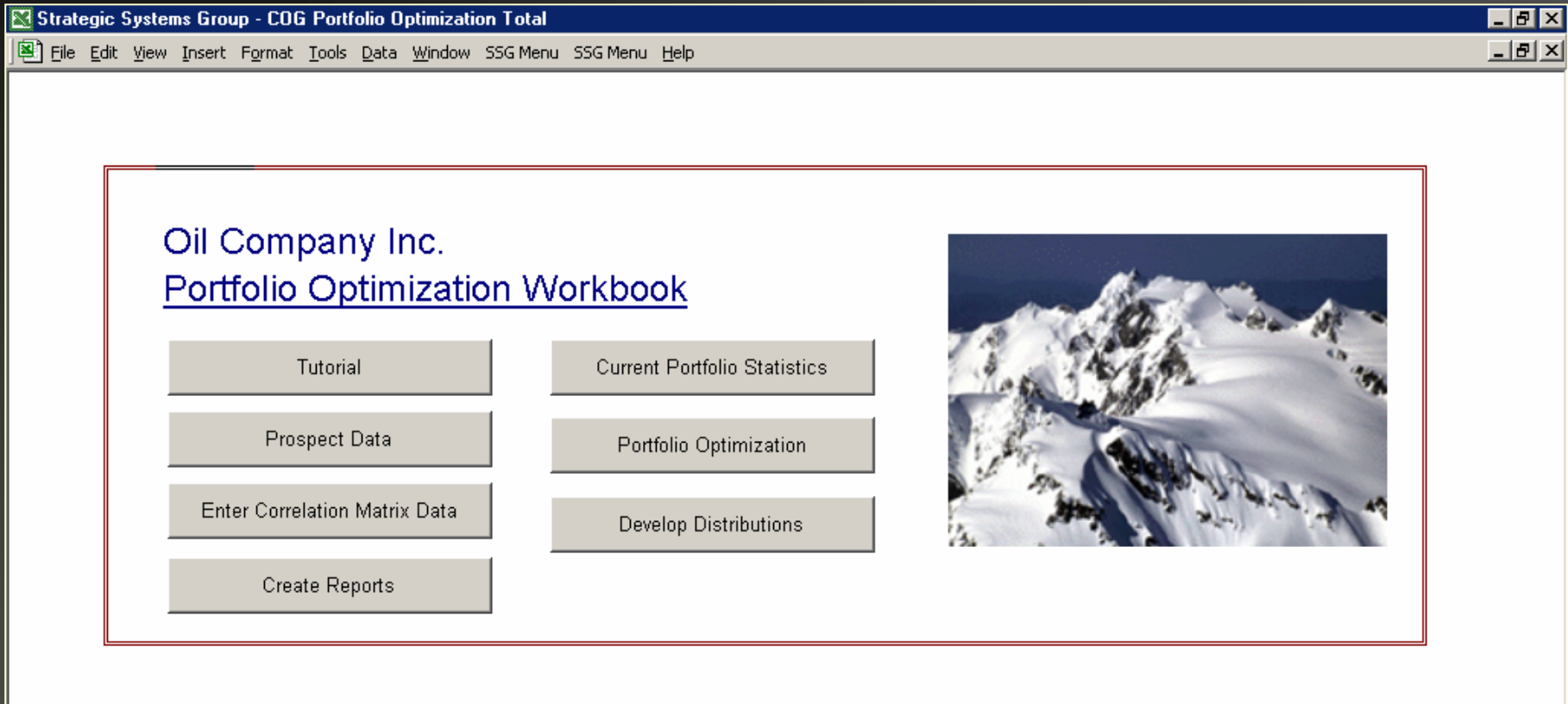
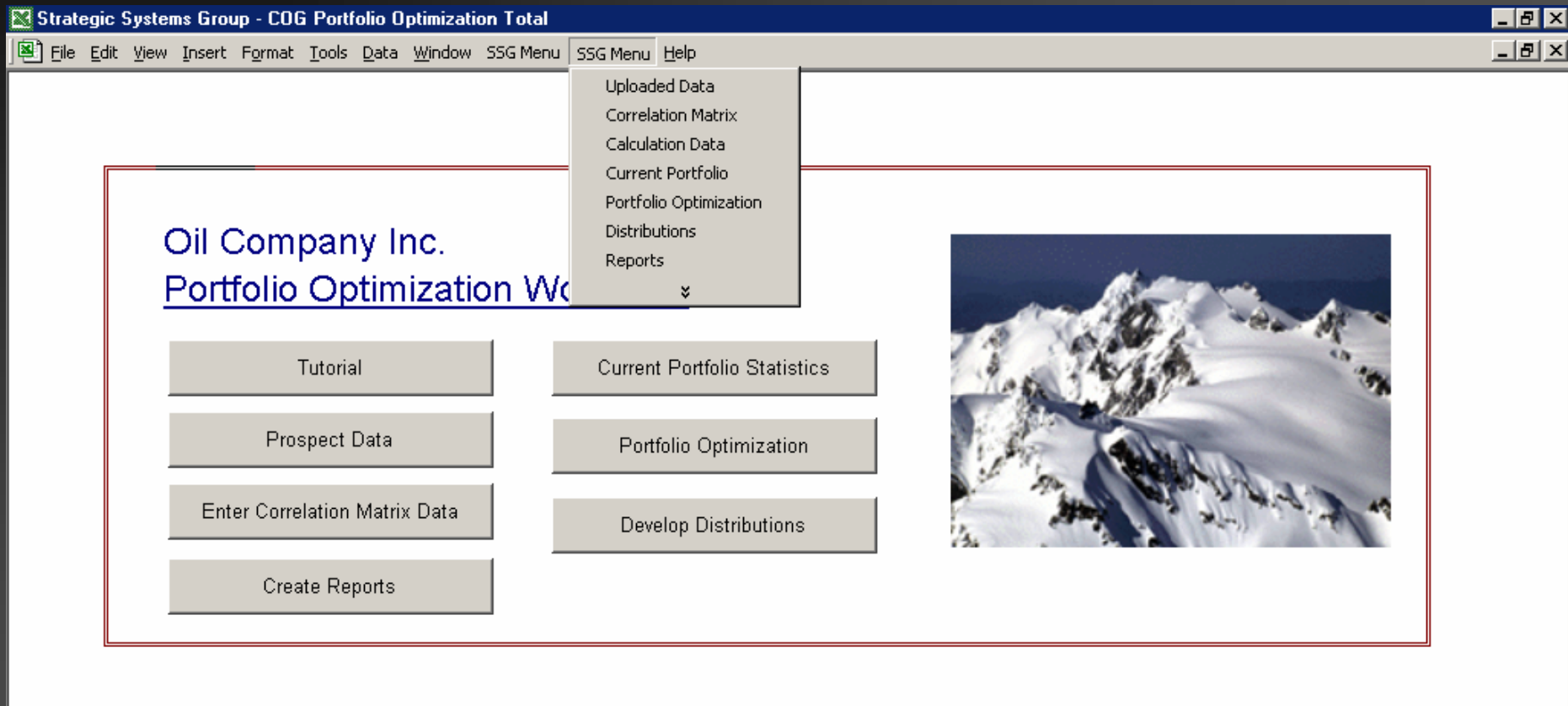


# Petroleum Portfolio Optimization Model



- Excel-based model
- Visual Basic programming for ease of use

# Menu-Driven Design Facilitates Use



- User can access multiple worksheets through menu.
- Integrated with all Excel functions.

# Comprehensive Economic Inputs

Strategic Systems Group - COG Portfolio Optimization Total									
File Edit View Insert Format Tools Data Window SSG Menu SSG Menu Help									
F3 = 66									
A	B	I	J	K	L	M	N	O	P
1	<b>UPLOADED ECONOMIC INPUT DATA</b>								
2	<b>English Units</b>								
3									
4	(w) = well basis, (p) = prospect basis								
5									
6	<b>Prospect Name</b>	<b>PA ORISKANY</b>	<b>REDMAN</b>	<b>ROME TROUGH</b>	<b>ARANSAS PASS 2-4</b>	<b>ARANSAS PASS A 4</b>	<b>ATCHAFALAY A BAY</b>	<b>AUGEN</b>	<b>BACCHUS</b>
7									
8	<b>Well Information</b>								
9	Location (Country Specifier)	Apl	Apl	Apl	Gulf Coast	Gulf Coast	Gulf Coast	Gulf Coast	Gulf Coast
10	Type (Must be either Oil or Gas)	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
11									
12	<b>Exploration Data</b>								
13	Probability of Exploration Success	55%	20%	10%	65%	65%	25%		25%
14	Number of Exploration Wells (Total)	13	1	16	1	2	1		1
15	Number of Exploration Wells (Budget Year)	5	1	4	0	2	0		0
16	Current Working Interest	100%	100%	100%	100%	100%	100%		100%
17	NPV Exploration	1,862.20	2,036.88	7,587.61	\$4,657.620	\$2,376.206	\$13,371.947		\$15,313.276
18	Drilling (w)	340.00	140.00	500.00	\$434.023	\$437.028	\$2,050.000		\$3,250.000
19	G&G Land - Capitalized (w)	50.00	30.00	17.50	\$0.000	\$0.000	\$135.000		\$0.000
20	G & G Seismic - Expensed (w)	100.00	175.00	125.00	\$0.000	\$0.000	\$173.500		\$0.000
21	Completion and Tie-In Tangible (w)	200.00	520.00	562.50	\$133.546	\$75.119	\$371.541		\$786.544
22	Completion and Tie-In Intangible (w)	135.00	25.00	187.50	\$66.773	\$83.466	\$228.459		\$538.456
23	Facilities (P)	-	-	-	\$66.773	\$83.466	\$750.000		\$750.000
24	Operating Cost (w)	-	-	-	\$0.000	\$0.000	\$0.000		\$0.000
25	Reserves: Oil (MBOE) (w)	-	200.40	-	63.367	38.991	169.043		202.794
26	Gas (Bcf) (w)	1.09	-	4.06	1.584	0.975	5.076		5.747
27	% Reserve Additions Budget Yr. (P)	38%	100%	25%	0%	100%	0%		0%
28	Production: Oil (MBOE) (w)	-	35.56	-	0.000	4.096	0.000		0.000
29	Gas (Bcf) (w)	0.16	-	0.43	0.000	0.102	0.000		0.000
30	Discount Adjustment Factor	0.9377	1.0250	1.0335	0.826	0.984	0.868		0.909
31	<b>Development (Conditional) Data</b>								
32	Probability of Development Success		80%	38%	70%	70%	75%		75%
33	Number of Development Wells (Total)		10	32	1	2	1		1

- User can easily download project economics – model accommodates up to 200 assets.
- Probability data is the foundation of project uncertainty.

# Modeling Dependencies Among Projects

Strategic Systems Group - COG Portfolio Optimization Total

File Edit View Insert Format Tools Data Window SSG Menu Help

H17 = 0.3

	A	B	C	D	E	F	G	H	I	J	K
1	<b>CORRELATION MATRIX DATA</b>										
2											
3	<b>Input Correlation Coefficients:</b>										
4	Global Correlation Coefficient*		2								
5	Oil / Oil or Gas / Gas Coefficient		0.3								
6	Oil / Gas Coefficient		0.1								
7											
8	* Global Coefficient Must be Between -1 and 1										
9	Else Specific Coefficients are Activated										
10											
11											
12											
13	Populate Matrix										
14				<b>DEV BIG 6 Average</b>	<b>DEV GT 35 Average</b>	<b>DEV LT 35 Average</b>	<b>COVERED BRIDGE</b>	<b>DRY ICE DEV</b>	<b>EAST SUMMIT</b>	<b>PA ORISKANY</b>	<b>REDMAN</b>
15		<b>PROSPECT</b>									
16		<b>DEV BIG 6 Average</b>		1	0.3	0.5	0.75	0.3	0.3	0.3	0.3
17		<b>DEV GT 35 Average</b>		0.3	1	0.3	0.3	0.8	0.3	0	0.3
18		<b>DEV LT 35 Average</b>		0.5	0.3	1	0.3	0.3	0.3	0.3	0.3
19		<b>COVERED BRIDGE</b>		0.75	0.3	0.3	1	0.3	0.8	0.3	0.3
20		<b>DRY ICE DEV</b>		0.3	0.8	0.3	0.3	1	0.3	0.3	0.3
21		<b>EAST SUMMIT</b>		0.3	0.3	0.3	0.8	0.3	1	0.3	0.3
22		<b>PA ORISKANY</b>		0.3	0	0.3	0.3	0.3	0.3	1	0.3
23		<b>REDMAN</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	1
24		<b>ROME TROUGH</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
25		<b>ARANSAS PASS 2-4</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
26		<b>ARANSAS PASS A 4</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
27		<b>ATCHAFALAYA BAY</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
28		<b>AUGEN</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
29		<b>BACCHUS</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
30		<b>BEAURLINE</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
		<b>BELLE ISLE-A</b>		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

- Correlation matrix allows for different correlations among multiple projects.
- Product price, technical, political, cost, etc. dependencies can be modeled in portfolio analysis.

# Project and Portfolio Calculation Module

Strategic Systems Group - COG Portfolio Optimization Total

File Edit View Insert Format Tools Data Window SSG Menu Help

B16 = Probability of Exploration

Uploaded Data  
Correlation Matrix  
**Calculation Data**  
Current Portfolio  
Portfolio Optimization  
Distributions  
Reports

	A	B	C	D	E	F	G	H
1		<b>Calculation Data</b>						
2		<b>English Units</b>						
3								
4		Gas to Barrel of Oil Equivalent Ratio						
5		<b>Prospect Name</b>						
175		Total Production of development failure (P)		0.000	0.000	0.000	0.000	0.000
176		<b>Total Expected Production (P)</b>		0.551	1.722	2.828	0.000	0.000
177		Budget Year Production of development success (P)		0.230	0.638	1.047	0.000	0.000
178		Budget Year Production of development failure (P)		0.000	0.000	0.000	0.000	0.000
179		Budget Year Expected Production (P)		0.184	0.574	0.943	0.000	0.000
180								
181		Variance (P)		39,285,573	359,402,553	456,725,384	0	5,605,885
182		Standard Deviation (P)		6,268	18,958	21,371	0	2,368
183		<b>Total Prospect Standard Deviation</b>		6,268	18,958	21,371	30,440	2,368
184		<b>Prospect Risk Return Characteristics - Current Working Interest</b>						
185		Total Expected Cost	\$320,864	\$5,136	\$29,942	\$40,057	\$13,195	\$2,310
186		<b>Total Budget Year Expected Expenditures</b>	<b>84,148</b>	<b>1,712</b>	<b>9,981</b>	<b>13,352</b>	<b>1,466</b>	<b>1,540</b>
187		Total Portfolio Variance	107,688,299,948					
188		Portfolio Standard Deviation	328,159					
189			\$343,234					
190		<b>Expected NPV (\$000)</b>	<b>\$433,830</b>	<b>\$9,839</b>	<b>\$39,796</b>	<b>\$40,962</b>	<b>\$25,241</b>	<b>\$3,463</b>
191		<b>Total Expected Reserves (BCF)</b>	354,333	11,188	48,323	54,806	21,137	0,840
192		<b>Budget Year Expected Reserves (BCF)</b>	<b>107,778</b>	<b>3,729</b>	<b>16,107</b>	<b>18,268</b>	<b>2,349</b>	<b>0,560</b>
193		<b>DPI</b>	1.35	1.92	1.33	1.02	1.91	1.50
194		<b>Total F&amp;D Costs (\$/MCF)</b>	\$0.91	\$0.46	\$0.62	\$0.73	\$0.62	\$2.75
195		<b>Budget Year F&amp;D Costs (\$/MCF)</b>	\$0.78	\$0.46	\$0.62	\$0.73	\$0.62	\$2.75
196		<b>Recycle Ratio</b>						
197		<b>Expected Production (BCF)</b>	12,907	0.551	1.722	2.828	0.554	0.000
198		<b>Budget Year Expected Production (BCF)</b>	<b>6,388</b>	<b>0.184</b>	<b>0.574</b>	<b>0.943</b>	<b>0.062</b>	<b>0.000</b>

- Computations for all performance metrics including NPV, finding costs, reserves, production, profitability index, etc. are computed at project and at the portfolio level.

# Analysis of Firm's Current Portfolio

Strategic Systems Group - COG Portfolio Optimization Total

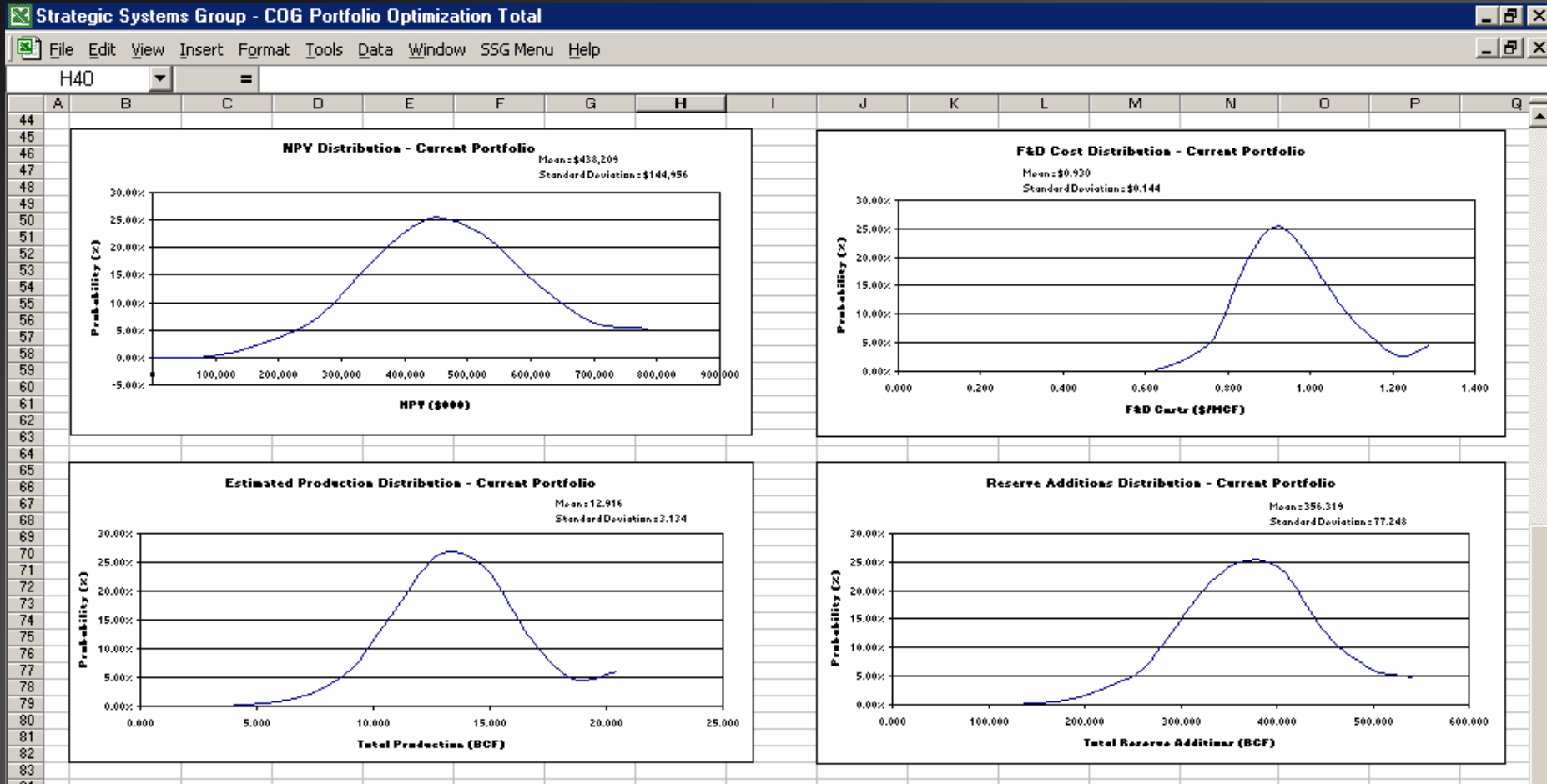
File Edit View Insert Format Tools Data Window SSG Menu Help

H12 =

Current Portfolio Data										Current Portfolio Working Interest and Portfolio Weights				
	NPV (\$000)	F&D Costs (\$/MCF)	Production (BCF)	Reserves (BCF)	DPI	Total Expenditure (\$000)	Standard Deviation (\$000)	DryHole Expense (\$000)		Total	DEY BIG 6 Average	DEY GT 35 Average	DEY LT 35 Average	
<b>Total</b>	<b>\$433,830</b>	\$0.91	12.907	354.333	1.35	\$320,864	<b>\$145,613</b>		Work. Int		100%	100%	100%	
<b>Budget Year</b>		\$0.78	6.388	107.778		\$84,148		\$25,400	Wt. Cond.	67%	0.0%	0.0%	0.0%	
* ALL VALUES ARE ON A TOTAL EXPECTED BASIS										Wt. UnCond.	33%	1.6%	9.3%	12.5%
										Total -	100%			
Generate Statistics for Current Uploaded Data					Develop Distributions									
Specify Number of Iterations:	2000			Recommended Range for Iterations is 1,500 to 3,000										
Actual Iterations Completed:	2000													
Distribution Statistics for Current Portfolio - TOTAL														
	NPV (\$000)	F&D Cost (\$/MCF)	Production (BCF)	Reserves (BCF)	DPI	Dry Hole Exp (\$000)								
<b>Mean</b>	\$438,209	\$0.930	12.916	356.319	1.339									
<b>Std. Dev.</b>	\$144,956	\$0.144	3.134	77.248	0.346									

- Mean and standard deviations are computed for all performance metrics for current portfolio.
- Portfolio weights for each project are computed.
- User may choose to simulate in order to see uncertainties associated with each metric.

# Simulation Outputs – Current Portfolio



- Characterization of uncertainty for each of the firm's key performance metrics in its current portfolio of assets.

# Portfolio Optimization Module

Strategic Systems Group - COG Portfolio Optimization Total

File Edit View Insert Format Tools Data Window SSG Menu Help

J4 =

Constraints specified here – user may turn on or off during different optimization runs.

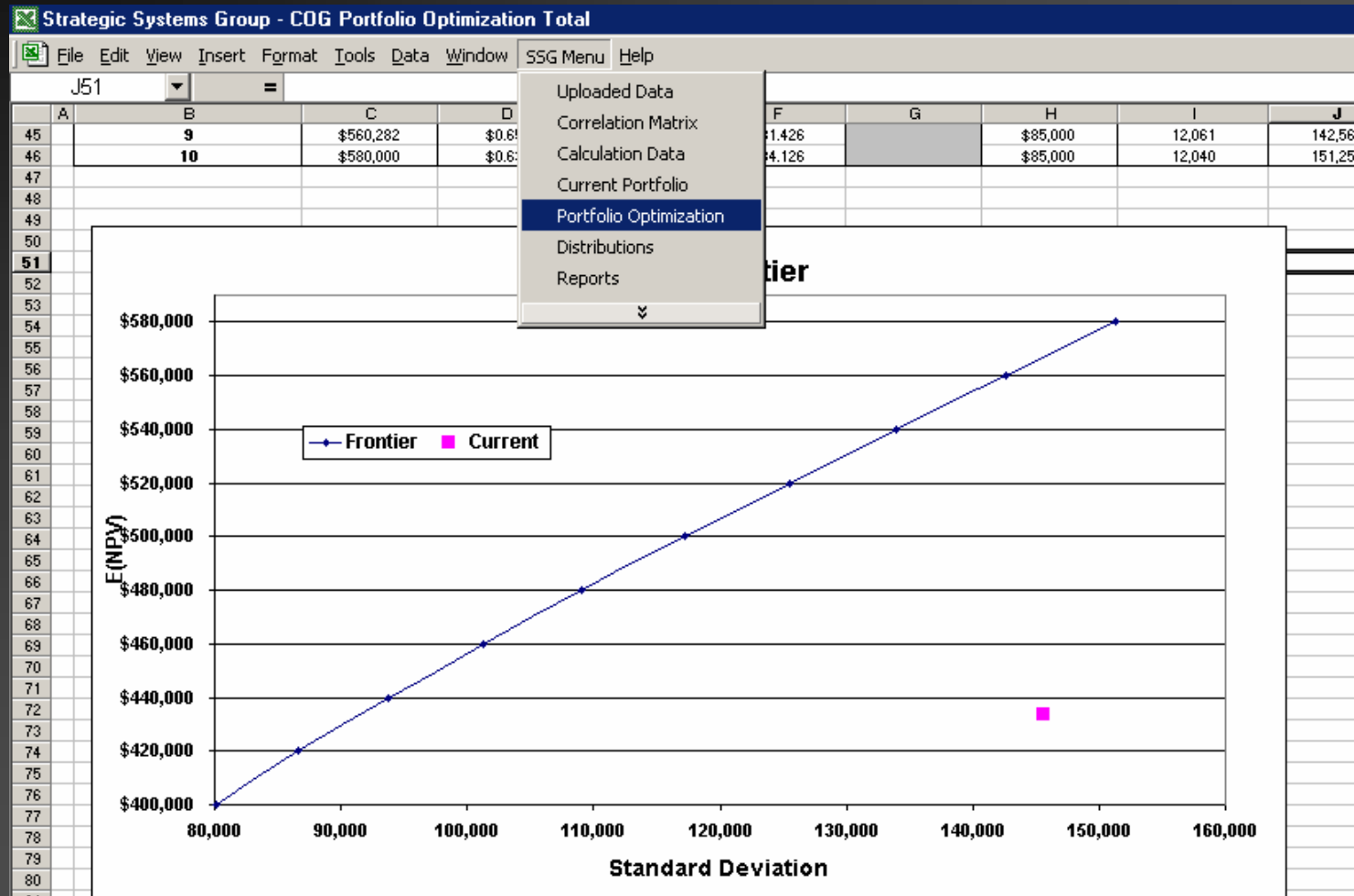
Input Parameter Constraints								Input Vo
	Expected NPY (\$'000)	Exp. F&D Costs (\$/MCF)	Exp. Production (BCF)	Exp. Reserve Add. (BCF)	Discounted Profitability Index	Total Expenditures (\$'000)	Dry Hole Expense (\$'000)	
	greater than:	less than:	greater than:	greater than:	greater than:	less than:	less than:	Current Maxim
<b>Total Constraint</b>	\$400,000	\$0.75	20.000	100.000	1.00	\$80,000		Minim
<b>Activate?</b>	1	0	0	0	0	0		
<b>Budget Year Constraint</b>		\$0.35	8.000	175.000		\$85,000	\$25,000	
<b>Activate?</b>		0	0	0		1	1	
<b>Run Optimization</b>								
Optimization Results								Working
Constraint Used	Total Expected NPY (\$'000)	F&D Costs (\$/MCF)	Production (BCF)	Reserve Add. (BCF)	DPI	Tot. Expend. (\$'000)	Dry Hole Expense (\$'000)	NPY Standard Deviation
<b>Total Constraint</b>	\$400,000							
<b>Budget Year Constraint</b>						85,000	25,000	
<b>Current - Total</b>	\$433,830	\$0.91	12.907	354.333	1.35	\$320,864		145,613
<b>Current - Budget Year</b>		\$0.78	6.388	107.778		\$84,148	25,400	
<b>Seed Value</b>	\$400,000							
<b>Increment</b>	\$20,000							
<b>Scenarios - Total</b>								
<b>1</b>	\$400,000	\$0.85	15.105	342.673	1.37	\$291,413		80,131
<b>2</b>	\$420,000	\$0.85	15.462	356.447	1.39	\$302,756		86,581
<b>3</b>	\$440,000	\$0.85	15.726	370.286	1.40	\$315,406		93,895
<b>4</b>	\$460,000	\$0.85	15.943	383.495	1.41	\$325,853		101,291
<b>5</b>	\$480,000	\$0.85						109,046
<b>6</b>	\$500,000	\$0.85						117,164
<b>7</b>	\$520,000	\$0.85						125,566
<b>8</b>	\$540,000	\$0.85						133,993
<b>9</b>	\$560,282	\$0.86						142,565
<b>10</b>	\$580,000	\$0.86						151,253

Optimization minimizes risk subject to a user-specified E(NPV) and defined constraints. Each scenario represents a portfolio on the efficient frontier – all metrics for each portfolio are computed.

- User specifies flexibility in terms of project participation levels, as well as additional constraints for optimization.



# Optimized Portfolios – Efficient Frontier



- Model constructs efficient frontier and identifies location of firm's current portfolio with respect to frontier.

# Composition of Optimized Portfolios

Strategic Systems Group - COG Portfolio Optimization Total									
File Edit View Insert Format Tools Data Window SSG Menu Help									
J51 =									
	K	L	M	N	O	P	Q	R	S
2	<b>Input Working Interest Constraints</b>								
3		<b>DEV BIG 6 Average</b>	<b>DEV GT 35 Average</b>	<b>DEV LT 35 Average</b>	<b>COVERED BRIDGE</b>	<b>DRY ICE DEV</b>	<b>EAST SUMMIT</b>	<b>PA ORISKANY</b>	<b>REDMAN</b>
4	<b>Current WI (For Comparison)</b>	100%	100%	100%	100%	100%	100%	100%	100%
5	<b>Maximum Allowable WI</b>	150%	150%	150%	200%	200%	200%	200%	200%
6	<b>Minimum Allowable WI</b>	0%	0%	0%	0%	0%	0%	0%	0%
7									
8	zation								
9									
10									
11	<b>Working Interest Results</b>								
12		<b>DEV BIG 6 Average</b>	<b>DEV GT 35 Average</b>	<b>DEV LT 35 Average</b>	<b>COVERED BRIDGE</b>	<b>DRY ICE DEV</b>	<b>EAST SUMMIT</b>	<b>PA ORISKANY</b>	<b>REDMAN</b>
13									
14									
15									
16	<b>Current</b>	100%	100%	100%	100%	100%	100%	100%	100%
17									
18									
19									
20									
21									
22									
23									
24	Scenario 1	150%	150%	150%	65%	200%	109%	104%	110%
25	Scenario 2	150%	150%	150%	79%	200%	105%	108%	120%
26	Scenario 3	150%	150%	150%	90%	200%	90%	122%	134%
27	Scenario 4	150%	150%	150%	105%	200%	88%	130%	144%
28	Scenario 5	150%	150%	150%	111%	200%	72%	134%	176%
29	Scenario 6	150%	150%	150%	124%	200%	69%	135%	184%
30	Scenario 7	150%	150%	150%	138%	200%	68%	135%	193%
31	Scenario 8	150%	150%	150%	154%	200%	63%	155%	200%
32	Scenario 9	150%	150%	150%	155%	200%	54%	180%	200%
33	Scenario 10	150%	150%	150%	174%	200%	54%	173%	200%
34									
35									

User can view composition of optimized portfolios and how participation levels change for each asset in the portfolio as we move farther out the efficient frontier.

- User can see how participation levels change in projects as the company moves further out the efficient frontier.

# Simulating Optimized Portfolios

Strategic Systems Group - COG Portfolio Optimization Total

File Edit View Insert Format Tools Data Window SSG Menu Help

D3 = 2000

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	<b>Distribution Results</b>													
2														
3	Specify Number of Iterations:	2000												
4	Actual Iterations Completed:	2000												
5														
6	<b>Current - BUDGET YEAR</b>													
7		<b>NPV</b>	<b>F&amp;D Cost</b>	<b>Production</b>	<b>Reserves</b>	<b>DPI</b>	<b>Dry Hole Exp</b>							
8		<b>(\$000)</b>	<b>(\$/MCF)</b>	<b>(BCF)</b>	<b>(BCF)</b>	<b>(Ratio)</b>	<b>(\$000)</b>							
9	<b>Mean</b>	432,974	\$0.849	6.337	107.663		26,025							
10	<b>Std. Dev.</b>	147,015	\$0.150	1.689	20.592		4,437							
11														
12	<b>Histogram</b>													
13	Bin 1	-8,071	0.0				\$12,715	0.55%						
14	Bin 2	80,138	0.0				\$15,377	1.00%						
15	Bin 3	168,347	1.0				\$18,039	2.85%						
16	Bin 4	256,556	7.0				\$20,701	6.80%						
17	Bin 5	344,765	19.0				\$23,363	15.00%						
18	Bin 6	432,974	27.0				\$26,025	20.95%						
19	Bin 7	521,183	21.0				\$28,687	23.30%						
20	Bin 8	609,392	12.0				\$31,349	19.50%						
21	Bin 9	697,601	5.0				\$34,011	7.80%						
22	Bin 10	785,810	5.0				\$36,673	2.25%						
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33	Totals		100.0				0.00%	100.00%						
34														
35														
36														
37														

**Distribution Specifications**

Check the Boxes For the Portfolio To Be Included in the Distribution Analysis  
(Only 5 Total Portfolios May Be Selected)

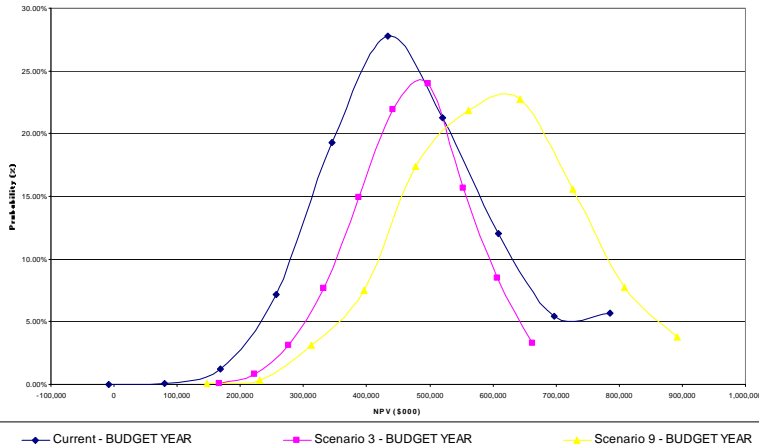
Current Portfolio  
 Risk Minimized Portfolio

Scenario 1 Portfolio  
 Scenario 2 Portfolio  
 Scenario 3 Portfolio  
 Scenario 4 Portfolio  
 Scenario 5 Portfolio  
 Scenario 6 Portfolio  
 Scenario 7 Portfolio  
 Scenario 8 Portfolio  
 Scenario 9 Portfolio  
 Scenario 10 Portfolio

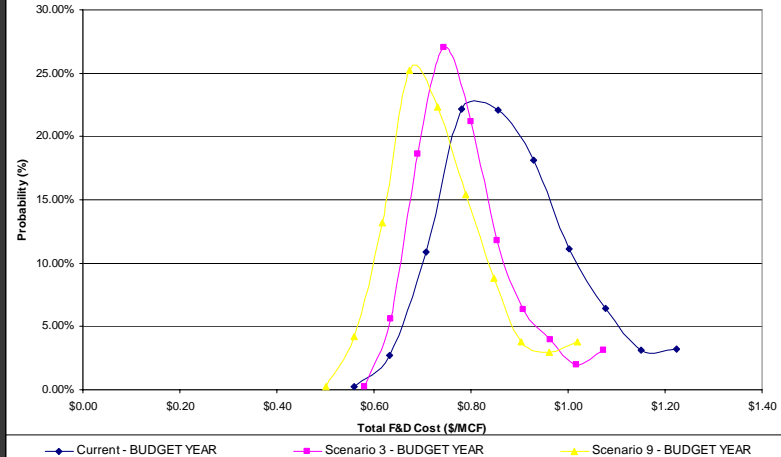
- User may select portfolios on frontier to simulate.
- Simulation reports uncertainty on all the firm's performance metrics.

# Simulation Provides Additional Insight

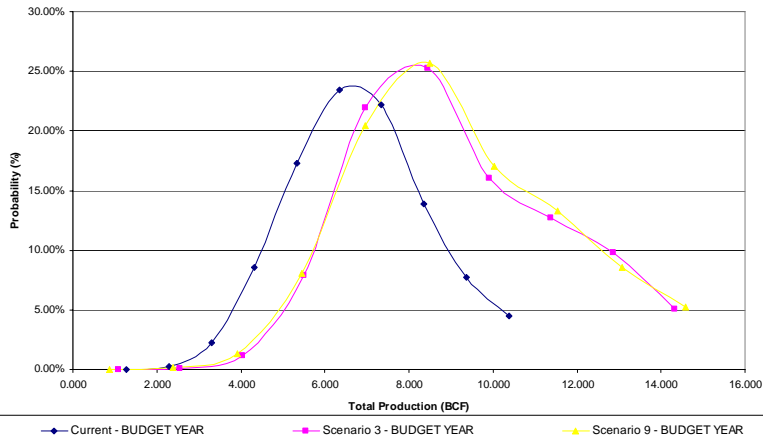
**NPV Distributions**



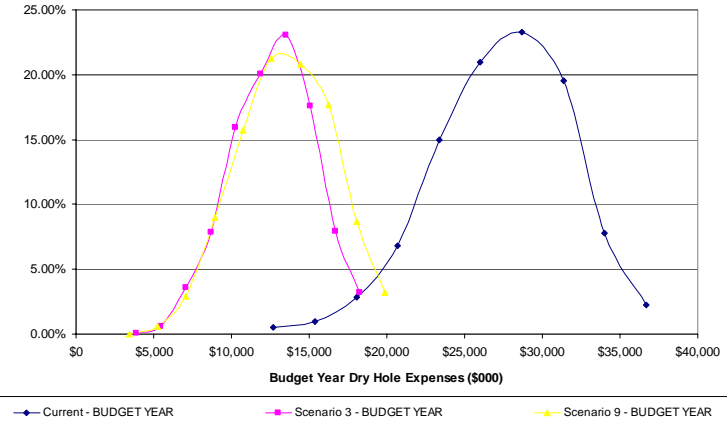
**F&D Cost Distributions**



**Production Distributions**

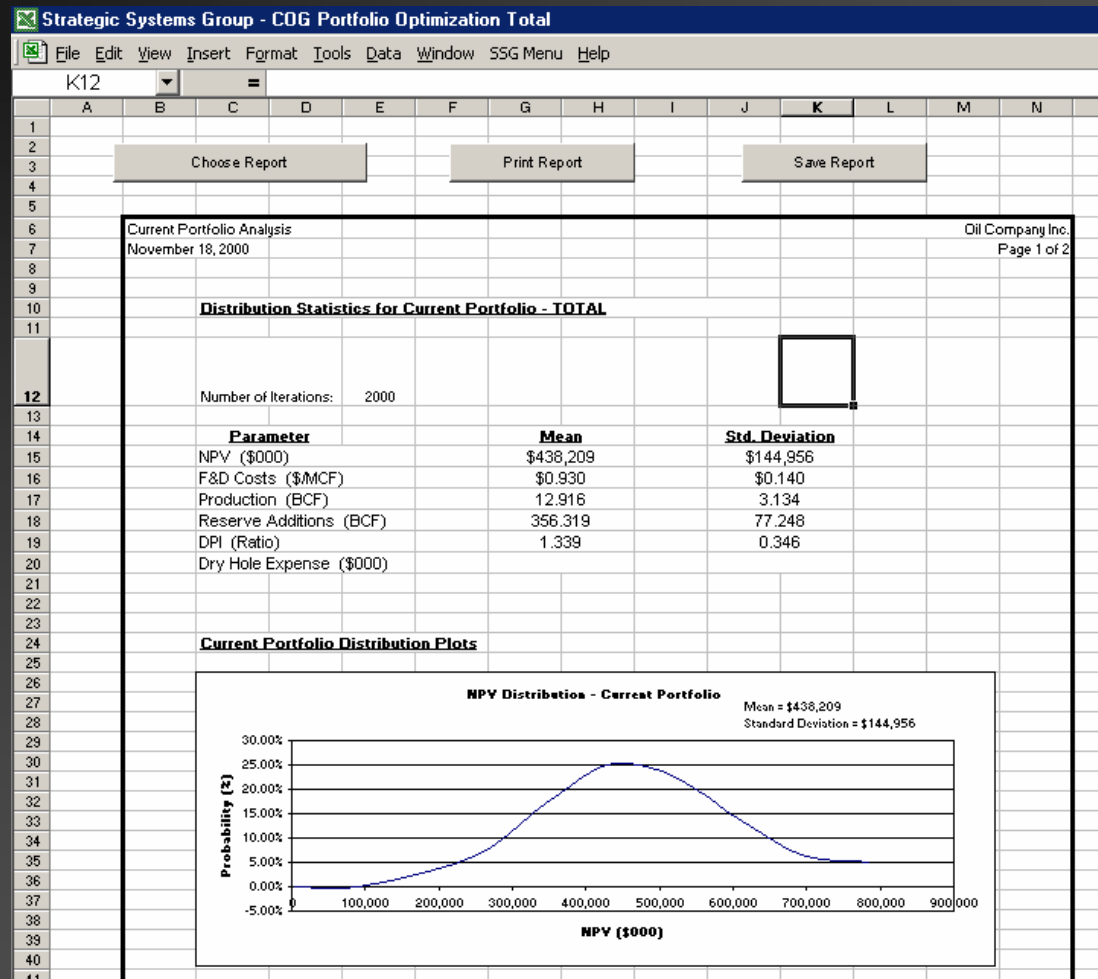


**Dry Hole Expense**



■ Compare uncertainty on multiple portfolios.

# Report Module Summarizes Results



- User may choose from multiple reports both for current and optimized portfolios.

# Summary

## ■ Model Components

- *Comprehensive portfolio management.*
- *Integrated risk management model.*
- *Up to 75 asset classes can be included in analysis.*
- *Designed for sensitivity and scenario analysis.*

## ■ Impact on Strategic Decision Making

- *Rich insights regarding your mix of assets.*
- *Comprehensive risk and return analysis.*
- *Guidance with regard to new ventures.*
- *Measurable impact on firm performance.*
- *Easy to use and understand.*