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Committee on Ways & Means
U.S. House of Representatives
1102 Longworth House Office Building
Washington D.C. 20515

This is in response to your April 4, 2007, request for analysis of alternative extensions of the existing production tax credit (PTC) that would apply to wind generators only. Specifically, you requested analysis of the following wind PTC extension options:

1. No extension (AEO2007 Reference Case)
2. Five-year credit extension of 1.9 cents per kilowatthour (2006 dollars)
3. Five-year credit extension of 1.5 cents per kilowatthour
4. Five-year credit extension of 1.0 cent per kilowatthour
5. Permanent credit extension of 1.9 cents per kilowatthour
6. Permanent credit extension of 1.5 cents per kilowatthour
7. Permanent credit extension of 1.0 cent per kilowatthour

In all cases, the qualifying wind generators are to receive the inflation adjusted credit for the first 10 years of their operation, as specified in the current PTC. In the five-year extension cases, the production tax credit is set to expire on December 31, 2013.

Presently, a PTC applies to qualifying renewable facilities placed in service by the end of 2008. Wind, closed-loop biomass, and geothermal plants receive a PTC of 1.9 cents per kilowatthour generated (2006 dollars). Electricity generation from municipal solid waste (MSW), landfill gas, open-loop biomass, and hydro plants are eligible for a PTC equal to one-half of the full credit amount.

The analysis provided below is based on the *2007 Annual Energy Outlook (AEO2007)* reference case. That case was prepared before the recent one-year PTC extension and does not include any 2008 capacity additions that might be stimulated by the extension. [Historically, the Energy Information Administration (EIA) has seen that two to three gigawatts of new wind capacity have been added in the final year of PTC eligibility, but these possible additions are not included here. However, the cost to the Treasury of wind capacity added in 2008 is included in the reference case costs.]

The analysis was prepared using EIA's National Energy Modeling system (NEMS). NEMS, like all models, is a simplified representation of reality. Projections are dependent on the data, methodologies, model structure, and assumptions used to develop them. Since many of the events that shape energy markets are random and cannot be anticipated (including severe weather, technological breakthroughs, and geopolitical developments), energy markets are subject to uncertainty. Moreover, future

developments in technologies, demographics, and resources cannot be foreseen with certainty. Nevertheless, well-formulated models are useful in analyzing complex policies, because they ensure consistency in accounting and represent key interrelationships, albeit imperfectly, to provide insights.

EIA's projections are not statements of what will happen, but what might happen, given technological and demographic trends and current policies and regulations. EIA's *AEO2007* reference case is based on current laws and regulations as of October 31, 2006. Thus, it provides a policy-neutral starting point that can be used to analyze energy policy initiatives. EIA does not propose, advocate, or speculate on future legislative or regulatory changes within its reference case. Laws and regulations are generally assumed to remain as currently enacted or in force (including sunset or expiration provisions); however, the impacts of scheduled regulatory changes, when clearly defined, are reflected.

Electricity Sector Capacity, Generation, Prices and Emissions

Extending the PTC for wind-generating facilities is expected to have a moderate effect on fuel use, electricity prices, and emissions. Projections of wind capacity and the resulting impacts of the extension depend on the amount and duration of the production tax credit. With the exception of the 1.0 cent five-year extension case, all cases in this analysis lead to growth in wind capacity and generation above the level seen in the reference case. In some cases there is a slight decrease in electricity retail prices relative to the reference case; however this comes at a cost to the U.S. Treasury, which funds the credit extension.

Capacity

In the reference case, wind capacity is projected to increase from approximately 10 gigawatts in 2005 to 18 gigawatts in 2030 (Table 1). Extending the 1.9 cent production credit for five years results in an additional 6 gigawatts of wind capacity, when compared to the reference case, by 2030 (Figure 1).

A similar five-year extension of the PTC with a lower credit price of 1.5 cents per kilowatthour is also expected to increase 2030 wind capacity by nearly the same amount. However, cutting the current PTC to 1.0 cent per kilowatthour is not expected to induce incremental wind capacity over reference case levels.

A permanent extension of the full tax credit for wind plants is projected to result in about 38 additional gigawatts of wind capacity above the level seen in the reference case by 2030 (Figure 2, Table 2). Lowering the credit to 1.5 cents per kilowatthour and 1.0 cent per kilowatthour limits the 2030 capacity increases relative to the reference case to about 16 gigawatts and 6 gigawatts, respectively.

Generation by Fuel

In the reference case, coal-fired plants are expected to grow as the primary source of electricity, increasing from 50 percent of total supply in 2005 to 57 percent in 2030. Both

nuclear and natural gas plants provided 19 percent of total generation in 2005, but their 2030 shares of generation are projected to fall to 15 percent and 16 percent, respectively. While both technologies show a gradual growth in capacity over the forecast horizon, their shares decline because this growth is smaller than the corresponding increase in total electricity generation. In the reference case, wind generation is expected to more than triple over this 25-year period, although the share of total generation remains below 1 percent through 2030.

Compared to the reference case, a five-year extension of the full PTC for wind facilities increases their generation in 2030 by almost 40 percent. The 1.5 cent tax credit has a nearly identical effect. In these cases, the share of total generation from wind is approximately 1.2 percent by 2030. A five-year extension with a reduced PTC of 1 cent per kilowatthour is not expected to result in additional wind power than what is projected under business-as-usual conditions.

A permanent extension of the PTC increases wind generation in each of the credit amount cases. Compared to the reference case, a permanent extension of the current 1.9 cents per kilowatthour credit would more than triple 2030 generation from wind plants. With a similar extension and a lower PTC amount of 1.5 cents per kilowatthour, wind generation in 2030 would still more than double relative to the reference case, whereas the permanent extension of a PTC of 1.0 cent per kilowatthour would increase wind generation by about 40 percent over the reference case level in 2030. In this lowest credit amount extension case, wind generation at the end of the period is five-fold the 2005 level. The share of total electricity generation projected to come from wind facilities in 2030 with a permanent PTC extension ranges from 1 percent with a 1.0 cent per kilowatthour PTC to 3 percent with a 1.9 cent per kilowatthour credit.

In each of the PTC extension cases, total electricity sales are unchanged. Therefore, the additional generation from wind displaces generation from other technologies. In the 1.9 cent five-year extension case, the 20 additional billion kilowatthours of generation from wind facilities slightly slows nuclear and coal expansions, although there is also less electricity generated from dedicated biomass facilities. This wind expansion results in 500 fewer megawatts of biomass capacity relative to the business-as-usual forecast. In 2030, when compared to the reference case results, nuclear generation is lesser by 10 billion kilowatthours, and there is a similar effect on coal generation. In the permanent extension cases, which have greater effects on the fuel mix, most of the additional wind generation is at the expense of coal generation growth. Nearly all of the 2030 wind power production levels that are above reference case levels result in a dampening of coal generation of the same magnitude. In the 1.9 cent permanent extension case, 122 billion kilowatthours of additional wind generation is balanced by a drop of 122 billion kilowatthours in electricity generated from coal. Even in this case, however, coal generation in 2030 is 59 percent above 2005 levels.

Electricity Prices

The increase in wind generation from an extension of the PTC results in little change in electricity prices. Capital costs for wind turbines are generally higher per unit of output than capital costs for fossil technologies such as coal or natural gas. However, the

availability of the PTC offsets this increase in cost. The resulting decreases in fuel expenditures are not sufficient to have much impact on electricity prices with either a five-year or permanent extension of the PTC.

Tax Credits

The PTC results in lost revenue to the U.S. Treasury. Including facilities that begin operation between 2005 and 2008 (when the current PTC expires), the tax credits for wind projects are projected to total about 5 billion dollars in the reference case¹. As noted earlier, this estimate does not include the expected addition of facilities that might open in 2008 to take advantage of the recent one-year credit extension. The impact on tax revenues of extending the PTC depends on the length of the extension and the amount of the credit. Compared to the reference case, a five-year extension of the current credit amount (1.9 cents per kilowatt-hour) increases the tax credits by about 5 billion dollars. A similar extension with a credit of 1.0 cent per kilowatt-hour would have a minimal impact on tax revenues. Although no new wind capacity is expected to occur in this case, there are some plants expected to begin operation after the original expiration of the PTC that would be eligible to collect the payments if the deadline were extended.

A permanent extension of the PTC would encourage more wind facilities and result in larger reductions in tax payments to the treasury. With this extension, the incremental lost revenue is projected to range from 2 billion dollars with a permanent 1.0 cent per kilowatt-hour PTC extension to more than 20 billion dollars with a permanent 1.9 cent per kilowatt-hour credit extension.

Carbon Dioxide Emissions

In the reference case, electric power sector carbon dioxide (CO₂) emissions grow from 2,375 million metric tons in 2005 to 3,338 million metric tons in 2030, an increase of 41 percent. This results from greater use of fossil fuels, particularly coal. The increased wind generation induced by extending the PTC leads to slower growth in coal generation and moderately lower projected growth in CO₂ emissions. A five-year extension of the PTC would have a negligible impact on CO₂ emissions for all of the credit payments examined in this analysis.

Relative to the reference case, the expected reduction in 2030 CO₂ emissions due to a permanent extension ranges from about 0.2 percent with a 1.0 cent per kilowatt-hour PTC to about 3 percent with a 1.9 cent per kilowatt-hour PTC. However, even if the PTC were to be extended at the full credit price for wind-generated electricity, 2030 CO₂ emissions in the electric power sector would be 37 percent higher than 2005 levels, only slightly below the 41 percent growth seen in the reference case.

¹ Dollar amounts are quoted in real (not adjusted for inflation) 2006 dollars. No discount factor is applied to account for the time value of money.

Comparisons

As noted, the analyzed cases only extend the tax credit for new wind facilities. EIA has run alternate PTC extension cases in which all existing eligible technologies continue to receive their allotted credits. In a five-year full extension case, other renewable generation grows in addition to wind. Biomass, which is assumed to be open-loop and receives one-half of the full credit amount, shows strong growth, increasing in capacity by nearly 8 gigawatts. Municipal solid waste and geothermal resources also increase their electricity production, but their capacity increases by fewer than 500 megawatts. Despite the large increase in biomass power, wind growth is not dampened under the five-year full PTC extension case when compared with the exclusive credit extension. In both scenarios, most of the wind additions occur in northwestern regions of the United States, where biomass resources are limited. Thus, with a five-year extension, wind and biomass were not found to compete since the resources are in different areas. Given the renewable credit incentive, the Mid-Atlantic and other eastern regions generate additional power from biomass, while the West primarily adds new wind. The full five-year PTC extension also reduces CO₂ emissions more than the wind-only extension, although the 2030 difference is only about one percent of total emissions. The cost to the U.S. Treasury is much larger when the credit is extended for additional renewable technologies.

Uncertainty

All long-term projections engender considerable uncertainty. It is particularly difficult to foresee how existing technologies might evolve or what new technologies might emerge as market conditions change, particularly when those changes are fairly dramatic. The potential impact of high levels of wind generation on regional electricity grids is also subject to significant uncertainty. Some of these costs, such as additional reserve capacity, under-utilization of wind capacity, and reduced value of wind generated during off-peak hours, are explicitly accounted for in this analysis. Other costs such as potential need for energy storage and localized operational changes are not explicitly accounted for, but are believed at this point to be minor at the levels of wind generation projected in these scenarios.

Sincerely,

John J. Conti
Director, Office of Integrated Analysis
and Forecasting
Energy Information Administration

Enclosures

Table 1: Summary Results for a Five-Year Extension of the Production Tax Credit for Wind

	2005	2020				2030			
		Reference	PTC 1.0	PTC 1.5	PTC 1.9	Reference	PTC 1.0	PTC 1.5	PTC 1.9
Capacity (gigawatts)									
Coal Steam	314.8	353.8	353.6	352.9	352.9	465.3	465.1	463.1	465.1
Other Fossil Steam	121.3	89.3	89.9	90.2	90.0	87.5	87.4	86.9	87.4
Combined Cycle	176.6	203.9	203.8	202.8	203.1	211.6	211.7	211.2	212.0
Combustion Turbine/Diesel	133.2	127.2	126.8	127.7	127.7	155.1	154.2	157.7	155.0
Nuclear Power	100.0	111.7	111.7	111.7	111.7	112.6	113.5	111.7	111.2
Pumped Storage	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
Other	0.0	2.1	2.3	2.3	2.1	11.4	11.6	11.7	11.4
Conventional Hydropower	80.6	80.7	80.7	80.7	80.7	80.8	80.8	80.9	80.8
Geothermal	2.3	2.8	2.8	2.7	2.7	3.1	3.2	3.2	3.2
Municipal Solid Waste/Landfill Gas	3.6	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2
Wood and Other Biomass	6.5	8.3	8.2	8.1	8.1	11.0	10.7	10.6	10.5
Solar	0.6	1.6	1.6	1.6	1.6	3.5	3.5	3.3	3.4
Wind	9.6	17.8	17.8	23.6	23.8	18.0	18.0	23.6	23.8
Other Industrial Capacity ²	17.7	27.4	27.3	27.4	27.3	35.2	35.1	35.2	35.0
Total	987.6	1051.6	1051.5	1056.7	1056.7	1220.2	1219.8	1224.2	1223.9
Generation (billion kilowatthours)									
Coal	2014.6	2488.5	2485.2	2481.9	2487.0	3329.9	3327.3	3313.9	3321.8
Petroleum	121.9	103.0	103.0	102.7	102.2	107.2	107.2	106.8	106.5
Natural Gas	751.7	1060.3	1061.4	1042.6	1042.1	936.6	936.0	940.8	936.7
Nuclear Power	780.5	885.2	885.3	885.6	885.5	895.7	902.6	889.8	885.9
Pumped Storage/Other	13.0	7.8	7.8	7.8	7.8	8.5	8.5	8.5	8.5

Table 1: Summary Results for a Five-Year Extension of the Production Tax Credit for Wind (cont'd)

	2005	2020				2030			
		Reference	PTC 1.0	PTC 1.5	PTC 1.9	Reference	PTC 1.0	PTC 1.5	PTC 1.9
Conventional Hydropower	265.1	307.0	307.0	307.0	307.0	307.7	307.7	308.2	307.7
Geothermal	15.1	19.8	19.9	19.5	19.4	22.7	23.1	23.2	23.1
Municipal Solid Waste/Landfill Gas	23.3	27.2	27.2	27.2	27.2	27.7	27.7	27.7	27.7
Dedicated Biomass	33.3	47.8	47.5	46.5	46.6	67.5	64.7	64.2	63.4
Biomass Co-Firing	4.5	35.9	39.0	41.9	38.8	34.4	35.2	36.1	38.0
Solar ¹	0.9	3.3	3.4	3.3	3.4	7.2	7.1	6.8	6.9
Wind	14.6	51.4	51.4	72.2	72.4	51.9	51.9	72.2	72.4
Renewable Total	356.8	492.3	495.3	517.7	514.8	519.0	517.4	538.4	539.2
Total (All Generation)	4038.4	5037.2	5038.0	5038.2	5039.4	5796.9	5799.1	5798.2	5798.7
Costs to Government of Wind PTC (billion 2006 dollars)									
Cumulative PTC payments	0.02	4.59	4.83	8.17	9.09	4.59	4.84	8.17	9.17
Electricity Prices and Sales									
Electricity Sales (billion kilowatthours)	3660	4528	4529	4529	4530	5168	5170	5170	5172
Retail Electricity Price (2005 cents/kwh)	8.10	7.90	7.90	7.89	7.88	8.05	8.03	8.04	8.03
Electric Sector Emissions									
Nitrogen Oxides (million short tons)	3.6	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Sulfur Dioxide (million short tons)	10.2	3.9	3.9	4.0	3.9	3.6	3.7	3.6	3.7
Mercury (tons)	51.3	19.2	19.5	19.3	20.1	15.5	15.6	15.7	16.0
Carbon Dioxide (million metric tons)	2375.0	2831.7	2827.8	2818.9	2822.6	3338.0	3331.9	3323.5	3324.0
Fuel Prices									
Natural Gas Wellhead Price (2005 dollars per thousand cubic feet)	7.51	5.22	5.22	5.20	5.19	5.98	5.91	5.92	5.91
Coal Minemouth Price (2005 dollars per ton)	23.34	21.58	21.62	21.52	21.54	22.60	22.63	22.63	22.59
¹ Includes solar thermal power, utility-owned photovoltaics, and distributed photovoltaics ² Includes capacity in the industry sector fueled by petroleum, natural gas or other gaseous fuels. ³ Includes other gaseous fuels and other sources of generation.									
Source: EIA Office of Integrated Analysis and Forecasting. National Energy Modeling System runs AEO2007.D112106A, PTC10X05W.D041307A, PTC15X05W.D041307A, PTC19X05W.D041707A.									

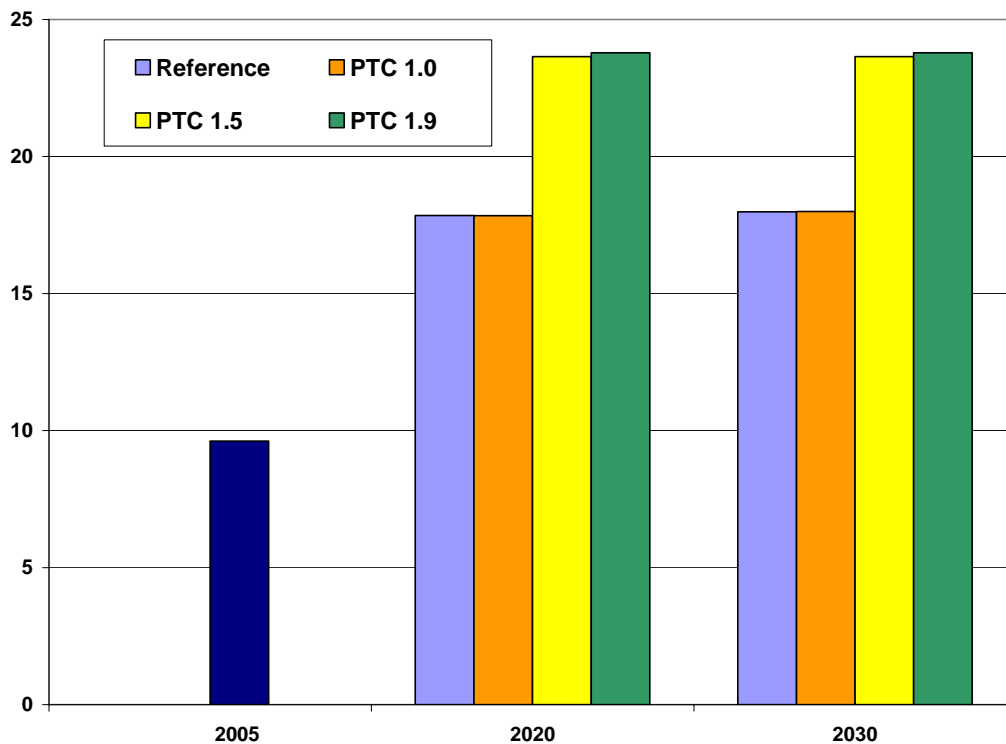
Table 2: Summary Results for a Permanent Extension of the Production Tax Credit for Wind

	2005	2020				2030			
		Reference	PTC 1.0	PTC 1.5	PTC 1.9	Reference	PTC 1.0	PTC 1.5	PTC 1.9
Capacity (gigawatts)									
Coal Steam	314.8	353.8	353.8	352.2	348.4	465.3	467.7	457.9	448.7
Other Fossil Steam	121.3	89.3	88.5	89.0	89.4	87.5	85.7	85.8	86.4
Combined Cycle	176.6	203.9	201.9	202.1	203.0	211.6	211.0	212.4	213.7
Combustion Turbine/Diesel	133.2	127.2	127.2	127.3	127.3	155.1	158.2	156.9	161.8
Nuclear Power	100.0	111.7	111.7	111.7	111.7	112.6	111.9	111.3	110.6
Pumped Storage	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
Other	0.0	2.1	2.3	2.3	2.2	11.4	12.9	13.0	12.0
Conventional Hydropower	80.6	80.7	80.7	80.8	80.8	80.8	81.0	81.0	80.8
Geothermal	2.3	2.8	2.7	2.7	2.7	3.1	3.3	3.2	3.2
Municipal Solid Waste/Landfill Gas	3.6	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2
Wood and Other Biomass	6.5	8.3	8.2	8.1	8.2	11.0	10.5	10.5	10.6
Solar	0.6	1.6	1.6	1.6	1.6	3.5	3.3	3.5	3.1
Wind	9.6	17.8	22.3	29.5	40.3	18.0	23.9	34.4	56.3
Other Industrial Capacity ²	17.7	27.4	27.4	27.4	27.3	35.2	35.3	35.3	35.1
Total	987.6	1051.6	1053.3	1059.6	1067.8	1220.2	1229.7	1230.1	1247.4
Generation (billion kilowatthours)									
Coal	2014.6	2488.5	2487.3	2475.5	2441.8	3329.9	3341.7	3273.6	3208.0
Petroleum	121.9	103.0	102.6	102.6	102.0	107.2	107.0	106.7	106.4
Natural Gas	751.7	1060.3	1043.4	1029.0	1031.8	936.6	913.1	947.1	954.4
Nuclear Power	780.5	885.2	885.4	885.3	885.3	895.7	889.4	886.2	881.0
Pumped Storage/Other	13.0	7.8	7.8	7.8	7.7	8.5	8.5	8.5	8.4

Table 2: Summary Results for a Permanent Extension of the Production Tax Credit for Wind (cont'd)

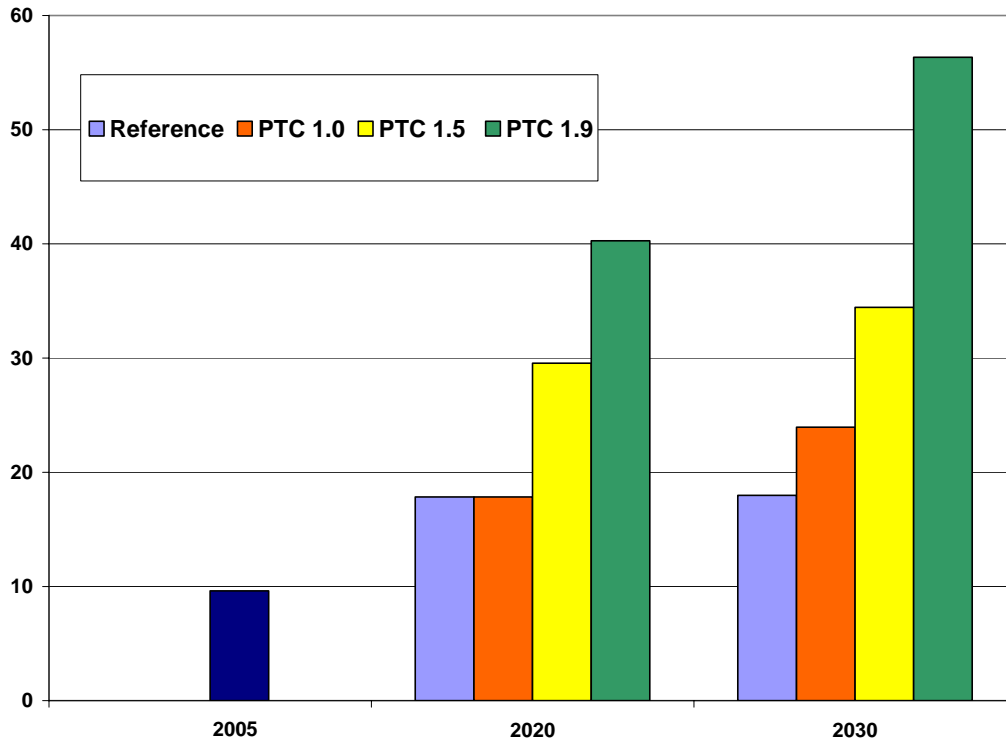
	2005	2020				2030			
		Reference	PTC 1.0	PTC 1.5	PTC 1.9	Reference	PTC 1.0	PTC 1.5	PTC 1.9
Conventional Hydropower	265.1	307.0	307.0	307.2	307.2	307.7	308.6	308.7	307.9
Geothermal	15.1	19.8	19.2	19.3	19.3	22.7	23.5	23.1	23.1
Municipal Solid Waste/Landfill Gas	23.3	27.2	27.2	27.2	27.1	27.7	27.3	27.5	27.3
Dedicated Biomass	33.3	47.8	47.0	46.5	47.0	67.5	62.6	63.2	64.5
Biomass Co-Firing	4.5	35.9	40.4	43.4	43.9	34.4	35.7	36.3	34.9
Solar ¹	0.9	3.3	3.4	3.4	3.3	7.2	6.8	7.2	6.4
Wind	14.6	51.4	67.7	91.3	122.9	51.9	73.0	106.1	172.6
Renewable Total	356.8	492.3	511.8	538.1	570.7	519.0	537.5	572.1	636.6
Total (All Generation)	4038.4	5037.2	5038.2	5038.4	5039.1	5796.9	5797.3	5794.3	5794.9
Costs to Government of Wind PTC (billion 2006 dollars)									
Cumulative PTC payments	0.02	4.59	5.38	9.68	11.79	4.59	7.03	12.36	26.20
Electricity Prices and Sales									
Electricity Sales (billion kilowatthours)	3660	4528	4529	4529	4531	5168	5168	5166	5168
Retail Electricity Price (2005 cents/kwh)	8.10	7.90	7.90	7.88	7.87	8.05	8.05	8.06	8.06
Electric Sector Emissions									
Nitrogen Oxides (million short tons)	3.6	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Sulfur Dioxide (million short tons)	10.2	3.9	3.9	3.9	4.0	3.6	3.6	3.7	3.6
Mercury (tons)	51.3	19.2	20.0	19.9	19.7	15.5	15.9	16.0	15.9
Carbon Dioxide (million metric tons)	2375.0	2831.7	2822.8	2811.6	2782.1	3338.0	3330.0	3298.7	3249.6
Fuel Prices									
Natural Gas Wellhead Price (2005 dollars per thousand cubic feet)	7.51	5.22	5.19	5.17	5.17	5.98	5.87	5.93	5.96
Coal Minemouth Price (2005 dollars per ton)	23.34	21.58	21.70	21.54	21.40	22.60	22.66	22.61	22.41
¹ Includes solar thermal power, utility-owned photovoltaics, and distributed photovoltaics ² Includes capacity in the industry sector fueled by petroleum, natural gas or other gaseous fuels. ³ Includes other gaseous fuels and other sources of generation.									
Source: EIA Office of Integrated Analysis and Forecasting. National Energy Modeling System runs AEO2007.D112106A, PTC10XALW.D041307A, PTC15XALW.D041307A, PTC19XALW.D041307A.									

**Figure 1: Wind Capacity in Reference and Five-Year PTC Extension Cases
(Gigawatts)**



Source: National Energy Modeling Systems runs AEO2007.D112106A, PTC10X05W.D041307A, PTC15X05W.D041307A, and PTC19X05W.D041707A.

**Figure 2: Wind Capacity in Reference and Permanent PTC Extension Cases
(Gigawatts)**



Source: National Energy Modeling System runs AEO2007.D112106A, PTC10XALW.D041307A, PTC15XALW.D041307A, and PTC19XALW.D041307A.