

Impact of Energy Policy Act of 2005 Section 206 Rebates on Consumers and Renewable Energy Consumption, With Projections to 2010

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National Energy Modeling System Results

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Preface

Section 206(d) of the Energy Policy Act of 2005 (EPACT 2005), which was signed into law August 8, 2005, provides:

(d) Renewable Fuel Inventory. – Not later than 180 days after the date of the enactment of this Act, the Secretary shall transmit to Congress a report containing – (1) an inventory of renewable fuels available for consumers; and (2) a projection of future inventories of renewable fuels based on the incentives provided in this section.

The Energy Information Administration (EIA), with the agreement of the Department, interpreted section 206(d) as calling for a listing of the types of renewable fuels available today, and a listing of those that will be available in the future based on the incentives provided in section 206(d). This report provides that information, and also provides information concerning renewable energy equipment and renewable energy consumption. EIA did not interpret section 206(d) as calling for a calculation of the total availability of various types of renewable fuels, because there is no way to reasonably determine the quantities for many types of renewable fuels such as sunlight or biomass.

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Summary of Results

Section 206 of the Energy Policy Act of 2005 (EPACT 2005) provides for the establishment of a rebate program for expenditures made to install renewable energy systems in connection with a dwelling unit or small business. The amount of the rebate is 25 percent of the expenditures for qualifying equipment made by the consumer or \$3,000, whichever is less. An analysis of the impact conducted by the Energy Information Administration (EIA) indicates the following results:

- Section 206 rebates would increase 2006 renewable residential energy consumption between 1 and 3 trillion British thermal units (Btu) above EIA Reference Case levels. By 2010, the estimated increase ranges from 7 to 14 trillion Btu. By comparison, EIA estimates total delivered residential energy consumption in its *Annual Energy Outlook 2006* Reference Case to be about 12 thousand trillion Btu from 2006 through 2010.
- Geothermal heat pumps (GHPs) account for the largest share of the increase. Annual sales in 2006 are expected to increase between two- and five-fold over Reference Case levels due to Section 206 rebates. By 2010, GHP annual sales are projected at three to four times Reference Case levels.
- Residential wood stoves are estimated to be a distant second to GHPs in providing additional renewable energy as a result of the Section 206 rebate program. Solar technologies provide only minimal additional energy. Residential wind turbines, geothermal direct use, and other forms of biomass (notably pellet fuel stoves) are not examined due to insufficient data.

Background

The Energy Policy Act 2005 (EPACT 2005) Sec. 206 provides for the establishment of a rebate program for expenditures made to install renewable energy systems in connection with a dwelling unit or small business. The amount of the rebate is set at 25 percent of the expenditures made by the consumer or \$3,000, whichever is less. Annual funding to carry out this program was authorized in the law, starting with \$150 million for Fiscal Year (FY) 2006 and ending with \$250 million for FY 2010. However, Congress has not appropriated these funds to date.

According to this legislation, renewable energy sources include energy derived from solar, geothermal, biomass¹, and wind for nonbusiness residential purposes. In addition, it includes any other form of renewable energy which the Secretary of Energy specifies by regulation for the purpose of heating or cooling a dwelling or providing hot water or electricity for use within a dwelling.

Methodology

To analyze the impact of the Section 206 rebate program, the Energy Information Administration (EIA) used the National Energy Modeling System (NEMS), which is the basis for the forecasts published each year in the *Annual Energy Outlook (AEO)*. While NEMS is a very flexible and comprehensive model, it does have some characteristics that limit this analysis. First, the only renewable energy sources modeled in the residential sector are wood-burning stoves, geothermal heat pumps (GHPs), solar thermal hot water heaters, and solar photovoltaic (PV) installations for electricity. This excludes several energy sources, notably residential wind turbines and pellet fuel stoves. While EIA does not collect data on or forecast these energy sources, some reliable anecdotal information is provided for them. Failing to account for residential wind turbines is unlikely to affect the results, since the installed cost of residential wind turbines is so high that the Section 206 rebate would likely not cause many additional units to be purchased. The second limit to this analysis is that no energy data (historical or projected) exist specific to small businesses, so potential benefits to them, largely in the commercial sector, were not examined. It should also be noted that this analysis does not consider possible synergies with State initiatives, particularly the new solar incentive recently adopted in California.² The final limit to the analysis is that the rebate case projections assume authorized funds are structured by calendar year, whereas Section 206 prescribes limits by fiscal year.

EIA modeled the impact of Section 206 rebates by examining two separate cases. In the first case, prescribed unit rebates were considered, without regard to the overall budget impact they would have. For the second case, the total rebate limits were adhered to by assuming that there would be a smaller rebate for GHPs, the technology that analysis indicates would receive the largest benefit from the program. Alternatively, Section 206 legislation could result in customers applying for program funds on a “first come, first served” basis for the most economically viable technologies. It is beyond the scope of NEMS to model this behavior.

¹ Biomass is considered to be any organic matter available on a renewable or recurring basis.

² On January 12, 2006, the California Public Utilities Commission created the California Solar Initiative, a 10-year, \$2.9 billion program whose goal is to increase installed solar capacity on rooftops by 3,000 megawatts by 2017.

The data for 2004 and 2005 shown in this report are actually estimates calculated by the NEMS Residential Demand Module. This module uses information from EIA's 2001 Residential Energy Consumption Survey (RECS)—the most recent RECS—as its base-year data. It then generates forecasts for each year through 2010 for this analysis using actual and forecasted weather and exogenous forecasts of housing starts and energy prices. External assumptions of projected energy equipment cost and performance are also used. NEMS then projects changes to housing and equipment stock and the resulting energy use. These estimates are calculated for each of the nine Census Divisions. Appendix B includes a description of the differences between these estimates and EIA's published estimates of renewable energy consumption in the residential sector.

To examine the impact of the Section 206 rebate program, EIA compared results from the Reference Case forecast published in the *Annual Energy Outlook 2006 (AEO2006)* with two Rebate Cases that contained the provisions of Section 206 described above.

Reference Case Results

In the *AEO2006* Reference Case, total delivered energy consumption (excluding electricity losses) for the residential sector in 2005 was estimated to be nearly 12 thousand trillion British thermal units (Btu) provided to more than 115 million households.³ Natural gas and electricity were the leading sources of energy for the sector, followed by petroleum. Wood space heating consumption was 430 trillion Btu, while solar thermal and PV together were 25 trillion Btu. GHPs provided 3 trillion Btu (Table 1). Information from external sources on pellet fuel, small wind turbines, and direct geothermal use is contained in the "Analysis Caveats" section of this report.

Rebate Case Study Results

Rebate Case 1 (Unconstrained)

Rebate Case 1 limits the rebate on individual units of renewable energy equipment to 25 percent of the unit's cost or \$3,000, whichever is less. Total funds available for rebates are not constrained.

In EIA's projections from 2005 to 2010, the major increase in renewable energy equipment due to Section 206 rebates is in GHPs. Whereas geothermal heat pump use almost doubles over this time period in the Reference Case, the Section 206 rebates increase residential geothermal heat pump energy consumption six-fold to 16.4 trillion Btu (Table 2a), or 0.1 percent of delivered residential energy consumption.

³ For history and the Reference Case forecast, refer to Energy Information Administration, *Annual Energy Outlook 2006* National Energy Modeling System Run ae02006.d111905a and related website: <http://www.eia.doe.gov/oiaf/aeo/index.html>.

For solar hot water heating and PV, EIA's Reference Case projects residential energy consumption expanding 23 percent to 30.4 trillion Btu in 2010. Section 206 rebates are forecast to increase residential energy consumption from solar PVs by 0.4 trillion Btu in 2010, with almost no change to solar hot water heating.

Residential wood space heating energy consumption rises through 2006, then declines through 2010 in both the Reference Case and Rebate Case 1. The decline beyond 2006 is due mainly to increased home "shell"⁴ energy efficiency. Wood energy consumption is affected, to a lesser extent, by population shifts to the South/ Southwest, where wood is little used as a heating fuel.

Under Rebate Case 1, wood space heating energy consumption follows a similar pattern to that in the Reference Case, but at slightly higher levels; an additional 2.4 trillion Btu of wood energy is added in 2010. The relatively large number of GHPs and small number of wood stoves and PV installations expected to be spurred by the rebates are the result of two factors. First, GHPs with the Section 206 rebate are expected to be less expensive than competing technologies in several Census Divisions. The Residential Demand Module chooses technologies based on the capital cost of the unit and the operating costs of the unit for a single year. Overall unit cost is determined by weighting the capital and operating costs. These weights vary by the efficiency of each technology and are set such that a 15- percent discount rate is achieved. A geothermal heat pump is very efficient and inexpensive to operate but has a high capital cost, compared to other technologies, e.g., natural gas. Once the GHP capital cost is lowered by the rebate, it picks up market share—though the share is still very small compared with total residential energy demand.

Second, the projected population shift to the South/Southwest favors GHPs because they perform relatively well in those climate conditions. On the other hand, as mentioned previously, there is little wood used for space heating in these regions. PV installations have high capital and low operating costs like GHPs, but the capital costs per unit of energy output are much higher. So even a \$3,000 rebate doesn't make PV installations competitive.

In analyzing the financial consequences of the rebates, it is important to note that rebates apply to the total number of units sold in a given year, including both units forecast to be purchased in the Reference Case and incremental units purchased in Rebate Case 1. As a result, only a portion of the rebates goes to the incremental units purchased in Rebate Case 1. Residential energy consumption under Reference Case and Rebate Case 1 assumptions is shown in Table 2a. The inventory of renewable energy equipment is shown for those cases in Table 3a, while rebates and annual sales of new units by renewable energy source and use are presented in Table 4a.

Using the total number of new units purchased for a given year, rebates peak at \$480 million in 2006, when tax credits in addition to the rebates are also in effect for GHPs and solar (Table 4a).⁵ This level is well in excess of the \$150 million authorized for that year. By 2010, Section 206

⁴ The "shell" of a home is that portion of the perimeter from the interior wall to the exterior surface.

⁵ EPCACT 2005 Section 1331 provides for a maximum of \$300 in tax credits per installation of a geothermal heat pump system in a dwelling during 2006 and 2007. Section 1335 provides for tax credits for qualified photovoltaic property expenditures and qualified solar water heating property expenditures in dwellings during 2006 and 2007. The solar tax credit is 30 percent of qualified expenditures up to a maximum of \$2,000.

rebates are down to about \$400 million, with almost 70 percent going to GHPs. This outlay results in an additional 13.9 trillion Btu of renewable energy and offsets small amounts of distillate, liquefied petroleum gas, and natural gas (Table 2a). This represents just over 0.1 percent of forecast residential sector energy demand. Clearly, if model results are representative and rebates were scaled back to EPACT 2005-authorized limits, the impact on energy consumption of Section 206, which is small without funding limits, would be even smaller. This situation is examined in Rebate Case 2 below.

Rebate Case 2 (Constrained)

Rebate Case 2 assumes that total rebate expenditures are constrained to levels authorized in Section 206: \$150 million in FY 2006 and 2007, rising to \$250 million by 2009 (Table 4b). Although every effort was made to adhere to the individual unit rebate mandates of Section 206, some exceptions were made, as noted below, in order to cap total rebates.

The impact of curtailing total expenditures is greatest on GHPs. The total number of GHPs expected to be in use for 2006 under Rebate Case 2 is 207 thousand, one-third lower compared with the inventory in Rebate Case 1 (Table 3b). The drop is even greater by 2010, 40 percent. Still, the 490 thousand units forecast for 2010 represent a 75-percent increase over the number of GHPs forecast to be in use in the Reference Case (278 thousand).

The principal reason for the lower number of GHPs in this case is that in order to limit program outlays to authorized levels, the GHP rebate in 2010 was reduced from \$2,352 in Rebate Case 1 to \$1,410 in Rebate Case 2 (Table 4b). The number of solar hot water heaters and wood stoves purchased does not change much when total expenditures are constrained. However, solar PV installations do appear to increase noticeably compared to Rebate Case 1 by 2009. The number of residential solar PV installations increases by 10 percent for 2009 and 13 percent for 2010. However, this change is largely a result of the fact that, in attempting to ensure that total program funds were not exceeded, the GHP limit was reduced to the point that total projected outlays were actually slightly less than authorized. It was then assumed that the remaining rebates would yield additional purchases of PV units, the next most likely technology to be chosen.

The effect of Rebate Case 2 on energy use is similar to its effect on the number of units sold. In Rebate Case 2, Section 206-authorized rebate limits call forth an additional 7.4 trillion Btu of renewable energy consumption by 2010, compared with the Reference Case (Table 2b). Over half, 4.4 trillion Btu, comes from GHPs. Energy from wood space heating and solar sources is essentially unchanged.

Even though Rebate Case 2 constrains total expenditures, it may still forecast more residential renewable energy usage than would likely occur in practice under Section 206. The reason is that by assuming an average individual unit rebate for GHPs (\$810 for 2006), more units would be sold than if the full average GHP rebate (\$2,278 for 2006 under Rebate Case 1) were actually provided to each purchaser but with a limited number due to the caps on appropriations. A rough approximation to this “first come, first served” approach may be obtained by reducing the total rebates for GHPs in Rebate Case 1 to a level such that the Section 206 funding constraints are adhered to, leaving the total rebates for all other technologies unchanged. Using this approach,

Section 206 authorized funds for 2006 and 2007 are insufficient to provide rebates for all GHP units sold in the Reference Case. For 2008 through 2010, Section 206 funds would support paying the rebate to all units sold in the Reference Case and some of the units sold in the rebate cases. Adhering to total funding limits and providing full unit funding would result in no additional energy consumption from GHPs as a result of the rebate for 2006 and 2007. For 2008 through 2010, only a modest amount of additional energy from GHPs above Reference Case levels would be provided, as a result of the rebate under a “first come first served” approach.

Analysis Caveats

As mentioned earlier, this analysis does not include all the possible residential renewable energy sources listed in the law, such as pellet fuels, small wind, geothermal direct use, and alternative forms of biomass. In the case of pellet fuels, small wind and geothermal direct energy, technology for the residential sector is available commercially but is not modeled in NEMS. Sales of pellet fuels made in the United States during 2004 totaled nearly 875,000 tons, or 14 trillion Btu. Industry expects sales to grow in the future.⁶ Most pellet fuel is shipped to the residential sector, with some either going to the commercial sector or exported.

The American Wind Energy Association estimates that a total of 35 megawatts of small wind capacity was operational in the United States, with an average size of 1,000 watts in 2004.⁷ Assuming that small wind turbines would have capacity factors similar to those of typical commercial-scale units, small wind turbines probably provide 6 to 10 trillion Btu of energy. But the typical cost of a small wind turbine is so high that it is unlikely that the rebate itself would increase the number of units.⁸

According to the Oregon Institute of Technology, Geo-Heat Center, the geothermal direct use of energy, not included in NEMS, may account for almost 1 trillion Btu of energy. In the case of alternative forms of biomass, the technology to use these alternative forms in dwellings is not widely commercialized, though it might be in the future.

⁶ Pellet Fuels Institute, Pellet Fuel Sales Survey, website: <http://www.pelletheat.org/3/industry/marketResearch.html>

⁷ American Wind Energy Association, *Home and Farm Wind Energy Systems: Reaching the Next Level*, (Washington, DC, June 2005), p. 1, website: <http://www.awea.org>.

⁸ The price of a 10-kilowatt (KW) residential wind turbine, including a voltage regulator, pump controller, or a line-commutated inverter, ranges from \$19,900 to \$24,750 according to a major manufacturer of residential wind turbines. The cost of a tower, depending upon the height, ranges from \$6,200 to \$9,200. Adding installation costs brings the estimated total cost to around \$45,000.

**Table 1. Residential Sector Renewable Energy Consumption Comparison, 2004, 2005 and 2010
(Trillion Btu)**

Energy Source	Reference Case			Rebate Case 1 (Unconstrained) 2010	Rebate Case 2 (Constrained) 2010	Rebate Case 1 vs. Reference Case 2010	Rebate Case 2 vs. Reference Case 2010
	2004	2005	2010				
Wood Stoves	407.3	429.5	437.1	439.5	439.6	2.4	2.5
Geothermal Heat Pumps	2.2	2.7	5.3	16.4	9.6	11.1	4.4
Solar Hot Water Heaters/ PV	23.7	24.7	30.4	30.9	31.0	0.4	0.5
Total	433.2	456.9	472.8	486.7	480.2	13.9	7.4

Note: Totals may not equal the sum of components due to independent rounding.

Sources:

Reference Case 2004, 2005 and 2010: AEO2006 National Energy Modeling System run aeo2006.d111905a

Rebate Case 1 2010: AEO2006 National Energy Modeling System run rssec206.d011006a

Rebate Case 2 2010: AEO2006 National Energy Modeling System run rssec206C.d011006a.

**Table 2a. Residential Sector Renewable Energy Consumption in Reference Case and Rebate Case 1 (Unconstrained), 2004-2010
(Trillion Btu)**

Energy Source	2004	2005	2006	2007	2008	2009	2010
Reference Case							
Wood Stoves	407.3	429.5	455.2	452.0	449.0	442.0	437.1
Geothermal Heat Pumps	2.2	2.7	3.3	3.9	4.4	4.8	5.3
Solar Hot Water Heaters/ PV	23.7	24.7	25.7	26.8	28.0	29.1	30.4
Total	433.2	456.9	484.3	482.7	481.4	475.9	472.8
Rebate Case 1 (Unconstrained)							
Wood Stoves			455.7	452.9	450.5	443.9	439.5
Geothermal Heat Pumps			6.1	9.2	11.7	14.1	16.4
Solar Hot Water Heaters/ PV			25.8	27.0	28.3	29.5	30.9
Total			487.6	489.2	490.5	487.6	486.7
Change from Reference Case							
Wood Stoves			0.5	1.0	1.5	1.9	2.4
Geothermal Heat Pumps			2.7	5.3	7.3	9.3	11.1
Solar Hot Water Heaters/ PV			0.1	0.2	0.3	0.4	0.4
Total			3.3	6.4	9.1	11.6	13.9

Note: Rebate program budget is assumed to be unconstrained.

Totals may not equal the sum of components due to independent rounding.

Sources:

Reference Case 2004-2010: AEO2006 National Energy Modeling System run aeo2006.d111905a

Rebate Case 2006-2010: AEO2006 National Energy Modeling System run rssec206.d011006a

**Table 2b. Residential Sector Renewable Energy Consumption in Reference Case and Rebate Case 2 (Constrained), 2004-2010
(Trillion Btu)**

Energy Source	2004	2005	2006	2007	2008	2009	2010
Reference Case							
Wood Stoves	407.3	429.5	455.2	452.0	449.0	442.0	437.1
Geothermal Heat Pumps	2.2	2.7	3.3	3.9	4.4	4.8	5.3
Solar Hot Water Heaters/ PV	23.7	24.7	25.7	26.8	28.0	29.1	30.4
Total	433.2	456.9	484.3	482.7	481.4	475.9	472.8
Rebate Case 2 (Constrained)							
Wood Stoves			455.7	453.0	450.6	444.1	439.6
Geothermal Heat Pumps			4.0	5.2	6.6	8.2	9.6
Solar Hot Water Heaters/ PV			25.9	27.0	28.3	29.6	31.0
Total			485.6	485.3	485.5	481.8	480.2
Change from Reference Case							
Wood Stoves			0.5	1.0	1.6	2.1	2.5
Geothermal Heat Pumps			0.7	1.3	2.2	3.3	4.4
Solar Hot Water Heaters/ PV			0.1	0.2	0.4	0.5	0.5
Total			1.3	2.6	4.1	5.9	7.4

Note: Rebate program budget is assumed to be limited to levels authorized in EPACT 2005 Sec. 206 (c) (4).

Totals may not equal the sum of components due to independent rounding.

Sources:

Reference Case 2004-2010: AEO2006 National Energy Modeling System run aeo2006.d111905a

Rebate Case 2006-2010: AEO2006 National Energy Modeling System run rssec206C.d011006a.

Table 3a. Residential Sector Inventory of Renewable Energy Equipment in Reference Case and Rebate Case 1 (Unconstrained), 2004-2010
(Number of Units)

Type of Equipment	2004	2005	2006	2007	2008	2009	2010
Reference Case							
Wood Stoves	2,036,977	2,024,913	2,011,016	1,996,972	1,982,842	1,969,150	1,955,969
Geothermal Heat Pumps	114,003	141,104	173,971	205,308	230,460	254,949	278,013
Solar Hot Water Heaters	345,713	357,715	369,614	381,249	392,563	403,629	414,506
Solar PV	5,508	7,004	10,000	17,495	26,629	40,955	63,649
Total	2,502,202	2,530,736	2,564,601	2,601,023	2,632,493	2,668,683	2,712,137
Rebate Case 1 (Unconstrained)							
Wood Stoves			2,016,664	2,008,063	1,999,537	1,991,503	1,983,765
Geothermal Heat Pumps			308,510	465,955	590,537	710,612	823,477
Solar Hot Water Heaters			369,614	381,251	392,564	403,628	414,505
Solar PV			19,504	32,004	48,671	69,504	92,198
Total			2,714,291	2,887,273	3,031,309	3,175,247	3,313,945
Change (Rebate Case 1 minus Ref. Case)							
Wood Stoves			5,648	11,092	16,695	22,353	27,796
Geothermal Heat Pumps			134,538	260,647	360,077	455,663	545,464
Solar Hot Water Heaters			0	2	1	-1	-1
Solar PV			9,504	14,509	22,042	28,549	28,549
Total			149,690	286,250	398,816	506,564	601,808

Note: Rebate program budget is assumed to be unconstrained.

Totals may not equal the sum of components due to independent rounding.

Sources:

Reference Case 2004-2010: AEO2006 National Energy Modeling System run aeo2006.d111905a

Rebate Case 2006-2010: AEO2006 National Energy Modeling System run rssec206.d011006a.

**Table 3b. Residential Sector Inventory of Renewable Energy Equipment in Reference Case and Rebate Case 2 (Constrained), 2004-2010
(Number of Units)**

Type of Equipment	2004	2005	2006	2007	2008	2009	2010
Reference Case							
Wood Stoves	2,036,977	2,024,913	2,011,016	1,996,972	1,982,842	1,969,150	1,955,969
Geothermal Heat Pumps	114,003	141,104	173,971	205,308	230,460	254,949	278,013
Solar Hot Water Heaters	345,713	357,715	369,614	381,249	392,563	403,629	414,506
Solar PV	5,508	7,004	10,000	17,495	26,629	40,955	63,649
Total	2,502,202	2,530,736	2,564,601	2,601,023	2,632,493	2,668,683	2,712,137
Rebate Case 2 (Constrained)							
Wood Stoves			2,017,204	2,009,129	2,000,929	1,993,136	1,985,612
Geothermal Heat Pumps			207,297	269,853	337,423	416,455	490,492
Solar Hot Water Heaters			369,614	381,251	392,564	403,628	414,505
Solar PV			19,942	33,363	52,128	76,802	103,756
Total			2,614,056	2,693,595	2,783,044	2,890,021	2,994,365
Change (Rebate Case 2 minus Ref. Case)							
Wood Stoves			6,188	12,157	18,087	23,986	29,643
Geothermal Heat Pumps			33,325	64,545	106,963	161,506	212,479
Solar Hot Water Heaters			0	2	1	-1	-1
Solar PV			9,942	15,868	25,499	35,847	40,107
Total			49,455	92,572	150,550	221,338	282,228

Note: Rebate program budget is assumed to be limited to levels authorized in EPACT 2005 Sec. 206 (c) (4).

Totals may not equal the sum of components due to independent rounding.

Sources:

Reference Case 2004-2010: AEO2006 National Energy Modeling System run aeo2006.d111905a

Rebate Case 2006-2010: AEO2006 National Energy Modeling System run rssec206C.d011006a

Table 4a. Residential Sector Renewable Energy Equipment Sales and Rebates in Reference Case and Rebate Case 1 (Unconstrained), 2006-2010

Energy Source	2006	2007	2008	2009	2010
Reference Case					
Sales (Units)					
Wood Stoves	66,354	69,409	72,091	74,877	73,400
Geothermal Heat Pumps	35,426	34,107	28,194	27,763	26,556
Solar Hot Water Heaters	34,434	34,431	34,673	35,081	35,576
Solar PV	2,996	7,495	9,134	14,326	22,694
Total	139,210	145,442	144,092	152,047	158,226
Rebate Case 1					
Sales (Units)					
Wood Stoves	71,988	74,860	77,728	80,593	78,905
Geothermal Heat Pumps	169,948	160,640	128,398	124,403	117,725
Solar Hot Water Heaters	34,434	34,431	34,673	35,081	35,576
Solar PV	12,500	12,500	16,667	20,833	22,694
Total	288,870	282,431	257,466	260,910	254,900
Unit Rebate Amounts (2004 Dollars)					
Wood Stoves	\$425	\$425	\$425	\$425	\$425
Geothermal Heat Pumps	\$2,278	\$2,278	\$2,353	\$2,353	\$2,352
Solar Hot Water Heaters	\$717	\$717	\$717	\$717	\$717
Solar PV	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Total Rebates (Million 2004 Dollars)					
Wood Stoves	\$30.6	\$31.8	\$33.0	\$34.3	\$33.5
Geothermal Heat Pumps	\$387.2	\$365.9	\$302.1	\$292.7	\$276.9
Solar Hot Water Heaters	\$24.7	\$24.7	\$24.9	\$25.2	\$25.5
Solar PV	\$37.5	\$37.5	\$50.0	\$62.5	\$68.1
Total Projected	\$480.0	\$459.9	\$410.0	\$414.6	\$404.1
Total Authorized (Fiscal Year)	\$150.0	\$150.0	\$200.0	\$250.0	\$250.0

Note: Rebate program budget is assumed to be unconstrained.

Totals may not equal the sum of components due to independent rounding.

Sources: Projected Rebates: AEO2006 National Energy Modeling System run rssec206.d011006a

Authorizations: EPACT 2005 Sec. 206 (c) (4).

Table 4b. Residential Sector Renewable Energy Equipment Sales and Rebates in Reference Case and Rebate Case 2 (Constrained), 2006-2010

Energy Source	2006	2007	2008	2009	2010
Reference Case					
Sales (Units)					
Wood Stoves	66,354	69,409	72,091	74,877	73,400
Geothermal Heat Pumps	35,426	34,107	28,194	27,763	26,556
Solar Hot Water Heaters	34,434	34,431	34,673	35,081	35,576
Solar PV	2,996	7,495	9,134	14,326	22,694
Total	139,210	145,442	144,092	152,047	158,226
Rebate Case 2					
Sales (Units)					
Wood Stoves	72,527	75,387	78,057	80,837	79,124
Geothermal Heat Pumps	68,733	65,445	70,801	82,602	78,015
Solar Hot Water Heaters	34,434	34,431	34,673	35,081	35,576
Solar PV	12,938	13,421	18,765	24,675	26,954
Total	188,632	188,684	202,296	223,195	219,669
Unit Rebate Amounts (2004 Dollars)					
Wood Stoves	\$425	\$425	\$425	\$425	\$425
GSHP	\$810	\$810	\$1,210	\$1,410	\$1,410
Solar Hot Water	\$717	\$717	\$717	\$717	\$717
Solar PV	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Total Rebates (Million 2004 Dollars)					
Wood Stoves	\$30.8	\$32.0	\$33.2	\$34.4	\$33.6
Geothermal Heat Pumps	\$55.7	\$53.0	\$85.7	\$116.5	\$110.0
Solar Hot Water Heaters	\$24.7	\$24.7	\$24.9	\$25.2	\$25.5
Solar PV	\$38.8	\$40.3	\$56.3	\$74.0	\$80.9
Total Projected	\$150.0	\$150.0	\$200.0	\$250.0	\$250.0
Total Authorized (Fiscal Year)	\$150.0	\$150.0	\$200.0	\$250.0	\$250.0

Note: Rebate program budget is assumed to be limited to levels authorized in EPACT 2005 Sec. 206 (c) (4).

Totals may not equal the sum of components due to independent rounding.

Sources: Projected Rebates: AEO2006 National Energy Modeling System run rssec206C.d011006a

Authorizations: EPACT 2005 Sec. 206 (c) (4).

Appendix A. Legislation – Energy Policy Act 2005

Section 206

(a) WEATHERIZATION ASSISTANCE.—Section 415(c) of the Energy Conservation and Production Act (42 U.S.C. 6865(c)) is amended—

(1) in paragraph (1), by striking “in paragraph (3)” and inserting “in paragraphs (3) and (4)”;

(2) in paragraph (3), by striking “\$2,500 per dwelling unit average provided in paragraph (1)” and inserting “dwelling unit averages provided in paragraphs (1) and (4)”;

(3) by adding at the end the following new paragraphs:

“(4) The expenditure of financial assistance provided under this part for labor, weatherization materials, and related matters for a renewable energy system shall not exceed an average of \$3,000 per dwelling unit.

“(5)(A) The Secretary shall by regulations—

“(i) establish the criteria which are to be used in prescribing performance and quality standards under paragraph (6)(A)(ii) or in specifying any form of renewable energy under paragraph (6)(A)(i)(I); and

“(ii) establish a procedure under which a manufacturer of an item may request the Secretary to certify that the item will be treated, for purposes of this paragraph, as a renewable energy system.

“(B) The Secretary shall make a final determination with respect to any request filed under subparagraph (A)(ii) within 1 year after the filing of the request, together with any information required to be filed with such request under subparagraph (A)(ii).

“(C) Each month the Secretary shall publish a report of any request under subparagraph (A)(ii) which has been denied during the preceding month and the reasons for the denial.

“(D) The Secretary shall not specify any form of renewable energy under paragraph (6)(A)(i)(I) unless the Secretary determines that—

“(i) there will be a reduction in oil or natural gas consumption as a result of such specification;

“(ii) such specification will not result in an increased use of any item which is known to be, or reasonably suspected to be, environmentally hazardous or a threat to public health or safety; and

“(iii) available Federal subsidies do not make such specification unnecessary or inappropriate (in the light of the most advantageous allocation of economic resources).

“(6) In this subsection—

“(A) the term ‘renewable energy system’ means a system which—

“(i) when installed in connection with a dwelling, transmits or uses—

“(I) solar energy, energy derived from the geothermal deposits, energy derived from biomass, or any other form of renewable energy which the

Secretary specifies by regulations, for the purpose of heating or cooling such dwelling or providing hot water or electricity for use within such dwelling; or

“(II) wind energy for nonbusiness residential purposes;

“(ii) meets the performance and quality standards (if any) which have been prescribed by the Secretary by regulations;

“(iii) in the case of a combustion rated system, has a thermal efficiency rating of at least 75 percent; and

“(iv) in the case of a solar system, has a thermal efficiency rating of at least 15 percent; and

“(B) the term ‘biomass’ means any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants (including aquatic plants), grasses, residues, fibers, and animal wastes, municipal wastes, and other waste materials.”.

(b) DISTRICT HEATING AND COOLING PROGRAMS.—Section 172 of the Energy Policy Act of 1992 (42 U.S.C. 13451 note) is amended—

(1) in subsection (a)—

(A) by striking “and” at the end of paragraph (3);

(B) by striking the period at the end of paragraph

(4) and inserting “; and”; and

(C) by adding at the end the following new paragraph:

“(5) evaluate the use of renewable energy systems (as such term is defined in section 415(c) of the Energy Conservation and Production Act (42 U.S.C. 6865(c))) in residential buildings.”; and

(2) in subsection (b), by striking “this Act” and inserting “the Energy Policy Act of 2005”.

(c) REBATE PROGRAM.—

(1) ESTABLISHMENT.—The Secretary shall establish a program providing rebates for consumers for expenditures made for the installation of a renewable energy system in connection with a dwelling unit or small business.

(2) AMOUNT OF REBATE.—Rebates provided under the program established under paragraph (1) shall be in an amount not to exceed the lesser of—

(A) 25 percent of the expenditures described in paragraph (1) made by the consumer; or

(B) \$3,000.

(3) DEFINITION.—For purposes of this subsection, the term “renewable energy system” has the meaning given that term in section 415(c)(6)(A) of the Energy Conservation and Production Act (42 U.S.C. 6865(c)(6)(A)), as added by subsection (a)(3) of this section.

(4) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this subsection, to remain available until expended—

(A) \$150,000,000 for fiscal year 2006;

(B) \$150,000,000 for fiscal year 2007;

(C) \$200,000,000 for fiscal year 2008;

(D) \$250,000,000 for fiscal year 2009; and

(E) \$250,000,000 for fiscal year 2010.

(d) RENEWABLE FUEL INVENTORY.—Not later than 180 days after the date of enactment of this Act, the Secretary shall transmit to Congress a report containing—

(1) an inventory of renewable fuels available for consumers;

and

(2) a projection of future inventories of renewable fuels based on the incentives provided in this section.

Appendix B: Data and Forecast Characteristics

The information shown in this report is derived entirely from the National Energy Modeling System (NEMS). This is done to provide a consistent basis for the year-to-year changes in renewable energy equipment due to the EPACT Section 206 rebate program. The *Annual Energy Outlook 2006* Reference Case projections do not include the impact of EPACT Section 206 because the Energy Information Administration (EIA) only includes the effects of those laws for which Congress has appropriated funding. As of December 31, 2005, Congress had not appropriated funding for Section 206 programs.

Although Section 206 covers both residences and small businesses, no EIA data exist on small businesses, which would largely impact the commercial sector. Accordingly, only the residential sector is examined in this report.

The data shown in this report for 2004 and 2005 are derived from the NEMS Residential Demand Module. This module uses information from EIA's 2001 Residential Energy consumption Survey (RECS) as its base-year data. It then generates forecasts for each year through 2025 using actual and forecasted weather as well as exogenous forecasts of housing units, energy equipment and appliances, and energy use. These procedures are performed for each of the nine Census Divisions.

EIA's published estimates of residential wood energy consumption are derived somewhat similarly but do not account for changes in housing stocks. Also, estimates are developed only at the national level. For geothermal heat pumps (GHPs), EIA does not publish a stock estimate but does estimate the energy that they offset. This energy estimate is based upon estimates of GHPs, technical performance data, and usage from the Oregon Institute of Technology's Geo-Heat Center. EIA has annual estimates of solar thermal and photovoltaic equipment dating back to the early 1980s and can make a good estimate of the stock of each with assumptions about retirements. Energy use is calculated in a similar manner to that done by the Residential Demand Module, making assumptions about product efficiencies.

The NEMS Residential Demand Module only forecasts technologies which are included in the RECS, which is fielded every 4 years. Since RECS does not collect information on residential wind turbines or any other form of biomass except wood,⁹ NEMS does not forecast these technologies.

Further information on the Residential Demand Module may be found in the EIA's *Assumptions to the Annual Energy Outlook 2005*, pp. 19-26 ([http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/0554\(2004\).pdf](http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/0554(2004).pdf)).

⁹The RECS definition of wood excludes pellet fuel.

Appendix C. References

American Wind Energy Association, Small Wind, website: <http://www.awea.org/smallwind.html>

Energy Information Administration, *Annual Energy Outlook 2006*, (Washington, DC, December 2005), website: <http://www.eia.doe.gov/oiaf/aeo/index.html>.

Energy Information Administration, Residential Energy Consumption Survey (RECS), website: <http://www.eia.doe.gov/emeu/recs/contents.html> .

Pellet Fuels Institute, Pellet Fuel Sales Survey, website: <http://www.pelletheat.org/3/industry/marketResearch.html>

Appendix D. Glossary

A glossary of energy terms may be found on the Energy Information Administration's website:
<http://www.eia.doe.gov/glossary/index.html>