



CASE STUDIES

■ South Africa

- Working with University of Cape Town Energy Research Center
- Incorporating Water Constraints into their energy planning tools: TIMES model
- Will use CGE model to understand trade-offs

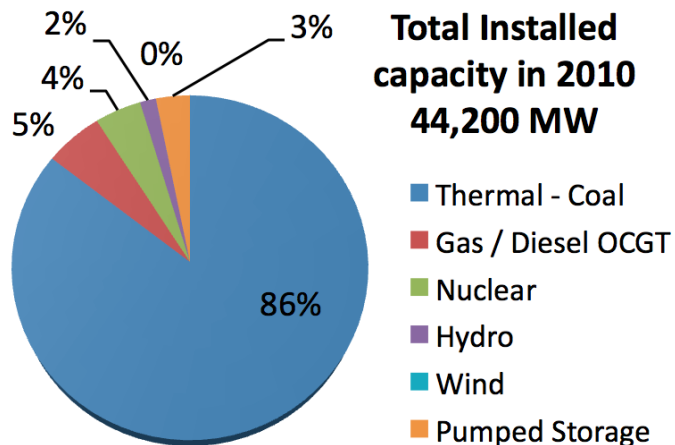
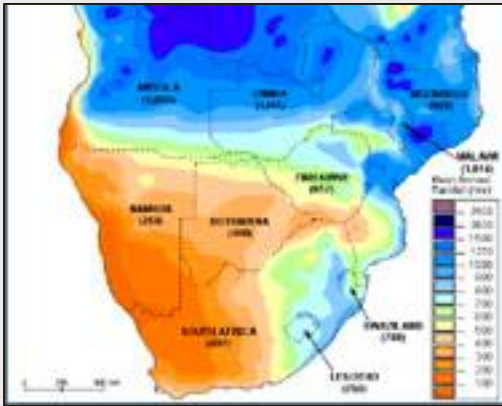
■ China

- In conversation NEA & IWHR
- Integrate ERI and/or Tsinghua TIMES with IWHR basin models
- Use in support of the 13th Five Year Plan

■ Morocco

- In conversation with ONEE (recently merged water & energy utility)
- Stakeholders consultations and interactive workshop with experts to determine working plan and understand their interest/concerns

South Africa: the case of A Water Scarce Country



Water scarce country with very stressed basins in terms of water allocation

Coal Thermal Power plants account for almost 90% of the power capacity installed

Competition for water across sectors will increase – Power plants have priority, which could negatively affect other sectors such as agriculture

Fracking for Shale Gas is being explored, which will put additional pressure on water resources

Need for Water and Energy Integrated planning to achieve a sustainable future and avoid water scarcity problems in the next years

Using what already exist : Improvement of existing TIMES model



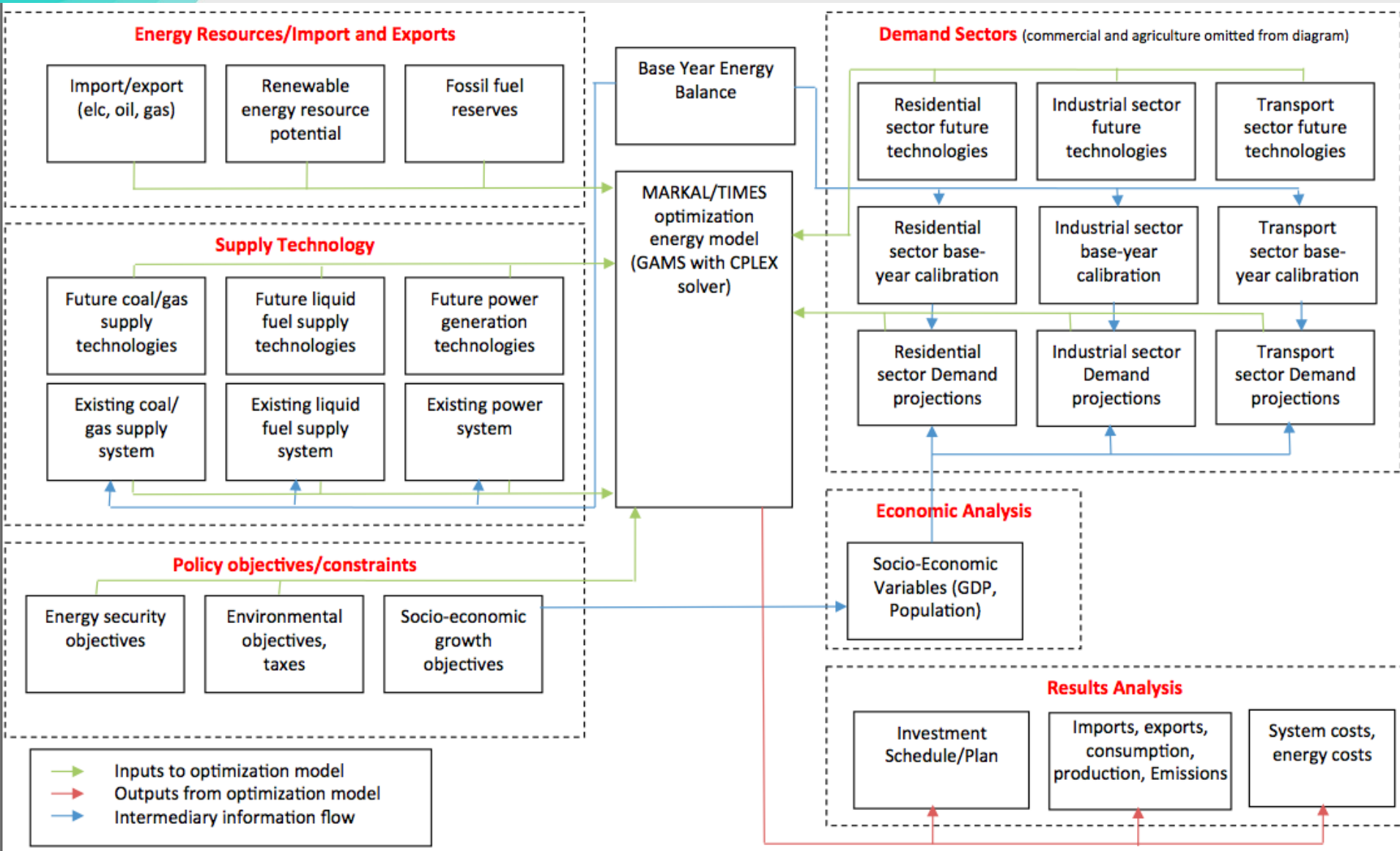
South Africa TIMES (SATIM):

- Partial equilibrium linear optimization model capable of representing the whole energy system, including its economic costs and its emissions
- Five demand sectors – industry, agriculture, residential commercial and transport - and two supply sectors - electricity and liquid fuels
- The model is capable of solving for a variety of constraints

PHASE 1:

1. Develop marginal water supply cost schedules
2. Develop the “water smart” SATIM
3. Energy-Water Model Simulations : run different scenarios to assess how energy sector development strategies change relative to the reference scenario depending if water is constraint, if water has a price, etc. **Look at expansion of coal, fracking, imposed GHG limits, etc.**

Overview of SATIM



Overview of **SATIM**: the power sector



SATIM PARAMETERISATION OF POWER PLANT TECHNOLOGIES

PARAMETERS	ADDITIONAL PARAMETERS FOR CHP PLANTS	ADDITIONAL PARAMETERS FOR NEW PLANT TECHNOLOGIES
Energy input commodity or fuel	Industrial process heat	Limits on capacity
Water consumption ¹	Operation in back pressure	Investment cost
Efficiency	Additional input fuel	Technology life
Output commodity		Technology lead-time
Energy availability		Upper bound on new capacity
Capacity availability		Upper bound on capacity factor
Capacity credit		Bounds on wind classes
Fixed operating and maintenance cost		Wind intermittency
Variable operating and maintenance cost		Capacity credit of wind
Refurbishment/retirement profile		Diurnal production of solar with and without storage by timeslice
"Season" & "Daynite" operating categories		

...but as of now there is no constraint on it, the model assumes that it is an infinite resource and with no price or regional constraint

Links to CGE model (E-SAGE)



E-SAGE: Energy---extended South African General Equilibrium model

PHASE 2:

- Run the CGE model to establish reference scenario demand projections for energy.
- Run SATIM with these given demand projections to produce a new Reference case, and then run a new EW-Nexus case that allows for reduced energy demands from economy-wide adjustments when energy prices rise to reflect water scarcity.
- Pass SATIM findings on increased energy production costs back into the CGE model in order to evaluate the economy-wide impact of accounting for water scarcity in energy sector development.
- Compare these reference and EW-Nexus scenarios.
- Compare the incremental water supply costs for energy expansion across the different water management areas in the model to other figures for water shadow prices by water management area. Using such comparisons, highlight where increased demands on water sources from energy sector expansion may particularly pose challenges to efficient water management across sectors and water management areas.



Economywide framework

