

DAYZER is a user-friendly detailed market analysis tool which facilitates the understanding of the complex operation of electricity markets with little training and effort.

Key Features Open Architecture Powerful Algorithms Intuitive Data Visualization

Who should use DAYZER?

Analysts: DAYZER is a powerful tool that can forecast Day-Ahead hourly LMPs (Zonal or Nodal), Shadow Prices and Congestion Costs under "what if" scenarios.

Market Monitors: DAYZER is useful tool that can be used to analyze bidding behavior and different market equilibria (marginal costs, Nash, etc...)



Cambridge Energy Solutions

www.CES-US.com

Day-Ahead Market Analyzer

34.70 320.00

181.00

48.00

141.00

17.50

Dayzer Prerelease version: NEPOOL 7-1-2002 (Fall)

Chart 325 Units

Generation Units | Load Zones | Transmission Lines |

NCC

STc200

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Pondage

Generation Unit | Type | Summer Capacity |

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DAYZER Sample Screen shots

Supply Curve

System Load

1. System Supply/Demand Curve 3. Line Flows and Congestion Costs

2. System Load and Unit Commitment 4. Transmission Rights Evaluation Tool - 🗆 × Dayzer Prerelease version: NEPOOL 7-<u>1-2002 (Fall)</u> _ 🗆 🗵 File Edit View Tools Held 🗅 🚅 📮 X 🖻 🖻 🎒 🤶 🕅 Run Sim 26 Lines Hour 1 + Summaru ۲ Hourly Flows: New England East-West Low Ð Generation Units Load Zones Transmission Lines a22 MW Q Line Min Limit Max Limit Avg Daily Pri 🔺 ≥ ∠ € Cornerford Moor .99999 920 0.00 Connecticut Im -2600 2300 0.00 -1200 1500 0.00 Connecticut Im Maine-New Ha. -1700 1700 0.00 Maine-New Ha. -1200 1200 0.00 0.00 NEMA Boston I. .99990 4000 New England E. -3300 2400 0.00 L.182 New England E 0.00 New England N -99999 4000 0.00 -303 liht New England N. -9999 1700 178.58 New York-NEP. -1700 2200 0.00 New York-NEP. .700 1300 0.00 North New Engl.. .2550 2550 0.00 North New Engl. .1150 3150 0.00 1400 0.00 Norwalk-Stamfo. .99990 -92 1000 Norwalk-Stamfo .99990 4 6 8 10 12 14 16 18 20 22 24 .99990 1050 0.00 Orrington South Нош Sandy Pond So. -9999 5500 0.00 0.00 Sandy Pond So. -9999 3000 -99999 0.00 Seabrook-South 1400 SEMA: Southe .. -99999 1450 0.00 SEMABL: SE M. -99999 2400 0.39 1150 0.00 Surowiec South -99999 SW Connecticu. -99999 2200 0.00 5, 163 | -129, -2599 _ 🗆 🗡 🚰 Dayzer Prerelease version: NEPOOL 🛛 _ 🗆 🗵 ile Edit View Tools Held Ø N



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(\$/MWh)

46,280 | -129,-2599

DAYZER AND ITS FEATURES

Cambridge Energy Solutions is pleased to present its Day-Ahead Locational Market Clearing Prices Analyzer (DAYZER) for analyzing the locational market clearing prices and transmission congestion costs in US electricity markets.

• **Simulates** operation of the electricity markets, ISO dispatch procedures and calculations made by the ISOs in solving for the security-constrained, least-cost unit commitment and dispatch in the day-ahead markets.

- Forecasts the day-ahead and hourly locational market-clearing prices and congestion costs.
- Updates using the most recently available data on fuel prices, demand forecast, unit & transmission line outages, emission permits costs.
- Incorporates all the security, reliability, economic and engineering constraints on generation units and transmission system components.

• **Customizable** to emulate specific operation of any regional market and the dispatch or operating procedures adopted and used by the ISOs, with its unique ability to capture the particularities of each regional market.

DAYZER is currently available for the NYISO, NEPOOL, PJM RTO, MISO, ERCOT, WECC and Ontario markets.

DAYZER has the following features:

➤ Easy to use and user friendly.

> Accurate security-constrained unit commitment and dispatch algorithms that mimic those used by the ISOs in the Day-ahead market.

> Accurate data inputs and assumptions (up-to-date database on thousands of items). Uses NAPD for information on generation and transmission system.

- > Accurate modeling of each market with its own particularities (second contingency constraints, locational reserve markets, etc.)
- > Captures marginal transmission losses in dispatch and prices in markets where implemented.
- > Graphical user interface plus transparent Access database and reporting output.
- > Captures transmission outages, transmission contingencies, and planned and known transmission upgrades.
- > Models accurately phase angle regulators and loop flows.
- > Allows users to analyze various scenarios and quantify the impact of various key variables/assumptions.
- > Validated against actual market prices (samples as shown in following graphs).

In addition to DAYZER as a core, DAYZER long-term uses the following modules:

- a. Long-term load forecast (based on historical load shape and forecasted peak demand)
- b. Fuel prices from NYMEX (Fuel Oil and Natural Gas)
- c. Random Outage using Bernoulli probability model
- d. Maintenance schedule (optimized based on reserves)
- e. Imports/exports

The simulation results shown in the graphs reveal good comparison to actual day-ahead market clearing prices published by the ISOs, given the following:

- 1. Error in zonal load forecast (uses load forecast rather than actual day-ahead bids for NYPP and assumes no virtual bidding for all markets)
- 2. Error in generation unit outages (assumes uniform de-rating of generation units)
- 3. Error in bid estimation (assumes marginal cost bidding)

The pattern shown in the graphs is consistent over longer periods.

WECC Monthly Average LMP Graphs

(Southern CA Edison Zone - 2008)









OFF-PEAK LMP GRAPH





Hourly Average LMP for WECC Southern CA Edison Zone

— Dayzer — CA-ISO



DAYZER VISUALIZER

🞆 Dayzer Visualizer: WECC-8-21-08-Muc1

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DAYZER VISUALIZER

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DAYZER -NY-ISO

NYPP Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market - NYC - 2008)

ON-PEAK LMP GRAPH







NYPP Hourly Average LMP Comparison - N.Y.C. '08

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NY-ISO (Using Marginal Bidding Cost + MIP + Bid-adder of \$10/MWhr for NYC Units from Jan - Jul '08) 250 200 Avg. LMP 150 100 50 0 Nov Hr-13 Dec Hr-16 Jan Hr-1 Jan Hr-10 Jan Hr-19 Feb Hr-13 Apr Hr-10 Apr Hr-19 May Hr-13 Jul Hr-10 Oct Hr-10 Oct Hr-19 Nov Hr-22 Dec Hr-7 Nov Hr-4 Feb Hr-z Feb Hr-22 May Hr-4 May Hr-22 Jun Hr-16 Var Hr-1 Mar Hr-Apr Hr-Jun Hr-Jul Hr Aug Hr-2 Sep Hr-1 Jul Hr-1 Aug Hr-Aug Hr-1 Sep Hr-Oct Hr-

NYPP Daily Average LMP Comparison - N.Y.C. '08

(Using Marginal Bidding Cost + MIP + Bid-adder of \$10/MWhr for NYC Units from Jan - Jul '08)



NYPP Hourly Average LMP Comparison - NYCapital '08

(Using Marginal Bidding Cost + MIP + Bid-adder of \$10/MWhr for NYC Units from Jan - Jul '08)



NYPP Daily Average LMP Comparison - NYCapital '08

(Using Marginal Bidding Cost + MIP + Bid-adder of \$10/MWhr for NYC Units from Jan - Jul '08)



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NYPP LMP Comparison - NYC - August'08

DAYZER

-NY-ISO

(Using Marginal Bidding Cost + MIP + Bid-adder of \$10/MWhr for NYC Units from Jan - Jul '08)



NEPOOL Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market - NEPOOL Hub - 2008)

ON-PEAK LMP GRAPH





NEPOOL Hourly Average LMP Comparison - NEPOOL Hub '08

-NE-ISO



NEPOOL Daily Average LMP Comparison - NEPOOL Hub '08

(Using Marginal Bidding Cost + MIP)



NEPOOL Daily LMP Comparison - NEPOOL Hub - July'08

(Using Marginal Bidding Cost + MIP)



- DAYZER

NE-ISO

— DAYZER — PJM-ISO

PJMRTO Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market - PJM Eastern Hub - 2008)









OFF-PEAK LMP GRAPH

— DAYZER — PJM-ISO

PJMRTO Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market - PJM Western Hub - 2008)



PJMRTO Hourly Average LMP Comparison - PJM Eastern Hub '08

(Using Standard CES Assumptions and Strategic Bidding)



PJMRTO Daily Average LMP Comparison - PJM Eastern Hub '08

(Using Standard CES Assumptions and Strategic Bidding)



- DAYZER

PJM-ISO

PJMRTO Hourly Average LMP Comparison - PJM Western Hub '08

(Using Standard CES Assumptions and Strategic Bidding)



PJMRTO Daily Average LMP Comparison - PJM Western Hub '08

(Using Standard CES Assumptions and Strategic Bidding)



— DAYZER

- PJM-ISO

PJMRTO Daily LMP Comparison - PJM Eastern Hub - Jul '08

(Using Standard CES Assumptions and Strategic Bidding)



- DAYZER

PJM-ISO

DAYZERMidwest-ISO

MISO Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market – Cinergy Hub – 2008)



DAYZERMidwest-ISO

MISO Monthly Average LMP Graphs

(Comparisons with Day-Ahead Market - Illinois Hub - 2008)



MISO Hourly Average LMP Comparison - Cinergy Hub '08

(Using Standard CES Assumptions and Strategic Bidding Options)



MISO Hourly Average LMP Comparison - Illinois Hub '08

(Using Standard CES Assumptions and Strategic Bidding Options)





DAYZER

Midwest-ISO

MISO Hourly Average LMP Comparison - Minnesota Hub '08

(Using Standard CES Assumptions and Strategic Bidding Options)



MISO Daily Average LMP Comparison - Minnesota Hub '08

(Using Standard CES Assumptions and Strategic Bidding Options)



MISO Daily LMP Comparison - Cinergy Hub - Aug '08

(Using Standard CES Assumptions and Strategic Bidding options)



DAYZER

Midwest-ISO

MISO Daily LMP Comparison - Minnesota Hub - Aug'08

(Using Standard CES Assumptions and Strategic Bidding Options)



Midwest-ISO

Real-Time-Market

ERCOT Monthly Average LMP Graphs

(Comparisons with Real-Time Market and ICE - South ERCOT Hub - 2008)

ICE



Real-Time-Market

ERCOT Monthly Average LMP Graphs

(Comparisons with Real-Time Market and ICE – Houston Hub – 2008)

ICE

ERCOT Hourly Average LMP Comparison - South ERCOT Hub '08

