PNNL-13182

Impact of 2001 Building Technology, State and Community Programs on United States Employment and Wage Income

M. J. Scott
D. J. Hostick
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March 2000

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

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Abstract

The Department of Energy Office of Building Technology, State and Community Programs (BTS) is interested in assessing the potential economic impacts of its portfolio of programs on national employment and income. A special purpose version of the IMPLAN input-output model called ImBuild is used in this study of all 38 BTS programs included in the FY2001 federal budget. Energy savings, investments, and impacts on U.S. national employment and wage income are reported by program for selected years to the year 2030. Energy savings from these programs have the potential of creating a total of nearly 332,000 jobs and about $5.3 billion in wage income (1999$) by the year 2030. Because the required investments to achieve these savings are capital intensive, the net effect after investment is 304,000 jobs and $5.0 billion.

Summary

As part of measuring the impact of government programs for improving the energy efficiency of the nation's building stock, the Department of Energy Office of Building Technology, State and Community Programs (BTS) is interested in assessing the economic impacts of its portfolio of programs. Specifically, BTS wants to know the potential impact on national employment and income. This assessment was made for the first time in FY1999 as a supplement to the Government Performance and Results Act (GPRA—formerly, Quality Metrics). This act provides estimates of primary energy savings, environmental aid, and direct financial benefits of the BTS programs. This current analysis performs this assessment on the FY2001 budget request from BTS.

The programmatic needs of BTS suggest that a simple, flexible, user-friendly method is needed to derive the national employment and income impacts of individual BTS programs. Therefore, BTS funded Pacific Northwest National Laboratory (PNNL) to develop a special-purpose version of the IMpact Analysis for PLANning (IMPLAN) national input-output model (Minnesota IMPLAN Group, Inc. 1997) specifically to estimate the employment and income effects of building energy technologies. IMPLAN was developed originally by the U.S. Forest Service, in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management, to assist the Forest Service in land and resource management planning. Since 1979, IMPLAN has been used by a wide variety of government and private agencies to assess economic impacts. The special-purpose version of the IMPLAN model used in this study is called ImBuild. Extensive documentation and a user's guide are provided in Scott et al. (1998). Compared with simple economic multiplier approaches, such as the published multipliers from the Department of Commerce Regional Input-Output Modeling System (RIMS II), ImBuild allows for more complete and automated analysis on the economic impacts of energy efficiency investments in buildings. ImBuild is also easier to use than the existing macroeconomic simulation models. In this report, the ImBuild model calculates the impact of all 38 BTS programs reported, based on the Office of Management and Budget "Passback Budget" dated 12/15/99 and provided to BTS for inclusion in the revised budget.[a]

BTS programs affect the economy through three primary mechanisms. First, if the incremental capital costs of the new technology per installed unit are different from those of the conventional technology, the level of purchases will change in the sectors involved in manufacturing, distribution, and installation for both technologies, changing the level of overall economic activity. Second, the efficiency investment may crowd out other domestic savings, investments, and consumer spending, offsetting some positive impact on the economy caused by the new efficiency investment. Third, energy and non-energy expenditures are reduced. On the one hand, this saving reduces final sales in the electric and gas utility sectors, as well as in the trade and services sectors that provide related maintenance, parts, and services.

(a) Investment costs (in 1995 dollars in the original document) and energy savings (in 1995 dollars) were updated to 1999 dollars for this report.

But, on the other hand, it increases net disposable income of households and businesses and increases general consumer and business spending in all sectors (including some increases in expenditures for electric and gas utility services and for retail trade and services).

Energy efficient technology is expected to have a measurable effect on the activity level of the U.S. economy. BTS programs are characterized by significant investment requirements and delivered energy cost savings, as shown in Table S.1 and Figure S.1.[(a)]

Figure S.1 and Table S.1 show the expected energy savings to be created by market penetration of the BTS programs will have the potential of creating nearly 332,000 jobs and about $5.3 billion in wage income (1999$) by the year 2030. However, not all of the gains would be immediately apparent because intensive investment in new energy technology and new building practices would be required during the first 30 years of the 21st century. These effects are incorporated in the full investment scenario shown in the lower half of Table S.1. For the most part, this incremental investment in energy technology, contrary to its popular image, is likely to be more capital-intensive than the average consumption and investment in the economy. This difference is because most of the increment to investment occurs in capital-intensive manufacturing processes. We assume that capital required to make the energy efficiency investments is diverted proportionately from all competing uses for money in the economy. Because a large proportion of this money is personal and business consumption of labor-intensive goods and services (such as groceries, clothing, travel services, and legal services), the investments reduce the employment level in the short run.

Only when the energy benefits of cumulative efficiency investments have grown large, relative to the costs of current investment, would the full impacts on employment and income become visible. Thus, in the full investment scenario, as the energy technologies and practices associated with the 38 BTS programs penetrate the U.S. marketplace over the next 30 years, the required capital investments are significant, increasing over most of the period to reach about $10.7 billion *per year* in 2020. These required investments divert national spending into capital-intensive sectors and initially reduce employment below what it otherwise be. However, the energy savings associated with these same investments are true economic savings that provide new economic opportunities, generate ever-increasing numbers of jobs and higher income, and eventually become the dominant economic result of the BTS programs.

About half of the jobs and net wage income benefits of the 3 BTS programs come from only 5 of the programs: Training and Assistance for (Energy) Codes, Advanced Lighting (Two Photon Source), Building Energy R&D on Roofs and Insulation and on Windows, and Technology Roadmaps and Competitive R&D. These five programs are large-scale, cost-effective programs that are expected to produce extensive energy savings, relative to the investments required. By the year 2030, each of these programs, if it makes its goals, will produce net annual savings to the U.S. economy (*after investment costs*) of more than $1.8 billion per year (almost $13 billion together) and 153,000 net total jobs (after

(a) In this analysis, program information was used from PNNL (2000) that it prepared with DOE/EE program managers. Delivered energy is used to calculate potential savings resulting from reduced demand for electrical generating capacity and natural gas pipeline capacity. See Scott et al. (1998).

Table S.1. Impact of 38 BTS Programs on the U.S. Economy

	Incremental Capital Cost (million 1999 $)	Delivered Energy Saved (10^12 Btu)	Potential Jobs Created (thousand)	Impact on National Wage Income (million 1999 $)
Impact of Energy Savings Alone				
2001	0	40	12	$224
2002	0	80	11	181
2003	0	128	18	314
2004	0	196	30	483
2005	0	273	42	685
2010	0	730	117	1,934
2015	0	1,221	196	3,239
2020	0	1,518	245	3,973
2025	0	1,837	291	4,676
2030	0	2,182	332	5,285
Impact of Full Investment Scenario				
2001	$3,593	40	-13	-$40
2002	3,321	80	0	51
2003	4,233	128	3	134
2004	4,859	196	12	283
2005	5,328	273	23	464
2010	8,613	730	85	1,615
2015	10,506	1,221	154	2,867
2020	10,727	1,518	201	3,590
2025	7,939	1,837	260	4,364
2030	7,075	2,182	304	4,989

investment effects). However, these are the predicted outcomes of mostly research and development programs whose benefits mainly are expected after the year 2010. If the individual projects within the Energy Star Program and the Lighting and Appliances Standards Program are grouped together as single programs, they each account for net savings impacts of $1.7 billion and $2.7 billion, respectively, and a combined positive impact of 59,000 net total jobs. The impacts of most of the other BTS programs are on a much smaller scale. Overall, the impact would be a small but significant boost to the U.S. economy that would continue to grow after 2030.

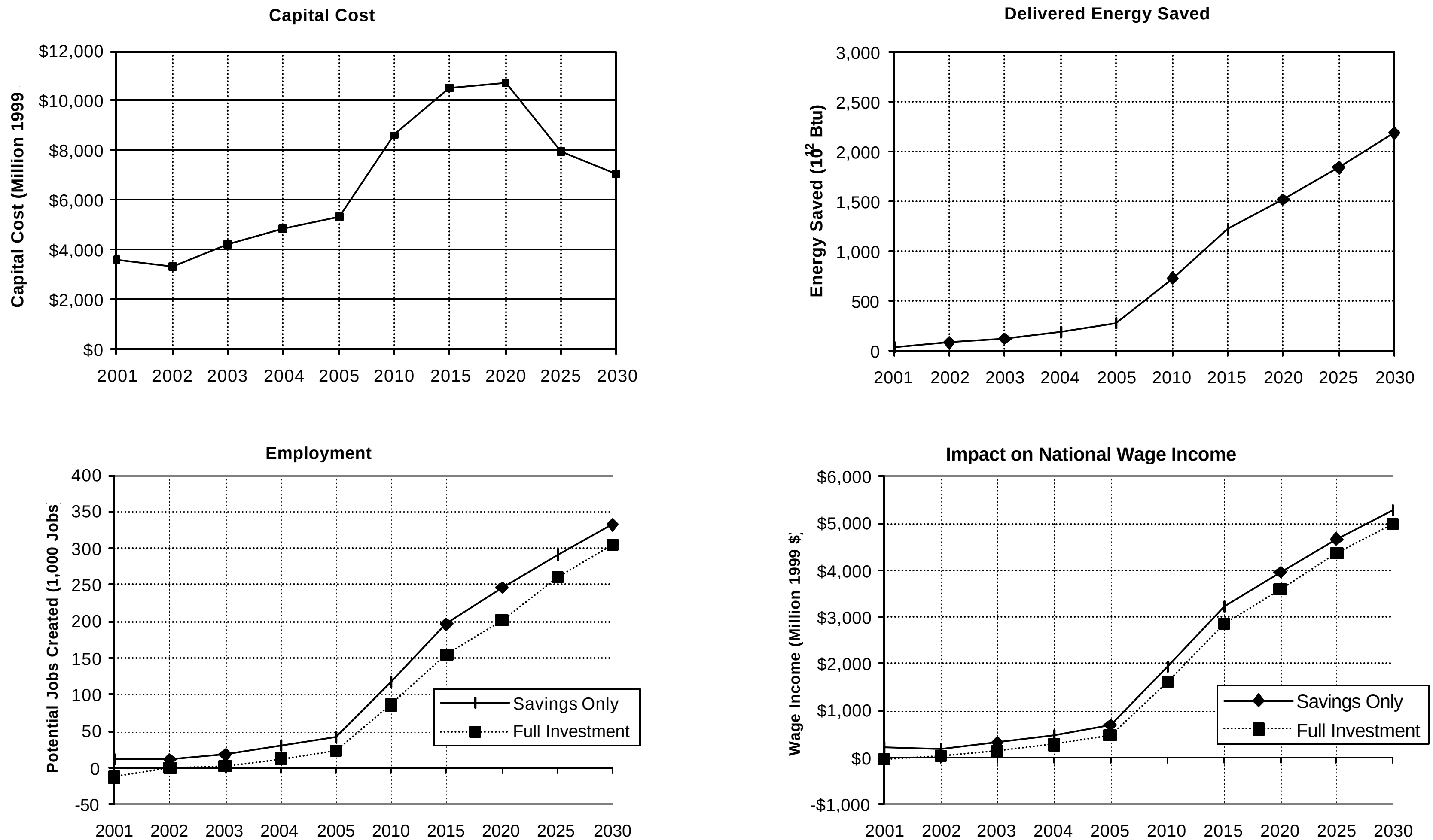

Figure S.1. Impact of 38 BTS Programs on the U.S. Economy

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Acronyms

AC	air conditioning
BTS	Office of Building Technology, State and Community Programs (DOE)
CFL	compact fluorescent lamp
DOE-EE	Department of Energy—Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
FY	fiscal year
GAX	generator-absorber heat exchange
GDP	Gross Domestic Product
GPRA	Government Performance and Results Act (formerly, Quality Metrics)
ImBuild	Specific purpose version of IMPLAN (PNNL)
IMPLAN	Impact Analysis for Planning
LPSL	low power sulfur lamp
PATH	Partnership for Advancing Technology in Housing
PNNL	Pacific Northwest National Laboratory
R&D	Research and Development
RIMS II	Regional Input-Output Modeling System
SIC	Standard Industrial Classification

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1.0 Methods

1.1 Introduction

When measuring the impact of government programs on improving the energy efficiency of the nation's building stock, the Department of Energy Office of Building Technology, State and Community Programs (BTS) is interested in assessing the economic impacts of these programs, specifically their impact on national employment and wage income. As a consequence, BTS funded Pacific Northwest National Laboratory to develop a simple method that could be used in-house to estimate the economic impacts of individual programs.

Three fundamental methods are available to estimate employment and wage income impacts for selected energy efficiency improvements in the U.S. economy: multipliers, input-output models, and macroeconomic simulation models. PNNL staff reviewed the BTS programmatic needs and available methods. Based on this assessment and on realistic resource constraints, PNNL designed and developed a special-purpose version of the IMPLAN national input-output model, specifically to estimate the employment and income effects of building energy technologies. This model is called Impact of Building Energy Efficiency Programs (ImBuild). Scott et al. (1998) discuss the methods, structure of the ImBuild model, its testing, and performance. For a detailed discussion of the methodology used in this study, refer to the ImBuild report.

In comparison with simple multipliers, ImBuild allows for more complete and automated analysis on the essential features of energy efficiency investments in buildings. ImBuild is also easier to use than extant macroeconomic simulation models. It does not include the ability to model certain dynamic features of labor markets and other factors of production featured in these more complex models, but for most purposes these excluded features are not critical. Such impacts can be managed well by an input-output model. The analysis should be credible, as long as the assumption can be made that relative prices in the economy would not be affected substantially by energy efficiency investments. The expected scale of these investments is small enough, in most cases, that neither labor markets nor production cost relationships will seriously affect national prices as the investments are made. The exact timing of impacts on gross product, employment, and national wage income from energy efficiency investments is not sufficiently understood that much special insight can be gained from the additional sophistication of a macroeconomic simulation model. Thus, ImBuild is a cost-effective compromise.

1.2 Calculation of Impact Using ImBuild

As cost-effective, energy-efficient technologies penetrate the marketplace, BTS programs will affect national employment and wage income. To analyze these effects, the ImBuild model requires certain information about BTS programs:

- size of the incremental investment in the technology over time, compared with the conventional technology it replaces

- corresponding fuel energy savings in physical and monetary terms that may include additional use of some fuels when one type replaces another

- non-energy operations savings (if any) in comparison with the current technology (Figure 1.1).

ImBuild calculates changes in the use of energy, labor, and materials due to incremental investments and economic savings associated with BTS-supported technologies (shown as Technology "A" in Figure 1.1). As the figure illustrates, new investments in these technologies affect the level of employment and wage income in the economy by multiple pathways. First, the procurement of equipment and installation services creates jobs and income in some industries, while diverting funds that otherwise would have been spent for different goods and services by businesses and consumers. At the same time, the investment in energy-efficient technologies or practices may make other investments in energy supply technologies (for example, power plants) unnecessary, thus directly and indirectly affecting jobs and income.

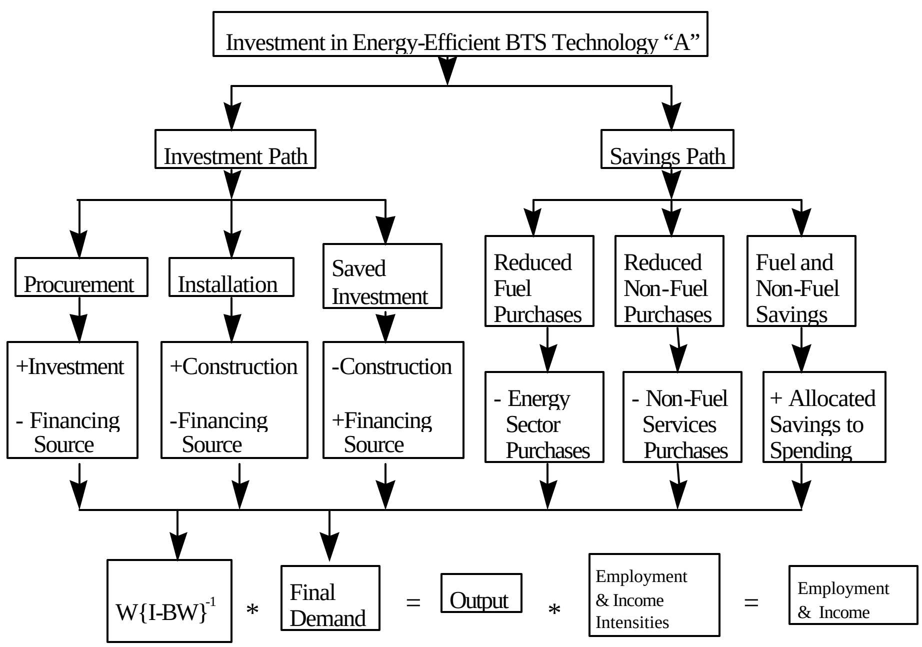

Figure 1.1. Detailed Calculations of the ImBuild Model

The issue is discussed in more detail in Scott et al. (1998).[a] For this report, we assumed that financing for the energy-efficient investments is drawn proportionately from the rest of the U.S. economy.[b] Figure 1.1 also shows that an investment in energy-efficient technology reduces the amount of energy needed. Reducing energy consumption reduces energy purchases (that in turn reduces employment and income in the energy-supplying sectors) and produces dollar savings that can be spent on any goods or services, including energy (which creates employment and income). In addition, some energy efficiency investments may save the purchaser other costs, such as maintenance services, and these savings also have impacts.

All of these pathways in Figure 1.1 either affect the inter-industry intermediate procurement (the matrix $W\{I-BW\}^{-1}$ in Figure 1.1) or the final demand (the set of goods and services in the economy purchased for final consumption or new investment, as distinguished from those purchased merely as intermediate inputs to current production). In residential applications, the necessary model calculations are relatively straightforward, because residential savings are assumed to be entirely recycled into personal consumption and investment (that is, final demand). For commercial building applications, the process is more complicated because the inter-industry relationships between specific sectors are affected, not only final demand. For savings in the commercial sector, the inter-industry portion of the input-output table is automatically recomputed; then the model is run with the recomputed table. Because the energy and maintenance intensity of the commercial sector changes, the coefficients of the input-output structure are automatically recalculated at each time step. The model computes the financial impacts of energy and non-energy cost savings (for example, savings in building maintenance). These savings are treated as free income, available to be saved or invested by the sector collecting the income.

A brief hypothetical example from Scott et al. (1998) illustrates the concepts and functioning of the ImBuild model. It is assumed that consumers spend a premium of $100 million on more-efficient residential heating and air conditioning equipment in the year 2000. Each year thereafter the premium saves them $15 million of electricity, $30 million in natural gas, and $5 million in building maintenance expenditures, for annual savings of $50 million. This $50 million yields a simple payback period of 2 years. The first two cases in Figure 1.2 show the employment effects of the $50 million saving alone. In the first case, the saving is confined to the residential sector. The second case shows how the impacts would change if these energy savings had instead been experienced in the commercial sector, where the savings are initially experienced as an increase in the profitability of those businesses saving the energy.

(a) For this report, electric power plant construction savings were estimated at about $590/kW of delivered electric energy, based on data in EIA (1997). The equivalent value for natural gas, about $1.20/cubic foot/day capacity, based on EIA (1996), was not used because much pipeline capacity is being resold or turned back. Most of the new capacity is oriented toward new sources of supply, not delivery problems. See Tobin (1997) and EIA (1996).

(b) It is assumed that personal (household) consumption represents 70 percent of spending; gross private fixed investment, 10 percent; federal defense spending 2 percent; federal non-defense spending, 6 percent; and state and local government spending, about 12 percent. These percentages are close to the actual distribution of final demand among these sectors in the U.S. economy.

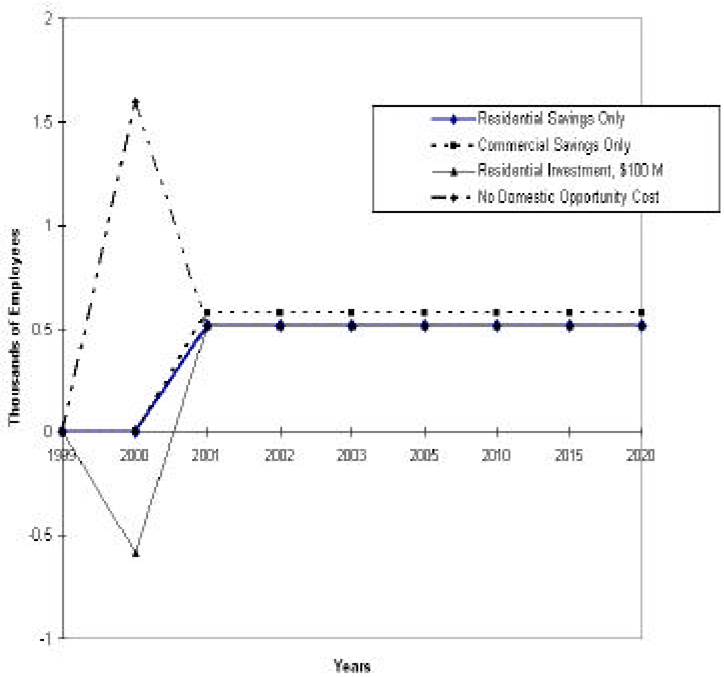

Figure 1.2. Impact on National Employment of a Hypothetical Once-Only $100 Million Investment in Appliance Efficiency

These profits are assumed to be recycled in the economy as spending by workers, by the firms themselves, and by governments experiencing increases in tax collections. In the first case, the energy savings in the residential sector of $50 million have a net impact of about 520 jobs in the U.S. economy, or about 1.1 additional jobs per $100 thousand dollars of direct energy savings. The impact is somewhat greater if the energy savings occur in the commercial sector (570 jobs). The impact is greater because the employment intensity of the spending mix of businesses, their workers, and government associated with commercial savings is slightly different from the spending intensity of the household sector alone that is associated with residential savings. Next, Figure 1.2 adds a third and fourth case to show the employment impacts of the $100 million investment itself. The third case shows the impact of the investment premium. In this case, even though investment in the technology itself generates employment, in the short run, net employment impact is negative (minus 580 jobs). The opportunity cost of the investment premium is the amount the investment would have produced elsewhere in the U.S. economy, which on average is more labor-intensive than the manufacturing sector that produces the new technology.[a]

Typically, efficiency programs are thought to be relatively labor-intensive, but this is not always the case. Heating and air conditioning equipment manufacture, for example, is quite capital-intensive. The strength and direction of the investment effect depends on the size of the investment premium and its

(a) Strictly speaking, the labor intensity that counts is the employment, direct and indirect, that is created by each dollar of spending. Thus, it is possible theoretically for a capital-intensive industry to buy large amounts of labor-intensive inputs from other industries and to have the total effect be labor intensive as a result.

combined domestic U.S. direct and indirect labor intensity, relative to that of other domestic spending (the opportunity cost of the investment). For the employment impact of the investment to be positive, the sectors supplying the new technology must on average create more domestic jobs per dollar of spending than does other domestic spending. An extreme form of this positive investment effect would occur if the investment were financed internationally (that is, if no domestic spending opportunities were lost). This is the fourth case in Figure 1.2 that shows a short-run job impact of 1600 and a long-run job impact of 520.

The energy and non-energy savings from installation of efficient technology do not affect employment in the national economy until reinvested or spent. For purposes of this report, any increments to the economic value-added as a result of the investment (that is, the energy and non-energy savings) are assumed allocated to the compensation of labor, capital, and business taxes in the same proportions as all other value-added[a] in that sector. The income of each sector then is assumed as existing compensation of labor, capital, and government. That is, if a given sector captures 1 percent of all personal consumption expenditures in the economy and a 0.7 percent share of all business fixed investment, it will receive these same percentage shares of the efficiency-related increase in spending. Similarly, if labor compensation represents 70 percent of the baseline total value added in an industry, it will receive 70 percent of any energy savings in that industry. Finally, labor compensation, business profits, and taxes are allocated to consumption, investment, and government spending, according to current proportions.

ImBuild accumulates the energy and non-energy savings in the residential buildings sector and the changes in economic value-added associated with energy and non-energy savings within the commercial buildings sector. The program then calculates spending impacts associated with these savings by proportionately increasing final demand across all sectors, as noted previously, while at the same time reducing final demand in the sectors supplying the resources that are saved. This step accounts for the spending associated with the monetary savings and improvements in technological efficiency and for the associated shift from energy to non-energy spending. It also accounts for changes in the patterns of activity in the economy due to technological change caused by the BTS programs (that is, less electricity is used per dollar of output in retailing because of more efficient lighting).[b]

ImBuild collects the estimates of the initial investments, energy and non-energy savings, and economic activity associated with spending of the savings (increases in final demand in personal consumption, business investment, and government spending). It then provides overall estimates of the

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(a) Economic value-added is the value of output of the sector, less the cost of purchased materials and services. The sum of value-added in all sectors is Gross Domestic Product (GDP).

(b) ImBuild does not account for all of the long-term run impacts of the technological change. The change in energy-using capital in the commercial sector would alter the marginal value of all of the factors of production (including labor and capital) and would induce a rearrangement of capital and labor that would ultimately result in an increase in output and in final demand. Part of this effect, the initial spending associated with the savings, is shown but not the effect of increased capital stock created by the investment portion of the spending. Most economic models, including many dynamic simulation models, do not completely reflect the effect of capital accumulation and growth in capacity on final output and employment.

increase in national output for each economic sector, using the adjusted input-output matrix. Finally, the model applies estimates of employment and wage income per dollar of economic output for each sector and calculates impacts on national employment and wage income.

2.0 Analysis

2.1 BTS Programs

Table 2.1 shows the level of incremental investments and net energy savings in the FY 2001, 2010, 2020, and 2030 for the BTS programs that were evaluated as a supplement to the FY 2001 Government Performance and Results Act (GPRA) Metrics Program for the DOE Office of Energy Efficiency and Renewable Energy (DOE/EE).[a] It is important to note the values in Table 2.1 represent levels of current investment and energy and non-energy savings in the year shown, because current investment and current energy and non-energy savings that determine the impact on employment and wage income. Reported in this way, the values in Table 2.1 cannot be used to determine a rate of return on any particular investment. The reason this is true is because an investment in a given year provides a stream of savings over several years, but the energy savings experienced in any particular year are a function of the cumulative previous investment in energy efficiency. The investment and energy savings levels in a given year affect the level of GDP in that year that, in turn, affects the level of employment and personal income. Although the BTS programs differ from each other in size and timing, for the most part the annual investment exceeds the annual savings early in the period, and savings tend to dominate later on.

The differences in investment reflect the differences identified by the GPRA Program:

1. Differences in the size of the potential market opportunity or market niche for each program

2. Differences in the expected rate of market penetration into each niche

3. Differences concerning the incremental cost of the new technologies and practices penetrating the market compared to the more conventional technologies or practices they replace.

By FY2030, about 46 percent of the total energy savings will occur in programs like Advanced Light Sources or Training and Assistance for Codes that are not projected to require any incremental investment beyond standard construction practice. Current savings do not necessarily correlate well with current investments. Some technologies and practices are expected to be extremely cost-effective and require relatively little incremental investment; others require relatively more incremental investment or may be less cost-effective. Savings are also sensitive to timing. For example, some programs like Cogeneration Fuel Cells or the generator-absorber heat exchange (GAX) Heat Pump are expected to remain in the midst of their intensive investment phase in FY2030. Others, like Rebuild America, are completed earlier and are enjoying all of their savings by that date. For BTS program details, refer to PNNL (2000).

(a) The GPRA FY2001 estimates for investments and energy savings were used, adjusted to 1999 dollars. More detail is provided in the attachment to this report.

Table 2.1. Levels of Investment Cost and Savings from BTS Programs in FY 2001, 2010, 2020, and 2030

Projcode	Description	Fiscal Year				
		2001	2005	2010	2020	2030
115	Residential Buildings Research and Development					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.8	$24.5	$153.6	$822.3	$1,539.8
124	Commercial Buildings Research and Development					
	Investment	$0.0	$7.9	$70.9	$3.9	$7.9
	Savings	$0.0	$19.3	$144.2	$390.8	$365.1
145	Analysis Tools and Design Strategies					
	Investment	$261.7	$609.6	$399.5	$153.7	$161.2
	Savings	$19.6	$144.2	$351.6	$422.3	$456.6
311	Space Conditioning R&D: GAX Heat Pump					
	Investment	$0.8	$311.8	$335.3	$600.2	$816.7
	Savings	$0.3	$72.2	$151.8	$268.1	$368.4
312	Space Conditioning R&D: Hi-Cool Heat Pump					
	Investment	$3.9	$194.3	$210.2	$353.1	$584.8
	Savings	$2.2	$45.6	$103.2	$180.2	$245.1
333	Space Conditioning R&D: Refrigeration					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$12.1	$93.0	$254.9	$425.1	$428.1
352	Cogeneration/Fuel Cells					
	Investment	$0.0	$0.0	$1,554.3	$5,336.3	$1,385.1
	Savings	$0.0	$0.0	$139.5	$1,027.2	$1,264.4
361	Space Conditioning R&D: Desiccants					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$17.5	$83.3	$137.2	$165.5
371	Technology Roadmaps and Competitive R&D					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$76.7	$377.8	$736.7	$1,364.8	$1,887.1
381	Appliances and Emerging Technologies R&D					
	Investment	$0.0	$17.4	$20.3	$23.1	$16.1
	Savings	$0.0	$19.9	$40.6	$70.4	$101.4
411	Adv. Light Sources, Electronics, and New Concepts (LPSL)					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$13.3	$72.8	$168.6	$235.9
412	Adv. Light Sources (Two-Photon Phosphors)					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$0.0	$90.9	$1,035.8	$2,108.8
422	Energy Star	See Detail in 4221-4228				
506	Residential Building Codes					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$0.0	$3.8	$34.9	$77.9
507	Commercial Building Codes					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$1.1	$43.2	$194.3	$910.8	$1,727.5
603	Lighting and Appliance Standards	See Detail in 6032-6039				

Table 2.1. (contd)

Projcode	Description	Fiscal Year 2001	2005	2010	2020	2030
901	Weatherization Assistance					
	Investment	$316.2	$338.1	$338.1	$338.1	$338.1
	Savings	$46.5	$239.8	$470.3	$672.4	$645.9
903	State Formula Grants					
	Investment	$168.1	$168.1	$168.1	$168.1	$212.8
	Savings	$40.6	$203.0	$398.0	$747.9	$1,101.8
1332	Rebuild America					
	Investment	$899.4	$1,102.5	$1,218.6	$43.5	$58.0
	Savings	$52.8	$292.5	$594.0	$581.5	$447.7
1335	Energy Smart Schools					
	Investment	$797.9	$319.2	$297.9	$0.0	$0.0
	Savings	$48.0	$116.9	$187.0	$148.8	$82.8
1336	Information Outreach					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$1.0	$5.2	$10.3	$20.7	$29.4
1337	Competitively-Selected Community Projects					
	Investment	$15.7	$15.7	$15.7	$15.7	$15.7
	Savings	$3.6	$17.7	$34.5	$64.9	$90.6
1338	Training and Assistance for Codes					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$18.1	$239.0	$903.7	$2,741.1	$4,507.9
1339	Partnership for Advancing Technology in Housing (PATH)					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$22.3	$183.4	$616.8	$1,267.6	$1,170.5
2111	Bldg. Envelope R&D: Windows					
	Investment	$20.2	$140.4	$514.9	$1,255.3	$1,444.7
	Savings	$5.6	$66.7	$357.8	$1,964.1	$3,838.7
2112	Bldg. Envelope R&D: Roofs and Insulation					
	Investment	$0.0	$552.1	$1,538.3	$793.6	$417.0
	Savings	$0.0	$196.5	$860.1	$2,268.4	$2,432.3
4221	Energy Star: Clothes Washers					
	Investment	$286.7	$188.7	$202.0	$254.5	$275.5
	Savings	$23.7	$78.1	$161.9	$253.5	$345.3
4222	Energy Star: Dishwashers					
	Investment	$116.0	$147.0	$157.0	$134.0	$150.1
	Savings	$6.3	$20.4	$40.9	$56.7	$74.4
4223	Energy Star: Refrigerators					
	Investment	$516.6	$210.8	$227.5	$236.2	$243.6
	Savings	$45.7	$80.9	$150.0	$152.2	$144.5
4224	Energy Star: Room Air Conditioners					
	Investment	$57.0	$45.9	$50.5	$87.8	$44.7
	Savings	$9.7	$24.6	$39.7	$35.3	$33.2
4226	Energy Star: Electric Water Heaters					
	Investment	$90.5	$203.1	$241.5	$205.0	$147.3
	Savings	$25.6	$223.4	$453.0	$695.0	$921.3

Table 2.1. (contd)

Projcode	Description	Fiscal Year 2001	2005	2010	2020	2030
4227	Energy Star: Windows					
	Investment	$27.5	$51.0	$155.1	$222.8	$211.0
	Savings	$3.9	$29.7	$132.7	$413.8	$676.2
4228	Energy Star: CFLs					
	Investment	$14.5	$55.8	$169.4	$151.7	$145.6
	Savings	$97.7	$361.1	$1,071.9	$935.4	$796.7
6032	Lighting and Appliance Standards: Commercial AC					
	Investment	$0.0	$0.3	$0.3	$0.3	$0.2
	Savings	$0.0	$77.9	$210.4	$313.4	$368.2
6033	Lighting and Appliance Standards: Gas Water Heaters					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$34.8	$60.9	$83.2	$93.4
6034	Lighting and Appliance Standards: Oil Water Heaters					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$4.9	$9.5	$14.6	$18.9
6035	Lighting and Appliance Standards: Central Air Conditioners					
	Investment	$0.0	$647.5	$727.0	$349.8	$398.6
	Savings	$9.0	$388.6	$1,124.3	$1,645.6	$1,851.9
6036	Lighting and Appliance Standards: Gas Furnaces					
	Investment	$0.0	$0.1	$0.2	$0.2	$0.2
	Savings	$0.0	$38.9	$123.7	$222.4	$280.9
6037	Lighting and Appliance Standards: Oil Furnaces					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.2	$4.8	$7.4	$7.9	$8.6
6039	Lighting and Appliance Standards: Distribution Transformers					
	Investment	$0.0	$0.0	$0.0	$0.0	$0.0
	Savings	$0.0	$196.8	$424.6	$557.7	$502.8
	Total Investment	$3,592.8	$5,327.5	$8,612.6	$10,727.2	$7,075.0
	Total Savings	$573.4	$3,996.1	$10,964.6	$23,122.3	$31,435.5

Most of the BTS programs have increasing market penetration and investment levels through FY2030. Thus, the energy savings levels for many of the programs are expected to increase far beyond 2030. By the end of FY2010 as shown in Table 2.1, total annual savings have exceeded total annual investments, and are continuing to accelerate. Investments as a group have begun to flatten out by FY2030.

2.2 Results

The investments and energy savings attributable to the penetration of BTS programs in the marketplace will result in substantial macroeconomic effects. The following tables summarize these effects. Table 2.2 shows the impact of only the energy savings on potential national employment on a year-by-year and program-by-program basis. Each BTS program is designated with a numerical project code (or Projcode) to ensure ease in numerical modeling and for tracing a given program as it undergoes periodic name changes. The employment effects are identified as potential in this table because this estimate is really one of the change in demand for workers. Actual employment effects could include changes in wage rates and also would be affected by changes in labor supply conditions. Table 2.3 shows the comparable effects on national wage income. Before accounting for investment costs, the effects of savings alone in FY2030 are an increase of almost 332,000 potential jobs and about $5.3 billion in national wage income.

As was previously discussed, obtaining these energy savings benefits requires a substantial national investment in energy efficient technologies and practices. For the most part, this incremental national investment will be made in manufacturing sectors by producing new or better equipment that is relatively capital intensive. The assumption is the source of the investment capital will be the U.S. economy as a whole that is less capital intensive on average than is manufacturing. Just as in the example in Figure 1.2, most of the energy efficiency investments will tend to reduce national employment while they are occurring, because they divert investment into capital-intensive sectors. Therefore, Table 2.4 that combines the employment effects of the required energy efficiency investments and the employment effects of the required savings, shows lower employment impacts than does Table 2.2 that includes only the effects of the energy and non-energy savings and ignores the investment effects. By FY2030, Table 2.4 shows a potential net employment increase of 304,500 jobs, almost 92 percent of the level in Table 2.2. Comparing the effects on national wage income in Tables 2.3 and 2.5 presents a similar, but slightly more mixed, picture. The net effect on wage income of the required investment, combined with the effect of resulting energy and non-energy savings, is mixed because many of the jobs created in the capital-intensive manufacturing sectors, as a result of energy-efficiency investments, are also high-paying. This situation tends to compensate to some degree for the reduction in overall employment levels associated with the diversion of national spending into capital-intensive manufacturing activity. By FY2030, Table 2.5 shows a potential net positive impact on national wage income of about $5 billion, over 94 percent of the level in Table 2.3.

The individual BTS programs differ significantly from each other in scale, timing, and impact. Taking investment effects into account, most of the positive job and wage impacts come from only five programs: Training and Assistance for (Energy) Codes, Advanced Lighting (Two Photon Source), Building Envelope R&D on Roofs and Insulation and on Windows, and Technology Roadmaps). Together they account for over 47 percent of the annual savings, 53 percent of the net savings, 50 percent of the jobs, and 47 percent of the net wage income effects. These programs are large-scale, cost-effective programs that are expected to produce large energy savings relative to the investments required. By FY2030, each of these programs will be producing net annual economic savings to the U.S. economy of over $1.8 billion per year (almost $13 billion together), even after investment costs in FY2030 are subtracted. The savings alone from these programs generate an estimated 158,000 potential jobs (153,000 after investment effects). Recall that these are the predicted outcomes of mostly research and development programs, and would be obtained only if the programs met their goals. The benefits mostly are expected after the year 2010. If the Energy Star Programs and Lighting and Appliances Standards programs are each counted as single programs, they each account for net savings impacts of over $1.7 billion and $2.7 billion respectively. They have a combined positive net impact of 66,000 jobs (59,000 after investment effects). The impacts of most of the other BTS programs are on a much smaller scale.

The initial effect of the required investment is a short-run reduction in jobs and income in the economy, but the net effect is small. By FY2003, the effects of the energy savings more than compensate for the effects of investment. Many of the BTS programs will have achieved only part of their ultimate market penetration at the end of the period. However, the overall positive net impact on positive employment (304,500) and wage income ($5.0 billion) in FY2030 still is a small, but significant boost to the economy, an effect that would continue to grow after FY2030 as savings increase and investments are complete.

Table 2.2. Effect of Energy Savings from BTS Programs on Potential National Employment

Projcode	Descriptor	Effect on Total National Employment (thousands of jobs)									
		2001	**2002**	**2003**	**2004**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
115	Residential Buildings Research and Development	0.0	0.0	0.1	0.2	0.3	1.7	4.8	8.9	12.9	16.7
124	Commercial Buildings Research and Development	0.0	0.0	0.0	0.1	0.2	1.6	3.6	4.2	4.1	3.9
145	Analysis Tools and Design Strategies	0.4	0.4	0.6	1.1	1.6	3.8	4.3	4.6	4.8	4.9
311	Space Conditioning R&D: GAX Heat Pump	0.0	0.2	0.4	0.6	0.7	1.5	2.3	2.8	3.2	3.7
312	Space Conditioning R&D: Hi-Cool Heat Pump	0.0	0.0	0.2	0.3	0.5	1.0	1.5	1.8	2.1	2.4
333	Space Conditioning R&D: Refrigeration	0.3	0.3	0.4	0.7	1.0	2.8	4.2	4.7	4.7	4.7
352	Cogeneration/Fuel Cells	0.0	0.0	0.0	0.0	0.0	1.2	4.5	8.8	10.7	10.4
361	Space Conditioning R&D: Desiccants	0.0	0.0	0.0	0.0	0.2	0.9	1.3	1.5	1.6	1.8
371	Technology Roadmaps and Competitive R&D	1.7	1.6	2.3	3.3	4.1	7.9	11.3	14.5	17.4	19.9
381	Appliances and Emerging Technologies R&D	0.0	0.0	0.1	0.2	0.2	0.4	0.6	0.8	0.9	1.1
411	Adv. Light Sources	0.0	0.0	0.0	0.0	0.1	0.8	1.4	1.8	2.2	2.6
412	Adv. Light Sources (Two-Photon Phosphors)	0.0	0.0	0.0	0.0	0.0	1.0	5.1	11.3	17.2	22.8
422	Energy Star Program	See Detail in 4221-4228									
506	Residential Building Codes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.8
507	Commercial Building Codes	0.0	0.0	0.1	0.3	0.5	2.1	5.9	9.9	14.3	18.7
603	Lighting and Appliance Standards	See Detail in 6032-6039									
901	Weatherization Assistance	0.9	0.9	1.4	1.8	2.3	4.4	6.4	6.3	6.1	5.9
903	State Formula Grants	0.8	0.8	1.2	1.7	2.1	4.0	5.8	7.5	9.1	10.8
1332	Rebuild America	1.2	1.1	1.5	2.5	3.1	6.3	6.9	6.2	5.4	4.7
1335	Energy Smart Schools	1.1	0.7	0.7	1.1	1.3	2.0	1.9	1.6	1.2	0.9
1336	Information Outreach	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3
1337	Competitively-Selected Community Projects	0.1	0.1	0.1	0.1	0.2	0.3	0.5	0.6	0.8	0.9
1338	Training and Assistance for Codes	0.4	0.5	1.0	1.7	2.6	9.7	19.9	29.4	39.0	48.1
1339	Partnership for Advancing Technology in Housing (PATH)	0.5	0.5	0.8	1.3	2.0	6.8	12.0	13.8	13.7	12.7
2111	Bldg. Env. R&D: Windows	0.1	0.1	0.2	0.4	0.7	3.8	11.1	20.9	30.9	40.3

Table 2.2. (contd)

Projcode	Descriptor	Effect on Total National Employment (thousands of jobs)									
		2001	2002	2003	2004	2005	2010	2015	2020	2025	2030
2112	Bldg. Env. R&D: Roofs and Insulation	0.0	0.4	0.8	1.4	2.2	9.4	19.3	24.7	26.1	26.4
4221	Energy Star: Clothes Washers	0.5	0.4	0.5	0.6	0.8	1.7	2.2	2.7	3.2	3.7
4222	Energy Star: Dishwashers	0.1	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.8
4223	Energy Star: Refrigerators	1.0	0.6	0.7	0.7	0.9	1.6	1.7	1.6	1.6	1.5
4224	Energy Star: Room Air Cond	0.2	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4
4226	Energy Star: Electric Water Heaters	0.6	0.5	1.2	1.8	2.4	4.9	6.3	7.4	8.6	9.8
4227	Energy Star: Windows	0.1	0.1	0.1	0.2	0.3	1.4	2.8	4.2	5.6	6.8
4228	Energy Star: CFLs	2.1	1.5	2.2	3.0	3.9	11.5	17.9	10.0	9.0	8.4
6032	Lighting and Appliance Standards: Commercial AC	0.0	0.0	0.0	0.4	0.9	2.3	3.1	3.4	3.7	4.0
6033	Lighting and Appliance Standards: Gas Water Heaters	0.0	0.1	0.2	0.4	0.4	0.8	1.0	1.1	1.1	1.2
6034	Lighting and Appliance Standards: Oil Water Heaters	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1
6035	Lighting and Appliance Standards: Central Air Conditioners	0.2	0.1	0.2	2.2	4.2	12.2	16.9	18.0	19.2	20.4
6036	Lighting and Appliance Standards: Gas Furnaces	0.0	0.0	0.0	0.3	0.5	1.6	2.4	3.1	3.7	4.3
6037	Lighting and Appliance Standards: Oil Furnaces	-0.3	-0.4	-0.4	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2
6039	Lighting and Appliance Standards: Dist. Transformers	0.0	0.5	0.9	1.6	2.2	4.7	6.3	6.1	5.8	5.4
	Total	11.9	11.4	18.0	29.9	42.2	116.9	195.9	245.5	291.3	331.8

Table 2.3. Effect of Energy Savings from BTS Programs on Potential National Wage Income

Projcode	Descriptor	Effect on Total National Wage Income (million 1999 $)									
		2001	**2002**	**2003**	**2004**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
115	Residential Buildings Research and Development	$0.4	$0.7	$1.8	$3.2	$5.5	$34.3	$98.2	$183.9	$266.1	$343.8
124	Commercial Buildings Research and Development	0.0	0.0	0.0	1.4	2.7	20.0	46.8	56.3	56.2	54.6
145	Analysis Tools and Design Strategies	8.5	7.0	11.9	19.9	27.9	67.3	75.6	80.6	83.9	86.7
311	Space Conditioning R&D: GAX Heat Pump	0.1	3.5	7.7	11.4	13.5	25.1	35.0	41.5	48.6	56.1
312	Space Conditioning R&D: Hi-Cool Heat Pump	1.0	0.6	3.6	6.4	8.6	18.3	25.9	31.3	36.8	42.4
333	Space Conditioning R&D: Refrigeration	4.3	2.7	5.2	6.8	9.4	25.9	38.7	43.7	44.6	44.6
352	Cogeneration/Fuel Cells	0.0	0.0	0.0	0.0	0.0	22.8	88.3	181.9	232.2	240.3
361	Space Conditioning R&D: Desiccants	0.0	0.0	0.0	0.0	1.8	8.5	12.4	14.2	15.7	17.3
371	Technology Roadmaps and Competitive R&D	31.1	25.3	40.5	50.8	63.2	123.4	177.2	228.6	274.4	316.0
381	Appliances and Emerging Technologies R&D	0.0	0.0	1.9	3.6	4.7	9.5	13.2	16.6	20.2	24.0
411	Adv. Light Sources	0.0	0.0	0.0	0.0	1.3	7.4	13.5	17.4	21.1	24.7
412	Adv. Light Sources (Two-Photon Phosphors)	0.0	0.0	0.0	0.0	0.0	9.3	47.6	106.9	164.1	220.3
422	Energy Star Program	See Detail in 4221-4228									
506	Residential Building Codes	0.0	0.0	0.0	0.0	0.0	0.8	3.5	7.8	12.3	17.4
507	Commercial Building Codes	0.4	0.5	1.4	2.6	4.6	20.8	57.1	96.4	139.8	183.9
603	Lighting and Appliance Standards	See Detail in 6032-6039									
901	Weatherization Assistance	16.7	16.9	26.6	33.7	41.9	80.9	116.6	114.0	110.1	106.2
903	State Formula Grants	14.8	11.4	18.4	22.7	28.1	54.5	77.8	100.4	121.6	143.5
1332	Rebuild America	16.7	7.6	14.6	16.8	21.0	42.2	46.3	41.8	36.6	32.9
1335	Energy Smart Schools	15.1	4.7	7.0	7.2	8.4	13.2	12.7	10.2	7.6	5.6
1336	Information Outreach	0.3	0.3	0.4	0.5	0.6	1.2	1.7	2.4	2.8	3.2
1337	Competitively-Selected Community Projects	1.1	0.4	0.8	0.8	1.0	1.8	2.5	3.1	3.5	3.8
1338	Training and Assistance for Codes	8.4	10.8	21.7	34.6	51.6	191.4	377.9	548.5	720.2	882.0
1339	Partnership for Advancing Technology in Housing (PATH)	10.0	10.1	16.9	25.9	40.8	137.5	244.6	282.4	279.5	260.3
2111	Bldg. Env. R&D: Windows	2.1	1.7	3.4	5.2	8.5	44.4	128.2	242.2	360.4	472.3
2112	Bldg. Env. R&D: Roofs and Insulation	0.0	8.0	16.4	27.0	41.2	178.8	365.7	467.6	490.3	492.4

Table 2.3. (contd)

Projcode	Descriptor	Effect on Total National Wage Income (million 1999 $)									
		2001	**2002**	**2003**	**2004**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
4221	Energy Star: Clothes Washers	10.4	7.8	10.8	13.0	17.2	35.1	44.7	54.7	64.4	74.4
4222	Energy Star: Dishwashers	3.0	2.2	3.1	3.7	4.8	9.6	11.4	13.3	15.4	17.6
4223	Energy Star: Refrigerators	21.4	12.2	14.4	15.7	19.0	35.2	36.4	35.8	35.1	34.2
4224	Energy Star: Room Air Cond	4.5	3.2	4.2	4.9	5.8	9.3	8.4	8.3	8.1	7.8
4226	Energy Star: Electric Water Heaters	12.0	10.3	26.3	39.6	51.1	99.9	128.7	152.5	177.2	203.4
4227	Energy Star: Windows	1.5	1.1	1.9	2.8	4.3	19.1	39.0	58.5	76.8	93.5
4228	Energy Star: CFLs	45.9	33.5	49.3	65.1	84.8	251.9	394.1	220.7	200.1	188.8
6032	Lighting and Appliance Standards: Commercial AC	0.0	0.0	0.0	4.2	7.9	21.5	28.8	32.4	35.5	38.5
6033	Lighting and Appliance Standards: Gas Water Heaters	0.0	1.0	2.1	2.6	3.2	5.7	7.1	7.7	8.2	8.7
6034	Lighting and Appliance Standards: Oil Water Heaters	0.0	-0.5	-1.0	-1.5	-2.1	-4.1	-5.4	-6.3	-7.2	-8.1
6035	Lighting and Appliance Standards: Central Air Conditioners	4.2	3.1	4.3	49.2	93.2	269.5	373.4	401.7	431.5	462.5
6036	Lighting and Appliance Standards: Gas Furnaces	0.0	0.0	0.0	2.8	4.6	12.5	18.3	27.4	36.1	44.3
6037	Lighting and Appliance Standards: Oil Furnaces	-9.5	-10.0	-12.8	-14.1	-14.6	-14.4	-13.1	-10.9	-9.0	-7.0
6039	Lighting and Appliance Standards: Dist. Transformers	0.0	5.0	11.5	15.1	20.0	43.3	59.4	57.6	55.0	52.6
	Total	$224.3	$181.0	$314.3	$483.3	$685.2	$1,933.6	$3,238.8	$3,973.1	$4,675.7	$5,285.4

Table 2.4. Effect of the Full Investment Scenario on Potential National Employment

Projcode	Descriptor	Effect on Total National Employment (thousands of jobs)									
		2001	2002	2003	2004	2005	2010	2015	2020	2025	2030
115	Residential Buildings Research and Development	0.0	0.0	0.1	0.2	0.3	1.7	4.8	8.9	12.9	16.7
124	Commercial Buildings Research and Development	0.0	0.0	0.0	0.1	0.2	1.3	3.4	4.2	4.1	3.9
145	Analysis Tools and Design Strategies	-1.2	-0.2	-0.3	-0.6	-0.4	2.6	3.8	4.1	4.3	4.4
311	Space Conditioning R&D: GAX Heat Pump	0.0	-2.5	-2.3	-2.2	-1.0	-0.3	-0.5	-0.5	-0.5	-0.6
312	Space Conditioning R&D: Hi-Cool Heat Pump	0.0	0.0	-1.6	-1.5	-0.6	-0.1	0.0	-0.1	-0.3	-0.7
333	Space Conditioning R&D: Refrigeration	0.3	0.3	0.4	0.7	1.0	2.8	4.2	4.7	4.7	4.7
352	Cogeneration/Fuel Cells	0.0	0.0	0.0	0.0	0.0	-6.3	-18.0	-16.9	-2.0	3.8
361	Space Conditioning R&D: Desiccants	0.0	0.0	0.0	0.0	0.2	0.9	1.3	1.5	1.6	1.8
371	Technology Roadmaps and Competitive R&D	1.7	1.6	2.3	3.3	4.1	7.9	11.3	14.5	17.4	19.9
381	Appliances and Emerging Technologies R&D	0.0	0.0	-0.1	0.0	0.1	0.3	0.5	0.6	0.8	1.0
411	Adv. Light Sources	0.0	0.0	0.0	0.0	0.1	0.8	1.4	1.8	2.2	2.6
412	Adv. Light Sources (Two-Photon Phosphors)	0.0	0.0	0.0	0.0	0.0	1.0	5.1	11.3	17.2	22.8
422	Energy Star Program	See Detail in 4221-4228									
506	Residential Building Codes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.8
507	Commercial Building Codes	0.0	0.0	0.1	0.3	0.5	2.1	5.9	9.9	14.3	18.7
603	Lighting and Appliance Standards	See Detail in 6032-6039									
901	Weatherization Assistance	1.2	1.1	1.6	2.0	2.4	4.6	6.6	6.5	6.3	6.1
903	State Formula Grants	-0.3	0.3	0.6	1.1	1.5	3.5	5.2	6.9	8.4	10.1
1332	Rebuild America	-4.9	-1.9	-2.1	-1.2	-0.6	2.2	6.7	6.0	5.2	4.5
1335	Energy Smart Schools	-4.3	-0.2	-0.2	0.0	0.2	1.0	1.9	1.6	1.2	0.9
1336	Information Outreach	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3
1337	Competitively-Selected Community Projects	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.6	0.7	0.8
1338	Training & Assistance for Codes	0.4	0.5	1.0	1.7	2.6	9.7	19.9	29.4	39.0	48.1
1339	Partnership for Advancing Technology in Housing (PATH)	0.5	0.5	0.8	1.3	2.0	6.8	12.0	13.8	13.7	12.7
2111	Bldg. Env. R&D: Windows	0.0	0.0	0.1	0.2	0.4	2.6	8.8	17.9	27.8	36.9

Table 2.4. (contd)

Projcode	Descriptor	Effect on Total National Employment (thousands of jobs)									
		2001	2002	2003	2004	2005	2010	2015	2020	2025	2030
2112	Bldg. Env. R&D: Roofs and Insulation	0.0	-0.2	0.2	0.4	0.9	5.9	15.6	22.9	25.1	25.4
4221	Energy Star: Clothes Washers	-2.2	-1.0	-0.9	-0.8	-0.1	0.8	1.0	1.5	1.9	2.3
4222	Energy Star: Dishwashers	-1.0	-0.5	-0.5	-0.4	-0.5	-0.3	-0.1	0.0	0.0	0.1
4223	Energy Star: Refrigerators	-4.0	0.5	0.6	0.7	-0.1	0.5	0.5	0.5	0.4	0.4
4224	Energy Star: Room Air Cond	-0.3	-0.1	-0.1	0.0	0.0	0.2	-0.1	0.0	0.0	0.1
4226	Energy Star: Electric Water Heaters	-0.3	-0.2	-0.5	0.3	1.4	3.7	5.1	6.5	7.8	9.1
4227	Energy Star: Windows	0.0	0.0	0.1	0.1	0.2	1.0	2.3	3.7	5.1	6.3
4228	Energy Star: CFLs	2.0	1.4	2.1	2.8	3.7	10.8	17.3	9.4	8.4	7.9
6032	Lighting and Appliance Standards: Commercial AC	0.0	0.0	0.0	0.4	0.9	2.3	3.1	3.4	3.7	4.0
6033	Lighting and Appliance Standards: Gas Water Heaters	0.0	0.1	0.2	0.4	0.4	0.8	1.0	1.1	1.1	1.2
6034	Lighting and Appliance Standards: Oil Water Heaters	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1
6035	Lighting and Appliance Standards: Central Air Conditioners	0.2	0.1	0.2	1.7	0.8	8.4	15.1	16.1	17.2	18.3
6036	Lighting and Appliance Standards: Gas Furnaces	0.0	0.0	0.0	0.3	0.5	1.6	2.4	3.1	3.7	4.3
6037	Lighting and Appliance Standards: Oil Furnaces	-0.3	-0.4	-0.4	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2
6039	Lighting and Appliance Standards: Dist. Transformers	0.0	0.5	0.9	1.6	2.2	4.7	6.3	6.1	5.8	5.4
	Total	-12.8	0.0	2.5	12.4	22.9	85.4	154.2	201.2	259.6	304.5

Table 2.5. Effect of the Full Investment Scenario for BTS Programs on Potential National Wage Income

Projcode	Descriptor	Effect on Total National Wage Income (million 1999 $)									
		2001	2002	2003	2004	2005	2010	2015	2020	2025	2030
115	Residential Buildings Research and Development	$0.4	$0.7	$1.8	$3.2	$5.5	$34.3	$98.2	$183.9	$266.1	$343.8
124	Commercial Buildings Research and Development	0.0	0.0	0.0	1.0	2.3	16.6	44.0	56.1	55.8	54.3
145	Analysis Tools and Design Strategies	-3.9	3.1	5.2	7.3	13.4	57.8	71.8	76.9	80.1	82.9
311	Space Conditioning R&D: GAX Heat Pump	0.0	-33.8	-30.7	-27.4	-10.1	-0.2	-4.0	-3.8	-4.2	-5.6
312	Space Conditioning R&D: Hi-Cool Heat Pump	0.4	0.3	-21.6	-19.1	-6.1	2.5	5.2	4.6	2.4	-1.8
333	Space Conditioning R&D: Refrigeration	4.3	2.7	5.2	6.8	9.4	25.9	38.7	43.7	44.6	44.6
352	Cogeneration/Fuel Cells	0.0	0.0	0.0	0.0	0.0	-22.7	-48.2	26.0	155.6	199.8
361	Space Conditioning R&D: Desiccants	0.0	0.0	0.0	0.0	1.8	8.5	12.4	14.2	15.7	17.3
371	Technology Roadmaps and Competitive R&D	31.1	25.3	40.5	50.8	63.2	123.4	177.2	228.6	274.4	316.0
381	Appliances and Emerging Technologies R&D	0.0	0.0	0.0	1.8	3.3	8.0	11.1	14.8	18.7	22.7
411	Adv. Light Sources	0.0	0.0	0.0	0.0	1.3	7.4	13.5	17.4	21.1	24.7
412	Adv. Light Sources (Two-Photon Phosphors)	0.0	0.0	0.0	0.0	0.0	9.3	47.6	106.9	164.1	220.3
422	Energy Star Program	See Detail in 4221-4228									
506	Residential Building Codes	0.0	0.0	0.0	0.0	0.0	0.8	3.5	7.8	12.3	17.4
507	Commercial Building Codes	0.4	0.5	1.4	2.6	4.6	20.8	57.1	96.4	139.8	183.9
603	Lighting and Appliance Standards	See Detail in 6032-6039									
901	Weatherization Assistance	12.3	14.6	24.2	31.3	39.6	78.6	114.2	111.6	107.7	103.9
903	State Formula Grants	6.2	7.1	14.1	18.4	23.8	50.2	73.6	96.1	116.7	138.1
1332	Rebuild America	-29.2	-15.3	-12.4	-11.3	-7.1	11.2	44.8	40.7	35.2	31.4
1335	Energy Smart Schools	-25.6	-1.8	-0.3	-1.0	0.3	5.6	12.7	10.2	7.6	5.6
1336	Information Outreach	0.3	0.3	0.4	0.5	0.6	1.2	1.7	2.4	2.8	3.2
1337	Competitively-Selected Community Projects	0.3	0.0	0.4	0.4	0.6	1.4	2.1	2.7	3.1	3.4
1338	Training and Assistance for Codes	8.4	10.8	21.7	34.6	51.6	191.4	377.9	548.5	720.2	882.0
1339	Partnership for Advancing Technology in Housing (PATH)	10.0	10.1	16.9	25.9	40.8	137.5	244.6	282.4	279.5	260.3
2111	Bldg. Env. R&D: Windows	1.3	1.0	2.2	3.5	5.7	34.5	110.1	218.0	334.9	444.5
2112	Bldg. Env. R&D: Roofs and Insulation	0.0	0.5	9.3	16.0	26.8	138.9	323.7	447.0	479.2	481.6

Table 2.5. (contd)

Projcode	Descriptor	Effect on Total National Wage Income (million 1999 $)									
		2001	**2002**	**2003**	**2004**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
4221	Energy Star: Clothes Washers	-29.5	-12.4	-9.7	-8.0	4.0	21.1	27.7	37.0	46.0	55.2
4222	Energy Star: Dishwashers	-13.2	-6.1	-5.5	-5.1	-5.5	-1.3	2.6	4.0	5.5	7.1
4223	Energy Star: Refrigerators	-50.5	11.5	13.7	14.9	4.3	19.4	20.3	19.4	18.4	17.2
4224	Energy Star: Room Air Cond	-3.4	-0.5	0.6	1.7	2.6	5.8	1.0	2.2	3.4	4.7
4226	Energy Star: Electric Water Heaters	-0.6	0.0	2.1	17.1	36.9	83.1	111.9	138.2	165.1	193.2
4227	Energy Star: Windows	0.4	0.8	1.5	2.1	3.3	16.1	34.8	54.2	72.8	89.5
4228	Energy Star: CFLs	45.4	33.2	48.8	64.4	83.9	249.3	391.6	218.3	197.7	186.5
6032	Lighting and Appliance Standards: Commercial AC	0.0	0.0	0.0	4.1	7.9	21.5	28.8	32.3	35.4	38.5
6033	Lighting and Appliance Standards: Gas Water Heaters	0.0	1.0	2.1	2.6	3.2	5.7	7.1	7.7	8.2	8.7
6034	Lighting and Appliance Standards: Oil Water Heaters	0.0	-0.6	-1.0	-1.5	-2.1	-4.1	-5.4	-6.3	-7.2	-8.1
6035	Lighting and Appliance Standards: Central Air Conditioners	4.2	3.1	4.3	41.5	44.2	214.5	348.7	375.3	403.2	432.4
6036	Lighting and Appliance Standards: Gas Furnaces	0.0	0.0	0.0	2.8	4.6	12.5	18.2	27.4	36.0	44.3
6037	Lighting and Appliance Standards: Oil Furnaces	-9.5	-10.0	-12.8	-14.1	-14.6	-14.4	-13.1	-10.9	-9.0	-7.0
6039	Lighting and Appliance Standards: Dist. Transformers	0.0	5.0	11.5	15.1	20.0	43.3	59.4	57.6	55.0	52.6
	Total	-$39.9	$51.0	$134.0	$282.9	$464.4	$1,615.3	$2,867.5	$3,589.6	$4,364.2	$4,989.0

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