

# West Virginia Business & Economic

# REVIEW

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## The Potential Impacts of the Kyoto Protocol on West Virginia

### Kyoto Protocol Important to West Virginia

The potential impact of the Kyoto Protocol on West Virginia's economy is of particular interest because the state's economy is concentrated in energy-producing and energy-consuming sectors. During the United Nations Earth Summit at Rio de Janeiro in 1992, 154 states signed the Framework Convention on Climate Change to promote climate stabilization through control of greenhouse gas emissions. Since then the parties to the Convention have held periodic formal conferences to review progress and negotiate further agreements. During the 1997 conference in Kyoto, participating countries negotiated a set of greenhouse gas emissions targets for the years 2008 through 2012 and agreed in principle to various so-called "flexibility" mechanisms that countries can use to help meet the targets. This agreement is known as the Kyoto Protocol.

A recent study conducted by researchers at the Bureau looked specifically at these questions: "What kind of impacts will the Kyoto protocol have on West Virginia's energy markets?" and "With the state economy so dependent on energy-intensive industries, what could this policy do to broader measures of state economic activity, such as employment, GSP, personal incomes, or population?"

The state's energy-intensive economy evolved in response to abundant supplies of comparatively low-cost energy—coal, natural gas, and electricity. Table 1 illustrates the importance of energy to West Virginia's economy with data on employment, employee earnings, and gross state product (GSP) for selected industries in 1997. Coal mining, oil and gas extraction, natural gas distribution, and electricity are the state's major energy-producing industries. In addition to being large sectors in the state, electricity and coal are important parts of the state's export base. West Virginia sold 70.4 percent of its electricity generated in 1998 and 83.1 percent of its coal production in 1997 out-of-state. The four manufacturing industries (out of twenty) in Table 1 each include sectors that spend over 5 percent of their revenues on electricity purchases. Primary aluminum spends 20.5 percent, cement 10.6 percent, carbon and graphite products 5.5 percent, and reconstituted wood prod-

**Table 1**  
West Virginia Employment, Earnings, and Gross State Product (GSP) of Selected Industries

Industry	SIC	Employment 1997	Earnings* 1997	GSP* 1997
West Virginia	-	864,305	17,355	38,228
<b>Mining</b>	-	28,843	1,492	3,154
Coal mining	12	20,289	1,284	2,886
Oil and gas extraction	13	7,457	168	204
<b>Manufacturing</b>	-	85,875	3,337	6,684
Lumber and wood products	24	12,171	290	447
Stone, clay, and glass products	32	6,432	196	341
Primary metal industries	33	11,861	637	827
Chemicals and allied products	29	15,114	991	3,065
<b>Transportation and public utilities</b>	-	45,135	1,682	4,672
Electric, gas, and sanitary services	49	10,782	597	2,605

Source: U.S. Department of Commerce, Bureau of Economic Analysis  
\*Note: Earnings and GSP expressed in millions of current dollars.

ucts 5.5 percent of revenues on electricity. Combined, just the eight listed energy-intensive industries accounted for 9.7 percent of employment, 24.0 percent of employee earnings, and 27.1 percent of GSP in the entire state economy!

### The Kyoto Protocol Targets

The Kyoto Protocol's emissions targets apply to 38 developed countries listed in Annex B of the Protocol. The targets cover six gases—carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs). The permitted level of emissions for each of the six gases for each participating country is set as a percentage change from

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the country's emissions in a base year. For CO<sub>2</sub>, methane, and nitrous oxide, the base year is 1990; for the other three gases, a country can choose either 1990 or 1995 for their base year. The United States agreed to a 7 percent reduction.

Total emissions of the six gases are usually expressed as metric tons of carbon equivalent, based on the carbon content of CO<sub>2</sub>. In 1990 the United States' total greenhouse gas emissions were 1,618 million metric tons, of which 1,346 million metric tons (83 percent) came from combustion of energy fuels. The Energy Information Administration forecasts that without the Kyoto Protocol, energy-related carbon emissions by 2010 would be 33 percent greater than in 1990 and 43 percent greater by 2020.

Fortunately, the flexibility mechanisms agreed to in the Protocol can be used to reduce compliance costs. First, there is some flexibility in timing—the emission targets apply to the average over the five-year period rather than to any single year. Second, the countries are free to substitute reductions in one of the six greenhouse gases for reductions in any of the others using the carbon equivalents. Third, the Protocol allows credit for carbon sinks “resulting from direct human-induced land-use change and forestry activities...since 1990.”

The Kyoto Protocol's flexibility mechanisms also include three types of international exchange. First, Annex B countries may trade carbon permits among themselves. Second, the Clean Development Mechanism allows Annex B countries to claim credit for verified greenhouse gas emission reductions that result from participation in projects located in developing countries. Third, a Joint Implementation provision allows Annex B countries to share credit for emission-reducing projects conducted jointly.

### *Uncertainties in Modeling Kyoto Protocol Impacts*

Any attempt to model the Kyoto Protocol's potential impacts on West Virginia's economy faces many uncertainties. First, political pressures make it unlikely that the Kyoto Protocol will be adopted in anything like its present form. Although many countries, including the U.S., have signed the Protocol, no developed country has yet to formally ratify it. Second, rules for implementing many of the flexibility provisions were not laid out in the Protocol. This includes many elements—such as international trading of carbon emission permits, the Clean Development Mechanism, and credit for carbon sinks—that would be significant in determining U.S. compliance costs. Although negotiations over these rules have continued, it is apparent that even the agreed-on flexibility mechanisms are interpreted differently by the U.S. than by the Protocol's other signatories. Third, carbon emission targets have not yet been negotiated for the period after 2012. The scenario in this study assumes that the emission target remains the same through 2020.

Debate over the national costs and economic impacts of implementing the Kyoto Protocol has been vigorous. Many agencies and organizations have prepared estimates and have arrived at a wide range of conclusions. RDI states that “up to...19 percent of GDP will be at risk in 2010” through

restricted electricity supply. WEFA predicts that GDP would be reduced by up to 3.2 percent and that carbon emission permits would cost \$265 per metric ton (1992 prices). DRI McGraw-Hill forecasts that a scenario using international trading for only 15 percent of required reductions of U.S. carbon emissions would require a permit price of \$180 per metric ton (1997 prices) and lead to a maximum GDP loss of 2.0 percent in 2007-8, while a scenario in which international trading meets 55 percent of required reductions would lead to a \$40 permit price and a 0.7 percent maximum GDP loss during 2013-2017. In contrast to these estimates, the Clinton Administration and the Council of Economic Advisors state that with “key developing country participation” in permit trading, the GDP loss in 2010 could be only 0.07 percent [sic] with a permit price of only \$14 per ton.

A few studies actually estimate net benefits from policies leading to substantial reduction in carbon emissions (that is, before claiming any benefits from reducing climate change). Prior to the Kyoto Protocol, a team from five national laboratories in the Department of Energy estimated that a mix of energy-efficiency and fuel-switching initiatives consistent with a carbon permit price of \$50 per metric ton (1992 prices) could hold U.S. carbon emissions in 2010 to the same level as 1990 with “energy savings that are roughly equal to or exceed costs.” The Tellus Institute has designed a scenario composed of policies to promote faster adoption of energy-efficient technologies that it predicts would reduce carbon emissions in 2010 to 7 percent below the 1990 level (that is, complying with the Kyoto target without any need for international trading), with net annual savings of \$46 billion in 2010.

### *The Study's Scenario*

This study used one of several scenarios from the U.S. Energy Information Administration (EIA). The specific EIA scenario is defined by actual U.S. CO<sub>2</sub> emissions in the 2008 to 2012 period equal to the U.S. 1990 reference plus 14 percent. This EIA scenario was selected because it includes published estimates on impacts to coal-fired electricity generation and Appalachian coal production. Also, the EIA's estimated carbon price—\$129 per metric ton (1996 prices)—and carbon emissions are similar to forecasts from several other credible sources that include Annex B trading, carbon sinks, and offsets for the other greenhouse gases. Since signatories to the Kyoto Protocol have agreed in principle to these flexibility mechanisms, this seems fairer than modeling a scenario based on either no international emissions trading, as some opponents have done, or on trading with all countries, as the Administration has done.

The Kyoto Protocol's aggregate impact on the national economy can be represented as a loss of Gross Domestic Product (GDP) relative to an alternative national baseline without implementation of the Protocol. However, the direct impacts on West Virginia go beyond a general decline in national GDP because the burden of compliance is focused on energy-producing and intensively energy-consuming sectors, especially when the energy comes from carbon-intensive fuels such as coal.

The scenario includes less coal mining, reduced production of electricity at the state's generating plants, and the disappearance of the advantage West Virginia has enjoyed its from relatively low-cost electricity. For businesses, especially electricity-intensive manufacturing industries, this means an increase in operating costs which will lead to reduced competitiveness. For households, this means a higher cost of living that effectively reduces the value of real incomes.

Adapting to the Kyoto Protocol involves changes to plant and equipment that embody greater energy-efficiency and less carbon-intensity. Therefore, anticipation of Protocol implementation will begin to have economic impacts several years before 2008. The scenario modeled in this study branches off from the baseline in 2005. The following changes were used in the scenario:

Change in GDP:	-0.4% in 2005 -1.7% in 2010 -0.5% in 2020
Change in Appalachian Coal Production:	-5.4% in 2005 -25.5% in 2010 -35.6% in 2020
Change in Coal-fired Electricity Production:	-9.9% in 2005 -38.7% in 2010 -63.5% in 2020
West Virginia Electricity Prices:	Converge to U.S. average over the period 2005-2010

### Impacts of the Kyoto Protocol

Using the above scenario, the Bureau researchers calculated the impacts of the Kyoto Protocol as the difference between a baseline forecast of the state's economy and an alternative forecast including the changes in the Protocol scenario. We used the REMI model, specifically designed to forecast the impact of public policies and external events on the state's economy and population, to simulate and compare these two forecasts.

Figures 1 through 3 graph the baseline and Kyoto scenario forecasts of real GSP, employment, per capita income, and population from 1997 through 2020. In each figure, the gap between the two graph lines represents the estimated policy impact of the Kyoto Protocol year by year. Table 2 reports the magnitude of these impacts for four representative years.

Four observations apply across the impacted variables:

- The timing of the impacts reflects the timing of the Kyoto Protocol scenario. There are no impacts until 2005, which is the first year that the policy scenario deviates from the baseline scenario. Between 2005 and 2010, all of the impacts become worse as the direct impacts on national GDP, West Virginia coal production, state production of electricity, and electricity prices all increase. From 2010 to 2020 the impacts remain negative, but the trends are mixed. In this period increased losses in state production of coal and electricity are offset by partial recovery of national GDP towards the baseline scenario.

**Table 2** Economic Impacts of Kyoto Protocol

	2005	2010	2015	2020
GSP (in millions of 1992 \$)	-848	-3,721	-4,675	-5,079
Employment	-8,800	-42,800	-47,800	-42,700
Per Capita Income (1992 \$)	-127	-393	-191	-1
Population	2,400	28,800	51,200	66,100

- Growth in GSP and even more so in employment shows a temporary slowdown in 1999 as a result of a national slowdown over the 1996 to 2010 period.

- The magnitude of the impacts is quite large compared to the overall size of the state's economy. The largest impacts are -9.9 percent of GSP in 2019; -5.5 percent of employment in 2014; 1.6 percent of per capita income in 2010; and -3.9 percent of population in 2020.

- The national and state economies would take a very long time to fully adjust to the Kyoto Protocol. This is reflected in the direct impact scenario derived from the EIA's national modeling, which has GDP and energy market impacts still changing in 2020. The West Virginia economy's dynamics represented in the REMI model also include long lags in adjustments of production and the labor market.

Figure 1 depicts the impact on West Virginia's gross state product (GSP). GSP is the value added by the state's businesses while producing goods and services; it excludes the value of intermediate inputs and includes only the additional value that the business creates with its factors of production (labor, capital, land). The results presented here are in 1992 dollars to remove the effect of inflation over the extended period of the impact simulation. Two points can be made about the impact of the Protocol on the state's GSP:

- The Kyoto Protocol reduces GSP starting in 2005 with the largest impacts in transportation and public utilities (which includes electricity) and mining. The remaining sectors of the economy are affected by reductions in

**Figure 1**

demand due to both the cuts in GDP and also the loss of coal and utility revenues that could have recirculated in the state economy. Increases in the price of electricity also begin to reduce the competitiveness of the state's industries.

- By 2020 the share of the mining and the transportation and public utilities sectors in the impacts is even greater—71.8 percent of GSP. Between 2015 and 2020 the size of the GSP impacts on other sectors actually decreases. The reason for this split pattern is that coal and electricity production are still decreasing in the policy scenario while national GDP partially recovers.

Figure 2 depicts the employment impacts of the Protocol, which parallel GSP impacts because businesses employ workers in order to make their products.

- Employment impacts are spread more evenly among divisions of West Virginia's economy than are the GSP impacts. Services, retail trade, and construction have employment impacts that are larger than transportation and public utilities or mining in the early years of the scenario. The services sector still has the largest employment impacts in 2020 because the electricity and mining sectors are very capital-intensive, whereas some of the divisions (retail, services) affected by the general reduction in demand, population, and incomes are more labor-intensive.

- In percentage terms, the impacts on employment are smaller than the impacts on output: -1.0 percent versus -2.0 percent in 2005, -4.9 percent versus -8.1 percent in 2010, and -4.9 percent versus -9.6 percent in 2020. The labor market's initial reaction to cuts in employment is to reduce the wage rate, which induces businesses to keep some of the employees who would otherwise be lost. In addition, the output losses are concentrated in sectors (mining and public utilities) that do not hire many workers per dollar of output.

Per capita income expressed in constant dollars (1992 prices) is a useful measure of the population's financial well-being (Figure 3). Personal income impacts depend on the specific components of personal income, especially wages and salaries. Population changes also contribute to impacts on per capita income.

- Even though the Kyoto Protocol's impact on West Virginia's total personal income continues to get larger every year through 2020, its impact on per capita personal income peaks in 2010. By 2020 the impact on per capita income is effectively zero. Per capita income impacts shrink back towards zero after 2010 because the influence of population losses eventually overtakes the influence of reductions in total personal income.

- In the early years of the forecast, changes in wage and salary earnings explain almost all of the impact on total personal income (over 100 percent in 2005 and 95.1 percent in 2010). Eventually, impacts on proprietors' income; dividends, interest, and rents; and transfer payments play a larger role and earnings impacts are not quite as important (85.5 percent in 2020).

- Even though real per capita income and disposable (i.e. after-tax) per capita income grow in both the baseline and scenario forecasts, West Virginia's disposable per capita income falls further behind national disposable per capita income. In 1997 the state's disposable per capita income is 88.0 percent of the national average, but by 2020 it is only 81.4 percent in the baseline scenario forecast.

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The complete version of *Impacts of the Kyoto Protocol on West Virginia's Economy* by David Greenstreet is available on the Bureau website:

<http://www.be.wvu.edu/serve/bureau/index.htm>. A printed version is available for \$10 plus 6 percent sales tax. Contact the Bureau at (304) 293-7534 to order this report. Two companion reports, *Impacts of Phase II SO<sub>2</sub> Emission Restrictions on West Virginia's Economy* and *Impacts of the NO<sub>x</sub> SIP Call on West Virginia's Economy* are also available at the same price.



# West Virginia: A 20th Century Perspective on Population Change

As we approach the beginning of a new century, we should first take a step back and look at how the past 100 years have shaped West Virginia's demographic makeup. As the 20th century began, West Virginia's population was quite small, registering a total of 959,000 residents. However, increases in coal and timber production prompted a dramatic increase in the number of persons migrating into the state in search of employment. As a result, West Virginia's resident population skyrocketed until 1950, at which point the state's population reached its highest mark at 2,006,000. As Table 1 shows, West Virginia's total population change from 1900 to 1950 (109.1 percent) outpaced that of the entire U.S. (98.6 percent) as well as all of the surrounding states, which include Kentucky, Virginia, Ohio, Maryland and Pennsylvania.

While West Virginia's population grew nearly every year during the first half of the century, the second half has been quite different in that there have been several periods of population growth and decline. In fact, West Virginia's total population declined by 9.7 percent, whereas the U.S. and surrounding states gained residents, during the 1950-1998 period. Between 1951 and 1970, there were only three years (1958, 1959 and 1964) in which West Virginia's population did not decline. West Virginia lost 262,000 residents from 1951-1970. Following this period of substantial population losses, West Virginia experienced a resurgence in population during the 1971-1981 time period. Over this span of ten years, West Virginia experienced positive population growth in each year, eventually gaining 184,000 residents, or approximately 80 percent of the total residents lost between 1951 and 1970. These impressive gains in population were primarily guided by the "Energy Crisis." As some areas in the United States suffered due to increased energy prices, areas rich in energy-related resources experienced increases in population and employment. Overall, West Virginia's population increased by 10.4 percent from 1971 to 1981.

By late 1982, however, the good times ended and West Virginia fell victim to a deep global recession and a restructuring of the coal mining industry and several key manufacturing industries. In February 1983, West Virginia's unemployment peaked at a rate of almost 20 percent, leaving many West Virginians with relatively few job options. As a result, the state experienced its worst decade of population

decline. This is evidenced by the fact that in 1990 West Virginia had 156,000 fewer residents than in 1980, yielding an 8.0 percent decline in total population.

Presently, West Virginia's resident population is estimated at 1,811,000. Although this is approximately 18,000 residents above the 1990 Census count, the state's population has declined for three consecutive years through 1998. West Virginia's population has increased at a slower pace than the nation's (1.1 percent vs. 8.4 percent) thus far during the 1990s.

Although West Virginia's total resident population has changed quite dramatically over the course of the century, an even greater change has occurred in the state's age composition. One way to examine these changes in a region's age composition is through a population pyramid. A population pyramid is a useful way to graphically represent a population's age and sex characteristics. The pyramid also makes it much easier to compare age and sex compositions of different time periods for different geographic regions. Population pyramids display age data vertically, generally by 5-year age cohorts up to 75 years and over. Each horizontal bar represents the percent of the total population in that specific age group. The shapes of population pyramids are quite useful because they provide insight into the relative changes in age composition, fertility, mortality and migration.

Figure 1 (page 7) uses population pyramids to compare the relative age and sex distributions of West Virginia and the United States at specific points in the 20th century. In 1900, West Virginia and the United States had very similar triangular distributions, indicating a growing population and a high birth rate, patterns that are more reflective of less-developed countries. West Virginia, however, had a noticeably larger percent of its total population in the lower age groups. Consequently, the median age for West Virginia in 1900 was nearly three years younger than the United States (20.3 compared to 22.9).

By 1950, a noticeable shift had occurred in the population makeup of West Virginia and the United States. Although both the state and nation were in the midst of the post-war "baby boom," West Virginia's total population remained more heavily concentrated in the lower age groups. The U.S. distribution became much less triangular than West Virginia's due to bulges in the middle age groups,

Table 1

Population of West Virginia, U.S. and Surrounding States: 1900-1998

Year	Ky.	Md.	Oh.	Pa.	Va.	W.Va.	U.S.
1900	2,147,174	1,188,044	4,157,545	6,302,115	1,854,184	958,800	76,212,168
1950	2,944,806	2,343,001	7,946,627	10,498,012	3,318,680	2,005,552	151,325,798
1990	3,685,296	4,781,468	10,847,115	11,881,643	6,187,358	1,793,477	248,709,873
1998	3,936,499	5,134,808	11,209,493	12,001,451	6,791,345	1,811,156	270,298,524
1900-1950 Growth	37.1%	97.2%	91.1%	66.6%	79.0%	109.2%	98.6%
1950-1998 Growth	33.7%	119.2%	41.1%	14.3%	104.6%	-9.7%	78.6%

Source: U.S. Dept. of Commerce, U.S. Census Bureau; *Population of Counties by Decennial Census, 1900-1990 and Population Estimates*  
 Division Internet site: <<http://www.census.gov/population/www/estimates/popest.html>>

indicating that the U.S. had widened the median age gap. Indeed, West Virginia's 1950 median age of 26.3 was nearly four years younger than that of the United States (30.2).

Compared to 1900 and 1950, the population pyramid for 1998 has a substantially different distribution for both West Virginia and the United States. The distributions are no longer triangular for either region due to bulges in the 35-39, 40-44, and 75 + age groups, as well as smaller horizontal bars in the lower age groups. The shapes of these distributions indicate several aspects of each region's population. First of all, the overall shape of the distribution suggests that the population in West Virginia and the United States are older than in 1900 and 1950. Secondly, the smaller horizontal bars in the lower age group indicate a declining birth rate in both regions. Third, since states are sensitive to domestic migration trends whereas nations are not, a comparison of sequential decennial censuses may provide information about past migration patterns. Although not displayed, the pyramids for 1980 and 1990 contain relatively more persons in the 20-24, 25-29 and 30-34 age groups than 1998. This decrease indicates possible selective economic outmigration of West Virginia's working-age population.

Another important feature of the 1998 pyramids is that a greater percentage of persons 75 years and over are women. This illustrates the known fact that women have a longer life expectancy than men. Finally, while both West Virginia and the U.S. have larger bulges in the middle age groups, West Virginia also has a greater proportion of its total population (48 percent) above the age of 40 compared to the U.S. (42 percent). As a result, the median age for West Virginia is the highest in the nation at 38.6, and is more than three years older than U.S. median age (35.2).

Population growth is rarely distributed in an even pattern across all geographic regions in the United States, and West Virginia's counties have experienced substantial differences in the gains (and losses) to their respective populations. As shown in Table 2 (page 8), eighteen counties in West Virginia have increased their populations over the 1900-1998 time period by more than 100 percent. Thirteen counties, however, have actually lost residents during this same period. The remaining 24 counties are quite dispersed in their population gains, ranging from a modest 1 percent increase (Ohio and Monroe counties) to an 87 percent increase (Morgan County) from 1900- 1998. Berkeley County, though, has been the only county to increase in total resident population in each decennial census of the 20th century.

Just as West Virginia's population growth has been quite dynamic during the 20th century, the state's counties have undergone distinct periods of growth and decline. From 1900-1920, ten counties at least doubled their resident populations. Logan county's population, for example, increased from 6,955 to 41,006 (9.3 percent annually) over this twenty-year period. In addition, McDowell County's population increased from 18,747 to 68,751, or 6.7 percent annually. Overall, the six-county Southwestern region (Lincoln, McDowell, Boone, Wyoming, Logan, and Mingo counties) increased from 69,069 to 185,818 (5.1 percent annually) and accounted for 23 percent of the state's net population

growth during the 1900-1920 time period. During the next twenty-year period (1920-40), most counties in the state sustained relatively high levels of population growth. Eighteen counties outpaced the state's net population growth (2.1 percent annually) during this period, with five of the six Southwestern counties achieving this goal. As in the previous period, these six counties contributed to a substantial proportion (22 percent) of the state's net population growth. However, population gains were not isolated to this region during these early-century periods. Raleigh County, for example, increased its population from 12,436 in 1900 to 86,687 in 1940, yielding a 5.0 percent average annual growth rate, ranking second to Logan County's increase from 6,955 to 67,768 (5.9 percent annually).

The next two periods, 1940-1960 and 1960-1970, were periods of general population decline. Although West Virginia and several counties reached their peak populations for the century in 1950, both periods were marked by widespread decline in which the state's total population decreased, and nearly 40 counties lost residents or experienced near-zero population growth. Although seven counties gained residents in these two periods, only four counties (Jackson, Jefferson, Putnam, and Wood counties) managed to sustain average annual population growth above 1.0 percent in both periods.

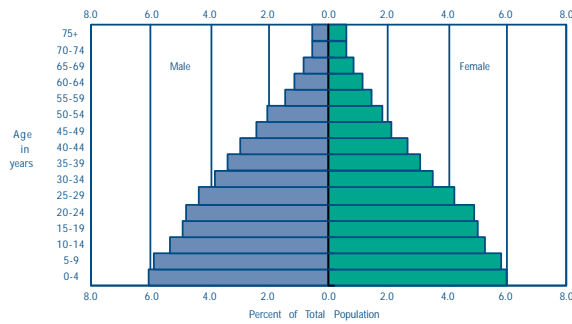
The 1970s were a time of relative prosperity for nearly all counties in West Virginia. Thirty-eight counties outpaced the state's average annual growth rate of 1.1 percent from 1970-1980, and seven of these counties more than doubled the state's growth rate. In addition, nine counties contributed to nearly half of the state's net population growth during the 1970-1980 time period. While the 1970s were good, the 1980s were not so kind to rural areas such as West Virginia. Although the state experienced its worst decade of population decline during the 1980s (-0.83 percent annually), many counties lost a more substantial proportion of the residents they had gained only years earlier. Twenty-six counties suffered population declines of more than 1.0 percent per year. Furthermore, by 1990, Fayette, McDowell, and Ohio counties dipped to their lowest population counts since 1900. The news was not bad for all regions in the state, however. Jefferson, Berkeley, Morgan, Putnam, and Hampshire counties posted average annual population growth rates of at least 1.0 percent from 1980-1990.

While West Virginia's population was greatly diminished during the 1980s, the 1990s have been a period of moderate population gains. Net population growth from 1990-1998 was 17,679. As in the previous decade, the Eastern Panhandle counties, Putnam County, and Hampshire County led the state in net population growth. Together, these five counties gained 30,278 residents, while the balance of the state lost 12,599 residents. Kanawha and McDowell counties ranked last in net population growth by losing 5,608 and 5,317 residents, respectively. In terms of total population growth, Berkeley County has been the fastest growing county since 1990, while Putnam, Hampshire, Jefferson, and Morgan round out the top five. Counties losing residents at the fastest rate during this decade are McDowell, Summers, Gilmer, Wyoming, and Mingo.

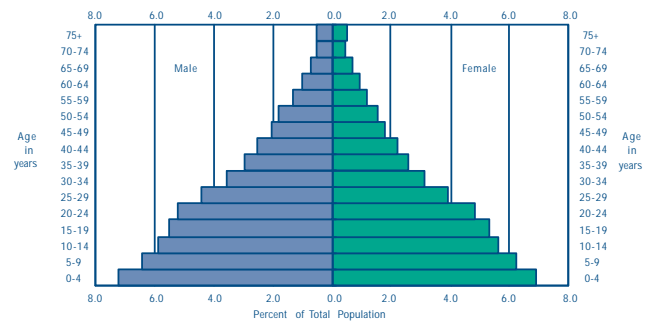
Figure 1

West Virginia and U.S. Population Distribution: 1900, 1950 and 1998

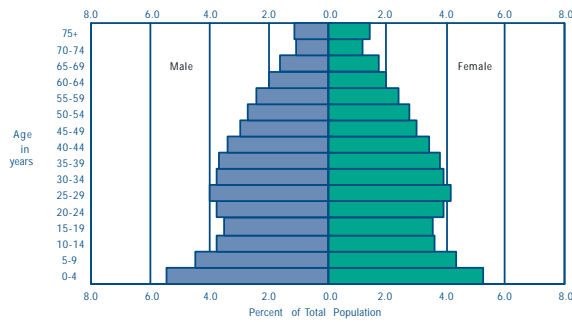
United States Population Distribution by Age and Sex: 1900



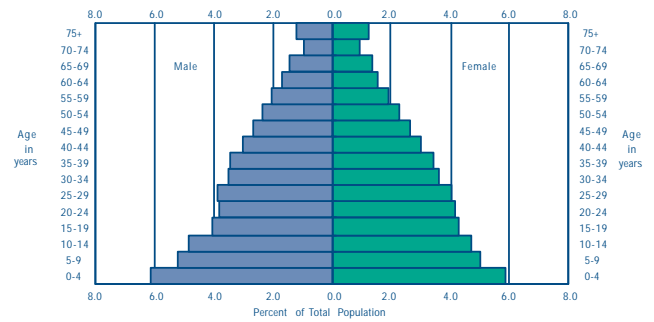
West Virginia Population Distribution by Age and Sex: 1900



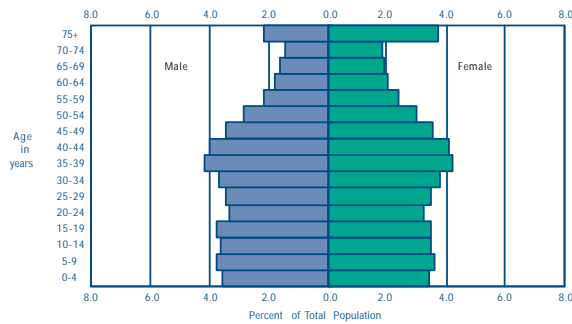
United States Population Distribution by Age and Sex: 1950



West Virginia Population Distribution by Age and Sex: 1950



United States Population Distribution by Age and Sex: 1998



West Virginia Population Distribution by Age and Sex: 1998

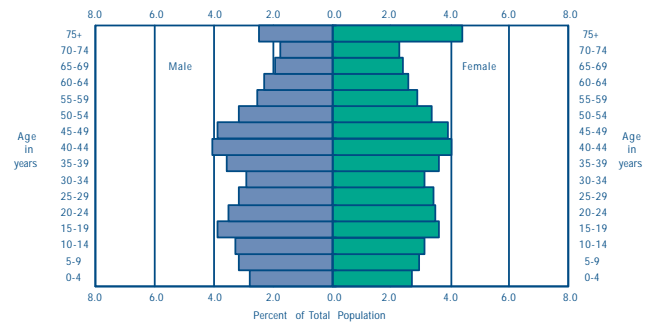


Table 2

## Population Estimates by County: 1900-1998

Area	Number											Percent Change	
	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	1998	1990-98	1900-98
<b>West Virginia</b>	958,800	1,221,119	1,463,701	1,729,205	1,901,974	2,005,552	1,860,421	1,744,237	1,949,644	1,793,477	1,811,156	1%	89%
Counties:													
Barbour	14,198	15,858	18,028	18,628	19,869	19,745	15,474	14,030	16,639	15,699	16,152	3%	14%
Berkeley	19,469	21,999	24,554	28,030	29,016	30,359	33,791	36,356	46,775	59,253	70,970	20%	265%
Boone	8,194	10,331	15,319	24,586	28,556	33,173	28,764	25,118	30,447	25,870	26,118	1%	219%
Braxton	18,904	23,023	23,973	22,579	21,658	18,082	15,152	12,666	13,894	12,998	13,185	1%	-30%
Brooke	7,219	11,098	16,527	24,663	25,513	26,904	28,940	29,685	31,117	26,992	26,004	-4%	260%
Cabell	29,252	46,685	65,746	90,786	97,459	108,035	108,202	106,918	106,835	96,827	94,273	-3%	222%
Calhoun	10,266	11,258	10,268	10,866	12,455	10,259	7,948	7,046	8,250	7,885	7,940	1%	-23%
Clay	8,248	10,233	11,486	13,125	15,206	14,961	11,942	9,330	11,265	9,983	10,530	5%	28%
Doddridge	13,689	12,672	11,976	10,488	10,923	9,026	6,970	6,389	7,433	6,994	7,554	8%	-45%
Fayette	31,987	51,903	60,377	72,050	80,628	82,443	61,731	49,332	57,863	47,952	47,930	0%	50%
Gilmer	11,762	11,379	10,668	10,641	12,046	9,746	8,050	7,782	8,334	7,669	7,130	-7%	-39%
Grant	7,275	7,838	8,993	8,441	8,805	8,756	8,304	8,607	10,210	10,428	11,098	6%	53%
Greenbrier	20,683	24,833	26,242	35,878	38,520	39,295	34,446	32,090	37,665	34,693	35,383	2%	71%
Hampshire	11,806	11,694	11,713	11,836	12,974	12,577	11,705	11,710	14,867	16,498	19,041	15%	61%
Hancock	6,693	10,465	19,975	28,511	31,572	34,388	39,615	39,749	40,418	35,233	33,973	-4%	408%
Hardy	8,449	9,163	9,601	9,816	10,813	10,032	9,308	8,855	10,030	10,977	11,829	8%	40%
Harrison	27,690	48,381	74,793	78,567	82,911	85,296	77,856	73,028	77,710	69,371	70,891	2%	156%
Jackson	22,987	20,956	18,658	16,124	16,598	15,299	18,541	20,903	25,794	25,938	27,972	8%	22%
Jefferson	15,935	15,889	15,729	15,780	16,762	17,184	18,665	21,280	30,302	35,926	41,368	15%	160%
Kanawha	54,696	81,457	119,650	157,667	195,619	239,629	252,925	229,515	231,414	207,619	202,011	-3%	269%
Lewis	16,980	18,281	20,455	21,794	22,271	21,074	19,711	17,847	18,813	17,223	17,427	1%	3%
Lincoln	15,434	20,491	19,378	19,156	22,886	22,466	20,267	18,912	23,675	21,382	22,192	4%	44%
Logan	6,955	14,476	41,006	58,534	67,768	77,391	61,570	46,269	50,679	43,032	41,080	-5%	491%
Marion	32,430	42,794	54,571	66,655	68,683	71,521	63,717	61,356	65,789	57,249	56,318	-2%	74%
Marshall	26,444	32,388	33,681	39,831	40,189	36,893	38,041	37,598	41,608	37,356	35,441	-5%	34%
Mason	24,142	23,019	21,459	20,788	22,270	23,537	24,459	24,306	27,045	25,178	25,869	3%	7%
McDowell	18,747	47,856	68,571	90,479	94,354	98,887	71,359	50,666	49,899	35,233	29,916	-15%	60%
Mercer	23,023	38,371	49,558	61,323	68,289	75,013	68,206	63,206	73,942	64,980	63,794	-2%	177%
Mineral	12,883	16,674	19,849	20,084	22,215	22,333	22,354	23,109	27,234	26,697	26,737	0%	108%
Mingo	11,359	19,431	26,364	38,319	40,802	47,409	39,742	32,780	37,336	33,739	31,926	-5%	181%
Monongalia	19,049	24,334	33,618	50,083	51,252	60,797	55,617	63,714	75,024	75,509	77,505	3%	307%
Monroe	13,130	13,055	13,141	11,949	13,577	13,123	11,584	11,272	12,873	12,406	13,205	6%	1%
Morgan	7,294	7,848	8,357	8,406	8,743	8,276	8,376	8,547	10,711	12,128	13,640	12%	87%
Nicholas	11,403	17,699	20,717	20,686	24,070	27,696	25,414	22,552	28,126	26,775	27,595	3%	142%
Ohio	48,024	57,572	62,892	72,077	73,115	71,672	68,437	64,197	61,389	50,871	48,287	-5%	1%
Pendleton	9,167	9,349	9,652	9,660	10,884	9,313	8,093	7,031	7,910	8,054	8,062	0%	-12%
Pleasants	9,345	8,074	7,379	6,545	6,692	6,369	7,124	7,274	8,236	7,546	7,421	-2%	-21%
Pocahontas	8,572	14,740	15,002	14,555	13,906	12,480	10,136	8,870	9,919	9,008	9,268	3%	81%
Preston	22,727	26,341	27,996	29,043	30,416	31,399	27,233	25,455	30,460	29,037	29,811	3%	31%
Putnam	17,330	18,587	17,531	16,737	19,511	21,021	23,561	27,625	38,181	42,835	51,164	19%	195%
Raleigh	12,436	25,633	42,482	68,072	86,687	96,273	77,826	70,080	86,821	76,819	79,066	3%	536%
Randolph	17,670	26,028	26,804	25,049	30,259	30,558	26,349	24,596	28,734	27,803	28,658	3%	62%
Ritchie	18,901	17,875	16,506	15,594	15,389	12,535	10,877	10,145	11,442	10,233	10,356	1%	-45%
Roane	19,852	21,543	20,129	19,478	20,787	18,408	15,720	14,111	15,952	15,120	15,342	1%	-23%
Summers	16,265	18,420	19,092	20,468	20,409	19,183	15,640	13,213	15,875	14,204	13,146	-7%	-19%
Taylor	14,978	16,554	18,742	19,114	19,919	18,422	15,010	13,878	16,584	15,144	15,326	1%	2%
Tucker	13,433	18,675	16,791	13,374	13,173	10,600	7,750	7,447	8,675	7,728	7,631	-1%	43%
Tyler	18,252	16,211	14,186	12,785	12,559	10,535	10,026	9,929	11,320	9,796	9,835	0%	-46%
Upshur	14,696	16,629	17,851	17,944	18,360	19,242	18,292	19,092	23,427	22,867	23,526	3%	60%
Wayne	23,619	24,081	26,012	31,206	35,566	38,696	38,977	37,581	46,021	41,636	41,957	1%	78%
Webster	8,862	9,680	11,562	14,216	18,080	17,888	13,719	9,809	12,245	10,729	10,230	-5%	15%
Wetzel	22,880	23,855	23,069	22,334	22,342	20,154	19,347	20,314	21,874	19,258	18,256	-5%	-20%
Wirt	10,284	9,047	7,536	6,358	6,475	5,119	4,391	4,154	4,922	5,192	5,669	9%	-45%
Wood	34,452	38,001	42,306	56,521	62,399	66,540	78,331	86,818	93,648	86,915	86,768	0%	152%
Wyoming	8,380	10,392	15,180	20,926	29,774	37,540	34,836	30,095	35,993	28,990	27,380	-6%	227%

Source: U.S. Dept. of Commerce, U.S. Census Bureau; *Population of Counties by Decennial Census, 1900-1990 and Population Estimates Division*  
Internet site: <<http://www.census.gov/population/www/estimates/popest.html>>



Table 3 shows the ten largest and smallest counties in West Virginia for selected decennial censuses as well as for 1998. Although Kanawha County has remained the state's largest county throughout the 20th century, the counties rounding out the ten largest have changed dramatically. For example, while Ohio County had approximately 2,000 fewer residents than Kanawha in 1900, it fell progressively lower and lower until 1998, at which point it was out of the top ten. Similar examples are Fayette and McDowell counties. Fayette County consistently held the ranking of fifth or sixth most populous county until 1960, at which point it fell to tenth, retaining that ranking until Berkeley County replaced it in 1990. McDowell County, on the other hand, skyrocketed to third by 1920 and remained in that position until 1960. Continuous declines in coal mining employment caused many residents to migrate out of McDowell County. Consequently, by 1970 Monongalia County replaced McDowell in the top ten.

The ten smallest counties by total population have changed even more dramatically than the largest ones. No county remains ranked as one of the ten smallest over the 20th century. Additionally, Wirt County maintained the same ranking for the longest period of time (1940-1998). More importantly, however, is that Logan is the only county to appear in both lists—it was the second smallest in 1900

and tenth largest in 1940. Of the ten smallest counties in 1998, Wirt, Pleasants, Pendleton, Gilmer, and Doddridge have fewer residents in 1998 than in 1900.

Overall, West Virginia has undergone significant changes over the course of the 20th century. Although the population is now almost twice as large as it was when the century began, the population continues to become progressively older—a trend that will likely continue into the next century. While the state's demographic makeup has changed significantly this century, West Virginia's counties have experienced more notable periods of growth and decline. On one hand, regions such as the southern coal-fields experienced explosive population growth during the first half of the century, but are now struggling to maintain current population levels. Simultaneously, regions such as the Potomac Highlands, the Eastern Panhandle, and Putnam County are experiencing seemingly unbounded population increases and appear to be headed for even stronger gains in the next century.

Brian Lego  
Research Analyst

The full version of this report is on the Bureau website:  
<http://www.be.wvu.edu/serve/bureau/index.htm>.

**Table 3**

**Population of the Ten Largest West Virginia Counties: 1900-1998**

1900		1990		1998	
Kanawha	54696	Kanawha	207619	Kanawha	202011
Ohio	48024	Cabell	96827	Cabell	94273
Wood	34452	Wood	86915	Wood	86768
Marion	32430	Raleigh	76819	Raleigh	79066
Fayette	31987	Monongalia	75509	Monongalia	77505
Cabell	29252	Harrison	69371	Berkeley	70970
Harrison	27690	Mercer	64980	Harrison	70891
Marshall	26444	Berkeley	59253	Mercer	63794
Mason	24142	Marion	57249	Marion	56318
Wayne	23619	Ohio	50871	Putnam	51164

**Population of the Ten Smallest West Virginia Counties: 1900-1998**

1900		1990		1998	
Hancock	6693	Wirt	5192	Wirt	5669
Logan	6955	Doddridge	6994	Gilmer	7130
Brooke	7219	Pleasants	7546	Pleasants	7421
Grant	7275	Gilmer	7669	Doddridge	7554
Morgan	7294	Tucker	7728	Tucker	7631
Boone	8194	Calhoun	7885	Calhoun	7940
Clay	8248	Pendleton	8054	Pendleton	8062
Wyoming	8380	Pocahontas	9008	Pocahontas	9268
Hardy	8449	Tyler	9796	Tyler	9835
Pocahontas	8572	Clay	9983	Webster	10230

Source: U.S. Dept. of Commerce, U.S. Census Bureau; *Population of Counties by Decennial Census, 1900-1990 and Population Estimates Division*.  
<<http://www.census.gov/population/www/estimates/popest.html>>

# Annual Economic Outlooks for the State and the Eastern Panhandle Released

In November 1999, the Bureau released its annual forecasts covering economic trends in the state overall and in the Eastern Panhandle region for the next five years (2000-2004). In this comprehensive analysis of such indicators as job growth, per capita personal income, and population, the West Virginia economy is forecast to continue to grow slowly during the next five years while the gap in income between the state and the nation will widen.

The *West Virginia Economic Outlook 2000* calls for the state to continue to register net job growth through 2004, but the pace will slow down. Steady but slower job growth produces a stable unemployment rate near current levels, which means that the unemployment rate gap between West Virginia and the U.S. will decline during the forecast. However, the state rate remains persistently above the national rate. With state job growth lagging behind the national rate and with job losses coming in relatively high-paying industries, growth in earnings from work has been below the national rate. This, combined with slower-than-national growth in income from dividends, interest, and rent and transfer income, has contributed to an increased gap in per capita personal income between the state and nation. With job and income growth lagging behind the nation, the state has lost population since 1995. However, Hammond points out that current estimates suggest that West Virginia has more residents now than it did in 1990. Besides the statewide forecast, the *West Virginia Economic Outlook 2000* also contains information on county performance through 1998 and West Virginia's status relative to its contiguous states.

The forecast for the Eastern Panhandle region of West Virginia calls for the region's strong economic growth in the 1990s to continue for the next five years, though at a slower rate, and the region is likely to outpace state and national growth rates in jobs, residents, and income. During the forecast period, the goods-producing sector far outperforms both the state and the nation, with strong gains in manufacturing in printing and publishing and transportation equipment. Diversified gains across the service-producing sectors are forecast to generate the bulk of new jobs. With these growth trends, the unemployment rate in the region is forecast to continue its descent. In addition, the region's strong population gains are likely to continue, adding residents at a pace nearly 50 percent above the expected national rate and far above the expected state rate. A similar pattern holds for the region's income.

Copies of the *Outlook 2000* are available for \$15 plus 6 percent sales tax; copies of the Eastern Panhandle forecast are available for \$10 plus 6 percent sales tax. To order, contact the WVU Bureau of Business and Economic Research by phone (304-293-7534) or e-mail (moore@be.wvu.edu).

## New Publications from the Bureau

### Economic Prospects of the Central W.Va. Chemical Industry

by David Greenstreet

A comprehensive analysis of the chemical industry in central West Virginia (Kanawha, Putnam, Cabell, and Wayne counties) and its future prospects. Funded by the West Virginia Manufacturers Association and the South Charleston Area Development Corporation. (\$20)

### Economic Impact of Mountaineer Race Track and Gaming Resort

Tables provide estimates on the Mountaineer Race Track's impacts on employment, employee compensation, output, business volume, and value-added for fiscal year 1998. (\$20)

### Economic Impact of WVHTCF Member Companies and Federally Supported Facilities in North Central W. Va. 1996-97

by David Greenstreet and Randy Childs

Information about West Virginia's high technology industries. Released in December 1998. (\$10)

### Economic Impact of WVU

Tables include impacts on employment, employee compensation, output, and assorted state taxes for fiscal year 1998. (\$20)

### WVU's Contribution to W. Va.'s Export Base

Analysis of the amount money brought into the state due to the presence of WVU, including money brought in through non-resident students, out-of-state financial aid, federal grants and contracts, and private grants, contracts, and gifts. (\$15)

To order any of these publications, send a check for the amount indicated plus 6% sales tax made out to West Virginia University to:

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# West Virginia and United States Economic Indicators

	98 Q3	98 Q4	99 Q1	99 Q2	99 Q3	1996	1997	1998
<b>United States</b>								
Real Gross Domestic Product (GDP) (Bil. \$1996 Chain-Wtd.)	8,536.0	8,659.2	8,737.9	8,778.6	8882.6	7,813.2	8,165.1	8,516.3
% Change	3.8	5.9	3.7	1.9	4.8	3.7	4.5	4.3
Consumer Price Index (CPI-U) (1982-84=100)*	163.4	164.0	164.6	166.2	167.2	156.8	160.5	163.0
% Change	1.6	1.4	1.6	3.9	2.5	2.9	2.3	1.6
Total Nonfarm Payroll Employment (Mil.)	126.1	126.9	127.6	128.2	128.9	119.6	122.7	125.8
% Change	2.1	2.4	2.5	1.9	2.0	2.1	2.6	2.6
Unemployment Rate (%)	4.5	4.4	4.3	4.3	4.2	5.4	4.9	4.5
Initial Claims for Unemployment Ins. (Thous.)	312	318	301	306	291	351	321	317
Industrial Production (1992=100)	131.6	132.3	132.7	134.0	135.2	119.5	126.7	131.4
% Change	0.9	2.2	1.3	3.9	3.6	4.5	6.0	3.7
Capacity Utilization Rate	81.5	80.9	80.3	80.4	80.6	82.4	82.9	81.8
Housing Starts (Mil.)	1.637	1.701	1.773	1.604	1.657	1.469	1.476	1.623
Retail Sales (Bil.\$)	2,744	2,815	2,906	2,956	3,024	2,500	2,618	2,746
% Change	0.6	10.8	13.7	7.0	9.5	5.8	4.7	4.9
Federal Funds Rate*	5.53	4.86	4.73	4.75	5.09	5.30	5.46	5.35
Thirty-Year Treasury Bond Rate*	5.47	5.11	5.37	5.80	6.04	6.70	6.61	5.58
<b>West Virginia</b>								
Total Nonfarm Payroll Employment (Thous.)	719.2	723.2	727.1	722.9	727.7	698.6	707.8	718.5
% Change	-0.2	2.2	2.2	-2.3	2.7	1.6	1.3	1.5
Mining	22.8	22.8	22.3	21.0	20.2	25.8	24.6	23.5
% Change	-17.2	0.6	-8.5	-20.9	-14.4	-5.1	-4.7	-4.5
Construction	34.2	35.2	35.7	34.2	34.5	34.4	34.9	34.5
% Change	-0.4	12.7	5.4	-15.5	3.2	4.6	1.5	-1.1
Manufacturing	82.3	82.2	81.1	81.7	82.8	81.9	81.6	82.4
% Change	-1.4	-0.6	-5.2	3.3	5.2	-0.6	-0.4	1.0
Trans., Comm. and Public Utilities	39.1	39.3	39.5	39.1	39.5	39.3	38.9	38.9
% Change	3.5	2.4	2.1	-3.7	3.5	-2.2	-1.0	0.0
Trade	163.6	164.5	166.4	166.6	166.1	160.3	161.7	163.2
% Change	1.7	2.3	4.8	0.5	-1.3	1.5	0.9	0.9
Finance, Ins. and Real Estate	28.6	28.9	29.6	29.3	29.5	27.3	28.2	28.6
% Change	2.4	4.3	10.0	-4.4	2.3	1.5	3.3	1.4
Services	208.6	210.4	212.0	210.4	214.4	191.0	198.9	207.0
% Change	5.4	3.4	3.1	-3.0	8.0	3.9	4.1	4.1
Government	140.1	139.9	140.5	140.5	140.7	138.7	139.1	140.5
% Change	-7.6	-0.5	1.6	0.0	0.8	1.7	0.3	1.0
Unemployment Rate (%)	6.7	6.2	6.3	6.7	6.4	7.5	6.9	6.6
Initial Claims for Unemployment Ins. (Thous.)	1,464	1,706	1,724	1,731	1,353	1,715	1,617	1,625
Average Weekly Hours Coal Mining	43.4	45.7	43.5	43.8	43.4	45.9	44.9	44.4
Average Weekly Hours Manufacturing	41.5	41.8	41.0	41.3	41.8	41.2	41.7	41.6
Average Hourly Earnings Coal Mining (\$)	19.72	19.56	19.24	19.29	19.51	20.09	19.73	19.73
% Change	-1.0	-3.2	-6.4	1.0	4.7	3.5	-1.8	0.0
Average Hourly Earnings Manufacturing (\$)	13.75	13.94	13.82	13.93	14.19	12.96	13.16	13.70
% Change	2.3	5.7	-3.5	3.2	7.7	2.6	1.5	4.2
Real Personal Income (Mil. 1996\$)	34,335	34,412	34,605	34,221	n/a	32,974	33,430	34,186
% Change	3.2	0.9	2.3	-4.4	n/a	1.7	1.4	2.3
Wage and Salary	17,675	17,679	17,797	17,375	n/a	16,750	17,058	17,539
% Change	5.4	0.1	2.7	-9.1	n/a	1.5	1.8	2.8
Other Labor	1,820	1,796	1,786	1,739	n/a	1,916	1,845	1,811
% Change	1.9	-5.3	-2.2	-10.0	n/a	-5.1	-3.7	-1.8
Proprietors	2,111	2,133	2,161	2,138	n/a	2,011	2,030	2,113
% Change	0.7	4.2	5.2	-4.1	n/a	-0.1	0.9	4.1
Dividends, Interest, and Rent*	4,936	4,948	4,945	4,958	n/a	4,908	4,923	4,927
% Change	1.3	1.0	-0.2	1.1	n/a	5.4	0.3	0.1
Transfer Payments	8,982	8,998	9,071	9,044	n/a	8,657	8,802	8,974
% Change	0.7	0.7	3.3	-1.2	n/a	1.6	1.7	2.0
Value of Total Housing Permits (Mil.\$)	311	382	393	357	352	290	291	327
West Virginia Export-Weighted U.S. Dollar (1980=100)*	138.6	132.6	134.6	138.0	137.7	116.4	127.2	136.7
% Change	2.9	-16.3	6.1	10.5	-0.9	3.2	9.3	7.4

Notes: West Virginia average weekly hours, average hourly earnings, and initial claims for unemployment insurance data are obtained from the West Virginia Bureau of Employment Programs and seasonally adjusted using seasonal factors derived by the Bureau of Business and Economic Research. West Virginia employment and the state unemployment rate are seasonally adjusted by the West Virginia Bureau of Employment Programs. Personal income data are seasonally adjusted by the Bureau of Economic Analysis, U.S. Dept. of Commerce. Components may not sum to totals due to rounding. All percent changes are measured from the previous period and expressed as annual rates. Value of total housing permits data are from the Bureau of the Census, U.S. Dept. of Commerce.

\* Not Seasonally Adjusted.

n/a - Not Available.



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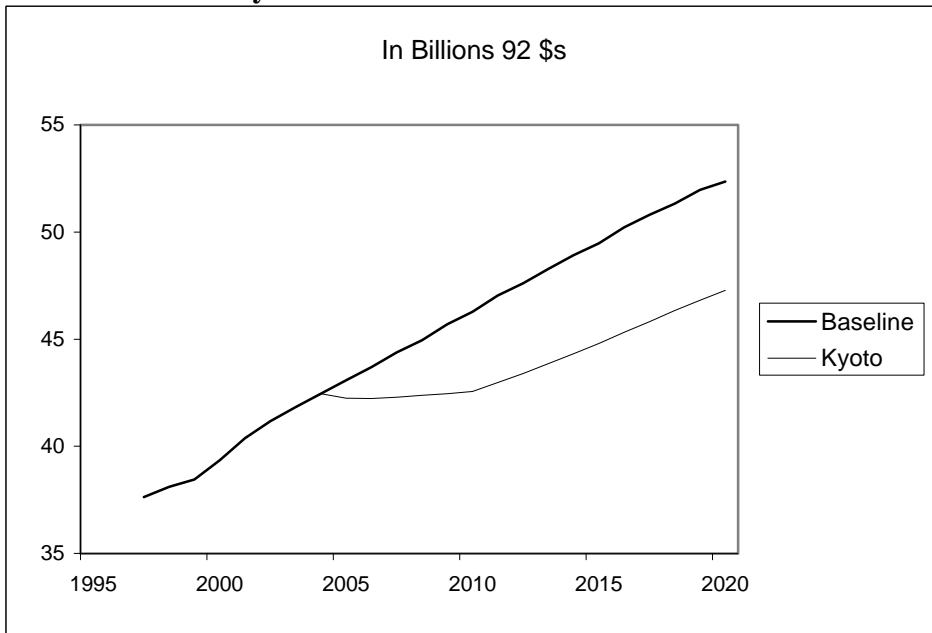
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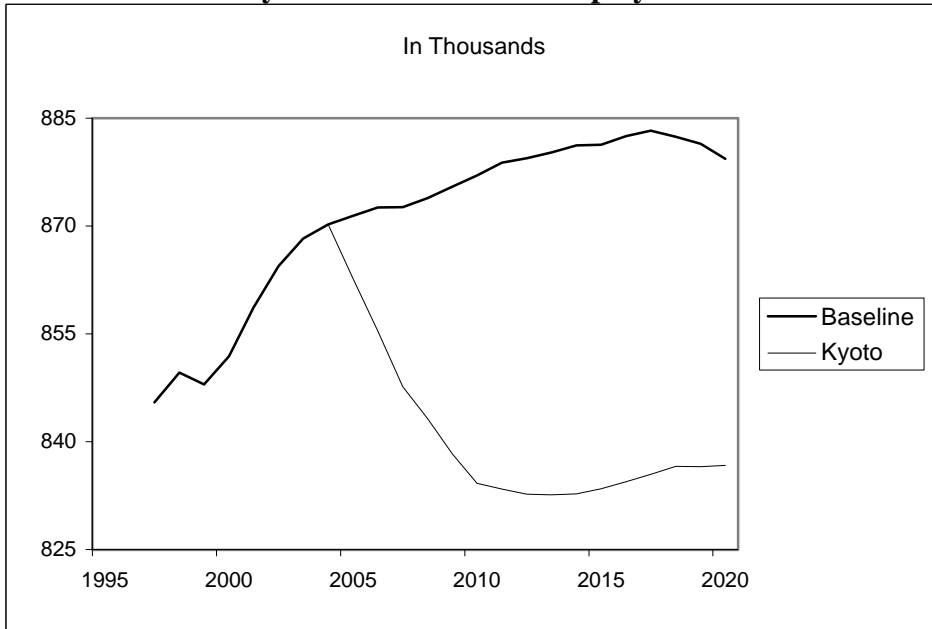


**Figure 1**  
**Kyoto Protocol: Gross State Product**



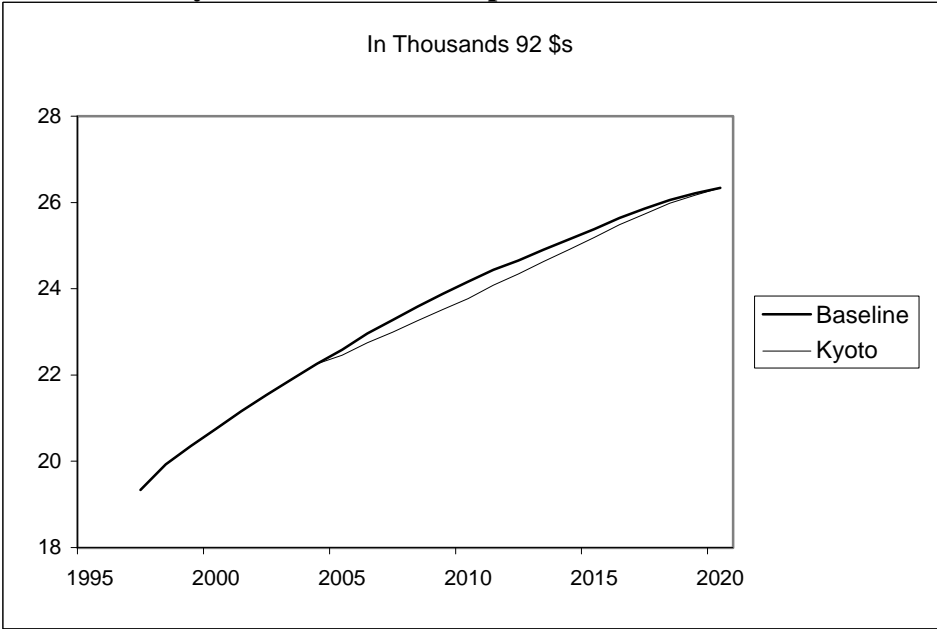
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**Figure 2**  
**Kyoto Protocol: Total Employment**



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**Figure 3**  
**Kyoto Protocol: Per Capita Personal Income**



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