ECONOMIC DEVELOPMENT POTENTIAL OF CONVENTIONAL AND POTENTIAL ALTERNATIVE ENERGY SOURCES IN APPALACHIAN COUNTIES

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Executive Summary

Appalachia has significant potential to contribute to both national energy independence and to achieve regional import substitution in the energy sector. There are significant opportunities for regional and community-scaled industrial development, especially in the areas of bio-fuels. Major choices exist in the selection of a minimum scale of production for many of the new technologies and energy sources. Technologies in these fields are changing rapidly, thus planning for Appalachia's energy future is dynamic.

The creation of new energy supplies associated with renewable and non-renewable energy sources is likely to generate substantial new employment. Appalachia's industrial base already contributes major inputs to the wind, solar, biofuels, and other non-fossil fuel energy industries. Estimates of future growth in these sectors are significant and some research suggests thousands of new jobs will be created as these sectors expand in and outside of the region.

Demand for non-renewable resources such as coal, natural gas, and oil is expected to expand assuming energy prices remain high. At the same time, job growth in the fossil fuel sector may be limited by the application of more productive mining practices at existing operations. There is some evidence that Appalachian coal may be at a disadvantage vis a vis western coal due to the higher sulfur content of Appalachian coal, lower production costs of western mines and reductions in the benefit of proximity to eastern power plants given that transportation costs are becoming an ever smaller share of the delivered cost of coal, especially in instances where imported coal can reach recipient power plants in reach of the Mississippi River.

In contrast, renewable energy sources may emerge as an important source of regional and local employment and economic development. The mature ethanol, wind and solar industries are likely to expand as economies of scale, improvements in technology and the rising cost of fossil fuels make them more competitive. New industries can be expected to emerge as lignocellulose biorefinery technology is developed. Similarly, methane sources such as municipal waste water, landfill, livestock manure, and mine ventilation air within Appalachia represent as yet untapped sources of jobs and energy production.

Carbon sequestration may prove to be an important strategy for reducing the Nation's CO_2 emissions. While there will be growth of employment in technical fields associated with identifying and developing alternative means of sequestering CO_2, there may also be job losses associated with the decommissioning of aging production equipment, power plants, and other sources of CO_2. Since sequestration technologies are in the research stage, estimates of impacts are impossible at present.

Introduction

The Nation faces a significant challenge: reduce dependence on foreign sources of energy while reducing our environmental impact associated with the energy we use. Currently America imports 62% of the oil used in the Nation at a cost of more than $250 billion last year (Department of Energy 2005). In 2002, fossil fuels, which are finite and nonrenewable, supplied 86% of the energy consumed in the United States. As Secretary of Energy Samuel Bodman suggests:

"With worldwide demand growing rapidly, and with concern about the environmental impact of greenhouse gases rising, the deployment of clean, reliable sources of energy is clearly in our national interest. "

Secretary of Energy Samuel W. Bodman (http://www.eren.doe.gov/)

Today the Nation is at a crossroads. Growing global demand for fossil fuels, the perception of declining world wide petroleum reserves, and existing geopolitical instability in key energy producing nations is raising the level of uncertainty in global energy markets. Recent spikes in the price of oil reflect this uncertainty and may be the harbinger of a new era of higher energy costs in America and the world. Concurrently, Americans are beginning to accept that Greenhouse gas emissions have to be reduced to ensure that changes in climate are not further exacerbated by human impacts. How do we as a nation develop greater energy independence while reducing our environmental impact?

What Is Energy Independence? HowDo We Achieve It?

There are a variety of definitions of energy independence. The spectrum includes achievement of the necessary energy resources to maintain an agreed upon standard of living without disruption. A more encompassing definition emphasizes the development of a life style that uses energy resources in the most efficient and environmentally benign manner possible through a reduction in dependence on fossil fuels and a

commensurate increase in the use of renewable energy resources. In this report, we adopt a working definition of energy independence which follows from the second set or principles. With that perspective in mind, this report examines the existence of energy resources in the Appalachian Region, the prospect of resource utilization across the region, and traces the direct effect of energy industry related economic activity among firms and industries across Appalachia.

Basic Assumptions of this Report

For the purposes of this report, we assume that the goal of federal, state and local policy is to reduce dependence on imported energy resources. We further assume that the US will pursue a strategy of energy independence through import substitution to achieve reductions in energy imports. As a recognized economic development strategy, "Import Substitution" focuses on developing the capacity to produce what otherwise would be imported from outside the region. Over time, import substitution can lead to the achievement of economies of scale in activities in which a region or nation chooses to specialize. This two step process can lead to the emergence of competitive advantages that are accompanied by the development of inter-industry linkages and further economic growth. The development of successful Asian economies including Japan, Korea, and Taiwan followed such a path to development starting in the 1950s. This report builds from the knowledge of this experience in considering the effects of a changing energy future for the United States.

To pursue an import substitution strategy will require an increase in the production of both non and renewable energy sources that are domestically based. All of these activities will require resources, capital investment, new technology, and investments in human capital. Given this assumption, how do communities and states plan to take maximum advantage of such a national goal as energy independence?

Our final assumption is that the Nation will pursue the goal of reducing American contributions to CO_2 emissions. From scientific evidence we

know that greenhouse gas emissions are linked to surface and ocean temperature increases, which in turn are thought to be correlated with increased climate variability. Corporations around the world are actively engaged in formulating plans and funding research to reduce CO_2 emissions (Environmental Protection Agency [EPA] 2006). Recent reports in the national press underscore the growing significance of this issue in corporate strategic planning. Major national and international oil and gas companies are planning for a world in which fossil fuel consumption will utilize non-CO_2 emitting production processes. To pursue this goal will require changing the mix of energy sources we produce and consume while enacting policies that lead to carbon sequestration in many different forms, those known and those still to be developed.

This report considers what opportunities exist in the pursuit of energy independence and CO_2 reductions for local, state, regional and national economies. It seeks to answer a number of questions, chief among them: How do we plan for an energy future in which the nation is less dependent on fossil fuels and more reliant on renewable energy sources? How do we determine what the economic impacts are of this future? And, how can communities contribute to this alternative energy future through the provision of goods, services, technology and a well-prepared workforce?

Job Estimates Depend on Specifying a Future State of Energy Production

This report provides a first cut at understanding the economic implications of an energy future that reduces the Nation's dependence on imported resources. This type of analysis requires that we specify a state, condition or mix of energy sources we wish to utilize in the future in order to estimate what such a change would mean in terms of the demand for goods and services and in turn the job impacts of such a change. At the same time, to the extent possible, we need to account for not only the benefits associated with a strategy to improve energy independence, but we also must incorporate into our calculus the costs of reducing our carbon footprint. To that end, this paper consists of four

parts.

Outline of the Report

- Part one explores a set of scenarios that are used by researchers to develop estimates of the job impact of various energy consumption and production profiles. This is necessary as we cannot calculate job impacts if we don't first specify a change in the actions and practices associated with the production and consumption of different combinations of energy resources, both renewable and nonrenewable. Drawing on reports produced by a number of organizations, we discuss alternative futures based on different combinations of energy sources. As part of this discussion, we also briefly examine the issues associated with carbon capture and reductions in US output of CO_2.

- Part two examines a range of sectors that are either direct sources of energy or are inputs to the generation of energy--both conventional non-renewable resources and alternative or renewable resources. This second part consists of a compilation and display of secondary data that illustrates the spatial distribution of energy sources and resources, where possible characteristics about them, and when realistic, a geographic representation of the likelihood of resource development. In other words, we present maps that display a range estimates of where in Appalachia these sources and opportunities are located.

- In part three, we look more closely at three alternative energy sectors in which extensive analysis of job generation potential has occurred: photovoltaic, wind energy, and biomass. This section examines renewable energy sources nationally, including: solar, wind, and biomass. We then move to the regional level and combine the findings from several studies to identify likely employment impacts in states that are members of the Appalachian region. As part of this discussion, we identify key firms in the states comprising the ARC that produce major manufactured

components used in the production of alternative energies, particularly wind power.

- In part four we identify nine sectors that account for a significant portion of key components in the alternative energy sectors of wind, solar, and biomass. We highlight these sectors and their employment in ARC states. We also examine the ARC share of total national industry employment in these sectors. We conclude this section with a summary and suggestions of areas of future research.

Caveats

This report is not exhaustive nor is every possible energy source explored in detail. With so many promising technologies still in the research stage, it is difficult if not impossible to offer concrete estimates of future job potential for all possible sources.

In this report, estimates of job development potential are extremely rough and cannot be generalized. Greater accuracy regarding the job generation potential of these energy sources requires additional data and more systematic and sophisticated estimation techniques. The report also does not explore in detail the job growth potential of non-renewable energy sources. Job estimates associated with the further development of coal require more detailed data. This report offers general information about possible energy options for the Appalachian region.

Part One: Job Implications of a 21st Century National Energy Portfolio: Methods of Estimating Job Impacts of the Growth in Non Renewable and Renewable Energy Sources and the Importance of Carbon Sequestration

Methods Used to Estimate Job Impacts of the Expansion of the Alternative Energy Sector

Since 2001, several major studies have been commissioned to examine alternative energy futures and the economic development potential of the expansion of renewable energy sectors, including wind, various forms of biomass and solar. In these studies, two widely used methods are employed to calculate the job impacts of a change in the nation's energy budget: input-output analysis, which captures the direct, indirect and induced effects of investment in a sector, and analytical models that yield an estimate of the direct job generation from the expansion of a sector based on the implied labor time required to produce industry components. While the first method provides a comprehensive means of estimating total job impacts including potential job losses associated with shifts between sectors and increasing efficiencies provoked by changes within sectors, it is data and computationally intensive. In contrast, an analytical approach to estimation is a simple and transparent means of creating a rough estimate of job generation potential from the expansion of alternative energy industries. For this report, we use the simpler approach as a starting point and recommend that a more comprehensive assessment be considered that employs input-output analysis.

For our purposes we illustrate the range of possibilities for growth in the number of jobs in separate industry segments, and investigate the prospect of sectoral growth in states that are currently the locations of alternative energy industry activity. These studies use as a baseline different energy scenarios that calculate the job impacts of future energy

portfolios including higher and lower reliance on fossil fuels. From these differences in energy portfolios, economic impacts can be calculated and then translated first into material inputs, operations and process activities and ultimately into total job impacts. If we isolate different combinations of renewable energy sources for the generation of electrical energy we see that there are considerable differences across the different feed stock combinations. According to some estimates, biomass-related energy generation is predicted to create more long-term jobs compared with other renewable energy sources (Table 1).

Table 1: Comparison of Estimated Employment Associated with Alternative Scenarios in the Production of Energy in the US

Scenarios	Average employment associated with each scenario (jobs)		
	Construction, Manufacturing, Installation	O&M and Fuel Processing	Total Employment
20% Renewable Portfolio Standard (RPS) by 2020 (85% biomass, 14% wind, 1% solar PV)	52,533	188,317	240,850
20% Renewable Portfolio Standard (RPS) by 2020 (60% biomass, 37% wind, 3% solar PV)	85,008	91,436	176,444
20% Renewable Portfolio Standard (RPS) by 2020 (40% biomass, 55% wind, 5% solar PV)	111,879	76,139	185,018
Fossil Fuels as Usual to 2020 (50% Coal, 50% Natural Gas)	22,711	63,657	86,369
20% Gas intensive by 2020 (100% Natural Gas)	22,023	61,964	83,987

Comparison of estimated employment created by meeting the equivalent of 20% of current US Electricity demand vian and expansion of fossil or renewables-based electricity generation.