

**APPENDIX 8-A. USER INSTRUCTIONS FOR THE LIFE-CYCLE COST ANALYSIS
SPREADSHEET FOR FURNACE FANS**

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APPENDIX 8-A. USER INSTRUCTIONS FOR THE LIFE-CYCLE COST ANALYSIS SPREADSHEET FOR FURNACE FANS

8-A.1 USER INSTRUCTIONS

The results obtained in this analysis can be examined and reproduced using the Microsoft Excel spreadsheets available on the Department of Energy's (DOE's) furnace fan rulemaking website:

http://www1.eere.energy.gov/buildings/appliance_standards/residential/furnace_fans.html. From that page, follow the links to the notice of Preliminary Analysis rulemaking phase and then to Analytical Tools.

8-A.2 STARTUP

DOE's spreadsheet enables users to perform life-cycle cost (LCC) and payback period (PBP) analyses for each product class. One spreadsheet exists for all nine furnace fan product classes.

To examine the spreadsheets, DOE assumes that the user has access to a personal computer with a hardware configuration capable of running Windows XP or later. All LCC spreadsheets require Microsoft Excel 2003 or later installed under the Windows operating system. Because certain variables inside the spreadsheets are defined as distributions, a copy of Crystal Ball (a commercially available add-on program) is required to view them.

8-A.3 DESCRIPTION OF LIFE-CYCLE COST WORKSHEETS

For all of the furnace fan product classes, DOE created a single spreadsheet containing a collection of worksheets. Each worksheet represents a conceptual component within the LCC calculation. To facilitate navigability and identify how worksheets are related, each worksheet contains an area on the extreme left showing variables imported to and exported from the current worksheet. The LCC spreadsheet contains the following worksheets:

Summary	The <i>Summary</i> worksheet contains a user interface to manipulate energy price trends and start year inputs, and to run the Crystal Ball simulation. LCC and PBP simulation results for each efficiency level are also displayed here.
LCC&PB Calcs	The <i>LCC&PB Calcs</i> worksheet shows LCC calculation results for different efficiency levels for a single Residential Energy Consumption Survey (RECS) household. ¹ During a Crystal Ball simulation, the spreadsheet records the LCC and PBP values for every sampled household.
Rebuttable Payback	The <i>Rebuttable Payback</i> worksheet contains the total and incremental manufacturer costs, retail prices, the installation costs, the repair and maintenance costs, energy use calculations, and the simple PBP calculations for each efficiency level. DOE's furnace fan test procedure is used to

calculate parameters used in energy use calculations.

Equip Price	The <i>Equip Price</i> worksheet calculates retail price values used as inputs in the LCC calculations in the <i>Summary</i> worksheet. DOE applied baseline and incremental markups to calculate final retail prices. DOE calculated the markups differently for replacement units and new units.
Installation Cost	The <i>Installation Cost</i> worksheet provides the weighted average installation cost for each design option. These results are used to calculate the total installed prices of the design options.
Maintenance and Repair Cost	The <i>Maintenance and Repair Cost</i> worksheet provides the maintenance and repair costs for each design option. These results are used to determine operating costs for the design options.
Labor Costs	The <i>Labor Cost</i> worksheet provides the labor cost by region as used to determine the installation and repair/maintenance costs.
RECS Sample	The <i>RECS</i> worksheet contains the RECS 2005 household data for each product class. During a Crystal Ball simulation, DOE uses these household characteristics to determine the analysis parameters.
Energy Use	The <i>Energy Use</i> worksheet calculates annual energy use by fuel type, depending on product class. The annual energy use calculations for each design option are inputs to the <i>LCC&PB Calcs</i> worksheet to calculate the annual operating cost of the LCC.
Static pressure Studies	The <i>Static Pressure Studies</i> worksheet shows the data from all reference used to calculate the external static pressure conditions for each household in the furnace fan sample.
Base Case Fan Efficiency	The <i>Base Case</i> worksheet determines the efficiency level of the base case units in 2018.
Energy Price	The <i>Energy Price</i> worksheet shows the estimated monthly natural gas, electricity, and oil prices.
Energy Price Data	The <i>Energy Price Data</i> worksheet shows the annual series of state level energy price data for all fuel types.
Energy Price Trends	The <i>Energy Price Trends</i> worksheet shows the future price trends of the different heating fuels. DOE used energy price data and forecasts from the Energy Information Administration's (EIA's) Annual Energy Outlook 2012 for the period until 2035 and extrapolated beyond 2035. ²

Discount Rate	The <i>Discount Rate</i> worksheet contains the distributions of discount rates for replacement and new units.
Lifetime	The <i>Lifetime</i> worksheet contains the distribution of lifetimes for equipment of that product class.
Furnace & AC Specs	The <i>Furnace and AC</i> worksheet contains furnace and AC parameters data used in the analysis.
Models Directory	The <i>Models Directory</i> worksheet includes characteristics of the furnace fan products used in the analysis.
AFUE and SEER (Existing)	The <i>Existing AFUE and SEER</i> worksheet includes the furnace and air conditioning efficiency for all years during the period 1966-2005.
Energy Use Adjustment Factors	The <i>Energy Use Adjustment Factors</i> worksheet contains adjustment factors for normal heating degree days and cooling degree days, as well as building shell efficiency index.
Census Population Data	The <i>Census Population Data</i> worksheet contains the Census estimated housing units by State.
Weather Data	The <i>Weather Data</i> worksheet contains heating degree days, cooling degree days, heating and cooling outdoor design temperature, and annual mean temperature by weather station.
Shipments	The <i>Shipments</i> worksheet contains historical furnace shipments by State by product class.
Forecast Cells	The <i>Forecast Cells</i> worksheet contains the outcome of the Monte Carlo simulations for the sample of 10,000 households for many parameters used in the analysis and the documentation.
NIA Inputs	The <i>NIA Inputs</i> worksheet contains intermediate inputs used for other DOE analyses.
TSD Tables	The <i>TSD Tables</i> worksheet contains the tables generated for use in the documentation describing the LCC Analysis.
TSD Ch.8 (Figures)	The <i>TSD Ch.8 (Figures)</i> worksheet contains the Figures generated for use in the documentation describing the LCC Analysis results in Ch.8.
Definitions	The <i>Definitions</i> worksheet contains variable definitions used in the analysis.

8-A.4 BASIC INSTRUCTIONS FOR OPERATING THE LIFE-CYCLE COST SPREADSHEETS

Basic instructions for operating the LCC spreadsheet are as follows:

1. Once the LCC spreadsheet has been downloaded, open the file using Excel. Click “Enable Macro” when prompted and then click on the tab for the *Summary* worksheet.
2. Use Excel's View/Zoom commands at the top menu bar to change the size of the display to fit your monitor.
3. The user can change the parameters listed under USER OPTIONS on the *Summary* worksheet. There are three drop-down boxes and one command button. The default parameters are:
 - a. Energy Price Trend: Defaults to “AEO 2012 - Reference Case.” To change the input, use the drop-down menu and select the desired trend (Reference, Low, or High).
 - b. Start Year: Defaults to “2018.” To change the value, use the drop-down menu and select the desired year.
 - c. # of Trials: Defaults to “10,000.” To change the value, use the drop-down menu and select the desired number of trials (1,000, 2,000, 3,000, 5,000, or 10,000).
 - d. Learning Curve: Defaults to “No Learning.” To change the value, use the drop-down menu.
4. To run the Crystal Ball simulation, click the “run” button (you must re-run after changing any parameters). The spreadsheet will then be minimized. You can monitor the progress of the simulation by watching the count of iterations at the left bottom corner. When the simulation is finished, the worksheet named *Summary* will reappear with the results.

REFERENCES

1. U.S. Department of Energy - Energy Information Administration, *Residential Energy Consumption Survey: 2005 Public Use Data Files*, 2005.
<<http://www.eia.doe.gov/emeu/recs/recspubuse05/pubuse05.html>>
2. Energy Information Administration, *Annual Energy Outlook 2012 with Projections to 2035*, 2012. Washington, DC. Report No. DOE/EIA-0383(2012).
<<http://www.eia.doe.gov/oiaf/aeo/>>