

ANSWER-TIMES Overview

Ken Noble

Noble-Soft Systems, Australia

Uwe Remme

IER, Germany

ETSAP Annex X Meeting

Brasilia, Brazil

21-23 November 2007



Presentation Outline

- ◆ *Similarities between ANSWER-TIMES and ANSWER-MARKAL*
- ◆ *TIMES differences from MARKAL affecting ANSWER*
- ◆ *Data year – model year independence*
- ◆ *Managing input data*
- ◆ *Specifying a Rule-based User Constraint*
- ◆ *Running a Model*
- ◆ *Model Results*
- ◆ *Status Summary*
- ◆ *Future Developments*
- ◆ *Acknowledgments*



Similarities between ANSWER-TIMES and ANSWER-MARKAL
 (Home Screen appears identical, a few facilities invoked from Home Screen differ)

The screenshot displays the 'Stanford demo - ANSWER-TIMES Energy Modelling' application. It features a menu bar (File, Edit, View, Run, Tools, Functions, Help) and a toolbar with icons for Region Management and Batch Management. The main interface is divided into two primary sections: 'Data Management' and 'Results Management'.

Data Management: This section contains two tables. The 'Scenarios' table lists various scenarios with columns for Name, Description, Created, and Modified. The 'Selected Scenarios' table shows a subset of these scenarios. Buttons for 'New...', 'Copy...', 'Delete', and 'Edit...' are located below the scenarios table.

Results Management: This section contains two tables. The 'Cases' table lists simulation cases with columns for Name, Description, Scenario, Created, and Status. The 'Selected Cases' table shows a subset of these cases. Buttons for 'Import...', 'View LST...', 'View QC...', 'Delete...', and 'Edit...' are located below the cases table.

At the bottom of the window, there are buttons for 'Browse Data', 'Edit Data', 'Run Model...', and 'Batch Run...'. The status bar at the very bottom indicates the database path and the current scenario: 'Database: C:\Vanswer\6FlexTS-BITrade619MKT\Answer_Databases\Stanfo [Edit Scenario:]'.



Similarities between ANSWER-TIMES and ANSWER-MARKAL
 (Data Screen identical paradigm, most facilities identical, some tabs different names)

The screenshot displays the 'Stanford demo - ANSWER-TIMES Energy Modelling' application in the 'Data Screen' view. The interface includes a menu bar and a toolbar with icons for 'Edit Data', 'Regions Filter...', 'Items: All', and 'Scenario: All'. Below the toolbar is a set of tabs: 'Global', 'TimeSlice', 'Commodity', 'CommGroup', 'Process', 'TradeProcess', 'Constraint', and 'Parameter'. The 'Process' tab is currently selected.

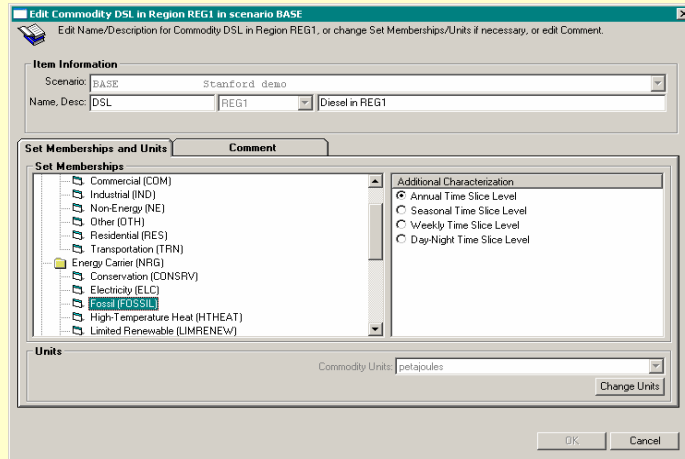
The main area shows a table of processes with columns for Name, Region, Description, and Status. Below this is an 'Item Management' section with buttons for 'New...', 'Copy...', 'Delete', and 'Edit...'. There is also a 'Select All Items' and 'Move...' option.

Below the process table is a 'Subset Parameters' section with a dropdown menu set to 'Process, Specific'. This section contains a table with columns for Scenario, Parameter, Region, Region2, Process, Commodity, Item3, Item5, Item6, and Value. The table lists parameters for 'BASE' across different regions and processes.

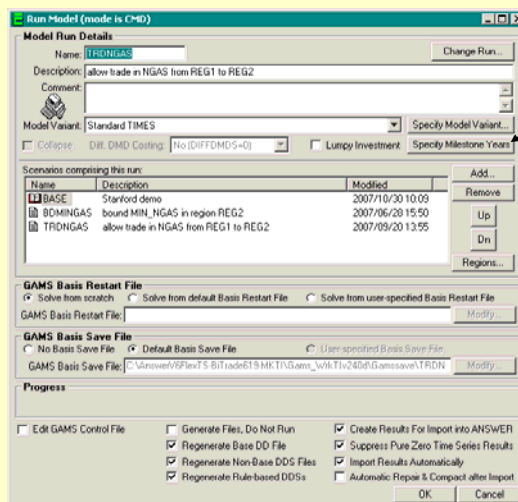
At the bottom of the window, the status bar indicates the database path and the current scenario: 'Database: C:\Vanswer\6FlexTS-BITrade619MKT\Answer_Databases\Stanford demo.m [Edit Scenario: BASE]'.



Similarities between ANSWER-TIMES and ANSWER-MARKAL
 (New/Edit Item identical for TimeSlice, Commodity, CommGroup, Constraint Items)



Similarities between ANSWER-TIMES and ANSWER-MARKAL
 (Run Model form is very similar, but note [Specify Milestone Years] button)



Specify Milestone Years button replaces End Year combobox



TIMES differences from MARKAL affecting ANSWER

- ◆ *TIMES supports data year – model year independence so model run periods (Milestone Years) can differ from data periods*
 - Both data periods and model run periods can have unequal spacing
- ◆ *TIMES distinguishes Internal and External Regions*
- ◆ *TIMES “Commodity Group” concept has no analogue in MARKAL, also adds complexity to Process definition*
- ◆ *TIMES allows a much richer set of user-defined Constraint options*
- ◆ *TIMES handles Trade between regions differently from MARKAL*
- ◆ *Of course TIMES has differently named Sets, and differently named Data Parameters and Results Parameters*
 - Some TIMES Data Parameters have as many as 6 arguments



Data Year – Model Year Independence

Revamped “New Database” form

The screenshot shows the 'New Database' dialog box. The 'Data Time Periods' section has 'Unequal spacing' selected and a list of years from 2021 to 2037. The 'Results Time Periods' section has 'Unequal spacing' selected and a list of years from 1900 to 1916. A red arrow points to the 'Results Time Periods' list with the text: 'Result years comprise allowable Milestone Years in model runs'.



Data Year – Model Year Independence

Data Screen showing data years 1995, 2000, 2003, 2005, 2008, ...

Database: C:\Answerv6\FlexTS-BIT\trade619MKT1\Answerv6_Databases\DataYearWEU.mdb | Edit Scenario: BASE



Data Year – Model Year Independence

Results Screen showing results years 2000, 2005, 2010, 2020, ...

Database: C:\Answerv6\FlexTS-BIT\trade619MKT1\Answerv6_Databases\DataYearWEU.mdb | Edit Scenario: BASE



Process tab – New Process form Special I/O Commodities tab to allow specification of I/O Commodities, PCG

Item Information

Scenario: BASE *Standard data*

Name, Desc: REFINERY REG1 Oil Refinery

Set Memberships, Units **I/O Commodities** **Comment**

Input/Output Commodities

Input-based Process Activity Output-based Process Activity

CommodIN	Description	Type	PCG
CRUDE-OIL1	Crude Oil 1	NFIG	<input checked="" type="checkbox"/>
CRUDE-OIL2	Crude Oil 2	NFIG	<input checked="" type="checkbox"/>

CommodOUT	Description	Type
DSL	Diesel in REG1	NFIG
GSL	Gasoline	NFIG

Buttons: Add Comen... Remove Comen... Add Comen... Remove Comen...

Use Add/Remove Comen buttons to add/delete Input Commodities. In the PCG column, check Commodities of the same Type that comprise the PCG. Use Add/Remove Comen buttons to add/delete Output Commodities.

OK Cancel



After exiting New Process form

MIN_OIL REG4 Extract oil

REFINERY REG1 Oil Refinery

RHEATELC REG1 Elec. device to provide res. heat

Subset Parameters: *C Process, Specific TID data

Scenari	Parameter	Regio	Region2	Process	Commodity	Item3	Item5	Item	Value
BASE	PRC_ACTUNT	REG1	-	REFINERY	-	REFINERY-G	-	-	1
BASE	PRC_CAPACT	REG1	-	REFINERY	-	-	-	-	1.0000
BASE	TOP-IN	REG1	-	REFINERY	CRUDE-OIL1	-	-	-	1
BASE	TOP-IN	REG1	-	REFINERY	CRUDE-OIL2	-	-	-	1

Add BASE

Process tab – For new process REFINERY, auto-generation of PRC_ACTUNT, PRC_CAPACT and topology (TOP) from I/O Commodities

OIL REG5 Oil

REFINERY-G REG1 PCG for REFINERY (Oil Refinery)

RHEAT REG1 Residential heating

Subset Parameters: *0 Commodity Group TID data

Scenari	Parameter	Regio	Process	Commodity	CommGroup	Value
BASE	COM_GMAP	REG1	-	CRUDE-OIL1	REFINERY-G	1
BASE	COM_GMAP	REG1	-	CRUDE-OIL2	REFINERY-G	1
BASE	PRC_ACTUNT	REG1	REFINERY	-	REFINERY-G	1

Add BASE

CommGroup tab - Auto-generation of "true" PCG REFINERY-G and of REFINERY-G COM_GMAP instances for CRUDE-OIL1 and CRUDE-OIL2



TradeProcess tab – New Trade Process form Special Traded Commodities tab to allow specification of Traded Commodities

New Trade Process in scenario TRDNGAS

Enter Name and Description for the new Trade Process. Specify Set Memberships, and change Units if necessary. Specify Traded Commodities. After clicking OK, specify parameter data as appropriate.

Item Information

Scenario: TRDNGAS allow trade in NGAS from REG1 to REG2
 Name, Desc: TRD_NGAS Trade in Natural Gas

Set Memberships, Units **Traded Commodities**

Type Of Commodity Naming:
 Same in All Regions, Export Name = Import Name Export, Import Commodity Name: NGAS
 Same in All Regions, Export Name <> Import Name
 Different Names in Different Regions

Specify Trade Matrix of Export, Import Commodities for Regions between which Trade occurs: Check Trade Matrix

EXP/IMP	Commodities	REG1	REG2	REG3	REG4	REG5
REG1	NGAS		☑		☑	☑
REG2	NGAS					
REG3	NGAS					
REG4	NGAS					
REG5	NGAS					



TradeProcess tab – after exiting New Trade Process form Auto-generation of Trade Process for each region involved in trade, and of TOP_IRE

Items Filter: Sets Named *All Trade Processes

Name	Description	Status
TRD_DSL	Trade in Diesel	S
TRD_NGAS	Trade in Natural Gas	S

Item Management: Current Trade Process: TRD_NGAS

Subset Parameters: 0 Trade Process, Specific TID data

Scenario	Parameter	Region	Region2	Process	Comm	Item3	Item5	Item6	Value	
M	TRDNGAS	PRC_ACTUNT	?	REG1	-	TRD_NGAS	-	NGAS	-	1
M	TRDNGAS	PRC_ACTUNT	?	REG2	-	TRD_NGAS	-	NGAS	-	1
M	TRDNGAS	PRC_ACTUNT	?	REG4	-	TRD_NGAS	-	NGAS	-	1
M	TRDNGAS	PRC_ACTUNT	?	REG5	-	TRD_NGAS	-	NGAS	-	1
M	TRDNGAS	PRC_CAPACT	?	REG1	-	TRD_NGAS	-	-	-	1.0000
M	TRDNGAS	PRC_CAPACT	?	REG2	-	TRD_NGAS	-	-	-	1.0000
M	TRDNGAS	PRC_CAPACT	?	REG4	-	TRD_NGAS	-	-	-	1.0000
M	TRDNGAS	PRC_CAPACT	?	REG5	-	TRD_NGAS	-	-	-	1.0000
M	TRDNGAS	TOP_IRE	?	REG1	REG2	TRD_NGAS	NGAS	-	NGAS	1
M	TRDNGAS	TOP_IRE	?	REG1	REG4	TRD_NGAS	NGAS	-	NGAS	1
M	TRDNGAS	TOP_IRE	?	REG1	REG5	TRD_NGAS	NGAS	-	NGAS	1
Add	TRDNGAS		?							



Specify Rule-based User Constraint - 1

Electric car at least 10% of automobile transport demand

1. Define TechFilter ALLTRN_DMD to select all automobile transport DMDs

New Technology Items Filter

Enter Name, Description, Comment and Specify Filter for New Technology Items Filter

Name: ALLTRN_DMD Description: All transport DMDs

Comment:

Technologies to be Included:

	Name	Description	Set Memberships	Input Commodity	Output Commodity
Look for:			PRC_DMD		"TCAR"
or:					
or:					
or:					
or:					



Specify Rule-based User Constraint - 2

2. Define Rule-based Constraint, using UCRULE_ACT and TechFilter ALLTRN_DMD

Standard demo - ANSWER-TIMES Energy Modelling

Global | TimeSlice | Commodity | CommodityGroup | Process | TradeProcess | **Constraint** | Parameter

Item Filter: Sets Filter Named Filter

Name: UC_CAR_ELC Region: REG1 Description: Electric car at least 10% of transport demand Status: SM

Item Management: Current User-Defined Constraint: UC_CAR_ELC Sets? New... Copy... Delete Edit... Select All Items Move RES

Submodel Parameters: *C User-Defined Constraint TS, TTD data

Scenario	Parameter	Region	Constraint	Side	Proc/Filter	Commod	TimeSlice	Item#	2005	2010	2015	2020
M	UCCARELC UC_RHSRT	REG1	UC_CAR_ELC	-	-	-	LD		0.0000	0.0000	0.0000	0.0000
M	UCCARELC UC_ACT	REG1	UC_CAR_ELC	LHS	TCAR-ELC	-	ANNUAL		1.0000	1.0000	1.0000	1.0000
M	UCCARELC UC_T_EACH	REG1	UC_CAR_ELC	-	-	-	-		1	1	1	1
M	UCCARELC UCRULE_ACT	REG1	UC_CAR_ELC	LHS	ALLTRN_DMD	-	ANNUAL		0.1000	0.1000	0.1000	0.1000
Add	UCCARELC											

Scenario	Parameter	Region	Constraint	Side	VarType	ParamNo	TimeSlice	Value
M	UCCARELC UC_R_EACH	REG1	UC_CAR_ELC	-	-	-	ANNUAL	1
M	UCCARELC UC_TS_SUM	REG1	UC_CAR_ELC	-	-	-	ANNUAL	1
Add	UCCARELC							

Database: C:\Answer\GFlexT5-6\Trade619MKTI\Answer_Databases\Standard demo.mc | Edit Scenario: UCCARELC



Specify Rule-based User Constraint - 3

3. Resolve Rule-based Constraint (to check we got it right)

Resolve Rule-based Constraint UC_CAR-ELC in region REG1

Case Selection

Name: _SELSCEN
 Desc: Temporary Case comprising selected scenarios, used for Resolve Rule-based Constraint
 Scen: BASE.BDMINGAS.TRDNGAS.UCCARELC

The spread displays how the TS part of the Rule-based Constraint will be resolved at Run Model time for Case: _SELSCEN
 The TID part of the Rule-based Constraint will match what is displayed in the TID spread.

Scenario	Parameter	Region	Constraint	Side	Technology	Commodi	TimeSlice	Boun	2005	2010	2015	2020
UCCARELC	UC_RHSRT	REG1	UC_CAR-ELC	-	-	-	-	LO	0.0000	0.0000	0.0000	0.0000
UCCARELC	UC_ACT	REG1	UC_CAR-ELC	LHS	TCAR-DSL	-	ANNUAL	-	-0.1000	-0.1000	-0.1000	-0.1000
UCCARELC	UC_ACT	REG1	UC_CAR-ELC	LHS	TCAR-ELC	-	ANNUAL	-	-0.9000	0.9000	0.9000	0.9000
UCCARELC	UC_ACT	REG1	UC_CAR-ELC	LHS	TCAR-GSL	-	ANNUAL	-	-0.1000	-0.1000	-0.1000	-0.1000
UCCARELC	UC_T_EACH	REG1	UC_CAR-ELC	-	-	-	-	-	1.0000	1.0000	1.0000	1.0000



Run Model Form with new [Specify Milestone Years] button After selecting Milestone Years, 3 different options for auto-generating B and E

Run Model (mode is FWD)

Model Run Details

Name: WEUDATYB
 Description: DataYearWEU model - run 0
 Comment: [Empty]
 Model Variant: Standard TIMES
 Specify Milestone Years [Specify Milestone Years] button

Milestone Years, Beginning Years, Ending Years

Milestone Years, B and E for case WEUDATYB are displayed in Edit mode.

Checkboxes that are checked specify which Results Periods will comprise Milestone Years for Run Model.

	2000	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Milestone Years (M)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Beginning Year (B)		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Allowable Milestone Years	2000	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Ending Year (E)		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Beginning Year and Ending Year

B and E halfway between Milestone Years (alternative condition)
 B and E such that Milestone Years at middle of B and E (official ETSAP condition)
 User specifies B for First Milestone Year and E for Every Milestone Year

[Specify First B and Last E] [Specify First B] [Specify First B and Every E]

Clear B and E Auto generate B and E

Load Default Milestone Years, B and E Save As Default Milestone Years, B and E

OK Cancel



Model Results – Parameter Tab

Right now comprise Detailed Flow Levels and Marginals, and Aggregate Costs

Case	Parameter	Region	Process	2000	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
WEUDAT5	COST_ACT	WEU	CO2DEFOR	1.10	1.02	0.94	0.74	0.55	0.44	0.33	0.30	0.26	0.23	0.20	0.17
WEUDAT5	COST_ACT	WEU	EBIOCR105	0.00	0.00	0.00	0.00	0.00	0.00	320.53	320.53	343.34	1,037.27	543.05	929.57
WEUDAT5	COST_ACT	WEU	EBIOP1100	0.00	174.67	343.05	411.26	422.70	422.10	359.67	0.00	0.00	0.00	0.00	0.00
WEUDAT5	COST_ACT	WEU	EBIOLC105	0.00	0.00	0.00	0.00	0.00	284.08	782.50	1,130.21	1,324.57	954.00	1,027.00	1,700.29
WEUDAT5	COST_ACT	WEU	ECDAON100	3,308.02	2,992.96	3,288.16	3,219.11	2,269.83	1,837.75	1,653.98	0.00	0.00	0.00	0.00	0.00
WEUDAT5	COST_ACT	WEU	ECDAFL100	0.00	0.00	0.00	0.00	29.53	23.52	21.53	0.00	0.00	0.00	0.00	0.00
WEUDAT5	COST_ACT	WEU	ECDAIG100	0.00	0.00	0.00	0.00	15.09	12.23	11.00	0.00	0.00	0.00	0.00	0.00
WEUDAT5	COST_ACT	WEU	ECDAFL105	0.00	0.00	0.00	0.00	107.16	211.56	243.56	597.36	597.57	529.15	560.54	565.11
WEUDAT5	COST_ACT	WEU	EGASCC100	261.50	0.00	0.00	0.00	0.00	267.63	206.01	0.00	0.00	0.00	0.00	0.00
WEUDAT5	COST_ACT	WEU	EGOICCA105	0.00	294.15	327.71	438.10	556.92	689.47	877.91	1,024.05	1,134.60	1,285.11	1,344.06	1,500.64
WEUDAT5	COST_ACT	WEU	EHYDAM105	0.00	0.37	124.56	350.50	556.67	725.35	889.10	1,059.39	1,243.66	1,429.95	1,565.16	1,700.37
WEUDAT5	COST_ACT	WEU	EUCLP400	2,343.49	2,280.27	2,470.96	2,476.37	2,475.02	2,115.04	1,805.42	2,201.79	2,697.96	3,206.09	3,805.07	4,329.54
WEUDAT5	COST_ACT	WEU	ENUCLWR105	0.00	0.00	0.00	50.62	271.45	271.45	263.01	446.10	870.83	1,160.01	1,496.79	1,772.29

- ◆ *TIMES does not have standard Results tables (c.f. MARKAL)*
- ◆ *Right now, use VEDA-BE for other sorts of results aggregation*



Model Results – Process Tab

Results Parameters may also be viewed on other tabs, e.g. Process tab

Case	Parameter	Region	Process	Commodity	TimeSlice	2000	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
WEUDAT5	COST_ACT	WEU	CO2DEFOR	-	-	1.10	1.02	0.94	0.74	0.55	0.44	0.33	0.30	0.26	0.23	0.20	0.17
WEUDAT5	VAR_ACT_L	WEU	CO2DEFOR	-	ANNUAL	1,100.00	1,017.50	935.00	742.50	550.00	440.00	330.00	297.00	264.00	231.00	198.00	165.00
WEUDAT5	VAR_ACT_M	WEU	CO2DEFOR	-	ANNUAL	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
WEUDAT5	VAR_FLOUT_L	WEU	CO2DEFOR	TOTCO2	ANNUAL	1,100.00	1,017.50	935.00	742.50	550.00	440.00	330.00	297.00	264.00	231.00	198.00	165.00
WEUDAT5	VAR_FLOUT_M	WEU	CO2DEFOR	TOTCO2	ANNUAL	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010



ANSWER-TIMES Status Summary Nov 2007 – 1

- ◆ **Data year – model year independence supported**
 - New Data years and new Model years can be added later as well
- ◆ **All standard TIMES Sets and Parameters in latest v2.4.0 TIMES GAMS code recognized**
 - Also some VDA extension parameters supported (ACT_EFF, FLO_EMIS, NCAP_AFC, NCAP_CEH, PRC_RESID)
- ◆ **“Run Model” enhanced to allow specification of Milestone Years, B and E and also to support GAMS Savepoint/Loadpoint (Basis Save/Restart) enhancement in TIMES GAMS code**
- ◆ **Import TIMES GAMS DD facility has been tested with a number of TIMES GAMS DDs**
 - Run Model out of ANSWER-TIMES replicating original LP matrix and objective value, including for VEDA-FE generated DDs



ANSWER-TIMES Status Summary Nov 2007 – 2

- ◆ **All Home Screen and Data Screen functions operational**
- ◆ **Process tab facilities enhanced to better handle special needs of TIMES, with new form to specify I/O commodities and PCG**
 - Including auto-generation of PRC_ACTUNT, PRC_CAPACT, TOP-IN, TOP-OUT, and “true” PCG with associated COM_GMAP where needed
 - Technology (Process) Items Filters facility available (as for ANSWER-MARKAL)
- ◆ **New/Edit TradeProcess form further refined to simplify Trade Matrix specification where traded Commodity has same name in all regions**
- ◆ **All types of TIMES User Constraints are handled, with UC_* parameters that ANSWER-TIMES auto-generates now adjusted to be compatible with recent changes to TIMES GAMS code defaults**
 - Special _GLOBAL region handles cross-region constraints
 - Special UCMARKET constraint type for common market share bounds
 - Rule-based Constraints facility available for all types



ANSWER-TIMES Status Summary Nov 2007 – 3

- ◆ *There is now a 16 character Item name limit*
 - As compared with 10 character Item name limit in ANSWER-MARKAL
- ◆ *Results that ANSWER-TIMES imports extended to include aggregate cost results, along with option to suppress pure zero time series results*
 - Thanks to Antti Lehtila for enhancing the TIMES GAMS code
- ◆ *ANSWER-TIMES results handling needs to be extended*
 - Have TIMES GAMS code create other aggregated results (analogous to standard MARKAL reports) and import into ANSWER?
 - Right now, use VEDA-BE for results handling
- ◆ *Preliminary ANSWER-TIMES User Manual documents the TIMES-specific aspects of ANSWER-TIMES*
 - Recently updated ANSWERv6-MARKAL User Manual fully documents ANSWER-MARKAL and hence documents each ANSWER-TIMES facility that operates identically to the same ANSWER-MARKAL facility



Future Developments

- ◆ *New ANSWER-TIMES evaluation system available December 2007*
- ◆ *Add support for user-defined inter- & extrapolation options*
- ◆ *Extend ANSWER-TIMES results handling*
- ◆ *Develop ANSWER-TIMES “smart” spreadsheets by extending approach used for ANSWER-MARKAL “smart” spreadsheets*
- ◆ *Enhance New/Edit Trade Process form to handle Trade Processes that involve trade in multiple commodities, while retaining full generality of naming permitted by TIMES*
- ◆ *Streamline operation of TimeSlice specification where same TimeSlices in each region*
- ◆ *Enhance to support advanced TIMES model variants, if there appears to be a demand*



Acknowledgments

- ◆ *Antti Lehtila, VTT Energy Finland, for his extremely generous assistance in answering TIMES queries in 2005, 2006 and throughout 2007 and for making a number of enhancements to the TIMES GAMS code that have benefited ANSWER-TIMES*
- ◆ *Uwe Remme, IER Germany, for his generous assistance in answering TIMES queries as far back as Dec. 2004, and for his assistance with a Stanford June 2007 ANSWER-TIMES presentation, and for delivering this Brasilia November 2007 ANSWER-TIMES presentation*
- ◆ *GianCarlo Tosato, ETSAP Project Head, for providing funding assistance to Noble-Soft Systems*

