

**APPENDIX 8A. NIA SENSITIVITY ANALYSIS FOR ALTERNATIVE  
PRODUCT PRICE TREND SCENARIOS**

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## APPENDIX 8A. NIA SENSITIVITY ANALYSIS FOR ALTERNATIVE PRODUCT PRICE TREND SCENARIOS

### 8A.1 INTRODUCTION

DOE used a constant price assumption for the default forecast in the NIA described in Chapter 10. In order to investigate the impact of different product price forecasts on the consumer net present value (NPV) for the considered CSLs for computer room air-conditioners, DOE also considered two alternative price trends for a sensitivity analysis. This appendix describes the alternative price trends and compares NPV results for these scenarios with the default forecast.

### 8A.2 ALTERNATIVE COMPUTER ROOM AIR-CONDITIONER PRICE TREND SCENARIOS

DOE considered two alternative price trends for a sensitivity analysis. One of these used an exponential fit on the deflated Producer Price Index (PPI) for all other miscellaneous refrigeration and air-conditioning equipments, and the other is based on the “deflator— other durables excluding medical” that was forecasted for EIA’s *Annual Energy Outlook 2011* (AEO2011).

#### 8A.2.1 Exponential Fit Approach (High Price Scenario)

For this scenario, DOE used an inflation-adjusted all other miscellaneous refrigeration and air-conditioning equipment PPI from 2001-2010 to fit an exponential model with *year* as the explanatory variable. DOE obtained historical Producer Price Index (PPI) data all other miscellaneous refrigeration and air-conditioning equipment spanning the time period 2001-2010 from the Bureau of Labor Statistics’ (BLS).<sup>a</sup> The PPI data reflect nominal prices, adjusted for product quality changes. An inflation-adjusted (deflated) price index for all other miscellaneous refrigeration and air-conditioning equipment was calculated by dividing the PPI series by the Gross Domestic Product Chained Price Index. In this case, the exponential function takes the form of:

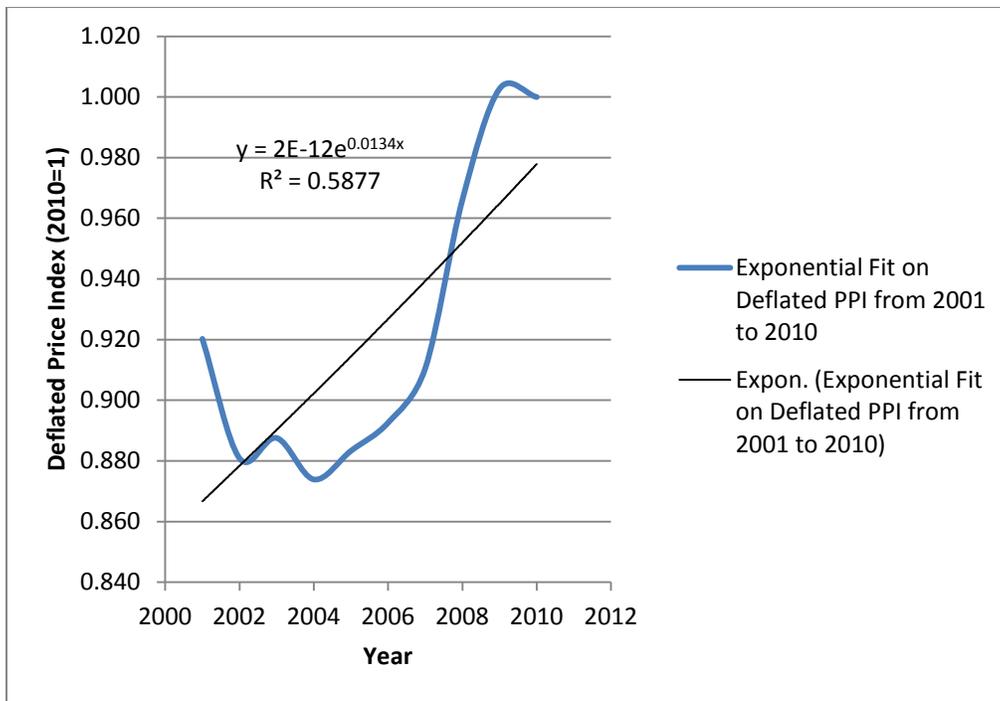
$$Y = a \cdot e^{bX}$$

where Y is the computer room air-conditioner price index, X is the time variable, *a* is the constant and *b* is the slope parameter of the time variable.

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<sup>a</sup> Series ID PCU3334153334159; <http://www.bls.gov/ppi/>

To estimate these exponential parameters, a least-square fit was performed on the inflation-adjusted computer room air-conditioner price index versus *year* from 2001 to 2010. See Figure 8A.2.1.



**Figure 8A.2.1 Relative Price of Computer Room Air-Conditioners versus Year, with Exponential Fit**

The regression performed as an exponential trend line fit results in an R-square of 0.588, which indicates a moderate fit to the data. The final estimated exponential function is:

$$Y = 1.90 \times 10^{(-12)} \cdot e^{0.0134X}$$

DOE then derived a price factor index for this scenario, with 2011 equal to 1, to forecast prices in each future year in the analysis period considered in the NIA. The index value in a given year is a function of the exponential parameter and *year*.

### 8A.2.2 Annual Energy Outlook 2011 Price Forecast (Low Price Scenario)

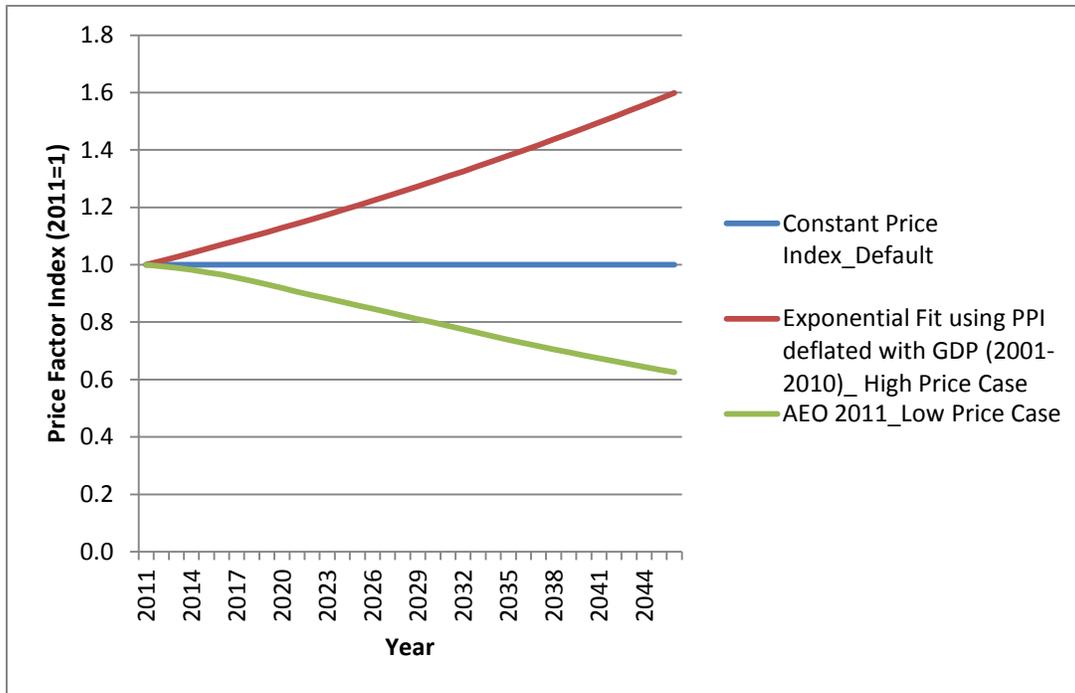
DOE also examined a forecast based on the “deflator— other durables excluding medical” that was forecasted for *AEO2011* out to 2035. This index is the most disaggregated category that includes computer room air-conditioners. To develop an inflation-adjusted index, DOE normalized the above index with the “chained price index—gross domestic product” forecasted for *AEO2011*. To extend the price index beyond 2035, DOE used the average annual price growth rate in 2026 to 2035.

### 8A.2.3 Summary

Table 8A.2.1 shows the summary of the average annual rates of changes for the product price index in each scenario. Figure 8A.2.2 shows the resulting price trends.

**Table 8A.2.1 Price Trend Sensitivities**

Sensitivity	Price Trend	Average Annual rate of change %
Medium (Default)	Constant Price Projection	0.00
Low Price Scenario	AEO2011-- “deflator— other durables excluding medical”	-1.34
High Price Scenario	Exponential Fit using data from 2001 to 2010	1.35



**Figure 8A.2.2 Computer Room Air-Conditioner Price Forecast Indexes**

### 8A.3 NPV RESULTS BY ALTERNATIVE PRICE TREND SCENARIO

Table 8A.3.1. Summary of Cumulative Net Present Value for Computer Room Air Conditioners: Low Price Scenario (Seven Percent Discount Rate)

Equipment Class	Net Present Value (Billion 2011\$)			
	Efficiency Level 1	Efficiency Level 2	Efficiency Level 3	Efficiency Level 4
Air conditioners, air cooled, <65,000 Btu/h	\$ 0.0005	\$ 0.000	\$ (0.003)	\$ (0.011)
Air conditioners, air cooled, ≥65,000 to <240,000 Btu/h	\$ 0.01	\$ 0.11	\$ 0.32	\$ 0.52
Air conditioners, air cooled, ≥240,000 Btu/h	\$ 0.01	\$ 0.08	\$ 0.23	\$ 0.39
Air conditioners, water cooled, <65,000 Btu/h	\$ 0.001	\$ 0.003	\$ 0.005	\$ 0.008
Air conditioners, water cooled, ≥65,000 to <240,000 Btu/h	\$ (0.004)	\$ (0.038)	\$ (0.131)	\$ (0.310)
Air conditioners, water cooled, ≥240,000 Btu/h	\$ 0.002	\$ (0.015)	\$ (0.072)	\$ (0.190)
Air conditioners, water cooled with fluid economizers, <65,000 Btu/h	\$ 0.001	\$ 0.002	\$ 0.003	\$ 0.004
Air conditioners, water cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.06)	\$ (0.17)	\$ (0.35)
Air conditioners, water cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.004)	\$ (0.018)	\$ (0.050)	\$ (0.107)
Air conditioners, glycol cooled, <65,000 Btu/h	\$ 0.001	\$ 0.003	\$ 0.005	\$ 0.007
Air conditioners, glycol cooled, ≥65,000 to <240,000 Btu/h	\$ 0.001	\$ (0.029)	\$ (0.122)	\$ (0.308)
Air conditioners, glycol cooled, ≥240,000 Btu/h	\$ 0.004	\$ (0.008)	\$ (0.056)	\$ (0.160)
Air conditioners, glycol cooled with fluid economizers, <65,000 Btu/h	\$ 0.001	\$ 0.003	\$ 0.005	\$ 0.007
Air conditioners, glycol cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.06)	\$ (0.20)	\$ (0.44)
Air conditioners, glycol cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.002)	\$ (0.023)	\$ (0.08)	\$ (0.19)

\* Numbers in parentheses indicate negative NPV.

**Table 8A.3.2. Summary of Cumulative Net Present Value for Computer Room Air Conditioners: Low Price Scenario (Three Percent Discount Rate)**

Equipment Class	Net Present Value (Billion 2011\$)			
	Efficiency Level 1	Efficiency Level 2	Efficiency Level 3	Efficiency Level 4
Air conditioners, air cooled, <65,000 Btu/h	\$ 0.0018	\$ 0.004	\$ 0.002	\$ (0.009)
Air conditioners, air cooled, ≥65,000 to <240,000 Btu/h	\$ 0.03	\$ 0.28	\$ 0.84	\$ 1.41
Air conditioners, air cooled, ≥240,000 Btu/h	\$ 0.02	\$ 0.18	\$ 0.56	\$ 0.98
Air conditioners, water cooled, <65,000 Btu/h	\$ 0.002	\$ 0.006	\$ 0.011	\$ 0.015
Air conditioners, water cooled, ≥65,000 to <240,000 Btu/h	\$ 0.002	\$ (0.048)	\$ (0.206)	\$ (0.530)
Air conditioners, water cooled, ≥240,000 Btu/h	\$ 0.012	\$ (0.005)	\$ (0.097)	\$ (0.305)
Air conditioners, water cooled with fluid economizers, <65,000 Btu/h	\$ 0.001	\$ 0.003	\$ 0.006	\$ 0.008
Air conditioners, water cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.02)	\$ (0.11)	\$ (0.30)	\$ (0.64)
Air conditioners, water cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.005)	\$ (0.030)	\$ (0.088)	\$ (0.194)
Air conditioners, glycol cooled, <65,000 Btu/h	\$ 0.002	\$ 0.005	\$ 0.010	\$ 0.014
Air conditioners, glycol cooled, ≥65,000 to <240,000 Btu/h	\$ 0.01	\$ (0.03)	\$ (0.18)	\$ (0.52)
Air conditioners, glycol cooled, ≥240,000 Btu/h	\$ 0.016	\$ 0.006	\$ (0.072)	\$ (0.259)
Air conditioners, glycol cooled with fluid economizers, <65,000 Btu/h	\$ 0.002	\$ 0.005	\$ 0.009	\$ 0.013
Air conditioners, glycol cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.10)	\$ (0.34)	\$ (0.80)
Air conditioners, glycol cooled with fluid economizers, ≥240,000 Btu/h	\$ 0.002	\$ (0.030)	\$ (0.13)	\$ (0.33)

\* Numbers in parentheses indicate negative NPV.

**Table 8A.3.3. Summary of Cumulative Net Present Value for Computer Room Air Conditioners: High Price Scenario (Seven Percent Discount Rate)**

Equipment Class	Net Present Value (Billion 2011\$)			
	Efficiency Level 1	Efficiency Level 2	Efficiency Level 3	Efficiency Level 4
Air conditioners, air cooled, <65,000 Btu/h	\$ (0.0001)	\$ (0.002)	\$ (0.011)	\$ (0.027)
Air conditioners, air cooled, ≥65,000 to <240,000 Btu/h	\$ 0.01	\$ 0.09	\$ 0.23	\$ 0.33
Air conditioners, air cooled, ≥240,000 Btu/h	\$ 0.01	\$ 0.07	\$ 0.20	\$ 0.33
Air conditioners, water cooled, <65,000 Btu/h	\$ 0.002	\$ 0.004	\$ 0.007	\$ 0.010
Air conditioners, water cooled, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.08)	\$ (0.22)	\$ (0.48)
Air conditioners, water cooled, ≥240,000 Btu/h	\$ (0.005)	\$ (0.042)	\$ (0.135)	\$ (0.311)
Air conditioners, water cooled with fluid economizers, <65,000 Btu/h	\$ 0.001	\$ 0.002	\$ 0.004	\$ 0.006
Air conditioners, water cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.02)	\$ (0.10)	\$ (0.25)	\$ (0.50)
Air conditioners, water cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.01)	\$ (0.03)	\$ (0.08)	\$ (0.16)
Air conditioners, glycol cooled, <65,000 Btu/h	\$ 0.001	\$ 0.004	\$ 0.007	\$ 0.009
Air conditioners, glycol cooled, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.07)	\$ (0.21)	\$ (0.47)
Air conditioners, glycol cooled, ≥240,000 Btu/h	\$ (0.002)	\$ (0.030)	\$ (0.108)	\$ (0.260)
Air conditioners, glycol cooled with fluid economizers, <65,000 Btu/h	\$ 0.001	\$ 0.004	\$ 0.006	\$ 0.009
Air conditioners, glycol cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.02)	\$ (0.11)	\$ (0.30)	\$ (0.65)
Air conditioners, glycol cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.01)	\$ (0.04)	\$ (0.13)	\$ (0.28)

\* Numbers in parentheses indicate negative NPV.

**Table 8A.3.4. Summary of Cumulative Net Present Value for Computer Room Air Conditioners: High Price Scenario (Three Percent Discount Rate)**

Equipment Class	Net Present Value (Billion 2011\$)			
	Efficiency Level 1	Efficiency Level 2	Efficiency Level 3	Efficiency Level 4
Air conditioners, air cooled, <65,000 Btu/h	\$ 0.0006	\$ (0.001)	\$ (0.014)	\$ (0.040)
Air conditioners, air cooled, ≥65,000 to <240,000 Btu/h	\$ 0.03	\$ 0.23	\$ 0.66	\$ 1.02
Air conditioners, air cooled, ≥240,000 Btu/h	\$ 0.02	\$ 0.17	\$ 0.50	\$ 0.85
Air conditioners, water cooled, <65,000 Btu/h	\$ 0.003	\$ 0.008	\$ 0.014	\$ 0.020
Air conditioners, water cooled, ≥65,000 to <240,000 Btu/h	\$ (0.02)	\$ (0.12)	\$ (0.39)	\$ (0.88)
Air conditioners, water cooled, ≥240,000 Btu/h	\$ (0.003)	\$ (0.061)	\$ (0.228)	\$ (0.558)
Air conditioners, water cooled with fluid economizers, <65,000 Btu/h	\$ 0.002	\$ 0.004	\$ 0.008	\$ 0.011
Air conditioners, water cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.04)	\$ (0.18)	\$ (0.46)	\$ (0.95)
Air conditioners, water cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.01)	\$ (0.05)	\$ (0.14)	\$ (0.30)
Air conditioners, glycol cooled, <65,000 Btu/h	\$ 0.003	\$ 0.007	\$ 0.013	\$ 0.019
Air conditioners, glycol cooled, ≥65,000 to <240,000 Btu/h	\$ (0.01)	\$ (0.10)	\$ (0.37)	\$ (0.87)
Air conditioners, glycol cooled, ≥240,000 Btu/h	\$ 0.004	\$ (0.039)	\$ (0.180)	\$ (0.468)
Air conditioners, glycol cooled with fluid economizers, <65,000 Btu/h	\$ 0.003	\$ 0.007	\$ 0.013	\$ 0.018
Air conditioners, glycol cooled with fluid economizers, ≥65,000 to <240,000 Btu/h	\$ (0.03)	\$ (0.19)	\$ (0.56)	\$ (1.23)
Air conditioners, glycol cooled with fluid economizers, ≥240,000 Btu/h	\$ (0.01)	\$ (0.07)	\$ (0.23)	\$ (0.53)

\* Numbers in parentheses indicate negative NPV.