Assessing the Impact of Potential New Carbon Regulations in the United States

Executive Summary

The U.S. power sector is undergoing a period of tremendous uncertainty, driven in large part by an unprecedented avalanche of new and anticipated regulations coming from the Environmental Protection Agency (EPA) covering everything from traditional air pollutants to carbon dioxide (CO_2). This report focuses on the economic impacts of just one aspect of the EPA's regulatory juggernaut: forthcoming EPA rules covering CO_2 emissions from fossil fuel-fired electricity generating plants under the Clean Air Act (CAA). These rules threaten to suppress average annual U.S. Gross Domestic Product (GDP) by $51 billion and lead to an average of 224,000 fewer U.S. jobs every year through 2030, relative to baseline economic forecasts.

These new rules are a central part of President Obama's June 2013 Climate Action Plan, a major initiative to cut U.S. greenhouse gas (GHG) emissions and "lead international efforts to address global climate change." In compliance with this plan, the EPA announced in September 2013 its New Source Performance Standard (NSPS) rule applicable to the construction of new fossil-fueled power plants. The President also instructed the EPA to ready proposed rules for existing power plants by June 2014 and finalize them within a year. While the exact form the existing plant rule might take has been subject to a great deal of speculation, it is generally expected that it will be of unprecedented magnitude, reach, and complexity.

Fossil fuel-fired power stations comprise almost 75% of the generating capacity and nearly 66% of the electricity generated in the United States. Accordingly, it is critical that the regulatory decision-making process be informed by realistic and robust analysis of the costs, benefits, and practical implications of any proposed actions on such a critical segment of the economy.

The U.S. Chamber of Commerce's Institute for 21st Century Energy (the "Energy Institute") represents the businesses and consumers that could be impacted by new EPA rules. Our perspective is unique, because our membership spans the entire spectrum of the U.S. economy. As such, we set out to develop a robust and comprehensive analysis of the potential economic impacts of the Administration's efforts. We undertook this effort in order to develop a better understanding of the true impacts of EPA's forthcoming proposal so that we can have a national debate based on facts and analysis, rather than emotion and conjecture.

The Energy Institute commissioned IHS Energy and IHS Economics (collectively, "IHS"), to examine and quantify the expected impacts of forthcoming power plant rules on the electricity sector and the economy as a whole, based on policy scenarios provided by the Energy Institute which are explained in detail herein. The conclusions drawn from this analysis are those of the Energy Institute.

The analysis in this report is based on a detailed existing power plant regulatory proposal by the Natural Resources Defense Council (NRDC), and the Obama Administration's announced greenhouse gas reduction goals. The NRDC proposal was utilized for this effort due to the widespread view that it incorporates many of the features that are likely to be adopted by the EPA in its regulatory regime applicable to existing power plants. While the analysis found that NRDC's proposed structure could not actually achieve the Administration's carbon reduction goal, it nevertheless reflects a framework for achieving greenhouse gas reductions that would be necessary if the Administration intends to pursue its stated emissions goal.

This analysis uses two power sector simulation cases: (1) a Reference Case with no additional federal regulations targeting U.S. power plant CO_2 emissions; and (2) a Policy Case with federal standards covering both new and existing fossil fuel-fired power plants. The results of these simulations were analyzed to assess their impacts on key U.S. and regional macroeconomic indicators. The Policy Case developed by the Energy Institute marries the NRDC's framework with the Obama Administration's stated goals of an economy-wide reduction in gross U.S. GHG emissions of 42% below the 2005 level by 2030 (as stated in the Administration's 2010 submission to the UN Framework Convention on Climate Change associating the U.S. with the Copenhagen Accord).

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In order to approach achievement of the Administration's aggressive goal, it was necessary to assume that carbon capture and sequestration (CCS) for new natural gas plants will be required beginning in 2022. IHS notes that adding CCS to natural gas-fired power plants can more than double their construction costs and increases their total production cost by about 60%. IHS also emphasizes that the prospects for the technological and financial viability of CCS remain highly uncertain. The Obama Administration reached a similar conclusion in its recently released National Climate Assessment, noting that CCS is "still in early phases of development."[1]

1 http://nca2014.globalchange.gov/

Power sector changes and costs of compliance

EPA regulation of CO_2 from existing power plants would result in extensive and very rapid changes in the structure of the power sector. Energy efficiency mandates and incentives in the Policy Case would be expected to lower U.S. power demand growth from 2013 through 2030 to 1.2% per year, or about 0.2% lower compared with the Reference Case.

Not unexpectedly, baseload coal plant retirements would jump sharply in the Policy Case, with an additional 114 gigawatts—about 40% of existing capacity—being shut down by 2030 compared with the Reference Case. The new capacity built to replace retiring coal and to meet remaining power demand growth is dominated by natural gas and renewables. However, with the implementation of tighter NSPS standards beginning in 2022 – which becomes necessary to approach the Administration's 2030 climate objectives – the new build mix shifts to a blend of combined cycle gas turbines (CCGT) with CCS, renewables, and a modest amount of nuclear capacity later in the analysis period. These changes mean coal's share of total electricity generation decreases from 40% in 2013 to 14% in 2030, while natural gas's share increases from 27% to 46%.

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As a result, annual power sector CO_2 emissions decline to about 1,434 million metric tons CO_2, resulting in an emissions reduction of about 970 million metric tons, or about 40% below the 2005 level by 2030. Even these dramatic changes fall short of the 42% emissions reduction goal in the Policy Case. To put this in perspective, the International Energy Agency estimates

that over the 2011-30 forecast period, the rest of the world will increase its power sector CO_2 emissions by nearly 4,700 million metric tons (MMT), or 44%. Those non-U.S. global emissions increases are more than six times larger than the U.S. reductions achieved in the Policy Case from 2014-30.[2] Considered in light of the challenges and costs associated with approaching 42% power sector CO_2 reductions, this international context should be instructive as the U.S. seeks to negotiate a post-2020 emissions reduction agreement.

By accelerating the premature retirement of coal plants, the CO_2 regulations included in the Policy Case force a significant increase in the unproductive deployment of capital by driving the noneconomic retirement of coal-fired generation facilities. Costs also are increased by a need to deploy nearly carbon-free new generation beginning in 2022—CCGT with CCS and nuclear—to approach a 42% emissions reduction goal in the power sector. When the costs for new incremental generating capacity, necessary infrastructure (transmission lines and natural gas and CO_2 pipelines), decommissioning, stranded asset costs, and offsetting savings from lower fuel use and operation and maintenance are accounted for, total cumulative compliance costs will reach nearly $480 billion (in constant 2012 dollars) by 2030 (Table ES-1).

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To date, the Mercury and Air Toxics Standard (MATS) is the most expensive power sector rule ever issued by the EPA, at a projected total cost of $9.6 billion per year.[3] Over the 17-year study timeframe utilized for the Policy Case, the average *compliance* cost of the EPA's CO_2 regulations is nearly triple that amount, at $28.1 billion annually during that period. Thus, the

2 International Energy Agency data from 2013 World Energy Outlook; 2014-2030 Policy Case emissions reductions versus the Reference Case equal to 750 million metric tons CO_2.

3 http://www.epa.gov/ocir/hearings/testimony/112_2011_2012/2012_0208_rm.pdf

Table ES-1 Incremental costs: Policy Case as compared with Reference Case

Incremental cost item	Incremental cost ($billion, real 2012$)
Power plant construction	339
Electric transmission	16
Natural gas infrastructure	23
CCS pipelines	25
Coal plant decommissioning	8
Coal unit efficiency upgrades	3
Coal unit stranded costs	30
Demand-side energy efficiency	106
Operations and maintenance costs	-5
Fuel costs	-66
Total incremental costs	478

Source: IHS Energy
Note: Please see Appendix C for power generation addition unit costs and more detail on the calculation of natural gas pipelines, transmission, CCS pipelines, coal plant decommissioning, and coal unit stranded assets.

GHG regulations analyzed in the Policy Case would dwarf the most expensive EPA power sector regulation on the books.

The impacts will be felt differently in different regions of the country. In order to comply with the Policy Case, the analysis finds that the South and the Midcontinent Independent System Operator (MISO) power regions, on average, will incur over half the U.S. total costs during the 2014-30 timeframe. The regional economic impact analysis confirms that the U.S. Census Divisions that depend on the South and MISO power regions (South Atlantic, East North Central, East South Central, West North Central, West South Central) will shoulder more of the economic consequences of compliance. However, it must be noted that the West (Non-California) power region will need to spend almost as much as MISO to achieve compliance. Within the Pacific Census Region, the blending of cost impacts from West (Non-California) and California (which requires lower additional compliance costs) results in overall lower numbers in the Policy Case.

Electricity expenditures

Consumers can be expected to pay much more for electricity during the 2014-2030 Policy Case analysis period. EPA CO_2 regulations will accelerate the already swift retirement of coal plants, currently underway because of the EPA's MATS rule and other regulations, combined with competition from natural gas. A visible byproduct of this shift will be higher electricity prices, as costs for compliance and system reconfiguration are passed through to consumers. Higher electricity prices ripple through the economy and reduce discretionary income, which affects consumer behavior, forcing them to delay or forego some purchases or lower their household savings rates.

Overall, the Policy Case will cause U.S. consumers to pay nearly $290 billion more for electricity between 2014 and 2030.

Table ES-2 shows the expected cumulative increases in retail electricity expenditures over three time periods and average annual increases in expenditures for different regions of the country. Overall, the Policy Case will cause U.S. consumers to pay nearly $290 billion more for electricity between 2014 and 2030, or an average of $17 billion more per year.

Table ES-2: Cumulative Changes in Electricity Expenditures, 2014-30
(Billions of Real 2012 Dollars)

Region	2014-2020	2014-2025	2014-2030	2014-2030 Annual Average Increase
West	4.9	17.5	46.9	2.8
California	0.6	1.3	2.2	0.1
RGGI	2.8	6.3	10.1	0.6
ERCOT	1.7	8.3	23.6	1.4
MISO	11.8	30.8	56.8	3.3
PJM	0.9	1.1	10.2	0.6
South	5.3	36.9	111.4	6.6
SPP	4.8	14.7	27.9	1.6
US	**32.8**	**117.0**	**289.1**	**17.0**

While consumers in all regions of the country will be paying more under the Policy Case, some areas will see larger increases than others, ranging anywhere from $2 billion to over $111 billion. Those regions that incur higher compliance costs will tend to see greater electricity expenditure increases and experience greater declines in real disposable income per household. Consumers in the South will pay much more on average annually ($6.6 billion) and in total ($111 billion) than any other area of the country. MISO ($57 billion) and the West ($47 billion) also show very large increases. Together, these three areas account for three-quarters of the U.S. total.

While the Policy Case has a very small impact in California, whose existing cap-and-trade program is included in the Reference Case, it and the Northeast are expected to continue to have the highest electricity prices in the continental U.S.

U.S. economy results and implications

The overarching objective of the economic impact analysis conducted for this study was to quantify the impacts, both on U.S. national and regional economies, of aiming for the Policy Case's reduction in power sector CO_2 emissions by 2030. These higher electricity prices will absorb more of the disposable income that households draw from to pay essential expenses such as mortgages, food and utilities. In turn, this will lead to moderately less discretionary spending and lower consumer savings rates.

In the Policy Case, GDP is expected to average about $51 billion lower than in the Reference Case to 2030, with a peak decline of nearly $104 billion in 2025.

More significant, however, are the opportunity costs associated with approaching the emissions reduction target by 2030. The $480 billion required to achieve compliance or replace prematurely one source of electricity generation with another represents an unproductive use of capital, meaning that the Policy Case's spending in pursuit of regulatory compliance rather than economic expansion will lead to an overall drop in U.S. economic output, relative to the Reference Case. The subsequent negative impacts on GDP and employment will exert additional downward pressure on disposable income and consumer spending.

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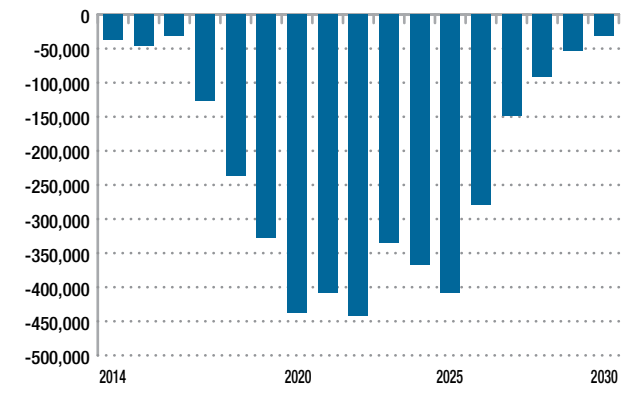
Table ES-3: Average annual impact, 2014–30

US Census Division	Potential real GDP (billions of dollars)	Employment (thousands)
New England	2.7	4.7
Middle Atlantic	7.5	13.7
South Atlantic	10.5	59.7
East North Central	7.4	31.7
East South Central	2.2	21.4
West North Central	3.2	27.4
West South Central	8.2	36.0
Mountain	5.0	26.5
Pacific	3.8	3.3
Overall US	$50.6	224.2

to 2030 (Table ES-3), with a peak decline of nearly $104 billion in 2025. These substantial GDP losses will be accompanied by losses in employment. On average, from 2014 to 2030, the U.S. economy will have 224,000 fewer jobs (Table ES-3), with a peak decline in employment of 442,000 jobs in 2022 (Figure ES-1). These job losses represent lost opportunities and income for hundreds of thousands of people that can never be recovered. Slower economic growth, job losses, and higher energy costs mean that annual real disposable household income will decline on an average of more than $200, with a peak loss of $367 in 2025. In fact, the typical household could lose a total of $3,400 in real disposable income during the modeled 2014-30 timeframe.

Figure ES-1: Employment Impact
Policy Case deviation from the baseline



Source: IHS Economics

The economic impact will vary significantly across the nine U.S. Census Divisions examined. Because California's cap and trade program and the Regional Greenhouse Gas Initiative (RGGI) that includes nine Northeastern States are included in the Reference Case, these regions are not significantly affected by federal CO_2 regulations. The cost of compliance for state-based regimes in these regions will already result in significant economic impacts, including high electricity prices, making the discussion about federal regulations less relevant. Despite California's lead in compliance, however, the remaining states will drag the Pacific region down moderately in the early years. The Northeast, on the other hand, will see little additional impact on its already high and increasing electricity rates from the imposition of a federal CO_2 regime.

The need to replace large portions of the coal generation fleet in the midcontinent Census Divisions (East North Central, East South Central, West North Central, and West South Central), however, means that these regions will experience the bulk of the economic distress in the early years, followed by the South Atlantic[4] in the latter years.

Overall, the South Atlantic will be hit the hardest in terms of GDP and employment declines. Its GDP losses make up about one-fifth of total U.S. GDP losses, with an average annual loss of $10.5 billion and a peak loss of nearly $22 billion in 2025. This region also will have an average of 60,000 fewer jobs over the 2014-30 forecast period, hitting a 171,000 job loss trough in 2022.

Overall, the South Atlantic will be hit the hardest in terms of GDP and employment declines. Its GDP losses make up about one-fifth of total U.S. GDP losses.

The West South Central[5] region also takes a big hit, losing on average $8.2 billion dollars in economic output each year and 36,000 jobs.

Cost per ton of reduced carbon

The economic cost to achieve each ton of emissions reduction also is extraordinarily high. This analysis indicates that the additional cuts in CO_2 emissions in the Policy Case come with an average price tag of $51 billion per year in lost GDP over the forecast

4 Includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

5 Includes Arkansas, Louisiana, Oklahoma, and Texas.

period, which translates into an average undiscounted economic cost of $143 per ton of CO_2 reduced. When EIA modeled the Waxman-Markey cap-and-trade bill, the economic cost per ton of CO_2 in its "Basic" scenario averaged an undiscounted $82 over the same period, still quite high but considerably less than the $143 figure arrived at under the Policy Case.

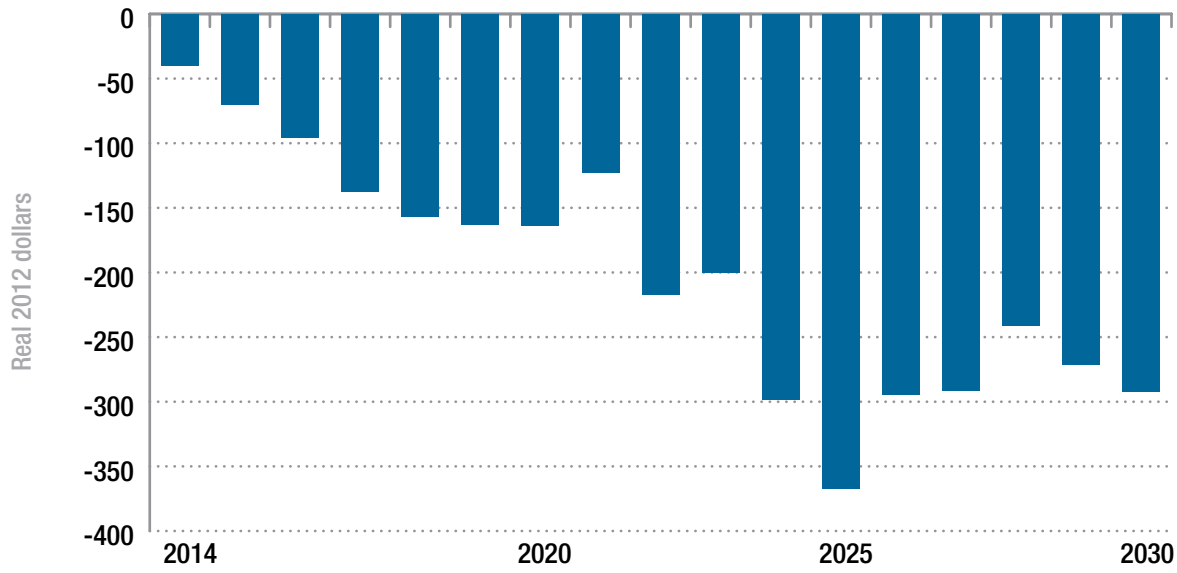
The economic cost for each ton of reduced CO_2 in the Policy Case also exceeds the upwardly revised social cost of carbon (SCC) estimates developed by the Administration's Interagency Working Group on Social Cost of Carbon in 2013. Based on the average SCC from three integrated assessment models at discount rates of 2.5%, 3%, and 5%, the Working Group estimated that by 2030, the SCC will have risen to between $17 and $82 per ton (in 2012 dollars). Applying the same range of discount rates, the average cost in the Policy Case ranges from $153 to $163 per ton over the analysis period, much higher than even the Working Group's 2030 figure.

Real disposable income per household

The impacts of higher energy costs, fewer jobs, and slower economic growth are seen in lower real disposable income per household (Figure ES-2). The Policy Case exhibits a sustained decline in real wages, especially from 2022 onward, and thus a long-term somewhat sustained lower standard of living for the U.S. population. The loss of annual real disposable income over the 2014-30 period will average over $200, with a peak loss of $367 in 2025. This translates into a shortfall in total disposable income for all U.S. households of $586 billion (in real 2012 dollars) over the 17 year period 2014–30.

This Energy Institute report provides clear evidence that, even with implementation features designed to keep compliance costs low, regulating CO_2 emissions at the thousands of existing fossil fuel-fired electricity generating plants in the United States under the CAA leads to nearly a half trillion dollars in total compliance expense, peak GDP losses over $100 billion, hundreds

Figure ES-2: Real Disposable Income per Household
Policy Case deviation from the baseline



Source: IHS Economics

of thousands of lost jobs, higher electricity costs for consumers and businesses, and more than $200 on average every year in lower disposable income for families already struggling with a weak economy.

Given the significant and sustained harm to the U.S economy coupled with the limited overall impact on worldwide greenhouse gas emissions that would result from implementing these regulations, serious questions must be raised and answered about the timing and scope of what EPA is pursuing.