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Employment Impacts of Clean Edge Act Proposals

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The “Clean Edge Act,” would dramatically increase public investment in clean and renewable energy technologies and create incentives for increased private spending in these areas. It would yield many important benefits for the economy including improvements in environmental quality, reductions in greenhouse gas emissions, reduced reliance on imported oil and improvements in the U.S. trade balance. This analysis estimates that spending resulting from this program would also generate approximately 531,000 jobs in the domestic economy when the program is fully implemented in 2009, as shown in Table 2.¹

Design and production of new technologies, equipment and products (such as bio-fuels) will increase the output of manufactured goods and employment in these industries in the U.S. Average wages in manufacturing industries are 12.5% higher than those in other (non-manufacturing) sectors of the economy. Many workers moving into Clean Edge-related jobs would be leaving jobs in other sectors of the economy which typically have lower pay and benefits than jobs in manufacturing. One of the most important benefits of the Clean Edge Act and other Apollo-type programs is that they would improve the wages and benefits received by hundreds of thousands of workers who move into these jobs. Other benefits include:

- The Clean Edge Act would generate jobs in every state and the District of Columbia. The leading job winners, in numeric terms are: California (54,000), Texas (38,000) and the industrial states of the Midwest and Northeast, including Michigan (29,000), New York (27,000), Pennsylvania (26,000), Illinois (26,000), Ohio (26,000) and Indiana (20,000), as well as Florida (23,000) (see **Table 4**).
- The 10 states where Clean Edge spending would have its biggest impact, as a share of total state employment, are Indiana (about 20,000 jobs, or 0.7% of total employment in 2004), Michigan (29,000 jobs, 0.7%), Wisconsin (17,000 jobs, 0.6%), South Carolina (11,000

¹ This estimate includes both direct jobs in the industry where spending takes place (e.g. purchase of hybrid vehicles) and “indirect” employment in the sectors which supply parts and materials to that sector. It does not include any “multiplier” effects and is thus a conservative estimate of the employment impacts of this legislation.

jobs, 0.6%), Missouri (14,000 jobs, 0.5%), New Hampshire (3,000 jobs, 0.5%), Ohio (26,000 jobs, 0.5%) and Arkansas (5,000 jobs, 0.5%), Vermont (1,400 jobs, 0.5%) and Kentucky (8,000 jobs, 0.5%) (see **Table 5**).

Investment, employment and the Clean Edge Act

The U.S. lost 3 million manufacturing jobs between 2000 and 2005. Growing U.S. trade deficits were responsible for a significant share of these job losses (Bivens 2006).² Likewise, the construction industry is threatened by a collapse in the housing sector in 2006 and 2007. Private building permits declined 20.8% in July 2006 from a year earlier and housing starts were off 7.7%. Increased public and private spending resulting from the passage of the Clean Edge Act would generate hundreds of thousands of jobs in the economy, and many of those jobs would be concentrated in the manufacturing and construction sectors of the economy, as shown below.

The proposed Clean Edge Act would support \$49 billion in spending in 2009, when it is fully implemented, as shown in **Table 1**. The estimates in Table 1 include both direct program spending and induced spending in the private sector for investments in new production capacity and purchases of renewable and alternative energy sources (Siu 2006).³ About half of projected spending resulting from implementation of the Act would be for wind energy investments, followed by Hybrid and Advanced Diesel (HAD) vehicles, biomass and solar with 9–11% each, and lesser amounts for other technologies and activities.

More than 90% of the spending would take place in the manufacturing and construction industries (industrial breakdown not shown). Spending under the program would ramp up quickly and would be sustained at high levels between 2007 and 2011, as shown in Table 1. This spending could help offset the projected decline in both of these sectors, as shown below. After

² Other significant causes of manufacturing job loss included rapid productivity growth and slow recovery of demand for manufactured goods after the 2001 recession.

³ This estimate assumes that the bulk of public spending authorized by the Clean Edge Act would take place in the first five years of the legislation. Thereafter spending (and employment) supported by the bill would drop sharply unless private spending on clean energy technologies and products increased rapidly, and/or public spending under the legislation was renewed.

2011, it is assumed that private spending on the technologies developed would continue, but at reduced levels.

It is estimated that Clean Edge Act spending would generate approximately 531,000 jobs in 2009, when the program is fully implemented, as shown in **Table 2**. Employment generated would remain at that level (that is, approximately 500,000 people would be continuously employed between 2007 and 2011) for the period of spending authorized under the Act. After that time, employment supported could decline, depending on the level of domestic spending induced after 2011 by the Act. The employment impacts of each program element are roughly proportional to projected spending, with 245,000 jobs generated by wind energy programs alone (nearly half of the total). Hybrid and Advanced Diesel projects, or HADs, would generate about 53,000 (10%) of the jobs generated, and lesser amounts would be generated by the remaining program elements.

The majority of jobs would be generated in manufacturing (251,000 jobs, 47.3% of the total) and construction (62,000, 11.7%) as shown in **Table 3**. Compensation in these sectors was approximately 12.5% and 7.5% higher, respectively, than in the rest of the economy in 2005.⁴ A number of indirect jobs would also be generated in high-income sectors such as information (38.5% higher compensation) and finance, insurance and real estate (25.3% higher), where a total of 22,000 jobs would be generated.⁵

The employment impacts of the spending outlined in Tables 2 and 3 (and Tables 4 and 5, below) were estimated using an employment requirements table prepared by the Bureau of Labor Statistics, as outlined in the methodology section below. This analysis estimated both the direct effects of spending by industry (e.g., the purchases of advanced diesel vehicles), and the indirect effects of spending on supplier industries (e.g., auto parts, steel and rubber).

⁴ Based on average hourly compensation in construction, manufacturing and the total economy (Mishel, Bernstein and Allegretto 2006, 167, Table 3.27). Average compensation in the rest of the economy was estimated using average weekly hours of production workers (BLS 2006, "Historical B Tables") to calculate total industry compensation in each sector, and then calculating average compensation in the rest of the economy as a residual (residual compensation/residual average weekly hours). It was assumed that average weekly hours in the total economy (including public sector workers) was equal to average weekly hours of production workers in the private sector (data on average weekly hours for non-production and public sector workers were not available). These estimates compare wages in each sector to those in the rest of the economy.

⁵ *Ibid.*

Job gains in every state

The Clean Edge Act would generate jobs in every state and the District of Columbia, as shown in **Table 4**, where states are ranked by the total number of jobs generated. States are ranked by job impact (jobs generated as a share of total state employment in 2004) in **Table 5**. About 54,000 jobs would be generated in California. Texas (38,000) and the industrial states of the Midwest and Northeast, including Michigan (29,000), New York (27,000), Pennsylvania (26,000), Illinois (26,000), Ohio (26,000) and Indiana (20,000), as well as Florida (23,000) would also see large gains.

The employment impacts of the Clean Edge Act, as a share of total employment, would be highest in the broad swath of industrial states running from New England to the Midwest and the South, regions hardest hit by the collapse of manufacturing jobs. The states that would benefit most heavily include Indiana (about 20,000 jobs, or 0.7% of total employment in 2004), Michigan (29,000 jobs, 0.7%), Wisconsin (17,000 jobs, 0.6%), South Carolina (11,000 jobs, 0.6%), Missouri (14,000 jobs, 0.5%), New Hampshire (3,000 jobs, 0.5%), Ohio (26,000 jobs, 0.5%) and Arkansas (5,000 jobs, 0.5%).

Conclusion

The Clean Edge Act would bring about a significant increase in the production of energy from renewable and alternative sources and the production of high-efficiency vehicles and other products. It would reduce the environmental impact of energy production and transportation in the U.S. It would also generate 531,000 jobs, most of them in sectors that would support good jobs with good benefits. The Clean Edge Act alone would generate enough jobs to replace 8% of the manufacturing jobs lost since 2000 in the U.S., and generate an additional 62,000 jobs to help offset the expected decline of the construction industry. It is a powerful example of the benefits to the economy from large scale commitments to the vision outlined in the Apollo energy program.

Methodology

This report estimates the direct and indirect effect of Clean Edge Act spending using an input-output based employment requirements table developed by the U.S. Bureau of Labor Statistics. This analysis was based on a detailed, industry-based study of the relationships between changes in spending and output and employment for each of 200 sectors of the U.S. economy. The North American Industry Classification System (NAICS) was initially used to classify the spending included in this study at the 4-digit NAICS level (SIU 2006). The BLS model uses a slightly different system of industries which consolidates some 4-digit NAICS sectors, while preserving industry detail for most manufacturing activities. The spending included in this analysis, as summarized in Table 1, includes both direct government expenditures and induced expenditures that the Act would generate in the private sector. For further details of the approach used in this analysis see Ratner (2006).⁶

Gross Versus Net Employment Effects

The estimates presented in Tables 2-5 are measures of the *gross* direct and indirect employment generated by the program. Whether or not the program would result in *net* new employment (i.e., create *more* jobs in the US economy rather than just pulling workers into Clean Edge supported jobs from other sectors) depends on a variety of factors, including: technological change and productivity growth, government spending and taxation, changes in the U.S. trade balance, and, most importantly, the Federal Reserve's monetary policies.

When the US economy is not at full employment⁷, the Clean Edge program would likely contribute to growth in total employment and reductions in the unemployment rate. In that case, some of the 531,000 jobs generated will go to people on the unemployment rolls or who have dropped out of the labor force. All of these newly employed workers will then be able to increase their spending, raising demand and employment economy-wide. These secondary impacts (or,

⁶ Ratner (2006) is an Appendix to the U.S. section of Faux, et al (2006), by Scott.

⁷ The Humphrey-Hawkins "Full Employment and Balanced Growth Act" of 1978 called for unemployment of all persons aged 16 and over to be reduced to 4%. <http://thomas.loc.gov/cgi-bin/bdquery/z?d095:SN00050:@@D&summ2=m&>

"multiplier effects") would further stimulate the economy and generate additional employment (though we do not incorporate these impacts in our analysis).

Full employment, defined as an unemployment rate of 4.0 percent or less of all persons in the labor force over age 16, has been an extremely rare occurrence over the last 35 years. Since 1970, unemployment was 4.5% or less in only 3 years (1998-2000), and reached 4.0 percent only in 2000.⁸ If the economy is not at full employment when the Clean Edge Act is implemented, the net employment effects would be substantial (Bureau of Labor Statistics 2006). Although (seasonally adjusted) unemployment has dipped below 5% during the past year, it could rise sharply if the economy slips into a recession, as a growing number of economists now expect (Delong, 2006). Nouriel Roubini (2006) places the odds of a recession in 2007 at 70%. There is room for significant employment expansion in today's economy.

The Clean Edge Act employment estimates reported in Tables 2-5 exclude these multiplier effects. As the Act would increase demand for manufactured goods and workers, and, as manufacturing jobs tend to pay higher wages, the multiplier effects could be substantial. Bivens (2003) has found that the "re-spending multipliers" in the manufacturing sector are generally 20-25 percent larger than the economy-wide average, due in large part to the higher wages paid in this sector. Further, the development of renewable and alternative energy sources and more efficient vehicles would generate many long run benefits for the economy in terms of increased production of renewable and alternative energy supplies, reduced energy consumption and improvements in the environment.

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⁸ The BLS reported unemployment rate also underestimates actual unemployment because it does not include workers who have dropped out of the labor force or are otherwise underemployed. Underemployment includes the unemployed and also discouraged workers, involuntary part-time workers and other marginally attached workers. The underemployment rate, which includes all these workers increased from 7.0% in 2000 to 8.4% in the first quarter of 2006 (Mishel, *et al* 2006 Table 4.6, p 230).

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Table 1
Clean Edge Act, Including Federal and Private Spending
 (billions of dollars)

	2007	2008	2009	2010	2011
Wind Energy	\$23.1	\$23.5	\$23.5	\$23.5	\$23.5
Solar Energy	4.9	4.6	4.6	4.6	4.6
Geothermal Energy	2.8	2.8	2.8	2.8	2.8
Biomass	4.1	4.2	4.2	4.2	4.2
Coal Gasification/ IGCC/ Advanced Coal	3.3	3.3	3.3	2.4	2.1
Flex Fuel Conversion Tax Credit	0.1	0.2	0.2	0.3	0.3
Renewable Refueling Stations	0.2	0.2	0.2	0.2	0.2
Transit Investments	2.3	2.3	2.3	2.3	2.3
Research into Energy and Advanced Vehicle Technologies	1.7	2.6	2.6	2.6	2.6
Hybrid and Advanced Diesel Investment Incentives (HAD)	1.9	3.7	5.6	5.6	5.6
Total Program Spending	\$44.2	\$47.2	\$49.2	\$48.3	\$48.1

Source: Sui 2006

Table 2
Employment impacts of proposed clean edge act
by program element

	jobs	percent
Wind Energy	244,654	46.1%
Solar Energy	43,711	8.2%
Geothermal Energy	33,993	6.4%
Biomass	47,693	9.0%
Coal Gasification/ IGCC/ Advanced Coal	37,497	7.1%
Flex Fuel Conversion Tax Credit	1,835	0.3%
Renewable Refueling Stations	2,194	0.4%
Transit Investments	36,963	7.0%
Research into Energy and Advanced Vehicle Technologies	29,134	5.5%
Hybrid and Advanced Diesel Investment Incentives (HAD)*	52,747	9.9%
Total Program Jobs	530,422	100.0%

Source: EPI analysis of Bureau of Labor Statistics data and Table 1

*The HAD employment impacts are job opportunities relative to a base case in which the U.S. would forego between "38,000 and 207,000 jobs" (or job opportunities) due to rising import market share and offshoring of U.S. auto production to Mexico, Canada and other countries (Hammet, Flynn, Sims and Luria 2004, 36).

Table 3
Employment impacts of proposed clean edge act
by major industry

	jobs	percent
Agriculture, Forestry, Fishing and Hunting	1,775	0.3%
Mining	2,437	0.5%
Utilities	1,820	0.3%
Construction	62,220	11.7%
Manufacturing	250,837	47.3%
Wholesale & Retail Trade, Transport & Warehousing	72,635	13.7%
Information, Finance Insurance and Real Estate	21,869	4.1%
Professional, Scientific, and Technical Services	40,680	7.7%
Management and Administration	41,434	7.8%
Other services	19,749	3.7%
Government	14,965	2.8%
Total	530,422	100.0%

Source: EPI analysis of Bureau of Labor Statistics data and Table 1

Table 4
Employment impacts of proposed clean edge act
by state (alphabetical)

California	53,679
Texas	37,518
Michigan	29,204
New York	27,118
Pennsylvania	25,933
Illinois	25,823
Ohio	25,577
Florida	23,036
Indiana	19,683
North Carolina	17,435
Georgia	16,971
Wisconsin	16,565
Missouri	13,761
Virginia	13,409
New Jersey	13,197
Massachusetts	13,059
Tennessee	11,952
South Carolina	10,691
Minnesota	10,366
Kentucky	8,271
Arizona	8,160
Washington	8,081
Alabama	7,802
Colorado	7,496
Maryland	7,252
Oregon	6,739
Connecticut	6,281
Louisiana	5,662
Iowa	5,624
Arkansas	5,444
Oklahoma	5,332
Kansas	5,310
Utah	4,039
Mississippi	3,947
Nevada	3,325
West Virginia	3,071
New Hampshire	3,067
Nebraska	2,765
New Mexico	2,232
Rhode Island	1,957
Idaho	1,949
Maine	1,865
South Dakota	1,551
Vermont	1,410
Delaware	1,257
Hawaii	1,180
Montana	1,139
North Dakota	851
Wyoming	830
Alaska	805
District of Columbia	685

Source: EPI analysis of Bureau of Labor Statistics data and Table 1

*Total differ from Table 3 due to rounding errors

Table 5
Employment impacts of proposed clean edge act
by number of jobs supported

	jobs	share of total employment in 2004
Indiana	19,683	0.7%
Michigan	29,204	0.7%
Wisconsin	16,565	0.6%
South Carolina	10,691	0.6%
Missouri	13,761	0.5%
New Hampshire	3,067	0.5%
Ohio	25,577	0.5%
Arkansas	5,444	0.5%
Vermont	1,410	0.5%
Kentucky	8,271	0.5%
Pennsylvania	25,933	0.5%
North Carolina	17,435	0.5%
Illinois	25,823	0.4%
Tennessee	11,952	0.4%
Georgia	16,971	0.4%
Oregon	6,739	0.4%
West Virginia	3,071	0.4%
Massachusetts	13,059	0.4%
Alabama	7,802	0.4%
South Dakota	1,551	0.4%
Kansas	5,310	0.4%
Rhode Island	1,957	0.4%
Texas	37,518	0.4%
Minnesota	10,366	0.4%
Iowa	5,624	0.4%
Connecticut	6,281	0.4%
Virginia	13,409	0.4%
California	53,679	0.4%
Utah	4,039	0.4%
Oklahoma	5,332	0.4%
Mississippi	3,947	0.4%
Colorado	7,496	0.3%
Arizona	8,160	0.3%
Idaho	1,949	0.3%
New Jersey	13,197	0.3%
Wyoming	830	0.3%
New York	27,118	0.3%
Florida	23,036	0.3%
Maine	1,865	0.3%
Nebraska	2,765	0.3%
Washington	8,081	0.3%
Delaware	1,257	0.3%
Louisiana	5,662	0.3%
Nevada	3,325	0.3%
Maryland	7,252	0.3%
New Mexico	2,232	0.3%
Montana	1,139	0.3%
Alaska	805	0.3%
North Dakota	851	0.3%
Hawaii	1,180	0.2%
District of Columbia	685	0.1%

Source: EPI analysis of Bureau of Labor Statistics data and Table 1

*Total differ from Table 3 due to rounding errors