

ANSWER-TIMES Update

Ken Noble

Noble-Soft Systems, Australia

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Summary of ANSWER-TIMES v6.6.1 Enhancements - 1

- ◆ **Supports most parameters in latest ETSAP TIMES GAMS code v3.0.3**
 - Previously was running against (ANSWER-aware) TIMES GAMS code v2.9.0
- ◆ **In particular, new Model Variant Specification facility supports following TIMES Extensions with no user intervention needed in *.GEN file:**
 - Elastic Demand
 - Climate
 - Damage (LP & NLP)
 - Discrete Capacity Investment
 - Endogenous Technology Learning (ETL)
 - MACRO (experimental)
 - Stochastic (Tradeoff/Sensitivity Analysis?)
 - Fixing Initial Periods (FIXBOH)
 - Time-Stepped Solve



Summary of ANSWER-TIMES v6.6.1 Enhancements - 2

- ◆ **Also supports following TIMES Objective Function options with no user intervention needed in *.GEN file:**
 - OBJ being set to one of AUTO, STD, MOD, ALT, LIN
 - Beginning of year, middle of year, end of year discounting
- ◆ **Support for N (non-binding) limit type in TIMES parameters**
 - ETSAP TIMES GAMS code is making increasing use of N limit type
 - Previously ANSWER-TIMES provided support for only LO, FX, UP bound types
- ◆ **v6.6.1 ANSWER-TIMES EXE incorporates new automated facility for updating system tables in existing database from the Template database**
 - More powerful and flexible than previous "File, Update System Tables from Excel" facility
- ◆ **"File, Increase Scenario and Case Name Length" facility allows user to increase Scenario, Case Name Lengths to either 12 or 16 characters**
 - Databases created by "File, New Database" facility will now have default Scenario and Case Name Length of 12 characters



Summary of ANSWER-TIMES v6.6.1 Enhancements - 3

- ◆ **New subsetting facility on Parameter tab allows user to subset Data Parameters displayed to just those that are specific to a particular TIMES Extension (so, e.g. display just Damage Parameters)**
- ◆ **Multi-select of Cases for Delete Case in the Cases listview (bottom LH quadrant of Home Screen)**
- ◆ **Demonstration ANSWER-TIMES database with non-BASE scenarios providing user with concrete examples of Data Parameters and Model Variant specifications needed for following TIMES Extensions**
 - Elastic Demand, Damage (LP and NLP), Discrete Capacity Investment, Endogenous Technology Learning (ETL), Stochastic, Fixing Initial Periods (FIXBOH), Time-Stepped Solve
- ◆ **Word documents "TIMES xxxx Extension in ANSWER-TIMES" (where xxxx = Elastic Demand, Damage etc) detail use of ANSWER-TIMES for each of the above TIMES Extensions**



Details of ANSWER-TIMES v6.6.1 Enhancements - 1

- ◆ Supports most parameters in latest ETSAP TIMES GAMS code v3.0.3, including the following recently added parameters:

Data Parameter	Data Parameter Description
ACT_CUM	Bound on cumulative process activity
FLO_CUM	Bound on cumulative process flow
G_OFFTHD	Threshold for OFF ranges
NCAP_CLAG-IN (a)	Lagtime of a commodity after new capacity ready - input
NCAP_CLAG-OUT (a)	Lagtime of a commodity after new capacity ready - output
UC_CUMACT	Coefficient for cumulative process activity
UC_CUMCOMNET (b)	Coefficient for cumulative commodity net
UC_CUMCOMPRD (b)	Coefficient for cumulative commodity production
UC_CUMFLO	Coefficient for cumulative process flow
UC_TIME	Multiplier of time in model periods (years)



Details of ANSWER-TIMES v6.6.1 Enhancements - 2

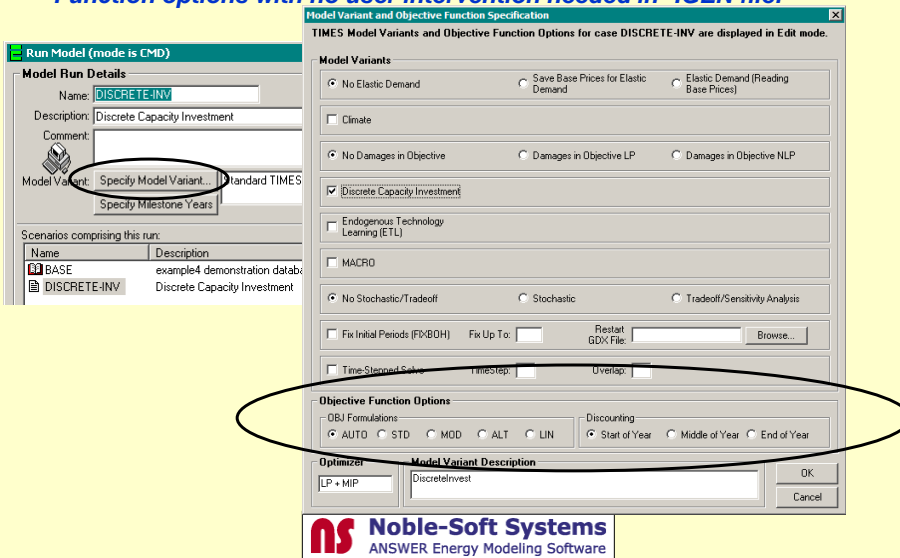
- ◆ New Model Variant Specification facility supports most TIMES Extensions with no user intervention needed in *.GEN file:

The image shows two overlapping windows from the ANSWER-TIMES software. The background window is titled 'Run Model (mode is CMD)' and shows 'Model Run Details' for a model named 'DISCRETE-INV'. The 'Model Variant' dropdown is set to 'Specify Model Variant...', and the 'Scenarios comprising this run:' table lists 'DISCRETE-INV' with the description 'Discrete Capacity Investment'. The foreground window is titled 'Model Variant and Objective Function Specification' and displays options for the 'DISCRETE-INV' case. Under 'Model Variants', the 'Discrete Capacity Investment' option is selected and circled. Other options include 'No Elastic Demand', 'Climate', 'No Damages in Objective', 'Endogenous Technology Learning (ETL)', 'MACRO', 'No Stochastic/Tradeoff', 'Fix Initial Periods (FIXBOH)', 'Time-Stepped Solve', and 'Objective Function Options' (AUTO, STD, MOD, ALT, LIN, Discouring).



Details of ANSWER-TIMES v6.6.1 Enhancements - 3

- ◆ **New Model Variant Specification facility supports TIMES Objective Function options with no user intervention needed in *.GEN file:**



Details of ANSWER-TIMES v6.6.1 Enhancements - 4

- ◆ **Support for N (non-binding) limit type in TIMES parameters**
 - ANSWER-TIMES uses NB (non-binding) as an alias for N
 - ANSWER-aware TIMES GAMS code converts NB used in ANSWER to N that TIMES GAMS code recognizes

	Scenario	Parameter	Region	Process	Year	Year	Limit	Value
Add	BASE	ACT_CUM	? REG	E01	2000	2050	<input type="text"/> FX LO NB UP	

Details of ANSWER-TIMES v6.6.1 Enhancements - 5

- ◆ **New subsetting facility on Parameter tab allows user to subset Parameters displayed to just those that are specific to a particular TIMES Extension**

The screenshot shows the software interface with the 'Parameter' tab selected. The 'Items Filter' dropdown is set to '*All Data Parameters'. The list of parameters is filtered to show 'Damage Data Parameters' selected. A second screenshot shows the 'Items Filter' set to 'Damage Data Parameters', displaying a detailed list of parameters such as DAM_BQTY, DAM_COST, DAM_ELAST, etc.

Name	Description	Status
DAM_BQTY	Base quantity of emissions	M
DAM_COST	Marginal damage cost of emissions	M
DAM_ELAST	Elasticity of damage cost	M
DAM_STEP	Step number for emissions up to base	M
DAM_TQTY	Base quantity of emissions by year	
DAM_TVOC	Variance of emissions by year	
DAM_VOC	Variance of emissions	M
S_DAM_COST	Marginal damage cost of emissions - stochastic	



Details of ANSWER-TIMES v6.6.1 Enhancements - 6

- ◆ **New Stochastic tab for handling of TIMES Stochastic Extension**

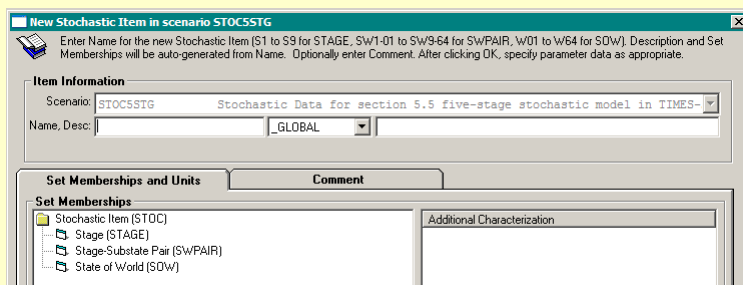
The screenshot shows the software interface with the 'Stochastic' tab selected. The 'Items Filter' dropdown is set to '*All Stochastic Items (STOC)'. The list of stochastic items is displayed, including S2, S3, SW1-01, SW2-01, SW2-02, SW2-03, SW3-01, SW3-02, and SW4-01. The 'Item Management' panel is visible on the right. Below the list, a table shows the subset parameters for the selected stochastic item.

Scenario	Parameter	Region	Item1	Item2	Tim	Limit	Stochastic	1/E	1990	2000	2010	2015	2020	2035	2050	2065	2080
M	STOC55TG	S_COM_PROJ	REG	-	TX	-	SW3-01	0				1.0700					
Add	STOC55TG																



Details of ANSWER-TIMES v6.6.1 Enhancements - 7

- ◆ **In ANSWER-TIMES, 3 different categories of Stochastic Items, with fixed Name and Description conventions:**
 - **Stages (named S1 to S9)**
 - **Stage-Substate Pairs (named SW1-01 to SW9-64)**
 - **States of World (named SW01-SW64)**



Special ANSWER-TIMES Library Region version for TIMES-ETP

- ◆ **IEA's Energy Technology Perspectives (ETP) model has for some years been run using a special Library Region version of ANSWER-MARKAL**
 - **Most recently used for ETP-2010**
- ◆ **IEA intends for ETP-2012 to be carried out using TIMES, so ETP model is being converted from MARKAL to TIMES to create TIMES-ETP, and a special Library Region version of ANSWER-TIMES is being created for TIMES-ETP**
 - **Initial ANSWER-TIMES Library Region version completed end of Sept. 2010, provided to IEA to assist in MARKAL to TIMES conversion process**
 - **Specifications for full production version of Library Region ANSWER-TIMES are close to finalization**



ANSWER-TIMES Library Region – Overview - 1

- ◆ Overall aim is to handle a large multi-region model with common naming conventions across regions for TimeSlices, Commodities, Commodity Groups, Processes, User-Defined Constraints
- ◆ Special Library Region contains Parent Items
 - TimeSlices, Commodities, Commodity Groups, Processes, Trade Processes, User-Defined Constraints
- ◆ Internal Regions, also called Local Regions, contain Child Items that inherit their attributes from their Parent in Library Region
 - Child Item has same Name, Description, Set Memberships, Units as its Parent
 - By default Child Item has same TS and TID Data Parameters, with same numeric values, as its Parent Item
 - User can update numeric values for Data Parameters associated with Parent Items, and then apply a single update operation that updates numeric values for Data Parameters associated with Child Items to match Parents' values



ANSWER-TIMES Library Region – Overview - 2

- ◆ For Process Parameters, so-called Operator Parameters allow numeric values for Child Item Parameters in Local Regions to be derived from numeric values of Parent Item by multiplication (x) or addition (+)
 - Override (O) of Parent Item numeric values is also an option

A screenshot of the 'Edit Operator Parameter' dialog box. The title bar reads 'Edit Operator Parameter'. Below the title bar, there is a folder icon and the text 'Edit Name or Description or Operator or other attributes for Operator Parameter' and 'NCAP_COST_MULT: NCAP_COST Multiplier'. The dialog has several fields: 'Name' with 'NCAP_COST_MULT', 'Description' with 'NCAP_COST Multiplier', and 'Operator' with a dropdown menu showing 'x'. Below that, 'TIMES Process Parameter' has a dropdown menu showing 'NCAP_COST' and its 'Description' is 'Investment cost for new capacity'. The 'Process Filter' section shows 'CC1_ALL' and 'CC1 Demand technologies' with a 'Named Filter...' button. At the bottom, there are three input fields: 'Decimal Places' set to '4', 'Default Value' set to '1', and 'Default I/E Optcode' set to '0'. 'OK' and 'Cancel' buttons are at the bottom right.

ANSWER-TIMES Library Region – Overview - 3

◆ Specify multiplier (x) for each local region

Scenario	Parameter	Region	I/E	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BASE	NCAP_COST_MULT	AUS	?	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BASE	NCAP_COST_MULT	EEU	?	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000	1.2000
BASE	NCAP_COST_MULT	FSU	?	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500
BASE	NCAP_COST_MULT	IND	?	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BASE	NCAP_COST_MULT	JPN	?	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BASE	NCAP_COST_MULT	USA	?	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BASE	NCAP_COST_MULT	wEU	?	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Add	BASE	NCAP_COST_MULT	?	0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Apply update operation: local region NCAP_COST values show effect of x

Scenario	Parameter	Region	Process	Com	CommGroup	CommG	Item5	Item6	I/E	2000	2005	2010	2015
BASE	NCAP_COST	LIBRARY	CC1DST000	-	-	-	-	-	0	95.0000	95.0000	95.0000	95.0000
x	NCAP_COST	AUS	CC1DST000	-	-	-	-	-	0	104.5000	104.5000	104.5000	104.5000
x	NCAP_COST	EEU	CC1DST000	-	-	-	-	-	0	114.0000	114.0000	114.0000	114.0000
x	NCAP_COST	FSU	CC1DST000	-	-	-	-	-	0	99.7500	99.7500	99.7500	99.7500
BASE	NCAP_DRATE	LIBRARY	CC1DST000	-	-	-	-	-	0	0.1420	0.1420	0.1420	0.1420



ANSWER-TIMES support for latest TIMES GAMS code v3.1.0

◆ ANSWER-TIMES will be enhanced to support most of the new features that have been added since release of TIMES GAMS code v3.0.4

- And also to support the UC_DYNBND feature that was released in TIMES GAMS code v3.0.4, but is not currently supported by ANSWER-TIMES.



Other Important ANSWER-TIMES Tasks

- ◆ *Create ANSWER-TIMES “smart” spreadsheets to facilitate bulk-loading of data into an ANSWER-TIMES database*
 - *Progressing...*
- ◆ *ANSWER-TIMES Getting Started Manual*
- ◆ *ANSWER-TIMES Training Courses*
- ◆ *Conversion of an existing ANSWER-MARKAL model to ANSWER-TIMES equivalent model*
- ◆ *Create cloning device to facilitate progressing all of the above*
 - *Progressing...*



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