The Impact of Proposed Greenhouse Gas Control Policies on Coal Mining and Railroad Employment

a paper prepared for the
Economic Policy Institute
Washington, DC

by

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August 2001

I. Introduction

1. The Impact of Greenhouse Gas Control Policy on Workers and Communities

According to a growing consensus among scientists, ongoing emission of carbon dioxide and other "greenhouse" gases into the atmosphere will result in significant changes in global climate. Public policies to reduce such emissions in the United States, while providing benefits in the form of climate stabilization and reductions in other environmental damage, are likely to have economic impacts that are unevenly spread through the American economy.

The Economic Policy Institute (EPI) and the Center for a Sustainable Economy (CSE) have designed a set of public policy measures to protect American workers' jobs and pay while making major reductions in greenhouse gas emissions in the United States. The EPI-CSE proposals (henceforth "the policy package") would actually modestly stimulate the overall American economy while minimizing the negative impacts on the energy-intensive sectors of the American economy.

The policy package is centered on a modest tax on the carbon in energy sources and the recycling of the carbon tax revenues through a reduction in the taxes paid by workers, an expansion of programs aimed at improving the overall energy efficiency of the economy, and generous transitional assistance to compensate any workers and communities harmed by the proposed greenhouse gas reduction policies.

While the overall impact of these greenhouse gas policies would be positive, certain sectors of the economy would be particularly hard hit. This paper looks in more detail at the impact of the policy package on two significantly impacted industries, coal mining and railroad transportation.

The paper begins with a discussion of the different meanings of the "job losses" that accompany almost all economic changes, even those with substantial net economic benefits. It then turns to the recent history of employment in these two industries where rising labor productivity has already substantially reduced total jobs. This sets the stage for an exploration of the impact that greenhouse gas emission policies would have on coal mining and the rail transportation of coal. We then consider public policies that could mitigate these impacts on workers. Such policies include phased implementation so that a substantial part of the adjustment can be made through normal job attrition and substantial support for laid off workers while they make the transition to new jobs.

We then turn to the likely geographic distribution of those impacts and the particular communities that are likely to be vulnerable as a result of laid off workers' reduced incomes and the overall reduction in employment opportunities for community members. We again look at the recent past experiences of these communities for clues as to the likely future impacts of the proposed greenhouse gas policies.

2. The Meaning of "Job Losses"

Because almost all of us depend on finding and holding a job in order to support ourselves and our families, the threat of losing our job arouses considerable anxiety and insecurity. In addition, job loss threatens our self-definition and feelings of competency. Most adults at least partially define who they are in terms of their job or profession. They demonstrate their competency as productive members of their community by the work they do. Job loss and unemployment threatens both economic and emotional well-being. That is why job loss and unemployment trigger such strong emotional reactions in public policy discussions.

Despite the undeniable importance of employment to individuals and the treat that "job loss" represents to them, it is important not to treat every shift in employment within the community or economy as a terrible, negative event that impoverishes workers or signals poor economic health or a declining economy. Some changes in employment status that could reasonably be described in terms of "job loss" may involve workers and/or communities making productive and beneficial economic transitions. It is important to distinguish these types of changes from those that do real damage to individuals and communities.

The language used in describing economic impacts is ambiguous and often misleading. When, within an industry, retiring workers and workers who quit to take what they perceive to be better jobs are not replaced, employment levels in the industry they leave decline, jobs are "lost," but no workers are laid off. In fact, some workers are better off (those who chose to pursue attractive alternatives) and no workers have been made worse off. It is not clear that this type of "job loss" is objectionable.

On the other hand, the actual lay off of a worker **does** have a serious negative impact. But the size of that impact can vary significantly. A layoff rarely involves permanent unemployment at zero pay. Skilled, previously well paid, workers, with successful work histories tend to be relatively quickly absorbed into the larger expanding economy. There are exceptions to this, of course. In very slow growing or contracting local economies, workers experience difficulty finding work without commuting considerable distances or moving away or accepting work at substantially lower pay than in the past. The point is that the impact of a layoff varies and some of the larger negative impacts can be reduced in size and duration by well-designed public policy. The policy package seeks to assure that such policies are put in place as part of an effective American climate stabilization program.

Similar distinctions need to be made when discussing job loss in the context of community economic impacts. When a plant expansion or the startup of a new business that has been discussed or speculated on does not take place, those potential jobs are "lost" even though they are jobs that no worker ever held. Even when workers are actually laid off and there is clearly a loss to the worker, the community may not experience a reduction in employment opportunities. For the economy as a whole, employment opportunities usually continue to expand because of the ongoing vitality of

the local economy despite the fact that some workers have been laid off. For an expanding community, at worst, what "job losses" represent to the overall economy is a rate of growth of employment opportunities that is somewhat slower than it otherwise would be. The "job losses" do not usually mean falling employment, rising unemployment, or the loss of population. Substantial "job losses" are consistent with the opposite, rapid employment growth, falling unemployment, and ongoing population growth, just at somewhat slower rates. As will be discussed below, this was true of almost three-fourths of the coal mining counties that lost coal jobs over the last two decades to technological change. Despite massive losses in the coal industry and the specialization of these counties in coal mining, their economies were able to continue expanding, generating a steady stream of new, but lower paying, jobs.

This does not mean that workers who have lost their jobs do not need assistance to make a difficult transition. The point is that while workers may need assistance, communities may not, depending on how diverse and dynamic the local economy is. The other quarter of the coal-mining counties we analyzed **did** suffer serious economic reverses and as still struggling with their losses.

This is important when interpreting the economic impacts that are reported from computer models of the local economy. "Job losses" are reported as declines in employment, suggesting that the number of employed people will actually decline. But that is not what is usually meant. The "job losses" are calculated by projecting how jobs would have increased under one scenario and then comparing that rate of growth with another scenario that is also likely to involve ongoing job creation. The difference between these two growth paths is the "job loss." Thus analysts can calculate massive "job losses" even when they are projecting ongoing expansion in employment opportunities.

The point is that the estimated "job losses," while they often represent real losses to employees if they cannot be accommodated through normal job attrition, may simply represent slightly slower growing economies rather than some negative trend. That makes a considerable difference in terms of the need for drastic and costly public policy measures. For the public there is a big difference between saying that there will be a loss of 1,000 jobs as opposed to saying that over the next five years the rate of growth of employment will be 2.0 instead of 2.2 percent or that 9,500 jobs will be created instead of 10,500 jobs. Both are descriptions of identical situations, but one description is likely to trigger a feeling of economic deterioration; the other might well be comforting.

II. The Impacts of Green House Gas Control Policies on Workers

1. A Recent History of Coal Mining Employment and Job Loss

Between 1979 and 1999 almost 174,000 coal mining industry jobs were lost. Over the 20-year period, coal mining jobs were lost at a rate of almost 8,700 per year. During the 1980s jobs were lost at a rate of 11,300 per year. During the 1990s the rate of job loss slowed but continued at a high rate, 6,100 per year. Over the full 20-year period, 66

percent of coal mining jobs were lost. During the 1990s alone, 41 percent of the coal mining jobs in 1989 were lost by 1999.

If there is one major industrial category where job losses have been very real, massive, painful, and disruptive, it is mining. During the 1980s, mining led all of the other major industries in the percentage of its workforce that was laid off. If one divides the number of workers actually laid off economy wide over a five-year period by the average employment during that period, the worker displacement rate in mining was 25 to 40 percent during the 1980s. In coal mining that worker displacement rate was even higher, 50 to 70 percent.[1]

Although these layoffs and reductions in industrial employment hit families and some communities very hard and almost certainly represent a permanent downsizing of the coal mining industry, it would be a mistake to treat these job losses as the equivalent of workers being rendered permanently unemployed. The vast majority of laid off miners have been re-employed in other economic activities. The Department of Labor has been using the U.S. Census Bureau's Current Population Survey to monitor displaced workers for twenty years. It estimates the re-employment rate of laid off-workers across all industries was 60 to 80 percent, depending on whether the economy was in a contraction or expansion.

In general, over the last 20 years, the re-employment rate among laid off miners was higher than that of all laid off workers.[2] For instance, in the 1998 analysis of displaced workers, 83 percent of miners had been re-employed within 14 weeks of being laid off, but only 62 percent of all workers had been re-employed this quickly.[3] That is not to say that miners and their families completely recover from losing their jobs. Laid off miners face much more substantial drops in pay in their new jobs. The median pay for a re-employed miner in 1992 was 35 percent lower than before the layoff while it was only 14 percent lower for all workers who were laid off and then re-employed. Re-employed miners continue to earn more than other re-employed workers, but the drop in pay for miners was much more substantial.[4] Unemployment rates are also higher among laid off miners than among laid off workers in general. This is partially an artifact of the fact that miners are less likely to get discouraged and leave the labor force altogether than are other laid off workers. When the percentages of workers that are unemployed and those that leave the labor force all together are combined, laid off miners appear to fare slightly better than other laid off workers in finding new jobs.

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[1] **"**The Industrial structure of job displacement, 1979-88, ***Monthly Labor Review***, September 1992, pp. 17-25.

[2] Worker Displacement during the Late 1990s, Bureau of Labor Statistics, Aug. 9, 2000; Worker Displacement in the mid-1990s, ***Monthly Labor Review***, July, 1999, pp 15-32; **The Industrial structure of job displacement, 1979-89, *Monthly Labor Review***, September 1992, pp. 17-25; Worker Displacement: A Decade of Change, ***Monthly Labor Review***, April 1995, p. 45-57; Recession Swells Count of Displaced Workers, *Monthly Labor Review*, June 1993, pp 14-23.

[3] **"**Worker Displacement in the mid-1990s," **Monthly Labor Review**, July, 1999, pp 15-32

[4] The Industrial structure of job displacement, 1979-89, ***Monthly Labor Review***, September 1992, pp. 17-25.

2. Projected Job Losses from Greenhouse Gas Control Policies in an Historical Context

Between 1979 and 1999 coal mining industry jobs declined at a rate of about 8,700 per year. Despite these steep job losses in the recent past, Department of Energy (DOE) projections are for this job loss to slow to about 800 a year through the year 2020, a 1.8 percent per year decline during the first decade and 0.5 percent per year decline in the second decade.[5] This represents a dramatic leveling off of productivity improvements even though there was no sign of such a leveling off during the 1990s.[6] In modeling the impacts of the policy package, the base case assumes more continuity with past declines in coal mining: about a 5 percent per year decline in coal mining jobs over the next ten years and a decline of about 1.4 percent per year in the following decade.

This modeling projects the loss of about 33,000 coal-mining jobs over the next twenty years in excess of the job losses associated with the base case. Averaged over the two decades that is a loss of 1,650 coal-mining jobs per year. The DOE analysis of CO2 controls projects job losses of about 1,300 per year in addition to those job losses associated with rising labor productivity. Other analyses of the impact of climate stabilization policy on coal mining have been similar. A 1998 study by Laitner and others projected coal mining job losses of 1,200 per year over a 15-year period while Scott's 1997 study projected coal mining job losses of 1,500 per year over a 25-year period.[7]

A rate of coal-mining job loss of 1,500 per year is only about a seventh of what was experienced in the 1980s and about a fourth of what was experienced in the 90s. The projected combined coal-mining job impact of greenhouse gas control policies and ongoing technological change (3,700 jobs per year) would be about a third of the 1980s rate of loss and about 40 percent below the 1990s rate of loss. In that sense the impact on coal mining jobs of greenhouse gas emission policies will be modest compared to what coal mining regions have already been through.

These projections assume implementation of greenhouse gas emission policies in the year 2001. That, of course, did not happen and implementation is not likely to happen

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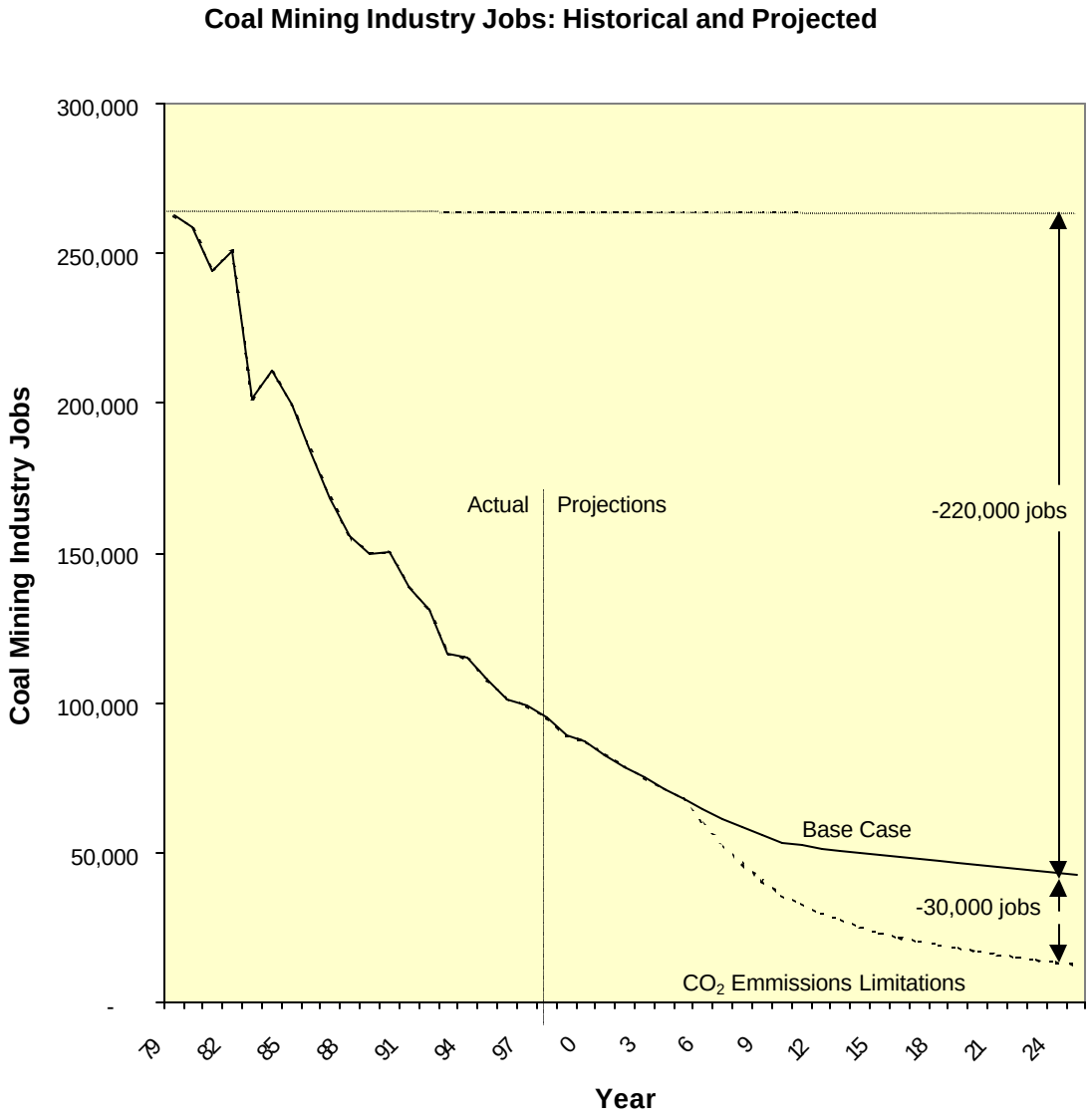
[5] **Analysis of Strategies for Reducing Multiple Emissions from Power Plants: Sulfur Dioxide, Nitrogen Oxides, and Carbon Dioxide**, December 2000, SR/OIAF/2000-05, Energy Information Administration, Office of Integrated Analysis and Forecasting, U.S. Department of Energy, Washington, DC 20585, pp. 50-51.

[6] The annual percentage change in output per hour in coal mining was 5.6 percent from 1990-1995 and 5.5 percent from 1995 to 1999. Bureau of Labor Statistics, http://stats.bls.gov/news.release/prin.t03.htm Table 3, Annual percent change in output per hour and related series: service-producing and mining industries.

[7] Laitner, Skip, Stephen Bernow, and John DeCicco. 1998. "Employment and Other Macroeconomic Benefits of an Innovation-Led Climate Strategy for the United States." ***Energy Policy*** 26(5):425-432.Scott, Robert. 1997. ***Accelerating Globalization? The Economic Effects of Climate Change Policies on U.S. Workers*** (Washington, DC: Economic Policy Institute).

in the next year or two. If implementation is assumed to be delayed to the year 2005 but is assumed to have approximately the same percentage impact on coal industry employment over the following 20 years, the base case and CO2 control case impacts on coal mining employment are shown in the figure below.



This adjusted projection is that an effective greenhouse gas control strategy may lead to about 1,500 coal-mining jobs per year to be lost between 2005 and 2025. These job declines will be in addition to the more substantial jobs losses caused by ongoing technological improvements. The primary impact on coal-mining workers and communities will continue to come from market forces and rising labor productivity, not greenhouse gas control policies. 46,000 jobs will be lost even if no greenhouse gas

policies are adopted. To this will be added the 30,000 job loss associated with those policies. The rate of coal mining job loss tied to greenhouse gas policies would be about 4.4 percent per year averaged over the two decades, 6.7 percent per year in the first decade and 2.8 percent in the second. In total between 1999 and 2025, over 76,000 coal-mining jobs would be lost, 86 percent of the jobs that existed in 1999. Those lost jobs would be concentrated in the 99 largely rural coal-mining counties where most coal mining takes place. We discuss the geographic and community impacts in a separate section below.

In addition to these coal mining job losses, railroad employment would also decline relative to what it otherwise would be without greenhouse gas policies. While some of these railroad jobs are associated with the coal mining areas, most of them are spread across the nation. Coal is shipped from the coal mining regions of the Appalachian Mountains (Pennsylvania, West Virginia, Virginia, and Kentucky), the coal fields of Illinois, Indiana, and Ohio, the coal fields of the Northern Great Plains (Wyoming, Montana, and North Dakota), as well as the coal fields of the central Rocky Mountains and the southwest (Colorado, New Mexico, Arizona, Utah, and Texas). It is shipped to most parts of the nation. Average rail shipping distances have been increasing, averaging 700 miles in the mid-1990s. For some regions, shipping distances are 1,200 miles or more.[8] The wide geographic dispersal of both coal producers and electric utility consumers leads coal-related railroad employment to be distributed broadly.

The projections assume that under an effective greenhouse gas control policy, coal production would decline at a rate of 9 percent per year during the first two decades of the 21st century. For the same time period DOE projected that greenhouse gas emission policies would lead coal production to decline about 3 percent per year. Under EPI's projections, 2020 coal production would be only 13 percent of what it was in 1999. In 1997 coal made up 27.3 percent of total rail carloads, 22.9 percent of 1997 total railroad freight revenues, and 45.4 percent of total tons carried.[9] Freight traffic appears to have been the source of about 86 percent of total railroad revenues.[10] If we assume that 25 percent of freight railroad employment is associated with the transportation of coal, that 86 percent of total rail employment is associated with freight traffic, and that coal transportation declines proportionately with coal production, we can estimate the impact of CO2 limits on railroad employment.

As with coal mining, we assume that greenhouse gas policies begin to be implemented in 2005 rather than in 2000 and trace the impacts through 2025. We use the same base case rate of railroad employment loss due to improvements in railroad labor productivity implicit in the EPI-CSE modeling, 2.4 percent per year. During the 1979-1999 period, railroad employment declined at a rate of 4.3 percent per year. Railroad transportation

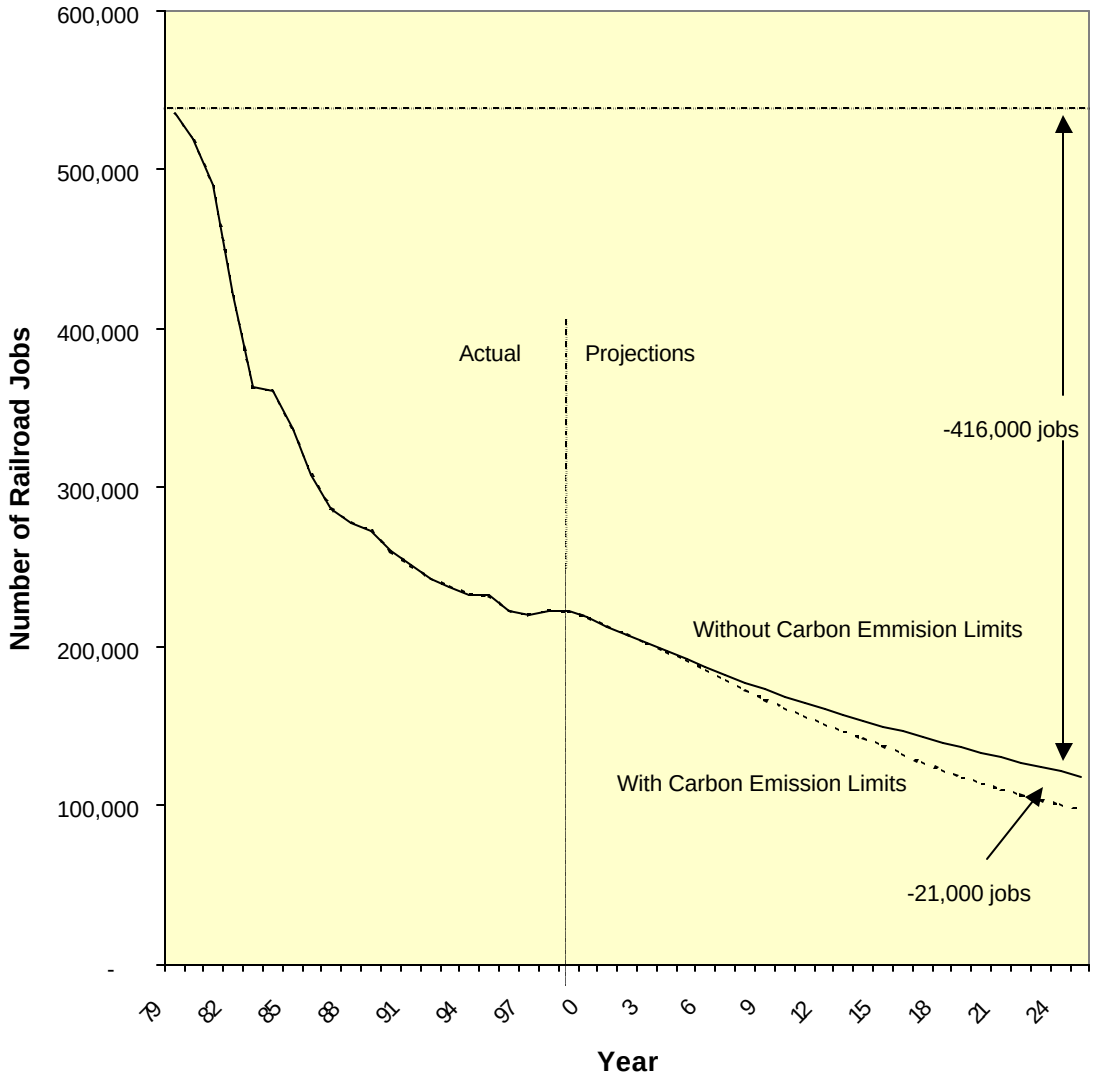
[8] Energy Policy Act Transportation Rate Study: Interim Report on Coal Transportation, Energy Information Administration, U.S. Department of Energy, DOE/EIA-0597, October 1995.
[9] Statistical Abstract of the U.S. 2000, 120th edition, Table No. 1062.
[10] Ibid. Table No. 1007.

labor productivity rose at an annual rate of 5.7 percent between 1990 and 1995 and 3.9 percent between 1995 and 1999. [11]

Our estimates are that greenhouse gas control policies will cause railroad jobs to decline at a rate of about 0.6 percent per year relative to what rail employment otherwise would be during the period 2005-2025. At the end of the period, rail employment would be 18 percent lower than it otherwise would have been. About 1,050 railroad jobs would be lost each year due to the greenhouse gas control policies between 2005 and 2025. These impacts are overwhelmed by ongoing market and technological forces that are the source of substantial railroad jobs losses regardless of greenhouse gas policy. When the impacts of ongoing technological displacement of rail workers are combined with the impact of the greenhouse gas control policies, rail employment is 87 percent lower in 2025 than in 1999. See the figure.

[11] Bureau of Labor Statistics, http://stats.bls.gov/news.release/prin.t03.htm Table 3, Annual percent change in output per hour and related series: service-producing and mining industries. Employment data from BEA REIS.

Railroad Employment with and without Carbon Emission Limits



The rate of job loss in rail employment is relatively low despite the loss of 69 percent of coal traffic because coal traffic is the source of only about a fifth of total railroad jobs (21% x 87% = 18%).

These projections of coal mining and railroad job losses do not mean that effective greenhouse gas policies would lead to that number of workers being laid off. Each year a significant number of coal miners and railroad workers retire and many others voluntarily change jobs. Because of this normal job attrition, much of the employment adjustment may take place without workers actually being laid off. We will discuss the quantitative size of this potential in the job loss mitigation section below.

3. Mitigating Job Losses in Coal Mining and Railroads

Job Turnover in Coal Mining and Railroads

Both the average and median age of a coal miner is about 45.[12] That means that over the next twenty-five years, as greenhouse gas control policies are put in place, over half of the existing coal miners will be retiring. In fact, because 75 percent of coal miners in the year 2000 were over 40, almost three-quarters of coal miners will reach retirement age during the period when greenhouse gas control policies are implemented. If the number of coal mining jobs were frozen at 1999 levels, the total retirements between 2000 and 2025 would total over 67,000. This is over twice the projected job losses due to greenhouse gas control policies and close to the total coal mining jobs losses due to the combination of technological change and greenhouse gas policies (74,000). Annual retirements would average about 5 percent of the declining workforce from 2000 through 2025 but would accelerate as time passes. During the first seven years retirements would be about one percent. During the following six years about four percent of the work force would reach retirement age each year. In the last half of the period, retirements would average 9 percent per year.

In addition to retirement, coal miners also regularly change their jobs for other reasons. Job tenure data gathered as part of the Current Population Survey indicates that about 15 to 20 percent of coal miners have worked for their current employer for less than a year. About 25 percent held a different job two years ago. About 30 percent have held their current job for 3 years or less, 35 percent four years or less, and 40 percent five years or less. The median job tenure is between 5.5 and 6 years, meaning half of coal miners have held their current job for this period or less.

This significant turnover[13] in employment took place during a period when the total number of coal mining jobs was declining dramatically. Between 1989 and 1999 an average of 6,100 coal mining job disappeared every year. Despite the declining number of total coal mining jobs, a significant number of workers (15 to 20 percent or 13,000 to 18,000 workers) were able to obtain new coal mining jobs. This suggests that there is considerable annual turnover in coal mining employment each year. If 5 percent of coal miners voluntarily leave their jobs each year before retirement age, the number of job slots that can be terminated annually without laying off workers doubles beyond what retirement alone would facilitate to 10 percent per year. Recall that the rate of job loss due to the greenhouse gas policies would be about 4.4 percent per year and that the combined impact of the greenhouse gas policies and technological change would be about 7.5 percent per year. It seems highly likely that if greenhouse gas emission

[12] Current Population Survey data, 36 months, 1998-2000, sample size 2,250.

[13] Although this is significant turnover, job tenure in mining, including coal mining, is higher than in any other major industry. For male workers in the late 1990 job tenure averaged about 4 years. "Employee Tenure in 2000," Bureau of Labor Statistics, http://stats.bls.gov/newsrels.htm, August 29, 2000. Coal mining specific data is from the special job tenure questions asked in the February Current Population Surveys of 1996, 1998, and 2000. Because the sample size was so small, all three years were combined. The results are not much different that for mining as a whole.

policies are phased in over the next twenty-five years, normal job attrition could be used to facilitate a good part of the transition. Rather than workers being laid off, workers who retire or leave voluntarily would simply not be replaced.

Similar possibilities exist in the railroad industry. The median age among railroad workers in 2000 was 44.5 years. Over the next 25 years, if the current workforce ages in place, retirements would average almost 6,000 per year. This compares to our projection of about 1,050 railroad jobs being lost per year due to greenhouse gas emission limits. Even the total job decline due to both technological change and greenhouse gas control policies, 4,700 railroad jobs a year, is less than the average retirement figure. Job tenure in the railroad industry, however, appears to be unusually high, with median time working for the current employer being over ten years. There is, however, still significant turnover. About 25 percent of railroad workers have worked for their current employer for less than four years.[14] Normal attrition within the railroad workforce can be used to make most of the employment adjustments required under greenhouse gas emission limitations that as phased in over time. It does not appear that special public policies would be needed to assist the transition in the rail industry.

Although average rates of retirement and job turnover over a 25 year period suggest that normal job attrition will be able to facilitate a significant part of the adjustment without the necessity of massive layoffs, the actual timing of the reductions in coal production and the retirement of coal miners is not likely to match closely. If implementation of the greenhouse gas policies begins in earnest in 2005, the bulk of the coal-mining job losses will take place in the 2005-2015 time period. Retirement rates will still be relatively low in this period. This mismatch between expected coal-mining employment reduction and normal job attrition is shown in the table below.

During the first five years, job loss associated with greenhouse gas control policies would substantially exceed normal job attrition. Between 2010 and 2015 normal job attrition would be sufficient to facilitate most of the job losses due to greenhouse gas control policies and would also almost cover total job losses. An early retirement policy that attracted those between 60 and 65 into retiring would allow all jobs losses to be covered during the 2010-2015 time period. This would continue to be true through the rest of the 25-year period. The biggest adjustment problem, therefore, would be in the first five years after the implementation of the greenhouse gas emission control policies. Some of this problem too could be solved by a combination of a slightly slower phase in of the policies and early retirement incentives.

Despite efforts to time the adoption of greenhouse gas control policies so as to minimize the impact on workers, a significant number of layoffs are still likely. All coal-mining operations will not be affected gradually and proportionately over time. Instead, particular individual mining operations are likely to abruptly shutdown at particular points in time. That means that older workers who would otherwise be protected by tenure will

[14] The age and job tenure information come from the Current Population Survey. The age data is for the year 2000, 12 monthly surveys, 1,900 observations. The job tenure information comes from the special job tenure questions asked in the 1996, 1998, and 2000 February surveys whose data was combined.

be laid off before reaching retirement age. As a result, job losses in particular operations will exceed normal attrition and some of the future retirements that would have taken place will not because the workers were permanently laid off earlier. Because such layoffs in coal mining are likely, EPI has proposed significant financial support for laid off workers to help them make productive transitions to new jobs.

Employment Declines and Workforce Turnover in Coal Mining: 2005-2025

	Annual Change at the Beginning of the 5 Year Period				
Year	2005	2010	2015	2020	2025
Job Loss Due to Greenhouse Gas Control	4,000	2,000	1,400	400	200
Total Job Loss Including Technological Change	7,000	5,000	2,000	1,000	800
Retirements as Workforce Ages in Place	900	3,100	3,600	3,900	2,200
Additional Turn Over at 2% of Workforce	1,400	700	460	340	250
Total Job Attrition	2,300	3,800	4,060	4,240	2,450

Direct Worker Transition Assistance

The policy package includes worker and community transition policies for the coal mining industry (as well as other industries that are especially hard hit by greenhouse gas control policies) that would have the following features:

a. All workers who are employed in coal mining as of the date the greenhouse gas reduction policies are adopted who are laid off during the implementation of those policies would qualify for transition support regardless of the cause of the layoff. Proof that the layoff was caused by greenhouse gas reduction policies would not be necessary. All existing coal mining workers would be certified as eligible.

b. All workers would qualify for two years of full, unconditional income replacement including the cost of health insurance and retirement contribution benefits.

c. Support beyond those two years would be provided for those engaged in full-time training or school. That support would cover educational and living expenses for up to four years of school or training.

d. Those within five years of retirement could opt to receive the equivalent of the support they would have received while being retrained instead as a financial bridge to early retirement.

Such worker transition support should allow most coal miners to avoid significant financial loss. As discussed earlier, coal miners are committed, disciplined workers who in the past, when faced with massive layoffs, have been able to relatively quickly obtain new jobs. Those jobs, however, often paid significantly less than coal mining did. However, many miners were successfully re-employed in the construction trades where their heavy equipment and materials handling skills could be productively re-deployed and relatively high blue-collar wages were available. With two year's of financial support and up to four years of full-time retraining available, laid off miners will be far more able to combine retraining, education, job search, and relocation in ways that protect their future earning capacity. In addition, the financial support for early retirement will allow the mismatch discussed above between future high retirement rates and nearer term layoffs to be bridged productively.

Carbon Capture and Sequestration Technologies

The United States has enormous coal reserves. The drawbacks associated with this energy source are its high carbon emissions as well as its emission of other dangerous chemicals. There may be net energy potential associated with coal even if the carbon is captured and safely sequestered. *If* scientific and technological developments in the future allow for the economic capture of the carbon emissions and their safe and permanent storage out of the atmosphere, the climate change concerns about the use of this fuel could be substantially reduced. *If,* in addition, the other pollution problems associated with the extraction and combustion of coal could also be solved, coal might play a significant role in the nation's energy future.[15] Those are, however, at this point in time and technology , very big "ifs." The point of mentioning this potential is that it is at least possible that the coal industry could continue to play a significant role in the national energy supply even within a world where carbon emissions were severely constrained.

III. The Impacts on Communities

1. The Local Economic Impact of Past Changes in Coal Mining Employment

Coal mining employment[16] has been changing dramatically over the last two decades as a result of market, technological, and regulatory changes. These ongoing changes

[15] For a discussion of carbon capture and sequestration see "**What Future for Carbon Capture and Sequestration?" Howard J. Herzog,** *Environmental Science and Tchnology***,** April 1, 2001, 35(7):148-53. A U.S. Department of Energy study projects that coal can serve as the dominant source of energy in the US **and** atmospheric carbon dioxide emissions can be dramatically reduced if currently discussed carbon capture and sequestration technologies can be brought down in cost and proven safe. **Potential for Advanced Carbon Capture and Sequestration Technologies in a Climate Constrained World,** S. H. Kim J. A. Edmonds, February 2000, PNNL – 13095, prepared for the U.S. Department of Energy under contract DE-AC06-76RLO 1830

[16] In the following discussions "coal mining employment" refers to all those employed in the "coal mining industry." That is, we use a coal mining industry count rather than a coal mining occupation count. The industry count includes not only those who actually extract the coal from the earth but also the

in the coal industry are crucial to an understanding of the likely impact of future reductions in coal production on state and local economies. We, therefore, begin our analysis with a review of coal industry employment between 1979 and 1999.

Impacts at the State Level

In 1999 there were 16 states with at least 500 coal miners. In most of these states, those coal-mining jobs represented a very tiny percentage of total employment. In 13 of the 16 states, coal mining represented less than one-half of one percent of total jobs. Only in Kentucky, West Virginia, and Wyoming did the importance of mining as a source of jobs approach or exceed one percent.

The massive job losses in coal mining did not have a major impact on all of the states. Between 1989 and 1998 12 of these 16 states had job growth as fast or faster than the average across the US. Among these coal-mining states, only Pennsylvania had job growth dramatically lower than the national average. Seven of the twelve states had population growth as fast or faster than the US average. West Virginia, Pennsylvania, and Ohio were the states in this group with significantly slower population growth. They were also among the states with the greatest loss of coal mining jobs. However, while in West Virginia coal mining employment was about 2 percent of all jobs, it was only about one-half of one percent of all jobs in Ohio and Pennsylvania. Thus the slow growth in Pennsylvania and Ohio economies is more likely tied to their slow growing manufacturing sectors rather than declines in coal mining. In the majority of these coal-mining states, however, real income and labor earnings grew slower than the national average. Arizona, Colorado, Texas, and Virginia were the exceptions where real income and earnings kept up with national growth.

While these measures of economic vitality in the 1990s suggest that most of the coal mining states had diverse enough economies to digest the loss of coal mining jobs, most of these states faced near stagnation or decline during the 1980s when the steepest declines in coal mining employment took place. As a result of the slow growth during the 1980s, the aggregate growth in real income and earnings over the 20-year period 1979-1998 was well below national averages in these coal-mining states. Given the small role of coal mining, the loss of jobs in that industry was just one of the causes for the relatively slow growth in the 1980s. Declines in other natural resource industries in rural areas as well as declines in manufacturing contributed significantly to the relative stagnation in earnings and income too.

In general, most of the coal mining states made productive adjustments to the massive declines in coal mining and diversified their economies, generating many more jobs in other sectors than were lost in coal mining. The few states most reliant on coal mining, however, showed clear negative signs of the declines in the coal industry.

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administrative and support staff of coal mining companies that organize and facilitate the production and sale of coal. The primary source of data is the U.S. Department of Commerce's Bureau of Economic Analysis, Regional Economic Information Service (REIS).

Impacts at the County Level

Most of the major coal-mining states have very diversified economies in which coal mining plays a relatively modest role. States like Pennsylvania, Ohio, Texas, Virginia, Illinois, Indiana, Colorado, and Arizona do not heavily rely on coal mining even though they are major coal producers. This is partially true because these are also heavily urbanized states where most of the population lives in large metropolitan areas far removed from coal mining.

Even within these states that are not significantly dependent on coal mining, there are counties that are quite dependent on coal mining for employment. In Greene County, Pennsylvania, 36 percent of jobs in 1998 were in coal mining. In Illinois, Gallatin County had over 12 percent of its total jobs in coal mining in 1998. In Virginia, Buchanan County had almost 22 percent of jobs in coal mining. In Ohio, Meigs County had almost 10 percent of jobs in coal, as did Pike County in Indiana. In West Virginia there were a half-dozen counties where coal's share of employment approached or exceeded 20 percent. In Kentucky, coal mining's share of total jobs exceeded 10 percent in almost a dozen counties. Within the 16 major coal mining states, 27 counties had coal shares of employment that exceeded 10 percent; 7 exceeded 20 percent. Clearly, one cannot rely on statewide data to indicate the relative importance of coal mining to the local economy.

In 1998 96 percent of all coal-mining jobs were located in the 99 counties that had 200 or more coal miners. Over the last 20 years these counties lost 113,000 coal-mining jobs, 57 percent of the coal-mining jobs that existed in1979. Given that mining jobs made up 10.3 percent of all jobs in these counties in 1979, one would expect these job losses to have had a major negative impact on local economic vitality. If the "indirect" and "induced" effects of these "direct" mining job losses, i.e. the "multiplier" impacts, are included, between 400,000 and 500,000 jobs could be estimated to have been lost.

These coal-mining job losses were concentrated in 71 of the 99 coal mining counties; the other counties saw coal mining employment expand. Between 1979 and 1998, 51 of those 71 counties that lost coal-mining jobs saw total employment remain stable or actually expand. Despite losing 77,000 coal-mining jobs (two-thirds of the total coal mining jobs lost), total employment expanded by 286,000 or about 21 percent. That is, in these coal mining dependent counties, the loss of 62 percent of those coal-mining jobs did not lead to overall job losses. As the overall economy expanded and coal mining contracted, the relative importance of coal mining as a source of jobs declined to a third of what it was in 1979, from 9.2 to 3.1 percent.

That is not to say that the laid off workers and these counties did not suffer significant negative consequences from the loss of these jobs. Individuals and families lost access to high paid jobs. The flow of income through the local economy slowed, slowing the overall economy. It is not clear, however, that those impacts can be adequately described in terms of the number of jobs lost. The underlying vitality of the local

economy allowed a net gain of 286,000 additional jobs rather than wiping out 400,000 to 500,000 jobs and leaving that number of people unemployed.

It certainly is true that if those coal-mining jobs had not been lost, total job creation is likely to have been significantly higher. This would have enabled the economy to expand more, allowing population to grow faster or avoid declining. There were negative impacts, but suggesting that 400,000 to 500,000 people lost their jobs and joined the ranks of the permanently unemployed does not accurately portray those impacts. Nothing on that scale happened in these coal-mining counties.

The 20 coal mining counties where both coal mining and total employment declined between 1979 and 1998 were far more dependent on coal mining. In these declining counties, 22.4% of all jobs were in mining in 1979 compared to 9.2 percent in the coal mining counties that saw total employment expand while coal mining was declining. In this set of declining counties, coal-mining jobs plummeted by 43,000 or 71 percent. These counties also saw stagnant or declining populations between 1979 and 1999 and aggregate payrolls dropped precipitously. The opposite was true of the few coal counties in which coal employment expanded. The table below tells the story for thirteen highly coal-dependent counties that faced dramatic losses of coal mining jobs, the "worst case" coal counties. Employment, population, aggregate income, and total payrolls all declined significantly. Declines in coal employment clearly had very strong negative impacts on the local economy.

If common multipliers were applied to the lost high wage jobs in all 20 coal-mining counties where both coal mining and overall jobs declined, total job loss would be projected to be 150,000 to 200,000. Actual employment declined by about 32,000 or 11 percent. Because the overall economy declined much less than did coal mining, the relative importance of coal mining as a source of jobs fell to a third of what it was in 1979, from 22.4 to 7.3 percent.

Counties Heavily Impacted by the Decline in Coal Mining 1979-1998

County	Estimated Coal Jobs 1998	Total Jobs 1998	Coal Mine Jobs as % of All Jobs 1998	% Change in Coal Jobs 1979-98	Estimated Coal Mine Jobs Lost 1979-98	Percent Change in Economic Indicator 1979-99			
						Total Employment	Population	Total Real Income	Total Real Pay
Gallatin, IL	356	2.898	12.3%	-56%	-455	-11%	-15%	1%	-45%
Perry, IL	450	8.646	5.2%	-72%	-1.129	-9%	-2%	0%	-38%
Harrison, OH	344	6.013	5.7%	-88%	-2.626	-25%	-9%	-2%	-51%
Monroe, OH	378	7.614	5.0%	-66%	-726	-23%	-10%	-6%	-50%
Buchanan, VA	2.432	11.221	21.7%	-71%	-5.853	-29%	-24%	-25%	-56%
Dickenson, VA	632	4.457	14.2%	-74%	-1.770	-23%	-16%	-34%	-64%
Wise, VA	2.663	21.092	12.6%	-56%	-3.394	4%	-11%	-10%	-28%
Boone, WV	3.292	9.291	35.4%	-44%	-2.601	-8%	-15%	-4%	-22%
Logan, WV	1.576	15.653	10.1%	-63%	-2.689	-4%	-20%	-1%	-20%
Marion, WV	620	7.085	8.7%	-89%	-4.869	-55%	-41%	-40%	-72%
Marshall, WV	1.280	25.915	4.9%	-49%	-1.246	-5%	-14%	6%	-15%
McDowell, WV	697	14.234	4.9%	-62%	-1.119	-18%	-14%	-1%	-27%
Wyoming, WV	1,113	7,367	15.1%	-75%	-3,425	-33%	-25%	-16%	-51%

Coal Mining and Unemployment

Unemployment rates in coal mining counties are significantly above the average unemployment rate in the state where the county is located. Averaged over the 1990-2000 period and across all coal-mining counties, the unemployment rate in those counties was 55 percent above the state rates. For some states such as Arizona and Virginia, the coal county unemployment rates are two to three times higher than the state unemployment rates. See the table below. Given the ongoing job losses in most coal mining counties due largely to labor-displacing technological change, these high unemployment rates might be expected. During the 1980s, for instance, the layoff rate in the mining industry was the highest of all the major industrial groups in the nation and the rate of job displacement in coal mining was much higher than in mining as a whole.[17]

Ratio of the Unemployment Rates in Coal Counties to the Statewide Average Unemployment Rate, 1990-2000																
AL	AZ	CO	IL	IN	KY	MT	NM	ND	OH	PA	TX	UT	VA	WV	WY	All Coal Ctny
1.05	2.64	1.31	1.50	1.38	1.64	1.76	1.38	1.82	1.75	1.44	1.23	1.73	2.95	1.27	1.02	1.55

It is not, however, just the job losses in coal mining that explain these high unemployment rates. Equally important in a quantitative sense is simply the relative importance of coal mining as a source of employment in these counties.[18] Even when there have not been large recent layoffs of coal miners, the unemployment rate in coal mining counties is higher than in other counties. Economists have studied this phenomenon for many years including analyses of the coal mining regions in West Virginia.[19]

The primary explanation for high unemployment being associated with mining counties even when there have not been layoffs is that the high wages paid in mining draw workers who hope to obtain one of these very high paying jobs. In addition, those miners who are laid off do not leave the area in search of other employment because it is unlikely that they will be able to find a job that pays as well. As a result, they too remain in the area hoping to be rehired. The outcome is a local labor supply that is persistently in excess of local labor demand. Workers are willing to accept lengthy periods of unemployment in order to increase the likelihood that they will be able to

[17] **"**The Industrial structure of job displacement, 1979-88, ***Monthly Labor Review***, September 1992, pp. 17-25.

[18] A regression of the unemployment rate relative to the state average on the percent of county employment in coal mining and the coal mining jobs losses between 1989 and 1998 expressed as a percentage of total employment shows that each of these variables have about the same impact on the relative unemployment rate. Both variables are statistically significant; Multiple R = 0.37, adjusted R^2 = 0.117 .

[19] Stephan Weiler, "Industrial Structure and Unemployment in Regional Labor Markets," ***Industrial Relations*** 39(2):336-359, April, 2000.

obtain one of these premium jobs. Given that the alternative, as seen by them, is the certainty of a much lower paying job, this behavior can be seen as a rational attempt to maximize expected long run wages. The normal adjustment to job loss and high unemployment rates, accepting alternative jobs and/or out-migration to regions where labor supply and demand are more in balance, is delayed and dampened because of the high financial rewards associated with obtaining a mining job. In this setting, high unemployment rates continue indefinitely even when there are no additional layoffs.

This phenomenon of high unemployment rates being associated with high-wage blue-collar jobs makes the interpretation of those unemployment rates somewhat more difficult. When the high unemployment is tied to recent layoffs, it clearly represents household and community stress. When it is tied to hopeful workers "lining up" in case a high wage job opens up, the higher unemployment represents a chosen long-run income strategy that, while it may or may not pay off, is voluntarily undertaken. Nonetheless, it is likely to be a strategy that puts both workers and families under stress. As it becomes clear that the downward trend in coal mining employment is permanent and that more layoffs, not new hiring, are likely, some of the excess unemployment will disappear as workers adjust to the harsh reality of limited coal mining employment opportunities. Regardless, the nation's coal mining regions will be facing additional losses of their relatively high paying mining jobs as labor productivity continues to improve faster than the demand for coal rises. To this ongoing job loss would be added the impacts of public policies aimed at reducing greenhouse gas emissions into the atmosphere. This can only add to the social and economic stress these regions have been experiencing for several decades now.

2. The Geographic Areas Most at Risk to Further Declines in Coal Mining

Although the dependence on coal mining for local jobs in the 99 coal mining counties we have identified has declined from 10.3 percent to 4.3 percent between 1979 and 1998, in 27 of these counties the dependence on coal remains greater than ten percent. Over half of these 27 counties are located in two states, 8 in Kentucky and 7 in West Virginia. In addition there are 3 in Virginia, 2 each in Wyoming, Illinois, and Ohio, and 1 each in Pennsylvania, Indiana, and Utah. The average dependence on coal mining for jobs in these counties was 28 percent in 1979 and had fallen to 13 percent in 1998. In 1998 almost half, 46 percent, of all coal mining jobs were located in these 27 coal-dependent counties. See the table below.

Most of these counties have successfully diversified away from coal over the last two decades, so that by the 1990s their total employment and population had stabilized. About a third of these counties, however, saw significant ongoing declines in population and employment during the 1990s. None of these counties, however, appear to have developed significant independent sources of economic vitality. Those that have shown significant expansion in jobs or population also saw expansions in coal mining rather than the declines that characterized most of the industry.

The vulnerability of these and other coal mining counties to future declines in coal mining is likely to be much lower than in the past for two reasons. First, the reliance on coal mining for employment has declined significantly. For all 99 counties it fell from 10.3 percent to 4.3 percent, almost a 60 percent decline. A similarly sized decline took place in the 27 coal-dependent counties we have identified. Second, projected job losses in coal mining, with or without greenhouse gas emission control policies, are much lower than the job losses experienced over the last two decades. The EPI-CSE projections are for 1,800 coal mining jobs to be lost a year even without greenhouse gas emission control policies. That is only one sixth of the annual losses during the 1980s and one third of the annual losses during the 1990s. With greenhouse gas emission control policies, job losses would be 3,000 per year, only a quarter of what was experienced during the 1980s and a half of the rate of loss in the 1990s. The job losses attributed to greenhouse gas emissions alone, 1,500, are only a quarter of the coal mining job losses in the 1990s.

If coal mining communities are only 40 percent as dependent on coal mining as they were in the recent past and job losses with greenhouse gas emission control policies will be only half of what they have been in the recent past, the maximum future impacts will be only about an fifth of what was experienced over the last decade or so. That is likely to be cold comfort for communities that have been severely disrupted in the past by the loss of coal mining jobs, but it is an important quantitative feature of likely future impacts. Communities will be far less disrupted than they were in the past, even if no mitigation strategies are implemented.

Counties Most at Risk to Further Declines in Coal Mining Employment			
County	State	% of All Jobs in Mining 1998	Estimated Coal Mining Jobs 1998
Gallatin.....	IL	12%	356
White.....	IL	11%	274
Pike.....	IN	13%	490
Harlan.....	KY	13%	1,048
Knott.....	KY	27%	1,167
Letcher.....	KY	27%	1,492
Martin.....	KY	13%	226
Muhlenberg....	KY	27%	1,242
Pike.....	KY	17%	4,495
Union.....	KY	14%	979
Webster.....	KY	15%	1,297
Meigs.....	OH	13%	739
Monroe.....	OH	10%	378
Greene.....	PA	17%	5,768
Emery.....	UT	17%	928
Buchanan.....	VA	21%	2,432
Dickenson.....	VA	15%	632
Wise.....	VA	11%	2,663
Boone.....	WV	31%	3,292
Clay.....	WV	17%	741
Logan.....	WV	11%	1,576
Marion.....	WV	13%	620
Mingo.....	WV	23%	2,502
Webster.....	WV	12%	528
Wyoming.....	WV	17%	1,113
Campbell.....	WY	21%	3,969
Converse.....	WY	12%	339

3. Mitigation Measures to Protect Communities

The policy package proposes that communities negatively impacted by climate stabilization policies be supported so that they, like workers, can make productive transitions that maintain their economic vitality. Communities in which layoffs took place in the pre-certified industries that the greenhouse gas control policies are expected to significantly impact would receive a lump sum payment of $10,000 per laid off worker to support economic development efforts. *All* laid off workers, whether the layoff was due to technological displacement or climate stabilization policies, would be counted in making these community transition payments. A community where 500 layoffs took

place, for instance, would receive $5 million. Of course, the support that will be provided to individual workers for several years after their layoff will also support the community as it adjusts to a new set of economic activities.

Small rural communities dependent on the energy intensive industries most likely to be impacted by an effective climate stabilization policy may face the loss of major employers. They will be able to use these assistance fund in anyway they believe will contribute to community stabilization and diversification. Given that these communities would be under stress as a result of ongoing losses of coal-mining jobs even if greenhouse gas control policies were not adopted, this support for all laid off miners, even those displaced by technological change, will provide those communities with much more support than they have received over the last two decades of coal mining layoffs that far exceeded those associated with climate stabilization. The combination of the support for miners and their families and the support for the communities will make the transition to a post-coal economy far less disruptive and far more productive.