

AN OPEN-SOURCE TIMES/MIRO APP

Joint presentation by

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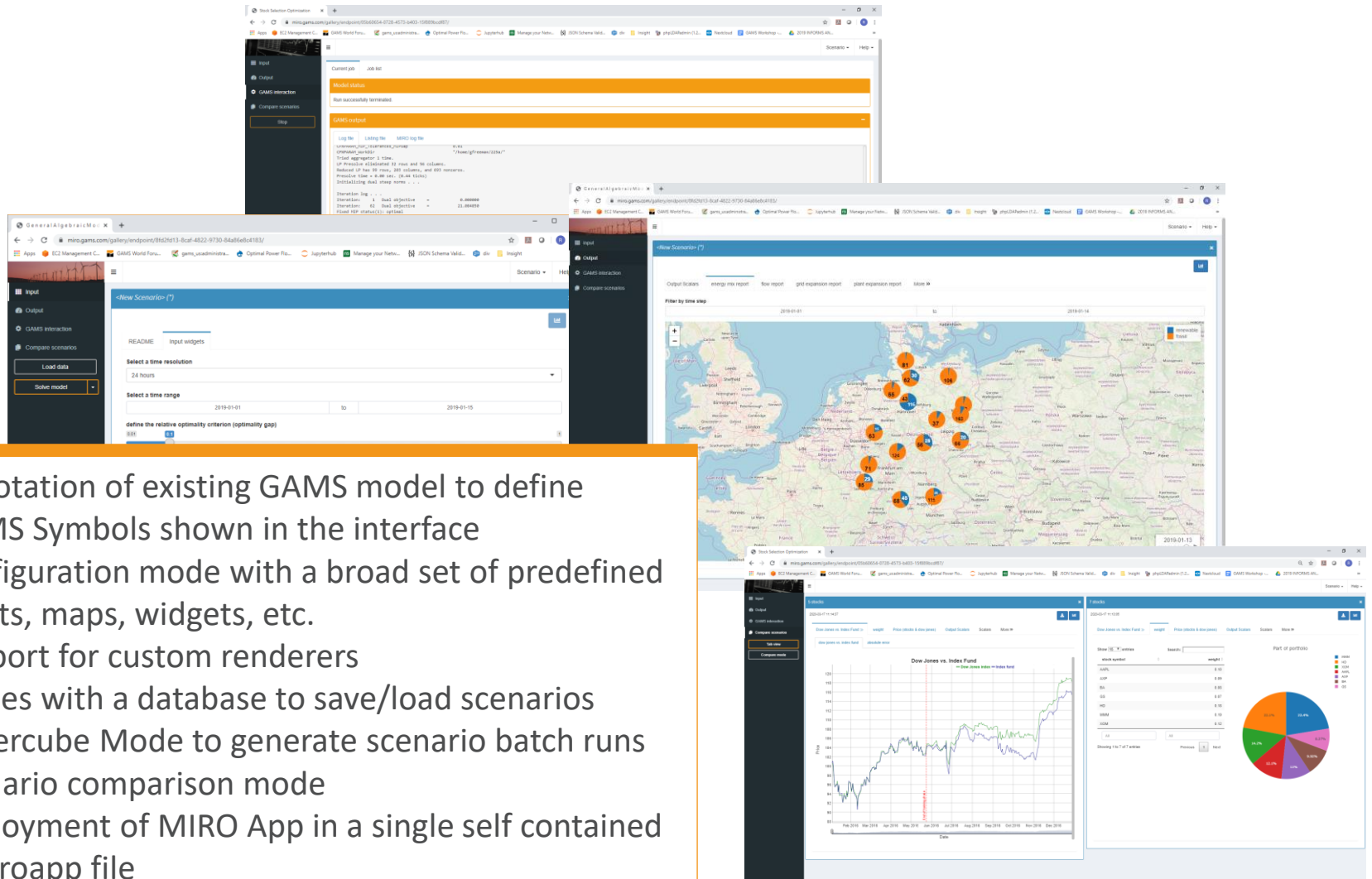
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Background

- TIMES source code published under an open-source license in Dec 2019
 - GAMS MIRO published under an open-source license in Apr 2020
 - GAMS MIRO is a deployment framework for GAMS models
 - Motivation
 - Open Modelling Trend
 - Many Energy Models implemented in GAMS are published open-source (such as TIMES)
 - Certain models rely on GUIs - no open-source TIMES GUI available so far
 - (Potential) TIMES users that operate on a tight budget...
 - ... have a need for a low-cost/free Graphical User Interface (GUI) to their TIMES Model
 - ... have a need for a low-cost/free GAMS/Solver licensing option
 - Dissemination of a TIMES model (e.g. to allow others to reproduce results)
- The TIMES/MIRO App...
- ... is open-source and published on [Github](#)
 - ... embeds a [NEOS](#) option that allows to solve models of any size “in the cloud” with a **free** GAMS demo license.

What is GAMS MIRO?

A Deployment framework to turn GAMS models into interactive (web) applications



- ✓ Annotation of existing GAMS model to define GAMS Symbols shown in the interface
- ✓ Configuration mode with a broad set of predefined charts, maps, widgets, etc.
- ✓ Support for custom renderers
- ✓ Comes with a database to save/load scenarios
- ✓ Hypercube Mode to generate scenario batch runs
- ✓ Scenario comparison mode
- ✓ Deployment of MIRO App in a single self contained *.miroapp file
- ✓ Gateway for optimizing in the cloud ([read more](#))

The TIMES/MIRO App

Basic Functionality

How to run TIMES

The TIMES/MIRO App acts like a wrapper that creates TIMES Data and the TIMES Driver

TIMES Driver (the *.RUN file)

```
$Title TIMES -- VERSION 4.1.0
option resLim=1000, [...], bRatio=1;
option [...], solver=cplex;
$offListing
[...]
$set OBJ MOD
$set BOTIME 1970
[...]
$batInclude initsys.mod
$batInclude initmtty.mod
$batInclude base.dd
$batInclude nt-agr.dd
$batInclude nt-com.dd
[...]
Set MILESTONYR / 2005,2010,2015,2020,2030,2050/;
$set RUN_NAME demo12
$batInclude maindrv.mod mod
```

TIMES Source

244 files
24,748 lines
→ Not touched!
[...]
initmtty.mod
initsys.mod
maindrv.mod
[...]

TIMES Data

*.dd files
base.dd
nt-agr.dd
nt-com.dd
nt-ind.dd
nt-rsd.dd
[...]
uc-trn90.dd

Browsing/editing data cube in powerful pivot tables

Symbol	DO File	User Constraint	Region	Time Slice	Limit Types	Currencies	Gen1	Gen2	Gen3	Commodity aggregate	2015	2017	2020	2025	2035	2045
ACT_COST	nt-agr	-	Starter	-	-	MUSD13	-	-	-	-	0.05					
ACT_EFF	nt-agr	-	Starter	ANNUAL	-	-	-	-	-	-	1.07		1.10	1.13	1.15	1.20
NCAP_AFA	nt-agr	-	Starter	-	UP	-	-	-	-	-	1.00					
NCAP_COST	nt-agr	-	Starter	-	-	MUSD13	-	-	-	-	15.00					
NCAP_POM	nt-agr	-	Starter	-	-	MUSD13	-	-	-	-	0.10					
NCAP_START	nt-agr	-	Starter	-	-	-	-	-	-	-	2,017.00					
NCAP_TLIFE	nt-agr	-	Starter	-	-	-	-	-	-	-	15.00					
UC_ACT	uo-agr90	AGR-Q-IM-UP	Starter	ANNUAL	-	-	LHS	-	-	-	-0.01					
		AOE-F-BIOPSF-LO	Starter	ANNUAL	-	-	LHS	-	-	-	1.00					

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Run configuration via user friendly widgets

The screenshot shows the GAMS MIRO web interface. On the left is a dark sidebar with navigation options: Input, Output, GAMS interaction, and Compare scenarios. The main area displays configuration for a model named 'starter20200621 (*)'. The 'Solve model' button is highlighted in orange. Configuration options include:

- Solver to use:** cplex
- Select active scenario(s):** B_VTS-UC90, P-CO2L20, P-CO2L30, P-CO2Tax (selected), P-LIMELC
- DD Files to read under \$offEps:** (empty field)
- Time limit for solve [seconds] (resLim):** Slider set to 1,000 (range 0 to 36,000)
- Basis indicator (bRatio):** Slider set to 0 (range 0 to 1)
- Adjustment for total available time span of years available in the model:** 1970
- Objective function formulation:** AUTO
- Selection for local solve, short and long NEOS queue:** Local

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Browsing/editing data cube in powerful pivot tables

Run configuration via user friendly widgets

“Solve model”:

- App writes *.dd files
- App writes the driver
- App runs the driver

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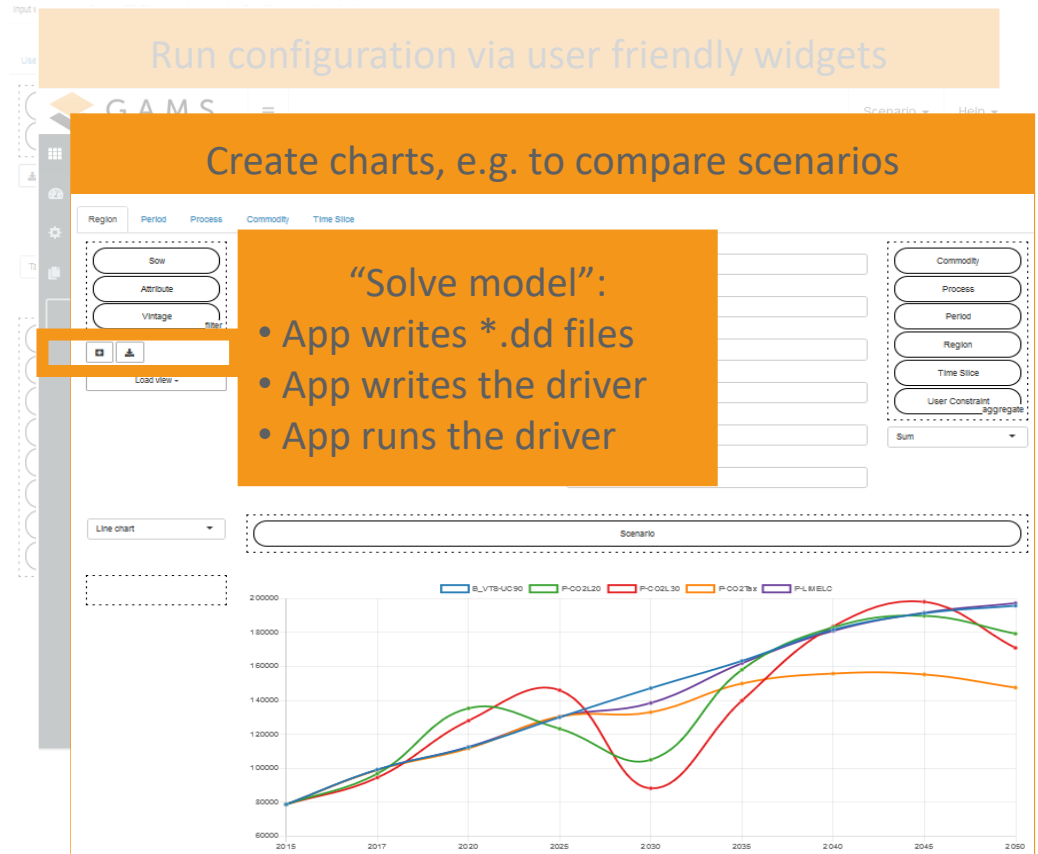
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Run configuration via user friendly widgets

Create charts, e.g. to compare scenarios

“Solve model”:

- App writes *.dd files
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Create charts, e.g. to compare scenarios

And much more...

- Enabling/Disabling TIMES extensions
- Batch runs to solve/compare multiple scenarios
- Access to GAMS output (.log and .lst)
- Comes with publicly available datasets (TIMES Demo/TIMES-DK COMETS)
- Supports import of any other TIMES data set (*.dd files required)
- Allows to submit model to the NEOS optimization server for solution (free GAMS Demo License sufficient)

The TIMES/MIRO App

NEOS Option



Solve models on NEOS (free GAMS Demo License sufficient)

Input widgets | Scenario DD File map | Input | Time Slices | Years for this model run

More >>

Solver to use
cplex

Select active scenario(s)
B_VTS-UC90 P-CO2L20 P-CO2L30 **P-CO2Tax**
P-LIME LC

Adjustment for total available time span of years available in the model
1970

DD Files to read under \$offEps

Time limit for solve [seconds] (resLim)
1,000 36,000

Basis indicator (bRatio)
0 1

Objective function formulation
AUTO

Selection for local solve, short and long NEOS queue
Local
Local
NEOS short queue
NEOS long queue

- Same look and feel as if solving locally
- It might take a while until the job is scheduled (depending on the queue)

- The **NEOS Server** is a free internet-based service for solving numerical optimization problems
- Access to 60+ state-of-the-art solvers (including Cplex, Gurobi, Mosek, Xpress, ...)
- The NEOS Server is available **free of charge for everyone**, anywhere in the world.
- NEOS allows
 - Unlimited #jobs per user (but asks to submit no more than 15 jobs at a time)
 - A maximum run time of 8 hours (long queue)
 - A maximum run time of 5 minutes (short queue)
 - Multithreading with up to 4 threads per job
 - Maximum memory requirement of 3GB RAM
- *You agree that any material, information, or data you transmit [...] or post to the Site [...] will be considered **non-confidential and non-proprietary**.*

Enjoy the Demo
by
Dr. Evangelos Panos

An Open-Source TIMES/MIRO App

Summary

- Strengths:
 - Powerful data browsing and charting facilities
 - Open-source
 - NEOS option allows usage free of charge
 - Build with MIRO - features/improvements of MIRO also improve the TIMES/MIRO app
- Shortcomings:
 - *.dd files required to create TIMES data set for the app
 - Build with MIRO - Even though highly customizable, MIRO is a general framework for all GAMS models which can be limiting when highly specialized tasks are required
 - No RES Network visualization or user defined sets
- Planned future work:
 - Enable the MIRO Hypercube mode to allow convenient configuration of batch runs
 - Improve MIRO “compare scenario” facilities to support better cross scenario analysis
 - Improve MIRO Pivot table to allow editing/adding/removing records to/from input data cube
 - Improve MIRO “save view” feature to allow persistent storing of input/output views
 - Creation of new data sets from *.dd files currently tricky for unexperienced GAMS users but will be improved and integrated into the app

Thank You!

For more information on the TIMES/MIRO App visit:
https://github.com/GAMS-dev/TIMES_MIRO

All prerequisites available free of charge:

GAMS 31.2.0 or newer	https://www.gams.com/download/
MIRO 1.1 or newer	https://www.gams.com/miro/download.html
Source code of the app	https://github.com/GAMS-dev/TIMES_MIRO
or Self-contained *.miroapp file	https://github.com/GAMS-dev/TIMES_MIRO/releases

For more information on the GAMS MIRO visit:
www.gams.com/miro