

# ETSAP Primary Systems Coordinator Activities

Gary A. Goldstein  
International Resources Group

ETSAP Annex IX Semi-annual Workshop  
Kyoto, Japan  
4 July 2005



## PSC Activities

- MARKAL Model Generator
- New ANSWER Load Templates
- VEDA Usage
- Other contributions
  - TIMES Documentation
  - ETSAP Annex VIII/IX Final Report
  - LEAP-2-TIMES Project Development
  - Support to global MARKAL user community
  - Next Newsletter



## MARKAL Model Generator New Benefit/Cost Facility

- Basic principle is to determine the Value Flows associated with each (requested) technology
- Value Flows are constructed by examining the intersections in all equations of each variable associated with a technology and the marginal costs of the corresponding equations and variables
- Final Benefit/Cost ratio is the sum of the benefits / the sum of the costs
- Implemented by means of a new GAMS CONVERT utility option (UnitBC), resulting in UnitBC.GDX containing the <Var>\_B/\_C unit benefit/cost for each variable
- Resulting code much less complex and sensitive to changes to the model code



## MARKAL Model Generator New Benefit/Cost Facility (Cont.)

$$UnitBenefit_j = \sum_{i \$(row.M_i * a_{i,j}) > 0} row.M_i * a_{i,j}$$

$$UnitCost_j = C_j - \sum_{i \$(row.M_i * a_{i,j}) < 0} row.M_i * a_{i,j}$$

*where row.M<sub>i</sub> = equation shadow price*

*a<sub>i,j</sub> = matrix coefficient*

*C<sub>j</sub> = Obj coefficient*



## MARKAL Model Generator New Benefit/Cost Facility (Cont.)

$$BenefitCostRatio_{tch,t} = \frac{\sum_j UnitBenefit_{j,t}}{\sum_j UnitCost_{j,t}}$$

$$BenefitCostRatio_{tch} = \frac{\sum_{j,t} UnitBenefit_{j,t}}{\sum_{j,t} UnitCost_{j,t}}$$



## MARKAL Model Generator New Benefit/Cost Facility (Cont.)

```
* check for a value for each variable, otherwise no GDX parameter is
* created and an EXECUTE error is encountered
* Activity
if(sum(tpprc(tp,prc),ACT.l(tp,prc)),
  execute_load 'unitbc' %1ACT_B, %1ACT_C
);
* Capacity
if(sum(tpch(tp,tch),CAP.l(tp,tch)),
  execute_load 'unitbc' %1CAP_B, %1CAP_C
);
* Investment
if(sum(tpch(tp,tch),INV.l(tp,tch)),
  execute_load 'unitbc' %1INV_B, %1INV_C
);
...
```



## MARKAL Model Generator New Benefit/Cost Facility (Cont.)

\* UnitBenefit of technology

$$\begin{aligned} \text{ub}(\text{tp}, \text{tchx}) = & \% \text{lact\_b}(\% 2\text{tp}, \text{tchx}) + \% \text{lcap\_b}(\% 2\text{tp}, \text{tchx}) + \\ & \% \text{linv\_b}(\% 2\text{tp}, \text{tchx}) + \text{sum}(\text{enc}, \% \text{lout\_b}(\% 2\text{tp}, \text{tchx}, \text{enc})) + \\ & \text{sum}(\text{z}, \% \text{lm\_b}(\% 2\text{tp}, \text{tchx}, \text{z})) + \\ & \text{sum}(\text{td}, \% \text{lctzyh\_b}(\% 2\text{tp}, \text{tchx}, \text{td}) + \% \text{lctzy\_b}(\% 2\text{tp}, \text{tchx}, \text{td})) + \\ & \text{sum}(\text{z}, \% \text{lthz\_b}(\% 2\text{tp}, \text{tchx}, \text{z})); \end{aligned}$$

\* UnitCost of technology

$$\begin{aligned} \text{uc}(\text{tp}, \text{tchx}) = & \% \text{lact\_c}(\% 2\text{tp}, \text{tchx}) + \% \text{lcap\_c}(\% 2\text{tp}, \text{tchx}) + \\ & \% \text{linv\_c}(\% 2\text{tp}, \text{tchx}) + \text{sum}(\text{enc}, \% \text{lout\_c}(\% 2\text{tp}, \text{tchx}, \text{enc})) + \\ & \text{sum}(\text{z}, \% \text{lm\_c}(\% 2\text{tp}, \text{tchx}, \text{z})) + \\ & \text{sum}(\text{td}, \% \text{lctzyh\_c}(\% 2\text{tp}, \text{tchx}, \text{td}) + \% \text{lctzy\_c}(\% 2\text{tp}, \text{tchx}, \text{td})) + \\ & \text{sum}(\text{z}, \% \text{lthz\_c}(\% 2\text{tp}, \text{tchx}, \text{z})); \end{aligned}$$


## MARKAL Model Generator New Benefit/Cost Facility (Cont.)

\* calculate the Benefit/Cost Ratio

$$\text{ratio}(\text{tp}, \text{tchx}) \$ (\text{uc}(\text{tp}, \text{tchx}) \text{ GT } .0000001) = \text{ub}(\text{tp}, \text{tchx}) / \text{uc}(\text{tp}, \text{tchx});$$

$$\text{ratiot}(\text{tchx}) \$ (\text{SUM}(\text{tp}, \text{uc}(\text{tp}, \text{tchx})) \text{ GT } .0000001) = \text{sum}(\text{tp}, \text{ub}(\text{tp}, \text{tchx})) / \text{sum}(\text{tp}, \text{uc}(\text{tp}, \text{tchx}));$$


## New ANSWER Load Templates

- Developed for SEE-REPD initiative, and more
- “Smart” Excel templates with
  - ❑ Link to an active ANSWER database
  - ❑ ANSWER Set forms for specifying set membership
  - ❑ ANSWER Unit tree for specifying commodity/technology units
  - ❑ Pick-lists for identifying commodities/technologies
  - ❑ Pre-load Quality Control checking for each sheet type
- 6 types of sheets
  - ❑ commodity/technology/constraint declaration
  - ❑ commodity/technology/constraint data



## New ANSWER Load Templates (Cont.)

Commodity	Constraint	Membership	Constraint	Membership
BO4WD	Full wood			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			
CO4WB	Wood cut			
CO4WA	Lights			



## New ANSWER Load Templates (Cont.)

The screenshot shows a Microsoft Excel spreadsheet with the following columns: TaskName, TaskDesc, Hour, LTD, PSC, CAP, REACT, DIST, and DIST2. The data is organized into rows for different tasks, such as 'PSC000000' through 'PSC000009'. The 'Hour' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'LTD' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'PSC' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'CAP' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'REACT' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'DIST' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24. The 'DIST2' column contains values like 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.



## VEDA Usage

- Primary PSC use of VEDA-FE is for the 6-state NE-MARKAL undertaking
- Provide input for user-oriented functionality requirements
- MARKAL code integration
- Debugging



## Other PSC Contributions

- TIMES Documentation (overview and parameters sections)
- ETSAP Annex Final Report, draft circulated
- LEAP-2-TIMES Project Development
- Support for ETSAP partners and global MARKAL (TIMES) community
- Soliciting ideas and contributions for the next (2) ETSAP Newsletters



## Other PSC Contributions LEAP-2-TIMES

- Motivation and approach outlined at ETSAP meeting: Florence, Nov 2004
- Team: IRG/Tellus/ERC/IER-VTT
- Tasks
  - Complete L2T parameters (and results) mapping tables
  - Identify and resolve compatibility issues
  - Define data exchange formats (DD and VEDA-BE dump)
  - Identify required additions to LEAP and TIMES pre/post-processor
  - Implement and test
- Costs-sharing – est. ETSAP contribution €25k '05 / €35k '06

