

**AMES Wholesale Power Market Testbed:  
A Free Open-Source Computational Laboratory for the Agent-Based Modeling  
of Electricity Systems (Li, Sun, and Tesfatsion)**

## **Manual of Basic Instructions**

Last Revised: 22 January 2011

**Section I: Basic Project Set-Up Info**

**Section II: Loading and Viewing AMES Test Cases**

**Section III: Development of New AMES Test Cases**

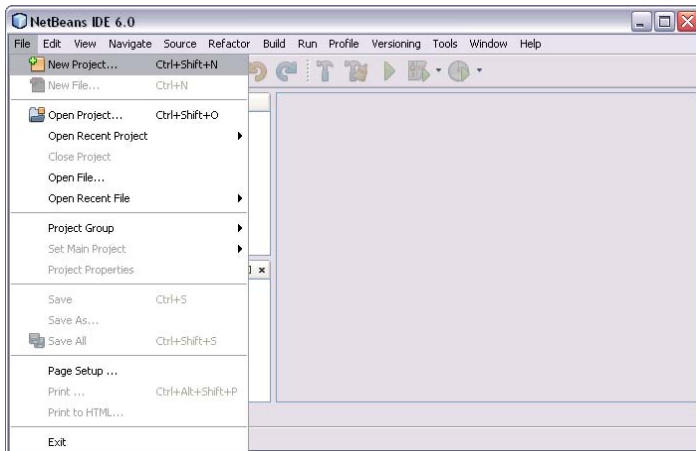
**Section IV: AMES Source Code Modification**

**Section V: Running AMES Experiments in Batch Mode**

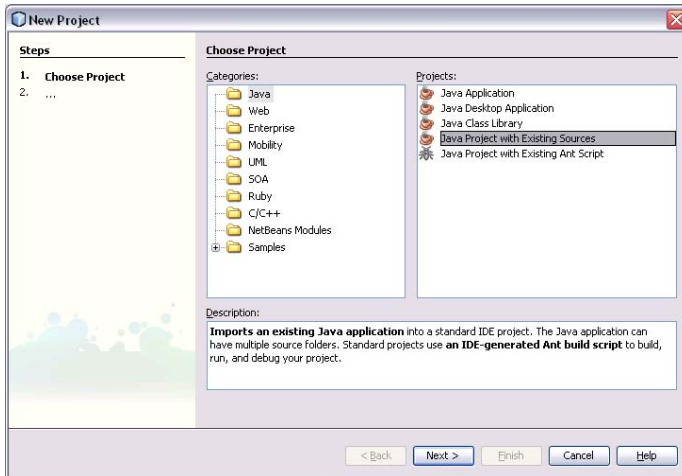
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### **SECTION I: Instructions for Setting Up AMES as a Java Project Using the NetBeans IDE (6.0 or higher)**

**Step 1.** Download the zip file for AMES from the homepage at <http://www.econ.iastate.edu/tesfatsi/AMESMarketHome.htm> and extract the zipped files to a local directory, say "D:\". If, for example, the AMES version is V2.0, the extracted files will be held in "D:\ AMESMarket.V2.0". All screens below are depicted for this particular version download.

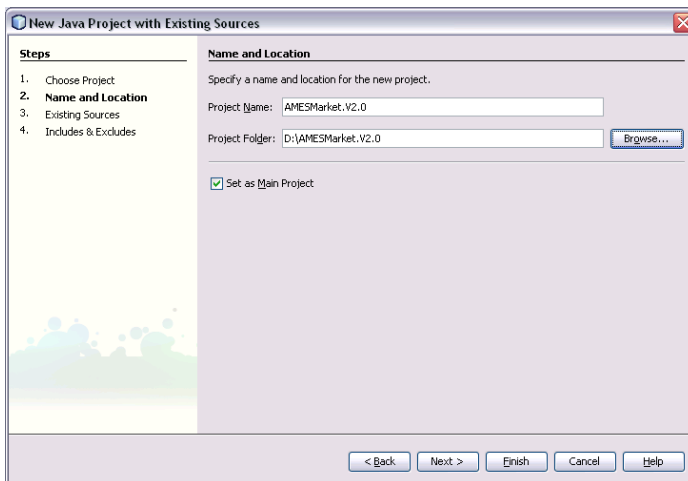


**Step 2.** Open the NetBeans IDE and select File->New Project.



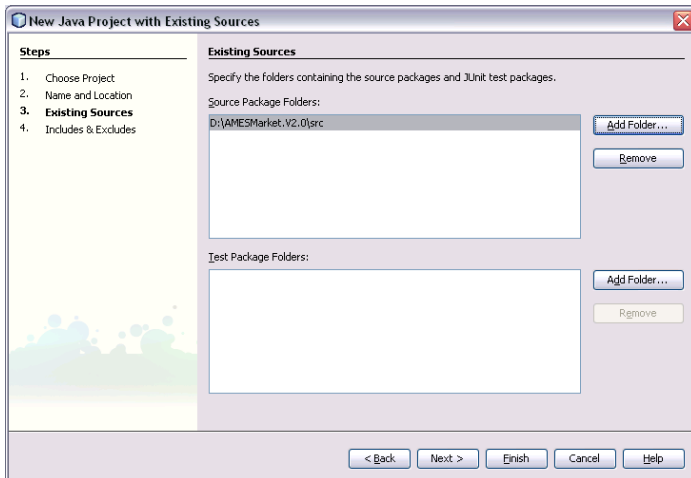
**Step 3.** In the “Categories:” list, select “Java”, and in the “Projects:” list, select “Java Project with Existing Sources”.

**Step 4.** Click “Next >”.



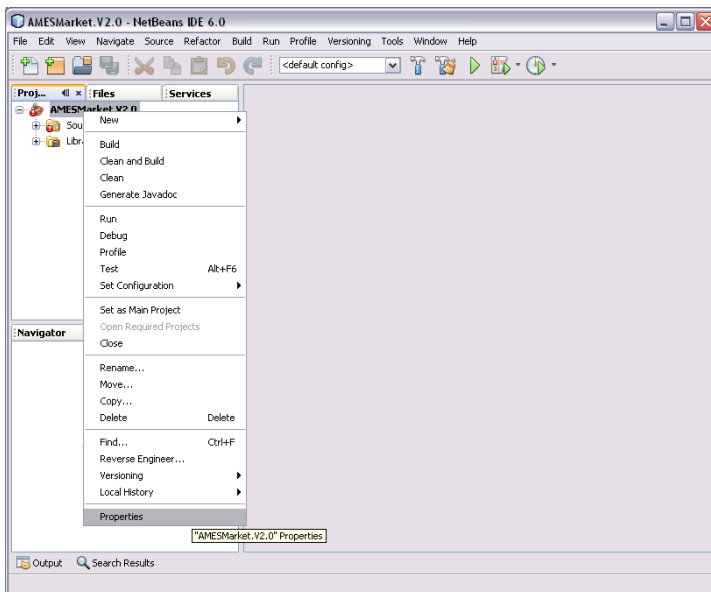
**Step 5.** Click the “Browse” button to find and select the directory holding the AMES extracted files, and set the “Project Name:” to the appropriate version name (e.g. “AMESMarket.V2.0”). Also, check the “Set as Main Project” box.

**Step 6.** Click “Next >”.

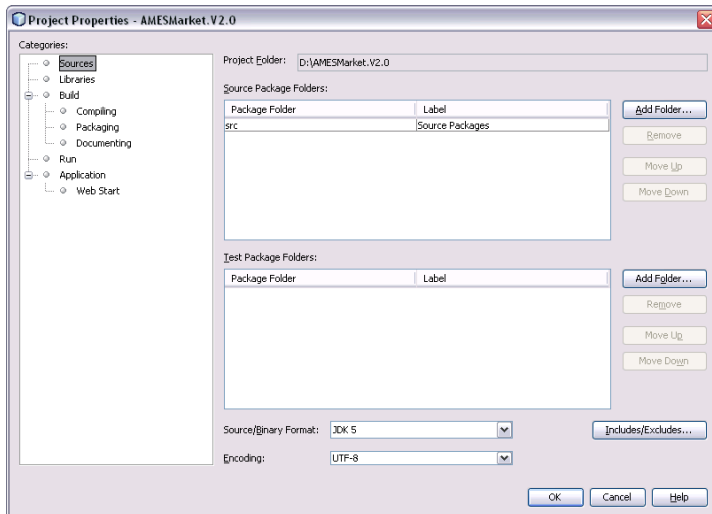


**Step 7.** Click the “Add Folder” button, find and select the AMES source code (src) directory (e.g. “D:\AMESMarket.V2.0\src”), and click “Open”.

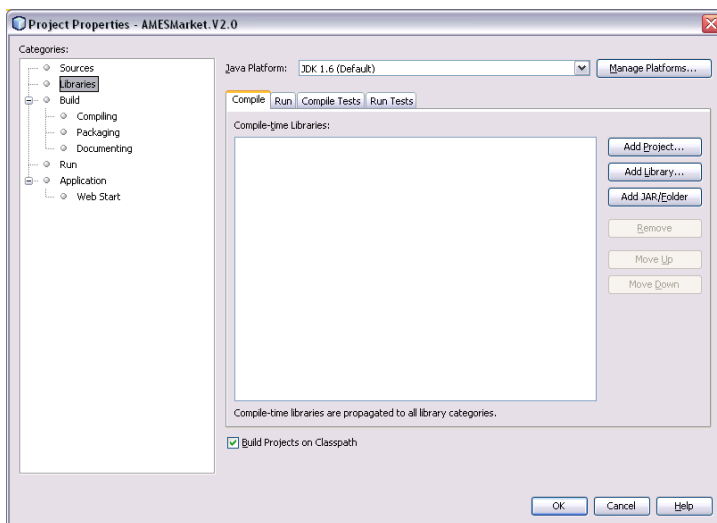
**Step 8.** Click “Finish”.



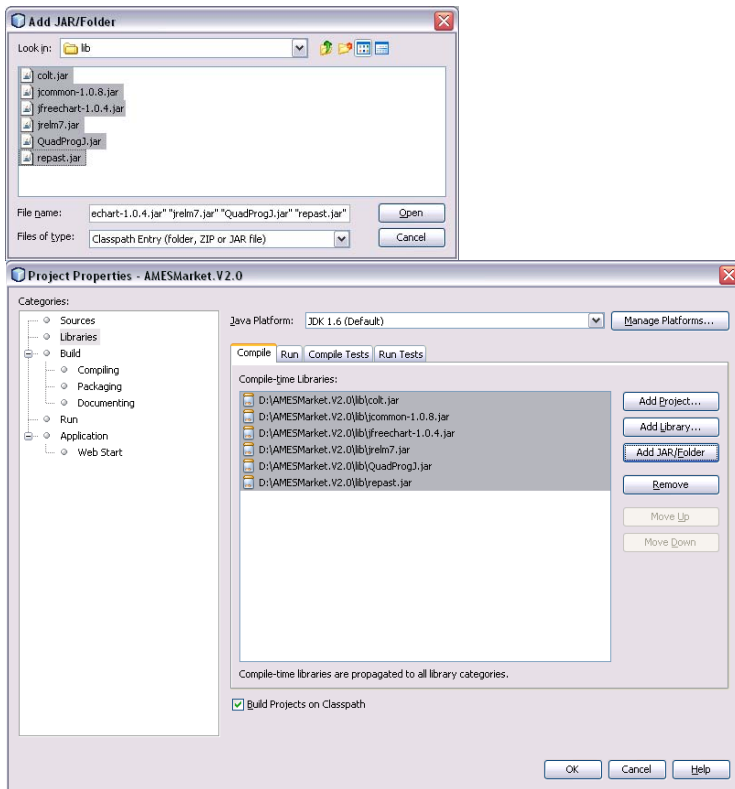
**Step 9.** Right click the project name (e.g. “AMESMarket.V2.0”), and select the “Properties” command.



**Step 10.** From the Project Properties menu, select " Libraries."

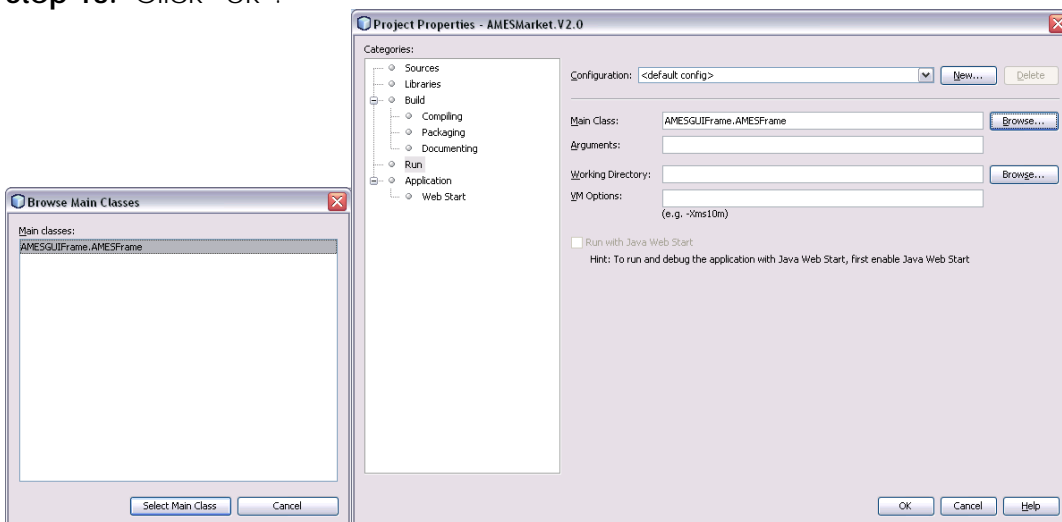


**Step 11.** Click the " Add JAR/Folder" button.



**Step 12.** Find and open the AMES library (“lib”) directory, select all included Jar files, and click “open”. Be sure that JDK 1.6 or higher is set as the “Java Platform” and that the “Build Projects on Classpath” box is checked.

**Step 13.** Click “ok”.

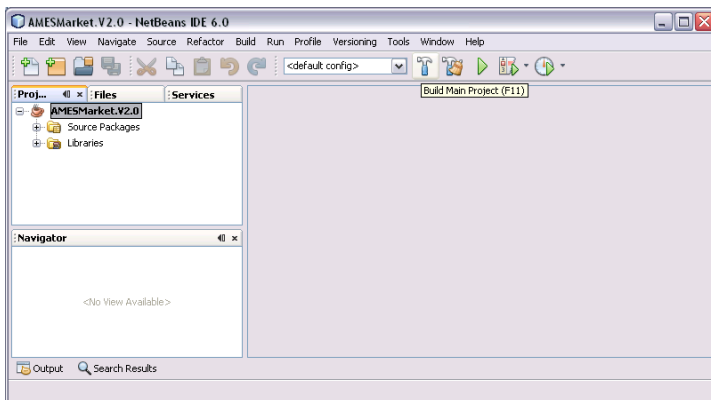


**Step 14.** Again from the “Project Properties” menu, select “Run”, click the “Main Class:” browse button, and select “AMESGUIFrame.AMESFrame” as your main class. Also, to ensure U.S. formatting is used for decimal separators and other local parameters, some users have reported they found it necessary to include one of the following instructions in the “VMOptions” tab:

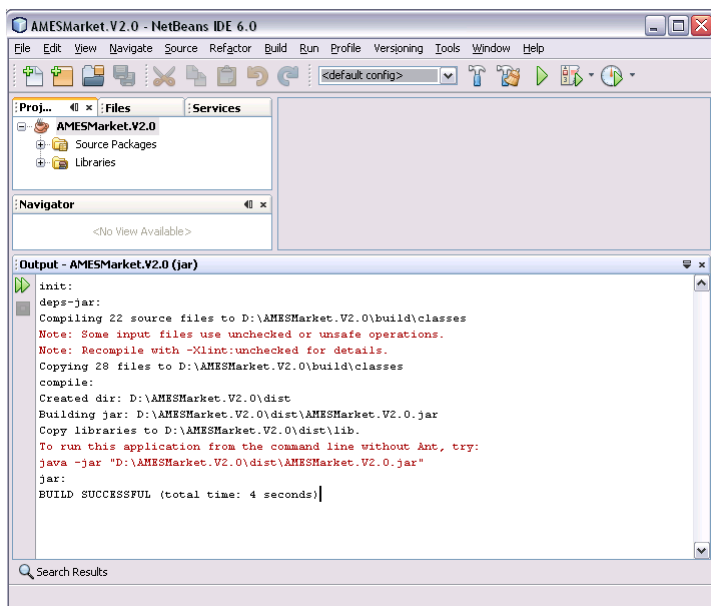
“-Duser.language=en -Duser.region=US” (Win OS)

“-Duser.language=en” (Mac OS X, version 10.5.8)

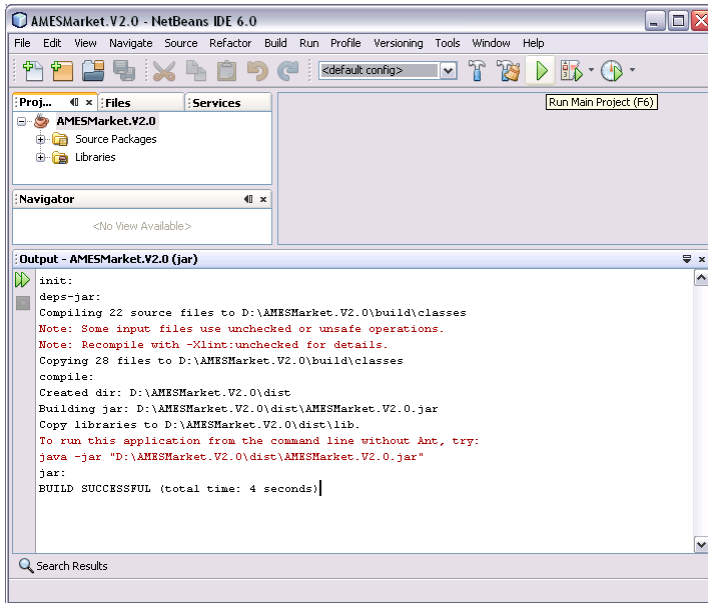
**Step 15.** Click “Ok”.



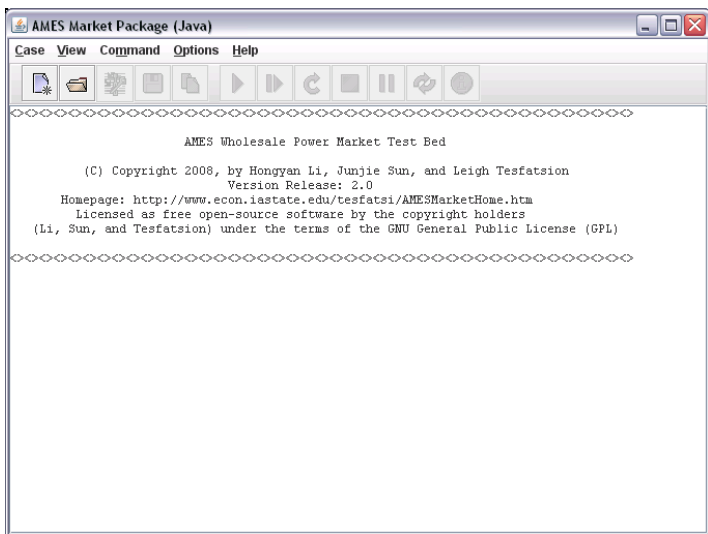
**Step 16.** Select the “Build->Build Main Project (F11)” command from the NetBeans menu.



**Step 17.** A “BUILD SUCCESSFUL” message should appear at the bottom of the output screen, as shown above.

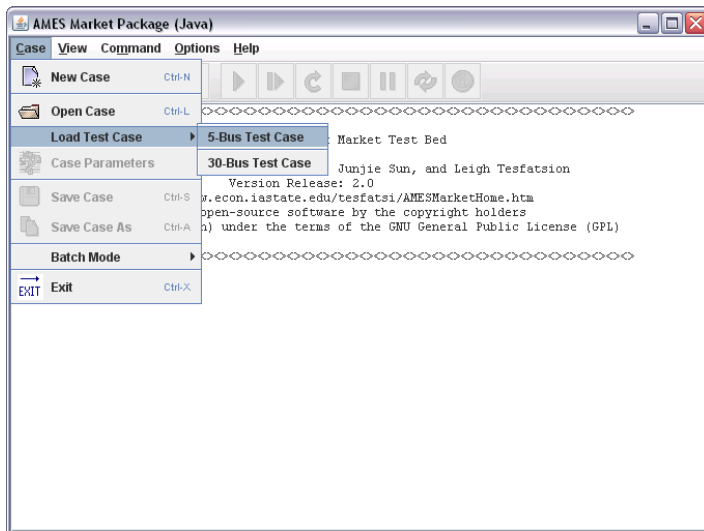


**Step 18.** Select the “Run-> Run Main Project F6” command from the NetBeans menu.

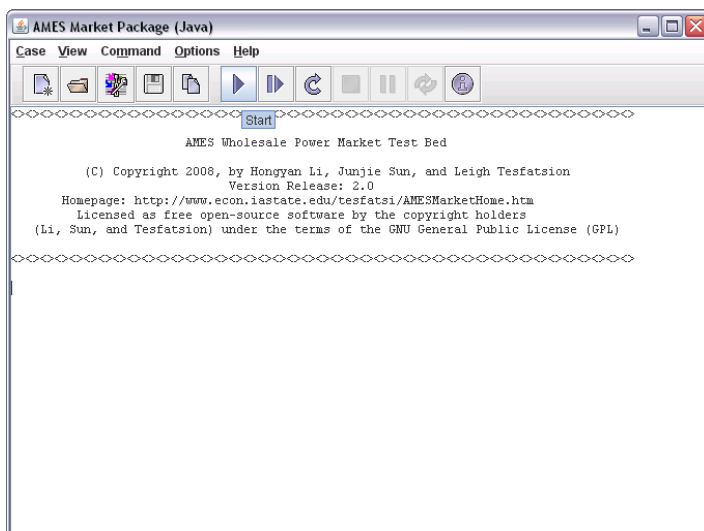


**Step 19.** The above main screen for the AMES Graphical User Interface (GUI) should be displayed.

## SECTION II. Loading and Viewing AMES Test Cases

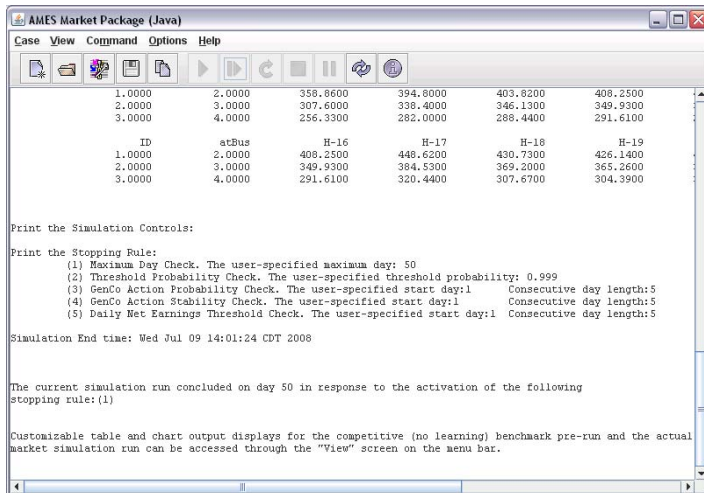


**Step 1.** To load the 5-Bus Test Case, select the “Case->Load Test Case->5-Bus Test Case” command from the main AMES GUI menu.



**Step 2.** To run the 5-Bus Test Case, click the “Start” icon on the AMES GUI toolbar or select “Command->Start” from the main AMES GUI menu.





**Step 3.** Scroll down to see the 5-Bus Test Case input displayed in tabular form.

**Step 4.** To see the output displayed in the form of user-customizable tables or charts, from the main AMES GUI menu select either the "View->Output Table View" command or the "View->Output Chart View" command.

## SECTION III: Development of New AMES Test Cases

The best way to understand the different options available in AMES is to load and run variations of the 5-Bus and 30-Bus Test Cases provided with the download of AMES in the "DATA" directory. These test cases can be used as templates for the creation of new test cases. How this can be done is discussed below, using the 5-Bus Test Case for concreteness.

It is suggested that users first load and run the 5-Bus Test Case under its default input data settings, as instructed in Section II. These settings can be viewed and studied by selecting the command "Case->Case Parameters" from the main AMES GUI menu.

Next, users should try experimenting with modified input data settings for the 5-Bus Test Case by changing the default settings in the input data screens accessed via "Case->Case Parameters". After hitting "Done" in the final input data screen, users can run their revised test case by clicking the "Start" icon on the AMES GUI toolbar or by selecting "Command->Start" from the main AMES GUI menu.

Users can save their revised input data settings as a new test case in a new file with a .dat extension by using the main AMES GUI menu command "Case->Save Case As". For example, these new settings can be saved in a file called "NewTest.dat" in the AMES "DATA" directory, e.g., d:\Data\NewTest.dat" (Users are not permitted to overwrite the default 5-Bus Test Case input data file in the

DATA directory – a different file name must be selected). The new test case can then be loaded by selecting “Case->Open Case->d:\DATA\NewTest.dat” from the main AMES GUI menu.

More generally, new test cases can be created from the default 5-Bus Test Case in one of three ways, as follows:

(1) Load and run the 5-Bus Test Case, enter input data changes by “Case->Case Parameters”, hit “Done” in the final input data screen (Step 6), and use “Case->Save Case As” to save the new input data as a new test case (with a .dat extension) under a new name in the DATA directory (or some other directory).

(2) Within the DATA directory, copy the 5-Bus Test Case into a new .dat file under a new name (e.g., d:\DATA\NewTest.dat) and fill in alternative values for some/all of the default input data. Then load this new test case by using the AMES GUI menu command “Case->Open Case->d:\DATA\NewTest.dat”.

(3) From the AMES GUI menu, select “Case->New Case” to open a set of input data screens that can be filled in with admissible input data values of your own choosing. Click “Done” in the final input data screen and save the data as a new test case in a new .dat file in the DATA directory or another directory of your choosing.

## **SECTION IV: AMES Source Code Modification**

AMES is developed entirely in Java. All source code for AMES is distributed as open source; it can be found in the “src” directory of the downloaded AMES Market Package.

To modify the AMES source code (as opposed to simply experimenting with alternative input data values through AMES GUI settings), you will obviously need to know something about Java.

For annotated pointers to online resources that can help you to learn Java, see Section II.B (“Introduction to Java”) at the following site:

<http://www.econ.iastate.edu/tesfatsi/repastsg.htm>

## SECTION V. Running AMES Experiments in Batch Mode

### A. What does “Batch Mode” mean?

AMES (version V2.0 and higher) supports experiments run in “Batch Mode”. This means that the user can construct a single *batch-mode file* for automatically carrying out successive experiments for one or more user-specified test cases, where each experiment for each test case in turn consists of one or more runs conducted with one or more user-specified pseudo-random number seed values.

AMES batch-mode files are designated by a “.bth” extension. After AMES loads a batch-mode file, it executes each indicated run for each indicated test case and saves the resulting output data in files. Once the batch-mode file is loaded, this entire process is carried out automatically without need for further user actions.

### B. Illustrative Application

This subsection illustrates the AMES batch-mode process using the 5-bus and 30-bus test case data files included with the AMES download in the “DATA” directory. The individual test-case data file names are ‘5BusTestCase.dat’ and ‘30BusTestCase.dat’.

A sample batch-mode file “30RS\_2Cases.bth” for running successive 5-bus and 30-bus test cases is included in the same directory (“DATA”) as the 5-bus and 30-bus test case data files; this is the default directory AMES uses to look for batch-mode files. The contents of this sample batch-mode file are given below:

```
// FILENAME 30RS_2Cases.bth
```

```
#RandomSeedsDataStart
```

```
2096966936
```

```
2131965672
```

```
1235967177
```

```
511529502
```

```
1063330821
```

```
870295371
```

```
1815184757
```

1880683622

122209384

220366820

736815417

132292439

207226519

1522886012

2000909491

808958575

1150478587

173232596

999975840

1616038132

1831032783

493464018

930068517

856336506

1205573239

794414294

1183491260

1846539650

437363834

2013640491

#RandomSeedsDataEnd

#MultiCasesDataStart

5BusTestCase.dat

30BusTestCase.dat

#MultiCasesDataEnd

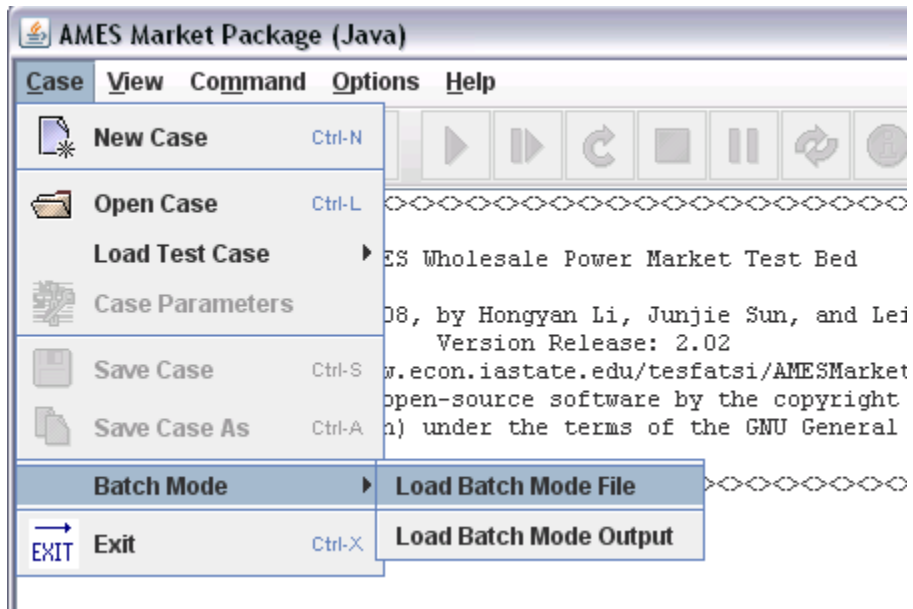
The explanations for the indicated components of this batch-mode file are as follows:

- (1) The line starting with "/" is a comment line.
- (2) The block delimited by "#RandomSeedsDataStart" and "#RandomSeedsDataEnd" is for user-specified random seed values to be used for the batch-mode experimental runs. The user is free to select the number and value of these random seeds within the admissible data type (long 64-bit signed integer) and the admissible range (a minimum value of -9,223,372,036,854,775,808, a maximum value of 9,223,372,036,854,775,807). In the present example, 30 random seed values happen to be set.

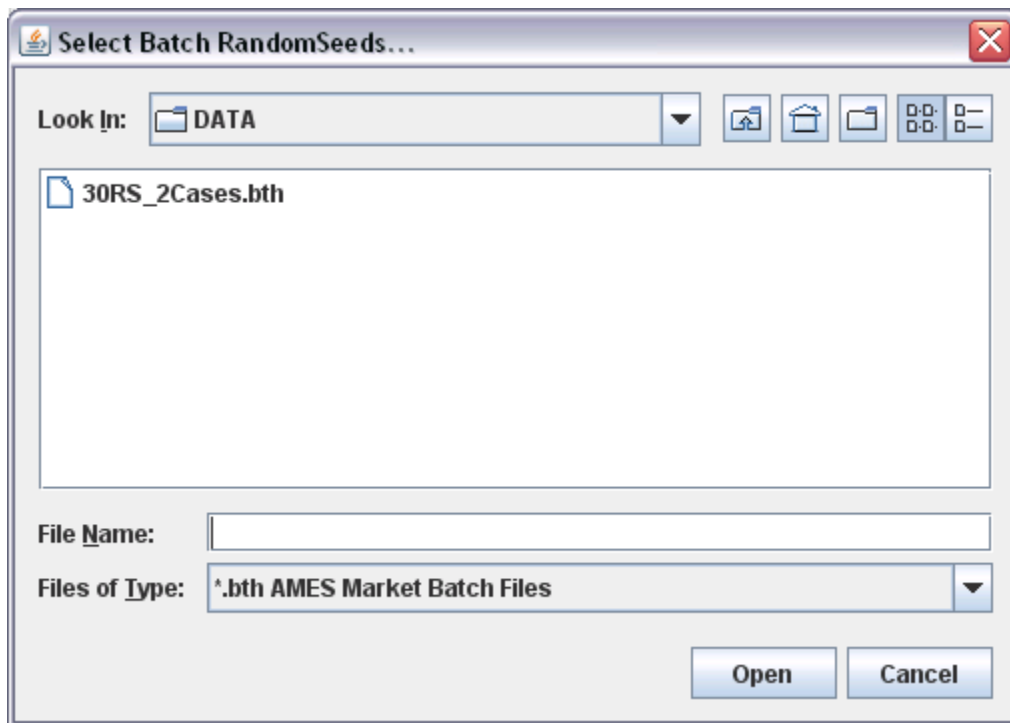
**Note:** In contrast, for an individual experimental run, the user specifies a single random seed value for this run in the "Simulation Control Parameters" screen accessed by the command "Options->Simulation Control" in the main AMES GUI.

- (3) The block delimited by "# MultiCasesDataStart" and "# MultiCasesDataEnd" is for a user-specified listing of test-case data files. The user can change the number of data files as well as the name of the data files.

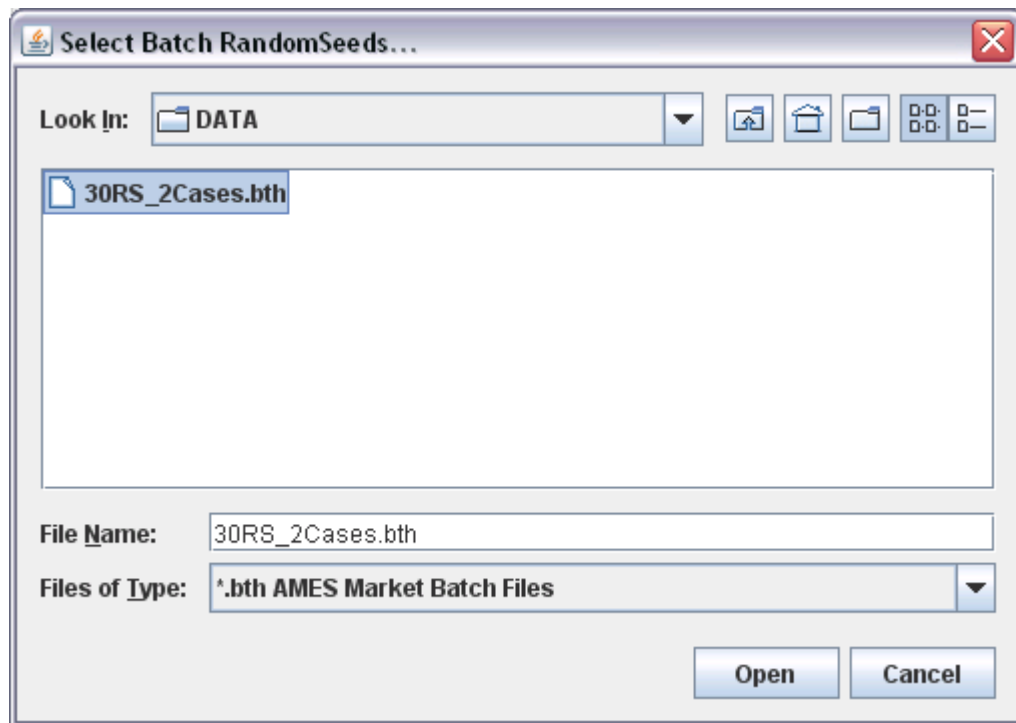
The following steps outline how to load this batch-mode file in AMES.



**Step 1.** To load the batch-mode file 30RS\_2Cases.bth, select "Case->Batch Mode->Load Batch Mode File" from the main AMES GUI menu.

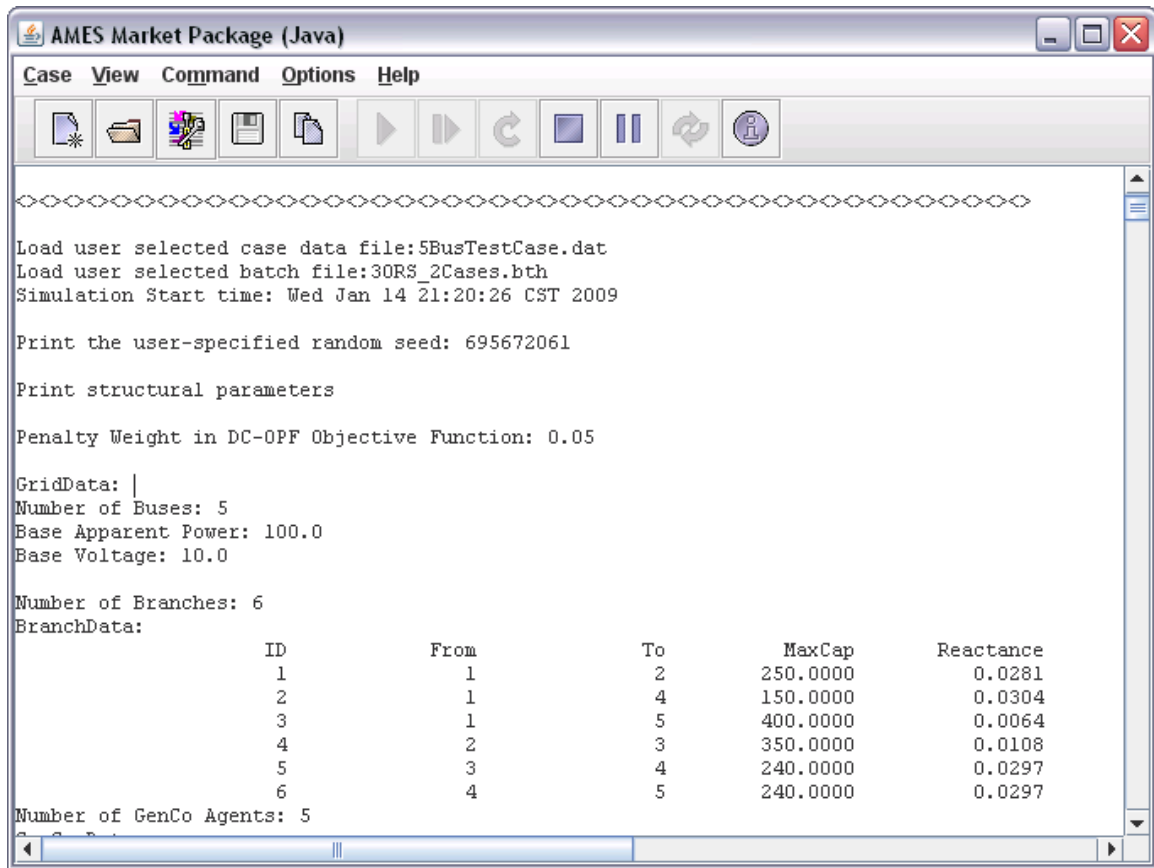


**Step 2.** Select "30RS\_2Cases.bth".



**Step 3.** Then click the "Open" command or double click "30RS\_2Cases.bth".

**NOTE:** At this point, if desired, you can customize the stopping rules to be activated for each run of this batch-mode experiment on the "Simulation Control Parameters" screen accessed from the main AMES GUI by the command "Options-> Simulation Control". (Otherwise, the default settings for the activation of stopping rules will be applied.)

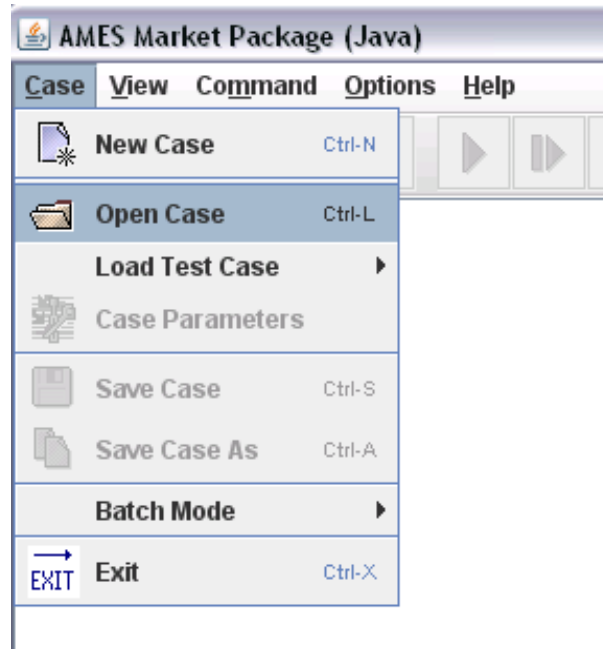


**Step 4.** You are now ready to load and run the batch-mode file "30RS\_2Cases.bth". Click the "Start" icon on the main AMES GUI toolbar or select "Command->Start" from the main AMES GUI menu.

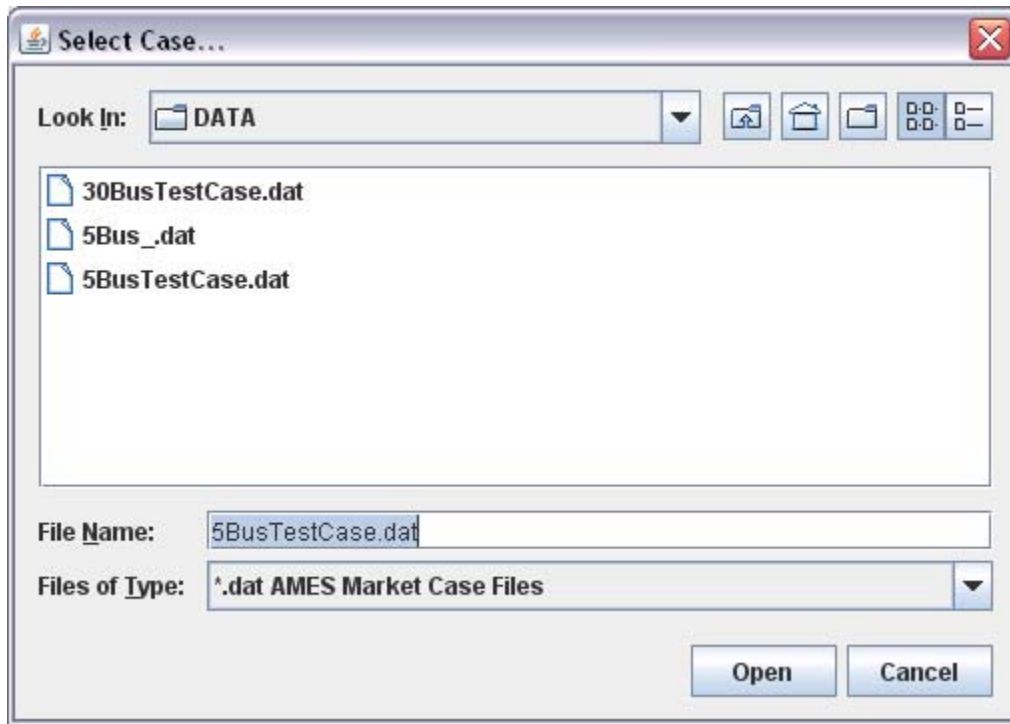
- (1) The running information for the batched test-case data files will be displayed in the main window. For example, as seen above, the random seed and part of the input data information are displayed for the first run for the first test-case data file (5BusTestCase.dat).
- (2) AMES first cycles through all runs for the test-case data file listed first in the batch-mode file, as determined by the user-specified list of random seeds. It then proceeds to do the same for each successively listed test-case data file.
- (3) An output data file for each run for each test-case data file is separately generated and stored in the same directory ("DATA") as the test-case data files. For example, the output data for the run corresponding to the first random seed value and the first test-case data file "5BusTestCase.dat" is stored in an output file named "5BusTestCase\_0.out".
- (4) Note that a zero-based index is used to successively index the user-specified random seed values listed in the batch-mode file. Thus, the "\_0" in the output



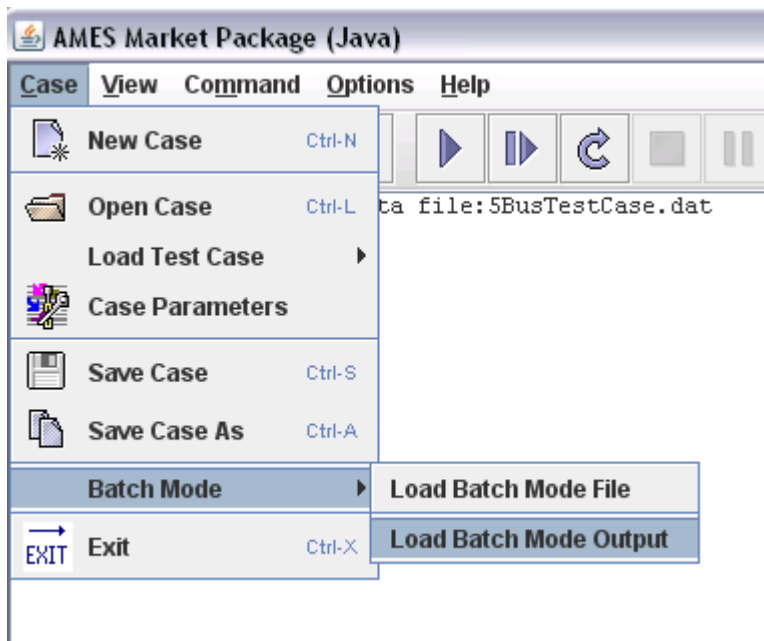
data file "5BusTestCase\_0.out" indicates that this is the output data file corresponding to the first random seed value listed in the batch-mode file.



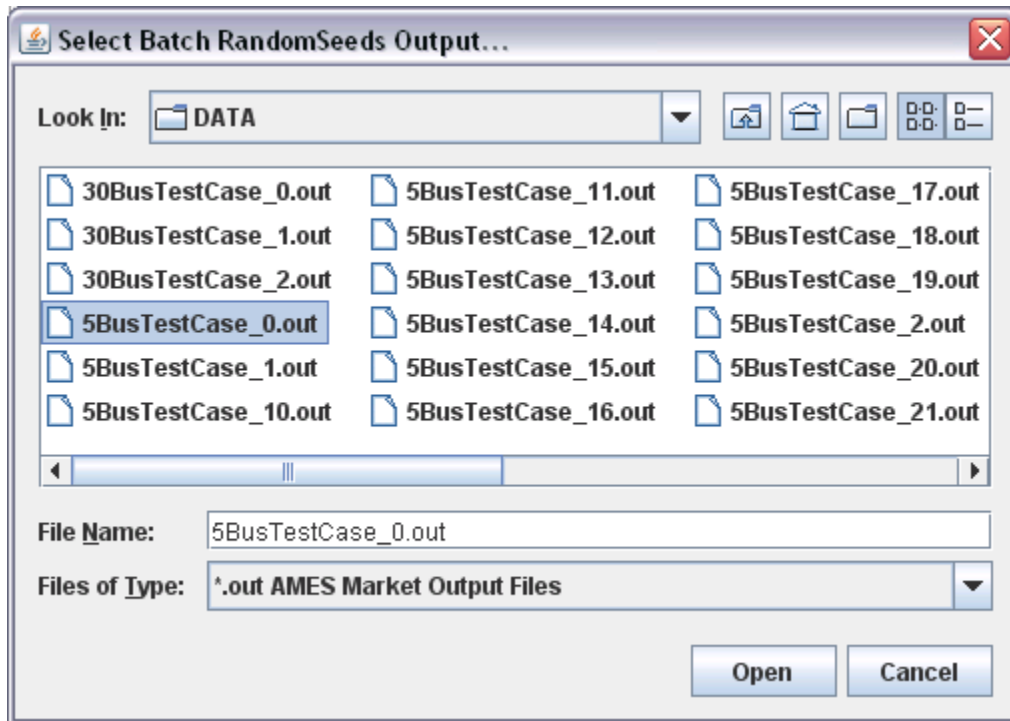
**Step 5.** To open, load, and view the output data files, for example the output data file "5BusTestCase\_0.out", first select "Case->Open Case" from the main AMES GUI menu.



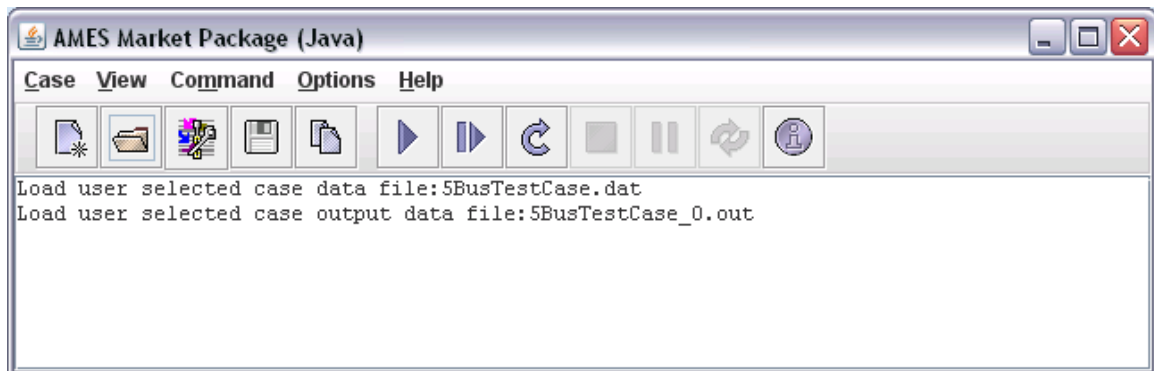
**Step 6.** Select "5BusTestCase.dat". Then click the "Open" command or double click "5BusTestCase.dat".



**Step 7.** Select "Case->Batch Mode->Load Batch Mode Output".



**Step 8.** Select the desired output data file "5BusTestCase\_0.out".



**Step 9.** AMES will check to ensure that your selected output data file (in this example "5BusTestCase\_0.out") correctly corresponds to your previously selected test-case data file (in this example "5BusTestCase.dat"). If this check is passed, the above type of message will be displayed.

**Step 10.** You can now choose to view the output data in the form of user-customizable table or chart displays by selecting either the "View->Output Table View" command or the "View->Output Chart View" command from the main AMES GUI menu.