Feasibility Study for the migration of TIMES

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All ETSAP partners are welcome to contribute in this feasibility study.

Aim

Develop a feasibility study on the possibility to migrate the TIMES code in a new language.

The focus of the project will be on the comparison between GAMS and alternative open source options (e.g. Python, Julia and JuMP), to identify the best alternative mainly handling the preprocessing step of TIMES.

Motivation

Cost of the tools is one of the main issues for developing countries to use ETSAP's tools.

An open source language will reduce the cost that has to be paid by new users and developing countries for using TIMES.

Motivation

		Commercial			Open-source		
Instance	JuMP	GRB/C++	AMPL	GAMS	Pyomo	CVX	YALMIP
lqcp-500	8	2	2	2	55	6	8
lqcp-1000	11	6	6	13	232	48	25
lqcp-1500	15	14	13	41	530	135	52
lqcp-2000	22	26	24	101	>600	296	100
fac-25	7	0	0	0	14	>600	533
fac-50	9	2	2	3	114	>600	>600
fac-75	13	5	7	11	391	>600	>600
fac-100	24	12	18	29	>600	>600	>600

TABLE 1

Time (sec.) to generate each model and pass it to the solver, a comparison between JuMP and existing commercial and open-source modeling languages. The `lqcp` *instances have quadratic objectives and linear constraints. The* `fac` *instances have linear objectives and conic-quadratic constraints.*

		Commercial		Open-source	
Instance	JuMP	AMPL	GAMS	Pyomo	YALMIP
clnlbeam-5	12	0	0	5	76
clnlbeam-50	14	2	3	44	>600
clnlbeam-500	38	22	35	453	>600
acpower-1	18	0	0	3	-
acpower-10	21	1	2	26	-
acpower-100	66	14	16	261	-

TABLE 2

Time (sec.) to generate each model and pass it to the solver, a comparison between JuMP and existing commercial and open-source modeling languages for derivative-based nonlinear optimization. Dash indicates not implemented.

JuMP is based on Julia programming language licensed under the MIT license.
http://julialang.org/

Target

The output of this feasibility study will:

- Give an indication about the possibility to migrate TIMES to a new language.

- Examine the possibility of a semi-automated (or automated) routine for the conversion.

- Identify the needed resources for the migration.

A very preliminary prototyping will be developed in order to benchmark the different options.

Relevance to the Annex XIV topics

This project is relevant for:

- Annex XIV Objective (a) "Tools Maintenance, Improving and Capacity Building" by contributing to the ETSAP Tools and Methodologies development for the long term analysis of the energy, economy, and environment interactions.

- Annex XIV Objective (b) "Research and Development" according to which ETSAP will support research and development activities in improved modelling of the interactions between the energy system and the economy. More specifically it is listed in the Annex XIV work programme that "*The possibility to include economic sectors analysis in ETSAP's tools (for example by building a CGE model generator hard-linked with the TIMES model generator) could be further investigated*".

Furthermore, if a **migration to an open source language proves feasible, this will reduce the cost** that has to be paid by new users and developing countries for using TIMES.

Expected Benefits for ETSAP:

This project will give a first input to the possibility of moving TIMES in a new direction and making the model generator fully accessible in an open source language.

Outputs and Costs

Deliverables:

Report describing the possibility to migrate TIMES, estimating possible improvements and required resources.

Time schedule: 6 months

Estimated Costs: € 6,500.