APPENDIX 8-A. USER INSTRUCTIONS FOR LIFE-CYCLE COST AND PAYBACK PERIOD SPREADSHEETS

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APPENDIX 8-A. USER INSTRUCTIONS FOR LIFE-CYCLE COST AND PAYBACK PERIOD SPREADSHEETS

To execute the life-cycle cost (LCC) spreadsheet, it is necessary for the user to have the appropriate hardware and software tools. The U.S. Department of Energy (DOE) assumed the user has a reasonably current computer operating under the Windows operating system. The development team uses relatively new systems and has not defined the minimum system requirements. At a minimum, users need Microsoft Excel to execute the spreadsheet. For full functionality in running Monte Carlo simulations, users will need a copy of a spreadsheet add-in called Crystal Ball, in addition to Excel. Without Crystal Ball, one can still use the LCC spreadsheet model, but will not be able to examine inputs and outputs as distributions. Approximate results are provided through a sample calculation that uses average values for the inputs and outputs, as displayed in the "Summary" worksheet.

8-A.1   STARTUP

The LCC spreadsheet is a stored Excel file. It can be found on the DOE website at http://www1.eere.energy.gov/buildings/appliance_standards/commercial/electric_motors.html. Open the file. (Each computer system will have a unique setup for loading a file. Users should refer to their software manuals if they have problems loading the spreadsheet file.) For users new to Excel and/or Crystal Ball, section 8.8.2 contains basic instructions for operating the LCC spreadsheets.

8-A.1.1   Electric Motors Worksheet Overview

LCC spreadsheet for electric motors contains the following worksheets:

Summary Results

This worksheet contains the input selections and the summary results tables of installed price, energy use, operating costs, LCC, and payback.

The left-hand section of the worksheet, controlling the Monte Carlo simulation, provides a means to change the user and simulation options. Simulation options are used to set the electricity price trend and the number of trials for the Monte Carlo simulation. In addition, the user may select among several sensitivity scenarios, including varying the equipment price, retail discount factor, whether the calculations consider the effects of the cubic relation between speed and power requirement (RPM effect).

The right-hand section of the worksheet summarizes the mean LCC and payback period (PBP) values from the distribution results produced by the simulation. This is a reporting step – values are not automatically updated. The results presented by DOE on this sheet were calculated using the default input values for electricity price trend, equipment price, retail discount factor, and no RPM effect.

LCC and Payback Calc (Life-Cycle Cost and Payback Calculation)

The spreadsheet reports the results of the calculation for the example scenario on the Summary worksheet. This example scenario allows users to produce provisional answers without performing a Monte Carlo simulation. The Summary worksheet of the LCC spreadsheet shows the results from this worksheet.

Definitions

This worksheet contains values used to populate the spreadsheet's form elements.

Rebuttable Payback

This worksheet calculates and presents the rebuttable presumption payback period for each of the eight representative units.

Energy Use

This worksheet calculates the annual electricity use of the representative equipment classes.

Equipment Price

This worksheet calculates the retail equipment price and total installed cost inputs for each representative unit. Inputs are derived from the baseline and incremental manufacturer costs of the engineering spreadsheet.

Sectors and Applications

This worksheet calculates the input data regarding sector, application, hours of operation, and motor loading for each representative unit.

Energy Price

This worksheet calculates retail electricity price distribution input data for industrial, commercial, and agricultural sectors.

Energy Price Trend

This worksheet contains the price trends of electricity; this trend represents the growth rate of electricity prices relative to the price in 2010. DOE took price data and forecasts from the DOE Energy Information Administration (EIA)'s *Annual Energy Outlook 2011(AEO 2011)* and the American Recovery and Reinvestment Act AEO-release for the period up to year 2035. To estimate the trend after 2035, DOE followed past guidelines provided to the Federal Energy

Management Program by EIA and used the average rate of change during 2025–2035 for electricity prices.

Discount Rate

This worksheet contains the discount rate analysis.

Lifetime

This worksheet contains the distributions of the age (in years) for each representative unit which equipment is retired from service. Motor lifetime is, in part, a function of the hours of operation.

Base Case Eff Dist (Base Case Efficiency Distribution)

Contains market efficiency distribution in the year the standard takes effect.

Forecast Cells

This worksheet contains the statistical results from the most recent simulation.

8-A.2 BASIC INSTRUCTIONS FOR OPERATING THE LIFE-CYCLE COST SPREADSHEETS

1. Once you have downloaded the LCC file from the Web, open the file using Excel. At the bottom, click on the tab for sheet "Summary."
2. Use Excel's View/Zoom commands at the top menu bar to change the size of the display to make it fit your monitor.
3. You can interact with the spreadsheet by clicking choices or entering data using the graphical interface that comes with the spreadsheet. Select choices from the various user-selectable options.
4. Click the "Run" button to run the simulation using DOE's parameters.

To produce custom sensitivity results using directly Crystal Ball, select *Run* from the *Run* menu (on the menu bar). To make basic changes in the *Run* sequence, including altering the number of trials, select *Run Preferences* from the *Run* menu. After each simulation run, the user needs to select *Reset* (also from the *Run* menu) before *Run* can be selected again. Once Crystal Ball has completed its run sequence, it will produce a series of distributions. Using the menu bars on the distribution results, it is possible to obtain further statistical information. The time taken to complete a run sequence can be reduced by minimizing the Crystal Ball window in Excel. A step-by-step summary of the procedure for running a distribution analysis is outlined below:

1. Find the Crystal Ball toolbar (at top of screen).
2. Click on *Run* from the menu bar.

3. Select *Run Preferences* and choose either Monte Carlo or Latin Hypercube.[a] Select number of Trials (DOE suggests 10,000).
4. To run the simulation, choose the following sequence (on the Crystal Ball toolbar): *Run, Reset, Run*
5. Now wait until the program informs you that the simulation is completed.

DOE provides the following instructions to view the output generated by Crystal Ball:

1. After the simulation has finished, click on the Windows tab bar labeled Crystal Ball to see the distribution charts.

2. The LCC savings and paybacks are defined as *Forecast* cells. The frequency charts display the results of the simulations, or trials, performed by Crystal Ball. Click on any chart to bring it into view. The charts show the low and high endpoints of the forecasts. The *View* selection on the Crystal Ball toolbar can be used to specify whether cumulative or frequency plots are to be shown.

  2a. To calculate the probability that a particular value of LCC savings will occur, either type 0 in the box by the left arrow, or move the arrow key with the cursor to 0 on the scale. The value in the *Certainty* box shows the likelihood that the LCC savings will occur.

  2b. To calculate the certainty of the payback period being below a certain number of years, insert that value in the far-right box.

3. To generate a printed report, select *Create Report* from the *Run* menu. The toolbar choice of *Forecast Windows* allows you to select the charts and statistics in which you are interested. For further information on Crystal Ball outputs, refer to *Understanding the Forecast Chart* in the Crystal Ball manual.

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[a]Because of the nature of the program, there is some variation in results due to random sampling when MonteCarlo or Latin Hypercube sampling is used.