Employment after coal

Creating new jobs in eastern Kentucky

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1. ARE THERE JOBS AFTER COAL?

The steep, ongoing decline of coal mining has caused the loss of 30,000 coal jobs in eastern Kentucky in the last 30 years.[1] Trends in energy markets and public policy make it clear that a coal-based economy is not coming back. A successful response to this crisis, replacing the lost kingdom of coal with a sustainable, community-controlled economy, is crucial to the hopes for forward-looking economic development in the region.

The issue reverberates far beyond the coalfields, as the national search for clean energy alternatives confronts impassioned claims about the need to protect coal mining jobs. In Kentucky and in the nation, a common but misleading frame on the debate suggests that there is no alternative, that "real" jobs can only be created by traditional industries, even if they are environmentally damaging.

In fact, the narrow, coal-centered vision of "real" jobs is fading away, and discussion of newer, cleaner alternatives is already underway. Community organizations such as the Mountain Association for Community Economic Development (MACED) and Kentuckians for the Commonwealth (KFTC) have sponsored grassroots job creation initiatives, and have identified key sectors where employment growth should be possible. Both MACED and KFTC advocate for a Just Transition, a bigger picture that combines existing initiatives into a single vision of a working economy, mapping the sustainable occupations and industries that will fill the void left by coal.

Our analysis describes a new pattern of employment that Appalachian Kentucky could aspire to reach by 2030. It is a more challenging and longer-term goal than is usually found in immediate grass-roots campaigns. At the same time, it is more limited, detailed and practical than a grand statement of ultimate objectives. It occupies an intermediate level of abstraction, a mid-range strategic vision of what the regional economy could look like in ten to twenty years.

1.1. Industries and targets

How many jobs are needed? In 2013 Appalachian Kentucky had 50,953 unemployed workers and 8,614 coal miners. (All of our data and calculations are for the 54 counties of Appalachian Kentucky, as defined by the Appalachian Regional Commission.) The large number of people out of work results from the long-term decline in coal mining jobs, combined with limited growth of other employment in the region. The unemployment rate in 2013 was 10.3% for the region, compared to 8.3% for all of Kentucky and

[1] Calculated from *Kentucky Coal Facts*, 15th edition (2015), http://energy.ky.gov/Coal%20Facts%20Library/Kentucky%20Coal%20Facts%20-%2015th%20Edition%20%282015%29.pdf

7.4% for the country as a whole.[2] To create a robust regional economy by 2030, many of the coal miners and currently unemployed workers will need new jobs. Our target for new job creation is summarized in

Table 1-1.

For coal miners, we assume that from now to 2030, employment will continue to decline but will not vanish. Specifically, we assume the loss of half of 2013 employment, or 4,307 coal mining jobs by 2030. As explained below, coal mining creates an average of a little more than one additional job in the region for every miner; thus a total of 9,088 new jobs will be needed to replace the loss of half of the region's jobs related to mining.

To bring Appalachian Kentucky down to the unemployment rate of the United States as a whole, 14,382 new jobs would have been needed in 2013, enough to absorb more than one-fourth of total regional unemployment. That number of additional jobs would not have eliminated joblessness in 2013, but would have allowed eastern Kentucky to catch up with the partial recovery of nationwide employment following the 2008-2009 economic crisis.

	2013 Coal Jobs and Jobless Workers	**2030** Replacement Jobs Target
Coal mining (direct employment)	8,614	4,307
Coal mining (total impact on region)	18,176	9,088
Unemployed workers	50,953	14,382
Total	**69,129**	**23,470**

Table 1-1. Mining jobs and unemployment in Appalachian Kentucky: 2013 actual data and 2030 replacement targets

Notes: Total is sum of last two lines. Total jobs impact of coal mining is based on data in Table 3-1 below, which imply that total job creation due to coal mining is 2.11 times the number of direct jobs in mining. Replacement jobs target is 50% of (total) coal jobs plus reduction of regional unemployment to match the national unemployment rate in 2013.

As

Table 1-1 shows, the combined replacement target is 23,470 new jobs in the region by 2030.

Past work by MACED has identified six areas as having potential for sustainable job growth:

[2] Unemployment in Appalachian Kentucky is reported by the Appalachian Regional Commission (ARC); see http://www.arc.gov/reports/custom_report.asp?REPORT_ID=30. The number of coal miners in "Kentucky (East)" is reported by the Energy Information Administration; see Table 18 in http://www.eia.gov/coal/annual/

- Energy efficiency
- Local food production
- Health care
- Sustainable forestry and wood products
- Tourism
- Environmental remediation

These are far from being the only opportunities for job creation in the region. Renewable energy production, affordable housing, arts and culture, elder care and child care, and infrastructure improvements, among others, could also be areas of job growth that would address urgent social needs. Our analysis narrows the field by focusing on areas that have emerged as priorities in MACED's organizing and reports, where there is an obvious potential or immediate need for increased employment.

In each of the six areas, we have developed scenarios for growth, based on the regional potential for expansion and the estimated costs and potential of each industry. For technical calculations we have relied on IMPLAN, a well-known model which is widely used to project employment impacts of policies and expenditures.

1.2. Three paths to economic development

If Appalachian Kentucky was a developing country, what advice would it get about economic development? In order to create more jobs, someone has to spend more money in the region. Broadly speaking, there are three ways to accomplish this. One is what economists have called import substitution: local enterprises can sell more to the region's households and businesses, replacing purchases from outside. Another is export promotion: local enterprises can sell more to customers outside the region. A third option is analogous to foreign aid: outside agencies can spend more money in the region.[3] Each of these strategies makes an appearance in our analysis.

Energy efficiency measures are a form of import substitution. When a household spends more on better insulation and less on electricity or heat, more of their spending stays in the region, paying the workers who install the insulation. When energy efficiency saves money for households, they will typically spend the savings on other consumer goods and services, creating additional local jobs.

Spending more on local food and less on food from outside has a similar effect. At present, eastern Kentucky grows very little of what it eats; local food production can create jobs in agriculture and food

[3] Yet another option, recruitment of retirees to the region, is analogous to immigration. Retirees bring new funds (their retirement incomes and assets) to the region, and spend money on local goods and services. While potentially important to the region, this option is not included in our analysis.

processing. In health care, likewise, a significant fraction of the region's spending currently flows to outside medical experts and facilities. Expansion of local health care options could create more jobs in the region, as well as improving access to medical care.

Sustainable forestry and wood product industries represent export sectors, aimed largely at selling local products outside the region. Tourism is another export industry that could bring outside spending to eastern Kentucky, potentially including eco-tourism based on forests, parks and mountains, and agri-tourism activities such as farm stays, petting zoos, horse riding, and other farm-based recreation. (Local food production could eventually become another export sector, selling food to nearby urban areas.)

Finally, remediation of environmental damages at abandoned coal mine sites is comparable to foreign aid. National and state-level decisions determine how much money is available for remediation, and how much of that will be spent in eastern Kentucky. The region has no shortage of appropriate sites for remediation efforts. Other arguments, as well, could be made for aid from outside to promote economic development in the region.

None of these approaches alone is sufficient. A successful strategy for employment after coal will have to make use of all the paths to economic development. The next section provides a more detailed description of the six sectors in which we have analyzed the potential for job growth.

2. SIX DIRECTIONS FOR JOB CREATION

2.1. Energy efficiency

Throughout the country, energy efficiency is frequently a cost-effective method for reducing energy consumption. Measures as simple as installing more efficient light bulbs and better insulation can pay for themselves quickly, reducing energy bills and leaving more money available for everything else. As an added bonus, installing efficiency measures creates more local employment than spending the same amount on electricity.

Kentucky Power Company, which provides electricity to much of the region, examined the potential for increased energy efficiency among its customers in July 2015.[4] The study found that most KPCO residential customers used electric heat, and that incandescent light bulbs were more common than compact fluorescents or LEDs. Among industrial customers most electricity use was for motors, which were frequently older and less efficient than newer motors.

[4] Applied Energy Group, "Kentucky Power Company (KPCO) Market Potential Assessment", July 30, 2015, filed by KPCO in Kentucky Public Service Commission case no. 2014-00271.

We rely on the KPCO study, scaled up to apply to all of the region.[5] That is, we assume the same potential for energy efficiency throughout the region as KPCO found in its service territory. (This is a conservative assumption, since some parts of the region currently have higher electric rates than KPCO, and therefore have even greater potential for cost-effective energy conservation.) KPCO's "achievable potential – high" scenario (despite the name, only the third-highest of five efficiency scenarios) projected that 17 percent of current electricity use could be saved by efficiency measures by 2035. We assume a slight acceleration, reaching that level of savings by 2030.

The result is that by 2030, we project that the region could be saving 2,154 GWh of electricity per year. The cost of efficiency measures reaches $97 million in that year, and the net savings to electricity customers are $108 million, almost all of it going to residential customers.[6] Of the money spent on efficiency measures, we estimate that one-third goes to workers who install the measures, and the remainder pays for the materials and supplies that they install. In addition, consumers will spend the net savings on a variety of goods and services, creating other jobs. The loss of jobs at utilities due to the reduction in electricity sales is quite small by comparison.

2.2. Local food production

Agriculture is important throughout most of eastern Kentucky. However, the region's agriculture has historically been dominated by beef and tobacco farming, so it has supplied relatively little of the region's food. As a result, there are ample opportunities to increase production of food for local consumption. This is especially important for farmers in light of the collapse in tobacco sales. The elimination of tobacco quotas in 2004 and the end of tobacco buyout payments to former quota holders in 2014 have forced many Appalachian tobacco growers out of the market.

A number of community initiatives are attempting to diversify and strengthen local food production.[7] In 2014, Barbourville and Hazard were among the 26 winners of EPA's nationwide "Local Foods, Local Places" grant competition, winning support for food distribution facilities that serve nearby communities. Yet such efforts remain rare, according to the county agricultural development plans filed with the Governor's Office of Agricultural Policy.[8]

One county plan after another tells a similar story: the leading agricultural products are cattle, hay and silage, and in some counties, tobacco. Steep slopes, moderately high elevation and land recently

[5] For regional totals we multiplied KPCO residential sales by 2.74, commercial sales by 1.74, and industrial sales by 1.44, reflecting the KPCO share of the regional market in each class of electricity consumers.

[6] This calculation is based on levelized costs, over the lifetime of the efficiency measures, of $0.034/kwh saved for residential customers and $0.057/kwh for commercial and industrial customers. All dollar amounts are in 2014 dollars.

[7] See the "Kentucky synopsis" section of Jean Haskell, "Assessing the landscape of local food in Appalachia", 2012, http://www.arc.gov/assets/research_reports/AssessingLandscapeofLocalFoodinAppalachia.pdf.

[8] The county agricultural plans are available at http://agpolicy.ky.gov/funds/Pages/county-info.aspx. As of September 2015, 42 of the Appalachian counties had filed agricultural plans with the state.

reclaimed from mining all favor pasture and livestock rather than crops. Options for diversification, generally described as speculative future possibilities, include fruits and vegetables, poultry, beekeeping. High tunnels – low-cost greenhouses built with plastic sheeting – could extend the growing season and improve growing conditions.

Another recent agricultural initiative is also worth noting. Hemp, an industrial fiber formerly grown in Kentucky, is now being reintroduced, following a 2014 change in federal law that allowed states to sponsor and license hemp production.[9] (A close relative of marijuana, hemp was banned for years under drug laws, even though it is not psychoactive.) It is too early to assess the long-term potential of hemp in Kentucky, and we have not attempted to project hemp-related employment.

According to the IMPLAN model, Appalachian Kentucky spends $1.13 billion on food, of which $436 million, or 39 percent, is supplied from within the region. The value of food imported from outside the region amounts to $694 million a year. While it would be impossible to produce all of that locally, it should be feasible to produce a noticeable share of it, creating jobs through import substitution and strengthening local communities and the environment. Recognizing that many foods cannot be produced in eastern Kentucky, we consider a scenario in which 25 percent of food from outside the region is replaced by locally grown food.

2.3. Health care

Demographic trends – above all, the aging of the population – imply that health services will be a growth industry for some time to come, in Kentucky and across the nation. Public health initiatives aimed at reducing and preventing illness are important to pursue, and are frequently the least expensive responses.[10] Yet the market for medical care will not vanish. Billions of dollars will continue to be spent, and jobs will continue to be created, meeting health care needs. A recent statewide analysis identifies health care occupations as among the most rapidly growing in Kentucky, and highlights potential shortages of particular skills and the need for additional training.[11]

According to IMPLAN, Appalachian Kentucky spends $6.75 billion a year on health care, 81 percent of it supplied locally. The remainder of the region's healthcare, with a price tag of $1.25 billion, is provided elsewhere, perhaps at larger medical institutions in nearby metropolitan areas. As with food production, it is hard to imagine 100 percent regional self-sufficiency in medical care. But it should be possible to

[9] Jessica Firger, "The great Kentucky hemp experiment", *Newsweek*, October 11, 2015, http://www.newsweek.com/2015/10/23/great-kentucky-hemp-experiment-381870.html.

[10] See, e.g., the discussion of health policy in SOAR, "2014 Regional Working Group Priorities", http://www.soar-ky.org/pdf/SOAR-Rupri-FullReport-092314.pdf.

[11] Kentucky Center for Economic Policy, "Developing the Healthcare Workforce: Growing Need is an Opportunity for Kentucky", January 2015, http://kypolicy.org/dash/wp-content/uploads/2015/01/Developing-the-Healthcare-Workforce-Final.pdf.

bring some of that $1.25 billion of outside medical expenditure back inside the region, creating valuable jobs, skills and institutions in the process.

Existing examples of local success in health care point the way to a strategy for the region. Pikeville Medical Center, an extensive complex of medical institutions with multiple specialties, has played an important role in strengthening the economy of Pike County and attracting other employers. Rockcastle Regional Hospital is known for its specialization in long-term respiratory care, and draws patients from across the state and beyond. Similar strategies for growth could be pursued in other communities.

We consider a scenario in which 25 percent of spending on outside medical care is replaced by spending within the region.

2.4. Sustainable forestry and wood products

Eastern Kentucky is heavily forested, and wood is the region's most abundant sustainable natural resource. A substantial forestry and wood products industry (combining logging, sawmills, and many varieties of wood products) already employs close to 4,000 workers in the region. According to IMPLAN, the industry's sales are worth just over $1 billion per year, of which about $300 million is used within the region. The region's wood and wood product exports to outside customers amount to $761 million per year.[12]

We explore the possibility of doubling of the region's current wood product exports; that is, adding another $761 million of sales outside the region. One recent study has proposed an even larger expansion of the forest products industry, based on harvesting half of the region's annual sustainable forest growth and promoting industries such as container and pallet manufacturing that can use low-quality timber.[13] That study effectively proposes twice as large an expansion of the wood products industry as we do.[14] The idea of committing half of the region's annual forest growth to an expanded wood products industry could be risky, although it deserves further examination. Since our scenario is about half as ambitious, it effectively commits one-quarter of the region's sustainable forest growth to the wood products industry.

A number of factors could impede the attempt to develop the region's forest resources in an ecologically sound manner. Much of the timber resources are owned by out-of-state energy and land-holding companies; unsustainable logging and forest management practices have been unfortunately

12 These are gross exports; the region also imports some wood products, so that net exports are somewhat smaller. However, gross exports to outside customers is the relevant category for our analysis.

13 University of Kentucky, Department of Forestry, "SOAR – Analysis of the Forest Industry's Potential in Eastern Kentucky", 2015, http://www2.ca.uky.edu/forestryextension/PDF/SOAR_Forest_Industry_Analysis_2015.pdf.

14 It projects an increase in direct spending (industry sales) of $1,497 million; adding this amount of new sales would roughly triple the industry's current exports from the region of $760 million. Their $1,497 million is roughly twice our maximum expansion of $760 million. The University of Kentucky study is also based on IMPLAN, and uses estimates of jobs per million dollars that are similar to ours.

common, especially on steep slopes; timber theft remains a problem; and most of the resource is still exported as raw timber rather than as value-added wood products. It is of great importance to address these problems, since the timber and wood products industry will be central to the future economy of Appalachian Kentucky.

2.5. Tourism

Despite some efforts at promotion of local attractions, it seems safe to say that eastern Kentucky has not yet become a major tourist destination. However, the favorable location, relatively close to major East Coast and Midwestern urban areas, suggests that the area could become better known and more widely visited, especially as coal mining becomes less widespread. Proposals for "eco-tourism", based on the region's forested mountain landscape, are easily compatible with sustainable forestry. In addition, many county agricultural plans mention the possibility of "agri-tourism", which could include farm stays or bed and breakfast accommodations, petting zoos, horse ranches and riding opportunities, hunting, and other activities.

Industries in Appalachian Kentucky that are associated with tourism currently have annual sales of $366 million to customers from outside the region.[15] We assume it might be possible to double these sales, bringing another $366 million per year into the region.

2.6. Environmental remediation

Eastern Kentucky has an unfortunate abundance of abandoned coal mine sites that are in need of remediation. The federal Office of Surface Mining Reclamation and Enforcement (OSMRE), a branch of the Department of the Interior, maintains a database of mines that were abandoned before 1990. It shows that a total of $208 million of still-unfunded remediation is needed at pre-1990 mine sites in the 54 counties of Appalachian Kentucky.[16]

Since 1977, coal mines have been subject to the Surface Mining Control and Reclamation Act (SMCRA), which sets standards for reclamation. Nonetheless, anecdotal evidence suggests that closure and abandonment of coal mines without reclamation did not entirely cease after 1977, or even after 1990, so the regional need is undoubtedly greater than $208 million. Systematic data are not available on the true extent of remediation needs. Since the adoption of the SMCRA, thousands of square miles of

[15] The IMPLAN industries that we associate with tourism are: transit and ground passenger transportation; scenic and sightseeing transportation; auto renting and leasing; travel arrangement and reservations; museums, historical sites, zoos and parks; hotels and motels (including casinos); other accommodations; restaurants and other food and drinking places. Eastern Kentucky is a net importer of these services – that is, spending on these services outside the region by residents of Eastern Kentucky is greater than spending on these services in eastern Kentucky by outside customers. However, we focus on gross exports of these services as the driver of local economic development and job creation.

[16] Our calculation from OSMRE data, downloaded from http://amlis.osmre.gov/Summaries.aspx.

Appalachia have been mined for coal.[17] A large fraction of that area is in eastern Kentucky; an uncertain, perhaps large fraction of that area is in need of remediation. Thus it seems likely that the real needs for remediation are larger, perhaps several times larger, than the OSMRE estimate for pre-1990 mines.

The Obama administration's 2016 budget includes the "Power Plus" plan for assistance to coal communities and workers. In addition to a number of smaller proposals, it includes $1 billion, to be spent over five years, on remediation of pre-1990 abandoned mines. The OSMRE database, however, shows more than $5 billion of unfunded remediation needs in six Appalachian states. Thus even if the Power Plus plan were fully funded at the requested level, it would meet only a part of the identified need. Much greater funding would be needed for full remediation of the damage from past coal mining.

3. MODELING EMPLOYMENT IMPACTS

Our analysis relies on IMPLAN, a widely used model of employment impacts. IMPLAN is an input-output model, ultimately based on data about the links between industries as collected by the Commerce Department. It calculates the indirect implications of each purchase: when consumers buy cars, the auto manufacturers buy steel, glass, tires and electronics from other companies, each of which buys supplies from other industries, and so on. IMPLAN can calculate the effects of these cascades of purchases, at the national, state, or county level, or for any combination of counties. All of our calculations for this report are IMPLAN results for the 54 counties of Appalachian Kentucky.

IMPLAN distinguishes three categories of jobs – direct, indirect and induced employment – that result from a purchase. When consumers buy cars, direct jobs are created in auto factories. Indirect jobs are created in auto parts companies and other suppliers to the auto industry. Induced jobs are created when auto workers and auto parts workers spend their wages, thereby increasing employment in many consumer goods and services industries.

Table 3-1 presents our estimates of the jobs created in the region per million dollars of spending in each of the six areas. (These are only intermediate results, and will be used to produce overall job creation estimates in a moment.) "Total" jobs is the sum of direct, indirect and induced jobs. For energy efficiency, there are separate job impacts for the costs of efficiency measures and for the energy savings, which customers will spend on other purchases.

Job creation per $1 million is highest in tourism industries, which tend to have lower wages than other industries shown here. Job creation per $1 million of spending is lowest in coal mining, because it is a capital-intensive, high-wage industry, and in energy efficiency costs, since two-thirds of those costs are

[17] C.E. Zipper, J.A. Burger, J.M. McGrath, J.A. Rodrigue and G.I. Holtzman (2011), "Forest Restoration Potentials of Coal-Mined Lands in the Eastern United States", *Journal of Environmental Quality* 40:1567-1577, citing OSMRE data.

spent on materials that are produced outside the region. Aside from these extremes, other activities shown in the table create about 5-10 direct jobs, and 7-15 total jobs, per $1 million of spending.

	Jobs per $1 million of spending *(2014 dollars)*	
	Direct	**Total**
Coal mining	1.6	3.4
Energy efficiency costs	2.1	4.7
Energy efficiency savings	4.7	7.1
Food production	9.7	15.5
Health care	9.9	15.1
Wood products	5.6	10.1
Tourism	17.3	21.6
Environmental remediation	4.8	8.7

Table 3-1. Jobs created in Appalachian Kentucky by $1 million of spending.

Source: IMPLAN defaults and authors' calculations. "Total" is the sum of direct, indirect and induced jobs.

4. SCENARIOS FOR JOB CREATION

4.1. Import substitution

Our job creation calculations include three activities that replace imports: energy efficiency, local food production, and expanded local health care services.

For energy efficiency, we project costs of $97 million and savings to customers of $108 million as of 2030, as explained above. (Here, and elsewhere, we multiply expenditures by the jobs per $1 million shown in Table 3-1 to calculate job creation.) The combined result, as shown in

Table 4-1 (adding the results in the first two rows), is about 700 direct jobs and more than 1,200 total jobs created in the region by energy efficiency.

	Expenditure (millions)	Direct jobs	Total jobs
Energy efficiency costs	$97	207	458
Energy efficiency savings	$108	508	762
Food production	$173	1,685	2,681
Health care	$313	3,099	4,733
Total	**$691**	**5,499**	**8,634**

Table 4-1. Job creation in 2030 from import substitution strategies.

Source: Authors' calculations. Food production and health care both assume that production in the region replaces one-fourth of current imports from outside the region.

For food production and health care,

Table 4-1 shows the effects of local production replacing one-fourth of the region's food and health care purchases from other regions. The result, for the import substitution strategies as a group, is about 5,500 direct jobs and 8,600 total jobs.

4.2. Export promotion and remediation

For the export industries, wood products and tourism, we assume that current "exports" (sales by businesses in the region to customers outside the region) might be doubled. The effects of that assumption are shown in Table 4-2.

For environmental remediation, we assume that the true need for remediation is twice the amount shown in the OSMRE database, or $416 million, and that it will be funded over the ten-year period from 2021 through 2030. This implies funding of $41.6 million per year, creating 218 direct jobs and 426 total jobs. The export industries plus remediation could create a combined total of about 10,800 direct jobs and 16,000 total jobs.

	Expenditure (millions)	Direct jobs	Total jobs
Forestry, wood products	$761	4,263	7,706
Tourism	$366	6,335	7,904
Remediation	$42	218	426
Total	**$1,169**	**10,816**	**16,036**

Table 4-2. Job creation in 2030 from export promotion and remediation strategies.

4.3. Job creation: summary

The results of the calculations for the six sectors are combined in Table 4-3. The result is a projection of 24,671 total new jobs in 2030 – which is about 1,200 jobs, or 5 percent, more than our target for replacing coal mining jobs and reducing unemployment (see Table 1-1).

	Expenditure ($ millions)	Direct jobs	Total jobs
Energy efficiency costs	$97	207	458
Energy efficiency savings	$108	508	762
Food production	$173	1,685	2,681
Health care	$313	3,099	4,733
Forestry, wood products	$761	4,263	7,706
Tourism	$365	6,335	7,904
Remediation	$42	218	426
Total	**$1,859**	**16,314**	**24,671**

Table 4-3. Job creation in 2030: Summary.

In other words, the level of effort and ambition we have assumed in these sectors is roughly what is needed to meet the targets of replacing half of coal jobs, and bringing regional unemployment down to the national level.

To summarize the basis for Table 4-3, we have assumed that

- Energy efficiency throughout the region reaches the high end of what Kentucky Power Company considers "achievable", a few years ahead of schedule. By 2030, ratepayers divert $205 million per year away from energy purchases, spending $97 million on measures such as better insulation and lighting, and saving $108 million.
- In both food production and health care, eastern Kentucky moves closer to self-sufficiency, with expanded local production replacing one-fourth of the food and medical services that are now imported from outside the region.
- In forestry and wood products, and in tourism businesses, the region doubles its current sales to customers outside the region.
- Federal and state funding pays for remediation of eastern Kentucky's abandoned coal mine sites, spending a total of $416 million over the ten-year period from 2021 through 2030.

Money will have to be spent to create these jobs; we project that about $1.8 billion per year is needed. Of that amount, about $700 million might come from recapturing money that is currently spent by residents outside the region, through promotion of energy efficiency, local food, and local medical services. The other $1,100 million might come from outside, by doubling the sales of the wood products and tourism sectors. Remediation of abandoned coal mines, while important to the environmental health of the region, is the smallest of the sectors we examined, both in potential expenditure and in jobs.

The transition to the new economy described here will not be effortless. Profound organizational changes, and one-time startup funding for many new or expanded enterprises, will be needed. Yet the goal of remaking the region, of creating post-coal jobs, is well worth working for. The old-economy jobs that have vanished could be replaced by a combination of greater self-reliance, through energy efficiency, local food, and local medical care, alongside expanded marketing of the region's wood products and tourism opportunities, and funding for remediation of abandoned mines. Coal is not coming back – and building a clean, sustainable economy is the best hope for the workers and communities of eastern Kentucky.