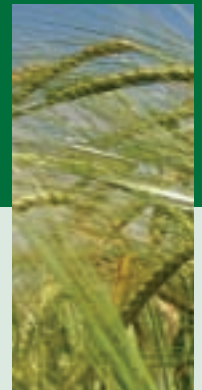
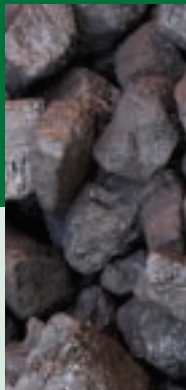


ENERGIZING Appalachia

A Regional Blueprint for Economic and Energy Development



OCTOBER 2006

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October 2006

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The Appalachian Regional Commission

The Appalachian Regional Commission (ARC) is a regional economic development agency representing a unique partnership of federal, state, and local governments. Established by an act of Congress in 1965, the Commission is composed of the governors of the 13 Appalachian states and a federal co-chair, who is appointed by the president. Local participation is provided through multi-county local development districts with boards made up of elected officials, businesspeople, and other local leaders.

Appalachia

Appalachia is a 200,000-square-mile region that follows the spine of the Appalachian Mountains from southern New York to northern Mississippi. It includes all of West Virginia and parts of 12 other states: Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia.

Contents

Introduction	1
Section I: Energy Overview	2
The Global and National Energy Landscapes	2
National Energy Policy	5
Appalachia’s Energy Landscape	6
Appalachia’s Energy Consumption	7
Appalachia’s Energy Resources	9
State Policies for Conventional and Alternative Energy, and Energy Efficiency	10
Section II: A Regional Agenda for Energy-Based Economic Development	12
Action Areas for Strategic Objectives	13
Objectives and Strategies for Energy-Based Economic Development	14
Strategic Objective 1	14
Strategic Objective 2	16
Strategic Objective 3	19
Section III: ARC Strategies and Partnerships	22
ARC Strategies for Objective 1	23
ARC Strategies for Objective 2	24
ARC Strategies for Objective 3	25

Introduction

ARC's Energy Goal is to develop the Appalachian Region's energy potential to increase the supply of locally produced, clean, affordable energy, and to create and retain jobs.

Strategic Objectives for Economic and Energy Development

- Strategic Objective 1:** Promote energy efficiency in Appalachia to enhance the Region's economic competitiveness.
- Strategic Objective 2:** Increase the use of renewable energy resources, especially biomass, in Appalachia to produce alternative transportation fuels, electricity, and heat.
- Strategic Objective 3:** Support the development of conventional energy resources, especially advanced clean coal, in Appalachia to produce alternative transportation fuels, electricity, and heat.

The Appalachian Region is rich in energy resources—conventional fossil fuels, as well as renewable and alternative energy fuels. The Region's mines currently produce more than a third of the nation's coal, and its electrical utilities provide 15 percent of the nation's electrical output. The development of alternative and renewable energy in the Region is growing rapidly.

In February 2006, at a governors' quorum meeting of the Appalachian Regional Commission (ARC), the governors of the 13 Appalachian states and the ARC federal co-chair called for the creation of an "Energy Blueprint" for Appalachia, in response to today's changing energy supply, policy, and use environment. The Commission's objective was to provide a strategic framework for the promotion of new energy-related job opportunities through the stimulation of sustainable energy production, efficiency measures, and innovation efforts throughout the Region. Many Appalachian states are pursuing economic development through energy, but the ARC federal and state partners recognized the potential for greater benefit to the Region by acting together.

In developing the Blueprint, ARC took three steps. First, it commissioned a series of research studies to assess current conditions regarding renewable and conventional energy sectors in the nation and the Region. Second, it convened three public roundtables in the Region, where a total of more than 100 industry experts, educators, government officials, and entrepreneurs discussed energy opportunities, challenges, and strategies for developing a strong regional economy in Appalachia based on its energy assets. Third, it created the Energy Advisory Council (EAC), comprising high-ranking representatives from the energy offices of each of the 13 Appalachian states and representatives from the local development districts, to identify energy strategies for the Region.

This document condenses key findings and shares initial recommendations from the research studies, the regional energy roundtables, and the work of the EAC. Section I provides an overview of the global, national, and regional energy landscapes. Section II explains the Energy Blueprint's goal and strategic objectives. Section III identifies specific strategies that can be pursued by ARC and its partners. During 2007, ARC will develop a number of the specific strategies noted in Section III of the Blueprint. Using this experience as a guide, the Commission will give enhanced focus to job creation through energy innovation and development in 2008 and beyond.

As an economic development agency, ARC has an important role to play in energy development, not only because energy is a major expense in the budgets of businesses, households, and the public sector, but also because it is a sector of the economy that has the potential to create a large number of jobs and boost the competitiveness of the Appalachian Region.

Section I : Energy Overview



Reviewing the global, national, and Appalachian energy landscapes to assess the current conditions of various energy sectors was the first step ARC undertook in developing the Energy Blueprint.

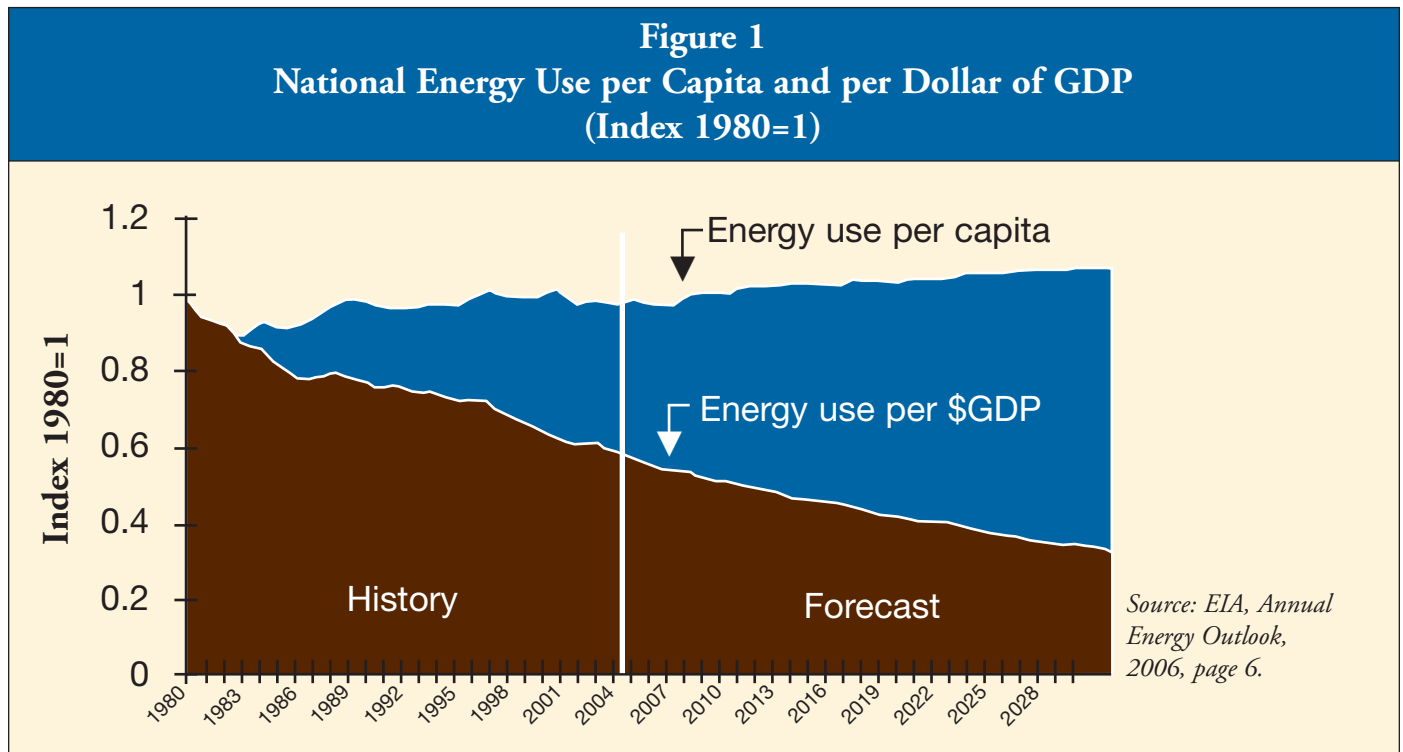
The Global and National Energy Landscapes

The global energy market volatility and rising energy costs of recent years have been driven principally by significant supply and demand imbalances in the world oil and gas markets, due to constraints on supply and rapid growth in demand since the summer of 2003. The world oil supply grew 6.2 percent between 2003 and mid 2006¹, but delays in developing new oil capacity, due to production and infrastructure problems, and political instability in key oil fields have disrupted growth in the oil supply. World natural gas markets have been afflicted by similar problems, although delays and bottlenecks in adding new production and distribution capacity have also been major factors in natural gas price increases. On the demand side, rapid economic growth has spurred the demand for oil and natural gas, especially because of the growing energy demands of the Chinese economy. These short-run imbalances have been reflected in the world spot market for oil (a market where oil is bought with cash and delivered immediately), where average prices increased by 139 percent between August 2003 and August 2006.² Beyond the short-term factors affecting oil markets, there is increasing concern that long-term growth in the oil supply will slow further as many major oil fields reach peak production over the next 10 to 15 years.³

Oil consumption in the United States has reached an all-time high, at 20 million barrels of oil a day—almost 25 percent of the world's use.

Imbalances in the oil and gas markets ripple through the energy economy in a variety of ways. The most obvious effect is on the costs of transportation fuels and residential and commercial heating. Rising oil and gas prices also affect the costs of generating electricity and supplying energy to the manufacturing and agricultural sectors of the world economy. As prices have risen for each type of energy demand, energy consumers in each sector have begun to switch to lower-cost fuel substitutes, such as ethanol for transportation fuel. In electrical generation, high-cost oil and gas-fired power plants are often taken off line in favor of lower-cost power plants, or replaced by alternative energy technologies such as wind, solar power, and biofuels. Fuel switching, however, takes time and investment. Nevertheless, the world economy has begun to switch fuels by supplying more energy through alternative technologies—where Europe has excelled—and by increasing the production of unconventional liquid fuels, such as gas-to-liquids, coal-to-liquids, and ethanol, particularly in the case of Brazil. A recent forecast by Cambridge Energy Research Associates concluded that these new fuel substitutes will begin to ease energy supply constraints over the 2010 to 2015 period.⁴ Despite these trends, the overall outlook for world energy markets is for slowly rising energy prices over the next few years, with a leveling off over the 2010–2015 period, and then a renewed steady rise in prices.⁵

The United States experienced a \$230 billion increase in energy costs in 2005, a 26 percent increase over the preceding year. In 2005, the country consumed approximately 10.5 million megawatt hours of electricity a day. Oil consumption in the United States has reached an all-time high, at 20 million barrels of oil a day—almost 25 percent of the world’s use. Approximately 12 million barrels of that 20 million are used solely for transportation. Transportation fuel demand is growing; the number of automobiles in the United States now exceeds the number of people per household. With 12.8 million barrels of oil imported daily, increased demand and high-risk supply have resulted in escalating prices for the fuels required to keep America running. Natural disasters like Hurricane Katrina and global political instability in energy-rich areas such as the Middle East only intensify the nation’s concern about future energy prices and the security of its supply. Recent disasters, combined with volatility in the marketplace, present a significant energy challenge to the nation.



While these challenges may seem daunting, the nation has managed to address some of its rising energy needs through improved energy efficiency, which can be measured in two different ways: energy use per dollar of gross domestic product (GDP) and energy use per capita. As Figure 1 shows, the amount of energy used for every dollar of GDP produced by the economy has fallen steadily since 1980. The Energy Information Administration (EIA) of the U.S. Department of Energy forecasts that this trend will continue, based on existing policies of the federal and state government and on private sector investment trends. Economic restructuring also plays a part in explaining the fall in energy use per dollar of GDP, because it caused a shift in economic activity away from manufacturing and energy-intensive uses and toward the relatively less energy-intensive service sectors. The combined effect of energy-efficiency measures and economic restructuring has been that the total amount of energy used by each person in the economy has remained relatively steady, as shown by the “Energy use per capita” trend line in Figure 1. Despite these gains from efficiency investments and shifting economic activity, there are some countervailing trends that are increasing energy use per capita, including increased travel demand and the rising intensity of energy demands by residential users and the service sector.

The EIA has forecast that energy use per capita will begin to rise and will continue to escalate slowly for the next two decades.

The growth of computing and telecommunications applications, due to the expansion of the Internet, has led to an increased demand for electricity by residential and commercial users. This trend is so widespread that the EIA has forecast that energy use per capita will begin to rise and will continue to escalate slowly for the next two decades. This means that total U.S. energy consumption will grow slightly faster than it has in the past.

In order to address these concerns, national energy policy has focused on ensuring energy reliability and affordability, and advancing energy independence by reducing dependence on foreign energy sources.⁶ To accomplish these goals, a number of policy tools have been deployed over the last five years by both the federal and state governments:

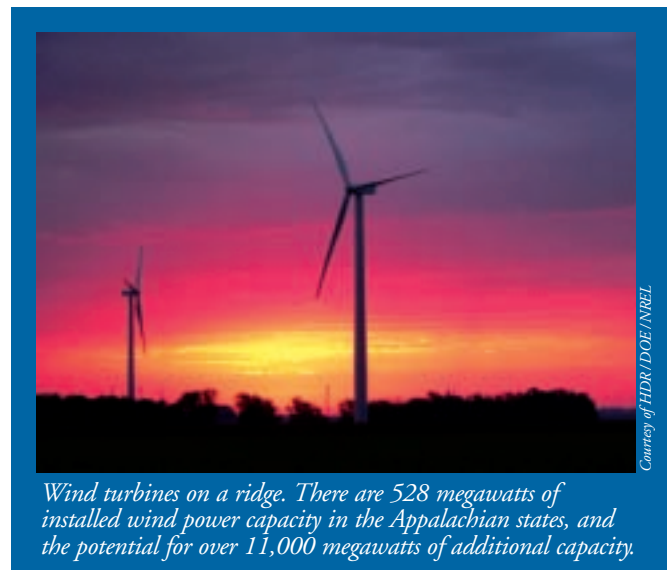
- *Technology Research and Development and Demonstration Programs* are typically directed to emerging technologies to help advance the effectiveness, and demonstrate the reliability, of the technology. Key examples include clean coal technologies such as integrated gasification and combined-cycle coal (IGCC), carbon-emissions capture, and sequestration.
- *Investment Incentives.* Investment in new energy technology is lagging because the technology is only marginally economical, or there is uncertainty about consumer demand. Examples of investment incentives include purchasing agreements to support demand for coal liquefaction plants that produce liquid fuels, and tax credits for alternative fuel stations that supply ethanol to consumers.
- *Production Incentives* can be effective tools to spur production of energy sources or efficient products, particularly where there is underused production capacity or existing capacity can be redeployed to make new products. A wide array of incentives has been legislated by the states, particularly for developing renewable energy production credits and energy-related manufacturing tax credits.
- *Consumer Adoption Incentives for Energy Efficiency Purchases* include providing information to advance energy-efficient products through consumer rebates, and tax incentives that reduce the cost of technologies and products that are more expensive to purchase but provide life-cycle benefits. Key programs are the federal government's Energy Star® labeling and tax incentives, and state programs that build on these incentives.
- *Standards and Mandates to Promote Energy Efficiency, Market Adoption, and Environmental Quality* are exercised when there is a compelling public policy reason and market-based approaches are not effective. Examples include renewable fuel standards, new building codes, and new emission standards, such as state-based greenhouse gas reduction mandates.



National Energy Policy

To meet the national energy policy objectives of energy independence, affordability, and reliability, the Energy Policy Act of 2005 (EPACT) set forth *supply-side policies* that are designed to increase the availability and diversity of fuel sources, advance technologies that use fuels more efficiently, and address fuel constraints through the development of alternative energy sources. In addition, the EPACT set forth *demand-side policies* and programs that are focused on reducing the need for energy and encouraging end-users to consume energy more efficiently. Many of the EPACT policies and programs described below are designed to take greater advantage of domestic energy sources such as coal and renewable energy or to find alternative energy sources such as biofuels to displace oil imports. This strategy of import substitution can not only increase energy security and price stability, it can also lead to the generation of new energy-based industries and jobs.⁷

- **Clean Coal Initiatives:** EPACT includes a variety of supports for clean coal technologies, including federal research, development, and demonstration investments in the FutureGen Initiative,⁸ a public-private sector partnership formed to develop innovative, low-emission technologies to produce hydrogen and electricity from coal and capture the carbon emissions for geologic storage; ultra supercritical pulverized coal plants, which hold the potential for increased efficiency and lower emissions than conventional pulverized coal plants; and new tax investment incentives for clean coal facilities and a seven-year accelerated recovery period on pollution controls on coal-fired electric power plants.
- **Coal-to-Liquids:** EPACT includes financial incentives for coal-to-liquids development, including loan guarantees and tax investment incentives, and a \$1 billion, three-year authorization.
- **Oil and Gas Production Incentives:** Incentives are provided to increase production in less-accessible, more costly areas, such as coal seams, deep reserves, oil sands and shales, and marginal wells. These “unconventional” oil and gas resources actually exceed the potential of “traditional” resources remaining in the United States. EPACT also provides tax credits of \$3.00 per barrel-equivalent for oil shale, tight sands, coal seams, and tar sands sold in the United States.
- **Renewable Energy Production Credits:** EPACT provides \$3.4 billion in production tax credits for ten years to encourage the production of electricity using renewable wind, solar (including the first-ever tax credit for residential solar energy systems), biomass, geothermal, hydropower, refined coal, landfill gas, and municipal solid waste energy sources.
- **Nuclear Power:** EPACT provides several investment incentives for nuclear power, including a 1.8 cent-per-kilowatt-hour tax credit for new nuclear generation, and a series of loan guarantees, investment protections intended to cover the costs of unforeseen legal or regulatory challenges to plant operations, Price-Anderson Act insurance indemnification extensions, and decommissioning trust tax policy changes, which amount to about \$5.7 billion in benefits for the nuclear industry. The tax credit is for the first 6,000 megawatts of new nuclear-generating capacity and is limited to the first eight years of operation and a total of \$125 million per 1,000 megawatts of capacity.
- **Alternative Fuels:** EPACT provides incentives for producing biofuels such as ethanol and biodiesel, and tax credits for alternative fuel stations to distribute these alternative fuels to consumers. In addition, EPACT provides research and development funding for exploring hydrogen-fuel and fuel-cell technologies.



Wind turbines on a ridge. There are 528 megawatts of installed wind power capacity in the Appalachian states, and the potential for over 11,000 megawatts of additional capacity.

Courtesy of HDR/DOE/NREL

- **Energy Efficiency:** EPACT includes a number of tax incentives to promote the implementation of energy efficiency measures and the purchase of efficient appliances by residential, commercial, and industrial energy consumers for the years 2006 and 2007. The U.S. Department of Energy and the U.S. Environmental Protection Agency (EPA) also sponsor a number of voluntary partnership programs that are intended to encourage industries, states, and the commercial and institutional sectors to commit to best practices in energy efficiency in exchange for technical assistance. These programs include:
 - EPA's Clean Energy-Environment State Partnership Program to encourage states to develop a comprehensive strategy for using existing and new energy policies and programs to promote efficiency and clean energy sources;
 - The ENERGY STAR Product Certification Program to encourage investments in energy efficiency; and
 - The SmartWaySM Transport Partnership, which is a voluntary collaboration between EPA and the freight industry designed to increase energy efficiency while significantly reducing greenhouse gases and air pollution.
- **Transportation:** EPACT also established provisions for increased fuel efficiency standards for light trucks and SUVs for the first time in a decade, raising the standard from 20.7 miles per gallon to 22.2 miles per gallon for model year 2007 vehicles. The provisions include income tax credits of up to \$3,400 per vehicle for purchasers of hybrid vehicles, and incentives for purchasers of fuel cell, advance lean burn diesel, and other alternative fuel vehicles.

Appalachia's Energy Landscape

Appalachia and energy have been closely linked throughout the history of the nation, mainly due to the importance of coal mining in the Region. Appalachian mines currently produce 35 percent of the nation's coal output, and Appalachian coal generated \$16 billion of output and \$720 million in taxes in 2005. Appalachia is also a net exporter of coal- and nuclear-generated electricity. In 2004, electrical power utilities in the Region generated 15 percent of the total U.S. electrical output, although the population of the Appalachian Region is only 8 percent of the nation's.⁹

Table 1
Direct Energy Industry Employment: United States and Appalachia

The energy industry involves a broad range of sectors, including oil and gas extraction; petroleum refining; natural gas distribution; electric power generation, transmission and distribution; coal mining; and other sectors (not shown are indirect supplier and distribution jobs).

SECTOR	U.S. Employment	Appalachian Employment
<i>Electric power generation, transmission and distribution</i>	436,000	64,000
<i>Oil and gas extraction</i>	330,000	20,000
<i>Petroleum refining</i>	123,000	8,800
<i>Natural gas distribution</i>	116,000	3,500
<i>Coal mining</i>	74,000	50,000
TOTAL	1,079,000	146,300

Source: U.S. Department of Labor, Bureau of Labor Statistics and Regional Economic Models, Inc., 2002

Another dimension of energy is its impact on employment. More than one million people are directly employed in America's energy industry. In Appalachia, almost 150,000 jobs are generated by the energy industry. Hundreds of thousands more are involved in the production and distribution of products and services for the energy industry. Coal production alone stimulated an estimated 60,000 jobs in indirect supply and the induced consumer spending in 2005.¹⁰

Table 2
United States and Appalachian Energy Consumption Estimates by Source, 2002

	United States		Appalachia	
	Trillion BTUs*	Share	Trillion BTUs*	Share
Coal	21,903	22%	3,532	38%
Natural Gas	23,806	24%	1,415	15%
Petroleum	38,400	39%	2,840	31%
Nuclear Electric	8,143	8%	1,020	11%
Hydroelectric	2,689	3%	160	2%
Biomass	2,571	3%	317	3%
Other	570	1%	4	0%
Total (excluding losses)	98,082	100%	9,287	100%

*British Thermal Units (BTUs) refers to a standardized measure of energy content.

Source: Energy Information Administration, 2006; Appalachian estimates prepared by ARC based on EIA state-level data.

Appalachia's Energy Consumption

Appalachia's energy consumption patterns differ from those of the United States as a whole because the Region exports electrical power. As Table 2 shows, Appalachia's higher share of coal and nuclear electric energy consumption reflects the use of these fuel sources to generate electricity for local consumption and to export to surrounding states. It is noteworthy that the Region's share of high-cost natural gas is lower than the nation's, while its share of "other sources," which is largely made up of renewable energy sources, is lower than the nation's, even though the Region possesses considerable potential in renewable energy sources.

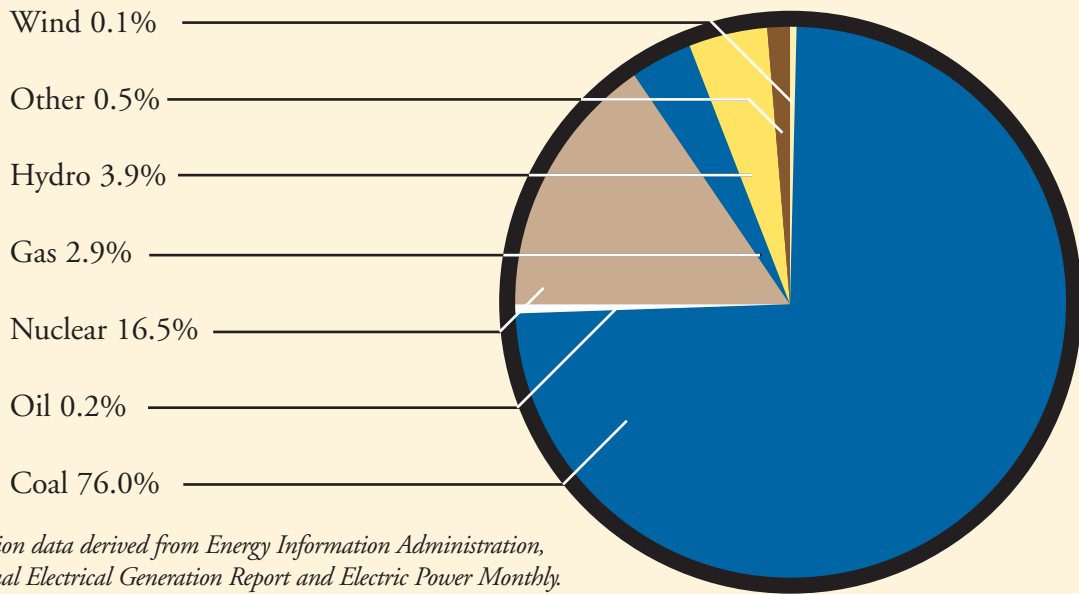


Pennsylvania's Keystone Biofuels, a soy-diesel plant that is owned and operated by Race Miner.

Courtesy of Joe Sherrick, Pennsylvania Energy Office.

Appalachia's electrical generation capacity and output is far more dependent on coal than the nation's. As Figure 2 shows, more than three-quarters of the Region's electrical output is derived from coal, and 16.5 percent is derived from nuclear power, while gas and oil together contribute about 3 percent. By contrast, the nation as a whole generates half its electricity from coal, 20 percent from nuclear power, and more than 21 percent from gas- and oil-fired power plants.

Figure 2
Electrical Generation Output by Fuel Source: Appalachia Only, 2004



Source: Electrical generation data derived from Energy Information Administration, EIA-860 Database Annual Electrical Generation Report and Electric Power Monthly.

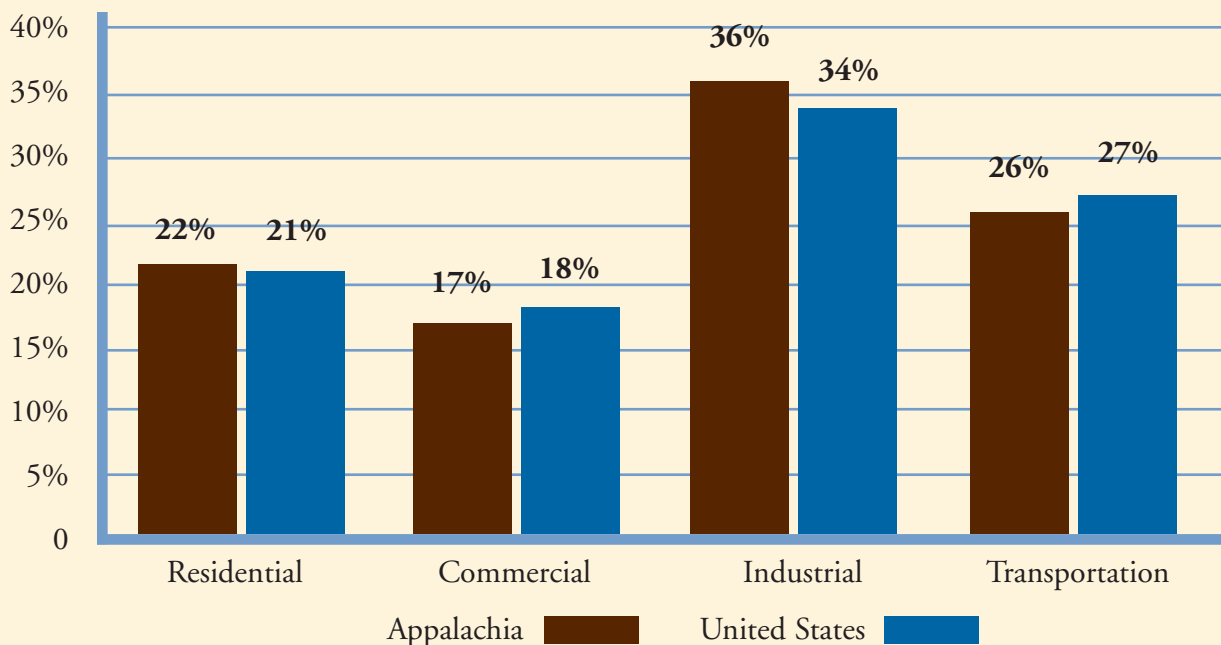
Another dimension of the Region's energy consumption is how it uses its energy in the residential, commercial, industrial, and transportation sectors. As Figure 3 shows, Appalachia uses slightly more of its energy on residential uses than does the United States as a whole. This probably reflects the lower efficiency of the Region's housing stock. Appalachia's commercial and transportation sectors are relatively smaller than the nation's, so they consume less energy; while the Region's greater manufacturing and electrical production is reflected in the higher share of the industrial sector's energy consumption.



Courtesy of TVA

A Tennessee Valley Authority Dam in Cherokee, North Carolina.

Figure 3
United States and Appalachian
Energy Consumption Shares by End-Use Sectors, 2002



Source: Energy Information Administration 2004, and ARC analysis of EIA data.

Appalachia's Energy Resources

Coal is abundant in Appalachia. The Region currently has recoverable reserves of 3.9 billion short tons of coal at active mines and recoverable reserves of 52 billion short tons.¹¹ New technologies are under development that will make possible new applications to enhance the extraction, processing, and conversion of coal to a variety of products, including gas and liquid fuels for electricity generation and as substitutes for imported oil. In addition, these coal gasification processes will use new techniques that minimize environmental impacts, such as the extraction of pollutants and carbon gases. The economic consulting firm Global Insight's analysis of the coal industry prospects over the next ten years, which was based on likely scenarios for energy price trends and demand, identifies key opportunities in clean-coal power generation and coal manufacturing of coal-to-liquids, coal-to-gas, and coal-to-chemicals products. The scenarios also suggested the likelihood of the implementation of a comprehensive national greenhouse gas emissions-control policy that provides economic incentives for investments in carbon gas capture and sequestration technology. A national policy could open still more opportunities for coal.¹²

The Region also has about 5 percent of the recoverable natural gas resources in the nation, primarily in Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia. The Appalachian Region also contains three to four billion barrels of unconventional oil resources, as evident in Kentucky's oil sands and oil shale.

Though Appalachia is best known for its coal resources, it is beginning to develop its potential for the development of renewable energy sources found in wind, water, and waste products. Wind power is significantly underdeveloped in the Region, and has the greatest potential for development along the ridge lines of the Appalachian Mountains. There are 528 megawatts of installed wind power capacity in the Appalachian states, nearly 1,000 megawatts of planned capacity, and the potential for over 11,000 megawatts of additional capacity.

Significant renewable energy opportunities can also be found in the development of energy from biomass, biofuels, solar power, and hydropower. Energy from biomass converts specially grown crops, sawmill wood

residue, agricultural wastes, and other organic matter into new energy sources and fuels. The total annual biomass resources for the Appalachian states are estimated to be over 108 million tons. Biofuel potential is estimated to be 500 million gallons annually, based on converting 2005 output for corn and soybean production to ethanol and biodiesel fuels. Solar power's best potential in the eastern United States, including Appalachia, is likely to be for residential or commercial application. In the Appalachian Region, production of residential and commercial photovoltaic (PV) power is currently viable in southern Appalachia, and several PV manufacturing plants are located throughout northern Appalachia. Passive solar installations such as day-lighting, solar ventilation air preheating, hot water heaters, and pool heating may give the best return on current investment in solar technology. Small and low-impact hydroelectric capability is another largely undeveloped energy resource in Appalachia. The Region is traversed by several major rivers and watersheds that create numerous opportunities for small-scale and low-flow hydropower installations. This category of hydroelectric generation is based on damless technology. Total hydropower potential could be as high as 5,700 megawatts of average available capacity.¹³

In addition to this impressive array of potential alternative energy resources, the Appalachian Region possesses an extensive industrial manufacturing base that is already engaged in the production of some of these emerging energy technologies, particularly wind turbine components, solar components and photovoltaic panels, and biofuel plants.¹⁴ Appalachia's industrial base has numerous potential supplier chain links that could be cultivated within these alternative energy sectors and that promise additional job creation for the Region's manufacturing base.¹⁵

State Policies for Conventional and Alternative Energy, and Energy Efficiency

Recent years have seen comprehensive energy plans either passed or under consideration in many Appalachian states.¹⁶ All have similar provisions but emphasize different approaches. These include:

- Promoting conventional fuel production and clean conventional technologies.
- Promoting the use of clean energy technologies, and energy efficiency.
- Maintaining or renewing an ecologically strong environment.
- Expanding electrical generation from renewable or alternative fuels.
- Using biomass, including landfill methane.
- Developing biofuels, including ethanol and biodiesel.
- Providing the lowest-cost energy consistent with other goals.
- Increasing economic development through the creation and expansion of alternative energy manufacturing and distribution.

Specific policies used in various Appalachian states include:

- **Conventional Fuels Incentives** programs are in place in many states to support the production and use of coal, oil, and gas, including tax exemptions for enhanced recovery of coal and gas and coal-bed methane and incentives for the development of clean coal technologies. Alabama and Virginia have production tax incentives for coal; and Kentucky, Maryland, and Virginia have incentives for indigenous use of coal in their states. Kentucky, New York, and Pennsylvania have clean coal tax incentives. Ohio has a \$1/ton tax incentive available to Ohio's investor-owned utilities that use Ohio coal. Several Appalachian states offer tax incentives for the purchase of pollution control technologies. Natural gas tax incentives are offered by Alabama, New York, Pennsylvania, Virginia, and West Virginia. Oil production tax credits are offered by Alabama, Kentucky, New York, and West Virginia. Other incentives include provisions for coal-bed methane recovery in West Virginia and Virginia. Ohio has a clean-coal technologies research, development, and demonstration/deployment (RD & D) program with projects supported by a \$100 million coal revolving bond fund. Various other states also have clean-coal technology research and development activities.

- **Net Metering**, where those who use qualified distributed generators powered by renewable or alternative fuels receive credit or payment for the electricity they produce. Net metering is allowed in North Carolina, Virginia,

Maryland, Ohio, Kentucky, New York, Pennsylvania, and Georgia. It is also available through the Tennessee Valley Authority (TVA) in the parts of Tennessee, Mississippi, and North Carolina TVA serves. The provisions in these laws vary, including what types of renewables are eligible, what size generators can be used, whether the programs are voluntary or compulsory, what price is paid for the distributed generation, who pays for the installation to the grid, and the total amount of generation a utility must accept.

- **Renewable Energy Portfolio Standards** require that a certain percentage of the power either generated or consumed in a state must come from renewable fuels. The utility is required to either build a renewable energy facility or buy renewable energy from another generator to meet the requirement. New York, Pennsylvania, and Maryland have renewable energy portfolio standards. There are differences among the states as to what should be considered “renewable energy.” All include solar and wind power, along with small-scale hydropower. Landfill gas is included by most states. Pennsylvania’s standard includes waste from wood or coal, as well as demand-side management. Standards are often divided into tiers, with requirements that given percentages must be met by using certain fuels such as solar or wind. While the tiers add complexity to the standards, they are considered desirable because they encourage the development of certain renewables. A recent development is the market for renewable energy credits. Under this program, a generator using renewables can meter the amount of energy produced. The producer then sells the renewable energy in one-megawatt credits, which can be purchased by a utility to satisfy its renewable-energy requirement.
- **Public Benefit Funds**, which attach a small charge to each customer’s monthly energy bill, are used in New York, Ohio, and Pennsylvania. Monies collected under these programs are used in a wide variety of ways, including subsidizing energy efficiency for low-income households; making low-cost loans or grants for the installation of renewable or alternative energy generation; supporting the research and development of renewable, alternative and efficient energy; encouraging the location of renewable-energy related industry in the state; and remediating impacts from pollution caused by energy generation from conventional fuels.
- **Grant and Loan Programs** are available in all Appalachian states for certain uses. These programs encourage the adoption, installation, and use of alternative or renewable technologies; provide low-cost loans; promote energy efficiency education; assist low-income consumers; finance research and development; locate renewable energy manufacturing; support the use of biofuels; and reward energy conservation. Differences among state programs are considerable and reflect both the priorities and the financial capabilities of the states using them.
- **Tax Incentives** are not as widespread as other inducements, but some Appalachian states grant personal and corporate tax incentives, such as deductions or credits for installing or producing renewable or alternative energy. New York, Maryland, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia provide or allow property-tax exemptions or rate reductions for certain forms of renewable generation or installation. Limited sales tax reductions are also available in Georgia, New York, Maryland, and Ohio for renewable installation.
- **Rebate Programs** are in place in some states, including New York, Maryland, Pennsylvania, South Carolina, and Kentucky. These programs include the installation of solar equipment, the purchase of energy-efficient appliances, and the production and use of alternative fuels.
- **Green Purchasing Programs**, which allow consumers to support the generation of clean energy by paying a slight additional charge, have been established by some states and utilities in the Region.

The Region possesses a diverse set of energy resources that hold the potential to generate new businesses and jobs. In addition, Appalachian energy production for the U.S. market will lessen dependence on foreign energy sources while strengthening the regional and national economies.

Section II : A Regional Agenda for Energy-Based Economic Development



ARC's Energy Goal: Develop the Appalachian Region's energy potential to increase the supply of locally produced, clean, affordable energy, and to create and retain jobs.

Strategic Objectives for Economic and Energy Development

Strategic Objective 1: Promote energy efficiency in Appalachia to enhance the Region's economic competitiveness.

Strategic Objective 2: Increase the use of renewable energy resources, especially biomass, in Appalachia to produce alternative transportation fuels, electricity, and heat.

Strategic Objective 3: Support the development of conventional energy resources, especially advanced clean coal, in Appalachia to produce alternative transportation fuels, electricity, and heat.

By using its full range of energy resources and staying at the forefront of emerging energy technologies and practices, the Region has the potential to increase the supply of locally produced, clean, affordable energy, and create and retain jobs. This approach will help the Region find new ways to satisfy domestic energy demand, minimize environmental impact, and attract service and supply-side industries and businesses that rely on energy resources to grow and sustain jobs. Developing Appalachia's energy potential will provide clean, safe, affordable, locally produced energy to customers, create and retain jobs, help companies stay competitive, and keep the Region economically strong and moving toward energy independence.

To help the Region achieve this energy goal, it is important for all stakeholders to work to realize the economic potential of energy efficiency, innovation, and independence. Engaging multiple stakeholders and leveraging the Region's finance, technology, and human resources will allow the Appalachian Region to maximize its energy potential.

Action Areas for Strategic Objectives

Five key action areas are vital to helping the Region reach its strategic objectives and realize the job creation potential of an energy-based economic development agenda.

1. Public-Sector Investments. Financing and expertise should be available to jump-start and support new energy initiatives and attract private-sector investment. State policies have helped stimulate diversification of the Region's energy mix; yet much of this potential is unrealized. Risk, uncertainty, and long turnover time on investments can be mitigated by public funds to help attract private investment and reduce risk for entrepreneurs, utilities, and companies interested in implementing new energy technologies to create jobs and compete globally.

2. Research and Analysis. Two types of energy research and analysis take place in the Region: one helps create and test technological innovations; the other identifies the best opportunities for growth in the Region's energy sector. Appalachia is fortunate to have many respected universities and research institutions working on energy issues. By tapping this scientific and technological expertise and applying it in targeted economic development efforts, the Region can grow and keep energy-related jobs in Appalachia.



Repairmen at the North Carolina Small Wind Initiative's research and demonstration site on Beech Mountain.

3. Workforce Development. Appalachia needs a skilled workforce to support existing and new energy and energy-related industries. Educating students and adult workers in science, technology, math, and engineering must be a priority for Appalachia's high schools, community colleges, and universities. A technically educated workforce is vital for the Region to grow its energy sector. The Region also needs architects, scientists, and engineers trained to design energy-efficient communities and the next generation of energy industries. Development of a workforce with an interest in and understanding of energy issues should begin with grade school and continue through universities, colleges, and technical schools.

4. Public Awareness and Outreach. The public needs clear information on the current energy environment and on the actions industry, government, educational institutions, and households can take to improve quality of life while using energy efficiently. Awareness campaigns can help citizens understand how to maximize efficiency in homes, schools, public buildings, and private businesses; and encourage the use of renewable energy and advanced coal.

5. Supportive Policies. There is a need for additional supportive government policies throughout the Region to encourage and reward investments in innovative and alternative energy solutions. One example is the fact that investors are currently unwilling to accept the risk necessary to develop alternative transportation fuel plants because the long-term market is uncertain. A change in government policy to commit to long-term fuel contracts would provide an incentive for this kind of innovation. There is also a need to provide technical and informational clearinghouses to facilitate energy business development.

Objectives and Strategies for Energy-Based Economic Development

The first step in implementing these strategic objectives is to identify and engage potential partners in the needs, resources, and roles in energy-based initiatives. Many energy initiatives are too large for a single entity to undertake alone. Some will require multi-state, multi-county, or public-private partnerships.

Partnerships could be developed with state energy offices (some states have several different types of energy offices); federal agencies, such as USDOE and USDA's Natural Resources Conservation Service, Rural Utilities Service, and Rural Development; state-based trade associations for coal, renewable energy, oil and gas, and others; local economic development organizations; environmental organizations; universities engaged in energy research and development, and university extension services; business and industry; and foundations that support environmental work such as development of clean energy.

Many energy initiatives are already under way, on a small scale, in parts of the Region and the country, and there is great potential to share and replicate best practices throughout the Region.

Not every source of energy is addressed in the Energy Blueprint's strategic objectives. For example, hydrogen is not discussed because it is not expected to be widely available to the public for at least several years. And, although several nuclear power plants throughout the South are under development or scheduled for operation in the next five years, there are ongoing national issues with mining, transporting, and storing nuclear fuels, as well as with the disposal of wastes, that would require a more in-depth analysis than could be covered here.

Many energy initiatives are already underway in parts of the Region and the country, and there is great potential to share and replicate best practices.

Strategic Objective 1: Promote energy efficiency in Appalachia to enhance the Region's economic competitiveness.

Energy efficiency strategies reduce energy costs and can help eliminate or reduce the need to import foreign energy. To maintain a competitive position in the global marketplace, businesses must pursue energy efficiencies, or higher energy costs will result in a market disadvantage, lost sales, and potential job layoffs. Efficiency measures are often the most cost-effective strategies to reduce energy costs and can be implemented the most quickly.

Efficiency is one of the best ways to maximize energy use with minimal environmental impact. Since 1970, about 75 percent of all new energy demands in the United States have been met by reducing energy needs through the use of energy efficiency measures.¹⁷

Energy audits, energy efficiency standards, and financial incentives are often used to promote efficiency. Energy audits provide an independent review of buildings to determine ways to cut energy costs or enhance efficiency. Energy efficiency standards can be established for high-energy consumers, such as appliances and buildings. Finally, some states, utilities, and local governments also offer a variety of financial incentives, such as grants, loans, tax credits, rebates, and exemptions, to encourage energy efficiency improvements.

Energy efficiency does face some implementation obstacles. There is less incentive to use energy-efficiency measures when energy costs are low, as they have been over the last decade. When an energy audit has been performed, recommendations are not always implemented due to lack of expertise or available funds. And architects, builders, and home manufacturers often lack incentives to apply energy-efficient strategies in the design and construction of commercial and residential buildings. These obstacles must be addressed as efficiency programs are created or enhanced.

Strategies:

The following strategies are examples of ways to support and promote energy efficiency.

Public-Sector Investments

- Develop or expand programs for technical assistance grants, loans, or incentives for energy audits/assessments and retrofits.
- Support the expansion of weatherization and state energy efficiency programs.
- Support programs for green construction and retrofitting of public buildings.
- Support demonstration projects to test and validate energy-efficiency approaches.
- Support programs that encourage efficiency in transportation, such as rural van-sharing programs, telecommuting, public transportation, smart growth planning, and fleet management, including purchase of hybrid or alternative-fuel vehicles.

Research and Analysis

- Determine the effectiveness of technical assistance initiatives or incentives for encouraging expanded energy-efficiency practices.
- Collect, analyze, and distribute information on the employment and economic effects of energy-efficiency practices in the Region.
- Support the Region's universities and other research institutions in developing new technologies for energy efficiency, and support the commercialization of these technologies.
- Research consumer energy attitudes, values, awareness, and willingness to act on energy issues.
- Examine the potential for eco-industrial development in the Region.

Workforce Development

- Partner with those who offer workforce training, such as community colleges, technical schools, and workforce investment boards, to develop programs for training workers in existing and emerging energy fields; specifically, work to identify future jobs in energy efficiency audits/assessments and retrofits.
- Support the training of workers in the building-trades, architects, developers, and building code officials in techniques and approaches to creating more efficient buildings.
- Support programs that increase the capacity of the private sector to provide technical assistance in energy efficiency.

Public Awareness and Outreach

- Create multi-state partnerships to augment existing outreach materials and activities and enhance their delivery.
- Deliver education and outreach materials or training for residents, local governments, businesses, and industry on available energy-efficiency incentives, technical assistance, and the costs and benefits of implementing efficiency measures.
- Compile, maintain, and promote information on emerging technologies, best practices, and the economic as well as environmental benefits of energy efficiency.

Supportive Policy

- Promote approaches to regulating utilities that create incentives for energy efficiency, such as efficiency portfolio standards.
- Support state and local governments in developing or strengthening residential and commercial energy codes for buildings and industry.
- Support federal, state, and local governments in expanding rebates, grants, loans, and sales tax incentive programs for energy efficiency technology, audits/assessments, and retrofits.
- Support the development or update of state energy plans.

Strategic Objective 2:

Increase the use of renewable energy resources, especially biomass, in Appalachia to produce alternative transportation fuels, electricity, and heat.

Appalachia has a wide array of renewable energy resources with potential for expanded use, including biomass, biofuel, wind power, solar power, landfill gas, and hydropower.

Biomass is organic matter, including waste streams from paper factories, lumber mills, and agriculture, and crops such as corn and switchgrass. It can be used directly for the production of electricity, or converted into biofuels such as biodiesel and ethanol. Biomass has been identified by many energy experts as possibly having the greatest regionwide potential of all renewable energy sources.

Biofuel is liquid fuel derived from biomass. Biofuels can be made from crops grown specifically for fuel production, such as corn, soybeans, and switchgrass, or recycled from fryer oil. Two major biofuels, ethanol and biodiesel, are often mixed with varying amounts of petroleum and require special transport, storage, and blending. Biofuel refineries are most prevalent in the southern part of Appalachia, where paper plants and farms are more plentiful and can provide biomass for conversion.

Wind energy turbines use existing wind to create electricity. In 2006, wind energy installations in the U.S. exceeded 10,000 megawatts in generating capacity—the amount of electricity needed to power over 2.5 million homes on an average day.¹⁸ The potential for wind energy in the Region is greatest along the ridgelines of the Appalachian Mountains.

Solar power harnesses energy from the sun's light. Building designs that incorporate passive solar heating and daytime lighting features reduce dependence on traditional fuel sources for light and heat, and photovoltaic (PV) panels can contribute to meeting commercial and residential energy needs. The solar power PV industry is a \$7 billion a year industry, with 5,000 megawatts of production capacity in place in the United States. The industry is growing at a rate of 40 percent annually, and is projected to create more than 40,000 new jobs in the next decade. In the Appalachian Region, production of residential and commercial PV power is currently viable south of Virginia and Kentucky, and several PV manufacturing plants are located throughout northern Appalachia.

Landfill gas (methane created from decomposing garbage) can be harnessed to generate electricity or heat. In one year, a typical four-megawatt landfill gas project can reduce enough greenhouse gases to equal removing the annual carbon dioxide emissions from 45,000 cars or offset the use of 1,000 railcars of coal. In addition, the cost of generating electricity from methane is very low.

Hydropower plants located throughout the Region generate electricity from several of Appalachia's waterways. While there may be some potential for small-scale hydropower installations throughout the Region, development is often complicated by river or stream bank issues. For this reason, development of hydropower is not specifically discussed in the following strategies.

Net metering, renewable energy portfolio standards, financial incentives, and utility bill fees are often used to encourage the development of renewable resources. Net metering provides an opportunity for customers producing energy (from PV panels or other sources) to sell it back to the grid or have their meter run backward when they are providing energy. Renewable energy portfolio standards, usually set at the state level, establish a percentage of energy that must come from renewable sources by a set date. Financial incentives, such as grants, loans, rebates, and tax incentives, are available at the federal, state, and local levels to encourage the development of renewables. In addition, fees can be added to utility bills to provide funds for investing in renewable energy sources. Two common fees are public benefit funds, which add a fee to every customer's bill, and green power programs, which allow customers to choose if they want to pay extra to support the development of renewable energy.



BlueRidge Biofuels staff with one of their fueling trucks.

Each renewable energy source faces its own challenges. Biomass energy generation requires appropriate feedstock, and presents policy issues. The development of biofuels will require widespread infrastructure improvements to transport, blend, and sell the fuels on a large scale. Areas in Appalachia most valuable for wind development are often protected from development, and can face opposition due to a real or perceived impact on wildlife, habitat, and views. Solar power is dependant on access to sufficient sunlight. Landfill gas projects face knowledge and policy barriers. And, as described above, development of new hydroelectric power is complicated by local issues.

Strategies:

The following strategies are examples of ways to support and promote the development of renewable energy.

Public-Sector Investments

- Support risk-reduction actions for new business and renewable energy market development through measures such as public procurement policies, guaranteed product prices, and guaranteed purchase volumes.
- Increase access to venture capital for renewable energy businesses by convening meetings with venture capitalists and interested firms.

- Provide grants, loan guarantees, tax incentives, and technical assistance to support the production and distribution of biofuels and other renewable energy sources.
- Facilitate investment in infrastructure to support renewable energy initiatives, especially biofuels initiatives.
- Coordinate with regional alternative fuels initiatives to maximize impact for the Appalachian Region.
- Examine the use and trading of Renewable Energy Credits to support renewable energy production in the Appalachian Region.
- Partner with existing federal energy programs to extend their reach in the Region.

Research and Analysis

- Develop a baseline analysis of existing energy-related employment within the Region, and project the employment and economic impact of several plausible scenarios for alternative energy investments, including an examination of the net effects on the existing conventional energy base in the Region.
- Partner with state agencies, Appalachian universities and research institutions, and nonprofit organizations working on renewable energy research, including research on project viability and development of appropriate technologies for both short- and long-term horizons.
- Examine opportunities for clustering value-added industries related to renewable energy technologies within the Region.

Workforce Development

- Partner with those who offer workforce training, such as community colleges, technical schools, and workforce investment boards, to develop programs for training workers in existing and emerging renewable energy sectors; specifically, manufacturing of parts for and production of biomass/biofuels, wind, and solar energy.
- Support science and math teachers' training, curricula development, expanded career opportunities and other actions to integrate energy issues into local education systems.

Public Awareness and Outreach

- Compile and disseminate information and conduct workshops on emerging technologies; best practices; and the benefits, including economic and environmental benefits, of renewable energy approaches.
- Convene meetings and support public dialogues to explore technological aspects of various renewable energy approaches, to partner with existing state and regional organizations and to raise awareness among residents, businesses, and industries.

Supportive Policy

- Pursue multi-state and local initiatives to examine renewable or alternative energy portfolio standards, possibly through a regional renewable or alternative energy credit trading system.
- Promote distributed energy production, net metering, green purchasing requirements for utilities, green prices by utilities, uniform interconnection standards, and the use of regional feedstock for biofuel production.



This wood-fueled boiler is producing renewable energy for a millwork plant in Toney, Alabama. The fuel is waste sawdust and wood shavings from the plant.

Courtesy of Alabama Department of Economic and Community Affairs.

- Provide infrastructure for alternative fuels such as biodiesel and ethanol throughout the Region by partnering with regional fuel distributors.
- Create or expand incentives and requirements for use of alternative fuel and hybrid vehicles (private or fleet); for the production of biofuels that meet American Society for Testing and Measurement standards; and for the exploration and development of other energy renewables, including wind, solar power, landfill gas, hydropower, and geothermal power.
- On an ongoing basis, convene state and local public and private leaders to discuss and implement effective renewable energy programs.

Strategic Objective 3: Support the development of conventional energy resources, especially advanced clean coal, in Appalachia to produce alternative transportation fuels, electricity, and heat.

The Appalachian Region is historically linked to the coal industry, and many states in the Region still rely economically on coal and coal-related businesses. Many Appalachian states also are home to substantial oil and gas businesses. As a result, there are still strong reasons to support fossil fuel development, particularly coal, in the Region. The future for continued coal development is known as “advanced coal,” which includes integrated gasification, combined cycle, and other clean coal technologies; carbon capture and sequestration; and coal-bed and coal mine methane capture and use.

According to the U.S. Department of Energy, fossil fuels—coal, oil, and natural gas—currently provide more than 85 percent of all the energy consumed in the United States. They provide nearly two-thirds of the nation’s electricity and most of its transportation fuels, as well as the raw materials for other industries, such as petrochemicals. Appalachia boasts over 3,907 million short tons of America’s economically recoverable coal reserve. The Region has about 5 percent of the recoverable natural gas resources in the nation, primarily in Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia. The Appalachian Region also contains three to four billion barrels of unconventional oil resources, as evident in Kentucky’s oil sands and oil shale. Fossil fuel exploration, extraction, processing, and distribution provide an economic boost to Appalachia in the form of jobs and taxes. In 2004, an average of 49,327 Appalachians worked directly for mines in the Region, and the oil and gas industry employs almost 17,000 Appalachian workers annually. Most of these workers are in small and independent oil and gas exploration and production companies and service firms.

The U.S. government anticipates that the nation’s reliance on fossil fuels will increase in the next 20 years, despite the aggressive focus on expanding the development of renewable energy. One reason for this is that the United States has one quarter of the world’s coal reserves. Due to its low cost and abundance, coal will likely continue to be the dominant fuel for electric power production in the United States for many years to come. And coal is not only a fuel, but also a feedstock that can be used to produce value-added products such as coal liquids, coal-to-process gas, and others. Coal use may also expand as natural gas costs rise and oil becomes more difficult to import.

Fossil fuels are not without their share of challenges. Carbon is released when fossil fuels are burned, and researchers in the Region are investigating clean coal processes to find ways to diminish greenhouse gas effects by reducing the amount of carbon emissions released when coal is burned, or by capturing and sequestering it before it can enter the atmosphere. At present, the technology is immature. Application of new technology is expensive, but the race is on to make it consistently and economically viable in anticipation of federal government mandates on greenhouse gases, as Europe and California have.

In addition to pollution controls, workforce issues are an important consideration. The coal industry will need advanced skills to operate equipment and manage processes. For instance, an advanced coal facility is more like a chemical plant than a traditional coal plant. Engineers and chemists will be required for operations. As new advanced coal facilities open around the world, competition for resources and qualified workers will be great. An additional challenge is increasing public awareness of and support for advanced coal processes and applications.

Strategies:

The following strategies are examples of ways to support and promote the development of advanced coal and other conventional energy sources.

There is a need for further discussion on what the public-sector role is in large, mature industries working with other fossil-energy sectors in the Region, such as coal-bed methane, enhanced oil recovery, and natural gas. A few strategies stand out, including advocating for advanced conventional energy development, addressing the needs of existing electric transmission plants and energy infrastructure, and developing regulatory policies that are consistent with replacing imported energy with domestic energy.

Public-Sector Investments

- Enhance infrastructure related to advanced coal development.
- Facilitate partnerships and broker deals that promote advanced coal products and seed regional and local innovation in advanced coal.
- Support the use of a portion of coal, oil, and gas tax revenues for general economic and community development efforts in Appalachia.
- Identify coal-to-liquids and coal gasification as a national priority, to be addressed through financing and product-purchasing incentives.
- Encourage energy development as a recognized economic development activity.
- Address issues related to carbon capture and sequestration through the adoption of technologies that mitigate greenhouse gas emissions at existing energy facilities.

Research and Analysis

- Coordinate and partner with a consortium of research institutions and nonprofit organizations in Appalachia to work on clean coal technologies.
- Collect, analyze, and distribute information on the employment and economic effects of advanced coal technologies and other fossil fuel sources in the Region.
- Examine opportunities for clustering value-added industries related to advanced coal and other advanced energy and fuel technologies.

Workforce Development

- Partner with those who offer workforce training, such as community colleges, technical schools, and workforce investment boards, to develop programs for training workers in existing and emerging energy fields; specifically, work to identify future jobs in advanced coal and other fossil energy sources

and develop training programs for them. This will include training a new generation of coal miners, mining engineers, oil and gas workers, and propane industry workers.

- Develop or improve energy education modules for students at all levels of education and support an emphasis on appropriate preparatory subject matter (including geology, engineering, math, and chemistry) for entering the energy field.

Public Awareness and Outreach

- Disseminate information on emerging technologies and best practices in energy.
- Disseminate material to integrate information on coal, oil, and gas extraction in elementary and secondary education.
- Partner with states and regional carbon-sequestration organizations to convene public dialogues and public outreach to explore technological aspects of geologic, terrestrial, biological, and chemical sequestration technologies.

Supportive Policy

- Pursue a multi-state initiative to examine Alternative Energy Portfolio Standards (AEPS) that might include more than renewable sources. For example, Pennsylvania's AEPS include waste coal, coal mine methane, polygeneration, and coal gasification.
- Pursue a multi-state initiative to explore regional climate change approaches. Many experts feel that it is only a matter of time before carbon and other greenhouse gasses face greater regulation in the United States. Creating such a partnership now would place the Region's industries in a favorable position when regulations are adopted. New York and Maryland are currently participating in a multi-state climate change initiative.
- Actively participate in existing carbon-sequestration regional partnerships and address gaps in current plans. Appalachian states are currently members of two such partnerships: the Southeast Regional Carbon Sequestration Partnership includes Alabama, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia; and the Midwest Regional Carbon Sequestration Partnership includes Maryland, Ohio, Pennsylvania, Kentucky, and West Virginia.
- Establish policies that encourage the development of clean coal technologies, such as integrated fluid bed combustion, and the infrastructure, such as electric transmission lines, needed to support this development; this can include helping facilitate permitting processes, compiling information needed to site projects, and providing utility regulation flexibility to allow such plants to be financed.



Section III : ARC Strategies and Partnerships



The Appalachian Region can develop its energy potential to create and sustain jobs by meeting the challenges of promoting energy efficiency, increasing the use of renewable energy resources, and developing conventional energy resources.

Strong partnerships among federal, state, and local governments, particularly the U.S. Department of Energy and state energy offices; business and industry; research and educational institutions; public and private utilities; and non-governmental organizations will be vital to helping the Region achieve this goal. All will have key roles to play in helping the Region develop more efficient, safer, cleaner, locally produced energy.

Strong partnerships will be vital to helping the Region achieve its energy potential.



Courtesy of National Renewable Energy Laboratory

Greenhouse with solar panels. Production of residential and commercial photovoltaic (PV) power is currently viable in southern Appalachia, and several PV manufacturing plants are located throughout northern Appalachia.

To aid in ARC's work on these strategies, and as part of its commitment to advancing the overall goal, objectives, and strategies of the Energy Blueprint, the Commission will establish the Energy Advisory Council as a standing ARC committee. This will allow the 13 Appalachian states to continue to collaborate and share energy-related information and opportunities to move the Region forward.

In partnership with Appalachian state energy offices, relevant federal agencies, local development districts, local governments, state utility commissions and others, ARC will consider the following strategies, within funding limitations, to address the Energy Blueprint objectives.

ARC Strategies for Objective 1

Energy efficiency is central to maintaining the cost competitiveness of the Region's manufacturers, and plays a key role in business and job retention. Although increased energy efficiency investments may reduce the demand for specific energy uses, the fact that total per capita energy consumption is currently rising, and is forecast to continue to rise, indicates that there is room for efficiency gains without decreasing aggregate energy demand for regional energy producers, particularly the electrical generation sectors.

Energy efficiency is central to maintaining the cost competitiveness of the Region's manufacturers.

Energy efficiency investments with payback periods of two years or less are immediately beneficial to the Region because they can reduce energy bills for households, businesses, and the public sector, and recover the costs of investment quickly. In addition, such investments create a variety of direct jobs in the construction, renovation, and energy-audit businesses in the Region and stimulate indirect jobs among manufacturing suppliers and service businesses.

ARC will consider the following strategies under Objective 1. Where programs are already in place, ARC will support the expansion of program activities in the Region.

- *Support the development of programs to perform energy audits and retrofits of public buildings and identify and develop employment opportunities in the energy-efficiency sector.*
- *Develop an energy-efficient housing initiative with a focus on low-income families.*
- *Support the training of technicians, engineers, apprentices, workers, and managers to implement energy-efficiency activities.*
- *Promote public awareness campaigns for energy-efficiency opportunities for residential, industrial, and commercial application.*
- *Support the development of industrial and commercial energy-efficiency programs.*
- *Promote a regionwide program of performance-based energy-efficiency contracting, in which contractors are paid with savings resulting from energy-efficiency improvements.*
- *Support research and analysis to identify the best regional job growth opportunities in the energy-efficiency sectors, and assess the net effects of efficiency on the Region's economy, particularly the existing energy base.*

ARC Strategies for Objective 2

Appalachia's renewable energy resource base contains considerable untapped potential that could be readily used to produce alternative sources of power and fuels. In addition to business- and job-creation potential in the production of these new power and fuel sources, the industrial base of the Region is competitively well positioned to supply the necessary resources for these energy production and conversion processes. In some cases, regional businesses are already engaged in the production of these emerging energy technologies, particularly wind turbine components, solar components and photovoltaic panels, biofuel plants, and other components and parts. From an economic development perspective, there are numerous supplier-chain links that could be cultivated among existing businesses to supply other resources for these alternative energy technologies. A strategic cluster-based approach to the most competitive alternative energy sectors would position the Region to develop its comparative advantages.

The industrial base of the Region is competitively well positioned to supply the necessary resources for renewable energy production and conversion processes.

ARC will consider the following strategies under Objective 2. Where programs are already in place, ARC will support the expansion of program activities in the Region.

- *Develop "green economic development corridors" along Appalachian highways, which would support business development and provide consumers with access to alternative transportation fuels.*
- *Support the training of technicians, engineers, apprentices, workers, and managers for renewable energy jobs.*
- *Support the implementation of risk reduction strategies, such as creation of government-guaranteed markets, to aid in the development of renewable energy businesses.*
- *Promote business development in renewable energy by encouraging the use of energy incubators, entrepreneurship programs, industrial clustering, and similar tools.*
- *Support research and analysis to identify the best regional job growth opportunities in the renewable energy sectors, including developing supplier chains and clustering value-added activities, and assess the net effects of renewable development on the Region's economy, particularly the existing energy base.*
- *Promote public awareness campaigns for renewable energy opportunities.*

ARC Strategies for Objective 3

New, advanced coal and other fossil fuel technologies hold potential over the next five to ten years to yield competitive energy products, including gas and liquid fuels for electricity generation and as substitutes for imported transportation fuels. With the proper policy support, it should be possible to demonstrate the feasibility of manufacturing coal-to-liquids, coal-to-gas and coal-to-chemicals products and to stimulate engineering, construction, manufacturing, and distribution jobs in the Region. In addition, coal-gasification processes will make possible the extraction of pollutants, and carbon-gas capture and sequestration technologies, which will generate jobs for engineers, chemists, geologists, environmental scientists, and heavy construction workers.

ARC will consider the following strategies under Objective 3. Where programs are already in place, ARC will support the expansion of program activities in the Region.

- *Provide a forum to facilitate the pooling of demand for conventional energy.*
- *Support the training of technicians, engineers, geologists, apprentices, miners and other workers and managers for jobs in conventional energy.*
- *Support research and analysis to identify the best regional job growth opportunities in the advanced coal technology sectors, including developing supplier chains and clustering value-added activities, and assess the net effects of renewable development on the Region's economy, particularly the existing energy base.*
- *Convene forums to discuss the future of clean coal in Appalachia, focusing on what public- and private-sector leaders throughout the Region can do to facilitate the development of emerging clean coal technologies.*
- *Promote a K–12 education program by partnering with and expanding existing programs that familiarize students with energy issues, and with energy occupations and opportunities that will be developing throughout the Region in the coming years.*



New, advanced coal and other fossil fuel technologies hold potential over the next five to ten years to yield competitive energy products.

Conclusion

The Appalachian Region is well poised to take advantage of economic development opportunities in today's changing energy landscape. As the Energy Blueprint has shown, the Region possesses a diverse set of energy resources that hold the potential to generate additional businesses and jobs. Working together, the ARC partners can act as a catalyst to help the businesses and communities of Appalachia take full advantage of opportunities in energy efficiency, conventional energy production, and the development of renewable energy sources.



The Appalachian Development Highway System's Corridor B in Virginia is one of many possible "green economic development corridors," which would support business development and provide consumers with access to alternative transportation fuels.

Endnotes:

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