

**ANSWER-TIMES  
and  
ANSWER-MARKAL  
Updates**

**Ken Noble**

**Noble-Soft Systems, Australia**

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# Acknowledgments

***Gary Goldstein, DecisionWare Group USA, for suggesting:***

- ***Enhancements to ANSWER-TIMES “Import Model Data from Excel” facility***
- ***Creation of a new version of the ANSWER-TIMES Smart Workbooks, similar to the ANSWER-MARKAL Smart Workbooks, to facilitate migration of USEPA US9r MARKAL data across to TIMES***

***Antti Lehtila, VTT Energy Finland***

- ***For his continued generous assistance re assorted technical aspects of TIMES***



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# **ANSWER-TIMES Latest Enhancements - Summary**

## **ANSWER-TIMES v6.9.7 Update released April 2015**

- **Support for most recent TIMES GAMS code version 3.8.4 (May 2015)**
- **Makes available first 64-bit Excel compatible version of original ANSWER-TIMES Smart Workbook (“master” XLSM ANSWER-TIMESver1-691.xlsm), along with Manual with all screenshots and text updated**
- **“Import Model Data from Excel” enhanced by addition of “Remember Settings by Scenario” facility and of a new “Excel Files in Same Folder as Current Database” checkbox option**
- **Decided to delay release of 64-bit Excel compatible version of ANSWER-TIMES ver2 Smart Workbooks, pending further enhancements (required for ETSAP TIMES Starter Model) of beta version**
  - **Potential for these enhancements to create compatibility issues with current beta version**

# **ANSWER-TIMES Library Region Latest Enhancements**

## ***ANSWER-TIMES Library Region v6.9.7 Update released May 2015***

- ***Special Library Region version of ANSWER-TIMES is used by IEA Paris for their ETP (Energy Technology Perspectives) model***
- ***Primary purpose of update – provide support for most recent TIMES GAMS code version 3.8.4 (April 2015)***
- ***“Import Model Data from Excel” enhanced by addition of “Remember Settings by Scenario” facility and of a new “Excel Files in Same Folder as Current Database” checkbox option***
- ***A few other enhancements made to standard version of ANSWER-TIMES over the past 18 months have also been incorporated***

# ANSWER-TIMES Latest Enhancements – 1

## *Support for most recent ETSAP TIMES GAMS code version 3.8.4 (May 2015)*

- *Main features of TIMES GAMS code v3.8.4 as compared with TIMES GAMS code v3.6.0 distributed with ANSWER-TIMES v6.9.1 (May 2014):*
  - Addition of dedicated ramping constraints
  - Addition of flow-based maximum availability factors (implemented as a variant of NCAP\_AFC/NCAP\_AFAC parameters)
  - Enhanced TIMES-MACRO-MSA released October 31 2014 (see ETSAP website under Documentation/TIMES/Extensions/Macro MSA)
  - Added support for CHP modeling via CDME & BPME (c.f. via NCAP\_CEH & ACT\_EFF)
  
- *New Data Parameters Added to TIMES and ANSWER-TIMES*
  - ACT\_UPS(REG, YEAR, PRC, TS, BD) – Max. change in load level in proportion to capacity, per hour (used for dedicated ramping constraints)
  - NCAP\_AFCS(REG, YEAR, PRC, CG, TS) – Availability of capacity for CG, by Timeslice
  - NCAP\_BPME(REG, YEAR, PRC) – Back pressure mode efficiency
  - NCAP\_CDME(REG, YEAR, PRC) – Condensing mode efficiency
  - TM\_HSX(REG, YEAR) – Hockey-stick exponent for non-market damage
  - TM\_MDTL(REG) – Linear coefficient for market damage
  - TM\_MDTQ(REG) – Quadratic coefficient for market damage

## **ANSWER-TIMES Latest Enhancements – 2**

### ***The need for 64-bit Excel compatible ANSWER-TIMES Smart XLSTM (same considerations apply to ANSWER-MARKAL Smart XLSTM)***

- ***You can be running a 32-bit or a 64-bit Windows operating system – I'd expect all of you would be running a 64-bit Windows OS***
- ***If you're running a 64-bit Windows OS and running Excel 2010 or higher (as part of Office 2010 or higher), you might be running the 32-bit version of Excel (Office) or you might be running the 64-bit version***
- ***The 32-bit ANSWER-TIMES Smart XLSTMs (ver1 and ver2) are incompatible with the 64-bit version of Excel (owing to Microsoft Excel 64-bit VBA limitations, e.g. no support for treeview, listview)***
- ***VBA for both ver1 and ver2 ANSWER-TIMES Smart XLSTMs has been significantly recoded to be 64-bit Excel compatible***

# ANSWER-TIMES Latest Enhancements – 3

## *“Import Model Data from Excel” enhanced by addition of ‘Remember Settings by Scenario’ facility*

- *Database remembers all settings of “Import Model Data from Excel” form for previous Import into a Scenario – facilitates model development cycle*

**Import Model Data from Excel**

Import Model Data from Excel allows Item, TS and TID data in one or more Microsoft Excel Files to be imported into an existing ANSWER database.

**Target Scenario**

Scenario: **NT-PP** Date of Last Import: **2014/11/04 23:49:13**

Before Import, Delete Online Results involving Target Scenario

**Excel Files to be Imported**

FileName	Date Modified	Status
C:\AnswerTIMES\6\Answer_Databases\Turkey\AT2_Turkey_NewTechPP(v01a).xslm	2014/11/04 23:40:53	Earlier

Excel Files in Same Folder as Current Database  Excel Files contain I/E Opt Column

**Options**

Import only Modified or Added Excel Files

Strong Checking of TS and TID Data Parameters

Merge/Overwrite information in the Target Scenario with that on Sheets being Imported

Before Import, Delete Parameter information in the Target Scenario for Items on Data Sheets

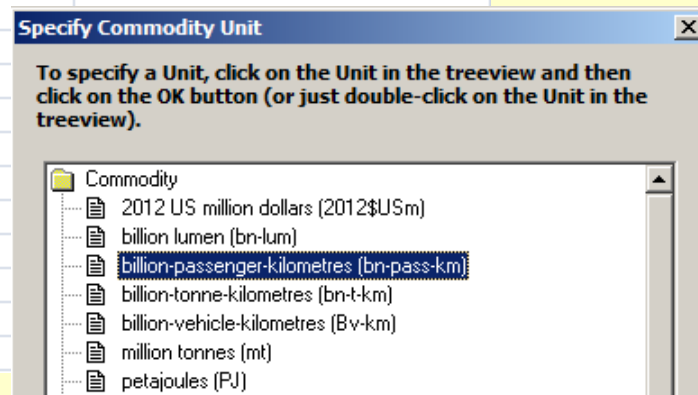
Before Import, Delete All Information in the Target Scenario for Region(s) being Imported

# ANSWER-TIMES Latest Enhancements – 4A

## Creation of ANSWER-TIMES Version 2 Smart Workbooks, with Parameters as column headers on Data sheets

### ➤ Commodities Smart Sheet – use of [CommUnit] Smart Button

	A	B	C	D	E
1	Commodities	GLOBAL,TURKEY,IMPEXP,MINRNW			
2					
3	Check Sheet				
4				CommUnit	Set Memberships
5					
6					
7		CommName	CommDesc	CommUnit	Set Memberships
8	<b>* Energy Carriers</b>				
9	TURKEY	ELCT	Electricity to Transmission Grid	PJ	COM,NRG,DAYNITE,ELC
10		ELCD	Electricity to Distribution Grid	PJ	COM,NRG,DAYNITE,ELC
11		HEAT	Heat	PJ	
12	<b>* Commodities to Electricity</b>				
13	TURKEY	PWRCOALHRD	Coal to electricity generation	PJ	
14		PWRCOALLIG	Lignite coal to electricity generat	PJ	
15		PWROILDSL	Diesel to electricity generation	PJ	
16		PWRGASNGA	Natural Gas to electricity genera	PJ	
17		PWRRNWHYD	Water for hydropower	PJ	
18		PWRRNWBIO	Biomass to Electricity Sector	PJ	
19		PWRRNWWND	Wind to Electricity Sector	PJ	
20		PWRRNWSOL	Solar to Electricity Sector	PJ	
21		PWRNWGEO	Geothermal to Electricity Sector	PJ	





# ANSWER-TIMES Latest Enhancements – 4B

## Creation of ANSWER-TIMES Version 2 Smart Workbooks, with Parameters as column headers on Data sheets

### ➤ Processes Smart Sheet – use of [Set Memberships] Smart Button

	A	B	C	D	E
1	Processes	TURKEY			
2					
3	Check Sheet				
4				ProcUnits	Set Memberships
5					
6					
7		ProcName	ProcDesc	ProcUnits	Set Memberships
8	* Advanced Electricity Capacity				
9		ECOALSTM	Pulverized Coal Steam - from 2015	PJ,GW	PRC,ELE,SEASON
10		ECOALLIGSTM	Lignite Coal Steam - from 2015	PJ,GW	PRC,ELE,SEASON
11		ENGAACC10	Natural Gas - Combined-Cycle (Turbine)	PJ,GW	PRC,ELE,DAYNITE
12		ENGACC15	Natural Gas - Combined-Cycle (Turbine)		
13		ENGACC	Natural Gas - Combined-Cycle (Turbine)		
14		ENGACCA	Natural Gas - Advanced Combined-Cycle		
15		ENGACT10	Natural Gas - Combustion Turbine		
16		ENGACT15	Natural Gas - Combustion Turbine		
17		ENGACT	Natural Gas - Combustion Turbine		
18		ENGAECT	Natural Gas - Advanced Combustion Turbine		
19		ECOALIGCC	Integrated Coal Gasif. Combined Cycle		
20		EBIOIGCC	Biomass Integrated Gasification Combustion		
21		EGEOBCFS	Geothermal - Binary Cycle and Flash		
22		EGEOEGS	Geothermal - Enhanced Geothermal Steam		

**Specify Process Set Memberships**

To specify Set Memberships, click on the appropriate leaf node in the LHS treewiew, 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)

# ANSWER-TIMES Latest Enhancements – 4C

## Creation of ANSWER-TIMES Version 2 Smart Workbooks, with Parameters as column headers on Data sheets

- CommData Smart Sheet – assorted Smart Buttons, including [Check Sheet]
- Use of [CommName, CommDesc] button creates links to Commodities Sheet

	A	B	C	D	E	F	G	H	I
1	CommData	TURKEY							
2									
3	Check Sheet	CommName, CommDesc, Units							
4	Parameter				COM_PROJ	COM_PROJ	COM_AGG	COM_AGG	COM_AGG
5	Qualifier1						CO2	NOX	SO2
6	Qualifier2								
7		CommName	CommDesc	Units	0				
11	* Heavy Duty								
12		TA	Transportation.AIR	bn-pass-km	5	50			
13		TB	Transportation.BUS	Bv-km	5	50			
14		TM	Transportation.Medium Duty Trucks	Bv-km	5	50			
15		THS	Transportation.HDV Short Haul	Bv-km	5	50			
16		THL	Transportation.HDV Long Haul	Bv-km	5	50			
17		TS	Transportation.SHIP	bn-t-km	5	50			
18		TRF	Transportation.RAIL.FREIGHT	bn-t-km	5	50			
19		TRP	Transportation.RAIL.PASS	bn-pass-km	5	50			
20		TC	Transportation.TRUCK.COMMERCIAL	Bv-km	5	50			
21	* Off Road								
22	*	TOHDSL	Off-road Transport.OH.DSL	Bv-km	5	50			
23	*	TOHGSL	Off-road Transport.OH.GSL	Bv-km	5	50			
24									
25	* Emissions								
26		CO2TRN	Transportation sector CO2	kt			1		
27		NOXTRN	Transportation sector NOx	kt				1	
28		SO2TRN	Transportation sector SO2	kt					1

# ANSWER-TIMES Latest Enhancements – 4D

## Creation of ANSWER-TIMES Version 2 Smart Workbooks, with Parameters as column headers on Data sheets

- ProcData Smart Sheet – assorted Smart Buttons, inc. [CommIN], [CommOUT]
- Use of [ProcName, ProcDesc] button creates links to Processes Sheet
- Use of [CommIN], [CommOUT] buttons creates links to Commodities Sheet

	A	B	C	D	E	F	G	H	I	J	K
1	ProcData	TURKEY									
2											
3	Check Sheet	ProcName, ProcDesc, Units			CommIN	CommOUT					
4	Parameter							ACT_EFF	NCAP_START	NCAP_TLIFE	PRC_CAPACT
5	Qualifier1							ACTGRP			
6	Qualifier2							ANNUAL			
7		ProcName	ProcDesc	ProcUnits	CommIN	CommOUT	Activity I/O		TID		TID
8		ELFGICE	Landfill gas to energy: Engines	PJ,GW	PWRRNWLFG			0.36	2015	40	31.536
9						ELCT					
10		ELFGGT	Landfill gas to energy: Gas Turbine	PJ,GW	PWRRNWLFG			0.3	2015	40	31.536
11						ELCT					
12		ELFGST	Landfill gas to energy: Steam Turbi	PJ,GW	PWRRNWLFG			0.271	2015	40	31.536
13						ELCT					
14		ELFGGCC	Landfill gas to energy: Combined C	PJ,GW	PWRRNWLFG			0.45	2015	40	31.536
15						ELCT					
16		EMSWSTM	Municipal Solid Waste: Waste-to-er	PJ,GW	PWRNWMSW			0.2	2010	40	31.536
17						ELCT					

If Process Activity is:  
Output-based, leave blank.  
Input-based, insert I.

# ANSWER-TIMES Latest Enhancements – 4E

- ◆ ***Import Model Data from Excel facility in ANSWER-TIMES EXE enhanced to handle new ANSWER-TIMES Smart Workbooks***
  - ***Includes auto-generation of TOP-IN, TOP-OUT, PRC\_ACTUNT (and where PCG is a true CG, auto-generation of true CG and its associated COM\_GMAPs)***



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# **ANSWER-TIMES ver2 Smart Workbook Enhancements Pending (for ETSAP TIMES Starter Model)**

- ◆ ***Improve handling of process parameters that have CG (Commodity Group) arguments***
  - *Best achieved by introducing CommGroups “smart” worksheet, and modifying ProcData sheet accordingly?*
  - *Remove ProcData sheet restriction that CommIN and CommOUT commodities for a process must be specified on different rows*
    - *Restriction because ambiguity: some TIMES process parameters can be used to specify either input or output commodities*
- ◆ ***Introduce Constraints and ConstrData “smart” sheets?***
- ◆ ***Other Enhancements Needed***
  - *Update ANSWER-TIMES EXE to handle Import of new/changed “smart” worksheets*
  - *Create ver2 Smart Excel Workbook Manual*
  - *Create small demonstration ver2 Smart Excel Workbook and associated ANSWER-TIMES database*
  - *Consolidate ver1 and ver2 Workbooks into single Smart Excel Workbook?*

# **ANSWER-MARKAL Latest Enhancements – Summary**

## ***ANSWER-MARKAL 64-bit Excel Compatible Smart XLSM (March 2015)***

- ***Makes available first 64-bit Excel compatible version of ANSWER-MARKAL Smart Workbook (“master” XLSM ANSWERver6.5.xlsm)***
- ***ANSWER-MARKAL Smart Load Templates Manual updated to ver6.5***
- ***New 64-bit Excel compatible example Smart XLSM file UtopiaSmartTemplatev6.5.xlsm created***

## ***ANSWER-MARKAL v6.4.30 update (April 2015)***

- ***“Import Model Data from Excel” enhanced by addition of new “Excel Files in Same Folder as Current Database” checkbox option (“Remember Settings by Scenario” facility already in ANSWER-MARKAL)***
- ***First formal documentation of “Remember Settings by Scenario” facility, and of “Excel Files in Same Folder as Current Database” checkbox option***
- ***Advanced “Import Model Data from Excel” Dependency XLS feature now handles larger dependency XLS file***
- ***Incorporates latest version of the ETSAP GAMS-MARKAL code, version 5.9g***