ANSWERv6-TIMES
"Smart" Excel Workbook Manual
(Excel 2007 and higher)

version 6.8

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Noble-Soft Systems Pty Ltd

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(Excel 2007 and higher, version 6.8)

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Acknowledgements

Aspects of the development of the ANSWER-TIMES "Smart" Excel Workbooks, and the creation of this Manual, were assisted by the existence of the ANSWER-MARKAL "Smart" Load Templates and Manual. The latter were the result of a collaborative effort in 2006 between Gary Goldstein of DecisionWare and Noble-Soft Systems.

But the reader of this Manual who is familiar with the ANSWER-MARKAL "Smart" Load Templates will soon realize that in important respects the ANSWER-TIMES "Smart" Excel Workbooks differ significantly from the ANSWER-MARKAL "Smart" Load Templates. In particular the format and operation of the ANSWER-TIMES "Smart" work<u>sheets</u> differ significantly from those of ANSWER-MARKAL.

The development of the ANSWER-TIMES "Smart" Excel Workbooks has benefited from suggestions made by Dr. Uwe Remme of the International Energy Agency.

Some financial support was provided by ETSAP, and also by the International Energy Agency – the latter in the context of a larger project to create a special Library Region version of ANSWER-TIMES for the TIMES version of the IEA's Energy Technology Perspectives (ETP) Model.

1. Background

The task of assembling data for a TIMES model requires various data preparation steps that are usually performed using the power and flexibility of spreadsheets (Excel). New ANSWER-TIMES "Smart" Excel Workbooks have been developed to allow the analyst to assemble the model data from its sources in a form readily loaded into ANSWER-TIMES. The process is guided by a few rules and supported by "smart" buttons and selection trees or lists, along with quality control checking, to facilitate the direct (and correct) loading of the data.

The "Smart" Excel Workbooks are loaded into an ANSWER-TIMES database by means of the "File, Import, Model Data from Excel" facility. For an overview of the use of this facility see section 12 'Loading a Smart Excel Workbook into ANSWER-TIMES' of this manual, and for a detailed explanation see section 2.10 'Importing Model Data from Excel' in the *ANSWERv6-TIMES User Manual.pdf* in folder C:\AnswerTIMESv6\UserManuals.

In sections 4-11 that follow each type of worksheet will be presented. The next two sections however describe opening a "smart" workbook and the general layout and philosophy embodied in all the worksheets.

Note that an example Smart Excel Workbook, **SmartDemoMultiRegion.xlsm**, that demonstrates the specification in its entirety of a multi-region TIMES model is provided as part of the ANSWERv6-TIMES installation files in folder C:\AnswerTIMESv6\Ans_WrkTI. See section 13 'Example ANSWER-TIMES Smart Excel Workbook' of this manual.

2. Workbook Setup
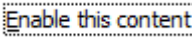
Anyone wishing to work with an ANSWER-TIMES "Smart" Excel Workbook must create an ANSWER-TIMES Smart Workbook to start. See Appendix A for more information on the various ways in which this can be done. In addition, note that the functioning of some of the macro facilities in the ANSWER-TIMES Excel Workbooks requires that ANSWER-TIMES be installed on your computer.

Upon opening a "Smart" Workbook, depending on your Excel 2007 (or higher) security settings, you may receive a **Security Warning** (indicating that the macro code that underlies the "smart" buttons has been disabled):
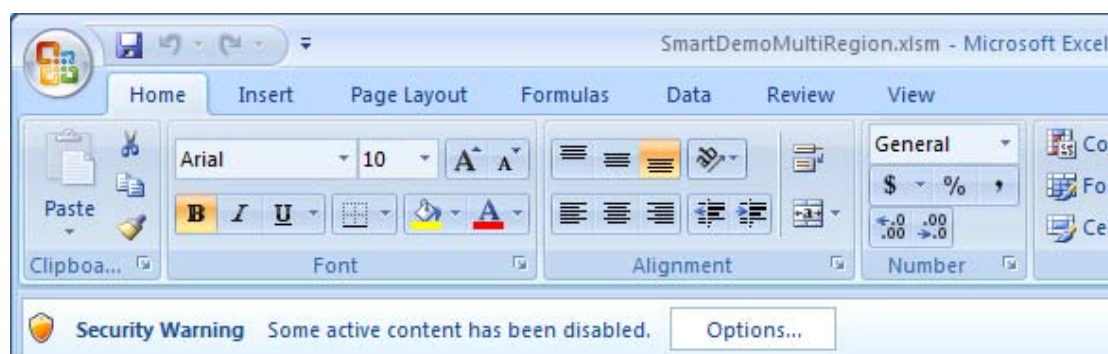
Click on the [Options...] button to bring up the Microsoft Office Security Options form:
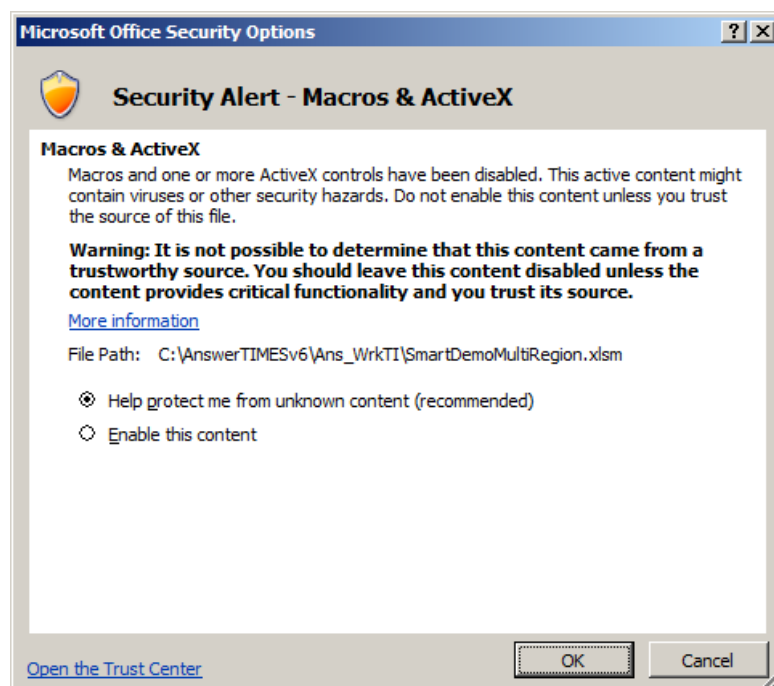
then click on the [⊙ Enable this content] option button and click on the [OK] button. In the remainder of this document, we refer to this process as **"Enable Macros"**.

Once you have carried out the "Enable Macros" process, you will be prompted to specify an ANSWER-TIMES database that will be associated with the workbook:
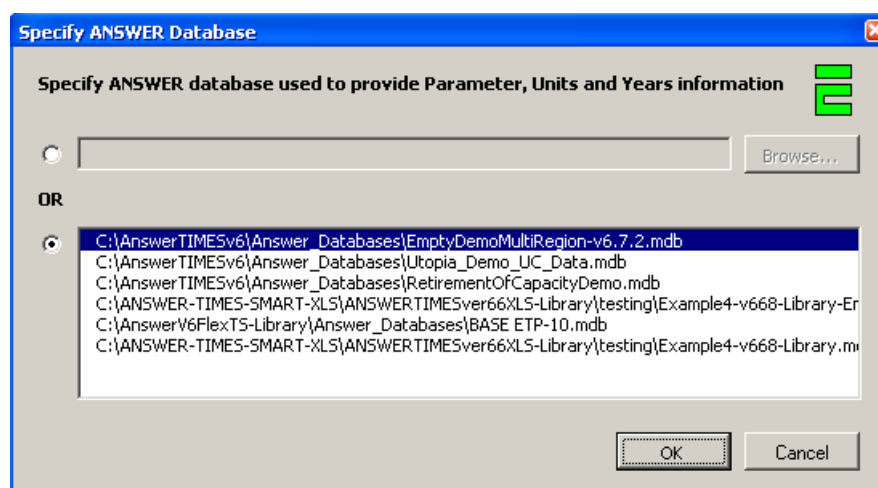
You should always specify an ANSWER-TIMES database because the operation of nearly all of the "smart" buttons in the ANSWER-TIMES workbook requires that you do.

Once you have used an ANSWER-TIMES "smart" workbook to load information into an ANSWER-TIMES database, then to derive maximum benefit from the facilities offered by an ANSWER-TIMES "smart" workbook, you should specify this ANSWER-TIMES database (or a copy of it) as the associated database when you subsequently load further information into this database from an ANSWER-TIMES "smart" workbook.

- *This is because an ANSWER-TIMES "smart" workbook offers an important new facility (not available in an ANSWER-MARKAL "smart" workbook) – the ability to access Item information that is in the associated database, as well as in the ITEMS sheet. So for example the [Check Sheet] button on a TS DATA sheet checks arguments for Time Series Parameters against both Items on the ITEMS sheet and Items in the database.*

3. Worksheet Layout and Philosophy

This section briefly indicates each of the eight types of "smart" worksheets currently available in an ANSWER-TIMES Smart Excel Workbook, as presented in Table 1. They are segregated into two types Declare (Declaration) and Data, and are identified by one of the ANSWER-TIMES Indicators REGIONS, ITEMS, TS DATA, TID DATA, TS&TID DATA, TS TRADE, TID TRADE or TS&TID TRADE appearing in cell A1 of the worksheet.

Table 1 – ANSWER-TIMES Smart Worksheets

Worksheet	Type	ANSWER Indicator	Description
Regions	Declare	REGIONS	The Internal and External Regions are named and described, and their Set Memberships information is declared. (ANSWER's special _GLOBAL region is pre-defined on the sheet.) See section 4.
Items	Declare	ITEMS	Items whose specification is under user control (TimeSlices, Commodities, Commodity Groups, Processes, User Constraints) are named and described, and (where applicable) their Units and Set Memberships information are declared. See section 5.
Time Series Data	Data	TS DATA	TIMES Time Series Data Parameters that have a single region index are specified. See section 6.
Time Independent Data	Data	TID DATA	TIMES Time Independent Data Parameters that have a single region index are specified. See section 7.
Time Series and Time Independent Data	Data	TS&TID DATA	TIMES Time Series & Time Independent Data Parameters that have a single region index are specified. See section 8.
Time Series Bilateral Trade Data	Data	TS TRADE	TIMES Time Series Data Parameters that have *two* region indexes are specified. See section 9.
Time Independent Bilateral Trade Data	Data	TID TRADE	TIMES Time Independent Data Parameters that have *two* region indexes are specified. See section 10.
Time Series and Time Independent Bilateral Trade Data	Data	TS&TID TRADE	TIMES Time Series & Time Independent Data Parameters that have *two* region indexes are specified. See section 11.

NOTES:

1. Only one REGIONS sheet may be included in a workbook.

2. Only one ITEMS sheet may be included in a workbook.

3. Any number of each type of Data sheet is permitted.

4. ***Version 6.8 does not handle the TIMES Stochastic Extension***, and hence does not allow Stochastic Items to be declared on the ITEMS sheet, nor does it allow Stochastic Time Series & Time Independent Data to be specified on the TS DATA, TID DATA, TS&TID DATA sheets.

The name given to each worksheet is up to the user, although the ANSWER-TIMES Indicators in cell A1 must match those in Table 1. In addition, a workbook may contain as

many other sheets as desired, but the user is encouraged to leave cell A1, the ANSWER-TIMES Indicator cell, blank.

Each of the ANSWER-TIMES "smart" worksheets is governed by a few formatting guidelines (requirements), and has a fairly rigid format. The top 7 rows of each sheet comprise the "smart" buttons and header area. These rows are non-scrollable.

A row will be ignored if the first character of the cell in column A contains an '*', or if the row is completely blank.

3.1 – Role and Operation of "smart" buttons on ANSWER-TIMES Smart Worksheets

There are a number of "smart" buttons on each of the ANSWER-TIMES worksheets. You can use these buttons *to assist in the correct specification* of:

- **Set Memberships** on the REGIONS sheet
- **Component**, **Unit(s)** and **Set Memberships** on the ITEMS sheet
- **Parameter**, and Parameter Arguments (**Arg1**, **Arg2**, …, **Arg6**) on each of the 6 types of Data sheet, and also **I/E Opt** code on the 4 types of Data sheet where Time Series parameters may be specified

The operation of these buttons is context sensitive, that is you must first position the cursor in the appropriate cell (the active cell) below the column in which the "smart" button appears, and then click on the "smart" button to bring up a form, that most often allows you to select from a list of possibilities (e.g. from a list of Parameters, Processes, Commodities etc). When you exit the form, your selection will be transferred into the active cell in **violet**.

But you should also note that use of these "smart" buttons is entirely at your discretion. So for example on a Data sheet if you know the (name of the) TIMES Parameter that you want to insert in a row, and you also know the (names of the) Items that comprise this Parameter's Arguments then you can directly enter the Parameter and its Arguments into the desired row on the Data sheet, with no need to make use of the **Parameter**, **Arg1**, **Arg2**, …, **Arg6** "smart" buttons.

> *This is the case because in version 6.8 of the ANSWER-TIMES "Smart" Excel Workbooks, there are <u>no</u> linked references in Data sheets to Names of TimeSlices, Commodities, Commodity Groups, Processes or Constraints that occur on the ITEMS sheet.*

Note also that every worksheet has a **Check Sheet** "smart" button that may be clicked at any time to have a standard set of consistency and quality control checks performed.

Version 6.8 does not allow inheritance down columns B, E and F of Component, Units and Set Memberships on the ITEMS sheet. (Component, Units and Set Memberships must be specified in columns B, E and F of each row on the ITEMS sheet.) But it does allow inheritance down column A of the region-list on all sheets, except the TRADE sheets where a single region must be specified in column A of each row, (and also in column B of each row).

In the sections that follow each sheet is presented, with the buttons explained.

4. REGIONS Sheet

The REGIONS sheet is where the Internal and External Regions are named and described, and their Set Memberships information is declared. An example REGIONS sheet is shown below. (ANSWER's special _GLOBAL region is pre-defined on the sheet in row 8.)

	A	B	C	D
1	REGIONS	_GLOBAL,DEMO,UTOPIA,IMPEXP,MINRNW		
2				
3	Check Sheet			
4			Set Memberships	
5				
6				
7	Region	Description	Set Memberships	Comment
8	_GLOBAL	Special region for data parameters with no REG arg	ALL_REG	
9	DEMO	Demo region	ALL_REG,REG	
10	UTOPIA	Utopia region	ALL_REG,REG	
11	IMPEXP	IMPEXP region	ALL_REG,REG_EXT	
12	MINRNW	MINRNW region	ALL_REG,REG_EXT	
13				

The information entered on the REGIONS sheet that is directly provided by the user are the Region Names and Descriptions, appearing in columns A and B respectively.
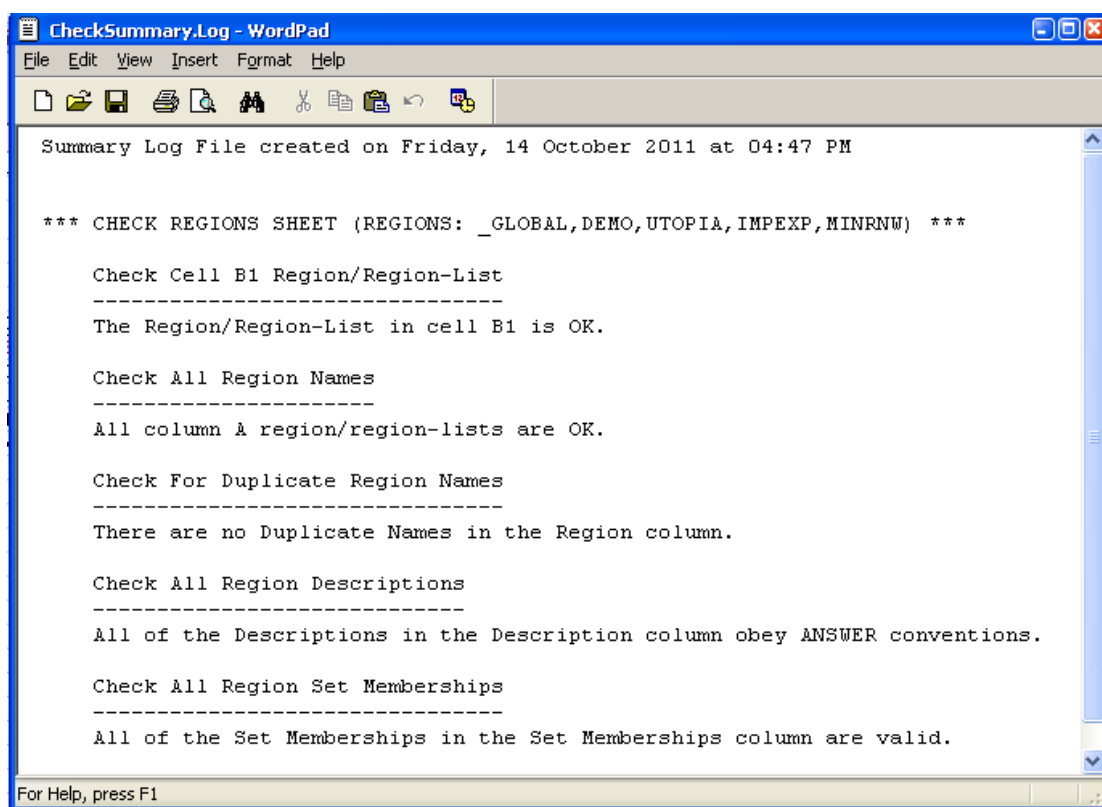
To specify that a Region is an Internal Region, enter **ALL_REG,REG** in column C; and to specify that a Region is an Internal Region, enter **ALL_REG,REG_EXT** in column C.

Or, after positioning the cursor in column C of a row, use the [Set Memberships] "smart" button to select Internal or External from the Region Set Memberships form, shown below (where the user has selected Internal):
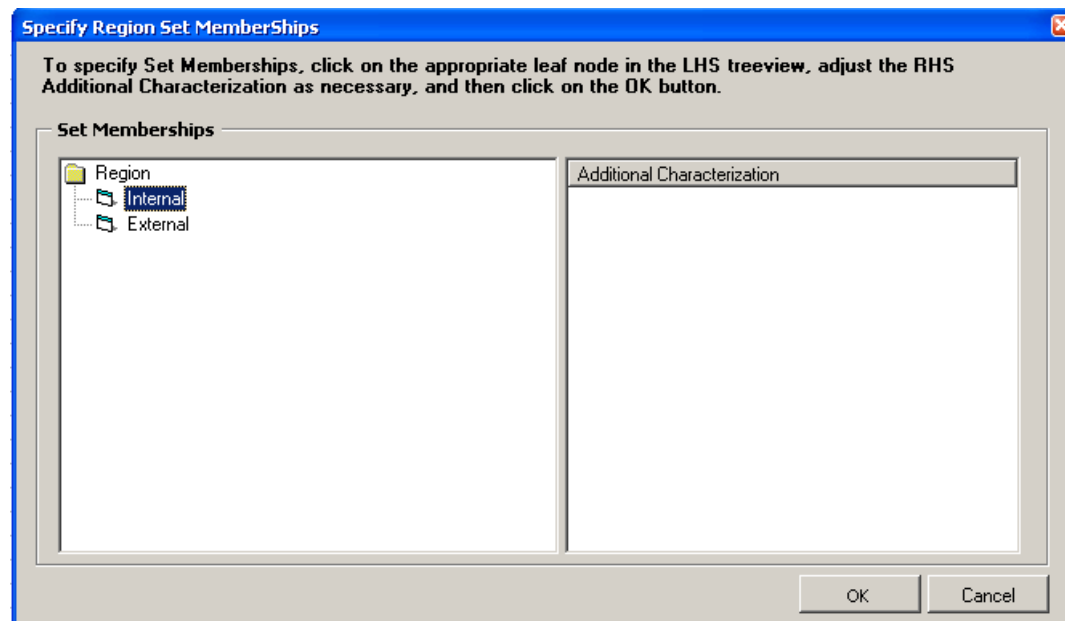
and then click on the [OK] button; the Set Memberships (in this case **ALL_REG,REG** for Internal) will be entered in column C of the row.

The [Check Sheet] button may be clicked at any time to have a standard set of consistency and quality control checks performed; the results of the checking are presented in a Wordpad file as shown below.

```
CheckSummary.Log - WordPad
File  Edit  View  Insert  Format  Help

Summary Log File created on Friday, 14 October 2011 at 04:47 PM


*** CHECK REGIONS SHEET (REGIONS: _GLOBAL,DEMO,UTOPIA,IMPEXP,MINRNW) ***

     Check Cell B1 Region/Region-List
     --------------------------------
     The Region/Region-List in cell B1 is OK.

     Check All Region Names
     ----------------------
     All column A region/region-lists are OK.

     Check For Duplicate Region Names
     --------------------------------
     There are no Duplicate Names in the Region column.

     Check All Region Descriptions
     -----------------------------
     All of the Descriptions in the Description column obey ANSWER conventions.

     Check All Region Set Memberships
     --------------------------------
     All of the Set Memberships in the Set Memberships column are valid.

For Help, press F1
```

5. ITEMS Sheet

The ITEMS sheet is where all the Items whose specification is under user control (TimeSlices, Commodities, Commodity Groups, Processes, User Constraints) are named and described, and (where applicable) their Units and Set Memberships information are declared. An example ITEMS sheet is shown below.

	A	B	C	D	E	F	G	H
1	ITEMS	_GLOBAL,DEMO,UTOPIA,IMPEXP,MINRNW						
2								
3	Check Sheet							
4		Component			Unit(s)	Set Memberships		
5								
6								
7		Comp	Name	Description	Unit(s)	Set Memberships	Comment	
8								
9	' Pre-defined Commodity Groups (cell A10 should contain comma-delimited list of all Internal Regions)							
10	DEMO,UTOPIA	D	ACTGRP	Activity-related Group		COM_GRP,COM_GRPDEF		
11		D	DEM	Demand Commodity Type		COM_GRP,COM_GRPDEF		
12		D	ENV	Environmental Commodity Type		COM_GRP,COM_GRPDEF		
13		D	FIN	Financial Commodity Type		COM_GRP,COM_GRPDEF		
14		D	MAT	Material Commodity Type		COM_GRP,COM_GRPDEF		
15		D	NRG	Energy Commodity Type		COM_GRP,COM_GRPDEF		
16								
17	' TimeSlice Items for _GLOBAL,DEMO,UTOPIA regions							
18	_GLOBAL,DEMO,UTOPIA	W	ANNUAL	Annual		ALL_TS,ANNUAL		
19		W	FA	Fall		ALL_TS,SEASON		
20		W	FAD	Fall Day		ALL_TS,DAYNITE		
21		W	FAN	Fall Night		ALL_TS,DAYNITE		
22		W	SP	Spring		ALL_TS,SEASON		
23		W	SPD	Spring Day		ALL_TS,DAYNITE		
24		W	SPN	Spring Night		ALL_TS,DAYNITE		
25		W	SU	Summer		ALL_TS,SEASON		
26		W	SUD	Summer Day		ALL_TS,DAYNITE		
27		W	SUN	Summer Night		ALL_TS,DAYNITE		
28		W	WI	Winter		ALL_TS,SEASON		
29		W	WID	Winter Day		ALL_TS,DAYNITE		
30		W	WIN	Winter Night		ALL_TS,DAYNITE		
31								
32	' Commodity Items for DEMO,UTOPIA regions							
33	DEMO,UTOPIA	E	CO2	Carbon Dioxide	kt	COM,ENV,ANNUAL,GHG		
34		E	ELC	Electricity	PJ	COM,NRG,DAYNITE,ELC		
35		E	HYD	Hydro Power	PJ	COM,NRG,ANNUAL,FRERENEW		
36		E	ID	Industrial Heating	PJ	COM,DEM,ANNUAL,IND		
37		E	RH	Residential Space Heating	PJ	COM,DEM,DAYNITE,RES		
38		E	RL	Residential Lighting	PJ	COM,DEM,ANNUAL,RES		
39		E	TX	Automobile Transportation	PJ	COM,DEM,ANNUAL,TRN		
40								
41	' Commodity Items for DEMO,UTOPIA, IMPEXP regions (ANSWER requires Commodity Items to be specified in External Regions involved in Import/Export)							
42	DEMO,UTOPIA, IMPEXP	E	DSL	Diesel	PJ	COM,NRG,ANNUAL,FOSSIL		
43		E	GAS	GAS	PJ	COM,NRG,ANNUAL,FOSSIL		
44		E	GSL	Gasoline	PJ	COM,NRG,ANNUAL,FOSSIL		
45		E	HCO	Coal	PJ	COM,NRG,ANNUAL,FOSSIL		
46		E	OIL	Oil	PJ	COM,NRG,ANNUAL,FOSSIL		
47		E	URN	Natural Uranium	PJ	COM,NRG,ANNUAL,NUCLR		
48								
49	' Commodity Group Items for DEMO,UTOPIA regions							
50	DEMO,UTOPIA	D	E41_OUT	E41_OUT		COM_GRP,COM_GRPTRU		
51		D	RHG_IN	RHG_IN		COM_GRP,COM_GRPTRU		
52		D	SRE-G	PCG for SRE-G (Oil Refinery)		COM_GRP,COM_GRPTRU		
53								
54	' Process Items for DEMO,UTOPIA regions							
55	DEMO,UTOPIA	T	BITRADE-ELC	Bilateral Trade in Electricity	PJ,GW	PRC,ELE,DAYNITE,IRE		
56		T	E01	Coal Steam Electric	PJ,GW	PRC,ELE,DAYNITE		
57		T	E21	LWR Nuclear Plant	PJ,GW	PRC,ELE,SEASON		

Note that when you first create an ITEMS sheet, rows 9-15 are <u>automatically generated</u>, and you must enter into cell A10 a comma-delimited list of the internal regions for your model.

> These auto-generated rows specifying pre-defined Commodity Groups are necessary to ensure that data parameters that require pre-defined Commodity Groups as arguments can be specified, and for the correct functioning of "Check Sheet". So you should always retain them.

The remaining information entered on the ITEMS sheet that is directly provided by the user for each Item are the Component, Item Name and Description, appearing in columns B, C and D respectively.

(Initially, the user may need to use the **Component** "smart" button to specify the single character Component Letter in column B:
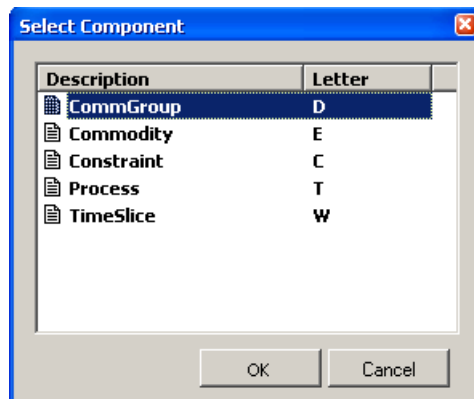
but rather quickly will come to learn the correspondence between the TimeSlice, Commodity, Commodity Group, Process, User Constraint Components and these 5 Letters.)
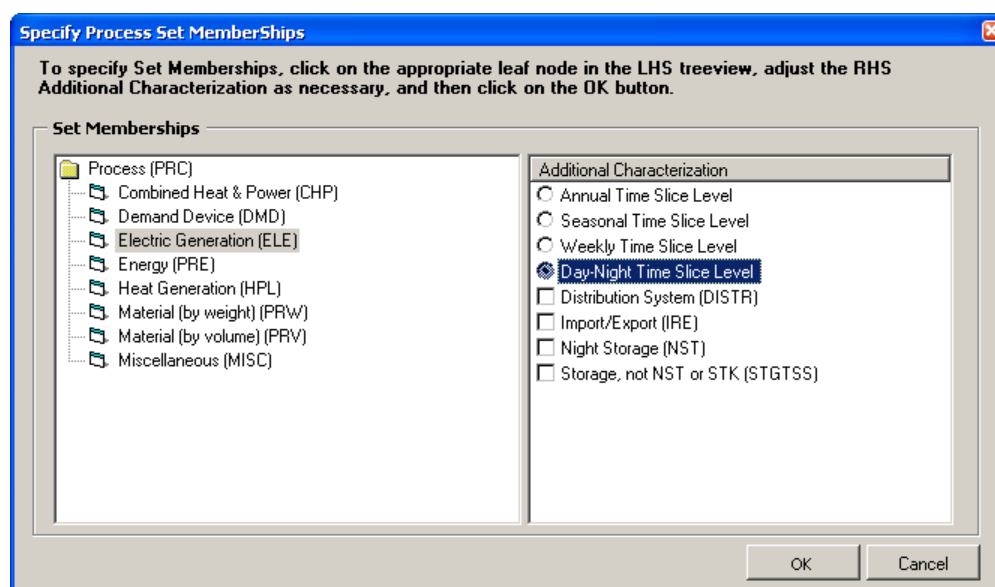
In addition, after positioning the cursor in columns E or F of a row the **Unit(s)** or

Set Memberships "smart" buttons may be used to select the Unit(s) or Set Memberships specifications, respectively.
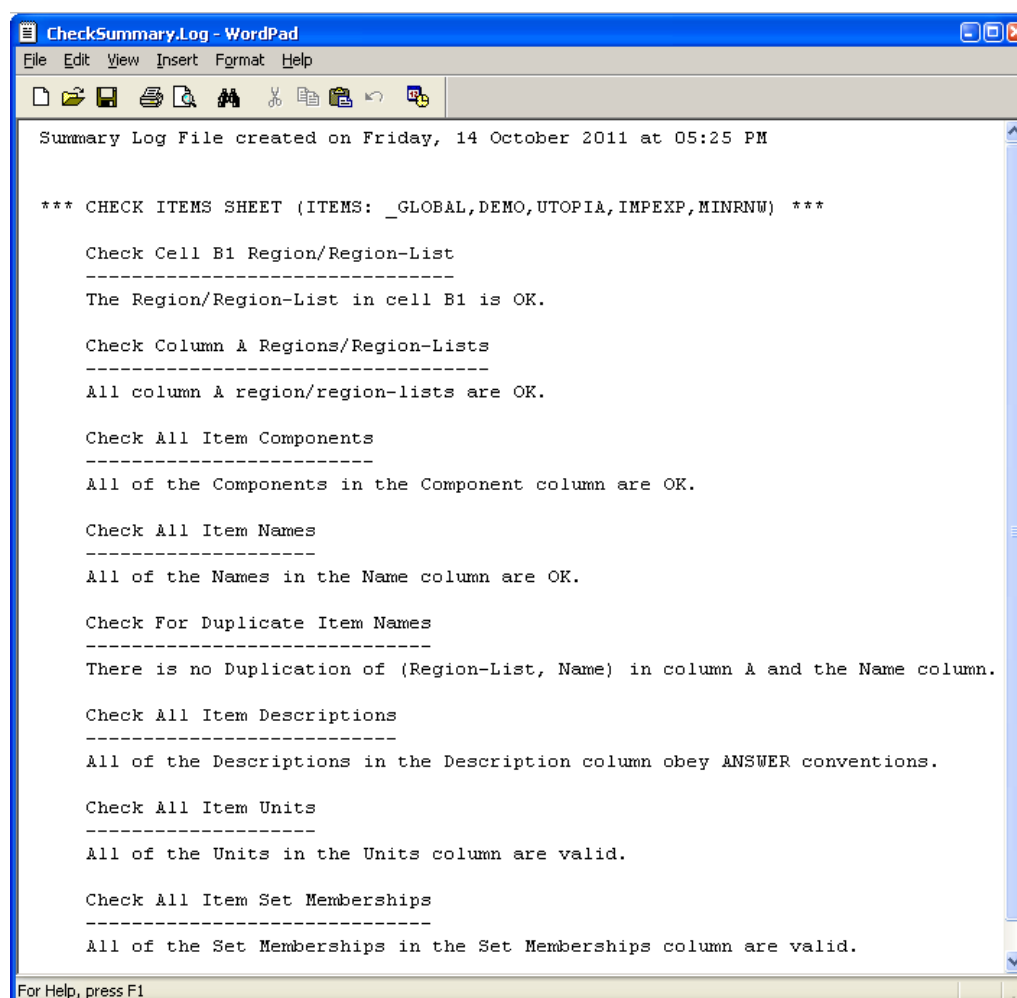
For example, if you click on the **Unit(s)** button when the cursor is positioned in column E, for a row in which the Component in column B is T (Process), the form shown below will be displayed, allowing you to specify the Process Activity Unit and Process Capacity Unit that apply for the Process (the form is shown after you have selected PJ, GW respectively):
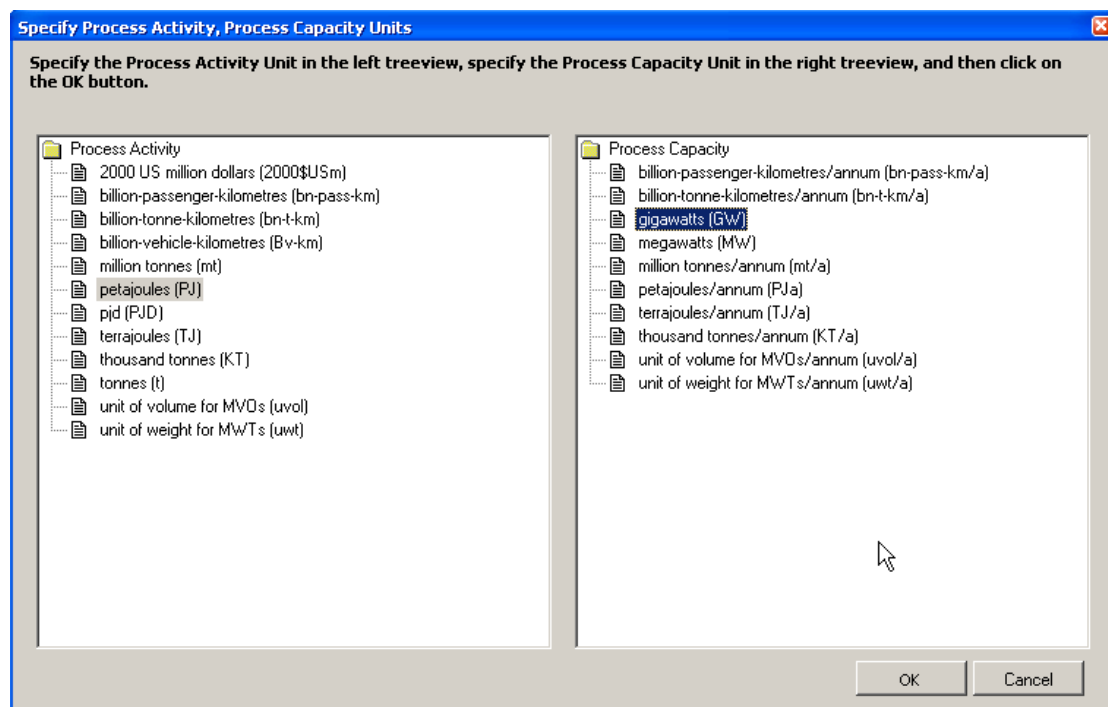
And if you click on the **Set Memberships** button when the cursor is positioned in column F, for a row in which the Component in column B is T (Process), the form shown below will be displayed, allowing you to specify the Set Memberships that apply for the Process (the form is shown after you have selected ELE, Day-Night Time Slice Level):

Specify Process Set MemberShips

To specify Set Memberships, click on the appropriate leaf node in the LHS treeview, adjust the RHS Additional Characterization as necessary, and then click on the OK button.

Set Memberships

Process (PRC)
- Combined Heat & Power (CHP)
- Demand Device (DMD)
- Electric Generation (ELE)
- Energy (PRE)
- Heat Generation (HPL)
- Material (by weight) (PRW)
- Material (by volume) (PRV)
- Miscellaneous (MISC)

Additional Characterization
- ○ Annual Time Slice Level
- ○ Seasonal Time Slice Level
- ○ Weekly Time Slice Level
- ◉ Day-Night Time Slice Level
- ☐ Distribution System (DISTR)
- ☐ Import/Export (IRE)
- ☐ Night Storage (NST)
- ☐ Storage, not NST or STK (STGTSS)

OK   Cancel

The **Check Sheet** button may be pressed at any time to have a standard set of consistency and quality control checks performed. The results of the checking are presented in a Wordpad file as shown below, and any offending cells are highlighted on the sheet in yellow along with a cell comment indicating the nature of the problem.

CheckSummary.Log - WordPad

File   Edit   View   Insert   Format   Help

```
Summary Log File created on Friday, 14 October 2011 at 05:25 PM


*** CHECK ITEMS SHEET (ITEMS: _GLOBAL,DEMO,UTOPIA,IMPEXP,MINRNW) ***

    Check Cell B1 Region/Region-List
    --------------------------------
    The Region/Region-List in cell B1 is OK.

    Check Column A Regions/Region-Lists
    -----------------------------------
    All column A region/region-lists are OK.

    Check All Item Components
    -------------------------
    All of the Components in the Component column are OK.

    Check All Item Names
    --------------------
    All of the Names in the Name column are OK.

    Check For Duplicate Item Names
    ------------------------------
    There is no Duplication of (Region-List, Name) in column A and the Name column.

    Check All Item Descriptions
    ---------------------------
    All of the Descriptions in the Description column obey ANSWER conventions.

    Check All Item Units
    --------------------
    All of the Units in the Units column are valid.

    Check All Item Set Memberships
    ------------------------------
    All of the Set Memberships in the Set Memberships column are valid.
```
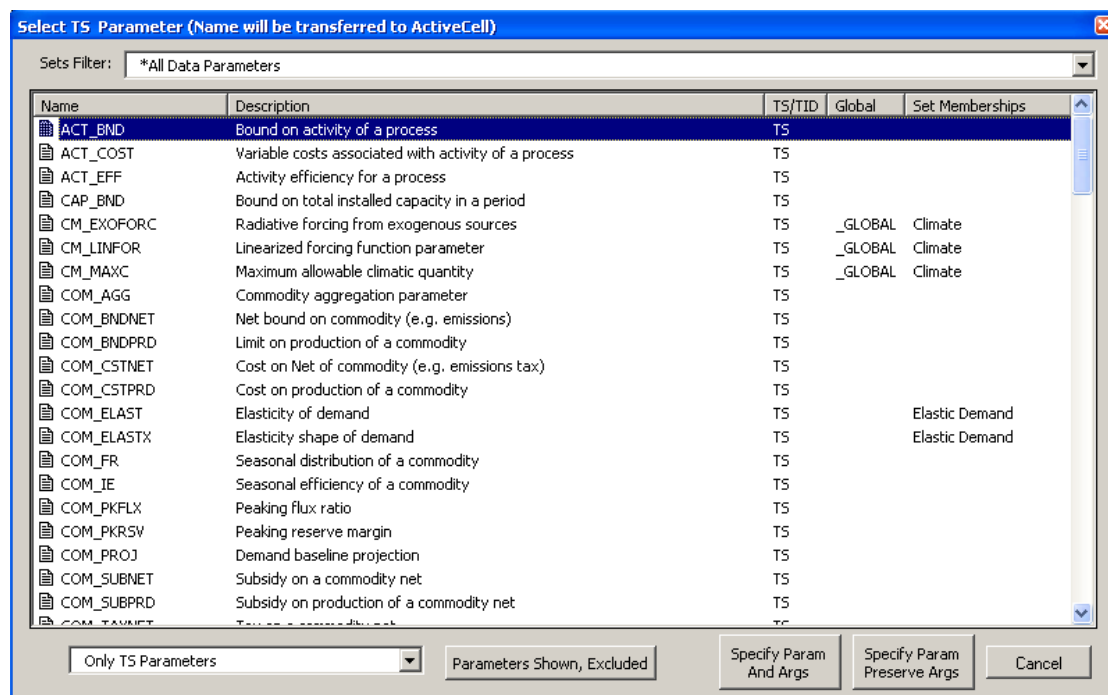
For Help, press F1

6. Time Series Data (TS DATA) Sheet

The TS DATA sheet is where Time Series Data Parameters are specified. An example of a TS DATA sheet is shown below.

To specify a Time Series Data Parameter, position the cursor in column B of a row below row 7, and press the [Parameter] "smart" button. This brings up a TS Parameter selection list as shown below:

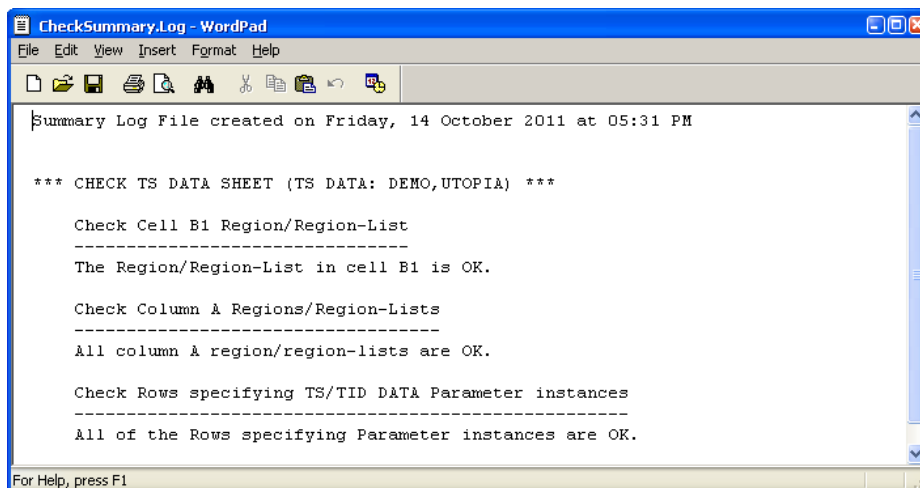Select the desired TS Parameter and (normally) click on the [Specify Param And Args] button. Then use the [Arg1] through to [Arg6] buttons, and the [I/E Opt] button, as appropriate to specify the Arguments and the I/E Opt code for the selected Parameter, followed by specification of the Parameter's numeric values.

See Appendixes B.1 and B.2 respectively for details regarding the operation of the Parameter selection form, and for details regarding the operation of the Item selection form that is displayed when you click on any of the [Arg1] through to [Arg6] buttons to specify the Arguments for the selected Parameter.

The [Check Sheet] button may be pressed at any time to have a standard set of consistency and quality control checks performed.

See Appendix B.3 for details regarding the checking that is carried out for a Data Parameter.

The results of the checking are presented in a Wordpad file as shown below, and any offending cells are highlighted on the sheet in yellow along with a cell comment indicating the nature of the problem.

```
Summary Log File created on Friday, 14 October 2011 at 05:31 PM


*** CHECK TS DATA SHEET (TS DATA: DEMO,UTOPIA) ***

    Check Cell B1 Region/Region-List
    --------------------------------
    The Region/Region-List in cell B1 is OK.

    Check Column A Regions/Region-Lists
    -----------------------------------
    All column A region/region-lists are OK.

    Check Rows specifying TS/TID DATA Parameter instances
    -----------------------------------------------------
    All of the Rows specifying Parameter instances are OK.
```
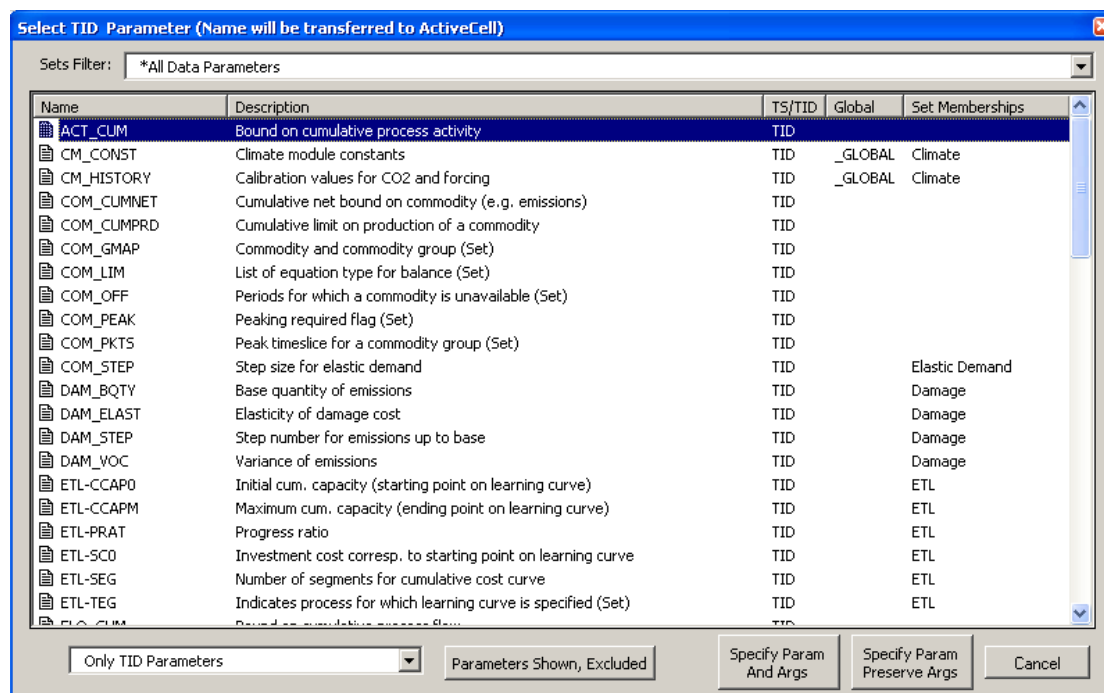
7. Time Independent Data (TID DATA)

The TID DATA sheet is where Time Independent Data Parameters are specified. An example of a TID DATA sheet is shown below.

	A	B	C	D	E	F	G	H	I	J
1	**TID DATA**	DEMO,UTOPIA								
2										
3	**Check Sheet**									
4		**Parameter**	**Arg1**	**Arg2**	**Arg3**	**Arg4**	**Arg5**	**Arg6**		
5										
6										
7		**Parameter**	**Arg1**	**Arg2**	**Arg3**	**Arg4**	**Arg5**	**Arg6**	**Value**	
8										
9	* TID DATA for DEMO,UTOPIA regions									
10	DEMO,UTOPIA	COM_GMAP	-	CO2	ENV	-	-	-	1	
11		COM_GMAP	-	DSL	NRG	-	-	-	1	
12		COM_GMAP	-	DSL	RHG_IN	-	-	-	1	
13		COM_GMAP	-	DSL	SRE-G	-	-	-	1	
14		COM_GMAP	-	ELC	E41_OUT	-	-	-	1	
15		COM_GMAP	-	ELC	NRG	-	-	-	1	
16		COM_GMAP	-	GAS	NRG	-	-	-	1	
17		COM_GMAP	-	GAS	RHG_IN	-	-	-	1	
18		COM_GMAP	-	GSL	NRG	-	-	-	1	
19		COM_GMAP	-	GSL	SRE-G	-	-	-	1	
20		COM_GMAP	-	HCO	NRG	-	-	-	1	
21		COM_GMAP	-	HYD	NRG	-	-	-	1	
22		COM_GMAP	-	OIL	NRG	-	-	-	1	
23		COM_GMAP	-	RH	DEM	-	-	-	1	
24		COM_GMAP	-	RH	E41_OUT	-	-	-	1	
25		COM_GMAP	-	RL	DEM	-	-	-	1	
26		COM_GMAP	-	TX	DEM	-	-	-	1	
27		COM_GMAP	-	URN	NRG	-	-	-	1	
28		COM_PEAK	-	ELC	-	-	-	-	1	
29		G_YRFR	-	-	-	-	ANNUAL	-	1	
30		G_YRFR	-	-	-	-	FA	-	0.25	
31		G_YRFR	-	-	-	-	FAD	-	0.167	
32		G_YRFR	-	-	-	-	FAN	-	0.083	
33		G_YRFR	-	-	-	-	SP	-	0.25	
34		G_YRFR	-	-	-	-	SPD	-	0.167	
35		G_YRFR	-	-	-	-	SPN	-	0.083	
36		G_YRFR	-	-	-	-	SU	-	0.25	
37		G_YRFR	-	-	-	-	SUD	-	0.18	
38		G_YRFR	-	-	-	-	SUN	-	0.07	

To specify a Time Independent Data Parameter, position the cursor in column B of a row below row 7, and press the [Parameter] "smart" button. This brings up a TID Parameter selection list as shown below:

Select TID Parameter (Name will be transferred to ActiveCell)

Sets Filter: *All Data Parameters

Name	Description	TS/TID	Global	Set Memberships
ACT_CUM	Bound on cumulative process activity	TID		
CM_CONST	Climate module constants	TID	_GLOBAL	Climate
CM_HISTORY	Calibration values for CO2 and forcing	TID	_GLOBAL	Climate
COM_CUMNET	Cumulative net bound on commodity (e.g. emissions)	TID		
COM_CUMPRD	Cumulative limit on production of a commodity	TID		
COM_GMAP	Commodity and commodity group (Set)	TID		
COM_LIM	List of equation type for balance (Set)	TID		
COM_OFF	Periods for which a commodity is unavailable (Set)	TID		
COM_PEAK	Peaking required flag (Set)	TID		
COM_PKTS	Peak timeslice for a commodity group (Set)	TID		
COM_STEP	Step size for elastic demand	TID		Elastic Demand
DAM_BQTY	Base quantity of emissions	TID		Damage
DAM_ELAST	Elasticity of damage cost	TID		Damage
DAM_STEP	Step number for emissions up to base	TID		Damage
DAM_VOC	Variance of emissions	TID		Damage
ETL-CCAP0	Initial cum. capacity (starting point on learning curve)	TID		ETL
ETL-CCAPM	Maximum cum. capacity (ending point on learning curve)	TID		ETL
ETL-PRAT	Progress ratio	TID		ETL
ETL-SC0	Investment cost corresp. to starting point on learning curve	TID		ETL
ETL-SEG	Number of segments for cumulative cost curve	TID		ETL
ETL-TEG	Indicates process for which learning curve is specified (Set)	TID		ETL
FLO_CUM	Bound on cumulative process flow	TID		

Only TID Parameters   [Parameters Shown, Excluded]   [Specify Param And Args]   [Specify Param Preserve Args]   [Cancel]

Select the desired TID Parameter and (normally) click on the [Specify Param And Args] button.
Then use the [Arg1] through to [Arg6] buttons as appropriate to specify the Arguments for the selected Parameter, followed by specification of the Parameter's numeric value.
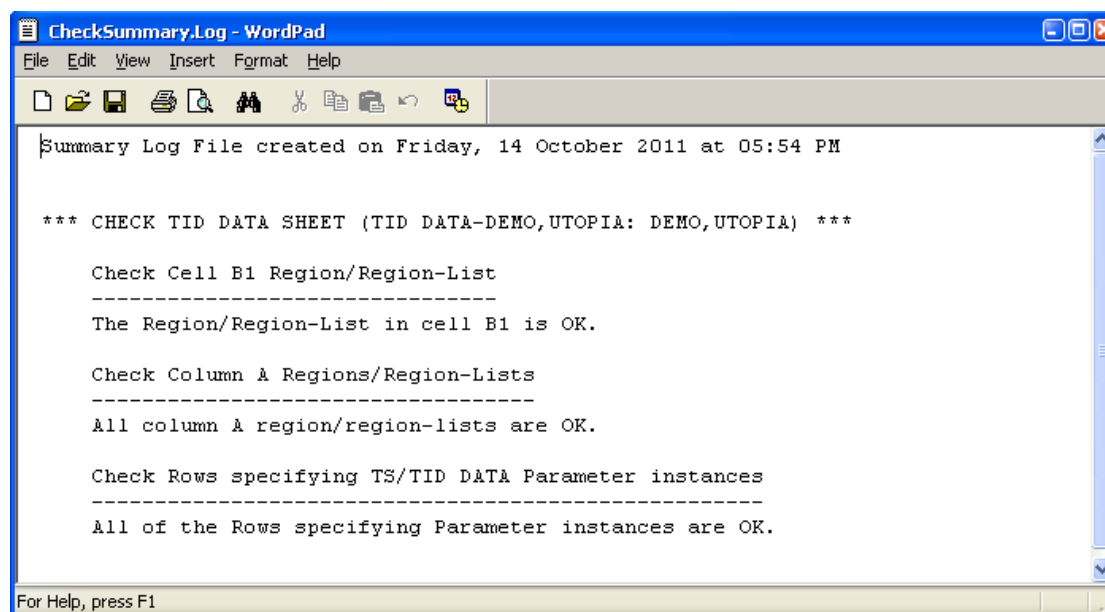
See Appendixes B.1 and B.2 respectively for details regarding the operation of the Parameter selection form, and for details regarding the operation of the Item selection form that is displayed when you click on any of the [Arg1] through to [Arg6] buttons to specify the Arguments for the selected Parameter.

The [Check Sheet] button may be pressed at any time to have a standard set of consistency and quality control checks performed.

See Appendix B.3 for details regarding the checking that is carried out for a Data Parameter.

The results of the checking are presented in a Wordpad file as shown below, and any offending cells are highlighted on the sheet in yellow along with a cell comment indicating the nature of the problem.

8. Time Series & Time Independent Data (TS&TID DATA) Sheet

The TS&TID DATA sheet offers the convenience of allowing both Time Series and Time Independent Data Parameters to be specified on a single sheet. An example of a TS&TID DATA sheet is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	TS&TID DATA	GLOBAL,REG1,REG2,REG3,IMPEXP,MINRNW											
2													
3	Check Sheet												
4		Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	I/E Opt				
5													
6													
7		Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	I/E Opt or Value				
8													
9	' TS and TID Process Data for Demand Devices, Grouped by Process - REG1,REG2,REG3 regions												
10													
11	' TS and TID Data for RHE												
12	REG1,REG2,REG3	ACT_EFF	RHE	-	ELC	-	ANNUAL	-	0	1	1	1	1
13		FLO_FR	RHE	RH	-	-	FAD	FX	0	0.18	0.18	0.18	0.18
14		FLO_FR	RHE	RH	-	-	FAN	FX	0	0.12	0.12	0.12	0.12
15		FLO_FR	RHE	RH	-	-	SPD	FX	0	0.06	0.06	0.06	0.06
16		FLO_FR	RHE	RH	-	-	SPN	FX	0	0.04	0.04	0.04	0.04
17		FLO_FR	RHE	RH	-	-	SUD	FX	0	0	0	0	0
18		FLO_FR	RHE	RH	-	-	SUN	FX	0	0	0	0	0
19		FLO_FR	RHE	RH	-	-	WID	FX	0	0.4	0.4	0.4	0.4
20		FLO_FR	RHE	RH	-	-	WIN	FX	0	0.2	0.2	0.2	0.2
21		NCAP_AF	RHE	-	-	-	ANNUAL	UP	0	1	1	1	1
22		NCAP_BND	RHE	-	-	-	-	UP	0	0	null	null	null	r
23		NCAP_COST	RHE	-	-	-	-	-	0	12	12	12	12
24		NCAP_TLIFE	RHE	-	-	-	-	-	0	30	30	30	30
25		PRC_ACTUNT	RHE	-	RH	-	-	-	1				
26		PRC_CAPACT	RHE	-	-	-	-	-	1				
27		TOP-IN	RHE	ELC	-	-	-	-	1				
28		TOP-OUT	RHE	RH	-	-	-	-	1				
29	' TS and TID Data for RHG												
30		ACT_EFF	RHG	-	RHG_IN	-	ANNUAL	-	0	0.7	0.7	0.7	0.7
31		FLO_EMIS	RHG	CO2	DSL	-	ANNUAL	-	0	75	75	75	75
32		FLO_EMIS	RHG	CO2	GAS	-	ANNUAL	-	0	56	56	56	56
33		FLO_FR	RHG	RH	-	-	FAD	FX	0	0.18	0.18	0.18	0.18
34		FLO_FR	RHG	RH	-	-	FAN	FX	0	0.12	0.12	0.12	0.12

To specify a Time Series or Time Independent Data Parameter on a TS&TID DATA sheet, position the cursor in column B of a row below row 7, and press the [Parameter] "smart" button. This brings up a TS and TID Parameter selection list as shown below:
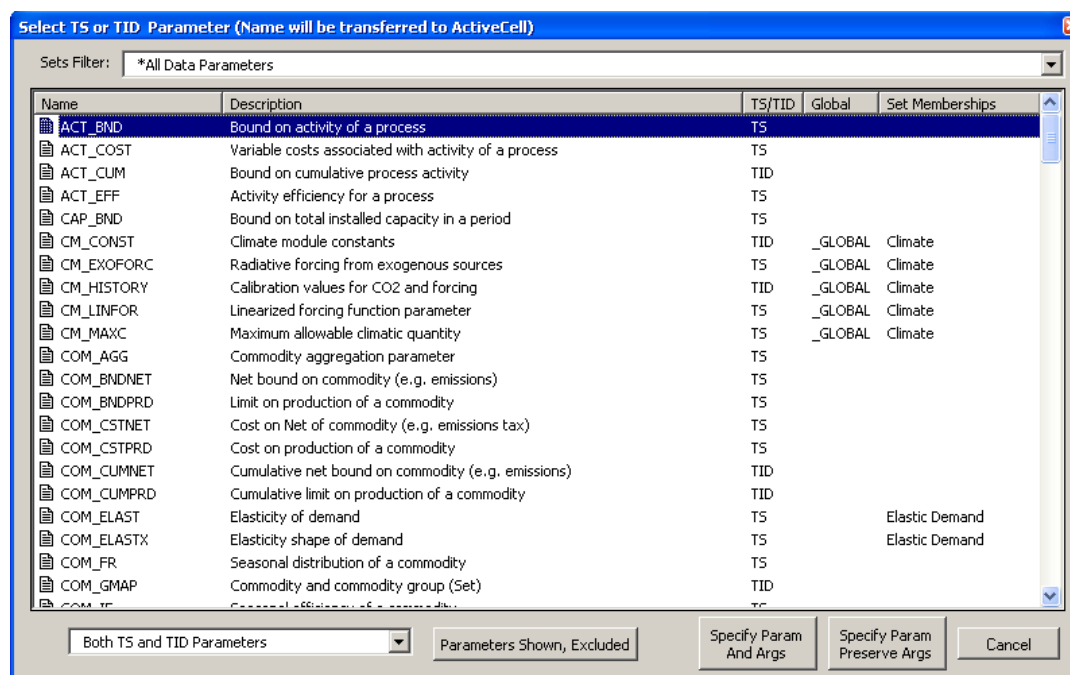

The mechanics of selecting the desired Parameter and specifying its Arguments, and the operation of the [Check Sheet] button are exactly the same as for the TS DATA and TID DATA sheets.

9. Time Series Trade Data (TS TRADE) Sheet

The TS TRADE sheet is where Time Series Trade Data Parameters are specified. These are TS Parameters that have *two* region indexes. An example of a TS TRADE sheet is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	TS TRADE	_GLOBAL,REG1,REG2,REG3,IMPEXP,MINRNW											
2													
3	Check Sheet												
4			Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	I/E Opt			
5													
6													
7	Region	Region2	Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	I/E Opt			
8													
9	' On TS TRADE sheet, a single region must be specified in column A (a comma-separated region-list is not allowed)												
10													
11	REG1	IMPEXP	IRE_PRICE	IMPDSL1	DSL	ANNUAL	-	IMP	-	0	10	10	10
12	REG1	IMPEXP	IRE_PRICE	IMPGAS1	GAS	ANNUAL	-	IMP	-	0	6.4	6.4	6.4
13	REG1	IMPEXP	IRE_PRICE	IMPGSL1	GSL	ANNUAL	-	IMP	-	0	15	15	15
14	REG1	IMPEXP	IRE_PRICE	IMPHCO1	HCO	ANNUAL	-	IMP	-	0	2	2	2
15	REG1	IMPEXP	IRE_PRICE	IMPOIL1	OIL	ANNUAL	-	IMP	-	0	8	8	8
16	REG1	IMPEXP	IRE_PRICE	IMPURN1	URN	ANNUAL	-	IMP	-	0	2	2	2
17	*												
18	REG2	IMPEXP	IRE_PRICE	IMPDSL1	DSL	ANNUAL	-	IMP	-	0	10	10	10
19	REG2	IMPEXP	IRE_PRICE	IMPGAS1	GAS	ANNUAL	-	IMP	-	0	6.4	6.4	6.4
20	REG2	IMPEXP	IRE_PRICE	IMPGSL1	GSL	ANNUAL	-	IMP	-	0	15	15	15
21	REG2	IMPEXP	IRE_PRICE	IMPHCO1	HCO	ANNUAL	-	IMP	-	0	2	2	2
22	REG2	IMPEXP	IRE_PRICE	IMPOIL1	OIL	ANNUAL	-	IMP	-	0	8	8	8
23	REG2	IMPEXP	IRE_PRICE	IMPURN1	URN	ANNUAL	-	IMP	-	0	2	2	2
24	*												
25	REG3	IMPEXP	IRE_PRICE	IMPDSL1	DSL	ANNUAL	-	IMP	-	0	10	10	10
26	REG3	IMPEXP	IRE_PRICE	IMPGAS1	GAS	ANNUAL	-	IMP	-	0	6.4	6.4	6.4
27	REG3	IMPEXP	IRE_PRICE	IMPGSL1	GSL	ANNUAL	-	IMP	-	0	15	15	15
28	REG3	IMPEXP	IRE_PRICE	IMPHCO1	HCO	ANNUAL	-	IMP	-	0	2	2	2
29	REG3	IMPEXP	IRE_PRICE	IMPOIL1	OIL	ANNUAL	-	IMP	-	0	8	8	8
30	REG3	IMPEXP	IRE_PRICE	IMPURN1	URN	ANNUAL	-	IMP	-	0	2	2	2
31	*												

To specify a Time Series Trade Data Parameter, select an (empty) row below row 7 and *enter the regions involved in the trade in the Region and Region2 columns* (columns A, B) of this row. Then position the cursor in column **C** of this row, and press the **Parameter** "smart" button. This brings up a TS Trade Data Parameter selection list as shown below:
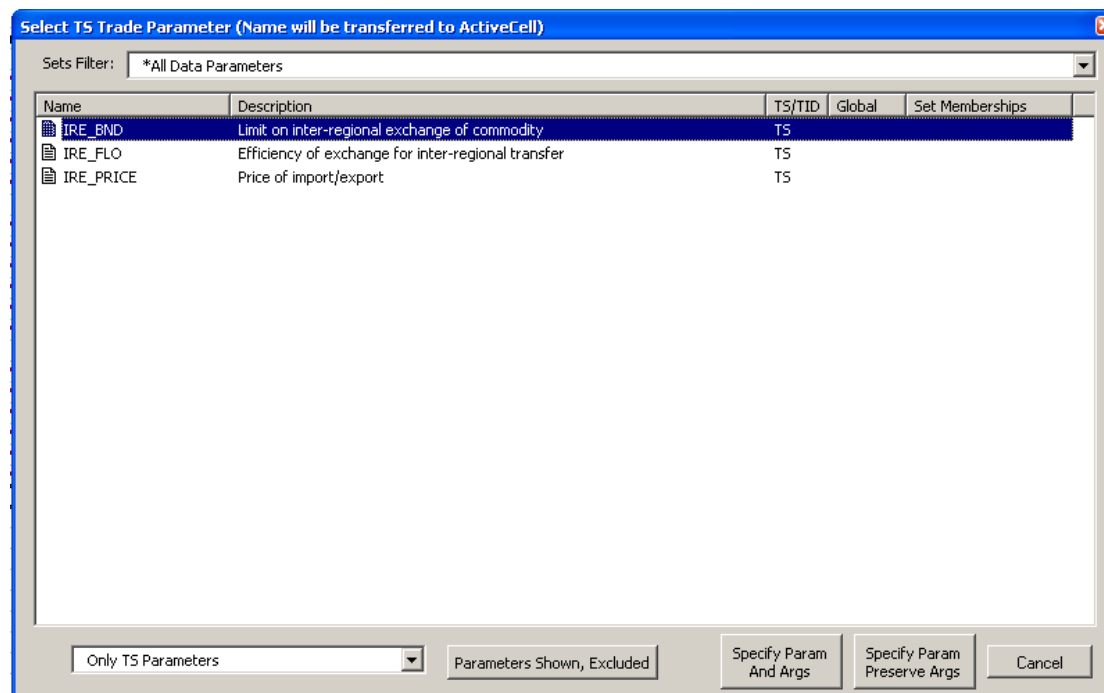
Select the desired TS Trade Parameter and (normally) click on the **Specify Param And Args** button.

Then use the [Arg1] through to [Arg6] buttons, and the [I/E Opt] button, as appropriate to specify the Arguments and the I/E Opt code for the selected Parameter, followed by specification of the Parameter's numeric values.
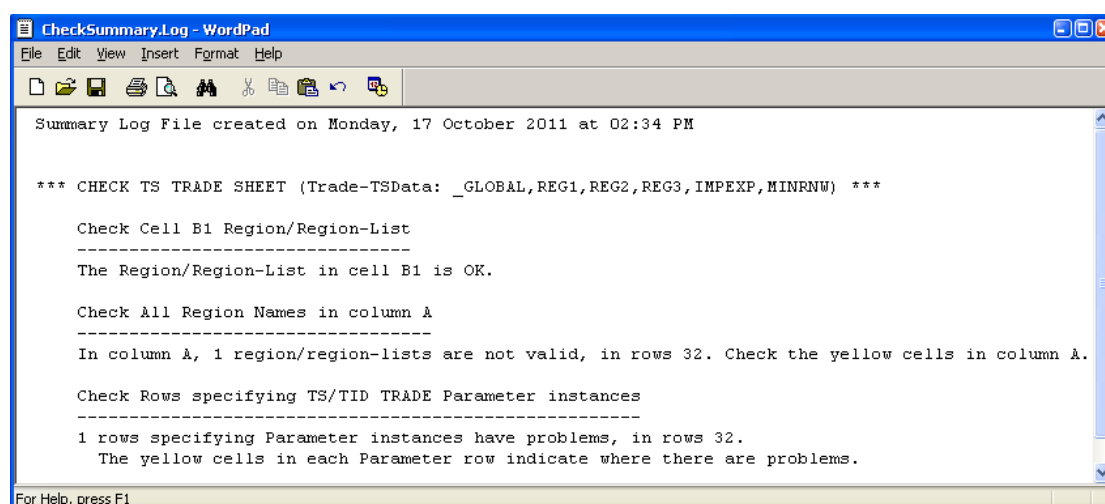
See Appendixes B.1 and B.2 respectively for details regarding the operation of the Parameter selection form, and for details regarding the operation of the Item selection form that is

displayed when you click on any of the [Arg1] *through to* [Arg6] *buttons to specify the Arguments for the selected Parameter.*

The [Check Sheet] button may be pressed at any time to have a standard set of consistency and quality control checks performed.

See Appendix B.3 for details regarding the checking that is carried out for a Data Parameter.

The results of the checking are presented in a Wordpad file as shown below, and any offending cells are highlighted on the sheet in yellow along with a cell comment indicating the nature of the problem. Suppose for example you specify parameter IRE_PRICE in row 32 but forget to specify Region and Region2 in cells A32 and B32. Then the Wordpad file will be as follows:

and the TS TRADE worksheet will have cells A32 and B32 highlighted in yellow as follows:

10. Time Independent Trade Data (TID TRADE) Sheet

The TID TRADE sheet is where Time Independent Trade Data Parameters are specified. These are TID Parameters that have *two* region indexes. An example of a TID TRADE sheet is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L
1	TID TRADE	,GLOBAL,REG1,REG2,REG3,IMPEXP,MINRNW										
2												
3	Check Sheet											
4			Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6			
5												
6												
7	Region	Region2	Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Value		
8												
9	* On TID TRADE sheet, a single region must be specified in column A (a comma-separated region-list is not allowed)											
10												
11	IMPEXP	REG1	TOP_IRE	IMPDSL1	DSL	-	-	-	DSL	1		
12	IMPEXP	REG1	TOP_IRE	IMPGAS1	GAS	-	-	-	GAS	1		
13	IMPEXP	REG1	TOP_IRE	IMPGSL1	GSL	-	-	-	GSL	1		
14	IMPEXP	REG1	TOP_IRE	IMPHCO1	HCO	-	-	-	HCO	1		
15	IMPEXP	REG1	TOP_IRE	IMPOIL1	OIL	-	-	-	OIL	1		
16	IMPEXP	REG1	TOP_IRE	IMPURN1	URN	-	-	-	URN	1		
17	*											
18	IMPEXP	REG2	TOP_IRE	IMPDSL1	DSL	-	-	-	DSL	1		
19	IMPEXP	REG2	TOP_IRE	IMPGAS1	GAS	-	-	-	GAS	1		
20	IMPEXP	REG2	TOP_IRE	IMPGSL1	GSL	-	-	-	GSL	1		
21	IMPEXP	REG2	TOP_IRE	IMPHCO1	HCO	-	-	-	HCO	1		
22	IMPEXP	REG2	TOP_IRE	IMPOIL1	OIL	-	-	-	OIL	1		
23	IMPEXP	REG2	TOP_IRE	IMPURN1	URN	-	-	-	URN	1		
24	*											
25	IMPEXP	REG3	TOP_IRE	IMPDSL1	DSL	-	-	-	DSL	1		
26	IMPEXP	REG3	TOP_IRE	IMPGAS1	GAS	-	-	-	GAS	1		
27	IMPEXP	REG3	TOP_IRE	IMPGSL1	GSL	-	-	-	GSL	1		
28	IMPEXP	REG3	TOP_IRE	IMPHCO1	HCO	-	-	-	HCO	1		
29	IMPEXP	REG3	TOP_IRE	IMPOIL1	OIL	-	-	-	OIL	1		
30	IMPEXP	REG3	TOP_IRE	IMPURN1	URN	-	-	-	URN	1		
31												

To specify a Time Independent Trade Data Parameter, select an (empty) row below row 7 and *enter the regions involved in the trade in the Region and Region2 columns* (columns A, B) of this row. Then position the cursor in column **C** of this row, and press the

Parameter "smart" button. This brings up a TID Trade Data Parameter selection list as shown below:
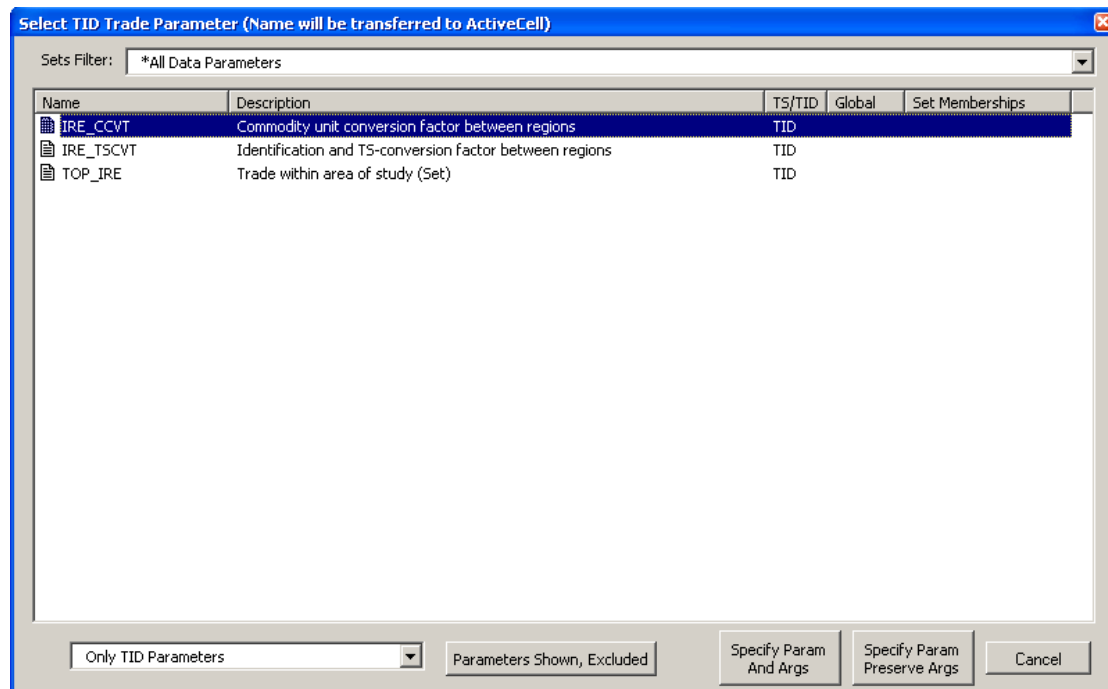
Select the desired TID Trade Parameter and (normally) click on the Specify Param And Args button.

Then use the [Arg1] through to [Arg6] buttons as appropriate to specify the Arguments for the selected Parameter, followed by specification of the Parameter's numeric value.
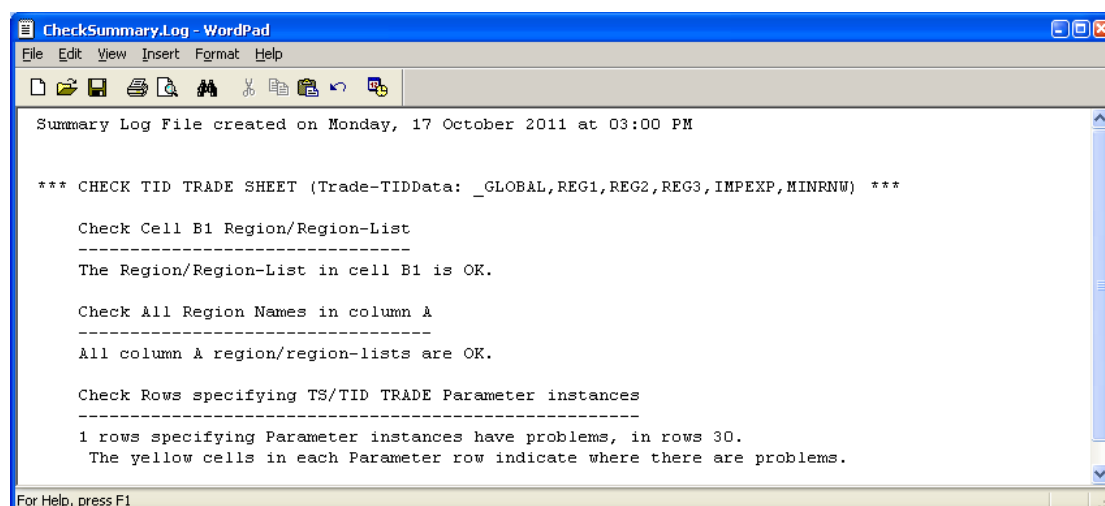
See Appendixes B.1 and B.2 respectively for details regarding the operation of the Parameter selection form, and for details regarding the operation of the Item selection form that is

displayed when you click on any of the [Arg1] *through to* [Arg6] *buttons to specify the Arguments for the selected Parameter.*

The [Check Sheet] button may be pressed at any time to have a standard set of consistency and quality control checks performed.

See Appendix B.3 for details regarding the checking that is carried out for a Data Parameter.

The results of the checking are presented in a Wordpad file as shown below, and any offending cells are highlighted on the sheet in yellow along with a cell comment indicating the nature of the problem. Suppose for example that while specifying parameter TOP_IRE in row 30 you press the [Check Sheet] button before replacing Commodity in the Arg6 column by the desired commodity name (URN in this case). Then the Wordpad file will be as follows:

and the TID TRADE worksheet will have cell I30 highlighted in yellow as follows:

The comment associated with the highlighted cell I30 indicates that the commodity name in the Arg6 column must be a valid Commodity Item Name for Region REG3, where REG3 is the region specified in the Region2 column (cell B30).

11. Time Series & Time Independent Trade Data (TS&TID TRADE) Sheet

The TS&TID TRADE sheet offers the convenience of allowing both Time Series and Time Independent Trade Data Parameters to be specified on a single sheet. An example of a TS&TID TRADE sheet is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	TS&TID TRADE	GLOBAL,REG1,REG2,REG3,IMPEXP,MINRNW											
2													
3	Check Sheet												
4			Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	I/E Opt			
5													
6										I/E Opt			
7	Region	Region2	Parameter	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	or Value			
8													
9	' On TS&TID TRADE sheet, a single region must be specified in column A (a comma-separated region-list is not allowed)												
10													
11	IMPEXP	REG1	TOP_IRE	IMPDSL1	DSL	-	-	-	DSL	1			
12	IMPEXP	REG1	TOP_IRE	IMPGAS1	GAS	-	-	-	GAS	1			
13	IMPEXP	REG1	TOP_IRE	IMPGSL1	GSL	-	-	-	GSL	1			
14	IMPEXP	REG1	TOP_IRE	IMPHCO1	HCO	-	-	-	HCO	1			
15	IMPEXP	REG1	TOP_IRE	IMPOIL1	OIL	-	-	-	OIL	1			
16	IMPEXP	REG1	TOP_IRE	IMPURN1	URN	-	-	-	URN	1			
17	*												
18	REG1	IMPEXP	IRE_PRICE	IMPDSL1	DSL	ANNUAL	-	IMP	-	0	10	10	10
19	REG1	IMPEXP	IRE_PRICE	IMPGAS1	GAS	ANNUAL	-	IMP	-	0	6.4	6.4	6.4
20	REG1	IMPEXP	IRE_PRICE	IMPGSL1	GSL	ANNUAL	-	IMP	-	0	15	15	15
21	REG1	IMPEXP	IRE_PRICE	IMPHCO1	HCO	ANNUAL	-	IMP	-	0	2	2	2
22	REG1	IMPEXP	IRE_PRICE	IMPOIL1	OIL	ANNUAL	-	IMP	-	0	8	8	8
23	REG1	IMPEXP	IRE_PRICE	IMPURN1	URN	ANNUAL	-	IMP	-	0	2	2	2
24	*												
25	IMPEXP	REG2	TOP_IRE	IMPDSL1	DSL	-	-	-	DSL	1			
26	IMPEXP	REG2	TOP_IRE	IMPGAS1	GAS	-	-	-	GAS	1			
27	IMPEXP	REG2	TOP_IRE	IMPGSL1	GSL	-	-	-	GSL	1			
28	IMPEXP	REG2	TOP_IRE	IMPHCO1	HCO	-	-	-	HCO	1			
29	IMPEXP	REG2	TOP_IRE	IMPOIL1	OIL	-	-	-	OIL	1			
30	IMPEXP	REG2	TOP_IRE	IMPURN1	URN	-	-	-	URN	1			
31	*												
32	REG2	IMPEXP	IRE_PRICE	IMPDSL1	DSL	ANNUAL	-	IMP	-	0	10	10	10
33	REG2	IMPEXP	IRE_PRICE	IMPGAS1	GAS	ANNUAL	-	IMP	-	0	6.4	6.4	6.4

To specify a Time Series or Time Independent Trade Data Parameter, select an (empty) row below 7 and **enter the regions involved in the trade in the Region and Region2 columns** of this row. Then position the cursor in column **C** of this row, and press the [Parameter] "smart" button. This brings up a TS and TID Trade Parameter selection list as shown below:
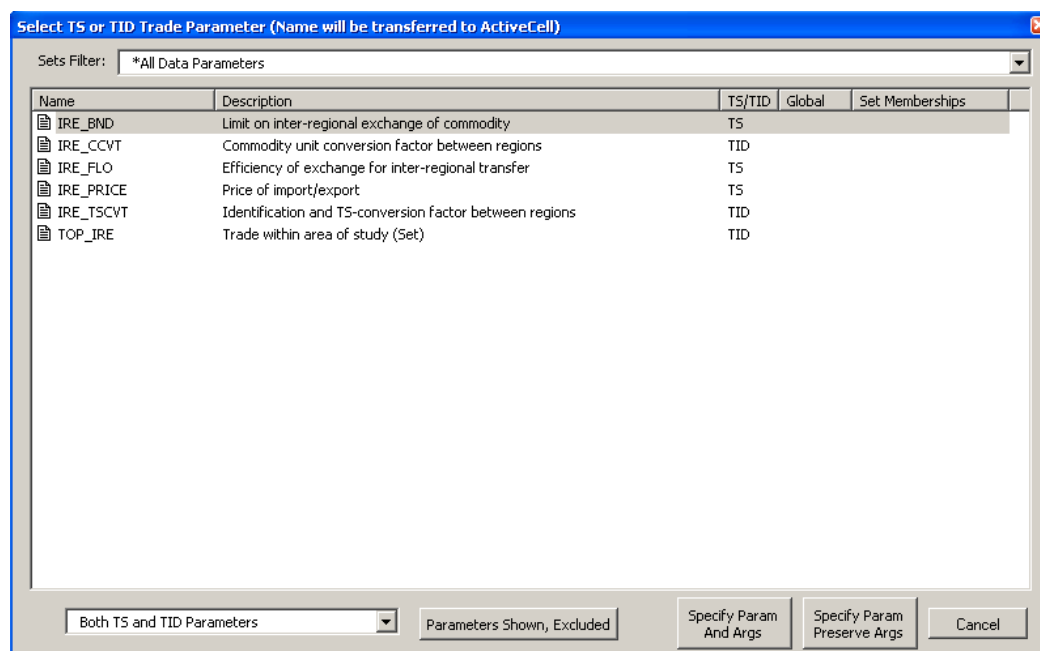

The mechanics of selecting the desired Parameter and specifying its Arguments, and the operation of the [Check Sheet] button are exactly the same as for the TS TRADE and TID TRADE sheets.

12. Loading a Smart Excel Workbook into ANSWER-TIMES

The "File, Import, Model Data from Excel" facility is used to load information in a "Smart" Excel Workbook into an ANSWER-TIMES database.

A brief overview of the steps involved in using this facility follows:

1. Open the ANSWER-TIMES database into which you wish to import the "Smart" Excel Workbook.
2. Invoke "File, Import, Model Data from Excel" to bring up the following form (initially with the 'Excel Files to be Imported' list empty, and not necessarily with either the 'Target Scenario' or 'Options' settings that are shown below):
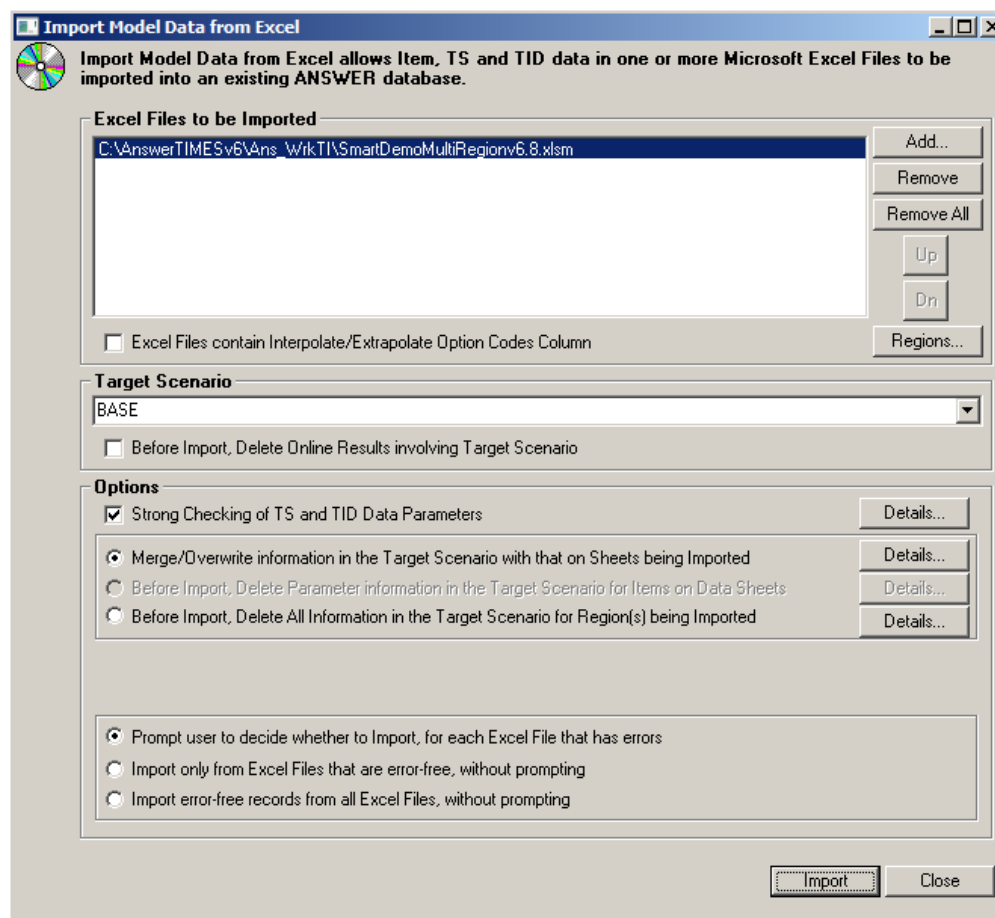
3. Click on the [Add…] button to bring up the common dialog file selection form and navigate to the folder in which you have stored the "Smart" Excel Workbook(s), then select one or more "Smart" Excel Workbooks to be imported.
4. Adjust the 'Target Scenario' combobox to select the target scenario for the import.
5. Adjust the radio button and checkbox Options to suit your particular needs.
6. Click on the [Import] button to carry out the import.

If at step 1 above you are unable to open the ANSWER-TIMES database, and get a message ending in "Perhaps … it is already in use?", most likely this database is already in use because you have an open "Smart" Excel Workbook and this database is associated with it. So simply close the "Smart" Excel Workbook so that the database is no longer associated with it, and hence no longer in use.

Most users will have a number of "Smart" Excel Workbooks, and will often find it convenient to load several Workbooks in a single Import operation. To facilitate multi-selection of "Smart" Excel Workbooks at step 3 above, store all Workbooks in a single folder.

13. Example ANSWER-TIMES Smart Excel Workbook

To provide users with a concrete example of an ANSWER-TIMES "Smart" Excel Workbook, *that demonstrates the specification in its entirety of a multi-region TIMES model*, the file *SmartDemoMultiRegion.xlsm* is provided as part of the ANSWERv6-TIMES installation files in folder C:\AnswerTIMESv6\Ans_WrkTI.

Also, an empty ANSWER-TIMES version 6.8 database *EmptyDemoMultiRegion-v68.mdb* that has compatible time periods for Import Model Data from Excel is provided in folder C:\AnswerTIMESv6\Answer_Databases.

To use *SmartDemoMultiRegion.xlsm* to explore various aspects of how an ANSWER-TIMES "Smart" Excel Workbook operates:

- If as part of exploring how an ANSWER-TIMES "Smart" Excel Workbook operates you intend to change the contents of the ANSWER-TIMES "Smart" Excel Workbook, it is suggested that you use Windows Explorer to make copies of both *SmartDemoMultiRegion.xlsm* and *EmptyDemoMultiRegion-v68.mdb* (so that you retain copies of both files as originally distributed).

- Open *SmartDemoMultiRegion.xlsm* and carry out the "Enable Macros" process (see page 3).

- When the 'Specify ANSWER Database' form appears, click on the top radio button and then use the [Browse…] button to select *EmptyDemoMultiRegion-v68.mdb* in folder C:\AnswerTIMESv6\Answer_Databases.

The following points should be noted about *SmartDemoMultiRegion.xlsm* (many of these points are exactly similar to points that have already been made in *Enhanced ANSWER-TIMES Format for Import Model Data from Excel.doc* (in folder C:\AnswerTIMESv6\Doc) in regard to the (non-Smart) Excel Workbook **DemoMultiRegion.xlsm**) but there are some important differences because an ANSWER-TIMES "Smart" Excel Workbook must contain a single ITEMS sheet):

- *As noted above, SmartDemoMultiRegion.xlsm contains the specification in its entirety of a multi-region TIMES model*.

- An ANSWER-TIMES "Smart" Excel Workbook must contain a single REGIONS sheet, and a single ITEMS sheet. (An ordinary ANSWER-TIMES Excel Workbook may contain multiple ITEMS sheets).

- The user is free to have multiple instances of the other worksheets (TS DATA, TID DATA, TS&TID DATA, TS TRADE, TID TRADE, TS&TID TRADE).

- Although each of the sheets has a rather rigid format, the user has considerable freedom in regard to how Items information is ordered on an ITEMS sheet, and to how TS and TID Data is ordered on the 3 types of DATA sheets and the 3 types of TRADE sheets. The introduction of the TS&TID sheets increases the user's flexibility, since there is now the choice as to when to use them, and when to stay with the TS and TID sheets.

- To some extent, the *SmartDemoMultiRegion.xlsm* should be seen as endeavouring to demonstrate a range of possibilities that are available to the user. But in some respects it should also be seen as suggesting approaches that may be beneficial to adopt whenever you specify a multi-region TIMES model in an ANSWER-TIMES "Smart" Excel Workbook.

    Note that it is not *necessary* to spread the TS and TID Data over 9 worksheets (GlobalTabData through to Trade-TIDData) as has been done in *SmartDemoMultiRegion.xlsm*. If wanting to specify the exact same information

that is contained in **SmartDemoMultiRegion.xlsm** in the <u>minimum</u> number of "smart" worksheets, it would be possible to use single TS&TID DATA and TS&TID TRADE worksheets (so 2 data worksheets replacing 9 data worksheets) while retaining the single REGIONS and ITEMS worksheets exactly as they are.

- There are aspects of the **ITEMS** sheet that you may find beneficial to often emulate in the ITEMS sheets of your ANSWER-TIMES "Smart" Excel Workbooks. Note that when you first create an ITEMS sheet, the following rows are **automatically generated** (but the cell A10 will initially be blank and you must enter into cell A10 a comma-delimited list of the internal regions for your model):

		Comp	Name	Description	Unit(s)	Set Memberships
7						
8						
9	' Pre-defined Commodity Groups (cell A10 should contain comma-delimited list of all Internal Regions)					
10	REG1,REG2,REG3	D	ACTGRP	Activity-related Group		COM_GRP,COM_GRPDEF
11		D	DEM	Demand Commodity Type		COM_GRP,COM_GRPDEF
12		D	ENV	Environmental Commodity Type		COM_GRP,COM_GRPDEF
13		D	FIN	Financial Commodity Type		COM_GRP,COM_GRPDEF
14		D	MAT	Material Commodity Type		COM_GRP,COM_GRPDEF
15		D	NRG	Energy Commodity Type		COM_GRP,COM_GRPDEF
16						

These rows specifying pre-defined Commodity Groups are necessary to ensure that you can specify data parameters that require pre-defined Commodity Groups as arguments, and for the correct functioning of "Check Sheet". So you should always retain them.
Note also that in ANSWER-TIMES, all TimeSlices must be specified for the _GLOBAL region, and for every Internal region. Using inheritance of the comma-delimited list of region names in cell A18 allows this specification to be made very compactly on rows 18 to 30.

- The **GlobalTab-Data** sheet demonstrates how to specify Global Tab data (that is not TimeSlice-related). You may find it beneficial to often have such a sheet in your ANSWER-TIMES Excel Workbook. What differentiates Global Tab parameters G_DYEAR and G_DRATE from most other parameters is that their definition does not rely on user-defined Items. The **GlobalTab-Data** sheet also demonstrates both of the new enhancements: the new TS&TID DATA sheet is used, with a comma-delimited list of region names in cell B1, and with column A used to specify that G_DYEAR should be created for the _GLOBAL region only, and that G_DRATE should be created for regions REG1,REG2,REG3 only.

- The **TimeSlice-Data** sheet provides another illustration of the use in column A of a comma-delimited list of region names – once a region-list is specified in column A, there is <u>inheritance</u> of this region-list to successive rows in the sheet, until such time as a new region-list is specified in column A. So for rows 11 to 21, by inheritance from row 10 the _GLOBAL region applies. (It is not necessary to have an explicit _GLOBAL in each of cells A11 to A21.) Then for rows 25 to 48, by inheritance from row 24 the region-list REG1,REG2,REG3 applies. (It is not necessary to have an explicit REG1,REG2,REG3 in each of cells A25 to A48.)

- On the **Commodity-Data** sheet, the majority of the Commodity-specific parameters are assumed to have numeric values that are region-independent. So all of the parameters specified in rows 10 to 57 of this sheet will be created for each of the regions REG1,REG2,REG3 specified in cell A10. But note the use in column A of a single region name of REG1 in row 60, and of REG2 in row 63, and of REG3 in row 66, so that numeric values for the COM_PROJ parameter that are <u>region-dependent</u> can be specified.

- The **Process-Data-DMD** sheet is presented to show TS and TID process data on a single sheet, with the data grouped by process name. The user may wish to consider whether this approach is beneficial to adopt for specifying processes. For example once a process of a particular type is known to be correctly specified, then copying all

of its TS and TID data rows and then changing the process name and I/O commodities (and numeric coefficients as necessary) may prove to be an efficient way of creating another process of this particular type.

- The ***Constraint-Data*** sheet is presented to show how a Cross-Region User Constraint (a Constraint involving Sum over Regions) similar to the one described in section 11.2 of the ANSWERv6-TIMES User Manual can be specified on a TS&TID DATA sheet. Note the role of the _GLOBAL region to specify the RHS for the Cross-Region User Constraint.

If you use the "Import Model Data from Excel" facility to import ***SmartDemoMultiRegion.xlsm*** into ***EmptyDemoMultiRegion-v68.mdb***, and then scan the Global, TimeSlice, Commodity, CommGroup, Process, TradeProcess and Constraint tabs, you will see that a multi-region TIMES model is indeed fully specified. You might also wish to carry out Run Model.

Appendix A: Establishing a New ANSWER-TIMES Smart Workbook

The process of establishing a new workbook must be done with care so as to ensure that all the functionality ("smart" buttons) and cell references (links) to the ITEMS sheet are properly retained. The following possibilities are detailed below:

- A.1. Creating a new (empty) ANSWER-TIMES Smart Workbook.
- A.2. Making an existing workbook aware of ANSWER-TIMES Smart Workbook facilities.
- A.3. Copying an existing workbook that is already aware of ANSWER-TIMES Smart Workbook facilities to create a new workbook.
- A.4. Updating an existing workbook that is already aware of ANSWER-TIMES Smart Workbook facilities when Noble-Soft distributes an updated version of the ANSWER-TIMES smart XLSM.
- A.5. Adding a new ANSWER-TIMES smart sheet to the current XLSM.

A.1 - Creating a new (empty) ANSWER-TIMES Smart Workbook

To create a new (empty) ANSWER-TIMES Smart Workbook, open the file ANSWER-TIMESver6 XLSM distributed by Noble-Soft, for example open ANSWER-TIMESver6.8.XLSM. Then carry out the "Enable Macros" process (see page 3) to bring up the single visible sheet of ANSWER-TIMESver6.8.XLSM as follows:
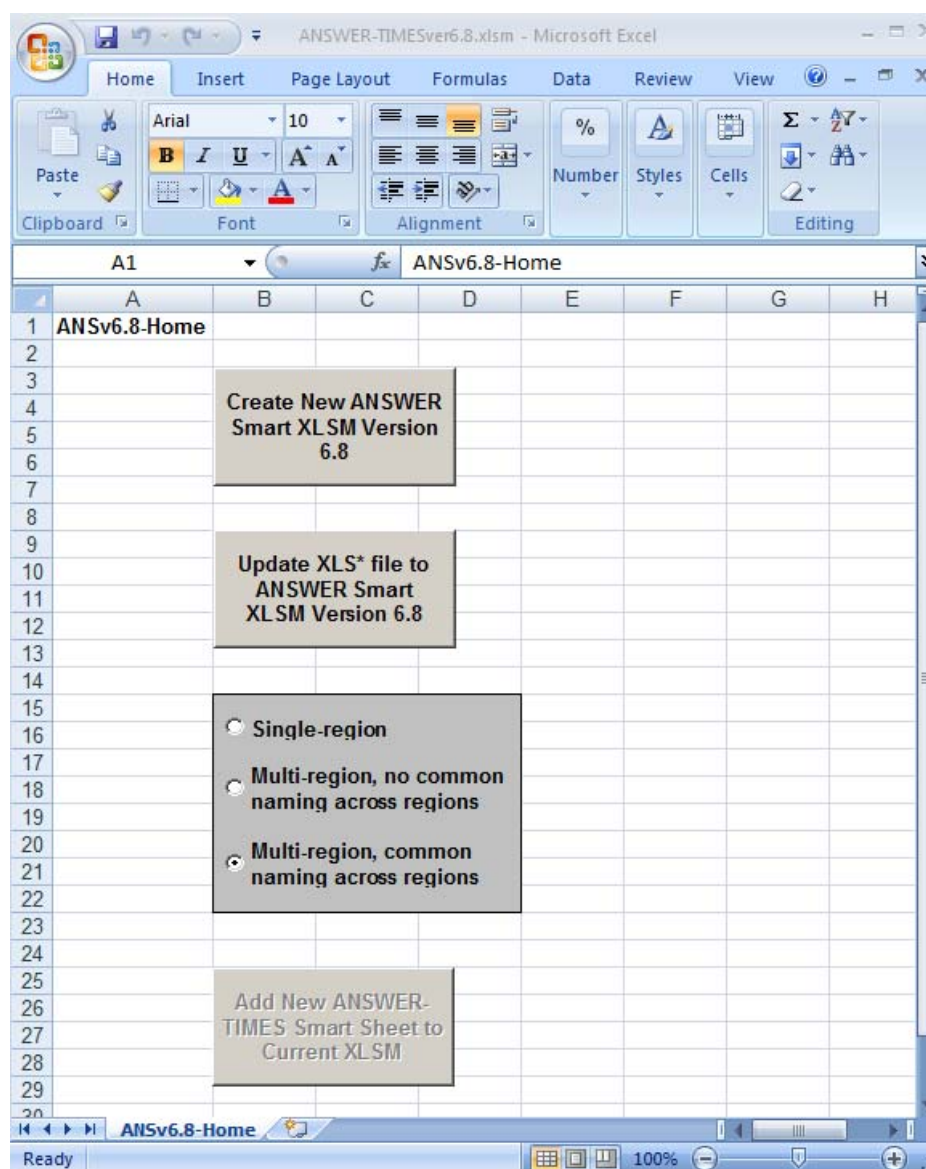
Retain the selection of the 'Multi-region, common naming across regions' radio buttons and then click on the 'Create New ANSWER Smart XLSM Version 6.8' button. This brings up the following form:
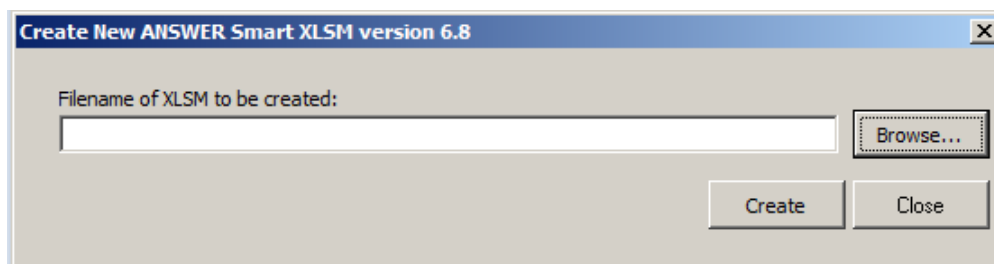
Use the 'Browse…' button to bring up the 'New ANSWER Smart XLSM' common dialog form, and if necessary use the LHS of the form to specify the folder where you want the new ANSWER Smart XLSM to be located, then key in the filename for the new XLSM in the 'File name' textbox near the bottom of the form, as follows:
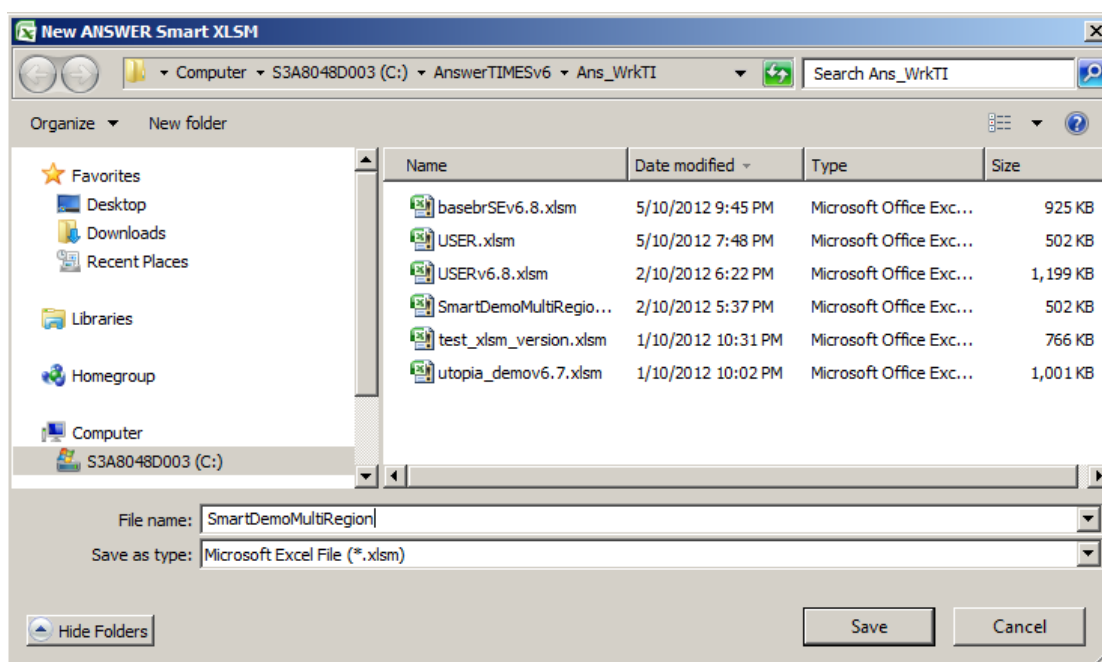
Click on the 'Save' button. The full filename of the new XLSM to be created will appear in the 'Filename of XLSM to be created' textbox, as follows:
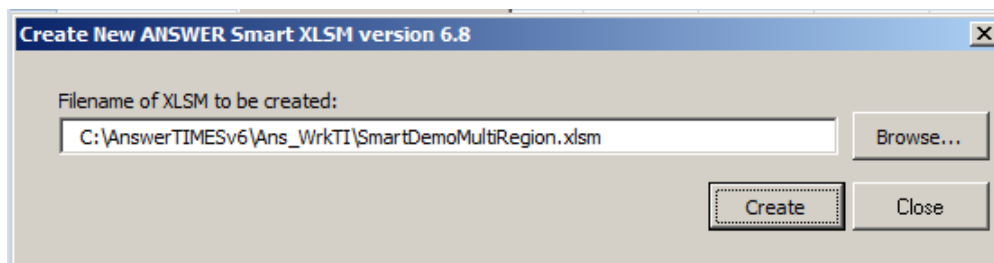
(An alternative to using the 'Browse…' button to specify the full filename of the new XLSM is to key the full filename into the textbox, but using the 'Browse…' button is recommended.)

Click on the 'Create' button. The creation process will proceed, concluding with a message box indicating that the creation of the new XLSM has been completed:

The form remains open so that additional new ANSWER-TIMES Smart XLSM files may be created, if desired.

Click on the 'Close' button to close the 'Create New ANSWER Smart XLSM' form.

Close ANSWER-TIMESver6.8.XLSM.

When you open any of the new ANSWER-TIMES Smart XLSM files that you have created, you will need to use the 'Add New ANSWER Smart Sheet to Current XLSM' button to add sheets to the XLSM. See A.5 below for details of the operation of this button.

A.2 - Making an existing workbook aware of ANSWER-TIMES Smart Workbook facilities

To make an existing workbook aware of ANSWER Smart Workbook facilities, ensure that this workbook is not open and open the file ANSWER-TIMESver6.8.XLSM distributed by Noble-Soft. Then carry out the "Enable Macros" process (see page 3) to bring up the single visible sheet of ANSWER-TIMESver6.8.XLSM as follows:
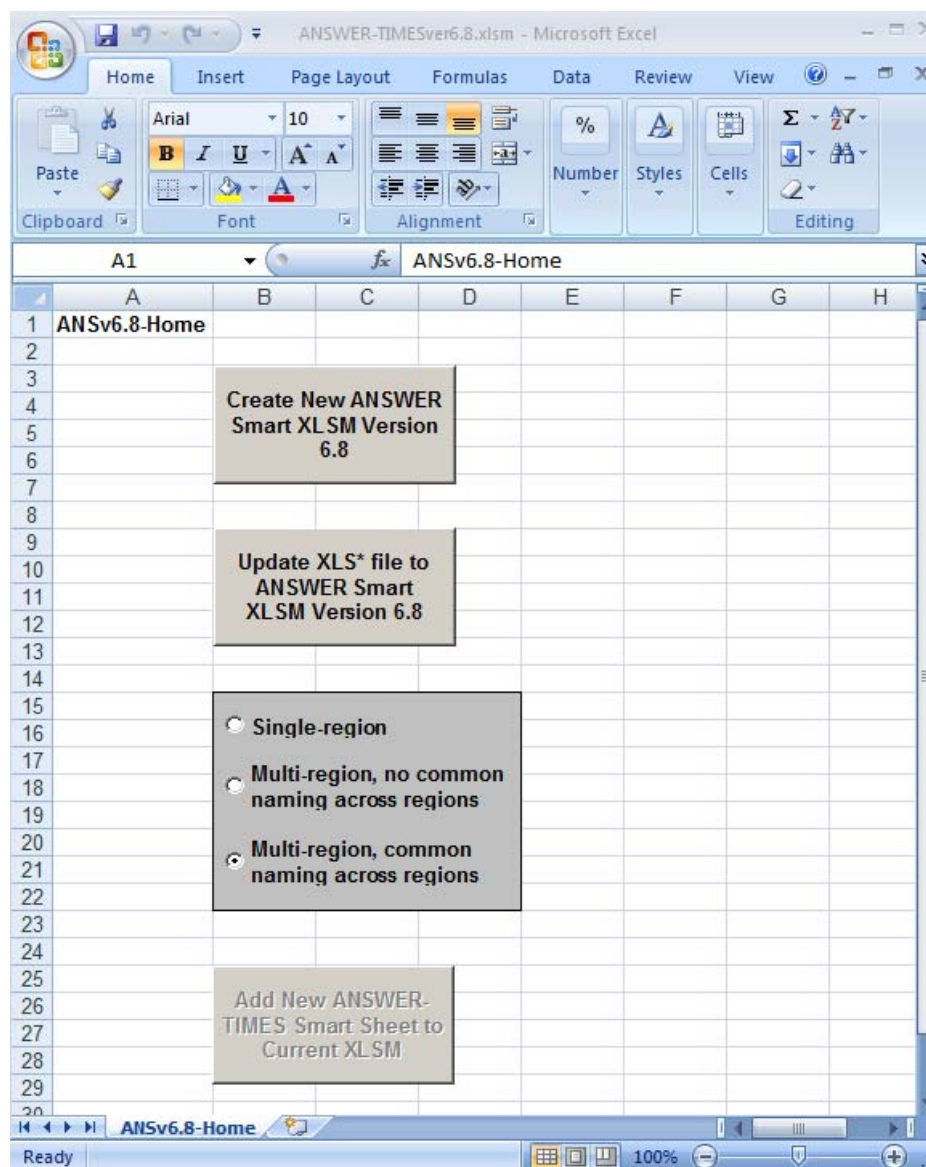
Retain the selection of the 'Multi-region, common naming across regions' radio buttons and then click on the 'Update XLS* to ANSWER Smart XLSM Version 6.8' button. This brings up the following form:

For clarity of explanation, suppose that the existing workbook that you wish to make aware of ANSWER Smart Workbook facilities is called USER.xlsm.

Use the 'Browse…' button to select USER.xlsm. The form now appears as follows:

The default filename given to the ANSWER smart XLSM that will be created by the update is taken to be the filename of the XLS* to be updated with v6.8 appended. So above v6.8 is appended to USER to provide USERv6.8 as the default filename.

Click on the 'Update' button. The update process will proceed, concluding with a message box indicating that the update has been completed.

The form remains open so that additional XLS* files may be selected to be made aware of ANSWER-TIMES Smart Workbook facilities, if desired.

Click on the 'Close' button to close the 'Update XLS* to ANSWER Smart XLSM' form.

Close ANSWER-TIMESver6.8.XLSM.

A.3 - Copying an existing workbook that is already aware of ANSWER-TIMES Smart Workbook facilities to create a new workbook

If an existing workbook is already aware of ANSWER-TIMES Smart Workbook facilities, then simply copying this workbook to create a (renamed) copy will result in the (renamed) copy being aware of ANSWER-TIMES Smart Workbook facilities. There are two ways of carrying out the copy:

- Open the existing XLSM in Excel and use 'File, Save As…' to resave with another name, being sure to save with a filetype of XLSM; or
- Use Windows Explorer to make a (renamed) copy of the XLSM.

In either case, all cell references (links) will be associated with the new file name.

Depending upon your reasons for creating a new workbook by copying an existing workbook, consider what changes may be needed in the newly created copy. For example, consider whether the Region specified in cell B1 on each of the ANSWER-TIMES smart sheets may need to be adjusted.

A.4 - Updating an existing workbook that is already aware of ANSWER-TIMES Smart Workbook facilities when Noble-Soft distributes an updated version of the ANSWER-TIMES Smart XLSM

To provide additional ANSWER-TIMES Smart Workbook facilities, or to correct bugs that are detected, from time to time Noble-Soft will distribute a new version of the ANSWER-TIMES Smart XLSM.

For example in due course a new version ANSWER-TIMESver6.9.XLSM will become available that provides additional facilities (and corrects bugs) in this current version ANSWER-TIMESver6.8.XLSM.

When this occurs, all that will be required to update your existing (version 6.8) ANSWER-TIMES Smart Workbook to version 6.9 will be to open the file ANSWER-TIMESver6.9.XLSM and follow the "Making an existing workbook aware of ANSWER-TIMES Smart Workbook facilities" procedure that is documented at A.2 above.

A.5 - Adding a New ANSWER-TIMES Smart Sheet to the Current XLSM

This facility allows the user to easily add a new ANSWER-TIMES smart sheet to their current ANSWER-TIMES Smart XLSM. To use the facility, proceed as follows:

1. Open an ANSWER-TIMES Smart XLSM and specify the ANSWER-TIMES database to be associated with the Smart XLSM.

2. Make the Home sheet the active sheet. For a version 6.8 ANSWER-TIMES Smart XLSM this sheet appears as follows:
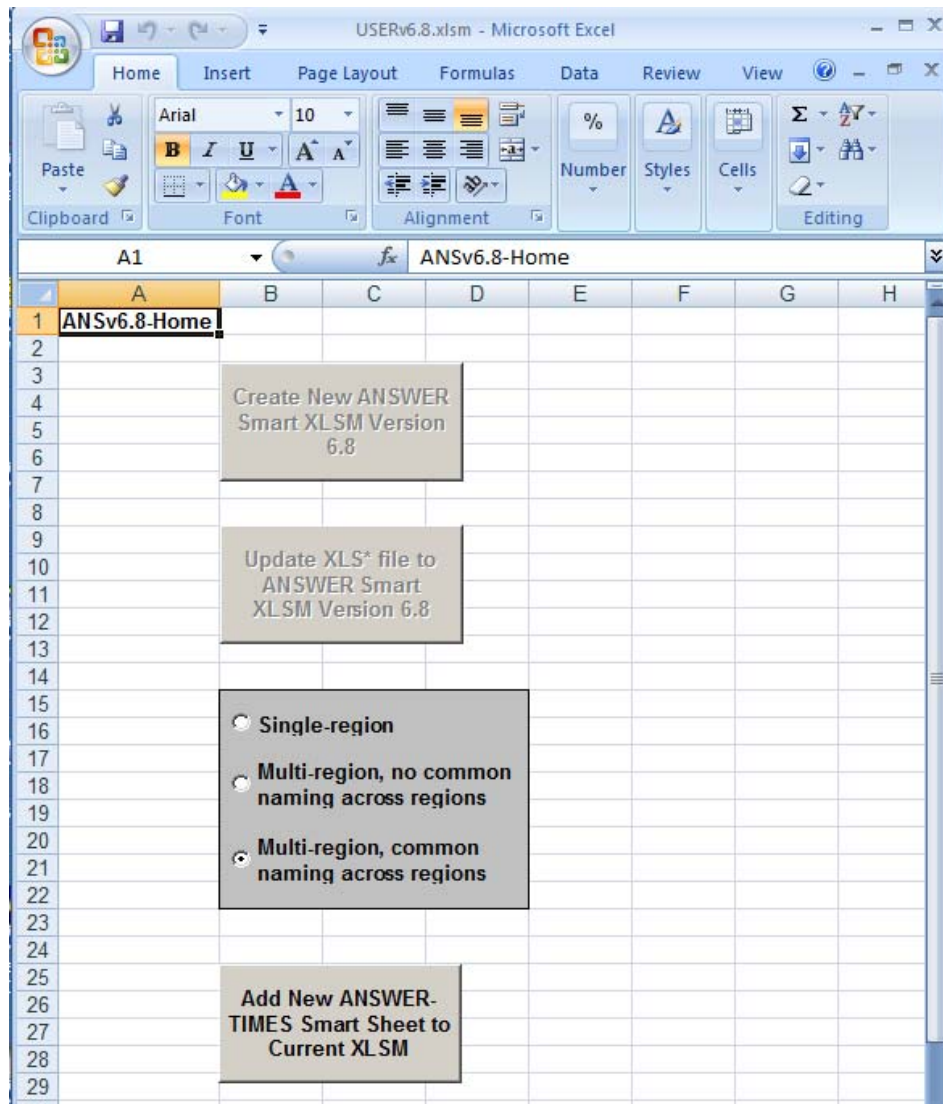
3.   Click on the 'Add New ANSWER Smart Sheet to Current XLSM' button. This brings up the following form:

The 'Select ANSWER Smart Sheet …' listbox contains the eight types of smart sheets, namely REGIONS, ITEMS, TS DATA, TID DATA, TS&TID DATA, TS TRADE, TID TRADE, TS&TID TRADE.

The 'Specify Region-List …' combobox contains a comma-delimited list of the regions in the ANSWER-TIMES database, listed in the order: _GLOBAL, Internal Regions (in alphabetical order), External Regions (in alphabetical order). Note that the comma-delimited list in the combobox may be edited by the user if desired.

4. Select the type of ANSWER-TIMES smart sheet that you wish to add by clicking on it in the listbox. For example, click on TS DATA if you wish to add a new TS DATA sheet to the current XLSM.

5. Edit the comma-delimited Region-List in the combobox as necessary. (It is allowable to delete Regions from the Region-List, and to add new Region Names to the Region-List.) When the smart sheet is created, its cell B1 will contain the comma-delimited Region-List that is specified in the combobox. Also, realize that the user can edit the contents of cell B1 at any time after the smart sheet is created to change the Region-List.

6. Click on the [Add Sheet] button.

7. The new smart sheet is created, and the 'Add New ANSWER Smart Sheet …' form remains open (so that the user can add another smart sheet) as follows:
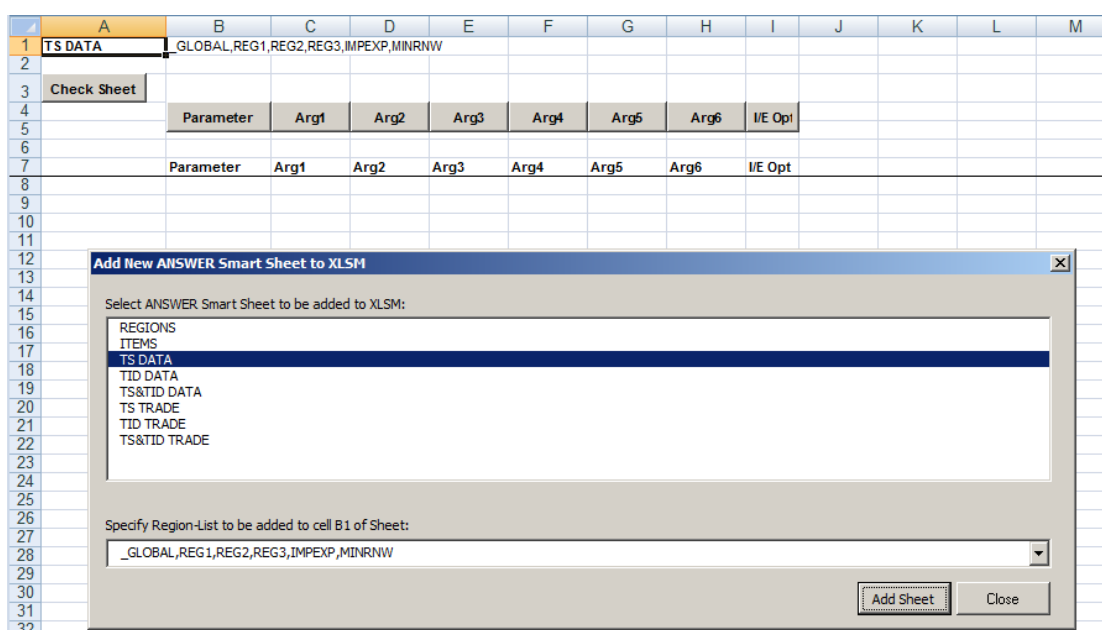
By default, the name given to the smart sheet that is created will be the same as the name in the listbox, so for example a TS DATA sheet will be given the default name "TS DATA". If the default name is already being used for another sheet, then "(2)" is appended and used as the name for the sheet, so for example "TS DATA (2)". If the name with "(2)" appended is already being used for another sheet, then instead "(3)" is appended, so for example "TS DATA (3)", and so on.

8. To add another smart sheet to the XLSM, select the type of ANSWER-TIMES smart sheet to be added, adjust the contents of the Region-List combobox as necessary, and click on the [Add Sheet] button.

9. Click on the [Close] button to close the 'Add New ANSWER Smart Sheet …' form.

**Appendix B: Details regarding the operation of the Parameter selection form, the Parameter Argument (Item) selection form, and [Check Sheet] Parameter checking**

There are six types of "smart" worksheets currently available in an ANSWER-TIMES Smart Excel Workbook for the specifying of Data Parameters:

TS DATA, TID DATA, TS&TID DATA, TS TRADE, TID TRADE, TS&TID TRADE.

For each of these worksheets, very similar mechanics apply to the specification of Data Parameters, with the user proceeding as follows:

- Selects an (empty) row below row 7, positions the cursor in the Parameter column of this row (column B for a DATA sheet, column C for a TRADE sheet) and presses the

  Parameter button. This brings up a Parameter selection form that displays all appropriate Parameters for that worksheet.

- Selects the Parameter of interest and (normally) clicks on the **Specify Param And Args** button, exiting the Parameter selection form and causing the Parameter Name and the nature and positions of its Arguments to be written to the (previously empty) row.

- Positions the cursor in turn in whichever of the Arg1 through to Arg6 columns of this

  row is appropriate, and uses whichever of the **Arg1** through to **Arg6** buttons is appropriate to specify the Arguments for the selected Parameter.

- Specifies the Parameter's I/E Opt code (if a TS Parameter) and specifies the Parameter's numeric value(s).

On any of these worksheets the **Check Sheet** button may be clicked at any time to have a standard set of consistency and quality control checks performed.

Details regarding the operation of the Parameter selection form, the Parameter Argument (Item) selection form, and [Check Sheet] Parameter checking are contained in each of the Appendixes B.1, B.2 and B.3 as follows:

B.1. Operation of the Parameter Selection Form, displayed after clicking on [Parameter] button.
B.2. Operation of the Item Selection Form, displayed after clicking on [Arg1]-[Arg6] buttons.
B.3. [Check Sheet] Checking for a Data Parameter.

B.1 - Operation of the Parameter Selection Form, displayed after clicking on [Parameter] button

For each of the worksheets used for specifying Data Parameters, the Parameter Selection

Form that is displayed after clicking on the ⬚ Parameter button is extremely similar, as is the operation of the Form.

Here the operation of the Parameter Selection Form is described with reference to the Parameter Selection Form as it is displayed when invoked from the TS DATA worksheet:
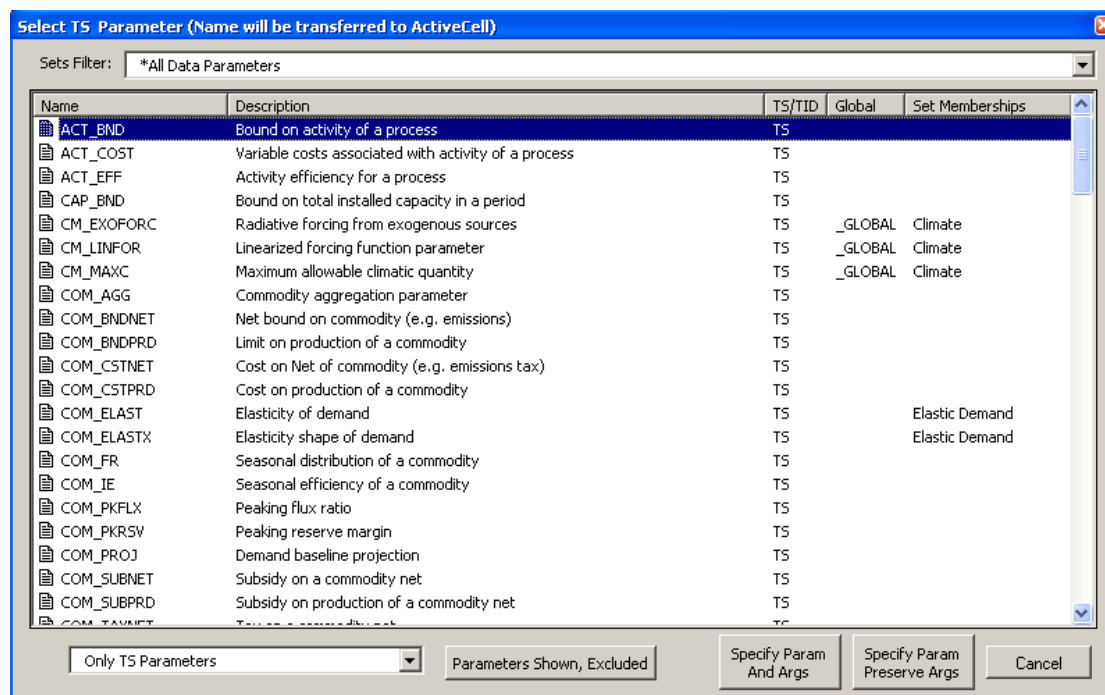
As has already been explained on the previous page, the basic operation of this form is as follows:

- Select the Parameter of interest.

- Click on the ⬚ Specify Param And Args button, thereby exiting the Parameter Selection Form and causing the Parameter Name and the nature and positions of its Arguments to be written to the Parameter and Arg1-Arg6 columns of the row where the cursor was positioned when the ⬚ Parameter button was clicked.

For example if the cursor is placed in row 59, so at cell B59, and ACT_BND is the selected

Parameter, then after clicking on the ⬚ Specify Param And Args button row 59 will appear as follows:

This indicates that the ACT_BND Parameter must have Process, TimeSlice and Limit Arguments in positions 1, 5 and 6 respectively (and with the place-holder of - (minus) in positions 2, 3, 4).
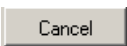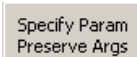
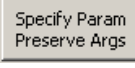### Sets Filter combobox (to expedite selection of Parameter of interest)

The Sets Filter combobox at the top of the form allows the user to reduce the number of Parameters that are displayed in the selection list, and thereby to expedite the selection of the Parameter of interest.

- Use of the Sets Filter combobox may be beneficial when the Parameter Selection Form has been invoked from the TS DATA or TID DATA or TS&TID DATA worksheets.

- When the ANSWER-TIMES database that is associated with the workbook is version 6.7.2 or higher, it will often be beneficial to choose the second setting for the combobox "All Data Parameters, Excluding Parameters for TIMES Extensions, so that Parameters that are displayed in the selection list are confined to "standard" TIMES (TS) Data Parameters:
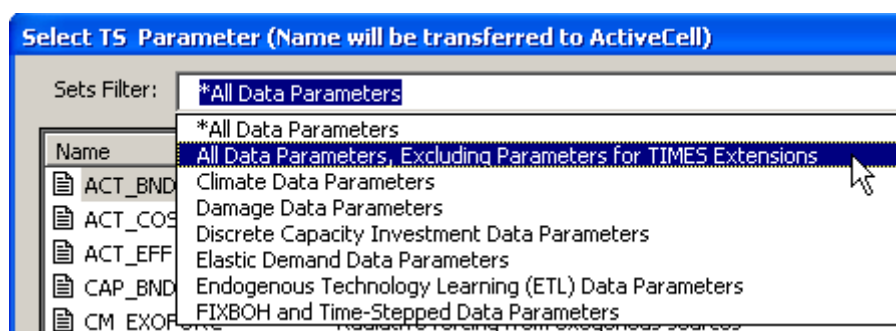
[Specify Params] buttons

Two buttons are provided to the left of the [Cancel] button, a [Specify Param And Args] button, and a [Specify Param Preserve Args] button.

- The [Specify Param And Args] button is used when initially specifying a Parameter instance, because it indicates the nature and positions of the Arguments that must be specified for the selected Parameter. See the example for the ACT_BND Parameter presented above.

- The [Specify Param Preserve Args] button (the one immediately to the left of the [Cancel] button) can be useful if you have already specified a Parameter instance, including its Arguments, and subsequently realize that you got the Parameter Name wrong, but that the correct Parameter Name has exactly the same Arguments as those for the wrong Parameter Name!

B.2 - Operation of the Parameter Argument (Item) Selection Form, displayed after clicking on [Arg1]-[Arg6] buttons

For each of the worksheets used for specifying Data Parameters, the Parameter Argument

(Item) Selection Form that is displayed after clicking on any of the [Arg1] through to

[Arg6] buttons is extremely similar, as is the operation of the Form.

Here the operation of the Parameter Argument (Item) Selection Form is described with reference to the Select Process Form for the ACT_BND example from Appendix B.1:

To specify the Process, position the cursor in cell **C59** and click on the [Arg1] "smart" button. This brings up the Select Process form, as shown below:

An important feature of the form is the pair of option buttons [Select from ITEMS Sheet / Select from Database] at the bottom left of the form that allow the user to choose whether the form displays:

- Processes that are specified on the ITEMS sheet, when the [Select from ITEMS Sheet] option button is on (the default) <u>or</u>
- Processes that are specified in the associated ANSWER-TIMES database (the database that you specified when you opened the "smart" workbook), when the [Select from Database] option button is on.

Another useful feature of the form is the availability at the top of the form of a **Sets Filter** and a **Name and Description Filter**. Particularly for large models, the user may find either or both of these filters beneficial in reducing the number of Process Items that are displayed,

and thereby expediting the selection of the Process Item of interest. This pair of Filters may be used for either of the ⦿ Select from ITEMS Sheet and ⦿ Select from Database option button settings.

Sets Filter, Name and Description Filter

The **Sets Filter** combobox allows the user to filter the Processes that are displayed to those that have particular Set Memberships, for example to those that are Electric Generation Processes (ELE):
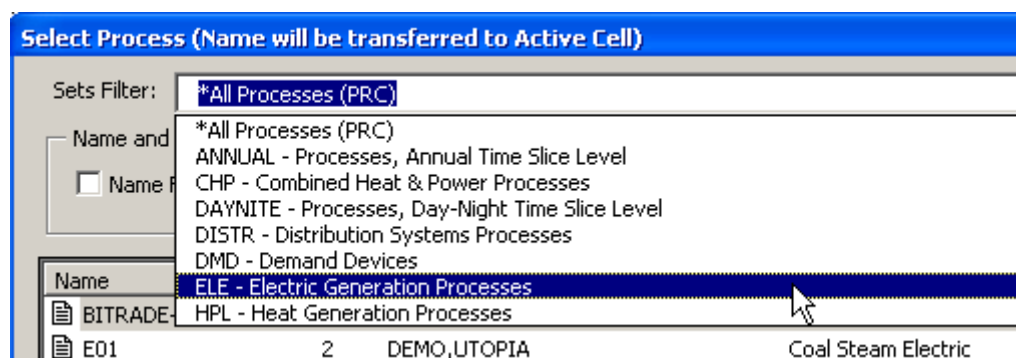
The **Name and Description Filter** allows the user to filter the Processes that are displayed by Name or by Description or by a *compound* filter that involves both a Name Filter and a Description Filter, that are applied with a logical AND or OR.

- For example if the user wishes to display those Processes whose Description contains **Electric**, what is required is to enter ***Electric*** in the Description Filter (like) textbox, and then check the Description Filter checkbox:
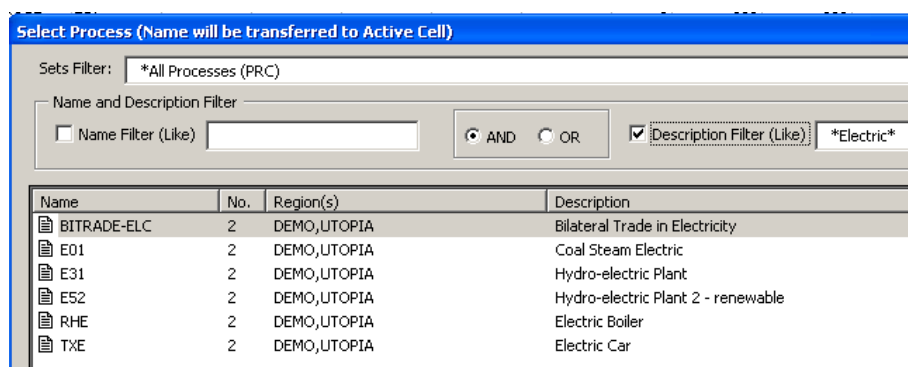
  The ***Electric*** filter (where the asterisk character * indicates zero or more characters) selects those Processes that contain **Electric** anywhere within their Description. (To select those Processes whose Description *starts with* **Electric** use the filter **Electric***; to select those Processes whose Description *ends with* **Electric** use the filter ***Electric**.)

- The Name Filter checkbox and textbox operate in an exactly similar fashion to the Description Filter checkbox and textbox.

- It is possible to specify a *compound* filter that involves both a Name and a Description Filter, that are applied with a logical AND or OR. For example to select those Processes where the Name ends in **E** or where the Description contains **Electric**, check the Name Filter checkbox and enter ***E** in its textbox, select the OR option

button, check the Description Filter checkbox and enter ***Electric*** in its textbox, and

then click on the [Apply Filter] button:

- The Name and Description Filter is always used in conjunction with the current setting of the Sets Filter combobox.

Specifying Parameter Arguments for Items that cannot occur on the ITEMS sheet

We have seen in section 5 that only Items under user control (TimeSlices, Commodities, Commodity Groups, Processes and Constraints) can be specified on the ITEMS sheet. For all such Items, the operation of the Parameter Argument (Item) Selection form mimicks that of the Process Selection Form described above.

- In particular the user will be able to select such Items as Arguments from either the ITEMS sheet or the associated ANSWER-TIMES database.

Where a TIMES Data Parameter has as an argument a Component Item that cannot occur on the ITEMS sheet, an Argument (Item) Selection form is still displayed when the user clicks on

the appropriate button from among the [Arg1] through to [Arg6] buttons, but the user will be able to select such Items as Arguments *only from predefined Items in the associated ANSWER-TIMES database*.

An example of such a Component is the Limit Component, which we previously saw was in the Arg6 position for the ACT_BND parameter.

To specify the Limit, position the cursor in cell H59 and click on the [Arg6] "smart" button to bring up the Select Limit form:

When the Select Limit form appears, the [○ Select from ITEMS Sheet] option button is disabled, the [● Select from Database] option button is on, and the form displays the predefined members of the Limit Component that are stored in the ANSWER-TIMES database (and that are appropriate for the ACT_BND Parameter).

- The Limit Component in TIMES comprises NB (non-binding) as well as FX, LO, UP but NB is not displayed because only FX, LO, UP are appropriate for the ACT_BND Parameter.

B.3 - [Check Sheet] Checking for a Data Parameter

On each of the worksheets used for specifying Data Parameters, the [Check Sheet] button may be clicked at any time to have a standard set of consistency and quality control checks performed.

The checking that is carried out includes checking that:

- Each Parameter that is specified is a valid Data Parameter.
- For a valid Data Parameter, each of its Arguments occurring in the Arg1 to Arg6 columns (columns C through H, or columns D through I for a TRADE sheet) is valid. This means that Arguments must occur on either the ITEMS sheet or in the associated database, and must be of the correct Component. (So for example when checking an instance of the ACT_BND parameter, Arg1 must occur on either the ITEMS sheet or in the associated database, and must be a Process.) Also the Argument must satisfy any Set Memberships requirements.

For an Argument such as for the Process Component, that can be specified on the ITEMS sheet, or may already occur in the associated ANSWER-TIMES database, checking is carried out as follows (for clarity of explanation, we suppose that the Argument being checked has Item Name E01 and must be a Process):

- First the ITEMS sheet is checked to see whether it contains a Process with Item Name E01. If it does, then the associated database is not checked. However other checking of E01 is carried out:
    - (a) Are its Set Memberships (as specified on the ITEMS sheet) appropriate for the Parameter?
    - (b) Does the Region-List for E01 (as specified on the ITEMS sheet) embrace every region in the Region-List on the TS DATA sheet that applies to the Parameter?

- If the ITEMS sheet does not contain a Process with Item Name E01, then the associated database is checked to see if it contains such an Item. This checking is carried out for every region in the Region-List on the TS DATA sheet that applies to the Parameter. In addition the Set Memberships (as specified in the associated database) are checked for appropriateness for the Parameter.