



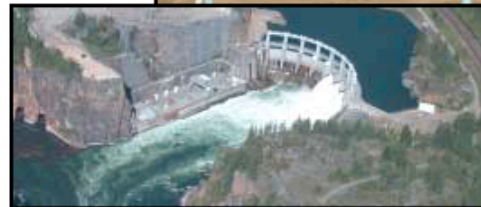
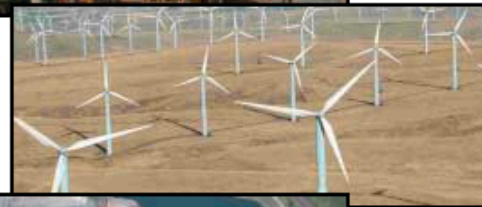
# Integrated Resource Planning

## IRP Modeling with AURORA

2003 Electricity  
Market Forecasting  
Conference

September 26, 2003

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**2003  
Integrated  
Resource  
Plan**



# Business Requirements

- Meet bi-annual regulatory requirement for IRP
  - add stochastic risk evaluation
- Develop method(s) to enhance long-term planning
  - more granular looks
  - better understanding of market drivers
  - uniform filter for resource comparison
  - shift from qualitative to quantitative



## Business Requirements (cont.)

- Replace existing portfolio dispatch model, because it
  - was *SLOW*
  - didn't do a WECC market forecast
  - wasn't user-friendly (i.e., no GUI)
  - was too black-box like
  - was too FTE-intensive
    - especially for regulators



# Selection Criteria for Market Model

- Excellent GUI
- Deterministic capability to accurately model fundamentals
- Scenario modeling capability
- Stochastic risk analysis
- Capacity expansion capability



## Models Evaluated

- ICF Consulting – IPM
- NewEnergy Associates – MarketPower
- Henwood – Prosym/MarketSym/RiskSym/Theo
- LCG Consulting – UPlan
- GE – GE Maps (limited eval. due to no GUI)
- M.S. Gerber & Associates – MidasGold Suite
- EPIS, Inc. – AURORA



# Selection: AURORA

- Best Met Criteria
  - “perfect” score on GUI & Capacity Expansion
  - among top on Stochastic and Scenario capabilities
  - 2<sup>nd</sup> on deterministic
  - overall rating substantially higher than peers
- Company selected AURORA
  - provided state regulators with AURORA licenses
    - full versions, including EPIS technical support
    - 2 days of training @ EPIS headquarters



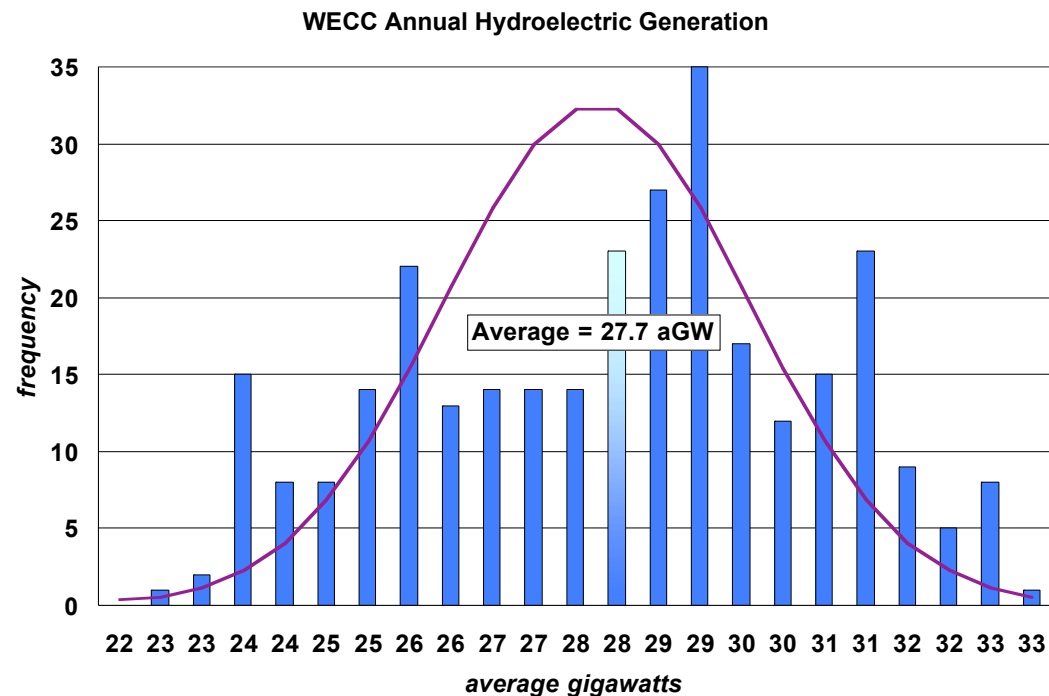
## Unanticipated “Extras”

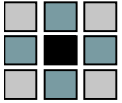
- Portfolio tracking capability
- Interact with SQL & Oracle
- System diagram
- Spreadsheet data links
  - input and output
- Significant improvement in understanding market fundamentals



# Key Drivers of Variability

- Hydro output
  - 60-year hydro record from NWPP
- Natural gas price
  - assumed 50% stdev
- WECC loads
  - FERC 714 hourly data by utility





# Modeling Key Drivers of Variability With AURORA

- Input & output
  - customized weekly Monte Carlo routine for variability
  - customized database for WECC and portfolio
  - Oracle database for data storage
    - input and output
- Used VB Scripting to handle data exchange with database and to run model iterations



## Steps Performed

- Modify databases
  - e.g., Resources, Fuel, New Resources
    - included demand-side resources in NR table
- Run long-term study
- Run Monte Carlo iterations through AURORA
- Run various scenarios
  - all-coal, high gas, carbon tax, etc.
- Extract portfolio values from database (200 iter.)
- Run LP to identify preferred resource mix



## End IRP Results

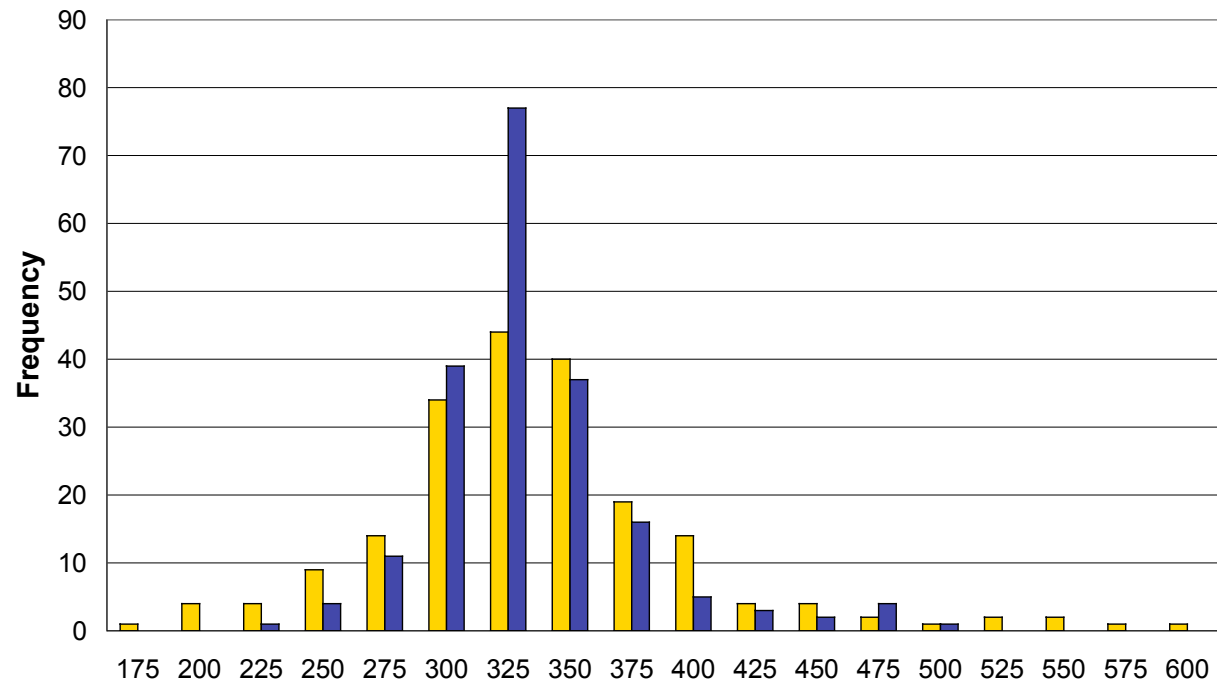
- IRP with better information delivered on-time to Commissions
  - accepted on
    - 08/28/03 Idaho
    - 09/04/03 Washington
- Find report and technical appendices at
  - <http://www.avistautilities.com/resources/plans/electric.asp>



# End IRP Results (cont.)

**Chart 7.9**  
**Distribution of Net Power Supply Expenses – 2013**  
*Preferred Resource Strategy vs. No Additions*  
(in Millions of Dollars)

- Risk assessment of resource strategies at a given point in time

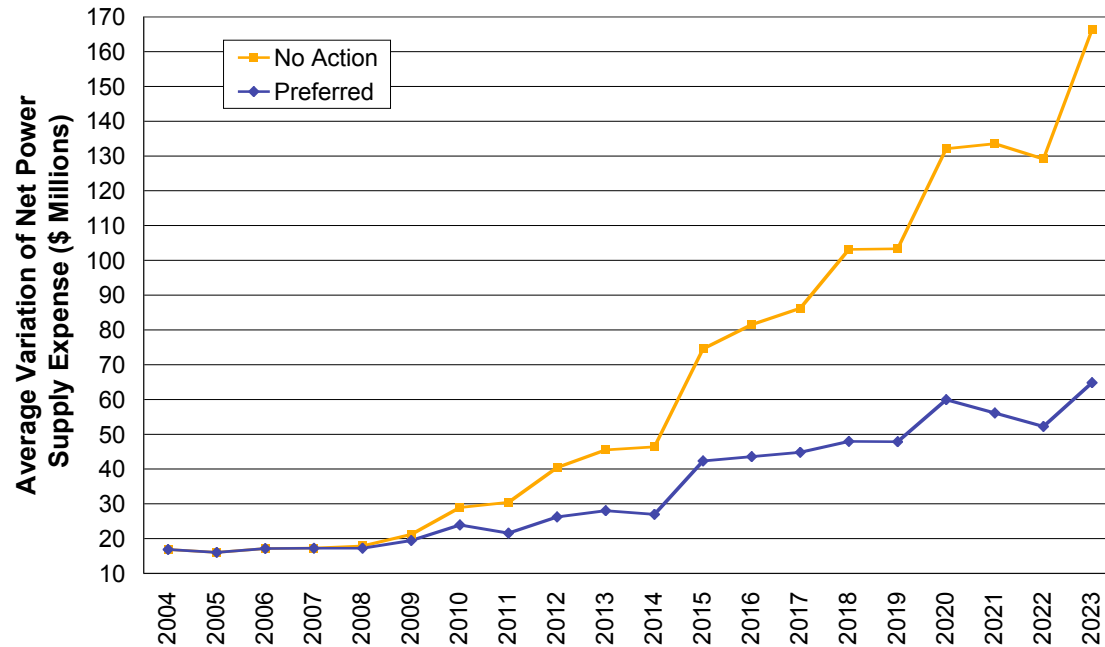




# End IRP Results (cont.)

Chart 7.8  
Variance in Net Power Supply Expenses  
*Preferred Resource Strategy vs. No Additions*  
2004-2023

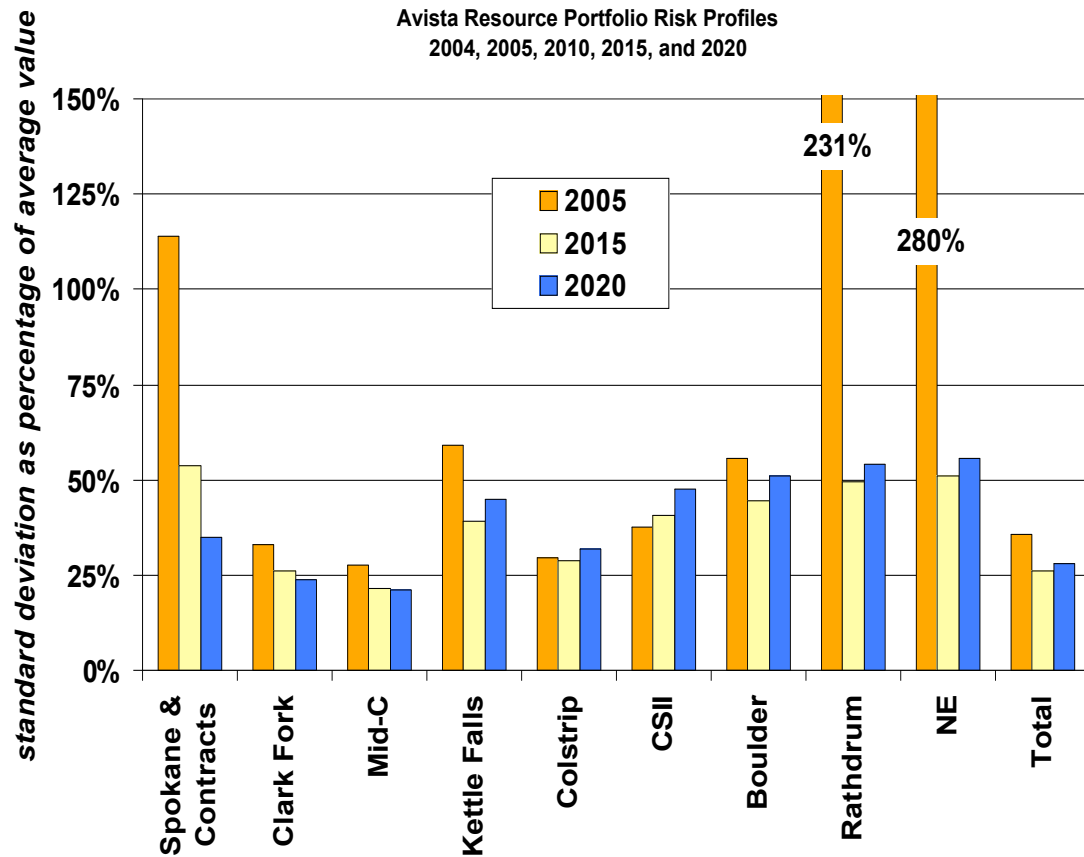
- Understand risk over time





# End IRP Results (cont.)

- Understand resource contribution to portfolio risk over time





## End Business Results

- IRP exceeded regulatory expectations
- Better internal models
  - resource evaluations allow apples-to-apples evaluation of very different resource types
  - risk modeling for earnings studies
  - fast and comparatively easy to use
- Long-term (LT) price forecast available
- Regulatory relationship is stronger



## Improvements for Next Time

- Add forced outage to variables
- Adjust hydro matrixes based on water years
- Additional automation
- Better conservation program integration
- Run multiple load growth baselines



## Next Steps (outside of IRP)

- Develop LT price forecast for wholesale traders
- Evaluate risk of peer utility portfolios compared to Avista
  - to illustrate for management how we rank
- Evaluate impact of planning margins
- Evaluate impact of large wind plants on marketplace



## What It Took

- AURORA Model
  - two-user license @ \$62,500
- License for regulators
  - two single-user licenses @ \$37,500 each
- Screaming computer(s) with big hard drives
  - three @ \$5,000 each



## What It Took (cont.)

- Modest VB coding ability
  - existing staff, so no incremental cost
- Decent database skills
  - MS Access (SQL knowledge helps, too)
- Linear programming add-in to Excel
  - Lindo System's *What'sBest!* @ \$4,000
- Total ~ \$150,000 + 2 FTE