

ETSAP-TIAM recalibration and recent improvements

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Mandate for 2007 (June 2007)

- To re-calibrate the model to year 2005
- To “clean-up” and simplify the database structure of TIAM (templates, other input files)
- To continue to improve input data (already started in 2005-2006) in selected sectors:
 - Electricity production technologies
 - Alternative fuel production
 - Renewable potentials
 - End-use sectors: Transportation first, others later
- To facilitate creation of a new region

Mandate for 2008

- Tie the loose ends of 2007 work
- Renewables potentials (and biomass structure)
- Continue revision of end-use sectors
- Updated India and China regional data (spillover from the TOCSIN project)
- Consider adding new regions to TIAM (Brasil, Russia) or to redefine some regions (Europe)

KAIZEN* applies well to model maintenance

*(*Webster: Kaizen means "improvement". Kaizen strategy calls for never ending efforts for improvement involving everyone in the organization)*

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Work done to-date

- Recalibration to 2005: 100%
- Clean-up of templates and other files: 90%
- Electricity sector: 80%
- Alternative fuel production: 100%
- Road transport: 95%
- Industry: 50%
- Buildings: 50%
- Earlier work (2006):
 - Many TCH data improvements in all sectors
 - Coal, oil, and gas potentials (IER)
 - Trade of energy (IER)

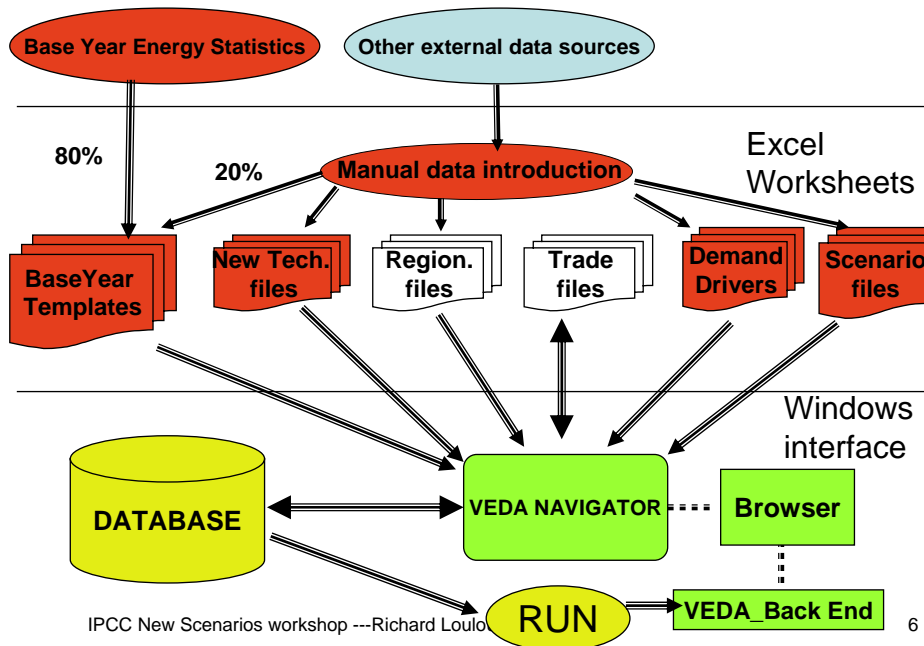
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Access to Database

- ETSAP members that paid the 2007 fee will get the complete set of input files at the Brasilia ETSAP workshop
 - List of input files explaining nature of contents
- Periodic updates will be made available on website.
 - Participating members will be informed of new updates by e-mail (we need a list of e-mails of authorized members)
 - List of input files explaining nature of contents

TIAM File structure in VEDA_FE



TIAM Input Files

VEDA Models

TIAM Nov13

Databases

SubRes_Tmpl

SuppXLS

Demands

Trades

UConstraints

Contents	Update frequency for scenario analysis
75 Templates	Very rarely
DB's	Never manually
Future techs	occasionally
Scenarios	Very often
Drivers, Elast.	Rarely
Trades	Rarely
Special UC's	Never

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Types of files

- **Base Year Templates** hold all data pertaining to the base year (installed capacities, energy inputs and outputs, emissions, various shares) for each region and each sector (75 files)
- **NewTech file and SubRes files:** SubRes_Newtech contains technoeconomic data for new technologies, organized by sector (1 file, 4 worksheets). SubRes_XXX files contain data on additional technologies and fuels
- **Regionalization files** (_trans files, one per each SubRes file): contain information required to modify or define technology data that are region-specific)
- **Demand drivers file(s):** one or more files. Each file contains the values of the demand drivers for a particular demand scenario

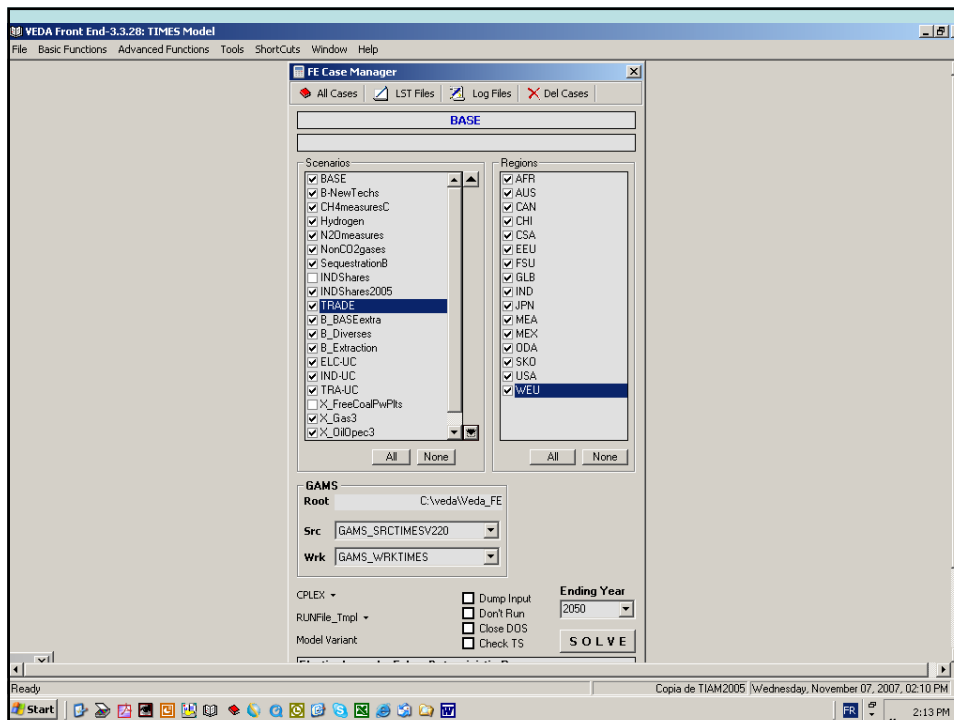
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Types of files cont'd

- **Trade file(s):** each file contains all qualitative and quantitative information on each commodity trade (trade links, costs, efficiencies)
- **Scenario files:** contain data that define elements of various scenarios. They usually modify data contained in other files, for example: upper bounds, costs, taxes, etc.

RULE: If two files contain data on the same parameters, the one listed last in the VEDA_FE 'Solve' window prevails



Test runs

- BASE CASE
- GHG TAX (200\$/ tonne of CO₂-EQ)
- Bound on forcing (2.2 W/m² in 2050)

Plan of remainder of presentation

1. Re-calibration to 2005
2. Clean-up of templates and other files
3. EPG, alternative fuels, End-use sectors

Re-calibration to 2005

Objective

Initial year = 2005 instead of 2000

Steps

- Read the 2005 IEA data (and verify the compatibility between the different versions of the IEA database)
- Collect and read the 2005 installed capacities
- Adjust the user's constraints and the fuel shares (eg. INDShare)
- Test the model and check the dummy imports (generally meaning inappropriate bounds)
- Identify and adjust the inappropriate bounds or data



Clean-up of templates and other files

Objectives

- Transfer the user's constraints from the templates to scenarios (UC-*)
- Remove useless information
- Avoid the duplication of information in several scenarios



Make the files more friendly for new users

Clean-up of templates and other files

Templates

- Update IEA_data sheet
- Remove most of the user's constraints, the remaining ones will be removed soon
→ *Transferred to UC and Share scenarios*
- Adjust the installed capacities
- Remove the values related to fossil resources
→ *Data now included in B_Extraction scenario*
- Adjust the climate parameters to 2005 values (in AFR_UPS template, Climate sheet)

Clean-up of templates and other files

Scenarios

- Create INDSHare2005 (formerly: user's constraints in templates)
- Create UC scenarios (formerly: user's constraints in template)
- Transfer to templates many data from B_BASEextra
- Transfer to templates all the data from B_Diverses and remove B_Diverses

SubRes

- Corrected Afforestation structure in Sequestration

Clean-up of templates and other files

List of files

TIAMNov13\VT_REG_ELC_v1p1 TIAMNov13\VT_REG_IND_v1p1 TIAMNov13\VT_REG_RES_v1p1 TIAMNov13\VT_REG_TRA_v1p1 TIAMNov13\VT_REG_UPS_v1p1	Regional templates (15 REG + GLB)
SubRES_TMPL\SubRes_AltFuel SubRES_TMPL\SubRes_AltFuel_Trans	New alternative fuel technologies
SubRES_TMPL\SUBRES_B-NewTechs SubRES_TMPL\SUBRES_B-NewTechs_Trans	New technology repository
SubRES_TMPL\SubRes_CH4measuresC SubRES_TMPL\SubRes_CH4measuresC_Trans	CH4 mitigation options
SubRES_TMPL\SUBRES_Hydrogen SubRES_TMPL\SUBRES_Hydrogen_Trans	Hydrogen technologies
SubRES_TMPL\SubRes_N2Omeasures SubRES_TMPL\SubRes_N2Omeasures_Trans	N2O mitigation options
SubRES_TMPL\SUBRES_NonCO2gases SubRES_TMPL\SUBRES_NonCO2gases_Trans	NonCO2 emissions
SubRES_TMPL\SUBRES_SequestrationB SubRES_TMPL\SUBRES_SequestrationB_Trans	CO2 capture and sequestration options

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Clean-up of templates and other files

List of files (cont')

SuppXLS\Demand\Base_Drivers SuppXLS\Demand\Dem_Alloc+series	Macro-economic drivers, allocation of drivers to demands, elasticities of demands to the drivers
SuppXLS\Trades\ScenTrade_TRADE	Trade description (costs and bounds)
SuppXLS\UConstraints\ScenUC_INDShares2005	IND Shares
SuppXLS\EFDA_Qdata	Cost regionalization
SuppXLS\Scen_B_BASEextra	Modifications of data included in Templates and SubRES files To be included in all runs
SuppXLS\Scen_B_Extraction	Modifications of fossil resources proposed by IER. To be included in all runs
SuppXLS\Scen_ELC-UC SuppXLS\Scen_IND-UC SuppXLS\Scen_UPS-UC	User's constraints To be included in all runs

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Clean-up of templates and other files

List of files (cont')

SuppXLS\Scen_X_FreeCoalPwPlts	To be included to de-activate the coal power plan limit included by default
SuppXLS\Scen_X_Gas3	To increase gas price
SuppXLS\Scen_X_OilOpec3	To increase oil price
SuppXLS\Scen_EMITAX200	Tax scenario
SuppXLS\Scen_CCVTEST	Scenario for climate module
TIAMNov13\SysSettings	Interpolation options

Clean-up of templates and other files

To do

- Transfer the remaining user's constraints from templates to scenarios
- Review Oil sands extraction and processing
- Analyze and remove the remaining dummy imports
- Check the CH4 options ? (check no-regret options in the base case)

Technology review and update: Power sector and alternative fuels

Power sector

- **Focus: conventional power plants w/o and w CCS**
- **Renewables (technologies and potentials):**
 - Wind converters
 - PV
 - Hydro
- **To be done:**
 - Solarthermal power plants
 - Biomass plants
 - Geothermal power plants (flash steam/binary-cycle and enhanced geothermal (hot dry rock))

Alternative fuels

- FT fuel from coal (w,w/o capture), natural gas and biomass
- Diesel by hydrothermal upgrading
- Hydrogen from coal, natural gas and coal

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Fossil power plants

Fuel & Technology	Starting year	Investment costs		Efficiency	Efficiency loss	Additional fuel	Capture efficiency
		w capture	w/o capture	w capture	Compared to w/o capture		
		[\$/kW]	[\$/kW]	LHV [%]	LHV [%]		
Coal, Steam cycle, Postcomb	2010	2250	1300	38	9	24	85
Coal, Steam cycle, Postcomb	2020	2000	1250	41	9	22	85
Coal, Steam cycle, Postcomb	2030	1850	1150	44	8	18	85
Coal, Steam cycle, Oxyfueling	2010	2400	1300	37	10	27	90
Coal, Steam cycle, Oxyfueling	2020	2100	1250	41	9	22	90
Coal, Steam cycle, Oxyfueling	2030	1900	1150	44	8	18	90
Coal, IGCC, Precomb	2010	2300	1700	40	9	22	85
Coal, IGCC, Precomb	2020	2000	1500	45	6	13	85
Coal, IGCC, Precomb	2030	1800	1475	48	6	13	85
Biomass, IGCC, Precomb	2025	2600	1925	26	8	31	85
Gas, CC, Postcomb	2010	1000	600	49	8	16	85
Gas, CC, Postcomb	2020	850	550	55	6	11	85
Gas, CC, Postcomb	2030	800	550	57	6	11	85
Gas, CC, Oxyfueling	2010	1250	600	48	10	21	95
Gas, CC, Oxyfueling	2020	1100	550	51	10	20	95
Gas, CC, Oxyfueling	2030	950	550	55	8	15	95
Coal, IGCC & SOFC	2035	2200		48	9	19	90
Gas, CC & SOFC	2030	1600		58	12	21	90

Sources: /Damen 2007/, /IEA 2004/, /IEA GHG 2003, 2005, 2006a, 2006b, 2006c/, /Rhodes 2005/, /Rubin et al. 2007/, /ZEP 2006/

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End-use sectors

Transport

- First update of technology characterization (with focus on cars)
- Further work : future development potential, other transport technologies, regional differences, modelling of short/long distance travel

Residential and Commercial

- First update of warm water and heating boilers, lighting, cooking
- Further work required on other technologies and saving options

Industry

- First update of steam and process heat boilers, motors
- Further work: saving options and potential,
- Process-based modelling of major industry sectors ??

TIMES NEW FEATURES

- Sensitivity Analysis and Trade-off Analysis
- Bounding of Regional Cost Components
- Non-constant price elasticities of demands
- Climate Module:
 - Random Climate sensitivity and Lag parameter
 - Methane cycle and forcing (separate from CO₂)
 - N₂O cycle and forcing (separate from CO₂)