The Electric Generation Expansion Analysis System (EGEAS) Software
2015 EPRI Update

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Overview of EPRI’s Electric Generation Expansion Analysis System (EGEAS)

- EGEAS is a state-of-the-art modular production costing and generation expansion software package.

- EGEAS is used by electric company planners and others to develop and evaluate integrated resource plans, avoided costs, plant life management plans, and environmental compliance plans.

- EGEAS accommodates dispatchable generation sources (e.g., coal, gas, nuclear), demand-side management (DSM) and renewable energy sources.

- EGEAS was the forerunner of the current generation planning simulation and optimization models, and continues to be used today by a number of electric companies and regional planning organizations (e.g., MISO).

- To learn more about EGEAS, please visit EPRI.com here: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001016192 and here: http://eea.epri.com/models.html#tab.=3
Short History of EGEAS

- EPRI originally developed EGEAS in 1983 as a research project. Key contractors included Stone & Webster Engineering Corp. and the MIT Energy Lab.

- In the 1990s, Stone & Webster Management Consultants Inc. developed a graphic user interface (GUI) to ease data input.

- In 2013, EPRI reactivated EGEAS v9.02.

- In April, 2014, EPRI released v10 – an updated and integrated version that included a new GUI and improved “back end.”

- In June 2015, EPRI released a new, updated EGEAS v11.0
  - Software development by NG Planning
  - Financial support provided by MISO & EPRI
EGEAS has Evolved to Meet the Needs of Company Generation Planners, Regulators, ISOs and Others

- **Version 1** – 1983 Initial release
- **Version 2** – 1985 Storage optimization, Must-run, Spinning reserve
- **Version 3** – 1986 Purchase & sale contracts, Incremental costs
- **Version 4** – 1989 Financial constraints
- **Version 5** – 1990 Fuel constraints, Multi-area modeling
- **Version 6** – 1990 Emission Constraints, System average rate
- **Version 7** – 1993 Revenues, Avoided costs, Risk analysis
- **Version 8** – 1996 Multi-Parameter Gamma method
- **Version 9** – 1997 Bid-based pricing
- **Version 9.02** – 2007 Cost and Revenues report; Ability to change measurement units; increase # of plant types and load blocks
  - **Version 9.02** – 2013 Reactivated by EPRI
  - **Version 10.0** – 2014 Integrated GUI and underlying EGEAS code; removed Finance + and RISKMIN
  - **Version 11.0** – 2015 Added “dump energy “ penalty and State RPS
Important EGEAS Features

- Includes dynamic programming algorithm to develop candidate portfolios from identified alternatives meeting a reliability constraint (e.g., maintain 10% capacity reserve margin).

- Conducts minimum present value revenue requirements (PVRR), or lowest electric rate economic ranking of candidate portfolios dispatched, with an existing and future set of assets.

- Once data inputs are set-up, many different scenarios can be run to test different generation plans easily and quickly.

- Simple economics based on present worth method - easy to understand and explain results.

- EGEAS is used by electric utilities, state regulators and various regional planning organizations.

- Results are easily understood, and well accepted by regulators.
EGEAS Version 10 — Key Features

- One-stop software licensing process via EPRI or EPRI software “commercializers,” such as NG Planning LLC.
- Consolidated EGEAS, Graphic User Interface, DSMLINK, and RPWorkstation programs
- Eliminated Finance+ and Riskmin programs which are no longer supported or used
- Updated EGEAS Capabilities Manual and all other User’s Guides / Manuals
  - Capabilities Manual
  - Users Guide
  - DSMLink Manual
  - RPW Users Guide
- Revised EGEAS documentation and manuals with consistent EPRI copyright, logo, and disclaimers.
- At MISO's request, EPRI made the Capabilities Manual and Users Guide available to the public online for free.
EGEAS Version 11 — Software Development

- MISO provided “base” funding to develop v11.
- EPRI provided needed “supplemental” funding, and engaged NG Planning to develop v11.
- Project execution included developing and testing of a pre-production “beta” version 11 with MISO.
- EPRI’s Software Quality Assurance (QA) process was completed successfully for both the beta and final production versions of EGEAS v11.
EGEAS Version 11 — New Enhancements

- Two new features added:
  1. Dump Energy Penalty Factor
  2. Renewable Portfolio Standard (RPS) Constraint

- Fixed EGEAS program bugs

- Updated software users manuals as appropriate

- Updated to operate with Windows Vista, Windows 7 (32-bit and 64-bit), and Windows 8.
Renewable Portfolio Standards (RPS) Constraint

- EGEAS v11 includes new regional Renewable Portfolio Standard (RPS) constraints.

- EGEAS users can now create regional annual RPS constraints directly in EGEAS.

- EGEAS users now can develop optimized generation expansion plans that comply with the annual RPS requirements over the study period.
Dump Energy Penalty Factor

- “Dump energy" refers to electricity expected to be generated in EGEAS from a proposed generation asset portfolio that is greater than the amount needed to meet forecasted demand.

- EGEAS v11 incorporates a new “dump energy penalty factor,” so the cost of dump energy can be directly “charged” a financial or other type of penalty.

- EPRI and NG planning worked with MISO to define appropriate methods to apply the dump energy penalty.

- Previously, EGEAS simply noted how much dump energy would be produced, and priced dump energy at the cost of the resources producing it for each generation expansion plan.
EGEAS Version 11 — Pricing & Licensing

- EGEAS can be licensed (i) directly from EPRI, or (ii) from one of EPRI’s EGEAS software commercializers, including:
  - NG Planning LLC
  - Lummus Consulting

- EPRI charges $30,000 for a new EGEAS v11 user license
  - One-time license fee; no annual license maintenance fee
  - No limit on the amount of users in a single company
  - Existing registered licensees of v10 only can obtain a one-time upgrade to v11 for $5,000 from EPRI

- Members of EPRI programs 178 / 178b receive an EGEAS v11 license at no additional cost

- EPRI software commercializers may charge different EGEAS licensing fees
The Status of EGEAS at EPRI

- EGEAS’s “home” is EPRI research program #178b which focuses on “Fuels, Power Markets and Resource Planning.”
  - Only a very few P178b members use EGEAS
  - There is no support among P178 members to pay for enhancements to EGEAS, or to provide end-user support
  - EPRI receives little revenue from EGEAS, and P178 does not receive any revenue from EGEAS licensing

- EPRI members funded the original development of EGEAS in 1983, and enhancements through v9.02 in 2013.
- EPRI has continued to update EGEAS with funding largely provided by MISO supplemented with internal EPRI funds.
- Going forward, EPRI is willing to continue to develop new versions of EGEAS so long as 3rd parties pay the full cost of software development and EPRI QA testing.
EGEAS End-user Support and Services

- EPRI does **not** provide end-user support or training
- EPRI does **not** provide end-users with maintenance, consulting or technical support services
- EPRI has licensed two firms to commercialize EGEAS and provide end-user support services, including:
  - Sublicensing EGEAS to new users
  - Providing resource planning consulting services with EGEAS
  - Providing EGEAS software training, installation, support and maintenance services
EPRI Collaboration with NG Planning LLC

- EPRI has provided NG Planning with a license to commercialize EGEAS
- EPRI and NG Planning are collaborating to explore development of new enhanced versions of EGEAS
- NG Planning coordinates the annual EGEAS User Group meeting in conjunction with MISO
- In recent years, NG Planning has helped to increase the EGEAS user base by licensing EGEAS to state PUCs and several electric companies
In March 2015, EPRI Awarded John Lawhorn of MISO an Environment Sector Technology Transfer Award

“Using the Electric Generation Expansion Analysis Software System (EGEAS) to Address Electric Sector Planning and Reliability Challenges”

Challenge
MISO wanted to expand use of EGEAS among its members to facilitate communication and planning for the proposed federal Clean Power Plan.

Solution
MISO brought EGEAS to the attention of the Organization of MISO States (OMS), and helped OMS members purchase EGEAS and obtain training.

Results and Benefits
• Ten of the 15 states in MISO’s region now use EGEAS. Several state public utility commissions and electric companies in MISO’s region are using EGEAS.

• MISO helped promote and expand the EGEAS User’s Group.
Contact Information

Together…Shaping the Future of Electricity

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