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# **Cloud Strategies for Optimization Modeling Software**

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**OR 2017: International Conference on Operations Research**

*Berlin, September 6-8, 2017*

**WB-02, Modeling Systems I — Wednesday, 11:00-12:30**

# *Computing in the Cloud*

## *Client side*

- Local computing device owned by the user
  - \* Company, organization, university, individual
- Client application run by the user on the local device

## *Server side*

- Remote computing facility owned by a provider
  - \* Company, organization, university
- Service running automatically at the remote facility

## *Client does not own the server*

**AMPL**

## **^ Optimization in the Cloud**

### *Multiple solvers as a service*

- **NEOS Server**
- Satalia SolveEngine

### *Modeling system + solvers as a service*

- AMPL Online (*forthcoming*)

### *Dedicated solver as a service*

- IBM Decision Optimization on Cloud
- **Gurobi Instant Cloud**

### *Distributed application development*

- FICO Analytic Cloud
- IBM Data Science Experience
- **QuanDec for AMPL**

# **NEOS Server** [www.neos-server.org](http://www.neos-server.org)

## *Network Enabled Optimization System*

- Originated 1995 at Argonne National Laboratory and Northwestern University
  - \* U.S. Department of Energy
  - \* National Science Foundation
- Since 2011 at University of Wisconsin, Madison
  - \* Wisconsin Institutes for Discovery

## *Free “optimization on demand”*

- Over 40 solvers
- Several optimization modeling languages

# Architecture

## *Distributed workstations*

- Offer varied inputs & solvers
- Process submissions on demand
- Contributed by varied organizations

## *Central scheduler*

- Receives and queues submissions
- Sends submissions to appropriate workstations
- Returns results

## *Minimal hands-on management*

- *Distributed*: Install NEOS software on workstations
- *Central*: Update server database of workstation locations and abilities

*NEOS Server*

## **Original Facilities**

### *Local submission clients*

- Email
- Website
- NEOS submission tool

### *Problem description formats*

- Linear: MPS and other solver files
- Nonlinear: Fortran or C programs
  - \* automatic differentiation of programs

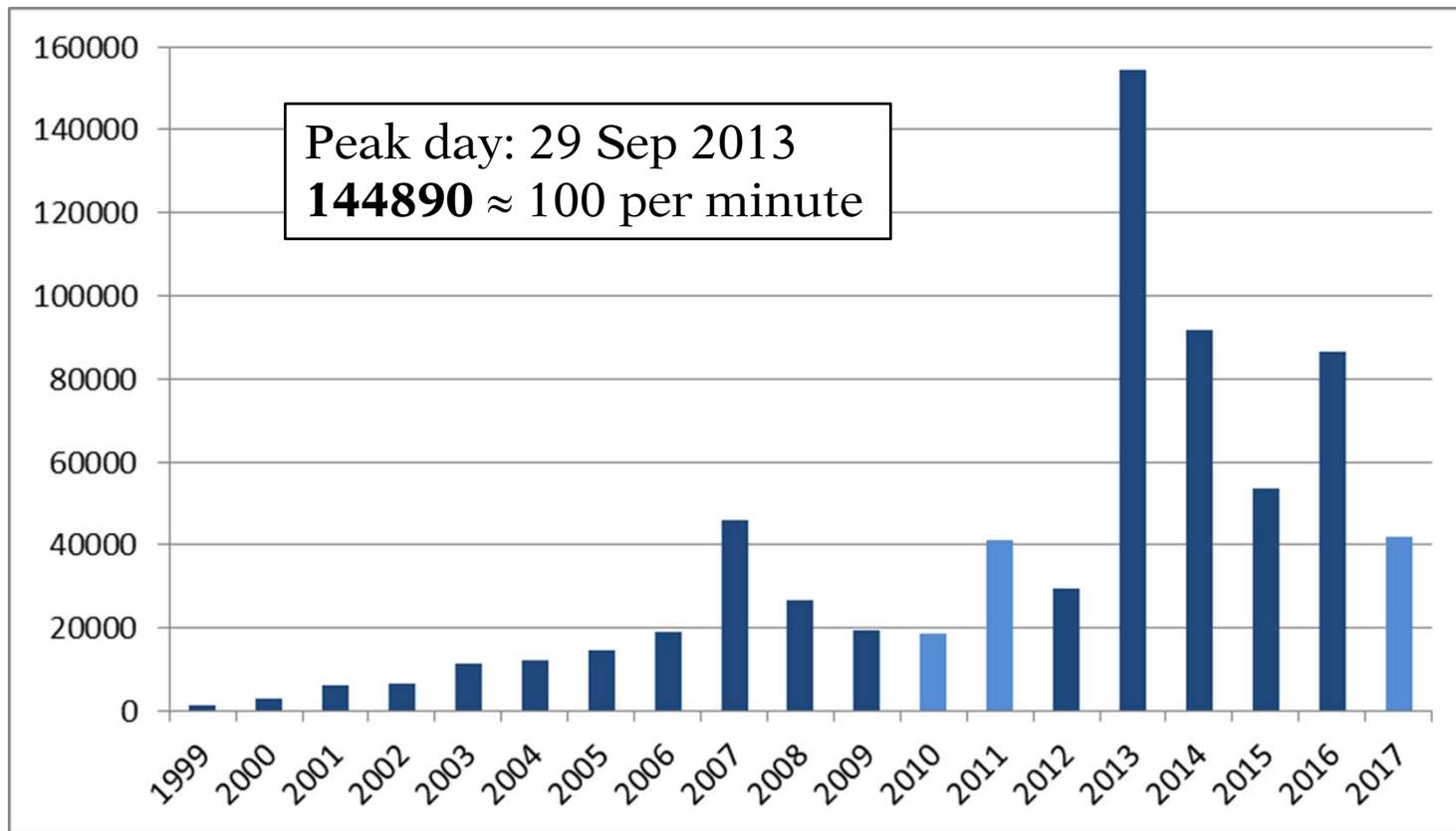
W. Gropp and J.J. Moré, 1997. **Optimization Environments and the NEOS Server**. *Approximation Theory and Optimization*, M. D. Buhmann and A. Iserles, eds., Cambridge University Press, 167-182.

J. Czyzyk, M.P. Mesnier and J.J. Moré, 1998. **The NEOS Server**. *IEEE Journal on Computational Science and Engineering* **5**(3), 68-75.

NEOS Server

# Impact: Total Submissions

*Monthly rates since 1999*

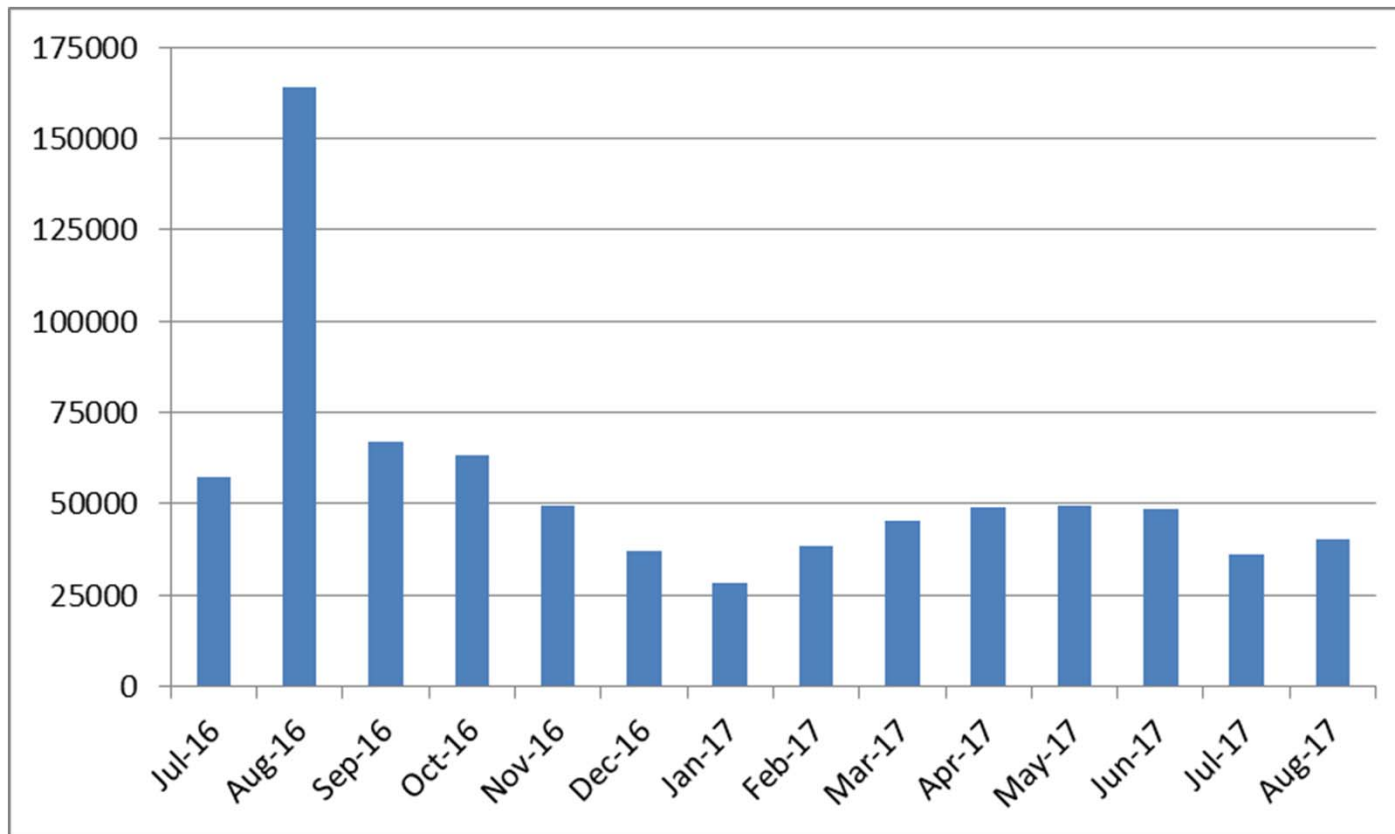


*45000/month  $\approx$  one per minute*

*NEOS Server*

# Impact: Recent Submissions

*Monthly rates for past year*



*45000/month  $\approx$  one per minute*



# **Assessment**

## *Strengths*

- Free
- Choice of solvers
  - \* Every popular solver available
- Easy to use
  - \* No account setup
  - \* No advance scheduling

## *Weaknesses*

- Stand-alone focus: submission of “solve jobs”
- Non-profit management
  - \* Limited support & development
  - \* No guarantee of confidentiality
  - \* No guarantee of performance

# Modeling Languages in NEOS

## *Modeling language inputs*

- AMPL model, data, commands files
- GAMS model, options,.gdx files

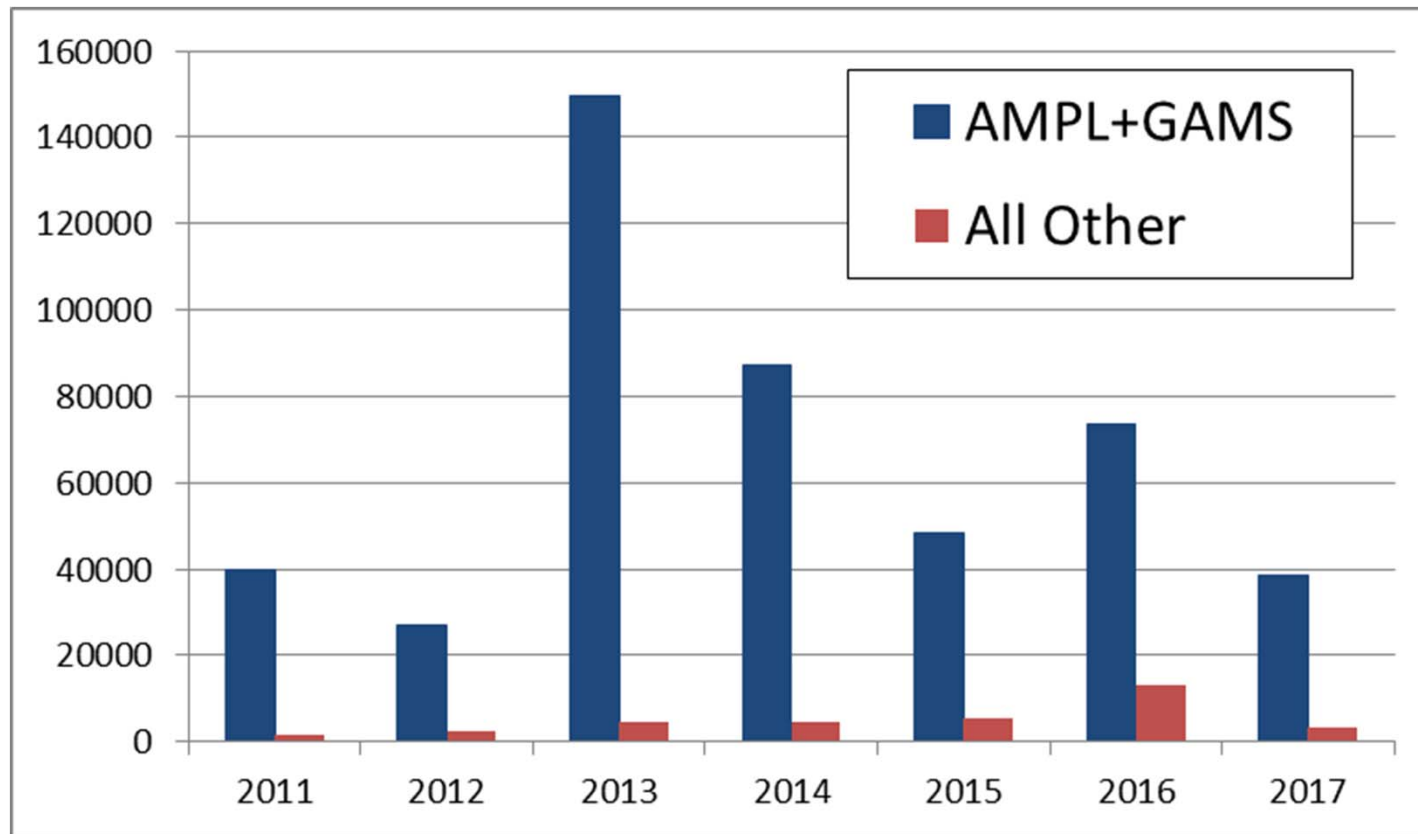
## *Modeling language operation*

- User chooses a solver and a language
- NEOS scheduler finds a compatible workstation
- NEOS workstation invokes modeling language system with given inputs
- Modeling language system invokes solver

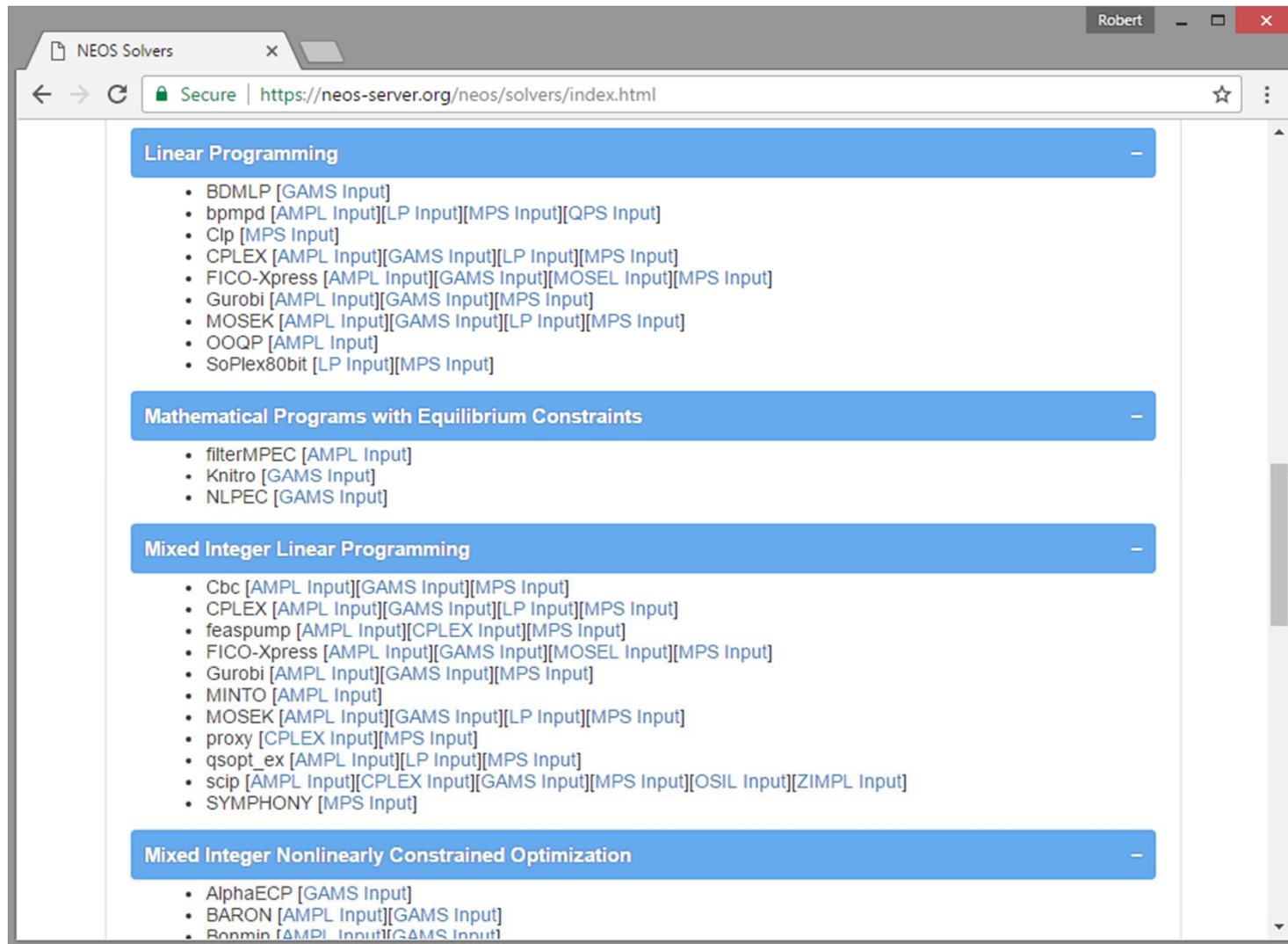
E.D. Dolan, R. Fourer, J.J. Moré and T.S. Munson,  
**Optimization on the NEOS Server.** *SIAM News* **35:6**  
(July/August 2002) 4, 8–9. [www.siam.org/pdf/news/457.pdf](http://www.siam.org/pdf/news/457.pdf)

# Impact: Modeling Languages

*Monthly rates since 2011*



# Solver & Language Listing



The screenshot shows a web browser window with the URL <https://neos-server.org/neos/solvers/index.html>. The page is titled "NEOS Solvers" and lists various optimization solvers categorized into four main groups:

- Linear Programming**
  - BDMLP [GAMS Input]
  - bmpnd [AMPL Input][LP Input][MPS Input][QPS Input]
  - Clp [MPS Input]
  - CPLEX [AMPL Input][GAMS Input][LP Input][MPS Input]
  - FICO-Xpress [AMPL Input][GAMS Input][MOSEL Input][MPS Input]
  - Gurobi [AMPL Input][GAMS Input][MPS Input]
  - MOSEK [AMPL Input][GAMS Input][LP Input][MPS Input]
  - OQOP [AMPL Input]
  - SoPlex80bit [LP Input][MPS Input]
- Mathematical Programs with Equilibrium Constraints**
  - filterMPEC [AMPL Input]
  - Knitro [GAMS Input]
  - NLPEC [GAMS Input]
- Mixed Integer Linear Programming**
  - Cbc [AMPL Input][GAMS Input][MPS Input]
  - CPLEX [AMPL Input][GAMS Input][LP Input][MPS Input]
  - feaspump [AMPL Input][CPLEX Input][MPS Input]
  - FICO-Xpress [AMPL Input][GAMS Input][MOSEL Input][MPS Input]
  - Gurobi [AMPL Input][GAMS Input][MPS Input]
  - MINTO [AMPL Input]
  - MOSEK [AMPL Input][GAMS Input][LP Input][MPS Input]
  - proxy [CPLEX Input][MPS Input]
  - qsopt\_ex [AMPL Input][LP Input][MPS Input]
  - scip [AMPL Input][CPLEX Input][GAMS Input][MPS Input][OSIL Input][ZIMPL Input]
  - SYMPHONY [MPS Input]
- Mixed Integer Nonlinearly Constrained Optimization**
  - AlphaECP [GAMS Input]
  - BARON [AMPL Input][GAMS Input]
  - Bonmin [AMPL Input][GAMS Input]

NEOS Server

# AMPL Input Page



The screenshot shows a web browser window with the URL <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>. The page features a navigation bar with "NEOS", "Contact", and "Help" links, along with "Sign In" and "Sign Up" buttons. A large banner image displays the "neos SOLVERS" logo and the word "Optimization" in a stylized font, with mathematical expressions like  $0 = \nabla_x \mathcal{L}(x, u) \perp x$  and  $0 < -\nabla_u \mathcal{L}(x, u) \perp u > 0$  overlaid. A sidebar on the right lists "NEOS Interfaces to CPLEX" and provides links for "WWW Form & Sample Submissions", "Email", and "XML-RPC". The main content area has a section titled "CPLEX" with text describing the NEOS Server's use of the IBM ILOG CPLEX Optimizer for MILP problems. Below this is a section titled "Using the NEOS Server with AMPL/CPLEX" which provides instructions on submitting model files and solver options.

NEOS  
SOLVERS

Optimization

$0 = \nabla_x \mathcal{L}(x, u) \perp x$   
 $0 < -\nabla_u \mathcal{L}(x, u) \perp u > 0$

NEOS Interfaces to CPLEX  
WWW Form & Sample Submissions  
Email  
XML-RPC

## CPLEX

The NEOS Server offers the IBM ILOG CPLEX Optimizer for the solution of mixed-integer linear programming (MILP) problems that can be modeled in AMPL format.

For information on IBM Decision Optimization products, including the CPLEX Optimizer, visit [IBM Decision Optimization](#).

For information on all IBM software available to academics, visit the [IBM Academic Initiative](#).

## Using the NEOS Server with AMPL/CPLEX

The user must submit a model in AMPL format to solve a mixed-integer linear program. The [examples section](#) of the AMPL website provides examples of models in AMPL format.

The MILP problem must be specified by a model file with the options of a data file and a commands file. If the commands file is specified, it must contain the AMPL solve command. However, the command file must *not* contain the model or data commands. The model and data files are renamed internally by NEOS.

The commands file may include option settings for CPLEX. To specify solver options, add

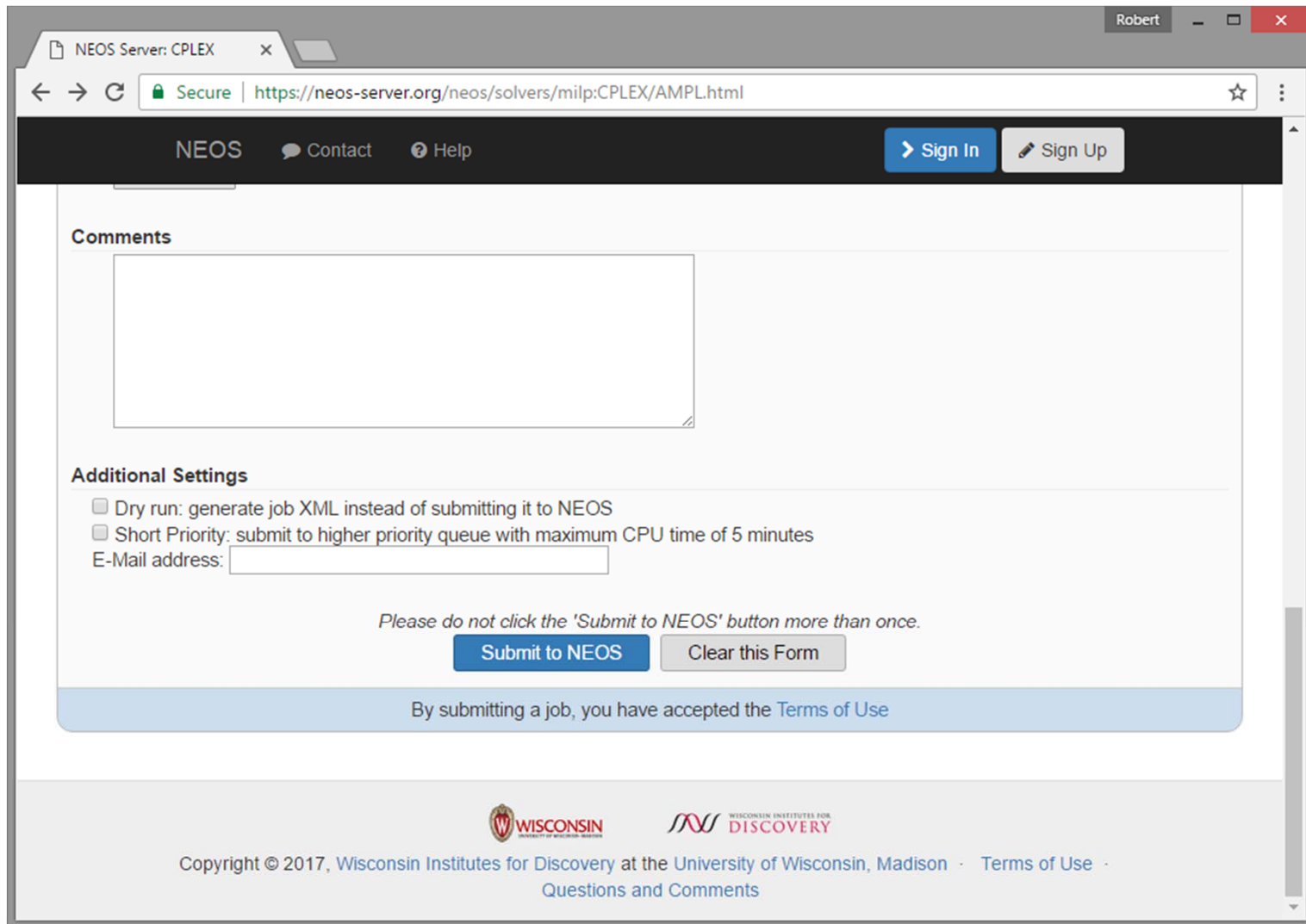
# AMPL Input Page

The screenshot shows a web browser window with the URL <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>. The page title is "Web Submission Form". The form contains the following sections:

- Model File**: Enter the location of the AMPL model (local file). A "Choose File" button is present, and the text "cut.mod" is displayed below it.
- Data File**: Enter the location of the AMPL data file (local file). A "Choose File" button is present, and the text "cut.dat" is displayed below it.
- Commands File**: Enter the location of the AMPL commands file (local file). A "Choose File" button is present, and the text "No file chosen" is displayed below it.
- Comments**: A large text area for entering comments.
- Additional Settings**: Two checkboxes are visible:
  - Dry run: generate job XML instead of submitting it to NEOS
  - Short Priority: submit to higher priority queue with maximum CPU time of 5 minutes

NEOS Server

# AMPL Input Page



The screenshot shows a web browser window with the URL `https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html`. The page has a dark navigation bar with the NEOS logo, 'Contact', 'Help', 'Sign In', and 'Sign Up' buttons. The main content area includes a 'Comments' section with a text input field, an 'Additional Settings' section with two checkboxes for 'Dry run' and 'Short Priority', and an 'E-Mail address' input field. Below these are two buttons: 'Submit to NEOS' and 'Clear this Form'. A warning message states: 'Please do not click the "Submit to NEOS" button more than once.' At the bottom, a blue bar contains the text: 'By submitting a job, you have accepted the Terms of Use'. The footer features logos for 'WISCONSIN UNIVERSITY OF WISCONSIN MADISON' and 'WISCONSIN INSTITUTES FOR DISCOVERY', along with copyright information and links for 'Terms of Use' and 'Questions and Comments'.

NEOS Server: CPLEX

Secure | <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>

NEOS Contact Help Sign In Sign Up

Comments

Additional Settings

Dry run: generate job XML instead of submitting it to NEOS

Short Priority: submit to higher priority queue with maximum CPU time of 5 minutes

E-Mail address:

Please do not click the 'Submit to NEOS' button more than once.

Submit to NEOS Clear this Form

By submitting a job, you have accepted the [Terms of Use](#)

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*NEOS Server*

## **APIs**

### *Application programming interfaces*

- Access NEOS from a local program

### *Implementations*

- Version 1: XML-RPC remote procedure call
- Version 5: full Python API

### *Uses*

- NEOS submission tool
- NEOS option in Solver Studio for Excel
- **NEOS as a “solver” for modeling systems**



*NEOS Server*

# Modeling Systems as NEOS Clients

## *New “solvers”*

- Kestrel for AMPL
- Kestrel for GAMS

## *Familiar operation*

- Choose Kestrel as the local “solver”
- Set an option to choose a real solver on NEOS
- Initiate a solve and wait for results

E.D. Dolan, R. Fourer, J.-P. Goux, T.S. Munson and J. Sarich,  
**Kestrel: An Interface from Optimization Modeling Systems  
to the NEOS Server.** *INFORMS Journal on Computing* **20**  
(2008) 525–538. [dx.doi.org/10.1287/ijoc.1080.0264](https://doi.org/10.1287/ijoc.1080.0264)

# AMPL Interactive Session

```
ampl: model sched1.mod;
ampl: data sched.dat;

ampl: let least_assign := 16;

ampl: option solver kestrel;
ampl: option kestrel_options 'solver=cplex';

ampl: solve;

Connecting to: neos-server.org:3332
Job 4679195 submitted to NEOS, password='JMNRQoTD'

Check the following URL for progress report :

http://neos-server.org/neos/cgi-bin/nph-neos-
solver.cgi?admin=results&jobnumber=4679195&pass=JMNRQoTD

Job 4679195 dispatched
password: JMNRQoTD

----- Begin Solver Output -----

Job submitted to NEOS HTCondor pool.
```

# AMPL Interactive Session

```
----- Begin Solver Output -----
```

```
Job submitted to NEOS HTCondor pool.
```

```
CPLEX 12.6.2.0: optimal integer solution; objective 265.9999999999943
```

```
135348 MIP simplex iterations
```

```
17430 branch-and-bound nodes
```

```
ampl: option omit_zero_rows 1, display_1col 0;
```

```
ampl: display Work;
```

```
Work [*] :=
```

```
  1 16   11 16   36 19   72 20   82 20   106 16   114 20   125 20
```

```
  3 16   29 16   66 17   79 19   104 19   112 16   121 16
```

```
;
```

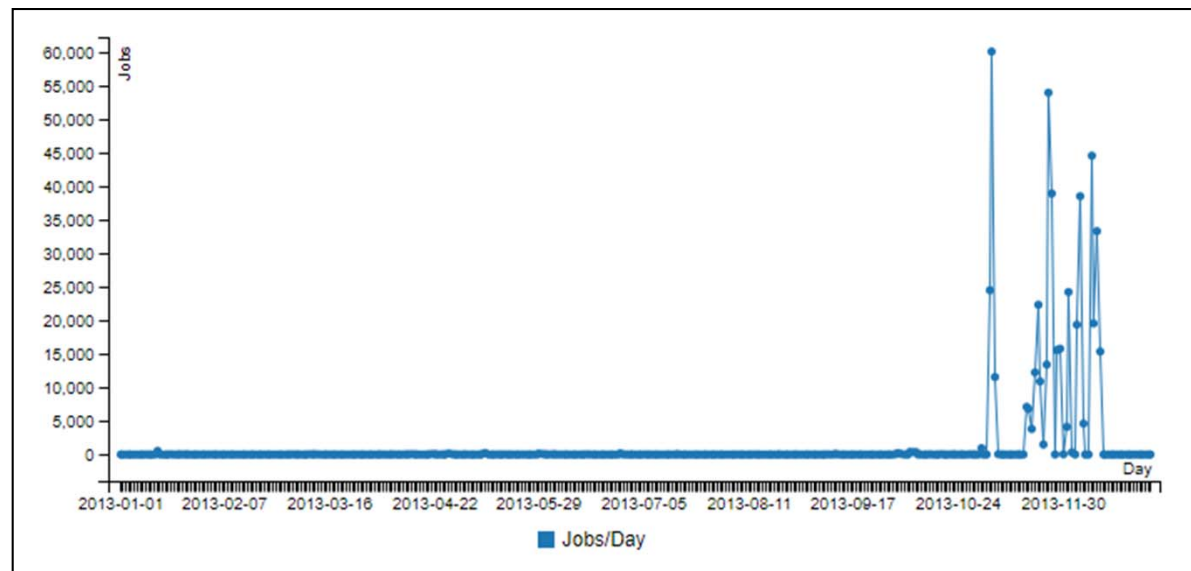
```
ampl:
```

*NEOS Server*

# Kestrel Impact

## *Some success*

- Intensive use in short bursts
  - \* Peaks of 10,000-60,000 per day
- Modest use on average
  - \* Average of 1,750 per month
  - \* Mostly AMPL/CPLEX



# **Kestrel Assessment**

## *Strengths*

- Powerful local client for modeling
- NEOS facilities for solving

## *Weaknesses*

- Not all NEOS solvers available
- Local solver software is strong competition . . .
  - \* Bundled with modeling languages
  - \* Free for trial use
  - \* Free for course and academic use
- Limited support & development

*. . . Kestrel for AMPL new release forthcoming*

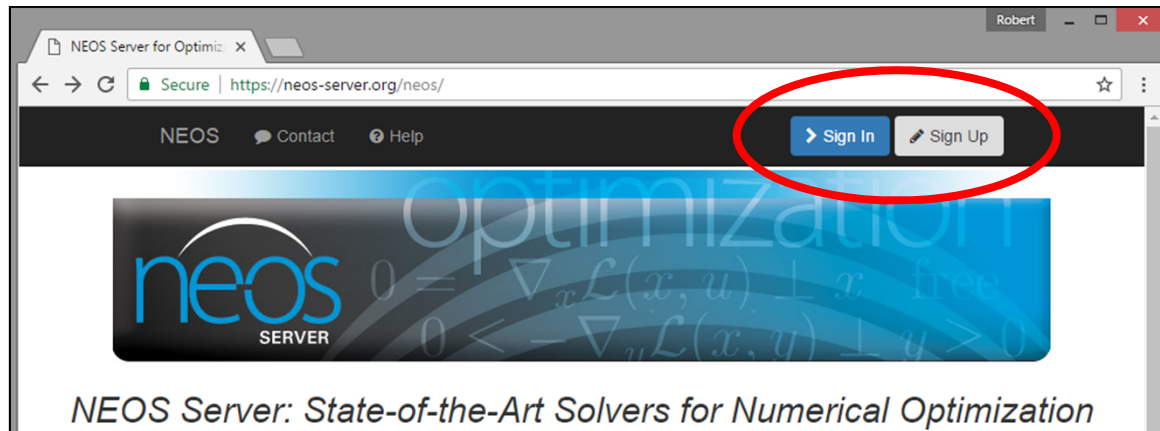
*NEOS Server*

## Recent Developments

### *Intensified support*

- Shift to HTCondor “high-throughput” platforms
- Updated Kestrel client
- Updated solver offerings

### *User accounts*



- Higher priority for job scheduling
- “My Jobs” tab listing recent jobs & links to results

# Satalia SolveEngine [www.satalia.com](http://www.satalia.com)

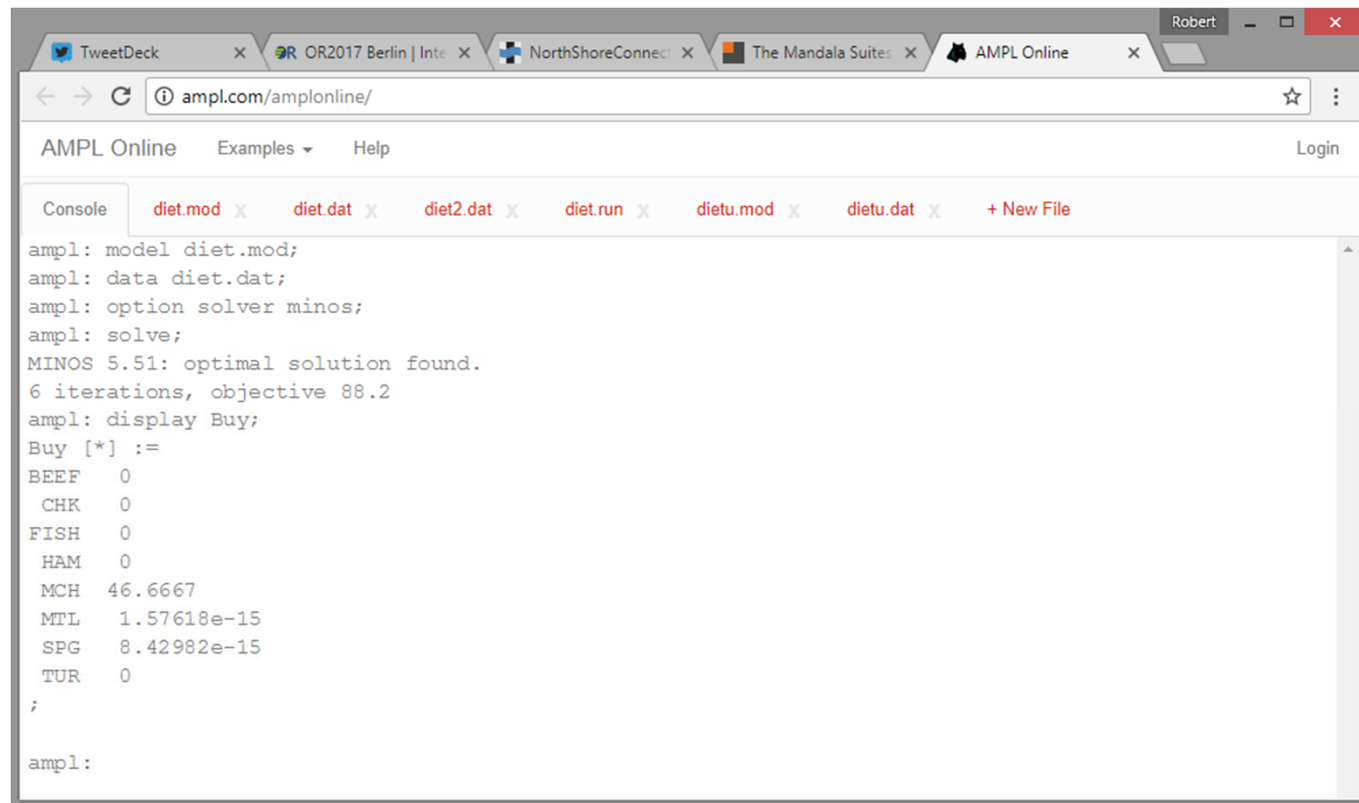
## *Like a commercial NEOS*

- Range of inputs and solvers
- Royalties to clients and to solvers
  - \* Planned Kestrel-like support of AMPL, GAMS
- Automated solver choice
- Free, pay-as-you-go, and subscription services

# AMPL Online *(forthcoming)*

## *AMPL command line in a browser*

- Interactive AMPL + solvers as a service
- User's files saved between sessions



The screenshot shows a web browser window with the URL `ampl.com/amplonline/`. The page title is "AMPL Online" and it includes navigation links for "Examples" and "Help", along with a "Login" button. Below the navigation bar, there is a "Console" tab and several file tabs: `diet.mod`, `diet.dat`, `diet2.dat`, `diet.run`, `dietu.mod`, and `dietu.dat`, along with a "+ New File" button. The console displays the following text:

```
ampl: model diet.mod;
ampl: data diet.dat;
ampl: option solver minos;
ampl: solve;
MINOS 5.51: optimal solution found.
6 iterations, objective 88.2
ampl: display Buy;
Buy [*] :=
BEEF  0
CHK   0
FISH  0
HAM   0
MCH  46.6667
MTL   1.57618e-15
SPG   8.42982e-15
TUR   0
;

ampl:
```



# IBM Decision Optimization on Cloud

[www.ibm.com/us-en/marketplace/decision-optimization-cloud](http://www.ibm.com/us-en/marketplace/decision-optimization-cloud)

## *Commercial NEOS-like functions for CPLEX*

- “DropSolve” service similar to NEOS
  - \* .lp files and OPL model/data files
- “DOcplexcloud API” like NEOS API
- Pay-as-you-go, committed hours, “flex tier” services

**NEW**

# **Gurobi 7.5 Instant Cloud** [cloud.gurobi.com](http://cloud.gurobi.com)

## *Client side*

- Standard Gurobi installation
- Cloud license

## *Server side*

- Compute server for Gurobi solver
  - \* Single-machine solves
  - \* Distributed MIP solves
  - \* Distributed tuning
- Server pools with load balancing

*... hosted on Amazon Web Services*

*“Cloud computing technology is changing quickly.  
Please check these documents periodically to ensure  
you have the latest instructions for the Gurobi Cloud.”*

# Gurobi Instant Cloud for AMPL

## *Client side*

- AMPL installation (command-line or IDE)
- Standard Gurobi-for-AMPL installation

## *Server side*

- Gurobi compute server
- Gurobi optimizer

*Gurobi Instant Cloud for AMPL*  
**ngcloud.gurobi.com**

The screenshot shows the homepage of the Gurobi Instant Cloud service. At the top, there is a navigation bar with the Gurobi logo (a red cube) and the text "GUROBI OPTIMIZATION". To the right of the logo are menu items: PRODUCTS, DOWNLOADS, RESOURCES, ACADEMIA, SUPPORT, and ABOUT. Further right is a search bar with the placeholder text "Search gurobi.com & the community", a user profile icon, and a "Get Gurobi" button. The main header area has a blue background with a world map made of small squares. The text "Gurobi Instant Cloud" is prominently displayed in white, with the subtitle "Instant access to powerful optimization software and fast machines" below it. Two red buttons are positioned to the right of the main text: "Open Cloud Manager" and "Discuss Your Needs". Below the header, there are three white boxes with red titles and bulleted lists of features. The first box is titled "Great for..." and lists five benefits. The second box is titled "Easy and Robust" and lists four benefits. The third box is titled "Cost Effective" and lists four benefits. At the bottom of the page, there are three blue buttons: "Learn more", "Cloud Guide", and "Pricing".

**GUROBI**  
OPTIMIZATION

PRODUCTS DOWNLOADS RESOURCES ACADEMIA SUPPORT ABOUT

Search gurobi.com & the community

Get Gurobi

# Gurobi Instant Cloud

Instant access to powerful optimization software and fast machines

Open Cloud Manager

Discuss Your Needs

### Great for...

- Handling spikes in demand
- Solving challenging models
- Meeting periodic optimization needs
- Delivering cloud-based solutions
- Providing cloud-based failover

### Easy and Robust

- Automatically start, manage and stop multiple machines
- Access from your existing applications
- Select dedicated machines from a data center near you
- Stay secure with built-in 256-bit AES encryption

### Cost Effective

- Use and pay for only what you need
- Reduce or eliminate local data center costs
- Support Windows, Linux and Mac clients
- Access includes Gurobi Support

Learn more Cloud Guide Pricing

# View Available Licenses

Menu icon Licenses ? Share icon

Show 10 licenses Search:

License	Active Machines	Rate Plan	Credit (US Dollar)	Expiration Time	
142032	0	No Charge	\$25	10/30/2016 7:00:00 PM	
121420	0	No Charge	\$24.12	4/28/2016 7:00:00 PM	

Showing 1 to 2 of 2 licenses First Previous 1 Next Last

[CONTACT SALES](#) [SUPPORT CENTER](#) [GETTING STARTED](#)

# Get Gurobi License File

```
# This is a license file created by the Gurobi Instant Cloud
# Created on Mon, 17 Oct 2016 20:46:26 GMT
# License Id: 142032
# Place this file in your home directory or one of the following
# locations where XXX is the Gurobi Optimizer version you are using:
#   * C:\gurobi\ or C:\gurobiXXX\ on Windows
#   * /opt/gurobi/ or /opt/gurobiXXX/ on Linux
#   * /Library/gurobi/ or /Library/gurobiXXX/ on Mac OS X
# Or set environment variable GRB_LICENSE_FILE to point to this file
# Do not share this license file because it contains your secret key

CLOUDACCESSID=fedf3901-04f1-44d7-9725-e36c1c3f70f6
CLOUDKEY=0v9XdWrDQLiE3EiAAEKtFw
CLOUDHOST=ngcloud.gurobi.com
```

*Gurobi Instant Cloud for AMPL*

## **Use with AMPL: Setup**

```
AMPL> model multmip3.mod;
AMPL> data multmip3.dat;

AMPL> option solver gurobi;

AMPL> option gurobi_options
AMPL?   'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
AMPL?   cloudkey=0v9XdWrDQLiE3EiAAEKtFw';

AMPL>
```

*Gurobi Instant Cloud for AMPL*

## **Use with AMPL: Startup**

```
AMPL> model multmip3.mod;
AMPL> data multmip3.dat;

AMPL> option solver gurobi;

AMPL> option gurobi_options
AMPL?   'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
AMPL?   cloudkey=0v9XdWrDQLiE3EiAAEKtFw';

AMPL> solve;

Gurobi 7.0.0: cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6
cloudkey=0v9XdWrDQLiE3EiAAEKtFw

Waiting for cloud server to start.....
```



*Gurobi Instant Cloud for AMPL*

## Use with AMPL: *Solve*

```
ampl: model multmip3.mod;
ampl: data multmip3.dat;

ampl: option solver gurobi;

ampl: option gurobi_options
ampl?   'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
ampl?   cloudkey=0v9XdWrDQLiE3EiAAEKtFw';

ampl: solve;

Gurobi 7.0.0: cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6
cloudkey=0v9XdWrDQLiE3EiAAEKtFw

Waiting for cloud server to start.....
Capacity available on 'default' cloud pool - connecting...
Established 256-bit AES encrypted connection

Gurobi 7.0.0: optimal solution; objective 235625
289 simplex iterations
25 branch-and-cut nodes
plus 35 simplex iterations for intbasis

ampl:
```

## Use with AMPL: *Continue*

```
ampl: display {i in ORIG, j in DEST} sum {p in PROD} Trans[i,j,p];  
  
:      DET   FRA   FRE   LAF   LAN   STL   WIN   :=  
CLEV   625   375   550    0   500   550    0  
GARY    0     0     0   400    0   625   375  
PITT   525   525   625   600    0   625    0  
;  
  
ampl: reset data;  
ampl: data multmip3a.dat;  
  
ampl: solve;  
  
Gurobi 7.0.0: cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6  
cloudkey=0v9XdWrDQLiE3EiAAEKtFw  
  
Capacity available on 'default' cloud pool - connecting...  
Established 256-bit AES encrypted connection  
  
Gurobi 7.0.0: optimal solution; objective 238450  
163 simplex iterations  
plus 33 simplex iterations for intbasis  
  
ampl:
```

# Manage Server Configuration

The screenshot displays the Gurobi Instant Cloud management interface. On the left is a blue sidebar with the Gurobi logo and navigation options: Instant Cloud, Robert Fourer (4er@ampl.com), LICENSES, POOLS, MACHINES, MANUAL LAUNCH, HISTORY, and SETTINGS. The main content area features a search bar and a table of server configurations. The table has columns for Name, Rate Plan, Credit (US Dollar), and Expiration Time. Two rows are visible, both with a 'No Charge' rate plan. The first row has a credit of \$19.75 and an expiration time of 10/30/2016 7:00:00 PM. The second row has a credit of \$24.12 and an expiration time of 4/28/2016 7:00:00 PM. Below the table is a pagination control showing '1' of 1 items. A 'GETTING STARTED' button is also visible.

Name	Rate Plan	Credit (US Dollar)	Expiration Time
ve achines	No Charge	\$19.75	10/30/2016 7:00:00 PM
	No Charge	\$24.12	4/28/2016 7:00:00 PM

# Check Costs

The screenshot shows the Gurobi Instant Cloud interface. A modal dialog box titled "Cost Estimate" is open, displaying the following information:

- 1 compute server will be launched.
- You will be charged \$0.838 per hour for the machine costs.
- You will be charged \$0 per hour for the Gurobi license.

The background interface shows a "Pools" table with the following columns: ID, Compute Servers, Machine, Region, License, Rate Plan, and Distributed Workers. A search bar and a "Current Licenses Only" checkbox are also visible.

# Gurobi Cloud Costs

## *Commercial plans*

- Annual subscription fee, *plus*
- Hourly rates for use:
  - \* Gurobi rate for compute servers
  - \* Amazon rate for distributed workers

## *Trials, academic use, special grants*

- Amazon rate only

*. . . set up through sales rep*

# Gurobi Cloud for AMPL: Assessment

## *Strengths*

- Security
- Reliability (via Amazon)
- Support for multi-server and/or multi-worker pools
- Support for local modeling clients

## *Drawbacks (compared to NEOS)*

- Not free
  - \* Budgeting can be complicated
- Solver-specific
- Not quite “optimization on demand”

# QuanDec [ampl.com/products/quandec](http://ampl.com/products/quandec)

## *Server side*

- AMPL model and data
- Standard AMPL-solver installations

## *Client side*

- Interactive tool for collaboration & decision-making
- Runs on any recent web browser
- Java-based implementation
  - \* AMPL API for Java
  - \* Eclipse Remote Application Platform

*. . . developed / supported by Cassotis Consulting*

# Quan $\Delta$ ec

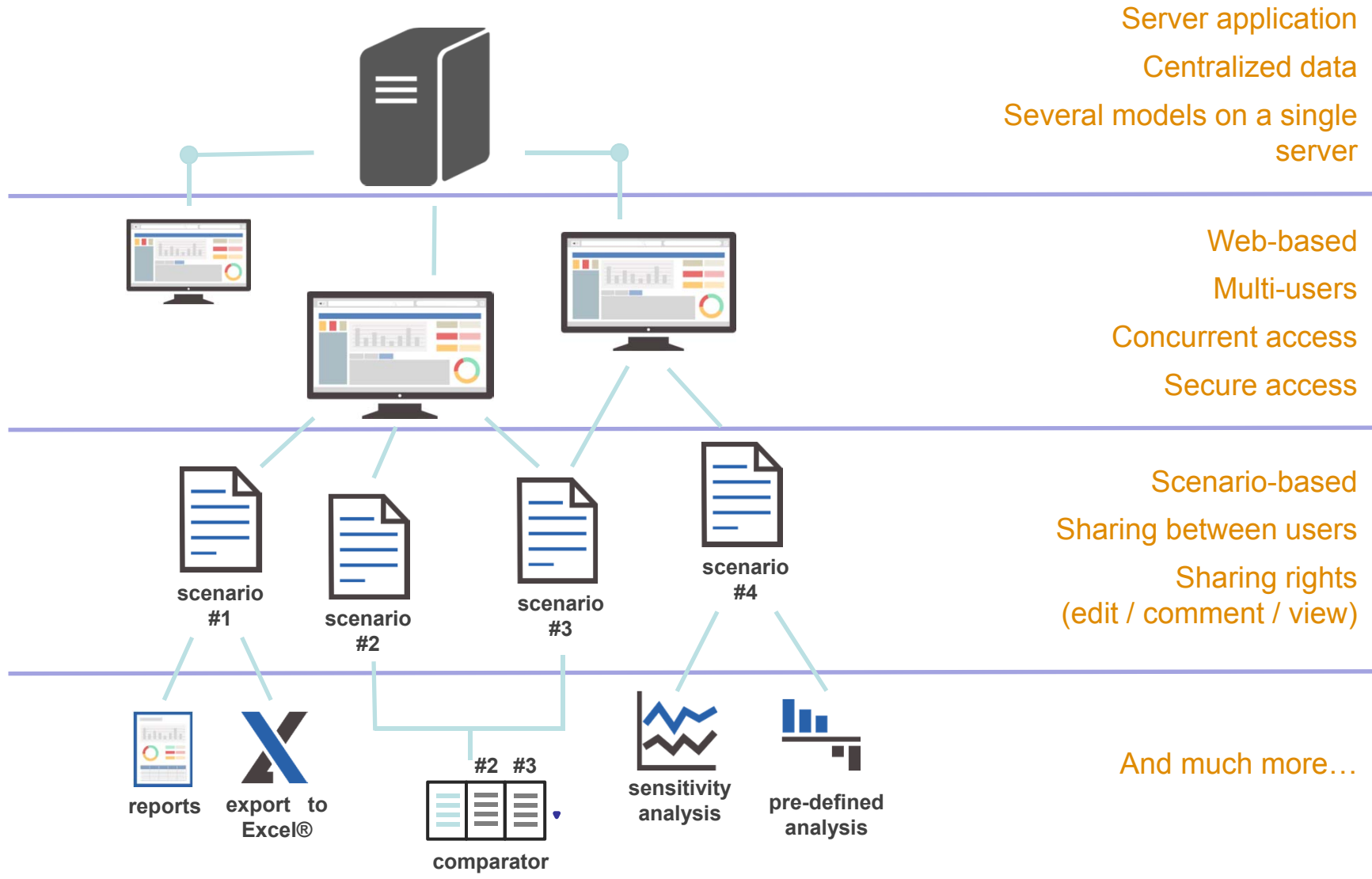


The web-based graphical interface that turns optimization models written in AMPL into decision-making tools.





# Features



Server application  
 Centralized data  
 Several models on a single server

Web-based  
 Multi-users  
 Concurrent access  
 Secure access

Scenario-based  
 Sharing between users  
 Sharing rights  
 (edit / comment / view)

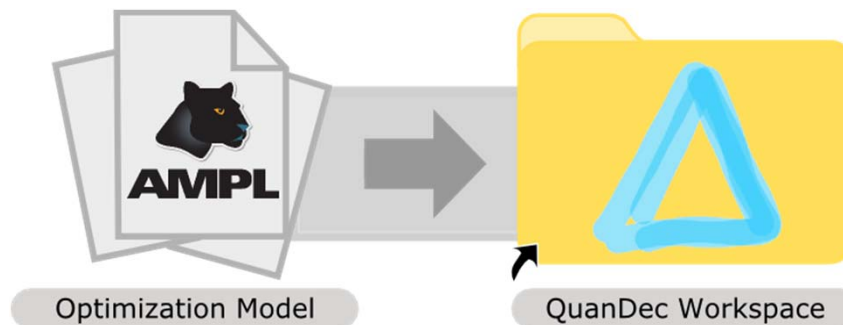
And much more...

# Getting started

**step 1:** install QuanDec on a server

**step 2:** copy & paste your model files (.mod and .dat) into  
QuanDec's workspace

**step 3:** create AMPL tables and link them to QuanDec explorer



# Quan ec

E-mail :

Password :

[Forgot?](#)

Enter your email to login

Version 2.3.1

**CASSOTIS** consulting

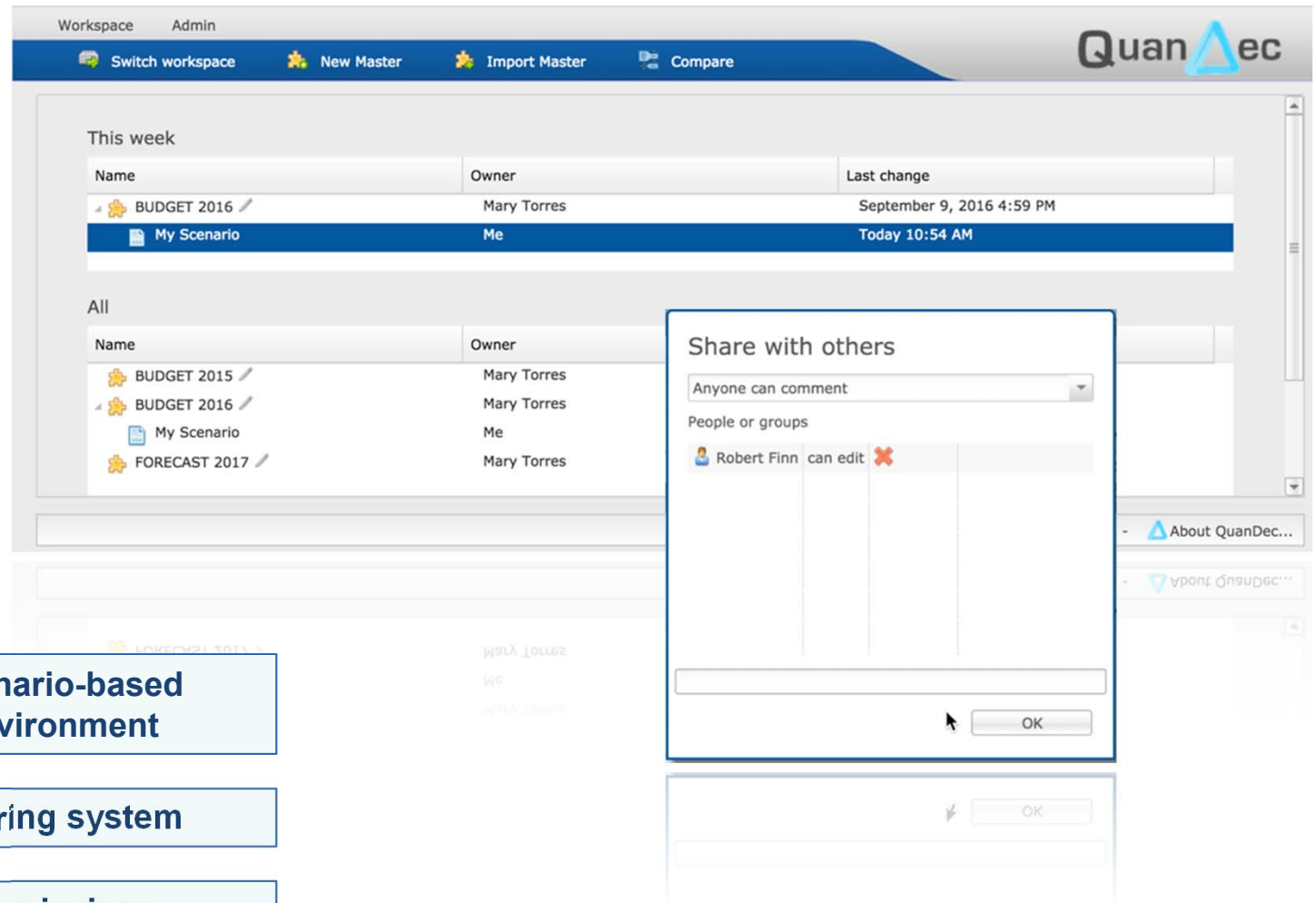
Login

**Web-application**

**Multi-user**

**Secure access**

**Concurrent access**



**Scenario-based environment**

**Sharing system**

**Permission:  
Edit – Comment - View**

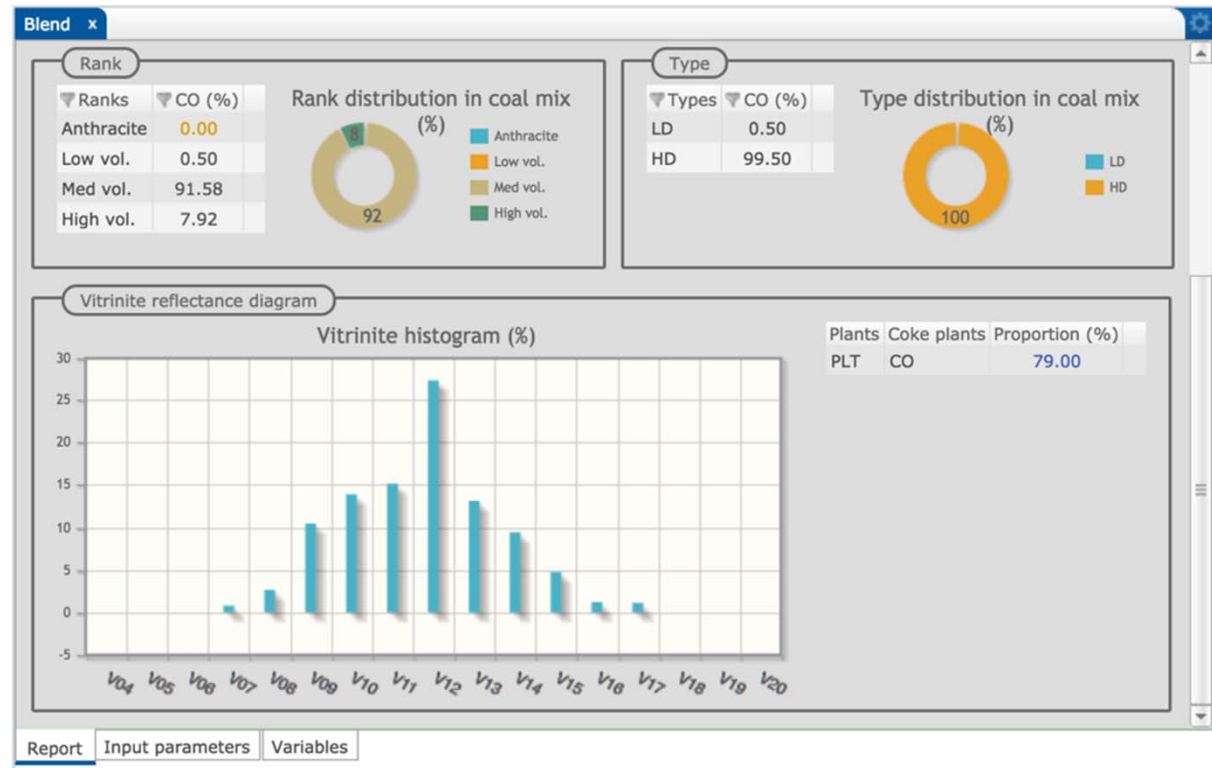
### 3 levels:

- Report
- Input parameters
- Variables

Chart and tables

Colored values  
for easier analysis

Constraint (min/max)  
on any variable



Collaborative work

Notification system

Comments between users

The screenshot displays a software interface with a data table, a chart, and three modal windows. The data table is as follows:

blend	SM1 (kg/t)	WAVG (kg/t)
Hot metal	889.89	889.89
Lump ores	0.00	0.00
Pellets	0.00	0.00

The chart, titled "Blend at conver", shows a horizontal bar with segments for Hot metal (blue), Lump ores (orange), Pellets (yellow), Recyclings (green), Fluxes (dark green), and Ferroalloys (light green). The x-axis ranges from 0 to 1200.

The "Comment this value" modal window contains the following text:

QUESTION

Mary Torres (written on March 25, 2016 12:57 PM)  
Do we use pellets at the converter?

Benjamin Steward (written on March 25, 2016 1:06 PM)  
No, we exclusively use lump ores.

Enter a message:

Buttons: Cancel, OK

The "Share with others" modal window contains the following text:

Anyone can comment

People or groups

Robert Finn can edit

Buttons: OK

The "New comment" notification window contains the following text:

Robert Finn has commented this dataset.

Coke plants x

Operating costs

Plants	Coke plants	Costs	Fixed (MUS\$/year)	Variable (US\$/t)
PLT	CO	Maintenance	7.75	0.90
PLT	CO	Labour costs	3.95	0.00
PLT	CO	Utilities	0.05	0.11
PLT	CO	Water treatment	7.78	0.00
PLT	CO	Court yard	5.36	0.00
PLT	CO	Services	0.02	0.94
PLT	CO	Indirect costs	2.57	0.00
PLT	CO	Depreciation	4.92	0.00
PLT	CO	Electricity	0.00	0.03

Report Input parameters Variables

Journal Bounds Regressions Comments Error Log

Operating cost at coke plant	PLT, CO1, co_elec, Variable	0.03	Today 11:26 AM	by Arthur Turner	✖
CO operational costs	PLT, co_elec	Electricity	Today 11:26 AM	by Arthur Turner	✖
CO operational costs	PLT	co_elec	Today 11:26 AM	by Arthur Turner	✖
Vitrinite reflectance inside of range at coke plant	PLT, CO1	MAX 79.00	Today 10:49 AM	by Arthur Turner	✖

Arthur Turner QuanDec STEEL BUDGET 2016 My Scenario

Arthur Turner QuanDec STEEL BUDGET 2016 My Scenario

Scenarios with changes history

Traceability and undo system

Workspace Admin

New Report Show/Hide differences Export to Excel

Quan<sup>△</sup>ec

Comparator

Variable	Unit	BUDGET 2016	My Scenario	Diff
Executive summaries				
Costs and Revenues				
Profit and Sales				
Production costs				
Absolute costs	MUS\$			
Detailed costs	US\$/t			
Internal price of intermedi	US\$/t			
Net production level	kt			
'PLT' 'CO'	kt	1763.98	1764.25	0.02%
'PLT' 'SI'	kt	4085.77	4084.46	-0.03%
'PLT' 'BF'	kt	5062.62	5060.91	-0.03%
'PLT' 'ST'	kt	5258.29	5256.75	-0.03%
'PLT' 'PO'				
Production cost of prod				
Production level				
Material blends				
Coke plants				
Sinter plants				
Blast furnaces				
Steel shops				
Power plant				
Raw materials				

Select the scenarios to compare:

- BUDGET 2015
- BUDGET 2016
- My Scenario
- FORECAST 2017

Cancel OK

Economics and Production

Variable	Index	Unit	BUDGET 2016	My Scenario	Diff
Economics per int. plant	'PLT' 'costs'	MUS\$	1515.59	1515.20	-0.03%
Economics per int. plant	'PLT' 'revenues'	MUS\$	1762.23	1761.77	-0.03%
Economics per int. plant	'PLT' 'profit'	MUS\$	246.64	246.56	-0.03%
Economics per int. plant	'PLT' 'margin'	%	14.00	14.00	-0.00%
Production cost of product	'PLT' 'coke'	US\$/t	164.48	164.54	0.04%
Production cost of product	'PLT' 'sinter'	US\$/t	77.55	77.50	-0.06%
Production cost of product	'PLT' 'hotmetal'	US\$/t	193.95	193.99	0.02%
Production cost of product	'PLT' 'slab'	US\$/t	286.27	286.28	0.00%
Production cost of product	'PLT' 'electricity'	US\$/MWh	125.75	125.75	0.00%
Production level of product	'PLT' 'coke'	kt	1818.54	1818.81	0.02%
Production level of product	'PLT' 'sinter'	kt	4085.77	4084.46	-0.03%

Report Structure

Reports

Name	User	Date	Action
Sulfur cycle	Benjamin Steward	March 18, 2016 3:45 PM	✖
Metallic blend at CV	Me	February 21, 2016 4:51 PM	✖
Raw material use at Reduction	Me	January 15, 2016 4:36 PM	✖
Economics and Production	Mary Torres	September 13, 2016 4:53 PM	✖
Flux consumption at Torpedo	Mary Torres	April 3, 2016 4:44 PM	✖
Slab sales	Robert Finn	January 30, 2016 5:30 PM	✖
Silicon cycle	Benjamin Steward	July 5, 2016 4:17 PM	✖

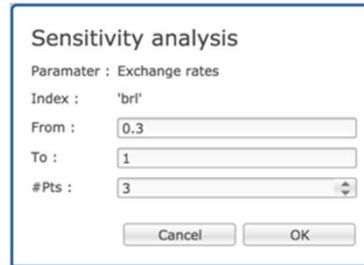
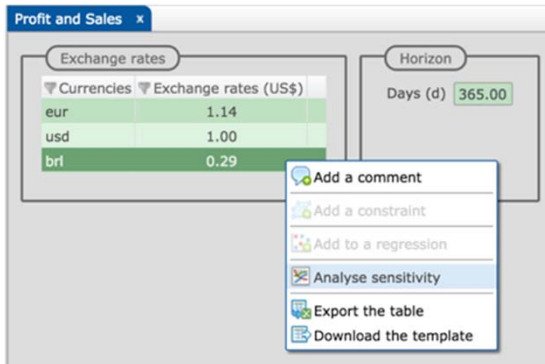
Scenario comparison

All variables can be compared

Display of relative difference

Custom reports





Sensitivity analysis

For both parameters AND variables

All variables can be compared

Display of relative difference

Workspace Admin

← Back to edition | 📄 New Report | 🔄 Show/Hide differences | 📄 Export to Excel

Quantec

Variable	Unit	0.30	0.65	Diff	1.00	Diff
Executive summaries						
Costs and Revenues						
Profit and Sales						
Economics per int. plant	MUS\$					
'PLT' 'costs'	MUS\$	1515.39	1544.99	1.95%	1633.34	7.78%
'PLT' 'revenues'	MUS\$	1754.70	1679.96	-4.26%	1670.71	-4.79%
'PLT' 'profit'	MUS\$	239.31	134.97	-43.60%	37.37	-84.38%
'PLT' 'margin'	%	13.64	8.03	-41.09%	2.24	-83.60%
Global economics	MUS\$					
External costs per process	MUS\$					
External costs per type	MUS\$					
Detailed external costs	MUS\$					
External revenues per process	MUS\$					
External revenues per type	MUS\$					
Detailed external revenues	MUS\$					
Detailed revenues	MUS\$/t					
Production costs						
Material blends						
Coke plants						
Sinter plants						
Blast furnaces						
Steel shops						
Power plant						
Raw materials						
Gases						

Variable	Index	Unit	0.30	0.65	Diff	1.00	Diff
Economics per int. plant	'PLT' 'costs'	MUS\$	1515.39	1544.99	1.95%	1633.34	7.78%
Economics per int. plant	'PLT' 'revenues'	MUS\$	1754.70	1679.96	-4.26%	1670.71	-4.79%
Economics per int. plant	'PLT' 'profit'	MUS\$	239.31	134.97	-43.60%	37.37	-84.38%
Economics per int. plant	'PLT' 'margin'	%	13.64	8.03	-41.09%	2.24	-83.60%
Production cost of product	'PLT' 'coke'	US\$/t	164.51	161.52	-1.82%	162.71	-1.10%
Production cost of product	'PLT' 'sinter'	US\$/t	77.68	83.23	7.15%	88.16	13.50%
Production cost of product	'PLT' 'hotmetal'	US\$/t	194.23	198.43	2.16%	202.93	4.48%
Production cost of product	'PLT' 'slab'	US\$/t	287.62	307.33	6.85%	326.85	13.64%
Production cost of product	'PLT' 'electricity'	US\$/MWh	125.62	125.73	0.08%	125.74	0.09%
Production level of product	'PLT' 'coke'	kt	1818.81	1815.95	-0.16%	1815.95	-0.16%
Production level of product	'PLT' 'sinter'	kt	4115.36	4007.25	-2.63%	4006.24	-2.65%
Production level of product	'PLT' 'hotmetal'	kt	5105.94	5051.71	-1.06%	5052.00	-1.06%
Production level of product	'PLT' 'trhotmetal'	kt	5025.36	4972.09	-1.06%	4972.37	-1.05%
Production level of product	'PLT' 'crudesteel'	kt	5657.39	5402.17	-4.51%	5372.49	-5.04%

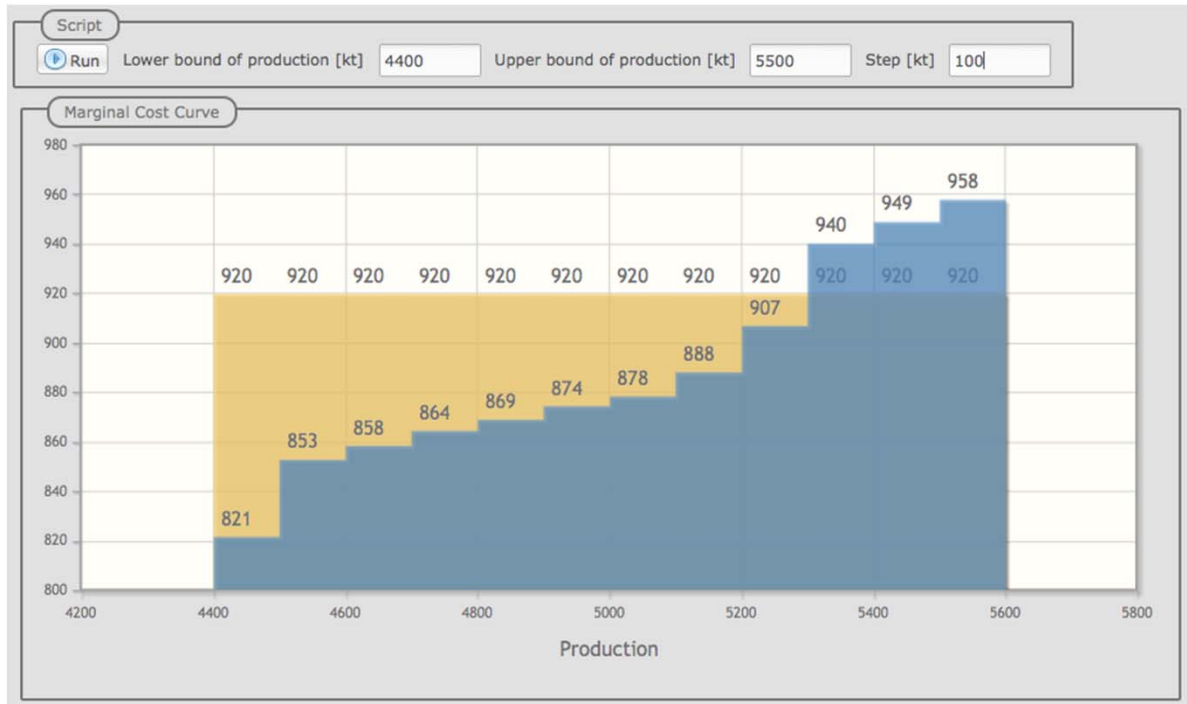
  

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	Silicon cycle	Benjamin Steward	July 5, 2016 4:17 PM	✖

Arthur Turner | QuanDec STEEL | BUDGET 2016 | My Scenario | About QuanDec...

Predefined analyses

Script parameters



# QuanDec Availability

*Ready now for commercial applications*

- Free trials available
- Pricing keyed to number of models & users

*First year's support included*

- Tailored setup support from Cassotis Consulting
- Customizations possible

*. . . contact [sales@ampl.com](mailto:sales@ampl.com) for details*