



# POWER GENERATION

S T R A T E G I C  
R E S O U R C E  
O P T I M I Z A T I O N

MANAGE  
UNCERTAINTY

MINIMIZE REGULATORY  
COMPLIANCE COSTS

OPTIMIZE RESOURCE  
PORTFOLIO

**ADVANCED ANALYTICAL**  
CONSULTING GROUP

Demand Ambiguity

Renewable Mandates

Reconfigure

Retire

Retrofit

Build

Aging Assets

NO<sub>x</sub> SO<sub>2</sub>  
Hg CO<sub>2</sub>

Fuel Price Volatility

Technological Uncertainty

# WHAT IS YOUR STRATEGY TO SURVIVE BUSINESS UNCERTAINTY?

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Electric power generators face unprecedented uncertainty in the form of looming regulatory requirements, uncertain demand, renewables mandates, new technologies and fuel price volatility. In the face of this uncertainty, utilities need to develop an optimal asset strategy plan for existing and new electricity sources.

Advanced Analytical Consulting Group's *Strategic Resource Optimization (SRO)* framework provides a fully integrated modeling capability to evaluate least-cost capacity expansion, retirements and emission control strategies for meeting energy demand and meeting/exploiting current and emerging emissions limits/markets.

- › Determine least-cost capacity expansion strategies
- › Exploit current and emerging emissions limits/markets
- › Meet energy demand
- › Set plant retirement schedules
- › Evaluate emission control cost impacts

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*The difference between 70 and 65 PPM New 8-Hour ozone limits for the next round of NAAQS amounts to \$77 billion dollars in compliance costs.*



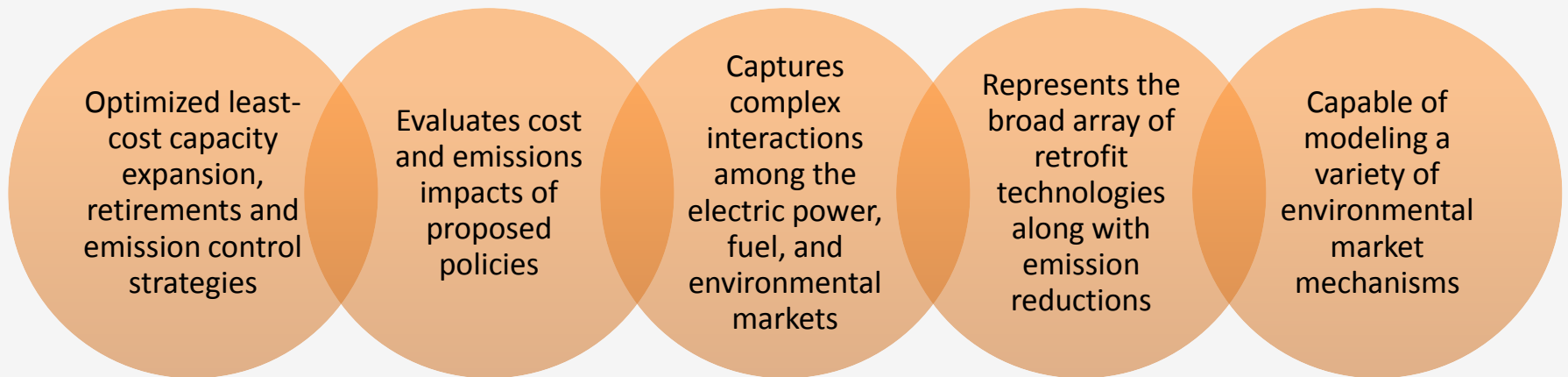
# STRATEGIC RESOURCE OPTIMIZATION

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Existing simulation approaches focus primarily on chronological dispatch decision-making based on hourly production costs and locational marginal prices. While these models fulfill their intended purpose, they have limited applicability toward higher-level strategic planning issues such as emissions compliance, future technology options, asset retirements and retrofits and capital planning in an era of unprecedented risks.

SRO is a new framework from Advanced Analytical Consulting Group (AACG) designed from the ground-up to analyze strategic planning issues while considering the future uncertainty affecting every aspect of the power generation business.

## MODEL CAPABILITIES



### EXISTING ASSETS



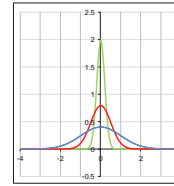
### BUILD OPTIONS



### FUTURE EXPECTATIONS

Demand Growth DSM  
 Fixed Charge O&M  
 Macro Economic Capital Costs  
 CO<sub>2</sub> SO<sub>2</sub> NO<sub>x</sub> Hg Energy Prices  
 Fuel Prices

### UNCERTAINTY

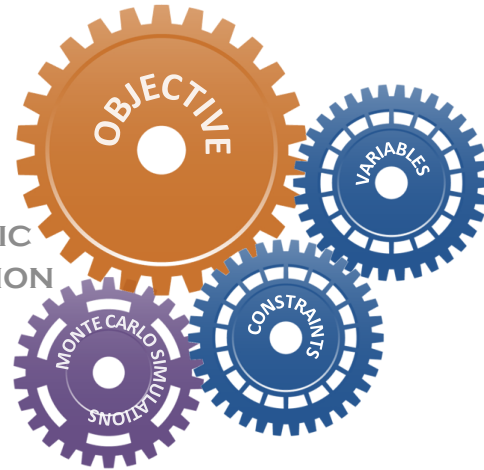


Probability Distribution for any input

INPUTS

- › No limitations in number of asset types or length of planning horizon
- › Relatively easy to populate and modify model inputs
- › Uncertainty can be assigned to any input

## STOCHASTIC OPTIMIZATION



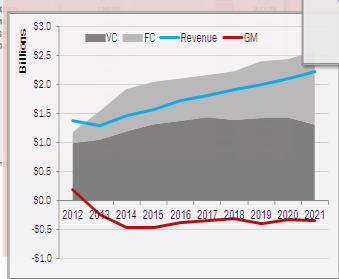
OPTIMIZATION

- › Combines powerful genetic algorithms with Monte Carlo simulation to offer true stochastic optimization
- › Accepts large numbers of optimization parameters, variables and constraints

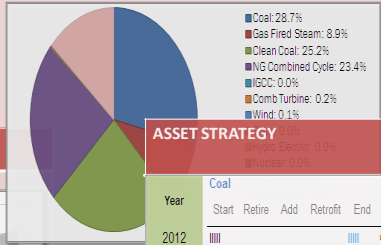
### ENERGY FORECAST

Year	Starting Energy	Energy Additions	Energy Retirements	Energy Power Purchases	Energy Power Sales	Ending Energy
2012	32,443,000					32,443,000
2013	32,443,000	7,495,300	-8,102,000	1,079,700		32,443,000
2014	32,500,000	4,968,000	-2,800,000			34,668,000
2015	30,979,200		-400,000			30,579,200
2016	30,840,400		-400,000			30,440,400
2017	30,893,000		-200,000			30,693,000
2018	30,893,000	2,483,400				33,376,400
2019	30,390,700	3,442,000				33,832,700
2020	29,695,400	3,000,000				32,695,400
2021	32,762,000	5,995,000	-400,000			38,357,000
2022	32,762,000	2,483,400				35,245,400
2023	35,245,400					35,245,400
2024	35,245,400					35,245,400
2025	35,245,400					35,245,400
2026	35,245,400					35,245,400
2027	35,245,400	2,483,400				37,728,800
2028	37,728,800					37,728,800
2029	37,728,800					37,728,800
2030	37,728,800					37,728,800

### FINANCIALS



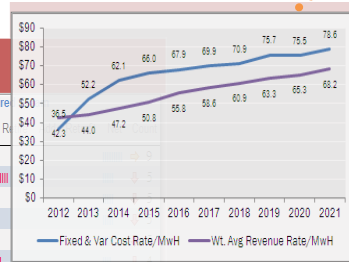
### RENEWABLES



### ASSET STRATEGY

Year	Coal					Gas Fire	
	Start	Retire	Add	Retrofit	End	Count	Start
2012						5	
2013						3	
2014						2	
2015						2	
2016						2	
2017						2	
2018						2	
2019						1	
2020						0	
2021						1	
2022						1	

### PRICING



OUTPUTS

- › Dynamic updating of decision-making as optimization runs
- › Dashboard views for operational and financial outputs
- › Familiar Microsoft Excel® front-end makes information retrieval easy

# SRO: EXAMPLES OF QUESTIONS ANSWERED

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## STRATEGIC

- \* Clean coal, gas-fired combined cycle or nuclear for new base-load plants?
- \* How will state renewable portfolio standards affect other resource choices?
- \* What price premium is justified for DSM as a hedging strategy?

## TACTICAL

- \* Should existing large coal-fired units be retrofit with SCRs and scrubbers or converted to burn natural gas?
- \* Which older uncontrolled coal units should be retired and when?
- \* How does the flexibility of mothballing units compare with the savings of retiring them?
- \* At what natural gas price levels do gas-fired combined cycle plants become uneconomic?

POWER MARKETS ARE EVOLVING. WHY BE ONE OF THE DINOSAURS?

# ADVANCED ANALYTICAL

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## CONSULTING GROUP

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Advanced Analytical Consulting Group assists business clients with strategic and operational consulting based on in-depth quantitative analysis of corporate data and the client's position in the market. Our advice provides empirically-based strategies drawn from powerful scientific methods in the fields of economics, statistics, and computing. Our technology and programs extend the benefits of our consulting engagements. By embedding our analytical methods in programs and tools that our clients can reuse, our clients continue to capture strategic benefits and operational insights on their own.

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For more information, contact:

Peter Spinney

*Senior Energy Economist*

857 205 7885

PeterSpinney@AACG.com

Dr. Daniel S. Levy

*National Managing Director*

617 901 6344

DanLevy@AACG.com

Karthik Padmanabhan

*Senior Manager*

312 551 9001

KarPad@AACG.com