Ohio consumers: investor-owned utilities, rural electric cooperatives and municipal electric systems. The three categories operate independently of each other and within differing regulatory structures.

Among Ohio’s utilities, power is generated by a fleet of power plants with a total of roughly 34,000 megawatts capacity. Slightly more than 87 percent of the state’s electricity is produced by coal-fired power plants, with most of the remainder coming from major regional nuclear power plants. Two nuclear plants (Perry and Davis-Besse) are located in Ohio, together producing about 2 percent of the nation’s nuclear power.

The power generation market largely operates competitively, with the lowest cost generation facilities supplying power at any time. Ohio’s network of power plants is interconnected by a vast high-voltage transmission grid, the key component in ensuring the reliable delivery of electricity to homes and businesses.

In recent years, the operation of the electricity transmission system has dramatically changed. Oversight of the nation’s electric transmission grid has been generally placed in the hands of Regional Transmission Organizations (RTOs), such as the Midwest Independent Transmission System Operator Inc. (Midwest ISO) and PJM Interconnection Inc., which operate in the midwest and east respectively.

Each company’s territory covers portions of Ohio, which creates a unique set of issues for operators wishing to transmit across Ohio. In addition, the use of the transmission grid - in frequency and distance of transactions - has increased exponentially over the past 20 years, as competition was introduced into wholesale power generation markets in the early 1990s.

As power demands continue to increase, there will be a need for new power generation. But new investments in generation capacity also require a robust transmission system so that long-term power deliveries can be reliably set at predictable prices. Expanding and strengthening the transmission grid will be critical to boost system reliability, support a robust competitive market and provide the infrastructure needed for base-load generating capacity additions. In the new RTO environment, it is somewhat unclear how policies and rates will be set for transmission expansion.

The Federal Energy Policy Act of 2005 includes a number of provisions intended to foster transmission investment, including:

- Backstopping of federal siting authority
- Identification of national transmission corridors
- Rate incentives for new transmission investments
- Policies to foster long-term transmission rights
- Cost recovery for investors of transmission enhancement

Promulgation of regulations and the future review of these policies are important to Ohio and our nation.

The transmission grid is a critical component of the equation for successfully meeting consumer electric needs, but the process for permitting and constructing new transmission capacity can

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24 Farmland Information Center, 2006
be time-consuming and costly. The public’s “not in my backyard” mindset is among the obstacles to long-term development. It has taken as long as 12- to 14 years to site significant new long-distance transmission projects. Utilities argue that it is important that policymakers support efforts to streamline permitting processes for critical projects, and they urge the government to help educate the public about such projects.

**Ohio’s Energy Future**

Ohio can be a source of energy solutions. The state has vast resources and broad areas of innovation. Described below are some of Ohio’s strengths and opportunities:

Ohio is rich in coal. Coal is now used primarily by utilities and industry for steam for electric power generation and industrial heating. However, it also could be used in other ways, such as coal gasification to produce either electricity or industrial process gas, the latter of which needs more development to make it economically viable. Coal also can be used to replace oil-based transportation fuels and natural gas through a process known as Fischer-Tropsch reforming, or through other processes such as flash pyrolysis. Once gasified (converted into a synthesis gas), abundant Ohio coal could be reformed into diesel, jet fuel, gasoline, ethanol or natural gas at potentially competitive prices.

Ohio also has abundant resources of fresh water, a key ingredient for many energy processes, such as new electric power generation, coal liquefaction and coal gasification facilities that might be built to serve the needs of the nation.

With its agricultural orientation, Ohio has the potential to become a leader in biofuels. As a leading producer of corn and soybeans, Ohio could become a major producer of feedstock (raw materials) for ethanol production, and several ethanol projects are under advanced development. There is also sizable opportunity for biodiesel production from a variety of fatty waste sources. And, as cellulosic ethanol technologies become more viable, Ohio should be able to pursue such opportunities vigorously.

As an alternative to imported crude oil, America has been exploring oil shales in the western United States and in Canada. Current estimates suggest that the United States has untapped potential of more than 1 trillion barrels in the form of oil shale, and some experts say that substantial shale deposits could underlie Ohio. The hurdles to accessing, mining and refining these resources in an environmentally sound way are substantial, but the potential merits further study. The state should consider developing a Center of Excellence for shale research in Ohio through a joint partnership with the U.S. DOE.

Ohio manufacturers and research institutes are studying new automotive technologies, including hybrid drive technology and high-efficiency diesel technology. These technologies, coupled with advances in battery- and fuel-cell technologies, could transform the transportation sector.

Ohio is a recognized leader in fuel cell technology and business development, as reflected by the Ohio Department of Development (ODOD)’s committed sponsorship of the Ohio Fuel Cell Coalition and the Wright Fuel Cell Group. Initially limited to niche applications, fuel cell technologies could eventually be economically viable for stationary power generation and for automotive application. Ohio is in the top two states in the country in advancement and support of this technology.

Ohio has a long history of affordable electricity, and Ohio utilities (such as AEP and Firstenergy) and vendors (such as Babcock & Wilcox) are leaders in seeking advanced technologies for coal-fired generation that reduce environmental impact, today and for future generations. Options include Integrated Gasification-Combined Cycle Generating (IGCC); ultrasupercritical pulverized coal (uscp) plants and fluidized bed boiler technologies that are compatible with carbon dioxide sequestration, fluid bed boiler technology, high-temperature fuel cells and hydrogen turbine systems.

Given the state’s abundant coal and strong history with generation technologies, Ohio should continue to actively push for federal (DOE) funding for clean-coal demonstration projects and further capitalize on its existing coal research, development and deployment program.

Perhaps surprisingly to some, Ohio has good wind resources - better than Pennsylvania, where thousands of megawatts of wind development are projected in the coming years. Several Ohio developers are actively exploring potential new wind projects. Because of the major transmission network crisscrossing the state, wind farms developed in Ohio are well-positioned to serve the “green” power needs for much of the eastern third of the nation. And, with its heavy-industry manufacturing base, Ohio could become a manufacturing- and supply-chain hub for wind turbine/ component companies, most of which are European companies now looking for North American locations.

The solar resources in Ohio are not the best in the states, but nevertheless solar resources here are superior to solar resource in Germany - the world’s second largest solar market. This suggests
that there is untapped potential for solar electricity generation in Ohio. Toledo-based First Solar, one of the largest solar photovoltaics manufacturers in the country, is evidence of the opportunity.

As an extension of its efforts in biofuels, Ohio could also take advantage of opportunities to generate electricity from biomass resources. Of particular interest would be anaerobic digesters that convert animal wastes into biogases that are useful for power generation. Similar opportunities are likely to exist by exploiting methane releases from landfills (i.e., Landfill gas) and farms.

Energy efficiency in buildings must play a major role in addressing the energy crisis, in Ohio and nationwide. The building stock in the state is relatively old, and there are significant opportunities to adopt higher efficiency standards for appliances and buildings. For instance, in a climate such as Ohio’s, geothermal heat pumps can reduce electricity/gas purchases for space heating/cooling by 30- to 60 percent relative to conventional HVAC technologies.

It is clear that Ohio has a big stake in solving the energy crisis, along with the resources and expertise to play a significant role in developing the menu of solutions. In the following four sections, this report will explore some of the state’s challenges and possible contributions, organized to correspond with the breakout groups at the March summit.
**BREAKOUT REPORT: Fossil Fuels and Nuclear Power**

**INTRODUCTION**

Fossil fuels and nuclear power will continue to supply the bulk of Ohio’s baseload electricity demand for the foreseeable future. Ohio is a national leader in the availability of inexpensive coal, our nation’s most prevalent traditional source of energy, and the state is actively promoting its use. In addition, Ohio will continue to be a modest producer of oil and natural gas. Although levels have decreased over time, Ohio’s fuels remain an important component of the nation’s oil and gas domestic production. Energy production capacity in Ohio is important, particularly because regulatory uncertainty has a chilling effect on investment in new technologies. Furthermore, new technologies for utilizing fossil resources--such as gasification and Fischer-Tropsch Reforming, new scrubber technologies, fuel cells and high temperature/pressure pulverized coal systems--also have substantial technical and financial risks.

Diversification of energy sources, including nuclear and clean alternative energy technologies, will be critical for our nation’s energy security. As new technologies are adopted, more people must be trained to build and manage the facilities. Nuclear power, mining, electrical generation and engineering skills, among others, will be important to the nation when it comes to meeting the demands of the future.

In addition, the public needs more accurate information about American energy issues. Citizens are more likely to support supply decision-making and efficiency efforts if they have appropriate information to develop informed choices.

**OUTLOOK COAL**

**Ohio’s Most Abundant Energy Resource**

**Baseload Electric Power Production**

Currently, most of Ohio’s electric energy originates from coal-fired power plants, of which supercritical-pulverized plants represent the backbone. This backbone – commonly referred to as “baseload generation” – is the source for much of Ohio’s reliable electricity. It produces electricity 24 hours a day, seven days a week, and represents the normal daily power generation that Ohioans have come to expect from their electric utilities.

The picture in Ohio reflects the still-dominant national pattern, considering that more than 70 percent of our nation’s baseload electricity is derived from coal and nuclear fuels each year. To meet our escalating need for reliable electricity, utilities are increasing the workload of their existing plants. This is reflected by the rising “capacity factor,” which is the amount of power produced as a percentage of a unit’s hypothetical maximum.

At U.S. nuclear generating stations, the capacity factor has increased from 66 percent in 1990 to more than 90 percent in 2002. In

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35 EIA, Nuclear power: 12 percent of America’s generating capacity, 20 percent of the electricity, 2003
the same years, the capacity factor for coal plants increased from 59 percent to 70 percent.26

Developing a new fleet of power plants to meet the growing demand of consumers will require considerable resources over time. The goal for the state of Ohio must be to continue with indigenous resources utilized in a clean, environmentally conscious manner, while installing new technologies to meet growing energy needs in compliance with environmental regulations.

**Need For Investment**

Economic and regulatory uncertainty discourages companies from investing in experimental energy production methods and unproven technologies. Equity markets will not assume those levels of risk without seeking operating performance guarantees from the technology provider.

For example, IGCC is a clean coal technology that turns coal into a gas and then removes impurities from the “syngas” before it is combusted. IGCC results in lower emissions of sulfur dioxide, particulates and mercury and also offers improved efficiency compared with current conventional pulverized coal when employing carbon sequestration strategies.27

Though this new technology looks promising, an IGCC plant could cost in excess of $1 billion to build, depending upon variables such as the inclusion of carbon sequestration measures and the use of alternatives such as biomass fuels. Companies are reluctant to assume this massive risk without adequate assurances that their investments will be safeguarded. To expect that the technical and financial risks in this new technology will be borne solely by risk-averse shareholders is unreasonable. Financial and technical risks associated with expensive, large generation facilities make other financing options difficult as we have seen with nuclear, refiners, liquefied natural gas (LNG) and similar energy infrastructure.

Given the barriers to financing new power plants, utilities may seek joint ventures with government agencies or additional forms of government support. For example, utilities might work proactively with the DOE to secure a partnership to build an IGCC demonstration plant in Ohio. One additional benefit of the demonstration could be the development of (Ohio-made) General Electric turbines capable of generating electricity from hydrogen produced from the demonstration project. In addition to producing electricity from Ohio coal, commercially produced hydrogen could lay the foundation for the state to become a leader in the hydrogen economy.

Another challenge in encouraging new power generation infrastructure is that Ohio’s economic-development incentives programs are not currently structured to attract major capital expenditures. Rather, the existing incentive programs are intended primarily to attract large numbers of jobs. Therefore, a modern capital-intensive power plant with superior production and environmental performance that would retain only a small number of jobs currently receives fewer incentives to locate in Ohio than would a retail establishment with higher numbers of relatively lower-wage positions. This factor serves as a disincentive to new, environmentally superior energy infrastructure investments in the state. The investment disincentive keeps the older and generally less efficient energy infrastructure in place and subject to repeated expensive updates and retrofits, and moves major capital projects to other states within the region.

**Upgrades Are Essential**

There are many technologies under development—including Oxycombustion, Ultrasupercritical (USC) generation, Ammonia Scrubbing Multiemissions Control Systems and IGCC—that would add generation capacity and comply with environmental requirements. Development and deployment of these new technologies is essential. In the meantime, utilities will address the needs of Ohio’s existing power plants.

Utilities often base the rate of change on two criteria: efficiency gains and economic dispatch. Generally, utilities will meet environmental compliance at the lowest cost. As such the new fleet of power plants eventually will overtake the old fleet in meeting emissions regulations, but this level of compliance will come at a tremendous financial cost.
The two methods for upgrading current power plants to meet regulations are retrofitting and repowering. Retrofitting requires adding environmental compliance measures onto existing units. This generally does not require extensive shutdown time. Retrofitting existing power plants with new carbon-capture and sequestration technologies may lessen capital costs compared to building new plants. Repowering, however, entails gutting existing structures and replacing equipment on the current footprint of the power plant. Operating costs with either set of upgrades may vary over time depending upon plant performance.

Among the new technologies and advanced materials now under development are those to permit operating pulverized coal plants under USC conditions (i.e., high steam temperature and pressures) and fluidized bed combustion (FBC), which will result in higher efficiency power plants that will generate fewer emissions, such as SOx, NOx and CO2, than do conventional plants. The development of systems that will enable emissions reductions at lower costs will enable power producers to upgrade their fleet of power plants while increasing efficiencies to almost 50 percent.38

Another reason that existing plants must be operated at an optimum level is that it takes many years for companies to secure the permits, siting approval and regulatory clearances to allow new facilities to be up and running. Lack of consistency among federal, state, tribal and regulatory agencies complicates development. It can take up to 12 years to secure the necessary permits for transmission lines, up to two years to obtain permits to build power stations and another three- to five years to build the generating stations themselves.

Companies already are spending money on meeting clean air regulations. In some cases, state and regional clean air authorities are adopting more stringent regulations than the federal government. Uncertainty in regulations, as well as multiple regulating environments, can drive up development and deployment costs for retrofitting an entire fleet of power plants or constructing a new plant.39 These delays can tie up hundreds of millions of dollars and complicate risk management strategies. In addition, delays increase cost exposure for the investment community, thereby reducing investment in existing plants and inhibiting the deployment of advanced technologies such as IGCC and USC. Uncertainties over regulations make the investment challenge even more difficult to predict.

New Transportation Fuels: Coal To Liquid

Coal-to-liquid (CTL) technology is under development as a domestic alternative to imported oil. CTL is one of two processes whereby coal is heated or gasified and converted into a variety of substances including gasoline, kerosene, diesel and jet fuels.40 The National Coal Council in April released an ambitious report outlining plans to significantly expand CTL technology to offset approximately 10 percent of the nation’s petroleum demand.41

In May, 2006 the Department of Defense (DOD) began seeking proposals from companies interested in supplying up to 200 million gallons of alternative or synthetic fuels in anticipation of major field tests by the Air Force and Navy in 2008 and 2009. These planned field tests are part of the military’s Assured Fuel Initiative designed to decrease its consumption of foreign sources of oil while also decreasing greenhouse gas emissions. The Pentagon is the single largest consumer of aviation fuels in the country. The fuels would likely be derived from a variety of sources including coal (through a CTL process known as Fischer-Tropsch Reforming), tar sands, and oil shales.42

As part of the Department of Defense’s program, Ohio has commenced its own Ohio Assured Fuels Initiative to utilize coal as an alternative to other fuel sources. The house appropriations committee has approved $7 million in funding for the small-scale project to take place at Wright Patterson Air Force Base in Fairborn, Ohio. The program will focus on the feasibility of converting Ohio coal into liquid jet fuel as part of the CTL technology.43 Pennsylvania, Wyoming and Montana also are pursuing coal-to-liquid projects using promising technology to promote nonoil alternatives.

Gasification—Synthetic Gas for Industrial Processes

In the 1990s, many “peaker plants,” which supply additional electricity at times of highest demand, were built to utilize what used to be cheap and abundant natural gas. In recent years, however, natural gas prices have skyrocketed, and electric utilities now are looking for opportunities to retrofit these plants to utilize other sources of fuel.44

The utility industry is not alone in its need to find other sources of energy to fuel its growth. For example, Ohio’s extensive glass manufacturing industry uses natural gas and is exploring other less expensive alternatives, such as producing “syngas” by gasifying coal. Syngas production would be appropriate for combined cycle combustion turbines (utility-scale generation) and for industrial production and utilization, but not for peaking turbines. This is

38 World Coal Institute, 2006
39 Barcott, 2004
40 UltraClean Fuels, 2006
41 Miliken, April 26, 2006
because peaking turbines are, by definition, low-capacity units that don’t run enough to justify the capital cost of a gasifier. The state may need to address potential siting issues for gasification facilities, similar to those for transmission projects, if such plants are to become a reality in Ohio.

**Coal a Raw Material Feedstock**

Chemical companies have traditionally used oil and natural gas as feedstock for a variety of products. The American Chemistry Council reports that the industry’s feedstock costs topped $40 billion during 2005, up from $34 billion in 2004 and $25 billion in 2003. These costs are triple the $12.8 billion the industry spent in 1999. As gas and oil prices skyrocket, the possibility of converting coal to chemicals becomes increasingly promising. Several U.S. companies are pursuing coal-as-feedstock projects and Ohio coal may find new markets.

**OUTLOOK: OIL AND NATURAL GAS**

**Independent Producers and “Small Oil”**

Ohio is now the seventh largest consumer of natural gas in the nation, with an annual consumption of 848,391 thousand cubic feet (mcf). Although the state has a long history of production, Ohio currently does not produce enough oil or natural gas to meet its own need. In 2003, Ohio produced 93,641 mcf of natural gas (11 percent of total state consumption), making it the nation’s 17th ranked producer. Ohio produced 5,651,705 barrels of crude oil in 2005 making it the 18th ranked domestic crude oil producer and accounting for less than 1 percent of total U.S. supply.

In Ohio, natural gas is used for home heating, chemical production, clean manufacturing processes and small peaking (behind the meter generation). Ohio’s oil is used mostly to produce motor oils and transportation sector blends.

All of Ohio’s oil and natural gas producers are independent producers. An independent producer is a nonintegrated company that receives its revenues from oil and natural gas production at the wellhead. Unlike major oil companies, independents have no retail or refinery operations, operating exclusively in the exploration and production business.

Independents are not the “big oil” companies the public may associate with this industry, though collectively they represent a sizable production capacity. Nationally, independent producers account for 90 percent of domestic oil and natural gas wells drilled and produce approximately 85 percent of domestic natural gas and 65 percent of domestic crude oil.

New wells constantly must be drilled to meet production demand because existing wells deplete. Access to potential fields is critical to the maintenance of this industry. Without new wells to replenish reserves, production will decline and the industry will be forced to liquidate. Drilling for oil and natural gas is a high-risk enterprise and independents face financial challenges unlike those of the major producers.

**Local Supply = Fewer Disruptions = Less Volatility**

Supply of oil and natural gas in the wake of Hurricane Katrina and other severe weather events in 2005 demonstrated the need for diversified sources of these fossil fuel resources. Investments in oil pipelines and natural gas storage facilities have been lagging in recent years, and these events brought to the forefront our nation’s lack of excess capacity. These factors coupled with the fact that imports originate in increasingly unstable parts of the world add up to an energy market deeply concerned about potential supply disruptions.

Ohio producers can help offset concerns about limited or disrupted pipeline capacity and other delivery constraints, particularly during
peak demand periods. These constraints are particularly important in Ohio because of the many consumers of natural gas. Since local production feeds into the eastern Ohio distribution system, Ohio citizens tend not to experience the extreme price swings caused by short-term peak-demand volatility that many high population centers suffered during recent years.  

**Extending Ohio’s Oil and Gas Production**

To maintain production, Ohio must increase the rate of technological innovation to extend the life of existing wells while finding ways to explore unconventional resources such as coal-bed methane. To meet the state’s growing production needs, the exploration and production (E&P) industry stepped up requests for access to resources on public lands and in urban and suburban areas in Ohio. This concept has generated considerable concern from portions of the public, and regulators are working to develop a balanced approach to this issue.

Ohio’s gathering, collection, storage and delivery infrastructure must be updated and expanded to allow for growth. Oil and natural gas pipelines must be updated, natural gas storage facilities must be expanded, and methods for gathering and processing natural gas must be enhanced.

The industry has been working to forge partnerships with state geologic surveys and other state agencies to share data and resources and develop risk-based management systems to keep up with the need for high-quality data.

Finally, the industry must continue to extract oil and gas in an environmentally sensitive manner. To accomplish this goal, Ohio should maintain strong and responsive regulatory programs that promote cost-effective production strategies. The state should continue to stay at the forefront of training for oil-field- and pipeline-emergency response and maintain good lines of communication throughout the decision-making chain to ensure program efficiency and effectiveness.

**OUTLOOK: NUCLEAR ENERGY — Reliable Baseload Generation?**

Nuclear energy is one solution to meet Ohio’s energy needs. FirstEnergy Corp. Currently owns and operates two nuclear power plants (Davis-Besse and Perryburg), which generate low-cost baseload power to customers in northern Ohio. Data from the U.S. Energy Information Administration show that as of June 2006 Ohio is the nation’s 19th largest producer of nuclear energy, generating about 2 percent of total U.S. Production.

**PRIORITIES**

**Maintain And Enhance Existing Fuel Resources**

To extend our state’s resources, reduce our reliance on foreign sources of energy and make the state more secure, Ohio must diversify its energy resources by identifying other sources of fossil fuels and adding nuclear, wind, solar, biomass, hydrogen and other clean alternative technologies.

The potential hydrocarbon-based alternatives include stand-alone gasification plants, which could produce syngas to be used like natural gas for home heating or manufacturing. The syngas from these plants could be sold to utilities for electric power generation or could be converted to transportation fuels. By distributing clean coal-based syngas plants throughout Ohio and the nation, domestic dependence on foreign energy and centralized petroleum refineries—which can be disrupted by weather, political events, loss of feedstocks, or terrorism—would be reduced.

Successful development of syngas facilities is feasible only if the market price of natural gas remains high. Financing a plant would hinge on developers being able to sell syngas at a high-enough price to cover the cost of gasifying coal and the return on capital investment in the plant. A large capital investment in a gasification plant could take 20 years or longer to recover. The state should consider ensuring cost recovery for producers by requiring or somehow encouraging industry and utility users who agree to use syngas to sign long-term contracts for the gas offtake. In addition,
Case Study

Powerspan ÉCO System - Bridging the Energy-Environment Divide

Powerspan Corp. is a Portsmouth, N.H., clean-energy technology company forging the way for coal-fired plants to provide clean, competitive power from their existing bases. Powerspan has developed a system called its Electro-Catalytic Oxidation (ECO) system, which is an air pollution control technology that achieves major reductions in air pollutants from coal-fired plants in the four “pollutants of concern” (SO₂, NOₓ, Mercury, and particulate matter).

The system is retrofitted onto an existing power plant and provides 99 percent reductions in sulfur dioxide (SO₂) emissions, 90 percent reductions in nitrogen oxide (NO) emissions, 80 to 90 percent reductions of mercury (Hg) emissions, and 95 percent reductions of fine particulate matter (PM2.5) emissions. This multipollutant solution significantly lowers costs for owning and operating a power plant. In addition, the ECO system produces ammonium nitrate fertilizer, which can be sold to help offset operating costs and minimize landfill disposal.

Powerspan successfully demonstrated the ECO process in a 50 megawatt commercial plant at FirstEnergy Corp.’s R.E. Burger plant in Shady Side, Ohio, and is proceeding to install a second system at First Energy’s Bay Shore plant in Oregon, Ohio.

The company also recently announced that it will test a promising CO₂ capture technology at the Burger Plant. The pilot project will process emissions from the ECO system to capture CO₂ in the flue gas and prepare it for subsequent sequestration. The pilot project will provide information on the cost effectiveness and ability of the system to capture carbon on a commercially reliable scale.

The Burger plant pilot is a joint project among Powerspan Corp., FirstEnergy and the Midwest Regional Carbon Sequestration Program, one of seven regional partnerships set up by the U.S. Department of Energy (DOE) to research carbon sequestration. According to Frank Alix, Chairman and CEO of Powerspan, the Burger CO₂ pilot is the first of its kind in the United States: "to our knowledge, this will be the first time that combined CO₂ capture and sequestration from a conventional pulverized coal-fired power plant will be demonstrated in the U.S. If successfully proven, this technology could help keep existing coal-fired power plants economically competitive in a carbon-constrained world." 43

the state should support corollary federal efforts to provide a price floor for such synfuel plants to promote more diversity of supply.

Distributed Energy

Achieving greater diversification will require modifications to Ohio’s existing power stations, coupled with new thinking about the method in which power is transmitted and distributed. Ohio’s electric generating infrastructure, like that of many states, is reliant upon the traditional “spoke and hub” system. This system contains large, centralized generating stations, usually burning coal or other fossil fuels that run turbines to push electricity across miles of transmission lines.

43 Procopis, 2006

Distributed energy resources are small-scale power generation
facilities (typically in the range of 3,000kW - 10,000 kW) located close to where electricity is actually used. Distributed power could help with problems of energy storage and national security by preventing an attack or natural disaster from knocking out a larger portion of the energy grid. Distributed generation also could reduce transmission losses incurred in the course of transporting electricity longer distances from centrally located power plants.45

In order to transmit distributed energy, however, Ohio must develop ways to use the existing electric distribution system more safely and efficiently. Distributed energy increases the infrastructure needs of the grid and would require moving power between microgrids. Establishing such infrastructure could be expensive and difficult. It is only an economic possibility today in areas such as small industrial parks, universities, cooperatives and very small communities. Additionally, there are health and safety considerations for line workers when microgrids are switched on and off during outages without adequate safeguards being installed. However, when these issues are properly addressed, the benefits of distributed energy to communities are substantial.

**Carbon Dioxide Emissions**

Several federal and state proposals offer to reduce greenhouse gas emissions, carbon dioxide being the most abundant. Since coal contains more carbon per unit of energy than most fossil fuels, solutions for carbon dioxide capture and sequestration would be needed to ensure the future use of Ohio coal.

The midwest is the source of 20 percent of U.S. carbon emissions and 5 percent of global carbon emissions. Traditional pulverized, coal-fired power plants are difficult to retrofit with technology that removes carbon dioxide from the flue-gas stream because such technology is extremely expensive and energy intensive. Many engineers believe that emerging technologies--such as gasification, IGCC, oxy-generation, ECO, USC and ammonia scrubbing--could help reduce carbon emissions in Ohio and provide an easier path to carbon separation and sequestration.45

Research and development funding and technology advancement must occur before such technologies become commercially available. Particularly important is research and evaluation of emerging technologies and their applicability in Ohio.

The state also should consider taking a leadership role in developing or joining a voluntary carbon trading program to identify economic incentives for reducing carbon emissions. Through this medium, Ohio could encourage the participation of other state businesses, industry, institutions and organizations. A small, time-limited incentive, such as a reduction in an entity’s income tax obligation, could encourage organizations to start and support such a system. Whatever program is developed must include adequate monitoring and verification in order to have any meaningful impact. The monitoring and verification industry is forecast to become a trillion dollar business in the next decade, and Ohio and its companies should be prepared to participate in this market.

**FutureGen**

FutureGen is a DOE initiative to build the world’s first integrated sequestration and hydrogen production research power plant. The $1 billion project is intended to create the world’s first zero-emissions fossil fuel plant.

Ohio was one of seven different states competing to serve as the FutureGen site. In May 2006 the Ohio FutureGen Task Force was one of seven states to submit proposals for consideration: one to be located in Tuscarawas County and the other in Meigs County. The Task Force, which included representatives from OAQDA, OAQDA’s Coal Development Office, Ohio Rail Development Commission, ODOD, Ohio Water Development Authority, Governor’s Office of Appalachia and U.S. Department of Agriculture’s Rural Development Office together offered a diverse package of incentives to the FutureGen industrial alliance and U.S. DOE.46

Unfortunately, Ohio’s proposals were not forwarded for funding, losing out to Texas and Illinois. There, four sites will be evaluated further for the need to meet carbon sequestration requirements and other technical specifications.

The hard work logged by the Task Force in developing the FutureGen proposal will not be in vain, however, as agencies are already using this information along with the partnership developed for the project to lure additional generating capacity to the state.

One interesting finding from this process was the fact that Ohio lags behind other states in the amount of information available to properly site a facility of this type. As our nation moves into an era where deep geologic sequestration of carbon dioxide may become a reality, Ohio must develop a better understanding of its deep geological formations that can accommodate CO₂ injection. As an endnote to the Task Force, Governor Taft and the state legislature have appropriated funding to be coupled with funding from the

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45 U.S. Department of Energy (U.S. DOE), Distributed energy, 2006
46 World Coal Institute, 2006
47 Ohio Air Quality Development Authority (OAQDA), Progress Report, 2006
OAQDA to drill a deep test well to gain a better understanding of Ohio’s bedrock. \cite{OAQDA} Data collected from throughout the FutureGen proposal process will undoubtedly help in the siting and permitting of future carbon sequestration facilities.

**Upgrading the Grid**

Public policies, including investment incentives, should encourage operators to revamp the national electrical grid, which was designed for 1940s-era consumption before the advent of long-distance transfers and power market trading. Upgrades will help support reliable and efficient economic transactions. The deterioration and inadequacy of our current transmission system raises the threat of power outages in major cities at a time when our increasingly high-tech economy has a growing need for high-quality power.

The Energy Policy Act of 2005 includes recommendations for grid upgrades. \cite{EnergyPolicyAct2005} For example, the Federal Energy Regulatory Commission (FERC) can expedite improvements to certain critical corridors. \cite{FERC} Ohio should consider facilitating these critical corridor upgrades, which should also be linked to the location of advanced energy resources so that grid improvements are completed with the future in mind. Upgrades should occur in high-density locations where alternative energy placement, such as Combined-Heat and Power (CHP) plants, solar arrays, wind generators and microturbines, would help alleviate grid stress.

**Job Training**

Many energy producers have an aging workforce. The state needs to undertake a survey regarding the education and training needs of companies that mine or drill for fuels, manufacture and maintain equipment, and produce energy. The state also must understand what steps will alleviate workforce shortfalls. For example, due to the decline in coal production in the eastern part of the country over the last 20 years, a whole generation of adequately trained coal miners and mining engineers has been lost. Similar trends have occurred in other resource extraction industries, including nuclear and oil engineering. \cite{OhioTraining} Ohio needs miner training programs at technical and two-year colleges and should reinstate mining engineering programs at colleges and universities.

**New Plays Could Impact Oil and Gas Extraction**

The 2005 Energy Policy Act mandates exploration and development of new oil and gas “plays.” An oil and gas assessment play is a set of known or postulated gas or oil accumulations that share similar properties such as source rock, migration pathway, timing, trapping mechanism and hydrocarbon type. Ohio has vast reserves of unconventional sources, such as Devonian shale, coal bed methane and tight gas sands that might be economically accessible utilizing the right resources. The costs associated with developing these resources may be high, and the private sector is unlikely to bear them without substantial government assistance. In the long term, further research through federal and state support could develop these Ohio resources and contribute to U.S. supply security.

**Reregulation**

There has been recent speculation centering on the potential to reregulate Ohio’s electric utility industry prior to the rate cap removal set for 2009. \cite{Reregulation} There should be a strong connection between state and federal policies to protect consumers if reregulation occurs. The topic of reregulation brings up a host of issues, including the potential effect upon market prices, the ability to draw the type of capital investment required to build coal-fired plants and gasification facilities, and the environmental consequences. The debate is still in its developmental stages and merits close review if and when movement begins to take place. Options and choices will need to be developed at least 12 months before the cap removal deadline in Ohio to allow for adequate implementation.

**Rail Issues**

\begin{thebibliography}{9}
\bibitem{OAQDA} OAQDA, *Ohio FutureGen task force final report*, 2006
\bibitem{FERC} Federal Energy Regulatory Commission, 2005
\bibitem{OhioTraining} Hill, 2006
\bibitem{Reregulation} Birgisson, 2005
\end{thebibliography}
Coal is one of the largest commodities, by weight, shipped by rail in the United States. Because the United States has few class one railroads that transport coal, some utility operators have become captive rail customers, meaning that their only option for shipping coal is a single railroad. This issue can be a problem for rail customers that transport bulk commodities, such as coal, grain and chemicals, which cannot be shipped economically by truck or barge.12

This issue is not as significant in Ohio as in western or southern states. Ohio has about 5,000 miles of railroad tracks that Class One, Two or Three Railroads use; regional rail providers; and approximately 35 short-line railroads, according to James Seney, Executive Director, Ohio Rail Development Commission. (Personal communication, June 1, 2006). In addition, Ohio is fortunate to have additional transportation options, including the Ohio River and the Great Lakes to barge-transport large quantities of raw materials. Finally, the overland distance between any one of these transportation corridors is close enough to the end user that trucking to the final destination is always an option. Ohio must maintain this strong competition to ensure the free flow of goods and reduce the impact of captive rail in the future. This will be important for shipping imported goods into Ohio, particularly in the automotive industry. Access to adequate feedstock may also impact the growing biofuels industry in the state.

A more pressing issue than captive rail in Ohio is that of private switching units and the lack of access between lines owned by different companies. Access to numerous privately owned switching units across the state prevents the freedom of movement of commodities because the privately controlled companies have no legal obligation to allow access by their competitors. Short lines also need to be provided with incentives to enhance service and access. There are a limited number of such cases across the state that may impact the transportation of energy feedstock.

**Beginning a Dialogue About Nuclear Power in Ohio**

New technological advances have reduced many of the safety issues that concerned the general public during early adoption of nuclear power. The Energy Policy Act of 2005 offers benefits to encourage industry to build new nuclear reactors, including loan guarantees, federal risk insurance and tax credits.13 This year, 16 companies nationwide have expressed interest in operating a nuclear power plant, (compared with two last year), although none has filed an application.14 There appears to be, however, no current interest among Ohio utilities in building additional nuclear generating capacity within the state.

Given Ohio’s close proximity to Canada, the state may want to consider joint partnerships with Canada to adopt technology such as the Canada Deuterium Uranium (CANDU) reactors, which are pressurized-heavy-water, natural-uranium powered reactors developed by a partnership of Canadian government agencies and private partners. This cross-border partnership could lay the groundwork for access to other sources of Canadian fuels. Another consideration is the potential for collaboration between the United States Enrichment Corporation (USEC), located in Piketon, Ohio, and energy companies exploring nuclear energy production for the future.

Another intriguing long-term possibility lies in ongoing efforts with U.S. DOE’s fusion reactor program, called a “stellerator,” and an international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power, called the International Thermonuclear Experimental Reactor (ITER).

**POLICY OPTIONS FOR FOSSIL FUELS AND NUCLEAR ENERGY**

**Assessment With an Eye Toward the Future**

**Policy Option 1:**
Ohio should consider the technical, financial and environmental needs of its existing lower cost, coal-based baseload fleet of electric generating power plants in order to improve their production efficiencies and environmental performance.

**Coal Gasification and Liquefaction**

**For Processed Gas**

**Policy Option 2:**
Ohio should conduct research into the economic viability of industrial-scale coal gasification and liquefaction as a domestic alternative to natural gas and promote long-term state offtakes for such production in state buildings, offices and vehicles.

**Policy Option 3:**
Ohio should explore different ways to use coal resources in nontraditional methods (e.g., Coal to Liquid processes).

**Policy Option 4:**
Ohio should consider ensuring cost recovery for producers by requiring industry and utility users who agree to use syngas to

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12 Consumers United for Rail Equity, 2006
13 Energy Policy Act 2005
14 Baker & Mulson, 2006
sign up to a 20-year contract for the gas offtake.

**Clean Coal Technology**

*Policy Option 5:*
Ohio, and more importantly the federal government, must continue support for precompetitive and broad research as well as development in clean coal technologies including IGCC, Coal-to-Liquid, Oxy Combustion, UltraSuperCritical, and CO₂ scrubbing.

**State Incentives**

*Policy Option 6:*
In the same manner as job creation is promoted, Ohio should modify its business incentive programs to promote infrastructure investment. This may help attract industries, such as electricity generation, which are highly automated but are equally highly dependent upon infrastructure.

*Policy Option 7:*
Ohio should take a comprehensive look at its regulatory system to identify methods to overcome substantive and procedural barriers to the installation of new coal plants.

*Policy Option 8:*
Ohio should encourage distributed generation (DG), including fuel cells, as a compliment and supplement to electric transmission and distribution system expansion, and should remove artificial barriers to this new technology. Grid hardening from severe weather as well as homeland security objectives supports the DG approach.

*Policy Option 9:*
As new distributed energy sources develop, Ohio should find ways to meet the critical infrastructure needs, including manufacturing installation requirements, to protect the health and safety of all workers employed in this new field while avoiding any barriers or costs that block the deployment of the technology.

*Policy Option 10:*
Electric and gas utilities in Ohio should develop standby, backup and supplementary rates that encourage distributed generation, similar to what California and New York have done.

*Policy Option 11:*
Ohio should identify and facilitate development of Combined Heat and Power (“CHP”) opportunities as a means of increasing fuel utilization efficiency in multifamily, industrial and commercial applications.

*Policy Option 12:*
Ohio should establish a Distributed Generation (DG) and Combined Heat and Power (CHP) registry to help consumers and manufacturers gain an appreciation of the availability and merits of these technologies.

**Increasing Oil and Gas Production**

*Policy Option 13:*
Ohio and the federal government should extend Ohio’s current well production by promoting research that leads to technology deployment such as fracture detection, 3D seismic imaging, new drilling and completion techniques, enhanced recovery and technology transfer.

*Policy Option 14:*
The governor should appoint a task force to make recommendations on the major issues revolving around access to “hard to reach areas,” such as public lands and urban and suburban communities, for oil and gas production to protect the state’s energy supply and to promote economic development.

*Policy Option 15:*
Ohio and the federal government should work with the private sector to significantly expand and upgrade the oil and gas infrastructure within the state.

*Policy Option 16:*
Ohio and the federal government should establish a stronger relationship with the oil and gas industry to expand innovations in data management, such as the development of a risk-based data management system.

**Streamlining Regulatory Processes**

*Policy Option 17:*
No permit should take longer than 12 months without a clear indication as to why the permit will require more time and an estimate for time of completion. Any cofire testing and permitting for an existing facility should be streamlined.

*Policy Option 18:*
Ohio should continue to actively promote clean alternative fuels as well as coal and clean coal options. Additional incentives for promoting these options could include expedited permitting, grants and tax credits.

*Policy Option 19:*
Ohio should streamline the regulatory process that utilities must follow to retrofit and/or repower power plants and should offer incentives for them to do so.

*Policy Option 20:*

Ohio should simplify the permitting and right-of-way acquisition processes for transmission and distribution projects, and provide one-stop permitting for new generation, liquids, alternative fuels or pipeline projects.

Transmission and Capital Investment

Policy Option 21:
The PUCO should review the cost-recovery process for transmission, smart grid, metering, Broadband Power Lines (BPL) and distribution investments to reflect that new marketplace rules and practices are rapidly changing the way investment decisions are made. Regulated utilities should receive fair and adequate returns while removing artificial pricing and cost barriers for unregulated utilities and retail service providers so they are not continually hindered from competing and providing competitive supply alternatives as contemplated by the legislature.

Policy Option 22:
Ohio should support and enhance ongoing utility and PJM/Midwest ISO Regional Planning processes to insure transmission reliability, investment, expansion and cost effectiveness.

Encouraging Participation In Voluntary Carbon Credit/CO₂ Sequestration Programs

Policy Option 23:
Ohio should endorse a voluntary carbon credit program that includes monitoring, reporting, verification and trading. The program should include an incentive such as appropriate tax incentives to help organizations engage in this program.

Policy Option 24:
The state and federal government should increase research- and development funding for technologies with the potential for compression of CO₂ and sequestration. Specifically, research into geological and soil sequestration, including biosequestration and the conversion of carbon dioxide to biofuels, is essential. This will help reduce the cost of separation and increase the reliability of this technology.
Modern transportation is often overlooked as a contributing factor to our way of life. Personal mobility by car and by public transit in larger urban areas gets us where we want to go when we want to be there. Freight transportation enables every American person, company and organization to purchase, sell, use, create and expect goods from the worldwide marketplace. Overall, however, the American public has little appreciation of the complex set of supply, distribution and logistics chains that make what we do every day possible.

Because transportation is interwoven with nearly every element of our lives, any program to achieve energy savings must give special attention to promoting energy-saving technology, products and processes in transportation. In order to be effective, programs should include a benefit to participating companies and their short- or long-term profitability.

According to the Bureau of Transportation Statistics, Ohioans are sixth in the nation in vehicle miles traveled annually. By not only are Americans spending more time in their vehicles, the types of vehicles they are choosing to drive have become increasingly heavier, more powerful and faster with less than exceptional improvements in fuel efficiency. The result of these trends is an overall increase in energy utilization, including traffic congestion, and increased vehicle emissions from mobile sources.

Developing new fuel and power technologies is essential to maintaining U.S. economic competitiveness. As transportation fuel prices rise, businesses can choose among a few options, including passing along increased costs for goods and services to customers, absorbing some or all of these additional costs in order to keep existing customers, and adopting fuel-efficiency methods such as travel reduction, maintaining route efficiency and improving vehicle maintenance methods.

In addition, moving toward domestically produced fuels would help ease price volatility by decreasing demand for petroleum-based fuels that come from increasingly unstable regions of the world. New and emerging technologies, such as biofuels and fuel cells, represent a method for reducing foreign oil consumption while creating new opportunities for high-paying jobs for Ohioans.

Summit participants recommend that public-private partnerships be established with the goal of improving transportation efficiency by considering increased use of intermodal and mass transit

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55 U.S. Department of Transportation Bureau of Transportation Statistics, 2001
56 EIA, Household vehicle energy use, latest data and trends, 2005
57 National Center for Transit Research, 2006
systems, decreasing mobile source emissions and supporting new energy-technology development.

**OUTLOOK**  
**New Technologies And a New Way of Thinking**

Ohio’s transportation system was made possible by sustained state and federal revenue, but today’s higher energy costs could reduce the state’s ability to fund projects that will impact travel and the transport of goods. Strategies for reducing energy consumption fall into three categories: developing new fuel and power technologies and improving existing ones; creating new policies and programs aimed at reducing travel, including more “smart” regional development; and establishing transportation policies that cut back on fuel waste.

New technologies such as biofuels and idle reduction techniques, coupled with hybrids and automotive fuel cells, can play a role in stretching existing fossil fuel stocks and decreasing harmful tailpipe emissions. Along with road improvements (such as intersection enhancements that reduce vehicle idling and congestion and signal coordination projects to improve traffic flow), intermodal transportation and mass transit have the potential to stretch fuel supplies and should be increased in the state of Ohio. By nature, states that have adopted such policies think more holistically about their transportation needs and are more responsive to local needs and concerns instead of adopting a one-size-fits-all approach.

Biofuel production represents a promising possibility for Ohio. The fact that 55 percent of the state is involved in agricultural production means that feedstocks are available.\(^{58}\) Ethanol, biodiesel and methanol markets represent an expanding niche for the agricultural industry. New production methods in the future, including cellulosic ethanol, also represent new research and manufacturing challenges that could help stimulate private-public partnerships and enhance the adoption of these technologies within the state.

Fuel cell technology represents one of the brightest possibilities for Ohio to become, a research and manufacturing leader. Ohio’s new fuel cell initiative is a good start, with approximately $103 million in state matching funds dedicated to attracting economic growth in this sector.\(^{59}\) In order to make this technology competitive, however, additional state and federal funding is needed for research on new technologies, such as plug-in hybrids, flexible fuel vehicle (FFV) hybrids, diesel hybrids, cellulosic ethanol, algal biodiesel and Fischer-Tropsch fuels.

In order to reduce energy consumption society must consider how current transportation policies are planned, funded and administered at all levels of government. One recent report by the U.S. Chamber of Commerce’s National Chamber Foundation\(^{60}\) predicted that without significant modifications the Federal Highway Trust Fund will be bankrupt by 2009. This obviously would jeopardize Ohio’s primary source of funding for transportation infrastructure.

The Ohio Department of Transportation (ODOT) receives approximately $1 billion per year in federal transportation funding. ODOT suballocates a large portion of its federal funding, nearly $300 million annually, directly to local governments or on behalf of local government programs for transportation priorities. The remaining federal funding ODOT receives is directed towards highway construction and rehabilitation and safety improvements, among other things.

The likelihood of Congress allowing the Federal Highway Trust Fund to go bankrupt is low and action to address this issue already has been considered. A national commission was established in the most recent federal transportation funding bill, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), to specifically examine and make recommendations on future federal transportation revenues and policies.

ODOT also receives nearly $1 billion in state transportation revenue. By Ohio’s constitution, this state funding can only be spent on road improvement projects. Public transportation and aviation projects are predominately funded in Ohio by federal transportation funding. Of the general revenue funding made available for these projects, approximately $18 million and $2 million are aimed at transportation and aviation projects respectively. These

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\(^{58}\) Farmland Information Center, 2006  
\(^{59}\) Office of the Governor, State of Ohio, 2005  
\(^{60}\) U.S. Chamber of Commerce, National Chamber Foundation, 2005
amounts are at record lows because of competing priorities for the state’s limited general revenue funding. State decisionmakers should highlight policies directly affecting energy consumption and explain to the public how transportation funding is obtained, allocated and spent.

Another problem facing Ohio legislators is noncompliance with Federal Clean Air standards in major metropolitan areas. The Ohio EPA says that it will be very difficult for eight northeastern counties to meet these new regulations, designed to reduce ground-level ozone and fine particulate matter generated by mobile sources. These new regulations, which will come on line in 2009, will be the responsibility of future leaders to sort out and address. The state may have no other option than to request the region be designated a higher nonattainment status. This designation would buy the state more time to determine how to come into compliance with the new regulations, but would also trigger more stringent mandatory compliance requirements.  

Beyond the proven human health impacts of excessive ground-level ozone, noncompliance with these new standards will result in the loss of federal highway funding, loss of industrial and commercial siting in the state, and decreased economic production. Different policy choices now could reduce consumption, increase air quality and maintain or even enhance economic and quality-of-life factors in this and other regions around the state.

**Priorities**

**Renewable and Alternative Fuels**

Technologies such as natural gas and diesel have become more reliable and cost-effective over time and will continue to play an important role in our nation’s transportation future. The state also should pursue development of renewable clean fuels such as ethanol and biodiesel. National standards and infrastructural support should be developed for the newer fuels so the transportation industry can be confident that the rules are viable, safe and useful to implement with wider public awareness and availability.

Biofuels production in Ohio is beginning to move forward but significant challenges remain. In Defiance, Ohio, a biodiesel processing facility that opened last summer is presently expanding its operations. In Toledo, another company plans to begin building a plant this year.  

There is, however, a widespread industry perception that current state environmental regulations make the permitting process for ethanol and biodiesel facilities difficult. Ohio needs better coordination among its agencies and their various policies in this sector. This includes environmental policies administered by the Ohio EPA and ODOT and policies aimed at attracting new businesses to the state. Flexibility at the state level is necessary if we are to balance the need to attract and retain biofuel production facilities with the need for adequate environmental safeguards. Legislative action such as Ohio Senate Bill 265, which was signed by the governor in May 2006, may address some of these issues by streamlining the permitting process for minor sources of air pollution while also strengthening the Ohio EPA’s authority over toxic emissions from major sources.

Ohio possesses a general lack of retail availability of biofuels. Ohio previously had a production tax credit for ethanol, but these cost savings were not passed along to the consumer and the program was discontinued. Other states have developed incentive programs for retailers to sell biofuels, mostly in the form of grants and tax credits. Adopting statewide renewable fuels standard, as 15 other states have done or are considering, will provide the necessary impetus to increase in-state production of renewable transportation fuels. A renewable fuels standard would gradually increase over a period of years the percentage of renewable fuels required as part of the state’s total transportation fuels. This would promote the development of the infrastructure and distribution capacity to offer these fuels to the market. To meet this increased demand, in-state production must be ramped up and production incentives should be considered to ensure adequate supply and distribution. Additionally, flexibility should be built into the proposed standard so that low blends (E10 - 10 percent ethanol with 90 percent regular unleaded gasoline) and high blends (E85 — 15 percent ethanol) as well as low blends (B2) to high blends (B99) of biodiesel would count towards attainment compliance with EPA clean air standards within the State Implementation Plans (SIP).

For example, Iowa, the nation’s largest corn growing state, recently passed the Iowa Renewable Fuels Standard, which mandates that the state gradually increase the percentage of its transportation fuels that are derived from renewable sources. As drafted, the percentage of increase caps out at 25 percent by 2015. The measure passed with overwhelming support from both the Iowa Senate and House and was signed by the governor earlier this year. As a result of this and similar legislative action over recent years (such as the adoption of production incentives and requirements that the state automotive fleet use renewable fuels), Iowa has become a national leader in the production of corn-derived ethanol. By the end of 2006, Iowa expects to have 26 ethanol plants capable of producing as much as 1.6 billion gallons annually. This new industrial sector
is benefiting the state by providing high paying jobs through plant operations, facility construction and agricultural management.

Ohio established a small incentive program in 2005, and the legislature recently expanded on this by passing HB 245, which will provide about $1 million in incentive funds for biodiesel and E85 retail, storage and “rack” blending infrastructures. Gov. Taft signed HB 245 into law on July 6, 2006. This is a good start and will facilitate development of many new retail sites in Ohio. The Ohio Department of Administrative Services should build upon this new law to require that all vehicles owned by the state use fuels derived from renewable sources when possible. To come into compliance with this requirement all other departments should conduct a top down analysis of their vehicle fleet and require adoption of similar practices.

Ohio retailers have begun to express strong interest in E85 and biodiesel. In response to a recent solicitation by USDOE, 99 retail sites - all within two miles of interstate highways in Ohio - were identified. Many more are expected. Based on this rapidly growing interest and enthusiasm in the business community, Ohio has great potential to be a leader in retail biofuels sales, and many Ohio motorists stand to benefit. However, for this to happen, Ohio will need to provide more substantial grant incentive support to make E85 and biodiesel widely available to consumers.

Ethanol and biodiesel are both renewable and complementary “biofuels.” One is more suitable for light duty and the other suitable for heavy duty vehicles. Just as fuel distributors and retailers often offer gasoline and diesel at the same location, they can easily transition to offer E85, E10 and blended biodiesel. Also, it is often sensible to locate ethanol and biodiesel production plants close to each other. Bundling the incentives together provides longer term predictability for retailers and distributors to invest in converting or developing new refueling equipment at single locations at the same time.

Because E85 has fewer BTUs than gasoline, it takes more of this fuel to drive an equivalent distance. This increased cost puts biofuels at a competitive disadvantage to gasoline. By altering the cost structure to become based upon the BTU content of the fuel, Ohio would create a true apples-to-apples pricing structure, making the alternatives cost competitive with gasoline.

On the biodiesel market, state support for enhancing retail and rack blending facilities is important. Mid-Wood Inc., located in Bowling Green, Ohio, began selling and delivering fuel blends with 2- to 20 percent biodiesel to its customers in 2001. In 2003, it added B5 (5 percent bio composition) to its station. In 2005 it sold 1.5 million gallons to drivers with diesel engines including Volkswagen Rabbits and Bowling Green State University buses.

Mid-Wood is part of a growing trend. As of August 18, 2006, 27 biodiesel retailers and existed in Ohio. Additional state support, particularly for rack blending of biodiesel, is critical to expand the retail network, lower the transportation-related costs for biodiesel and ensure consistent fuel quality.

Another challenge for E85 and biodiesel are franchise agreements that prohibit some retailers from advantageous “product placement” for these biofuels. Iowa has passed legislation outlawing use of franchise agreements to restrict biofuels. This may be a good model for Ohio to consider at this time. Biofuels should be placed in a conspicuous place, “under the awning,” where high-profit blends are sold.

**Automotive Fuel Cells**

News reports often mention the benefits of fuel cell technology, yet it is important to note that fuel cells are many years away from reaching the mass commercial market. For example, there are numerous challenges to mass commercialization for automotive fuel cells. Until these issues can be resolved, most fuel cells are likely to be small in production capacity (under one mega-watt) and will remain mostly in stationary applications.

The major issues affecting automotive fuel cells include:

- **Cost:** fuel cells must come down in cost to be competitive with gasoline-powered internal combustion engines (ICE). The cost for a traditional ICE power plant is currently around $25-35/Kw. A hydrogen fuel cell must be less than $50/kw to be cost competitive.

- **Durability:** the durability of fuel cell systems must increase. Fuel cell systems need to be as durable and reliable as ICEs, i.e., 5,000 hour lifespan (150,000 miles equivalent) and must function over the full range of vehicle operating conditions (-40 degrees to +40 degrees C).

- **Air management:** air management for fuel cells is challenging because current compressor technology is not suitable for automotive fuel cell applications.

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66 McCarthy, July 6, 2006
66 Clean Fuels Update, 2006
67 Rapier, 2006
68 McKinnon, 2006
69 National Biodiesel Board, 2006
Case Study

*SWACO Trash To Transit*

The Solid Waste Authority of Central Ohio (SWACO) has introduced its first hybrid vehicle powered by Land Fill Gas (LFG). SWACO intends to retrofit at least 16- to 20 additional heavy-duty trash trucks to run on LFG, which is one of the most promising sources of biogas methane. It contains methane, carbon dioxide (CO₂) and other substances.

SWACO operates the fifth largest publicly owned landfill in the United States in Franklin County, Ohio. Through a contract with Firmgreen Fuels LLC of Newport Beach, Calif., SWACO will capture the valuable landfill gas and CO₂ to provide methane for the production of methanol. Another vendor will use this methanol to produce biodiesel fuel on site. The center is expected to produce up to 20 million gallons of methanol per year, enough to provide up to 100 million gallons per year of B20 biodiesel to the marketplace. The LFG also will generate 1.6 megawatts from an engine and microturbines to provide heat and hot water for the administration building and maintenance facilities of SWACO. The annual reduction of greenhouse gases attributable to this project will have the same effect as removing the emissions of nearly 12,000 cars from the road for a year, reducing oil consumption by more than 142,000 barrels per year, or planting 16,704 acres of trees.

The purpose of the project is to make landfill-gas-to-energy products environmentally sound and commercially viable. Current estimates predict that the project will save SWACO 95 percent in energy costs and produce enough electricity to take it off the grid. The compressed natural gas produced will save an estimated $100,000 per year in fuel costs. The project design is currently being reviewed by the EPA.

• **Thermal and water management**: using fuel cells at lower temperatures creates thermal discrepancies between the operating and ambient air temperatures. To rectify this, heat exchangers and humidifiers must be added to the system, and they use a portion of the power produced by the fuel cell, which decreases overall system efficiency.

• **Size and weight**: the size and weight of current fuel cell systems has to be reduced to meet under-the-hood space requirements for automobiles. Size and weight reduction applies to the fuel cell stack (catalysts, membranes, gas diffusion media and bipolar plates) and secondary components such as compressor/expanders, heat exchangers, humidifiers and sensors, which make up the balance of the plant.

Many issues related to hydrogen technology must still be resolved before hydrogen fuel cell vehicles can become widely available to consumers, including:

• **Fuel storage**: on-board hydrogen storage must allow the driver to travel more than 300 miles without infringing upon cargo or passenger space.

• **Fuel production**: hydrogen is currently three- to four times as expensive as gasoline. To make fuel cells work, hydrogen must be cost-competitive with fossil fuels. Ohio has the potential to produce this resource from domestic sources such as coal.

• **Fuel delivery**: a cost-effective and energy-efficient hydrogen delivery infrastructure is needed to make this technology work.²⁰

### Biogas

Biogas refers to methane produced by the fermentation of organic matter including manure, wastewater sludge, municipal solid waste or any other biodegradable feedstocks under anaerobic conditions. Presently, biogas is often disposed of by flaring (burning it). Some progressive organizations are capturing and either using or selling this commodity as a fuel and profiting from the practice.

²⁰U.S. DOE, *Fuel cell overview*, 2006
Case Study

Truck Stop Electrification Idle Work Is The Hand Of Innovation

Heavy-duty diesel trucks idle their engines for many reasons, including driver comfort while sleeping. Truck idling produces emissions and increases fuel consumption. Truck stop electrification is an alternative to truck idling that can result in lowered emissions and fuel use. The Ohio Department of Development recently received a grant from the U.S. EPA to evaluate the emission reduction potential of one or more truck stop electrification (TSE) facilities within Ohio.

Despite ranking 35th in geographic size, Ohio has the nation’s fourth largest interstate highway system, upon which large tractor-trailers burning diesel fuel travel extensively. The resulting emissions contribute to Ohio’s significant federal air quality nonattainment problem. Though most emissions from long-haul diesel trucks occur while the trucks are traveling, a significant portion occurs while the trucks are simply idling at truck stops and other locations.

Currently, two types of TSE technologies exist: single systems and dual systems. In single systems, independent HVAC units are installed above each truck parking space, and the unit is attached through the window of the truck. Through this plug-in, the driver receives access to heating and cooling, cable TV, internet and other power needs, thus enabling the driver to turn off the engine overnight. The cost of the plug-in is estimated at $1.25 to $1.50 per hour, which is substantially less than burning fuel for idling. Dual systems require a retrofit of the diesel vehicle and plug-in infrastructure at the rest stops. Although a dual system carries a lower cost than a single system, it can only be used by fleets with suitable on-board equipment.

With the EPA grant, the Ohio Department of Development (Office of Energy Efficiency (OEE) will administer a project to evaluate the net impact of pollution and fuel consumption at several selected tse sites throughout Ohio. To encourage the installation of TSE technology, OEE is prepared to fund up to $400,000 toward the use of TSE and evaluate its usage. Site selection, permitting and financing should be completed by Fall 2006. Construction should be completed by Fall 2007, and data collection and evaluation of the facility (conducted with full cooperation of the TSE vendor) will continue, with a case study and final report due by the spring of 2008.
Idle-Reduction Technologies

Diesel engines are the workhorses of the American economy. However, they also emit harmful emissions including ozone smog, particulate soot and more than 40 hazardous air pollutants. Methods for reducing idling that are aimed at commercial trucks, buses, construction equipment and locomotives could have a significant and immediate impact on oil consumption. Locomotives spend 50- to 70 percent of their time idling, wasting precious fuel. A typical long-haul tractor-trailer idles about 1,830 hours per year. Though some laws attempt to reduce idling, truckers continue to idle to provide heating, cooling and electrical power and to keep the engine warm and battery charged. Truck stop electrification would allow vehicles to plug in and operate necessary systems. Trucks and locomotives also can be retrofitted with devices that provide the same benefits of idling without the use of fuel.

Estimates of school bus emissions reductions provide us with insights into the benefit of this technology. By one recent estimate, if the nearly 2,500 school buses in central Ohio reduced idling time by 30 minutes each day throughout the school year, the fleets would save a combined 112,050 gallons of fuel and eliminate 14.76 tons of NOX, 1.32 tons of volatile organic chemicals (VOC’s) and 0.95 tons of PM2.5 pollution each year.

Congress passed the Diesel Emissions Reduction Act (DERA) provisions of the Energy Policy Act of 2005 (EPA 2005) to establish voluntary national- and state-level grant and loan programs to promote the reduction of diesel emissions. Specifically, the bill authorizes $1 billion over five years, with the U.S. EPA granting 70 percent. Of the total funds, twenty percent are earmarked for states to develop retrofit programs, with an additional 10 percent available as an incentive for states to match federal dollars. The program also establishes priority areas for projects--such as those that are more cost-effective and affect the most people--and focuses the federal program on public fleets.

Finally, EPA 2005 includes provisions to help develop new technologies, encourage more action through nonfinancial incentives and require the EPA to report on the success of the program. The president has proposed funding the program at $49.5 million for FY ’07. The House proposed only $28 million for DERA. This program should be fully funded to reach its full potential.

Ohio should establish an idling reduction regulation for transit and other public fleets. This program could begin with voluntary adoption of policies by fleets to exhibit leadership in emissions reduction, followed by the mandatory adoption of a statewide idling regulation. Enactment of a program in 2006 is necessary in order to begin reducing emissions in time to meet federal ozone and PM2.5 Attainment demonstration deadlines. Enforcement could come through fines administered by law enforcement officials. The money generated through enforcement could go into a grant fund for retrofitting diesel equipment with pollution controls and/or anti-idling technology.

Ohio should also create an incentive for adoption of idle-reduction technologies by establishing a revolving loan, lease-to-own or grant program to assist fleets (public and private) with the initial purchase of idling-reduction equipment. Some states, including Texas and California, currently run grant programs that compensate recipients up to 80 percent of the cost to own such technologies in nonattainment areas. A program with the potential for an immediate and dramatic effect could be developed through a partnership with OAQDA and other appropriate Ohio agencies, such as the Ohio EPA and the Development's Office of Energy Efficiency (OEE). Through such a program, trucking companies and independent owner/operators would apply for loans to install anti-idling equipment and pay the loans off from fuel savings. Payback periods may be as short as 12- to 18 months in some cases.

Any public fleet purchasing new vehicles should consider including an Alternative Power Unit (APU) or engine preheater in the new vehicle specifications to yield greater emission reductions from the new vehicle and overall fleet. The Ohio Department of Administrative Services could stipulate this for all vehicle purchases under its purview.

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71 Mid-Ohio Regional Planning Commission (MORPC), 2005
72 MORPC, 2005
73 MORPC, 2005
74 Regional Air Pollution Control Agency, 2005
Truck stop electrification is one type of anti-idling technology that is gaining momentum in Ohio. Site identification for such facilities should include public rest stops and private truck stops. Preference should be given to sites near or in nonattainment areas and/or sensitive populations.

To assist in the deployment of these technologies, Ohio’s OEE, Ohio EPA and OAQDA should establish a financing program and collaborate on site selection. As a first step, the Ohio EPA should collaborate with OEE on the recently awarded Ohio truck stop electrification grant from the U.S. EPA to assess the benefits and feasibility of developing a large network of TSE facilities in Ohio.

Transportation Planning

Efforts to encourage more urban transportation options and redevelopment are often at odds with policies that indirectly encourage urban sprawl. The federal highway trust fund, which federal gas taxes pay for, supplies the majority of funding for state highway projects. Additional funding comes from vehicle registration fees and state taxes. The methods for allocating these funds are slanted toward out migration beyond the city core and even beyond the suburbs. Even though many states apportion transportation dollars based upon the amount of federal gas tax revenue paid into the trust, and others distribute their state shares based upon need, some evidence suggests that Ohio does neither. Historically Ohio has had a tendency to distribute its transportation dollars evenly among cities, counties and townships which may have the dual unintended consequences of diverting highway funds away from areas with the highest infrastructural needs (i.e. Cities) and encouraging sprawl.  

Transportation Demand Management

Ohio should enhance strategies that result in more efficient use of transportation resources that are sustainable and promote a new transportation planning environment. Transportation Demand management (TDM) is a travel reduction method strategy which includes increasing transportation options, increasing incentives to use alternative transportation, promoting better land use planning and management, and supporting policy and institutional reforms at the state county and local levels to promote these efforts.

Ohio should enter into a dialogue with its citizens about their priorities for TDM, which includes increasing fuel efficiency standards, land-use planning, high occupancy vehicle (HOV) lanes, telecommuting, gas guzzler taxes, emissions cap and trade programs, and anti-idling technologies.

Workshop participants specifically mentioned several TDM programs including the Complete Streets Program, Safe Routes to Schools and the DOE’s Clean Cities Programs. Complete Streets enables safe access for everyone including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. This concept means that transit agencies must move away from designing roads just for cars. The Safe Routes to Schools Program is designed to decrease traffic and pollution by promoting walking and biking to school. The program focuses on safety and highlights the health benefits gained by walking and bicycling. Finally, the DOE’s Clean Cities Program, which is part of the Office of Energy Efficiency and Renewable Energy’s Freedomcar and Vehicle Technology Program, aims to increase energy independence by supporting local efforts to reduce petroleum consumption. Clean Cities carries out this mission through a network of more than 80 volunteer coalitions, which develop public/private partnerships to promote alternative fuels and vehicles, fuel blends, fuel economy, hybrid vehicles and idle reduction.  

Specific options suggested by workshop attendees include:

• Increasing the Gas Tax

The federal government should revisit the funding formula for the gasoline tax which has remained at 18.5 cents per gallon since 1993. The tax doesn’t generate as much as it used to because of increased vehicle fuel efficiency, which has created a crisis in transportation finance. A survey in the New York Times found that 55 percent of the public would support an increase in the gas tax if the proceeds would be used solely to tackle environmental issues, energy independence, sustainable alternatives and alternative-fuel availability. However, the same survey found that 80 percent of the public would oppose a tax increase that is not linked with solving these issues.
• Use CMAQ Funds for Intended Purpose
The federal government has provided the states billions of dollars in Congestion Mitigation and Air Quality (CMAQ) funds for transportation agencies to invest in projects that reduce criteria air pollutants. Though these grants are intended to support projects such as idling-reduction technology and implementation, cities often target these resources for other projects, such as building highway systems around cities and lane widening. Federal CMAQ rules should be tightened and tied more directly to policy objectives that foster future energy independence. Specifically, Ohio should consider using CMAQ funding to promote the installation of anti-idling technologies, such as truck-stop electrification, that would reduce criteria air pollutants. These types of projects should be targeted to nonattainment areas in the northeast and southwest portions of the state.

• Offer Business Incentives to Adopt New Technology
Grants and financing should be coupled as two pieces of an incentive package to encourage industries to comply with new idling-reduction technologies and to retrofit equipment to use alternative fuels. Incentives should be offered for the development of facilities to produce transportation fuels and infrastructure to support and provide such fuels.

POLICY OPTIONS FOR THE TRANSPORTATION SECTOR

Policy and program recommendations fall under two major categories:

A. New or amended policies and programs at federal, state and local levels aimed at transportation investment, resulting in a more balanced system with more options for users.

B. Investment and incentives for instituting fuel and power technologies immediately that increase efficiency and decrease pollution.

Financing Transportation

Policy Option 25:
The federal gas tax should be increased and the new tax revenues used to offset the costs of infrastructure development in emerging transportation issues including fuel transmission facilities, new pumps, truck stop electrification and grants to develop next generation fuels.

Policy Option 26:
Ohio should begin a dialogue with the public on long-term transportation demand management alternatives with an emphasis on decreased transportation fuel utilization.

Policy Option 27:
Ohio should allow for increased public access to its tax collection systems. Information on gas tax collections should be released annually and should be linked geographically so that the public can see where motor fuels tax revenues are generated. The data should be listed by city, township, village and county. This information could be used by decision-makers to identify what communities generate by way of gas taxes relative to the amount of transportation services they are obtaining.

Statewide Review

Policy Option 28:
Within 100 days of its taking office, the new state administration should consider an action plan of incentive programs to encourage the production, promotion and distribution of biofuels. This action plan should address issues such as greater funding for fuel distribution centers, a reinstated production tax credit for ethanol production providing that savings flow through to consumers, a state Renewable Fuels Standard (RFS), and an analysis of Ohio’s tax structure for the promotion of its biofuels infrastructure and development.

Policy Option 29:
Ohio should appoint a task force to review and make recommendations on how the transportation sector can reduce energy consumption and improve environmental quality.

Policy Option 30:
Ohio should develop a method to quantify the impact of Ohio’s entire transportation fleet on air quality and energy consumption. This information can become a benchmark for future state policies.

Policy Option 31:
Ohio should dedicate state money for road improvements and use federal money in a more flexible manner to encourage nonautomotive transit options. This will lead to an overall reduction in energy consumption.

Policy Option 32:
Ohio should analyze the permitting processes employed in other states for best practices and should develop a streamlined permitting process that encourages alternative fuels manufacturing while safeguarding environmental quality.
Enhance Access To Biofuels

**Policy Option 33:**
The federal tax credit for the development of biofuel retail locations should be increased to at least 50 percent of the total cost of construction. Additionally, there must be some form of assurance that retail owners receive this tax credit for each location they manage rather than limiting the credit to a single location.

**Policy Option 34:**
Ohio should increase funding for HB 245 for grants to develop additional biofuel retail pumps in the state and possibly provide additional rack blending facilities for biofuels.

**Policy Option 35:**
Ohio should prohibit retail “franchise agreements” from being used to disallow the sale of biofuels at retail locations or to restrict access to preferred fuel dispensers such as those under the canopy, which are favored and used by consumers.

**Policy Option 36:**
The Ohio general assembly should establish a progressively increasing renewable fuels standard for transportation fuels sold in Ohio. By certain dates, this standard would be tied to in-state production and be met through a flexible combination of low- and high blends of biodiesel and ethanol. The recently passed Iowa Renewable Fuels Standard may provide a good model for consideration.

**Policy Option 37:**
The Ohio Department of Administrative Services should require that B20 biodiesel be used in all appropriate state-owned vehicles by December 31, 2006, and encourage counties and cities to follow suit by December 31, 2007.

**Policy Option 38:**
Ohio should require gas, electric, water, telephone and cable utilities to use biodiesel fuel in all appropriate vehicles by December 31, 2007.

**Policy Option 39:**
There is a potential to use biodiesel (blended or possibly even 100 percent) in power plants and combustion turbines. Renewable energy credits and emissions credits or offsets should be provided for this type of use, based upon the percentage of biodiesel consumed.

Incentives for Adoption of Biofuels

**Policy Option 40:**
Ohio should change the taxation basis for motor fuels to the BTU content of the fuel, not the volume.

**Policy Option 41:**
Ohio should encourage and incentivize the use of B20 biodiesel in private fleets such as car rentals, cabs and buses.

**Policy Option 42:**
Ohio should officially recognize biodiesel in the Ohio revised code for the purpose of creating tax credits.

**Policy Option 43:**
Ohio should extend the excise blender tax credit through 2010 to synchronize with the ethanol excise tax credit. Syncing the incentives will provide long-term predictability for retailers and distributors who may want to invest in converting or developing new refueling equipment at single locations at the same time.

**Policy Option 44:**
The federal government should increase the tax credit for retail development of B20 or greater blends of biodiesel.

Enhancing Production of Biofuels

**Policy Option 45:**
Ohio and federal governments need to work in concert to establish tax credits for biodiesel storage and blending facilities that will facilitate distribution of the fuel.

**Policy Option 46:**
Ohio should actively promote the development of a biodiesel production facility in regional markets around the state.

**Policy Option 47:**
Ohio should require energy capture technologies such as reciprocating engine use, microturbines, fuel cells or waste heat capture for new or renovated facilities that generate methane instead of allowing facilities to just flare gas emissions.

Expand the Use of Compressed Natural Gas Vehicles

**Policy Option 48:**
The federal government should ensure that rules being developed by the IRS around the 2005 Energy Policy Act support development of a CNG refueling infrastructure. These policies should support CNG vehicle conversion technologies as well as new CNG vehicles. Specifically, these policies should allow CNG vehicles to be eligible for the 80 percent tax credit for vehicles that meet a definable, existing emission standard to support attainment designations. In addition, these rules should allow dual-fuel vehicles to receive a 50 percent tax credit if owners can prove substantial annual use of CNG fuel in these vehicles.

**Policy Option 49:**
Ohio should provide grants or tax credits to support the
development of CNG fueling stations and CNG vehicle acquisitions and vehicle conversions.

**Promote Idling-Reduction Technologies**

*Policy Option 50:* Ohio should establish a mandatory statewide idling reduction regulation for public transit systems, school buses, and other public fleets. This should include factors such as idling time limits, temperature parameters (for priority parameters) and proximity to schools and residential areas. This could begin with voluntary adoption of policies, which will exhibit leadership in emissions reduction followed by mandatory adoption of a statewide idling regulation as soon as possible.

*Policy Option 51:* Ohio should adopt a mandatory statewide idling policy for commercial diesel-fueled vehicles no later than three months after U.S. EPA’s federal register publication of the idling guidance language. If the federal register notice is delayed, the state should move forward and adopt its own stringent anti-idling policy.

*Policy Option 52:* Ohio should create an incentive for adoption of idle reduction technologies by establishing a revolving loan or lease-to-own program to assist fleets (public and private) with the initial purchase of idling reduction equipment.

*Policy Option 53:* Ohio should begin addressing idling from private fleets by promoting a voluntary idling program for these operators. This program should involve extensive outreach to fleets operating in nonattainment areas, in urban environments and near sensitive populations. One option is to standardize contractual practice for public works projects that use private fleets, and to require the use of idling reduction operational policies and/or hardware to reduce emissions in the communities served.

*Policy Option 54:* Ohio should support full federal funding for all aspects of the DERA portion of the Energy Policy Act of 2005.

*Policy Option 55:* Ohio should develop a program to reduce idling from switchyard locomotives. A voluntary program followed by a mandatory requirement at a later date could be developed to target this source of emissions.

*Policy Option 56:* Ohio should work with the trucking industry and neighboring states to identify potential truck-stop electrification sites along heavily traveled corridors on major trucking routes.

*Policy Option 57:* Ohio should use CMAQ funds to help offset the costs associated with the installation of truck stop electrification (TSE).

*Policy Option 58:* The Ohio Department of Transportation should require that all newly constructed public rest stops/truck stops include the electrical infrastructure necessary to meet the increasing demand of long haul transportation on Ohio’s roadways and air quality requirements.

**Further Recommendations for Idle Reduction**

*Policy Option 59:* The federal government should develop a national policy and program to support diesel anti-idling, including deadlines for states to pass laws forbidding idling (longer than a designated number of minutes) of trucks, buses, switcher rail cars and other diesel vehicles.

*Policy Option 60:* The federal government should develop a coordinated national program of low-interest loan financing for diesel operators to install anti-idling devices where needed.

*Policy Option 61:* Ohio should establish a substantial public-private partnership for low-interest loans for installation of idle reduction equipment.

**Promote Smart Planning**

*Policy Option 62:* Ohio should adopt incentives for communities to participate in the complete streets and safe routes to school programs.

*Policy Option 63:* Ohio should encourage the federal government to increase support and funding for the DOE Clean Cities program to at least $50 million per year.

**Increase Research and Development**

*Policy Option 64:* Ohio should facilitate the development and deployment of several “almost here” technologies including plug-in hybrids, FFV hybrids, diesel hybrids, cellulosic ethanol, algal biodiesel, Fischer-Tropsch fuels and landfill gas methane, and include these promising technologies within its support for fuel cell research.
Policy Option 65:
Ohio should make Wright Center and Third Frontier funds available for research and development for a broad variety of technologies with the potential for deployment. These should including funding technology demonstration projects that involve developing new markets for Ohio-based companies.
**INTRODUCTION**

Americans are accustomed to a high standard of living. As energy is central to every aspect of this lifestyle, conservation efforts must be enhanced to enable future generations to have similar opportunities. By combining new technologies with foresight and planning, small changes in the way we live, work, travel and build can result in significant energy savings over time.

Around the world, people consume natural resources at an unsustainable rate, and the problem is particularly significant in the United States. Americans account for just 5 percent of the world’s population, yet we consume approximately 25 percent of the world’s resources, including fuels and other minerals.

Ohio faces many of the issues associated with the consumption of resources. For example, 55 percent of Ohio’s land is devoted to agriculture, and our farming techniques are very energy dependent. Also, the power industry is a huge consumer of fuel and water.

Energy usage also affects families’ pocketbooks. The typical American spends 3.5 percent of household income on paying energy bills, but for low-income households the cost for heating, cooling and basic electricity needs averages 14 percent\(^78\) and can be much higher for the poorest among us.

These statistics stress the increasing burden of rising energy costs on lower income families. They also serve to highlight the opportunity posed by enhancing programs such as the federal government’s Low Income Home Energy Assistance Program (LIHEAP), which assists low-income households with their home heating and cooling costs. The state and federal government should modify these and other programs to offer assistance in paying bills, coupled with developing and fully funding an energy insulation incentive program for low-income families.

America’s consumption patterns also represent an opportunity to change. For example, the fact that we no longer keep products as long as we once did means that they are replaced with newer possessions more quickly. New appliances and other equipment that are more energy efficient represent a tremendous opportunity for energy savings.

The average home spends more than $1,200 per year to run appliances and heating and cooling equipment. Replacing home appliances with newer high-efficiency models, such as energy star rated appliances, provide savings in the long run by decreasing energy consumption and costs.\(^79\) As an example of this principle

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\(^78\) U.S. DOE, DOE provides $96.4 million to low-income families for home weatherization, 2006

\(^79\) American Council for an Energy-Efficient Economy, 2006
being put into practice, some progressive communities such as Grove City, Ohio, are exploring the adoption of resolutions requiring all new homes to be built to Energy Star standards.

Ohio might consider developing a rebate program for the initial price of high-efficiency appliances. Other states with such programs most commonly offer rebates for high-efficiency refrigerators, air conditioning equipment and clothes washers. In addition, some gas utilities offer rebates for high-efficiency furnaces.

The state also should modify development patterns and building codes to promote energy efficiency. “Density” and “clustering,” are planning terms for development approaches that can reduce travel distances, improving travel options. “Density” refers to the number of people or jobs in a given area, while “clustering” refers to land use patterns whereby activities are located close together, often within convenient walking distance.

Young professionals are particularly likely to relocate to such areas. These people are a “fast-growing, highly educated, and well-paid segment of the workforce on whose efforts corporate profits and economic growth increasingly depend.” They do a wide variety of work in a wide variety of industries - from technology to entertainment, journalism to finance, high-end manufacturing to the arts.80

This “creative class” also represents the next generation of energy consumers: people who are willing to adopt new technologies, and savvy consumers who are interested in doing their part to reduce their individual energy footprint. It is to these and like-minded individuals that a growing number of businesses have begun to cater. Although consumers may be asked to pay premium prices for such goods and services, they have shown a willingness to do so when provided high-quality products.

Many of Ohio’s businesses have reduced their energy costs by adopting Sustainable Business Practices (SBPs), which include such things as using less land, developing in an environmentally conscious manner, using renewable energy, or reducing the waste stream and purchasing recycled materials. The traditional view of sustainability has held that businesses must be adopting sustainability for the “greater good.” Today, adopting SBPs means improving the bottom line by increasing efficiency and providing long-term security.

There are a number of sustainable business practices being adopted by businesses and local governments including:
- Life Cycle Assessment (LCA)
- Sustainable Value Chains
- Environmental Management Systems (EMS)
- Total Quality Environmental Management (TQEM)
- Waste Stream Management
- Environmentally Preferable Purchasing
- P2 Regulatory Integration (P2RI)81

**Outlook: Energy Efficient Businesses and Buildings**

**Development, Density and Redevelopment**

Ohio has experienced major urban sprawl over the last several decades, developing land much faster than the growth of our population, which causes huge stresses on services, schools and natural habitat. One recent report found that, between 1970 and 2001, the proportion of developed land in the Cincinnati region increased by 141 percent, although the population increased by just 15 percent.82 Other areas have seen similar growth ratios. Urban sprawl increases the use and cost of transportation and energy because many of these residential developments are further out from work and other activities, increasing car travel. One study suggests that in the past 15 years, vehicle miles driven have doubled nationally.83

Cities are now laid out in such a manner that walking from one store to another is prohibitive, due to safety issues and distance. However, new model zoning ordinances and some progressive planners are promoting “walkable” communities as a means of reducing vehicle travel, increasing public health and enhancing a sense of community. Nationwide, a number of city and county planners are arguing that communities should move to this development model to cut back on energy use, tread lighter on the environment and promote healthier living. Those regions that lack

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80 Florida, 2002
81 Ohio Environmental Protection Agency, 2005
82 University of Cincinnati School of Planning, 2001
83 U.S. Environmental Protection Agency, 2001
Case Study
The Cleveland Ecovillage Project

The Cleveland Ecovillage is the first urban ecovillage in the nation that includes an entire neighborhood of about 3,000 people. The goal of the Cleveland Ecovillage is the creation of a model urban community using principles of green building and ecological design. Along with community revitalization principles, the Ecovillage project also puts into practice innovative energy saving applications. The project includes 20 new units of energy-efficient infill housing, an energy-efficient demonstration renovation project, and solar panels at a local school. The project area is the quarter mile radius around the W. 65th-Lorain-Ecovillage rapid station.

The neighborhood includes historic churches, a 22 acre recreation center, and a portion of the Lorain Avenue commercial corridor. The neighborhood is ethnically and economically diverse with many low to moderate income residents. The median household income in Detroit Shoreway (a neighborhood in downtown Cleveland) in 2000 was $21,000. About 25 percent of Ecovillage residents are African-American and about 26 percent are Hispanic. The housing stock is primarily worker housing dating from the 1890s and early 1900s. About 15 percent of the population walk or ride public transit to get to work.

The innovative partnership between the Detroit Shoreway Community Development Organization (DSCDO) and Ecocity Cleveland has been key to the project’s success. In addition, strong partnerships with other organizations, including the Cleveland Green Building Coalition, the Greater Cleveland Regional Transit Authority (GCRTA), Parkworks, the Cleveland Asthma Coalition, the Cleveland Housing Network, Cleveland State University, Cleveland Magazine, the City of Cleveland and private sector partners has benefited the program.

The Cleveland Ecovillage incorporates many design considerations that benefit neighborhood redevelopment including transit-oriented infrastructure, a pleasing public aesthetic, healthy homes and buildings; affordability, renewable energy, optimal energy performance and life-cycle impacts.

Major project accomplishments to date include the completion, in 2004, of the $4.1 million West 58th Street Ecovillage Townhomes project, which included 20 1,600 square-foot units designed to heat for less than $400 per year. The selling price was $172,000 - and buyers qualified for a 15-year tax abatement - which was estimated to be affordable to a homeowner with an income of $34,000. The townhomes sold out quickly with upgrades bringing the average sales price to $215,000. At a cost of $93 a square foot, the Ecovillage townhomes demonstrate that green building is economical and can be affordable.

Another energy-efficient application was the installation of a 1 Kw solar panel system at Gallagher Middle School with assistance from the Foundation for Environmental Education, Key Bank, Wire-net, and Enterprise Community Partners. The solar panels are used in a science classroom as an educational resource.

An additional area enhancement will be the planned Michael Zone Recreation Center Sustainable Greenspace, which residents hope will become a national model for ecologically sustainable urban greenspace management. Alternative energy demonstrations, as well as storm water best practices and habitat restoration will be part of the project. A consultant team was recently formed to develop these ideas into the Zone Recreation Sustainable Greenspace Master Plan.

From vacant lots to energy efficient buildings, the Cleveland Ecovillage has resulted in a positive neighborhood transformation and has received numerous awards for energy-efficient design and innovations in community development.
Case Study
The University Of Cincinnati Leads With LEED

The University of Cincinnati’s new 350,000-square-foot Student Recreation Center is just one of nine sustainable design projects planned as part of a policy adopted in 2000 to reduce energy consumption in the construction and renovation of buildings on campus. The center, designed by Santa Monica architectural firm Morphosis, working in partnership with the local firm, KZF Inc., Will include housing, classrooms, a convenience store, dining area and new fitness facility.

The design of the building, including construction process and location, features several notable green components. The roof of the building was designed to collect rainwater in a cistern under the building for irrigating the nearby grounds. Bicycle racks and changing rooms make it convenient for those who choose to bike to work or class. Located on a brownfield site, no sacrifice of green space was required: existing buildings, including an old power plant, were torn down to make room for the new facility.

In addition, locally harvested and manufactured materials were employed to limit energy used for transportation. Specific types of paint, carpeting, furniture and other building materials were chosen to reduce toxins, fumes and other harmful substances. Close to 75 percent of the construction debris was recycled. Finally, mechanical systems were run, or “flushed,” for two weeks prior to occupancy to remove fumes and odors.

Other UC green building projects include additions and renovations to the Medical Sciences Building, student union and Swift Hall lecture facility. In total, seven buildings are currently pursuing LEED certification, with several at the silver level and one near gold. With these projects, UC joins a growing number of colleges and universities across the country, including Ohio’s Oberlin College, that are choosing green building designs not only to reduce energy costs and environmental impacts, but also to model civic responsibility for students and their surrounding communities.

Mary Beth McGrew, director of the University Architect Campus Building Division at UC, notes that green building is an important educational tool as well: “most good and progressive institutions of higher education see that it is their responsibility to look at conserving our resources and regard training the next generation of leaders, in whatever way you look at sustainability, to be a piece of that. Part of UC’s belief system is that the campus, as a whole, is part of the educational process. You might not like a specific building, but understanding its design intent or why it is considered a significant piece, is as much a part of your community education as whatever program you’re studying,” she is quoted as saying in Cincinnati City Beat.  

85 Pierce, 2006
vibrant, close-in-urban neighborhoods will be at a disadvantage in attracting and retaining talent.  

Some American cities, including Portland, Ore., and the Atlantic Station area of Atlanta, Ga., already have tried to reverse this trend by building or redeveloping neighborhoods in a way that reduces vehicle travel. These neighborhoods are more densely populated, and amenities such as schools or retail shopping are accessible by foot or bicycle.

**Priorities**

**Sustainable Businesses**

Ohio also can make energy savings gains in the business sector by attracting additional sustainable businesses to the state and encouraging existing companies to deploy sustainable business models. Examples of sustainable businesses would include industrial parks and companies that minimize their impact on the environment by reducing air pollution emissions and installing energy-efficient equipment. Another example would be companies that sell “green” and locally made products to support Ohio employment and thereby reduce travel and shipping costs.

**Energy Efficiency/Green Buildings**

Buildings use 36 percent of the energy resources consumed in the United States. Most buildings—even new buildings—are inefficient compared with what they could be. Currently the Ohio building code has minimum energy efficiency requirements based on the industry-standard ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers) 90.1 building code. With different standards, a 20- to 30 percent decrease in energy use for new buildings is achievable and could result in a significant reduction in energy consumption.

Ohio should become a leader in the development and construction of buildings certified under the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) program. The LEED building rating system is a voluntary, nationally recognized standard for excellence in sustainable building design. The state should use its purchasing power to choose vendors and practices that exemplify and promote these practices by relocating state offices to green buildings over time.

The LEED rating system ranks the impact that buildings have on the environment. As well as energy efficiency, it rates site planning, water use, material and resource use, and indoor environmental quality, and it gives credit for innovation. The system awards points for various categories, such as water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The accumulated points earn qualified buildings a certain designation, depending on how green they are. Currently there are LEED rating systems for new construction, existing buildings and commercial interiors; rating systems are under development for core and shell homes and neighborhood development.

To encourage more Ohio buildings to meet these higher energy-efficient and green standards, the state should set an example by requiring that all state-funded building projects meet LEED certification standards. Ohio is behind in this matter. For example, federal buildings funded by the General Services Administration (GSA) must be LEED certified. Neighboring states including Pennsylvania and Michigan require that state-funded projects be LEED certified.

As a prerequisite for certification, LEED requires that buildings meet the same minimum energy efficiency standards as the Ohio building code, ASHRAE 90.1. Energy efficiency credits are obtained by exceeding this minimum by certain percentages. By requiring that buildings obtain at least two LEED energy efficiency credits, new state buildings would use at least 14 percent less energy. In most instances, this percentage can easily be obtained at no additional construction cost through proper solar orientation, day lighting, envelope design and the installation of more efficient HVAC systems.

The LEED rating system promotes the use of clean renewable energy, and all of the components for most renewable energy systems are currently being produced in Ohio. In addition to displacing energy imports and reducing pollution, these systems would increase jobs and economic development in Ohio. Another benefit is suggested by studies showing that day lighting and views increase mental acuity and productivity. By requiring LEED credits for day lighting and views, Ohio might increase the productivity of workers using state facilities, potentially saving taxpayer money.

**Green Research Triangle Concept**

One method for encapsulating and promoting sustainable development might be the creation of a “Green Research Triangle” patterned after the successful research park in North Carolina. Several organizations are in the very early stages of creating an economic development corporation, lining up state and private industry partners focusing on environmentally sensitive development and growth of jobs and companies in key energy-related industries such as recycling and alternative energy.
Human Health and Development

Sprawl has a variety of consequences beyond energy and environmental impacts. Chief among them are the health consequences of over-reliance on automotive use and lack of physical exercise. One way to address this issue would be to include a consideration of human health impact in the list of factors to be taken into account when weighing various development decisions, such as the disbursement of federal highway funds. Encouraging planners to incorporate these concerns into the decision-making process could lead to a significant shift in development priorities over time.

Policy Options For Promoting Sustainable Development

General Policy Recommendations

Policy Option 66:
The governor should form an energy cabinet to coordinate state energy activities across departments and agencies.

Policy Option 67:
The governor should establish an office of land use and planning, which can recommend holistic approaches to land management, redevelopment and transportation, with an emphasis on energy and fuel savings in Ohio.

Policy Option 68:
Ohio should consider developing a rebate program for the initial purchase price of high-efficiency appliances.

Policy Option 69:
Ohio and local governments should adopt regulations precluding homeowner associations from restricting installation of renewable energy technologies (including solar and wind).

Policy Option 70:
The PUCO should explore mechanisms for rewarding electricity and gas utilities to decrease consumer energy waste and require all state utilities to pledge support for the National Action Plan for Energy Efficiency.

Opportunities For Redevelopment To Reduce Energy Utilization

Policy Option 71:
Ohio should promote integrated marketing and branding programs for downtown events, such as the National Trust for Historic Preservation’s Main Street Program. This program is a voluntary community-based method for revitalizing older business districts around the nation. Such an approach promotes walkable communities and leads to reduced vehicle travel.

Policy Option 72:
Ohio should increase funding from the Community Development Block Grant (CDBG) program to match with the Main Street Program to draw businesses toward the city center and reduce vehicle travel to shopping and entertainment destinations.

Policy Option 73:
State and federal policies should support dense developments, encourage rehabilitation of historic districts, and promote the construction of housing near places of work.

Promoting Green/energy Efficient Building Design

Policy Option 74:
Once the U.S. Green Building Council completes its standards for LEED Neighborhood Development certification, the state should require such certification for all new developments.

Policy Option 75:
Ohio should require LEED certification on all state-funded public buildings. This should include the requirement that each project obtain at least 2 energy conservation credits as well as the day lighting and view credits. The adoption of these standards would decrease energy consumption, reduce operation costs, help to conserve resources and increase productivity of building occupants.
It would allow the state to serve as a model for adoption of these practices at all levels of the public and private sector.

**Policy Option 76:**
The Ohio Building Code should increase energy efficiency requirements by 50 percent based on ASHRAE 90.1.

**Policy Option 77:**
Ohio should increase its residential and commercial building energy codes to the improved 2003 International Energy Conservation Code and Guidelines. Concurrently, the state should develop city and county education and support for building code reforms, and provide incentives to shift from master metering.

**Policy Option 78:**
The state legislature should request that the appropriate agency promulgate regulations requiring state agencies to evaluate the merits and cost effectiveness of installing stationary fuel cells and cogeneration as primary or back-up power sources for building and remote power applications.

**Encouraging Sustainable Businesses**

**Policy Option 79:**
Ohio should promote sustainable businesses through the streamlining of tax codes and regulatory infrastructure to reward businesses that are meeting waste stream management requirements.

**Policy Option 80:**
The state should promote sustainable businesses through the establishment of technology grants, such as those established by Michigan and Pennsylvania, for high-tech, energy efficient businesses.

**Policy Option 81:**
State and local governments should create a purchasing co-op and request-for-proposals processes that feature and promote the use of green and local products and services, as Minnesota has created.

**Policy Option 82:**
Ohio should encourage green businesses to locate near one another to create synergistic relationships for management of resources including fuel, electricity, waste stream, water, and supply chain management.

**Policy Option 83:**
As part of waste stream management measures, the state and local governments should encourage manufacturers to engage in “demanufacturing” (the process of breaking down equipment into parts that can be recycled) or “product take-back” programs whereby products are purchased back at the end of their lifecycle.

**Evaluating The Performance Of Energy Efficient Buildings**

**Policy Option 84:**
Ohio should require the Ohio Building Authority to work with individual agencies to enter energy consumption data into the state’s tracking system and, through an audit of these records, buildings with potential to save significant energy should be benchmarked. Utilities should partner on appropriate energy demonstration projects of value to the state in these buildings.

**Policy Option 85:**
Ohio should continue and expand its use of performance contracting for energy efficiency upgrades in state facilities, and should benchmark, inventory and report on the performance of such buildings.

**Policy Option 86:**
Ohio should require energy life-cycle cost analyses for new construction and renovations, and this information should be factored into the decision matrix for offsetting predicted operations and maintenance costs.

**Purchasing And Financing**

**Policy Option 87:**
The state should establish a revolving loan fund to internally finance energy efficiency projects and provide additional capital in state-owned facilities.

**Policy Option 88:**
Ohio should require consideration of energy-efficient and alternative fuels-based products in state procurements.

**Policy Option 89:**
Ohio should mandate the procurement of Energy Star rated equipment where possible.
**BREAKOUT REPORT**

**Clean Alternative Energy Technologies**

**INTRODUCTION**

For the foreseeable future fossil fuels will constitute a large portion of Ohio’s energy budget. However, clean alternative energy technologies - such as wind, solar, hydropower and biomass - have the potential to augment and diversify Ohio’s energy mix. Alternative energy technologies are not solely dependent upon fossil fuels. They produce minimal or no emissions. And they rely upon renewable, widely available fuel sources.

The state currently derives less than 1 percent of its power from renewable resources. Substantial obstacles still exist, however, to the wide deployment of these technologies, including cost, manufacturing capacity, intermittency of the resource, local zoning codes and permitting requirements. For example, all alternative energy sources face barriers to entering the market. And some forms of clean alternative energy produce electricity at costs comparable to those of new fossil fueled power plants, but they would have a hard time competing with Ohio’s lower-than-average cost of electricity now produced by the current fleet of coal-fired power plants.

To encourage the development and deployment of clean alternative energy technologies, many states have implemented standards and other incentives. The Alternative Energy Portfolio Standard (AEPS) requires electricity providers to include a specified amount of renewable energy as part of their portfolio of generating fuels. There are many varieties of AEPSs; no two states have enacted exactly the same provisions.

It is important to note that the delivery of clean, affordable, reliable energy will still come at a cost to our environment. State and federal requirements for wildlife impact analyses, local zoning ordinances and mitigation requirements need to be factored into the decision matrix as adoption of alternative energy sources are considered.

**OUTLOOK: TECHNOLOGIES WITH THE MOST POTENTIAL FOR OHIO**

**Fuel Cells**

Fuel cells efficiently convert hydrogen into usable energy without negative environmental impacts. In fact, when fuel cells use pure hydrogen as a fuel source, the only by-products are electricity and water. Although fuel cell-powered automobiles are engrained in our popular consciousness, their wide-scale deployment in the automotive industry is years away (for further explanation of the barriers to adoption of automotive fuel cells, please refer to the transportation section of this report). In many applications however, the future is already here.

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86 McCarthy, June 16, 2006
Fuel cells are being used in small scale applications where availability of fuels and large equipment are not factors. While most major automotive manufacturers are still trying to develop fuel-cell systems to power electric cars, others such as Rolls-Royce (which recently located a manufacturing facility near Cincinnati) are looking to build stationary power generators that could be linked together to create a distributed generation network or work as stand-alone units.\(^87\)

Ohioans approved a $500 million bond issue in November 2005 to fund high-tech investments. Of that money $103 million has been earmarked for fuel-cell development.\(^88\) This funding is helping drive fuel-cell manufacturers to the state.

Several types of fuel cells are under development throughout the nation, each with its own advantages, limitations and potential applications. They vary according to type of electrolyte they use, which determines the kind of chemical reactions in the cell, catalysts required, temperature range in which the cell operates, fuel required and other factors. These characteristics, in turn, affect the applications for which these cells are most suitable.\(^89\)

Fuel cells presently under development include:
- Proton Exchange Membrane (PEM)
- Alkaline
- Phosphoric Acid
- Molten Carbonate
- Solid Oxide

In order for electric rates from these systems to become competitive with traditional baseload generation, they will need substantial subsidies. Section 1224 of the EPAct of 2005 provides an incentive of 1.8 cents per Kwh for energy produced from advanced power systems such as fuel cells. This funding is limited to federal funding of $10 million per year for the first 10 million Kwh generated.

Even with these incentives, electricity generated through fuel cells has a hard time competing with traditional baseload generation. Westerville Electric, a municipal electric utility in Westerville, Ohio, provides a case in point. In 2004 Westerville Electric purchased, with grant assistance from the Ohio Department of Development, a 250 Kw fuel cell unit powered by hydrogen derived from natural gas. It was manufactured by Fuelcell Energy and distributed by Caterpillar, Inc. In 2005 the utility’s cost, including the cost of capital, to produce electricity from its fuel cell was approximately 20 cents per Kwh. As a comparison, a PUCO report dated April 15, 2005, lists residential electricity rates for eight select cities across Ohio between 8- and 11 cents per Kwh and commercial rates between 5- and 12 cents per Kwh.\(^90\) Fuel cell costs were substantially higher than electricity purchased directly from the grid because operating costs, particularly the cost of natural gas and maintenance, was much higher than originally estimated.

As a result of these higher costs, electricity generation from stationary fuel cells can be recommended only under specific conditions. Examples of such situations might include small distributed generation opportunities in conjunction with digesters or landfill gas or anywhere else where methane is abundant.

**Biomass/Waste Diversion**

Biomass is an abundant natural and renewable resource that has the potential to help create a more secure energy future. Among the many examples are wood residues, agricultural grains, crop residues, energy crops, municipal wastewater, solid municipal cellulose waste, food and beverage processing wastes, and livestock and poultry waste. Biomass is one of the largest energy resources in the nation.

Today’s bioenergy resources - derived from biomass - include ethanol, biodiesel, landfill gas, biomass power and industrial process energy. Currently used extensively in Europe, biomass has a strong potential to compete against conventional energy technologies. It also offers the added advantage of being “net-zero” for carbon dioxide production, thus reducing the amount of greenhouse gases produced.

Ohio has much potential for growth in this sector. One challenge is that biomass usually requires separate digesters to break down the raw materials. These add cost and increase complexity. New technologies present interesting opportunities to reduce these barriers. Ohio should enhance its research efforts into these technologies. (Refer to transportation section of this report for information on biofuels.)

\(^{87}\) Associated Press, May 29, 2006
\(^{88}\) Kelley, 2006
\(^{89}\) U.S. DOE, *Fuel cell overview*, 2006
\(^{90}\) Public Utilities Commission of Ohio, 2006

60  **Ohio: Securing America’s Energy Future**
Case Study
Fuel Cells Supply Tomorrow’s Technology Today

The Hocking College Energy Institute is on the cutting edge of fuel cell technologies and application. The institute houses the only operating fuel cell at an academic institution in the state of Ohio. It also offers two innovative, two-year programs: Alternative Energy and Fuel Cells and Vehicular Hybrids.

Developed in 2003, the fuel cell unit adjoins the Hocking College Police Department and is tied directly into the grid on the campus, contributing energy for hot water and electricity. Natural gas, pulled from wells on the campus grounds, is reformed to extract the hydrogen, heating hot water which contributes to producing electricity in the process.

The institute is an energy and education source. Students enrolled in the Alternative Energy and Vehicular Hybrids Programs observe first-hand and get technical experience with fuel-cell mechanics. The innovative, open design of the building enables students to see the power controls, heating and ventilation system, and various other functions of the building within a short distance of their classrooms. This experience makes graduates of the technical programs attractive to alternative energy companies: recent graduates of the Hocking College program are currently working with the alternative energy materials company Nextech in Columbus, and several have had internships with Third Sun Solar and Wind Power based in Athens.

Compared to other fuel cell initiatives in Ohio, the success of the Hocking College Energy Institute highlights the importance of having a cost-effective supply of fuel, such as natural gas, on site to power fuel cell generators. The case of the Westerville Electric Division is one such situation where rising natural gas costs and costly maintenance has limited the program’s expansion and competitiveness with other less costly fuel sources. With this in mind, the Energy Institute models the best use of both place and space for fuel cell technology.

Case Study
From Small Beginnings at Kurtz Brothers

Kurtz Brothers is a family owned and operated premier landscape and construction supply company based in Cleveland, Ohio. A pioneer in the use of recycled commercial and industrial byproducts, the company recycles various materials ranging from hardwood byproducts, green waste trimmings and biosolids to steel slag and spent nontoxic foundry sand. These materials are used in several ways: clean wood waste is recycled into the company’s AMERIMULCH® Brand or used in composting applications; reclaimed organic materials are used in landscape applications and fill.

Most recently, Kurtz Brothers, under the ownership of Bio-energy llc, has developed ground-breaking technology to convert a multitude of organic waste materials into bioenergy in a way that is economically competitive with other energy sources. In the past, such processes were only able to convert one feed source at a time into methane. Kurtz Brothers’ innovation allows them to use multiple sources, thus increasing efficiency and making the process more cost effective.

Solid organic wastes from water treatment facilities, industrial processes and animal feed operations are fed into a single-unit enclosed system where they are changed into methane or biogas. This bioenergy produces 75- to 85 percent cleaner emissions than fossil fuels and can fulfill major industry fuel needs such as electricity, motor vehicle fuel and boiler operations. The company will begin its processes in July 2006 in Akron, Ohio, and plans to open its second site in Columbus, Ohio, in the first or second quarter.
Wind energy continues to decrease in cost. The wind industry is still somewhat immature, with electricity generation volumes that pale in comparison with fossil fuel and nuclear generation. Although wind energy generation costs have declined significantly in recent years, high demand for new turbines, increased costs for steel and other raw materials and a bottleneck in the manufacturing pipeline have led to increased wind energy equipment costs. However, due to the projected growth in this market, cost factors affecting wind energy are changing rapidly, and costs should continue to decline once the industry and its supply chain grow and mature.\(^{91}\)

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**Case Study**

*Winds Of Change At Amp-Green Mountain Energy Wind Farm*

The American Municipal Power-Ohio/Green Mountain Energy wind farm is owned by the Ohio Municipal Electric Generating Agency (OMEGA) JV 6, a joint venture of 10 AMP-Ohio communities (Bowling Green, Cuyahoga Falls, Edgerton, Elmore, Monroeville, Montpelier, Napoleon, Oberlin, Pioneer and Wadsworth).

Ohio’s only utility-scale wind farm - located adjacent to the Wood County Landfill west of Bowling Green - is a partnership with Texas-based Green Mountain Energy Company, which purchases the green attributes of the energy produced by the wind farm, thus lowering the cost of the energy sold to participating communities.

The 7.2 Megawatt (Mw) facility consists of four 1.8 Mw wind turbines, manufactured and installed by Vestas American Wind Technology between November 2003 and October 2004. Each turbine sits atop its own 257-foot tower, and the rotors have three 132-foot blades, which at their highest point reach nearly 400 feet in the air. The units operate at wind speeds of 9 to 56 miles per hour and can withstand wind speeds of up to 133 mph. At a wind speed of 31.3 mph, the generator is at full capacity. The rotor’s nominal rotation is 16.8 Revolutions per minute.

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\(^{91}\) American Wind Energy Association, 2005
Wind generation can be categorized as either small scale, which is appropriate across the state for certain residential and agricultural purposes, or utility scale, which is economically feasible only in certain parts of the state, primarily northern and western Ohio.

Wind technologies typically have high up-front costs and minimal operating costs. The majority of the up-front costs come from the construction and purchase of wind turbines, which can be manufactured by Ohioans. These large capital costs are counterbalanced by the largest asset to this technology: wind is free.

In many cases, wind is still dependent upon the federal Production Tax Credit (PTC) to be cost-effective. The PTC was designed to offset the costs of utility-scale wind turbines for the first 10 years of operation. The current PTC, adjusted for inflation, currently stands at 1.9 cents/Kwh. The on-again-off-again nature of this tax credit has been a challenge for the wind industry, creating uncertainties for long-term planning and slowing incremental market growth. The federal government should extend the PTC to at least a five-year window rather than the two-year up-and-down cycle already in place.

Because of higher fuel costs, wind powered electric generation has been more cost effective than many natural gas fired facilities for some time. Once initial investments are made consumers are not at risk of increasing electric rates due to fuel cost hikes, because wind is a free resource.

Wind power projects, like other generation plants, bring new tax revenue to rural communities. Payments generally range from 1- to 3 percent of the project’s value. In addition, rural landowners who lease their land to wind developers typically receive about 2- to 4 percent of the gross annual turbine revenue—often between $2,000 to $4,000 for each turbine—which would help Ohio farmers by providing an important second revenue stream. In addition, wind turbines have a small individual footprint and do not occupy much land, so farming and ranching operations can continue.

Wind power projects create new jobs in rural communities in manufacturing, transportation and assembly construction. The state of Pennsylvania has installed eight wind farms, and a Spanish firm, Gamesa Eolica, whose U.S. subsidiary Gamesa Wind U.S. LLC, recently announced plans to move to that state as part of its global push to increase manufacturing capacity. When completed, the facility is projected to add an additional 300 high-paying jobs to the Pennsylvanian economy.

The Timken Company Harnesses Winds Of Opportunity

The Timken Company, a 106-year-old steel castings manufacturer based in Canton, Ohio, is making it a priority to develop new energy-efficient applications for its bearings. Utilizing its internationally recognized expertise in bearings and gear drives, Timken is providing major U.S. and European wind-turbine manufacturers and gearbox suppliers with bearings and bearing packages that reduce friction in turbines, allowing them to run more efficiently and make wind power more competitive with other energy sources.

The potential for wind power manufacturing is considerable; one recent federally funded study published by the Renewable Energy Policy Project estimated that total U.S. wind generation is expected to increase to 50,000 megawatts (Mw) by 2010. One Mw is enough to power 1,000 homes for a day. The study also predicted that new wind turbine construction over the next six years could create thousands of new jobs nationwide.

Timken joins two other major Ohio companies already supplying many of the components for wind generators: Owens Corning in Toledo and Cleveland Gear Co. Several more Ohio companies, including Cincinnati Gear, ERICO of Solon, and Michael Byrne Manufacturing Co. of Mansfield, are producing materials for various sectors of the alternative energy industry.

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Footnotes:
92 Great Plains Windustry Project, 2006
93 American Wind Energy Association, 2005
94 Nebraska Energy Office, 2004
95 PA PowerPort, 2005
96 Renewable Energy Policy Project, 2005

Case Study:
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Manufacturing for small-scale wind turbines is primarily focused overseas and in the western United States. Ohio’s main role in wind manufacturing lies in utility-scale components and turbine manufacturing. A number of Ohio firms presently construct and process turbine components, including The Timken Company in Canton (bearings), Owens Corning in Toledo (blades), and Magna Machine (milling and boring) and Cast-Fab (ductile iron castings) in Cincinnati.

An Apollo Alliance and Policy Matters Ohio report and data provided by the Renewable Energy Policy Project (REPP) indicate that Ohio has the potential to create thousands of manufacturing jobs if there is a massive national investment in renewable energy development. Although the results hinge on a number of assumptions built into this model, there is broad agreement that the numbers are significant, merit further study and indicate that Ohio has significant potential to be a major supplier of components and other technologies throughout the upcoming century.

**Solar**

The two types of solar power are solar electric/photovoltaic and solar thermal. Solar thermal is not an electric generation technology. Rather, it produces hot water as an alternative to natural gas or electric water heaters and has applicability in new home construction and remodeling. Solar electric/photovoltaic (PV) uses solar cells to generate electricity. PV cells convert sunlight directly into electricity. When sunlight strikes a PV cell, electrons are dislodged, creating an electrical current. The use of PV cells has become widespread throughout society in recent decades, as the cells have come to power many commonly used products, such as calculators and watches. More complex systems generate the power to distribute water, supply electricity to communications equipment, light homes and run household appliances. The concept of “solar security” has particular relevance when discussing energy independence. During electricity outages from natural and human-caused events, a solar energy/battery combination system can power essential systems such as hospitals, communications equipment, security systems for offices and banks, essential lighting such as traffic signals, and water treatment and pumping systems. Much of this backup power is now diesel generated - but could be solar powered in some applications. In remote areas pv cells often are the lowest-cost means to provide electricity and are valued due to their ease of maintenance and operation.

The cost of PV cells, a major barrier to wide scale application, has fallen by 90 percent since the early 1970s. With this decrease in cost, a strong market has been created in developing countries to provide rural electrification at costs far lower than could be provided by central station power plants. Centralized plants would require creation of an extensive and expensive transmission and distribution infrastructure. Despite significant technological advancements, however, in U.S. markets solar electric remains one of the most expensive forms of clean energy in terms of installed cost per Kw.

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97 Hanauer, 2005
98 Solar Electric Power Association, 2006

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**Case Study**

**Solar Applications Expand Ohio’s Potential**

To date, most installations of solar electric arrays in Ohio have been limited to smaller applications at individual homes, schools and gas stations (including BP covered fueling areas) and for construction and traffic signage.

However, two significant projects have been completed in recent months to demonstrate larger applications for solar electric generation. The roof of the ice arena at Bowling Green State University has been retrofitted to support 31 kilowatts (Kw) of solar electric panels. In addition, Oberlin college has just completed installation of Ohio’s largest solar electric array, a 100 Kw solar parking cover adjacent to the Adam Joseph Lewis Environmental Studies Center, which also boasts a solar electric roof. Despite significant technological advancements, solar electric remains the most expensive form of clean energy in terms of installed cost per Kw.
Ohio is home to First Solar, one of the largest manufacturers of solar panels in the country and the largest thin film PV manufacturer in the world. The company currently ships the majority of its product to Europe, and its current manufacturing capacity is maximized. First Solar plans to ship virtually all of its PV cells for the next three years to Germany, which has an extremely ambitious deployment program. Due to this fact, First Solar plans to open its next plant in Germany, not Ohio.

Hydropower

Large-scale hydroelectric generation in Ohio is generally limited to navigable rivers on which locks and dams control water levels, flows and traffic. Hydro generation in this configuration is commonly referred to as “run-of-the-river” because river flows are not blocked by impoundment dams. On the Ohio River, two large run-of-the-river hydroelectric facilities are currently in place at existing lock-and-dam structures (Greenup and Belleville), and others are being considered for development. Turbine advancements and other innovative technologies are reducing cost and wildlife impacts of this type of hydroelectric generation. These Ohio River systems provide most of Ohio’s current renewable energy.99

99 McCarthy, 2006

Other smaller hydroelectric installations are in place in Ohio, generally on smaller lakes and streams. Opportunities for further deployment of hydro resources in Ohio are limited primarily because of the length of time needed to license a facility, the lack of rivers capable of handling a system, and environmental concerns such as modifications to river flow regimes, water quality impacts, fish passage and protection, species protection and cultural resource protection.

Priorities
Development of an Alternative Energy Portfolio Standard

Ohio should adopt a modest but effective long-term Alternative Energy Portfolio Standard (AEPS, commonly referred to as a Renewable Portfolio Standard or RPS) for the state. An AEPS is a regulatory tool that requires electric utilities and retail electric providers to produce some specified percentage of their electricity using renewable resources. Twenty-two states and the District of Columbia currently have some form of AEPS.100 States frequently develop AEPS to meet specific policy objectives, resulting in little standardization among state programs.

Recent comments by PU CO chairman Alan Schriber to the Ohio Senate’s Public Utilities Subcommittee101 might encourage the adoption of an AEPS. On June 15, 2006, chairman Schriber spoke before the senate subcommittee and suggested that the time had come for Ohio to develop an AEPS pilot program that would include the use of wind, solar, hydroelectric and clean coal plants. During his testimony, the chairman suggested a 4 percent AEPS for a five-year period. The state currently derives less than 1 percent of its power from renewable resources, mostly from hydroelectric plants along the Ohio River.102 Although a five-year timetable may be ambitious, state officials should work with the PU CO to institute the chairman’s recommendations.

Interconnection Benefits All Consumers

Over the past several years, the technology required for delivering electricity from distributed sources to the local utility distribution system and the grid has become more cost effective. A distributed generation approach can help create a system that relies not on one centralized power generation system but will capitalize on power from a variety of clean alternative sources.

The federal Energy Policy Act of 2005 allows for opportunities to help farm, business and residential consumers access and utilize these new technologies. Key provisions of EPA 2005 that will assist in the adoption of these technologies include opportunities

99 McCarthy, 2006
100 Rabe, 2006
101 Schriber, 2006
102 McCarthy, 2006
for the adoption of net metering, smart metering, cogeneration, and small power production and sale requirements. These approaches are not likely to be adopted by consumers, however, unless incentives exist.

A streamlined interconnection strategy is the key to adopting this technology, which might help stabilize energy prices and ensure system reliability. The state should work with utilities and local transmission operators and regional transmission organizations to develop such a system.

**Externalities**

The full social cost of fossil fueled electricity is not incorporated into the price of electricity generation. As with all sorts of energy usage, tradeoffs such as the health effects of hydrocarbon utilization are frequently borne by all members of society. These externalities, like the health effects of air pollution and global warming, are either significantly reduced or virtually nonexistent with some forms of alternative energy.

One method for increasing the rate of adoption of renewable energy technologies would be to identify the additional costs (health, national security, and environmental for example) associated with the utilization of fossil fuels and include these in rate charges to end users. This would help many renewable energy technologies compete on a level economic playing field with long-established generation techniques.

**System Benefit Charge Increases**

Among deregulated states, Ohio collects one of the lowest amounts of per capita funding to support energy efficiency. ODOD’s Energy Loan Fund (ELF) is supported by a System Benefit Charge (SBC), or rider, on the electric bill of all customers of investor-owned utilities. The ELF is used by the ODOD to offset the installation of solar and wind powered systems. With rising fuel prices and a greater awareness of the benefits of these systems, the competitive grant program has become extremely popular, depleting grant monies. This rider was set at $0.00010758 in 2005, and the state collected roughly $15 million. In 2006 this collection rate was lowered to $5 million per year.

In order to meet many of the recommendations in this report, the state should increase, not decrease, this collection rate. Raising the rider to collect $46.6 million per year would translate to an annual per capita rate increase of $4.076, which would put Ohio slightly lower than the national per capita average of $4.65 among states with similar programs.

**Green pricing options**

Ohio should consider requiring electricity providers to offer green pricing options to their customers who wish to support clean energy alternatives. Green pricing options allow customers to voluntarily pay premium usage rates, as included on their regular electric bills. Currently, two of Ohio’s municipal electric systems (Bowling Green and Cuyahoga Falls) offer green pricing through AMP Ohio’s Nature’s Energy® program. In addition, Buckeye Power offers the Envirowatts Green pricing option to its participating rural electric distribution cooperatives. While no investor-owned electric utility in Ohio currently offers green pricing, Duke Energy has announced that it intends to offer a green pricing option to its Cincinnati-area customers soon.

**Policy Options for Clean Alternative Energy Technologies**

**Facilitating The Adoption Of Alternative Energy**

*Policy Option 90:*

Ohio should explore the process of transferring electrical generation to a cleaner AEP, similar to what Pennsylvania recently adopted and Michigan is exploring. This AEP should include a comprehensive list of qualifying technologies including: wind, solar, fuel cells, microgeneration, clean coal, hydropower, landfill gas, combined heat and power, and energy efficiency.

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101 Energy Policy Act, 2005
Policy Option 91: Ohio should work with federal agencies, research labs and national and state-wide organizations to help facilitate the process of adopting an AEPS.

Policy Option 92: The state government needs to lead by example by procuring a portion if its energy from clean alternative energy technologies and purchasing energy efficient products. The additional demand will further drive down the costs of such goods and services stabilizing markets for alternative energy technologies and enhancing their financial profile.

Policy Option 93: Ohio should consider adopting a broad definition of alternative fuels to encourage utilization of biomass. If a potential fuel can be successfully combusted and permitted, it should be considered as an alternative fuel and counted as a renewable energy source in Ohio.

Policy Option 94: As these technologies are adopted, Ohio and the federal government must continue to study issues related to proper siting, wildlife impacts and the associated human health impacts resulting from alternative energy deployment. These studies are not intended to hinder the installation of these technologies but to demonstrate that “due diligence” is being paid to the associated environmental and human health costs of adopting these technologies.

Policy Option 95: Ohio should encourage small wind on commercial buildings, eliminate zoning restrictions and combine wind power with complimentary technology (e.g., using energy storage) to even out generation shortfalls from intermittent capacity. A state transmission grid study should also be conducted to support AEPS technologies.

Policy Option 96: Ohio should encourage the use of alternative energy sources in new or remodeled commercial and industrial buildings by providing tax credits for installation of alternative energy technologies.

Opportunities for Development
Policy Option 97: Ohio should conduct more detailed analysis of the current clean alternative energy resources already in Ohio and should determine the cost of developing each resource so that development can be consistent with a new state AEPS.

Policy Option 98: Ohio should conduct a more detailed analysis of the potential for manufacturing job creation in all forms of conventional and alternative energy industries in the state and report back to the governor by 2008.

Policy Option 99: As part of its economic development strategy, Ohio should recruit advanced energy technology companies and end-users through the use of targeted financial incentives, grants, taxes and loan guarantees to meet their needs for early stage or project-specific financing and to supplement existing sources of investment capital.

Policy Option 100: Ohio should develop model zoning- and land-use regulations for the construction of wind turbines. Wind farms prefer to locate in areas with robust land use plans that have established methods for overcoming the barriers to wind generation.

Policy Option 101: The Ohio General Assembly should establish a biomass/biofuels facility loan guarantee program for the sole purpose of assisting the financing of biomass/biofuels facilities.

Policy Option 102: Ohio should facilitate the investment in infrastructure necessary to promote Ohio as a principal fuel cell manufacturing state. Ohio could use this opportunity to launch a new industry that could place the state in a national leadership position for new energy technology.

Policy Option 103: Ohio and local governments should adopt a broad definition of biomass. Utilities and the permitting agencies should decide what can and cannot be used as a fuel source.

Policy Option 104: Ohio should require that testing and permitting of alternative fuels be easier and more streamlined.

Policy Option 105: Ohio should consider changing its regulations to allow for cofiring to fall within the definition of renewable energy resources for permitting, attainment and AEPS compliance.

Possibilities for Enhanced Research
Policy Option 106: Ohio should facilitate the development of a clean energy research institute focused on basic and applied clean energy technology.
that is fuel diversified and focused on Ohio based/developed fuel sources.

Policy Option 107:
Ohio should enhance research into developing technologies that simplify the processing of biomass as an energy source.

Policy Option 108:
Ohio should work with solar manufacturers to identify ways that the state can maintain its competitive advantage in thin film, organic and dye-sensitized PV cell development.

Policy Option 109:
Ohio should conduct a top-to-bottom review of the external costs associated with fossil fuel consumption, including human, security of supply, and environmental health costs. This study should make recommendations to factor these costs into a model rate structure to see how comparable alternative energy might be when stacked up against fossil fuel consumption on a fair equivalent basis.

Economic Incentives
Policy Option 110:
The federal government should increase incentives for fuel cells and other advanced energy technologies, above the current $0.018/ Kwh that is allowed in section 1224 of EPAct 2005.

Policy Option 111:
The system benefit charge, a charge appearing on a customer’s bill that helps offset the costs of some public benefits such as energy efficiency, should be increased to a collection rate of $0.00035 per Kwh. This would yield collections of $46.6 million per year from customers of investor-owned utilities to support deployment of alternative energy technologies - all of which would count towards AEPS compliance.

Policy Option 112:
All of Ohio’s electric utilities should develop a green pricing program that offers electricity customers the option to purchase increments of green energy, including clean coal technologies. This policy should be based upon lessons learned through case studies of successful and unsuccessful programs in other states to apply benchmarks and best practices.

Policy Option 113:
If a green pricing program is implemented, Ohio should require proceeds to be used to fund additional renewable programs and projects to offset the initially higher renewable energy costs.

Policy Option 114:
As other states (Indiana, Pennsylvania, Massachusetts and New Jersey, for example) have done, Ohio should examine the possibility of establishing a manufacturing incentive program focused on providing venture capital and high-profile marketing for Ohio start-up businesses focusing on advance energy technologies.

Policy Option 115:
The federal government should extend tax incentives for energy-efficient commercial- and new-home construction.

Interconnection
Policy Option 116:
Ohio should develop a consumer-friendly interconnection strategy that would include new, cheaper technology that employs nationally recognized installation/use standards to ensure power quality protection and promotes uniform safety standards for all involved in Ohio.

Policy Option 117:
Ohio should draft an interconnection strategy that includes systems and procedures such as net metering, smart metering, cogeneration and size-demand response. Consumers should have the opportunity to install cost-effective, utility approved, automatic switching systems that activate on-site generation in the event of need.

Policy Option 118:
To promote participation in an interconnection program, Ohio should require utilities to offer interested consumers a special (and more cost-effective) rate structure through the development of an Integrated Resource Plan (IRP), which is a method for power utilities to evaluate a wide spectrum of power resources to include in their long-term strategies. Several investor-owned utilities in the western United States, including Pacificorp, Portland General Electric, Avista and Idaho Power, are analyzing or deploying this type of service to help meet peak demand.

Policy Option 119:
The federal government should adopt national standards for interconnection and stand-by charges, which would allow and encourage the siting of alternative energy in Ohio. This may be needed if interconnection standards at the state level continue to impede development.

Policy Option 120:
Ohio and the federal government should conduct a detailed review of regulatory barriers to identify what interconnection technologies works and what doesn’t work. For example, many European countries currently utilize mechanisms such as feed-in tariffs to promote distributed generation.
Pollution Prevention

Policy Option 121:

State and federal policies should reward alternative energy sources for displacing traditional electricity generation in pollution cap and trade programs. The Ohio EPA currently gives allowances to clean alternative energy sources and energy efficiency projects that reduce NO\textsubscript{X} emissions during the ozone season under the NO\textsubscript{X} State Implementation Plan (SIP). This program will be replaced in the near future by the Clean Air Interstate Rule (CAIR). The CAIR program should expand to give allowances to alternative energy sources and energy-efficiency projects not just during the ozone season but during the entire year.
INTRODUCTION

In 1995, then Governor Voinovich convened the Ohio Energy Strategy Interagency Task Force, which produced an extensive report. Among the key findings of the task force was the need to, "encourage and develop energy and environmental education for all levels of students and energy consumers to assist them in making better informed energy utilization decisions." Specifically, the report recommended increased education of utility customers; sharing energy conservation and renewable energy information for post-secondary coursework; designing new curricula for primary and secondary students to include energy dynamics and efficiency; and building strategic partnerships to help upgrade teacher education on energy dynamics and efficiency. The report recommended that utilities, school districts, the Ohio Board of Regents, and the Departments of Education and Development work together to implement these recommendations.

For several years following the release of that report, energy education efforts flourished with ample funding. More recently, however, funding has fallen considerably. That has been a trend broader than Ohio, and federal and other public funding for coordinated national energy education has decreased dramatically, despite the energy challenges facing the nation.

At the same time, deregulation has resulted in decreased utility investment in education, creating a similar reduction in private funding. The energy industry today spends less proportionately on public education and advertising than many other businesses. Some observers believe that an approach that balances the “3 E’s” (Energy, Economics and the Environment) could be beneficial for the industry’s public perception and bottom line by supporting efforts on both sides of the supply and demand equation.

Although many developments have occurred in the creation of educational materials and programs, their impact is limited by the lack of funding for dissemination. Meanwhile, the demand for energy education resources and programming continues to increase.

Section 133 of the Energy Policy Act of 2005 directs the U.S. DOE to take a leadership role in energy education by considering establishment of an ongoing energy education program. As a start, U.S. DOE convened an Energy Education Forum on January 4 and 5, 2006, in Washington, D.C., To make recommendations for the development of a national energy education effort. Many of the suggestions generated during that event resonate with efforts in the state of Ohio.
Each of the subgroups at the March 3 summit identified energy education as one of the nation’s most significant needs. As a result, a fifth breakout session and focus group was convened to discuss strategies for enhancing Ohio’s energy education efforts.

A compilation of the recommendations of all five groups suggested that energy education should be at least three-pronged: programs for the general K-12 population; technical and career-based programs in high schools, community colleges and universities; and an awareness campaign for the public.

An effective energy education program would address the following issues:

• The essentials of the market forces driving the production and consumption of energy in America and worldwide

• The impact that personal energy conservation efforts in homes, schools and public buildings can have on energy costs

• Policy level efforts to promote energy conservation, including the promotion of new and emerging energy technologies

• Strategies for meeting America’s increasing need for reliable, affordable, environmentally sustainable sources of energy

For Ohio, part of what is at stake is our competitiveness in today’s global marketplace. The response to the energy, science and mathematics crisis—the situation that forms the broader context of the need for energy education—will determine where Ohio stands in the growing “competitiveness gap” with regard to economics, education and environment.

**Outlook**

**Energy Literacy**

Energy education is critical because we must change the manner in which we use our energy resources. The success of any energy strategy will require high levels of public understanding and a more aware of renewable energy options, especially wind and solar. Clean Fuels Ohio and the Ohio Environmental Council have worked to inform fleet managers of developments in alternative fuels that can save businesses, schools and others energy and money while improving environmental performance. The interplay between the economy and the environment is a major factor in nearly every energy decision we face as individuals and as a society, and these arguments must be presented objectively.

Organizations that have recently received federal funds to promote awareness about energy in Ohio (in addition to Green Energy Ohio, mentioned above), include the central Ohio Clean Fuels Coalition, the Northeast Ohio Clean Fuels Coalition, Tri-State Clean Fuels Network, Columbus Green Building Forum, Cleveland Green Building Coalition and the Hamilton County/Cincinnati Green Building Forum.

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**Case Study**

**Ohio’s Energy Educators**

Ohio Energy Project (OEP), a nonpartisan energy education nonprofit organization, has been working for years to develop materials to educate school children about energy. OEP was one group highlighted in the 1995 Ohio Energy Strategies Task Force Report, and it continues to have a strong presence in Ohio schools. Its board of directors and sponsor network comprise an excellent cross-section of the Ohio energy industry. Ohio energy project is a model for innovative energy education within the state through its energy summits and fairs for teachers and students grades four through eight; Energy Bike Program, which demonstrates the conversion of mechanical energy (pedal power) into electrical energy (lighting a light bulb, fan or radio); Energy Smart Schools conservation and efficiency efforts; and customized energy workshops. 

Additional organizations such as Green Energy Ohio (GEO) have had a very positive effect on making the general public
commitment to the idea of becoming part of the solution. No matter what strategies are adopted by government, success requires that the public understand the costs and benefits of meeting the economic, environmental and educational challenges of energy.

An Energy Literate Society

Fundamental “energy literacy” is critical to the future of the energy industry and the economy. An increased emphasis on advanced science education at the high-school and post-secondary levels will have little effect if students lose interest in science and mathematics in elementary school. Likewise, the public must understand and embrace advancements in research to maximize impact on energy conservation, national security, economics and the environment.

A substantial and visible commitment by government and business is essential in generating public support for an energy-education initiative. Further, commercial and industrial energy users from outside the energy industry must be involved in solutions.

Select aspects of successful K-12 energy education include:

- Unbiased and balanced information about all aspects of energy (including the scientific, economic and environmental aspects of various energy sources, applications, issues and concepts), allowing students to become informed decision-makers
- Authentic learning situations encompassing hands-on experimentation and experiential learning
- A kids-teaching-kids (peer-teaching) approach promoting youth leadership, teamwork, skill development and effective decision making
- Correlation-to-the-content teaching standards and proficiency testing, so that science activities are not seen by schools as “extras” but as integrated parts of the curriculum
- Teacher professional development and ready-to-use curricula that allows for immediate implementation, even when teachers have little scientific background

Partnerships are the key to Success

All state agencies involved in energy and education—including the Ohio Department of Education, PUCO, OEP, ODNR and ODOD—should be willing partners in the development and implementation of K-12 energy curricula or courses for the general student population and the tech-prep and vocational segments. Manufacturers have a role in teaching students and the public how they use and conserve energy. Suppliers and developers should teach issues such as resource exploration, extraction, transmission and energy economics as well as the associated human and environmental costs of energy utilization. Finally, these partners should work in concert with organizations like the Ohio energy project and its national parent organization, the national energy education development project, which have expertise in program implementation and curriculum development. Through such partnerships, existing materials could be organized into courses that would be easily adopted, promoted and distributed by oep and its network of associates.

In addition to K-12 education, professional development should be expanded for current teachers and preservice teachers to prepare them to teach energy topics about which many instructors otherwise would have little training.

Most Ohio colleges, universities and community colleges already have provided leadership in developing coursework for future workers in energy-related fields, and they could have an even broader role in energy education. Among the colleges and universities that have direct academic offerings are Owens Community College, Hocking College and the University of Toledo, which has a well-recognized solar research and development program.

Supply and Demand

Ohio should work with colleges and universities to develop exemplary job training and degree programs and to find ways to inform potential students of the opportunities available in Ohio for entering this important and rewarding career field. Similarly, the Lead The Way Program has developed tech-prep coursework for high school students to enter technical fields. This program should be expanded significantly, anticipating future growth in the many new energy industries located in Ohio.

Also, existing community college and university courses on energy could be models for high school courses, which in turn could be modified appropriately for middle schools. Promoting an extensive unit of study or an entire course on energy would send a very valuable message about our state and national energy situation. Further, such a unit could act as a “capstone” idea that integrates a wide variety of seemingly disparate disciplines including history, economics, chemistry and biology. Energy is a very significant topic in every discipline of science, making it an ideal subject for cross disciplinary study. The course(s) could be designed, as all school and OEP programs are, around content teaching standards.
Each segment of the energy industry should consider significant efforts to increase its educational outreach and investment. Corporations, associations and agencies should consider investing in energy education as part of their corporate and organizational mission. This would foster good will with members of the general public, who routinely express concerns over the energy industry’s environmental stewardship. It would make sense for the industry to work with the institutions that will help to replace the aging energy industry workforce.

The workforce for nuclear energy and mining is getting close to retirement. Companies charged with managing the nation’s 103 operating nuclear power reactors are faced with an estimated loss of up to 23,200 employees, or 40 percent of their workforce, within the next five years.108 Because there has been no new construction of nuclear power plants in some time, college curriculums have moved away from training students for nuclear, power and mining engineering fields. There are presently 31 colleges and universities around the country with programs in nuclear engineering, including three in Ohio: Ohio State, University of Cincinnati and Air Force Institute of Technology at Wright-Patterson Air Force Base. With the projected growth in the nuclear power plant industry, these programs may fall short of our national need for highly skilled nuclear engineers. This trend mirrors similar personnel shortfalls across all sectors of the energy industry.

**Priorities**

**Achieving Energy Literacy**

Ohio should adopt the goal of achieving an “energy literate” citizenry who understand and appreciate the role energy plays in enhancing economic well-being and the tradeoffs associated with energy production and utilization. Energy-literate Ohioans would be able to make informed, well-reasoned decisions on energy usage. Informed citizens are capable of empowering their elected officials to develop sustainable energy policies that reflect those choices.

**Education and Job Training**

Ohio must retain an educated work force capable of meeting the needs of all sectors of the industry, including power plant operators, mining engineers, alternative energy installers and policy regulators. In a field that is ever-changing, it is difficult to stay on top of the latest technological improvements. Organizations and regulators should collaborate with universities and colleges to develop courses and training materials and set mandatory retraining guidelines and training credits for new and existing employees to stay up to date with changing technology.

The utility and industry sectors should work with universities to hire more cooperative education students, encourage faculty to pursue research in energy issues and foster a desire for students to study energy-related fields. Ohio should expand its college curricula and course offerings over the next decade, focusing on the areas of this report.

Ohio should identify its critical knowledge needs and enhance these and other programs across the state to attract the best and brightest crop of high-school graduates and maintain their talents and enthusiasm. Reducing Ohio’s brain drain is of crucial importance for the state’s energy industry and manufacturing sector.

**Developing A Public Awareness Campaign**

Once key needs for energy information have been identified, concepts could be selected for an awareness campaign aimed at the general public. Quick-hitting messages introducing or explaining various energy concepts could precipitate thought and discussion. An effective awareness campaign should include interactive mixed media, face-to-face presentations to every sector of society and advertising designed to excite and inspire the imagination.

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108 Anderson, 2006
A multilayered education campaign could help build public support for many potential energy solutions. The central messages must meet people where they are and move from there. It is important that these messages not preach a specific solution but rather allow individuals to assess the advantages and disadvantages of the issues. Each segment of the energy industry must be willing to support this effort financially and with their communication resources, including earned media, advertising and public-service announcements.

The campaign must be one of education, not activism and one of information, not emotion. Likewise, it is important that short- and long-term advances in the energy sector be given equal representation. One thing we know for sure about energy is that we must always have new ideas in the pipeline for situations that arise in the years to come. Technological advancement is of primary importance here in Ohio and throughout the global marketplace.

Many of the following recommendations require legislative action, reallocation of existing resources or new investments. These investments in the future are modest, however, when compared with the economic and security implications of inaction.

**Policy Options for Energy Education**

**State Coordination**

**Policy Option 122:**
The governor of Ohio should appoint a Task Force on Energy Education comprising state government agency officials, energy industry representatives, energy education practitioners (including established programs, universities, educational organizations, and state and federal associations) and advisory organizations. The purpose of the group would be to identify and make recommendations for enhancing the multitude of energy education efforts already underway.

**Policy Option 123:**
As part of its charge, the proposed Governor’s Task Force on Energy Education should consider the creation of an office, located within the governor’s office, to coordinate energy education efforts across the state. The task force should seek to coordinate its efforts with the findings of the U.S. DOE’s Energy Education Forum and would report to the chair of the Energy Cabinet proposed in the sustainable development section of this report.

**Policy Option 124:**
Federal and state agencies should align and coordinate their energy education efforts to deliver a consistent message and to maximize limited resources.

**Policy Option 125:**
State efforts and programs should be linked with national initiatives. Ohio should enter into a joint agreement with national organizations to stay abreast of advances in energy education. Potential collaborators include the National Energy Education Development Project, U.S. DOE and its Energy Information Administration, the alliance to Save Energy, the American Council for an Energy Efficient Economy, the Environmental Literacy Project and others.

**Policy Option 126:**
Ohio should develop an approach for sustainable funding for energy education that inhibits the erosion of existing funding and provides support for existing programs.

**Policy Option 127:**
Ohio education standards should present a clear definition of energy, where energy comes from and each individual’s role as a consumer and decision-maker.

**Policy Option 128:**
Ohio should correlate its efforts to standardized testing and education standards to maximize the use of energy education in the classroom (K-16).

**Energy Literacy**

**Policy Option 129:**
Ohio should set a goal of making its citizens energy literate by 2009, when electricity rate caps are to be lifted. This would prepare consumers for increasing rates and allow them to make informed decisions concerning their electricity generators.

**Policy Option 130:**
As part of its charge, the proposed Governor’s Task Force on Energy Education should create a definition of energy literacy along with some means to measure it across all three categories of education (K-12, post secondary, job training) and in general public awareness.

**Developing a Wide Array of Materials**

**Policy Option 131:**
In coordination with a variety of stakeholders, Ohio should develop a coordinated portfolio of energy education products and messages, providing factual information about each energy topic (information, not propaganda). This portfolio should include information on all aspects of energy, energy transformations, energy sources, transportation, electricity generation, efficiency,
conservation, economics, environmental impact and the role of technological advancement.

**Assessing the State's Progress Towards an Energy Literate Electorate**

*Policy Option 132:*
As part of its work, the proposed governor’s task force on energy education should identify benchmarks for success and an evaluation process for measuring the success of education efforts.

*Policy Option 133:*
In order to generate detailed, reliable information on Ohio energy production and consumption patterns, the state should establish an information clearinghouse which works in close coordination with the U.S. Energy Information Administration (EIA) to provide data at many levels.

**Federal Funding and Priorities**

*Policy Option 134:*
The federal government must enhance interagency coordination and communication among all agencies with energy-related interests: DOE, Department of the Interior, Department of Commerce, Department of Agriculture and EPA.

*Policy Option 135:*
In order to meet the predicted need of as many as 10,000 new STEM teachers, the federal government should fully fund the proposed Undergraduate Scholar Awards in Science, Technology, Engineering, and Mathematics (USA-STEM). This proposed program would award scholarships to students who obtain a four-year degree and obtain certification as a K-12 mathematics or science teacher. As proposed, the program would offer students up to $20,000 per year for school costs in exchange for a five-year commitment to teach science or mathematics.109

**Components of an Energy Education Portfolio**

*Policy Option 136:*
State-supported educational materials should seek to develop an understanding of the security implications and environmental consequences of all energy sources; instill an appreciation for demand and supply side; strive for an appreciation for energy efficiency and conservation; inform the public about building types and their effect on demand; and seek to reduce energy losses associated with production and distribution.

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109 Congressional Research Service Report, 2006

**Energy, Education And Economics**

*Policy Option 137:*
Ohio’s energy education materials should stress the state’s role in energy production, trade and the usage of energy, as well as the economic implications of consumption and the importance of Ohio’s energy patterns on global markets. These materials should consider energy market volatility (supply/demand), the geopolitics of energy and economic policy.

*Policy Option 138:*
Materials developed for the state should provide a strong basis in energy economics, starting at the earliest levels.

*Policy Option 139:*
Ohio should require electric utilities to disclose information about fuel sources, emissions and costs to consumers to better inform their purchasing decisions. Information could be included in monthly billing as well as other forms of communications.

*Policy Option 140:*
For industrial users, Ohio should encourage companies to integrate into the DOE’s Industrial Technologies Program and the EPA’s Climate Leaders Program to leverage those federal resources. Both of these voluntary programs encourage better decision-making by providing industry with additional information about energy usage, emissions and costs.

**Developing a Public Awareness Campaign**

*Policy Option 141:*
Ohio should develop a public awareness campaign to promote energy literacy. Ohio’s awareness campaign should include not merely advertising but also interactive mixed media, face-to-face presentations and other delivery channels designed to reach every sector of society.

*Policy Option 142:*
As we prepare for electric rate caps to come off in 2009, Ohio should enhance efforts to inform the public about the looming impact of increasing electricity costs.

*Policy Option 143:*
Ohio should expand its definition of “the public” to reach out and include news reporters, teachers, universities and legislators who relay much of the news on energy issues to the general public.

*Policy Option 144:*
Ohio should implement a comprehensive education program to inform residential consumers about how they can achieve the economic and environmental benefits of more efficient energy
use. Examples and choices they can make and cost consequences should be covered with utility communications support.

Policy Option 145:
As part of its awareness campaign, Ohio and the federal government should inform the public about the link between national security and energy independence.

Policy Option 146:
The proposed Governor’s Task Force for Energy Education should be charged with recommending methods for funding demonstration projects that show the viability of alternative energy technologies.

Policy Option 147:
Ohio should provide training and education on the availability, infrastructure and use of alternative transportation fuels for these respective markets.

Teacher Preparation
Policy Option 148:
Ohio should continue efforts to ensure that its teachers are qualified upon graduation to teach math, science and engineering principles.

Policy Option 149:
Ohio must provide continuing education and training to our existing school teachers and other education practitioners to keep them up to speed with advances in the energy field.

Job Training
Policy Option 150:
Ohio should develop a training program for employees working in departments with oversight of energy-related fields. For example, many Ohio EPA and ODNR employees do not agree about regulations, controls and the interpretation of laws.
CONCLUSIONS

Though each of the breakout sections of this report includes specific recommendations, it is worth reiterating the common themes that emerge from all the discussions:

- Government policies on energy, environment, sustainability and economic issues should be integrated and no longer developed in a vacuum.

- Emphasis should be placed on new fuels and technologies that can be used by industry and consumers in the near future, rather than focusing on those that have long-term applications. For example, the federal government should provide incentives to foster development of gasification, both as part of utility operation (IGCC) and as stand-alone units. Gasification of domestic coal and biomass provides a pathway for power generation with carbon capture and sequestration. It provides utilities with the opportunity to reform the gas into natural gas for home or business use and into liquid transportation fuels such as gasoline, diesel and jet fuel.

- State and federal agencies should examine how to work within the existing infrastructure of power plants, and how to improve established fuels and technologies such as coal, natural gas and diesel. In many cases, fine tuning existing facilities could be easier and less costly for industries than adapting new technologies or constructing new facilities. America will have to rely on a variety of energy sources in the future - both alternative and traditional energy- to meet demands.

- Incentives should be given to encourage businesses to adopt cleaner construction and transportation practices. Funding such incentives is a challenge because the federal deficit...
means that money must be raised to fund new programs. Existing taxes (such as the gasoline tax) should be re-examined, and some revenues should be redirected to support more sustainable programs.

• The public should be better educated about the problems of our historic energy consumption patterns. Programs should provide practical information about how consumers can make individual changes to reduce their energy consumption and impact on the environment.

• Ohio has the potential to replace much foreign energy with domestically grown and processed biofuels. While crop-based biofuels are a good start, even if published ethanol and biodiesel targets for 2020 are reached, they will replace less than 4 percent of foreign oil. Research and development is needed to create feedstocks for biodiesel and cheaper ethanol production that would produce higher yields than current crops.

The summit provided an important opportunity for public and private sector experts, representing a broad range of stakeholders, to meet together and discuss an extraordinary range of topics related to energy.

Certainly there is not yet agreement among participants about precisely which options should be adopted. The writers of this report hope that the debate will continue and that many of the ideas presented here will be thoroughly discussed and ultimately adopted as Ohio develops a comprehensive, forward-thinking energy strategy.

Meanwhile, although summit participants may differ in the solutions they prefer, they share a sense of urgency about the need for Ohio to move forward.

There are many potential strategies to displace imported energy in ways that offer Ohio economic development potential and environmental benefits.
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Bibliography
Appendix A: Welcome Letter from the Honorable Senator George V. Voinovich

February 21, 2006
David Conover
Principal Assistant Deputy Secretary, Domestic Policy & International Affairs
U.S. Department of Energy
1000 Independence Ave.
Washington, DC  20585

Dear Dr. Conover:

One of the most pressing challenges America faces today is reducing our reliance on foreign energy sources. It is critical that we grow more energy independent to increase our competitiveness in the global marketplace and improve national security. Our key challenge in this work is respecting the environment while responding to energy and economic needs. Because energy independence is absolutely vital to the future of our nation and Ohio, I have called for a “Second Declaration of Independence.” Towards this end, I invite you to a workshop that I am cohosting with Ohio University’s highly regarded and nationally recognized Consortium for Energy, Economics and the Environment (CE3) for the purpose of crafting recommendations on the role Ohio can play in our national effort to reduce dependence on foreign energy.

2006 State of Ohio Workshop:
Initiatives for U.S. Energy Independence
Friday, March 3 from 10:00 am - 4:30 pm
Verne Riffe Center - Columbus, Ohio

Your expertise and suggestions will add significant value to the workshop discussion and the “blueprint” plan that will follow it. This plan will serve as a helpful guide to Ohio energy innovators and policymakers in our shared efforts to maximize Ohio’s economic development as we advance national energy independence. The workshop will feature plenary speakers followed by four concurrent breakout discussions on the following areas: 1) Transportation; 2) Alternative Energy Sources; 3) Fossil Fuels; and 4) Sustainable Building Techniques.

The Consortium for Energy, Economics and the Environment is a unique partnership combining Ohio University’s most talented faculty in the areas of economics, energy and the environment with experts and practitioners in these fields in order to identify solutions for addressing our nation’s energy needs while harmonizing energy, environmental and economic policies. An agenda and further information will be sent to you in the coming weeks. In the meantime, please confirm your attendance with Cheryl Hanzel from Ohio University’s Consortium for Energy, Environment and Economics at 740-593-2222, no later than February 24.

I look forward to this opportunity to meet with you to discuss how we can move forward with energy independence and the opportunities for Ohio in this effort. Please feel free to contact Cara Dingus on my staff with any questions at (740) 753-1985. Thank you for your continued service to Ohio.

Sincerely,

George V. Voinovich
United States Senator
Appendix B: Summit Agenda

**Ohio: Securing America’s Energy Future**
2006 State of Ohio Workshop on Initiatives Leading
To U.S. Energy Independence

31st Floor, Vern Riffe Center for Government and the Arts
77 South High St., Columbus, Ohio
Friday March 3, 2006

9:00-10:00 AM  Registration and Breakfast

10:00-10:20 AM  Welcome and Opening Remarks:
  Roderick Caves, President, Ohio University
  The Honorable United States Senator George V. Voinovich

10:20-10:30 AM  Introduction of Participants

10:30-11:00 AM  Briefing on the State of Ohio Energy Profile:
  Don McConnell, Corporate Sr. Vice President, Battle Memorial Institute, and Chief
  Operations Officer, Battle Labs

11:00-11:30 AM  Perspective from DC:
  David Conover, Principal Deputy Assistant Secretary, Domestic Policy &
  International Affairs, Director of the Climate Change Technology Program, U.S.
  Department of Energy

11:30-11:45 AM  Overview of the Charge and
  Explanation of Break-out Sessions:
  Mike Zimmer: Energy Corporate Transactions & Securities, Thompson Hone LLP

11:45-2:45 PM  Breakout Sessions (with working lunch)
  Transportation  Alternate Energy  Sustainable Development  Fossil Fuels

2:45-4:15 PM  Breakout Session presentations and Group Discussion:
  Moderator: Mike Zimmer

4:15-4:30 PM  Summation/Wrap-up and Thank You
  Mike Zimmer
  The Honorable Senator George V. Voinovich


**Ohio’s Energy Future: Alternative Energy**

**Introduction:**
“Alternative energy” includes energy forms that are not popularly used, that come from nontraditional sources, that are not dependent on fossil fuels and that are considered to be more environmentally sound. These forms of energy often are thought to be renewable and sustainable.

As America makes important decisions about our economic future and national security, we must be sure that we have flexibility in our decision-making so that we can control outcomes and change course as technologies change, supplies change, markets change and world events dictate. We might think of alternative energy as buying a mutual fund of energy options when really it’s an issue of managing risks and allocating resources.

**Categories:**
A task of the break-out session will be to inventory forms of alternative energy, noting their current status of development in Ohio. Participants will be asked to comment on the environmental strengths and weaknesses of each form of energy, as well as barriers to commercialization. Finally, the potential for development in Ohio will be discussed with an emphasis placed on prioritizing all possible solutions. Alternative energy technologies include:

- **Wind energy**, including wind turbines used for generating electricity, charging batteries or pumping water
- **Solar energy**, which uses sunlight to generate electricity, to heat water, and to heat, light and cool buildings
- **Fuel cells**, which efficiently convert hydrogen into usable energy without negative environmental impacts
- **Biomass**, where carbon-rich organic materials are used to provide heat, make fuel or generate electricity. Energy can be created from special plants or crops now used for food, from agricultural or forest wastes, from oils that are byproducts of cooking, and even from landfill gas.
- **Distributed energy**, which involves placing new electric generation capacity closer to the point of use, resulting in reduced transmission losses and greater system efficiency. An efficiency distributed system might include use of microturbines and some reliance on waste fuels.
- **Alternative transportation fuels**

**Setting priorities:**
We should not think about energy in one dimension. Rather, it may be time to think of the development of alternative energy in three dimensions: energy, the environment and economic development. Perhaps the goal should be to:

1. Create job opportunities in the research, design, manufacture, construction and operation of energy projects
2. Protect and improve our environment
3. Reduce America’s reliance on foreign energy sources
Making evaluations:
Perhaps we need:

• To think of agriculture not only as food, but also as an energy source.
• To think of waste as a resource rather than “unwanted material.”
• To think of combining energy sources in synchronization to provide firm energy and maintain its economic viability (such as wind, solar and biofuels), including issues of connectivity and power distribution locally and nationally.
• To think about the ability to produce energy locally and distribute it to local users by downsizing and miniaturizing systems.

We are challenged to:

• Believe that Ohio, the contributor of light and flight to the nation, could contribute the next energy source or technology, the one that beats fossil fuels in the pocket book.
• Make the kind of commitment to research and development and capital expenditures historically provided to highway construction and aerospace.
• Harness Ohio’s natural advantages of work ethic, institutions of higher education, multitude of research facilities, agriculture and manufacturing to create an environment that encourages entrepreneurship and innovation and rewards the investment of risk capital.

Ohio’s Energy Future: Fossil Fuels

Introduction: Fossil energy will remain the core element of our energy system well into the future, but availability and affordability of fossil energy resources will become more challenging in the next decade. This dynamic will bring new challenges and opportunities to Ohio’s energy future.

U.S. dependence on imported petroleum and natural gas is higher today than it was at the height of the oil embargoes of the 1970s. At the same time demand for petroleum is rising, spare world oil production capacity is near its lowest level in three decades. The impact on petroleum prices suggests that clearing prices for benchmark crude will continue to hover at or above $60 per barrel, with supply disruptions potentially spiking crude prices as high as $120 per barrel.

Comparable issues of increasing demand in the face of flat- to declining domestic reserves will drive natural gas supplies and prices. Current estimates suggest that by 2025 the United States will need to import nearly 4 trillion cubic feet of liquefied natural gas each year at prices 25 percent above current clearing prices.

These dynamics will present a series of challenges for Ohio’s economic future. Nearly 80 percent of petroleum is used for transportation fuels, with additional petroleum resources being used as a feedstock for materials used in transportation. Recent studies by the University of Michigan suggest that rising oil prices can significantly impact Ohio employment. They estimate that sustained oil prices at or above $80/bbl could reduce U.S. auto employment by 297,000 workers, while benchmark crude prices at or above $100/bbl could reduce U.S. auto employment by 465,000 workers, with an overall impact on automotive industry profits in excess of $18 billion per year.


Trends in Ohio:
Increasing market prices are stimulating the development of new energy sources and new approaches to using energy more efficiently. Recent studies of the federal energy policy suggest six major trends that will impact our energy future in Ohio:

- Improvements in transportation efficiency and/or fuel substitution have the highest near and mid-term leverage on petroleum imports.
- A viable nuclear power option is essential to an energy future that must respond to environmental- and reliable electric energy availability.
- Zero emissions fossil generation could play very strongly against national goals, if key technical challenges are solved in capture and disposal of carbon emissions.
- Renewable energy will play a significant but constrained role in Ohio’s energy future.
- Continuing improvement in energy productivity, especially in buildings and industrial heating, is technically feasible and increasingly important to maintaining a competitive position for Ohio industry.
- The electric grid (capacity, reliability, power quality and price) is a central issue that will increase in importance over time.

Potential solutions:
Developments in Ohio could contribute to the nation’s slate of energy solutions:

- High demand for transportation fuels is driving fuel switching and enhanced fuel efficiency. Fuel switching options include oil sands, oil shale and biofuels, which could displace substantial quantities of imported crude oil. Current estimates of unconventional domestic oil reserves from oil sands and oil shale suggest that the United States has untapped potential reserves of more than 1 trillion barrels, over a third of which may underlie Ohio. Planning and research is now underway to develop these reserves, with initial production of oil sands already substantially supporting oil demand.

- Research into new automotive technologies by the private sector is driving hybrid drive technology, high efficiency diesel technology and, ultimately, fuel cell vehicles operating on hydrogen. Ohio manufactures and research institutes feature prominently in this drive to future propulsion and energy systems.

- The increasing cost of natural gas heavily impacts utility costs and is a strong driver of electric power generation options. The immediate impact is to increase the focus on coal-fired generation as means of meeting expanding demand for power in an increasingly electrified economy. Although this option remains a critical element in Ohio’s energy mix, it also raises the prospect of increasing environmental impacts from coal mining and combustion.

- Ohio utilities are leaders in seeking technologically advanced alternatives for coal generation that reduce the environmental impact of coal generation today and offer the prospects of mitigating climate impacts from carbon dioxide emissions in the future. Such options as integrated gasification - combined cycle generating plants that are designed to be compatible with CO₂ sequestration - are viewed as essential options for insuring the future of fossil energy for electric generation. There will also be opportunities in such emerging fields as high-temperature fuel cells and hydrogen turbine systems.
Conclusion:
Taken together, the changing face of fossil energy presents Ohio with challenges and opportunities. How we respond will shape Ohio's economic future.

Ohio's Energy Future:
Sustainable Development

Introduction:
Worldwide demand for resources now surpasses the regenerative capacity of the planet, leading one environmental expert to remark, "We are satisfying our excessive demands by consuming the earth's natural assets, in effect creating a global bubble economy." This insatiable appetite for resources contributes significantly to a host of social and environmental problems, including deforestation, soil erosion, habitat destruction and species loss, water scarcity, surface and groundwater pollution, urban sprawl, and food insecurity.

The problem of "excessive" demand is particularly acute in the United States. Although Americans account for just 5 percent of the world's population, we consume approximately 25 percent of the world's resources, including fuels and other minerals. If everyone consumed resources at the same pace as the average American, we would need four more earths to meet all our material and energy needs.

Ohio is confronted with many of these problems, including, for example, agriculture. Despite some fuel efficiency gains, most foods still require more energy to produce, process and distribute than they yield when we consume them. That's a major issue in a state where more than 55 percent of land area is devoted to agricultural production. In Ohio, agriculture is our leading source of nonpoint water pollution and uses a staggering 2 billion gallons of water daily.

And Ohioans discard 5.5 pounds of solid waste per day, compared to the national average of 4.6 pounds. Then there is urban sprawl. One report says that between 1980 and 2000, the proportion of developed land in the Cincinnati region increased by 141 percent while population increased by just 15 percent, a phenomenon replicated across the state and the cause of huge stresses on services, access, schools and habitats.

Some solutions:
To get from these inefficient and wasteful patterns of doing business, we need guideposts. First, the economy must be seen as a category of the environment instead of the other way round. Next, we must squeeze more out of each kilowatt, each gallon of gas and water, and each acre we till or convert to urban and suburban use. Then, we must reduce waste and ultimately eliminate the concept by mimicking nature's ways of recycling. Finally, we must invest in natural capital - water above and below ground, the air we breathe, our soils, forests, wildlife, pollinators - none of which we can do without.

The challenges are great, but the good news is that initiatives are under way in every corner of Ohio. With citizen engagement, political leadership, economic incentives and help from the media, Ohio could become a standard-bearer. For example, there is a vast array of smart growth proposals across the state; mall backlash is leading to redevelopment of more efficient and compact downtowns and urban neighborhoods; Brownfield restoration and redevelopment is happening in several cities; and there is renewed enthusiasm for high-speed rail in the
Ohio-Lake Erie Regional Rail Hub plan.

Though Ohio is losing farmland, we are gaining awareness of the economic and ecological benefits of organic agriculture, and the numbers of organic farmers and services for them are growing rapidly. Ohio has also built impressive information systems on biodiversity. ODNR, some towns and cities, and The Nature Conservancy, among others, have devoted resources to their protection. Green construction is booming across the state, from academic buildings to the Federal Building in Youngstown, to a Giant Eagle supermarket in Brunswick.

Meanwhile, the Apollo Alliance, which focuses on the connection between economic growth and sustainable energy, has a plan to add 130,000 new jobs in renewable energy, advanced technologies, high performance building and urban reinvestment. The Blue-Green Alliance, which pairs the labor and environmental movements, is promoting renewable energy and job growth via technological investment, green building, energy efficient appliance manufacturing and better transportation systems. The Ohio Water Resources Council is working to improve our highly inefficient use of water resources; the Ohio EPA and others are trying to monitor and protect our pressured aquifers; and OSU’s Ohio watershed network lists hundreds of watershed friends groups and restoration projects.

Categories of action: So what steps do we include when we refer to “sustainable development”? The options are amazingly broad, but many fall within these categories:

• Electric Power, including voluntary goals to reduce greenhouse gas emissions; improved environmental performance of power generation facilities; demand-side management services; wire charges to encourage development of cleaner energy systems; and energy efficiency and conservation initiatives

• Transportation, including cleaner fuels and vehicles; regional rail and other mass transit; and policies to encourage car-sharing, compact development and telecommuting

• Business development, including fostering ecoindustrial parks and climate-friendly business; accounting for the greenhouse gas emissions avoided if new facilities employ climate-friendly technologies; streamlined permitting for new low-carbon generating facilities and related infrastructure; and tax incentives for installation of climate-friendly and energy efficient technologies

• City development, including mitigating road and traffic congestion; planting trees to cool urban areas and sequester carbon; recovering methane from landfills; and instituting more community recycling and anti-littering programs

• Agriculture and forestry, including land restoration projects that could increase carbon sequestration; research on renewable energy crop production, recycling of organic wastes, use, and nutrient management; and development of eco-efficient ways to capture energy from agricultural byproducts (i.e., crop waste and manure), including methane

More questions:

• Which of these many initiatives promise a sustainable future?

• Which are most likely to yield big conservation benefits?
Which will contribute to Ohio’s economy in the short- and long-term?

What tools and mechanisms can we employ to transfer efficient technologies from design stage to the consumer?

What other steps can we take to ensure that our children and grandchildren will inherit a better Ohio?

Ohio’s Energy Future: Transportation Fuels

Introduction
Ohio’s highway-based transportation system was made possible by an abundance of cheap energy, but the situation is changing and higher energy costs could mean reduced travel of goods and people. With planning, the change could lead to bright spots, like a more localized economy yielding improved employment opportunities and a better quality of life. Solutions to Ohio’s transportation challenges fall into three categories: new technologies, including kinds of vehicles and fuels; travel reductions; and other policy initiatives.

Technology Based Solutions:

• Fuel cell car systems operate by electrochemically combining on-board hydrogen with oxygen taken from the air. Hydrogen molecules are brought into contact with the negative electrodes, causing them to split into protons and electrons. The protons are carried across a membrane to the positive electrode, generating electricity. The hydrogen and oxygen are combined, so that the only emission is water vapor. Both Ford and Daimler Chrysler plan to soon release fuel cell vehicles.

• Multifuel vehicles run on a variety of fuels or fuel combinations:
  - Ethanol - manufactured from food crops such as corn, sugarcane and wheat - can be blended with gasoline to produce E10 fuel (10 percent ethanol and 90 percent gasoline), or higher concentrations up to E95.
  - Bioethanol comes from the “cellulosic biomass” of trees and grasses.
  - Biodiesel is a renewable fuel manufactured from vegetable oils, including readily available recycled oils from restaurants. It is safe and completely biodegradable and emits much less particulate matter, carbon monoxide and other pollutants than regular diesel. It is blended 20 percent biodiesel and 80 percent petroleum diesel (B20) for use in unmodified engines, or used in pure form (B100) in a modified engine.
  - Commercial biorefining is not cost competitive with petrodiesel when using crop feedstocks mostly used for feeding humans and livestock. Oils from microalgae, however, have the potential to create thousands of barrels of biodiesel per acre, compared to less than ten for soybeans. Research is needed to pursue technologies that would use greenhouse gases from the exhaust of coal-fired power plants to efficiently grow vast quantities of microalgae for biodiesel production.
  - Hybrid vehicles (HEVs) combine the internal combustion engine of a conventional
vehicle with the battery and electric motor of an electric vehicle, thus achieving twice
the fuel economy of conventional vehicles.

• Heavy construction vehicles produce much air pollution, which could be reduced by
retrofitting to biodiesel.

• Freight and shipping technologies

Travel Reduction (TDM)

• Car sharing programs offer on-demand transportation. Vehicles are kept in a central
location and may be reserved for use by members. A car sharing program, City Wheels,
started by EcoCity Cleveland, primarily uses hybrid gas-electric vehicles. MORPC is
currently organizing a car-share program for Central Ohio.

• Mass Transportation:
  • Public transit systems exist in Ohio’s major urban areas, but there is no comprehensive
    system. More funding would allow steps to make existing urban networks more
    popular and effective, and to create regional and rural systems.
  • Existing systems could switch to alternative fuels.
  • Potential policies to increase the attractiveness of mass transportation include
    location-efficient mortgages and telecommuting incentives.
  • Promoting freight traffic via rail could reduce traffic congestion and fuel use.

• Complete Streets programs make streets safe and inviting for all modes of transportation,
including walking, biking and driving. A model in central Ohio encourages nonvehicular
modes of traffic.

Policies

• Land use and transportation interaction could be modified to encourage accountability
and coordination between local. Also, Transit-Oriented Development addresses the
connection between how we develop and how we become reliant on personal vehicles.
And building in nodes, or more compactly, reduces vehicle trips.

• Highway tolls can help pay for road construction and maintenance and also encourage
drivers to reduce their number of vehicle trips.

• Idling reduction technologies could address fuel waste and pollution problems that
result because a typical long-haul tractor-trailer idles approximately 1,830 hours per
year. Some laws attempt to reduce idling, but truckers continue to idle their engines
while they rest to provide heating, cooling and electrical power and to keep the engine
warm and the battery charged. Key reduction technologies are truck stop electrification,
allowing vehicles to “plug in” and operate necessary systems, and auxiliary power units.

• Cost-based transportation would allow congestion pricing and other systems of cost
recovery.

• Revised funding formulas might ensure that no mode of transportation is favored and
equitable funding is provided for highways, various freight systems, passenger rail and
mass transit.
• Taxes could be used to encourage mitigation of environmental and other impacts, in addition to direct user fees (e.g. gas tax).

Additional Discussion Questions

1. What existing transportation technologies can be used to decrease energy dependence?

2. What policies would encourage the use of innovative technologies?

3. What role does R&D play? How can the government support these efforts?

4. Are there regulatory, infrastructure or policy barriers in the transportation realm? How can these be addressed?

5. What role does Ohio’s existing infrastructure play in moving towards different energy consumption patterns?

6. How can transportation policies at the federal level encourage localized energy production and consumption for vehicles?
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Identifying safe, reliable, affordable and non-polluting sources of energy is the mission of the Consortium for Energy, Economics and the Environment (CE$^3$), a group of experts dedicated to developing energy solutions that complement communities' economic priorities and preserve the integrity of the environment.

**Collaboration**

CE$^3$ strives to make a significant impact on energy, economics and environmental issues by uniting Ohio University faculty and students studying economics, engineering, biology, geology, and environmental and plant sciences. It also draws local, state and federal government officials, industry representatives and Ohio nonprofit groups into this important dialogue.

**Projects**

CE$^3$ is dedicated to helping the region and the nation through applied research that has tangible benefits for communities. The group's track record includes:

- Clean coal research, resulting in patents to reduce emissions
- Alternative fuels research, which has led to new technologies to generate hydrogen for fuel cells from waste ammonia
- A biofuels initiative that led to the city of Athens running two trucks on biodiesel
- Ozone mapping for Cleveland, Columbus and Dayton from the CE$^3$ Clean Air Center
- A new kind of mercury tracking program, developed on behalf of the U.S. Department of Energy
- Water quality research that has led to a partnership with the Ohio Department of Natural Resources and technical assistance for local watershed organizations
- Economic analysis of the reliance on relatively inexpensive, accessible sources of energy

**Education**

The interdisciplinary approach of CE$^3$ results in an invaluable learning experience for some of Ohio University's brightest students. The George V. Voinovich Center for Leadership and Public Affairs works with the Russ College of Engineering and the College of Arts and Sciences to create a unique academic opportunity in which graduate and undergraduate students brainstorm, design, implement, monitor, evaluate and modify energy solutions. The work prepares students for professional careers, and helps develop a highly skilled workforce in Appalachian Ohio. In 2005, Ohio University named CE$^3$ a major research priority because of its past success and potential for national prominence.

**Policy**

Those involved with CE$^3$ hope that their research will aid legislators in economic and policy decisions. The consortium can help the state learn how to comply with federal air and water quality standards and also expose legislators to the economic benefits of cleaning up the environment.
GLOSSARY OF TERMS

AEPS: alternative energy portfolio standard, which requires electricity providers to include a specified amount of renewable energy as part of their portfolio of generating fuels

APU: auxiliary power unit, a relatively small self-contained generator used in vehicles to start the main engines, usually with compressed air, and to provide electrical power and air conditioning when the vehicle is not moving

ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers

B5: fuel with 5 percent biocomposition

B20: fuel with 20 percent biocomposition

BPL: Broadband over power lines, which allows customers to get high-speed Internet connections through their electrical outlets

BTU: British thermal unit, a standard unit of energy

CCX: Chicago Climate Exchange

CE3: the Consortium for Energy, Economics and the Environment at Ohio University

CHP: Combined heat and power, also known as cogeneration

CNG: compressed natural gas

CTL: Coal-to-liquid technology

ECO: Electro-catalytic combustion

Electric Cooperatives: Electric cooperatives are nonprofit, user-owned utilities. Some proceeds of the business are returned to members (customers) in the form of a lower electric rate, annual dividend and/or patronage refund. All cooperative members (customers) hold voting stock in the company and are its principal investors. All cooperatives follow a policy to serve their members in the best public interest and are regulated by federal charter.

Environmental Management Systems (EMS): the act of planning, implementing, reviewing and improving actions that an organization takes to meet its environmental obligations. Most EMS’s today are based on the recently issued ISO 14001 Standard.

Environmentally Preferable Purchasing: purchasing products that use less toxic materials, generate less waste, are recyclable or are made with recyclable materials. EPP reduces liabilities and costs related to waste stream management; human health risks; environmental compliance; and raw material costs.

FFV: a flexible-fuel vehicle or dual-fuel vehicle that typically can alternate between two sources of fuel. A common example is a vehicle that can accept gasoline mixed with varying levels of ethanol.
Appendix F: Glossary of Terms

GWh: gigawatt hour. One million kilowatt-hours of electric power

Hg emissions: mercury emissions

HVAC: Heating, ventilating, and air conditioning

ICE: internal combustion engines

IGCC: integrated gasification combined cycle

Investor-Owned Utilities: a for-profit company owned by its stockholders. IOUs are regulated by the Public Utilities Commission of Ohio (PUCO), which sets policies and rates to serve its customers in the best public interest. Currently, all IOUs are operating under so-called Rate Stabilization Plans (RSPs), which effectively freeze price levels for the next few years.

Life Cycle Assessments (LCA): an assessment tool that identifies environmental risks in the production and service life cycle. LCA’s evaluate the environmental threats to both businesses and customers.

LNG: liquefied natural gas

LFG: landfill gas

Midwest ISO: Midwest Independent Transmission System Operator (regional transmission organization which operates in the Midwest)

MORPC: Mid-Ohio Regional Planning Commission

Municipal Utilities: Municipal electric systems are often referred to as public power systems. They are nonprofit electric utilities owned by municipalities (cities or villages). These utilities are operated and governed by the municipality’s legislative authority (i.e. the city/village council or board of public affairs) elected by municipal residents.

NYMEX: New York Mercantile Exchange

Performance Contracting: a construction practice that allows a builder to install energy-saving improvements using existing funding and financing the energy saving technologies with money saved by reduced utility expenditures

OAQDA: Ohio Air Quality Development Authority

ODOD: Ohio Department of Development

OEC: Ohio Environmental Council

NOx emissions: nitrogen oxide emissions

ODNR: Ohio Department of Natural Resources
Appendix F: Glossary of Terms

**PJM:** PJM Interconnection Inc. (regional transmission organization that operates in the East)

**PUCO:** Public Utilities Commission of Ohio

**P2:** pollution prevention

**P2 Regulatory Integration (P2RI):** pollution prevention regulatory integration is a model for building incentives into environmental regulatory systems. P2RI helps develop programs and policies to reward businesses that implement sustainable technologies and building practices rather than penalizing them for failed compliance.

**PV:** electric/photovoltaic, which uses solar cells to generate electricity

**REPP:** Renewable Energy Policy Project, an organization that supports the advancement of renewable energy technology through policy research

**RTO:** regional transmission organizations (oversee nation's electric transmission)

**SO₂ emissions:** sulfur dioxide emissions

**Sustainable Value Chains:** models that help determine which functions in a business need to become more sustainable so that professionals can develop sustainability skills relevant to their jobs

**SWACO:** Solid Waste Authority of Central Ohio

**Total Quality Environmental Management (TQEM):** a method to understand the environmental aspects of production processes and how pollution is created in the first place

**USC-PC:** UltraSuperCritical Pulverized Coal

**U.S. EPA:** United States Environmental Protection Agency

**VOC:** Volatile organic compounds