CLOTHES WASHER NATIONAL ENERGY SAVINGS AND SHIPMENTS SPREADSHEET INSTRUCTIONS.

The clothes washer national energy savings (NES) and shipments spreadsheet is used to calculate the national energy, water and dollar savings from a clothes washer efficiency standard as well as to estimate future clothes washer shipments. The spreadsheet includes a clothes washer shipment model that uses clothes washer stock accounting together with a consumer decision model to forecast future shipments and sales. The consumer decision model includes probability functions that describe decisions regarding purchases, clothes washer repair, and breakdown information. The decision probabilities are used together with the accounting of purchases and stocks to forecast future clothes washer shipments under a variety of potential efficiency standards scenarios. The NES model uses input from the shipments model regarding washer purchases and compares the energy use between a baseline scenario and the various standards scenarios.

The 'Welcome NES' and 'Welcome Ship' worksheets act as the main user interfaces for NES and shipment forecast calculations respectively. When the user clicks on the 'Welcome NES' or 'Welcome Ship' tab, a user interface appears. For the NES scenario, this can be run for different standard levels and scenarios for energy price projection, start year, discount rate, annual horizontal axis (h-axis) market share increase, and water escalation rate. This worksheet also has a *Reset Base Case* button that allows the user to set the base case scenario. Similarly for the shipments forecast, different manufacturer price mark-ups, macro-economic explanatory variables, and consumer decision elasticities can be selected by the user.

In this version of the national energy savings and shipments spreadsheet, the user is allowed to specify a two-tiered clothes washer efficiency standard. In the two-tiered standard scenario, an initial standard is implemented at an earlier date, while a stricter standard is implemented several years later. The spreadsheet then calculates the shipments and energy savings impacts of the two-tiered scenario. In addition, the current version of the spreadsheet uses manufacturer price mark-ups that are consistent with the current version of the Manufacturers Impact Analysis.

BASIC OPERATING INSTRUCTIONS.

Once you have downloaded the NES/Shipments integrated spreadsheet file from the web, open the file using Excel. At the bottom, click on the tab for the 'Welcome NES' or 'Welcome Ship' worksheet. The 'Welcome NES' worksheet will display two tables: Energy and Water Savings, and Cost and Net Present Values. Also included is a chart, "Cost and Savings of Clothes Washer Standards". There is also a table: 'Summary of Shipments Results,' that conveniently summarizes the annual shipments numbers for other analyses. Use Excel's commands at the top, View/Zoom, to change the size of the display to make it fit your monitor.

In the revised NES and shipments analysis, operating costs along with the different model parameters and assumptions affect the base case shipments projection. Because of this, every time a parameter is changed, the base case scenario needs to be recalculated and saved for

comparison with the standard case scenario. Therefore the procedures for using the spreadsheet are as follows:

1. First select the Standard Case Design that you want to use for the base case scenario. Because the spreadsheet models the two-tiered scenario, there are two standard case designs. You must select the base case scenario for both tiers. Most often, this will be the Baseline selection. But if the user thinks for example that clothes washers will have a minimum efficiency level equivalent to one of the other Standard Case Designs even without implementation of a mandatory standard, then a specific Standard Case Design can be chosen as the base case instead.

2. Select the Energy Price Projection, Water Escalation Rate, Discount Rate, Start Year (for both tiers), and the Annual % Increase of H-Axis market share that is of interest.

3. In addition, if you want to change options in the shipments model, you need to go to the 'Welcome Ship' worksheet and select the combination of markup and elasticities of interest. After you make these selections, the spreadsheet will calculate the shipments and the energy use characteristics of the base case scenario.

4. Click on the ***Reset Base Case*** button in the 'Welcome NES' worksheet in order to reset the base case to the values you have chosen.

5. Select the standard scenario that you wish to compare to the base case, and the spreadsheet will calculate the new forecast of shipments, energy use, and water use. It will also calculate the expenses and savings of the standard scenario in comparison to the base case that was set. Make sure to select consistent standard levels for both standard tiers, and make sure to select the year of implementation for each standard level. The start year for the second tier must be after or equal to the start year for the first tier. To calculate the one-tier case, select the same standard level for both tiers.

FREQUENTLY ASKED QUESTIONS

What does the Clothes Washer NES and Shipments Spreadsheet do?

This spreadsheet provides an estimate of the national energy, water, and monetary savings for different clothes washer efficiency standards. It also calculates the estimated impact of clothes washer efficiency standards on shipments and sales. The estimates of future clothes washer shipments and stocks from the shipments model are used in a national accounting of energy and water use to estimate potential energy and water savings from possible energy standards. The spreadsheet also calculates the dollar value of these savings year by year. It estimates the amount of energy that will be saved at the source by considering generation, transmission and distribution losses. Total energy and water savings are presented along with the net present value of the net dollar savings from the standard.

What are the worksheets in the workbook?

In order to simplify the organization and presentation of the spreadsheet calculations, the computations are segregated into separate worksheets. Below we describe in general terms the different functions of the individual; spreadsheets. The technical details of the calculations will be provided in the Technical Support Document (TSD) of the Notice of Proposed Rule Making (NOPR). Draft versions of the relevant TSD documentation are provided in the Shipments Write-up and the Summary NES Documentation that is provided at the Energy Efficiency and Renewable Energy Network site on Clothes Washer Standards: http://erendev.nrel.gov/buildings/codes_standards/applbrf/clwasher.html.

Welcome NES

This worksheet is the main user page, providing list boxes and input cells that allow the user to choose a range of scenarios and parameter values for the different standards forecast scenarios. The worksheet also reports and summarizes the results of the national energy savings calculation. The worksheet allows the user to input the energy price projection, the discount rate that is used in the net present value calculation of standards benefits, the water price escalation rate, the base case horizontal axis clothes washer market penetration rates (Annual % Increase of H-Axis), and the start year for the standard. As described in the basic operating instructions, after changing any model parameters, the user must select the appropriate base case scenario in the Standard Case Option and reset the base case scenario by clicking on the *Reset Base Case* button. After the base case is reset, the user can then calculate the costs, savings, and benefits of standards by selecting the Standard Case Design. The user can return to the default base case by clicking on the *Parameters Reset to Defaults* button, then resetting the base case again with the *Reset Base Case* button.

Welcome Ship

This is the other main user page, providing list boxes where a user can select a range of shipment forecast scenarios. The user can choose the standard level and a range of elasticities with respect to washer price and features. (An elasticity is the percent change in the output, in this case shipments, from a percent change in an input, such as washer price.) The sales forecast is illustrated along with changes in mean clothes washer age and lifetime. Tables are presented which summarize the impacts relative to a base case calculated with medium values for the price elasticity, top-loading elasticity, and price markup. The user also has the option of changing price elasticity to “none” and choosing a “medium” or “high” value for one of the following elasticities instead: income elasticity, price/income elasticity, or interest/credit elasticity. Normally only one of these four types of elasticities should be used at one time, since any one of the four can be used as the explanatory factor for historic data. The worksheet is protected to help the user avoid erroneous modifications. The sheet can be unprotected by going to Tools>Protection>Unprotect Sheet.

Inputs

The Inputs worksheet contains the detailed model parameter values. These values should be modified only by advanced spreadsheet users, who may want to change historical scaling calibration parameters, logit decision model coefficients, market (purchase decision) discount rate, or other model details. Generally cells highlighted in yellow are those that can be modified by the more advanced users. The sheet is protected to prevent erroneous inputs, but may be unprotected by choosing Tools>Protection>Unprotect Sheet.

Shipment Forecast

This worksheet provides the detailed estimates of clothes washer populations. It contains the core of the shipment calculations and the tables which specify the estimates of each type of clothes washer purchase by age category, the used shipment and repairs, market segments of each category and the efficiency level market shares and shipments for each standard scenario.

Base Case

The 'Base Case' worksheet is the same as the 'Shipment Forecast' worksheet except that is contains the data for the base case scenario. It shows the washer population by age categories for the no standards scenario that was selected by the user when the ***Reset Base Case*** command button was selected on the 'Welcome NES' worksheet.

Charts

The charts worksheet provides additional illustrations of the model outputs, including the different categories of clothes washer shipment, gross dollar sales in real 1997 dollars, supply and demand of used clothes washers so that the user can see if they approximately match, and new vs used washers shipments.

Savings

This sheet lists the site and source annual energy savings in trillion Btu's. It also shows the annual and cumulative costs in dollar values. This worksheet effectively reports the results of the national energy savings calculation in tabular form.

Econ Inputs

This spreadsheet gives data for the different economic inputs that are used by the economic forecasting and consumer decision model. All the dollar values are reported in constant 1997 dollars. The data compiled in this worksheet include the price of different efficiencies of clothes washers (both baseline efficiency and an average forecasted market price), operating costs for different efficiencies of clothes washers, household income, per household credit, the prime interest rate, new housing completions, housing stock, historical clothes washer shipments (both automatic clothes washers and totals that include wringer washers), fuel and

water prices, and the inflation adjusted price indices which are used in the historical and forecasted fuel and water price projections.

Energy Inputs

This worksheet provides the detailed accounting of clothes washer energy uses based on the efficiency market share data and the engineering analysis of energy and water use for the different efficiency level machines.

Projections

This worksheet provides the data for the energy and water price projections. The water price projections with low, medium and high escalation rates is presented as are the energy price projections for electricity, gas, oil, and liquified petroleum gas (LPG).

Engineering

This worksheet contains the data on prices, energy use and water consumption for the clothes washers that meet different standard levels. This data was provided by the Association of Home Appliance Manufacturers as part of the engineering analysis. We have added a pre-baseline case that represents the minimum efficiency level for machines before the 1994 energy efficiency standard for clothes washers.

MS New Homes

Here we provide the market share (MS) calculation for the new housing market. There is an estimate on how purchase probabilities change as a function of price, operating costs savings, and features changes. Details of the model are explained in the Shipments Write-up.

MS Early Repl

Here we provide the market share calculation for the early replacement market. Again the estimates are based on probabilities in the purchase model, and an initial probability of purchase that is a linear function of clothes washer age.

MS non-owner

This sheet provides the market share calculation for the non owners who purchase clothes washers and become new clothes washers owners.

MS New vs Used

Here we provide the market share calculation for the consumers who choose between purchasing a new or a used washer.

MS Replace

This worksheet calculates the probability of replacement vs. repair as a function of economic decision parameters for each year. The annual probability of replacement is calculated for each category of clothes washer.

Retirement Function

This worksheet shows the fraction of washers that are expected to retire as a function of the number of years since the washer was purchased new. **(**Repairs may extend the life of the washer and are accounted for in the shipment forecast.)

What kind of output does the spreadsheet generate?

The spreadsheet provides output in charts, summary statistics and tables. Net present value and a quick look at energy savings are given in the 'Welcome NES' worksheet. Detailed illustrations of gross sales impacts are shown in the charts section. Shipments and populations of different types of stocks for different clothes washer age categories for each year are presented in the Shipment forecast sheet.