

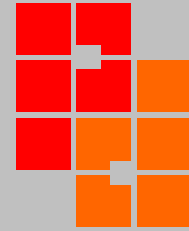
Consistent performance:

Reducing the impacts of price uncertainty through portfolio management practices

Paul D. Allan
PORTFOLIO DECISIONS, INC.

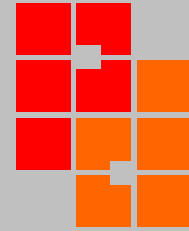
SPE Paper # 82001
SPE Hydrocarbon Economics and Evaluation Symposium
Dallas, Texas, U.S.A., 5–8 April 2003.

Overview



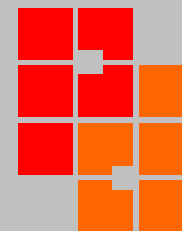
- Background
- Portfolio Model Description
- Methodology
- Conclusions

Background

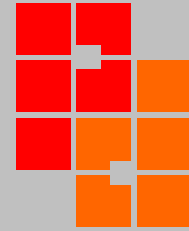


- Background: Why relevant? Why now?
- Portfolio Model Description
- Methodology
- Conclusions

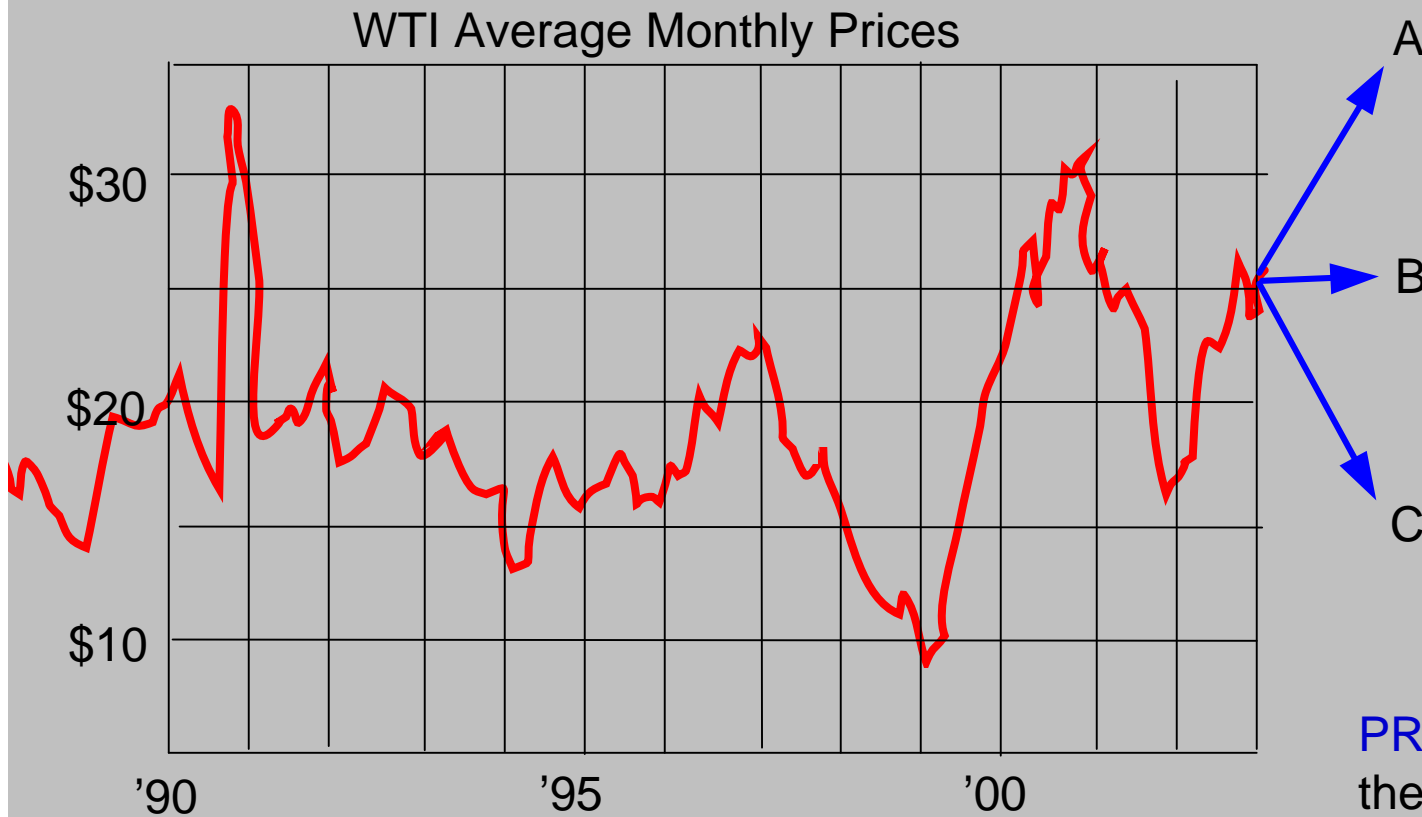
Background



- **Business Climate**
 - Market expects (rewards) consistent performance
... as long as consistently good performance
 - Performance measures often driven by product pricing (Operating income, NCF, ROCE...)
 - Pricing may represent one of the most significant uncertainties for many producers



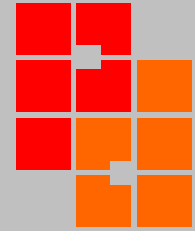
Background



Earnings = ?
NCF = ?
ROCE = ?

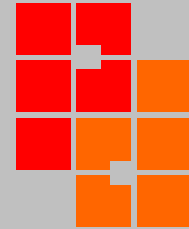
PRICE may represent the most significant factor in a company's ability to meet its performance **GOALS**...

Background



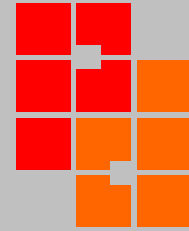
- **Business Climate: How are the impacts of price uncertainty managed?**
 - **Financial hedges** (options, collars, swaps...) allow producers to lock in results... at a cost
 - **Ignored** - can't control it and market expects exposure to price...at a cost...
 - **Portfolio Management** – Exploiting the natural 'hedging' of certain fiscal structures or opportunity timing...at a cost

Background

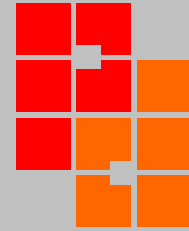


- What is required for portfolio management?
 - Understanding of portfolio **opportunities**, **goals**, and **constraints** necessary to effectively balance trade-offs (value the costs of the hedge benefit)
 - Complexity of business (project interactions, scale, uncertainties, options) makes ‘intuitive’ portfolio management difficult
 - Need quantitative approach to exploiting hedging effects of portfolio interactions

Portfolio Model Description

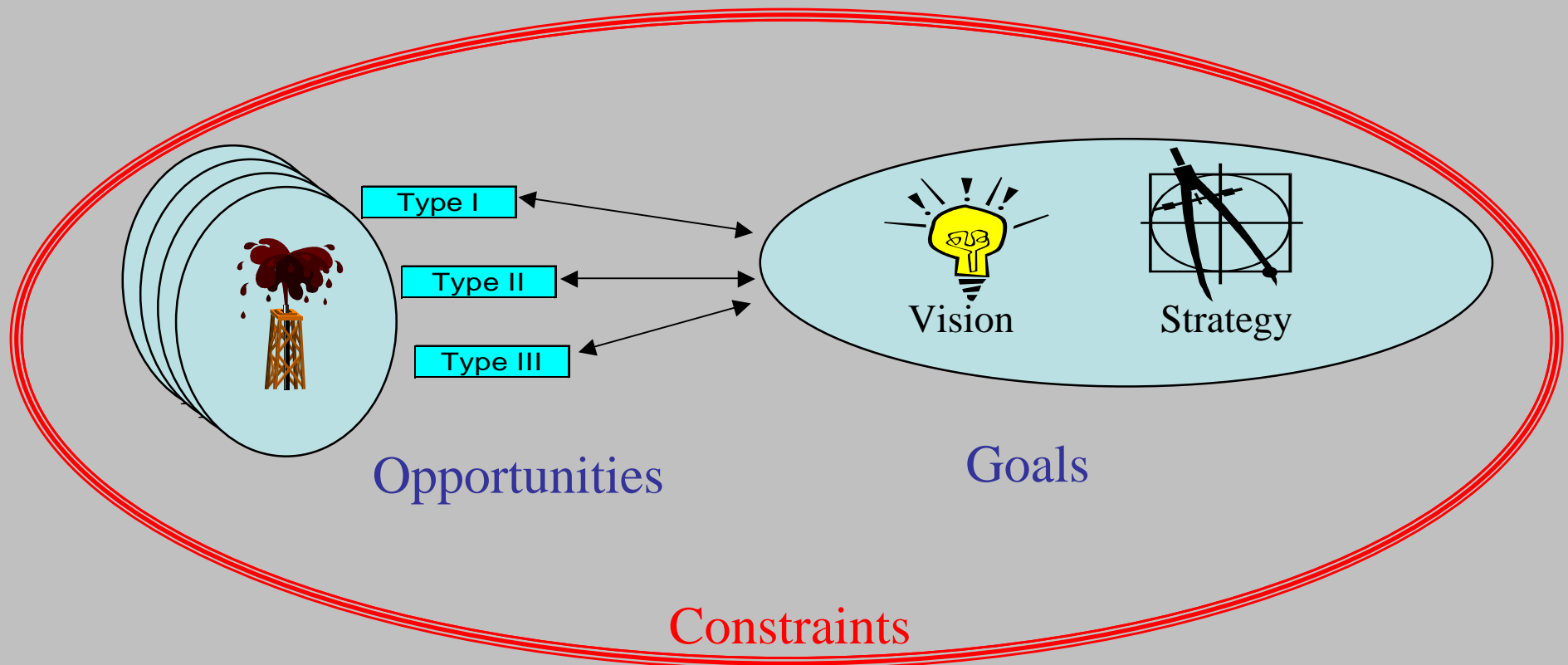


- Background
- Portfolio Model Description: Components
- Methodology
- Conclusions

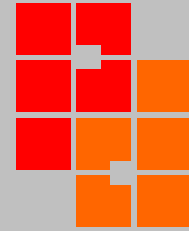


Portfolio Model Description

Opportunities – Goals - Constraints



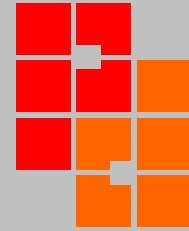
Portfolio Model Description



Opportunities

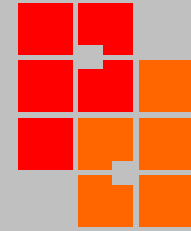
- Actual E&P Economic cases used (domestic & international)
- Consolidated cases into 95 unique 'Type' projects
- Simple stochastic descriptions (P10, P50, P90, Fail) for each project
- Each case evaluated at High, Reference, and Low price scenario (WTI Pricing) – used individual pricing offsets as appropriate

Portfolio Model Description



Opportunities: Pricing assumptions

- High Price scenario: WTI = \$25.00 per bbl (flat)
 - Reference scenario: WTI = \$19.50 per bbl (flat)
 - Low Price scenario: WTI = \$17.00 per bbl (flat)
-
- Flat pricing used for simplicity / demonstration.
 - These techniques would equally apply with time variable pricing assumptions.

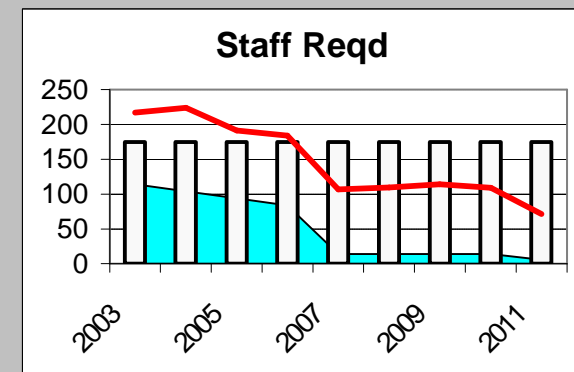
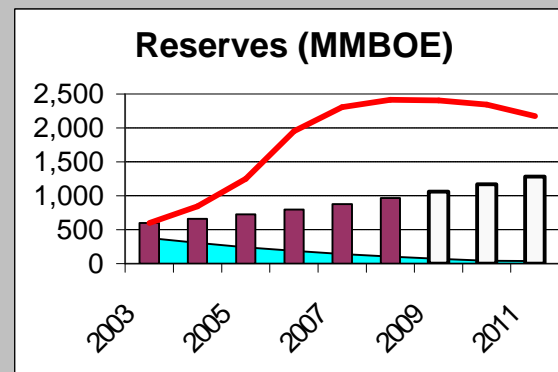
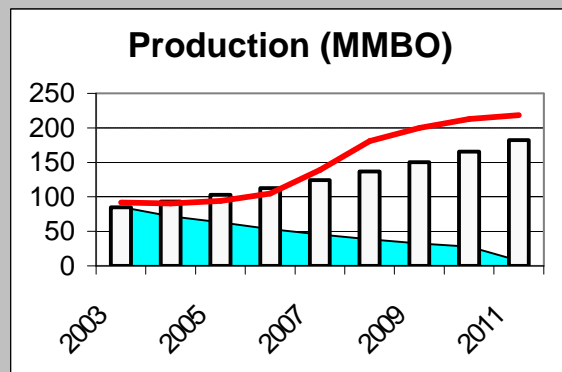
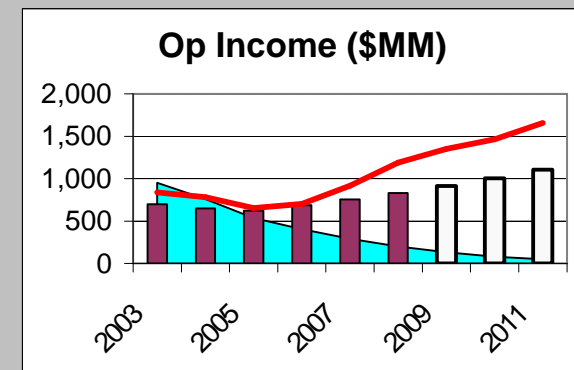
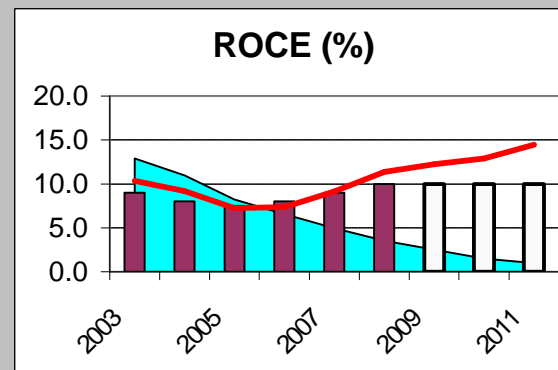
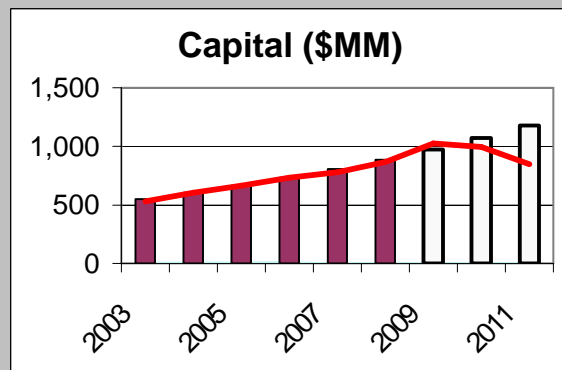


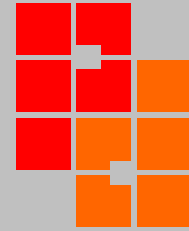
Portfolio Model Description

Goals, Constraints

Initial Reference Portfolio

Reference Price (WTI = \$19.50)



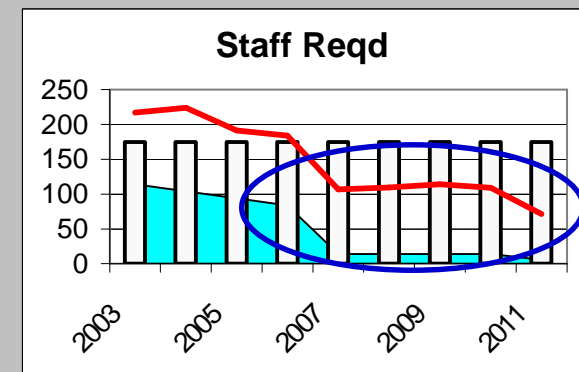
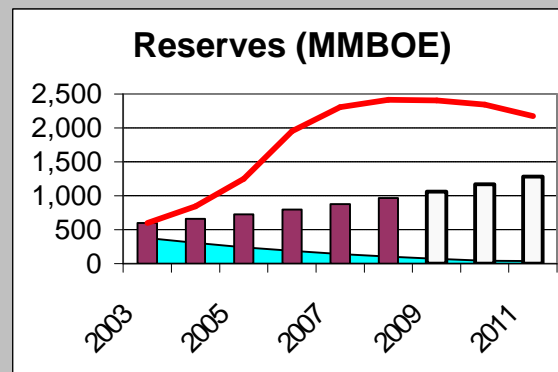
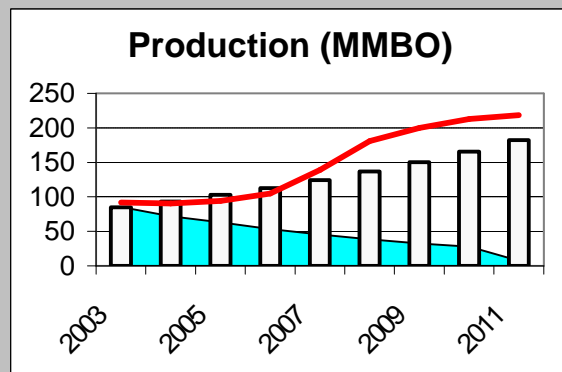
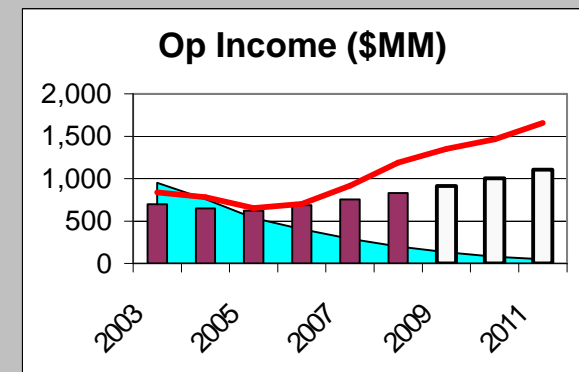
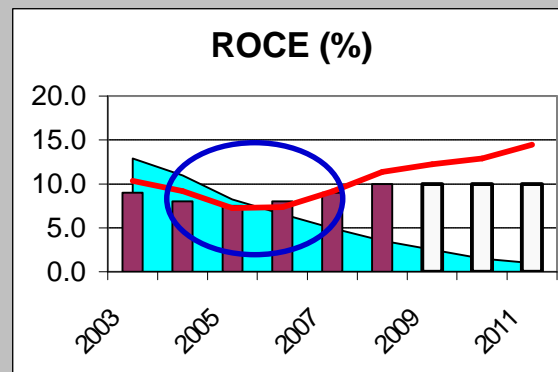
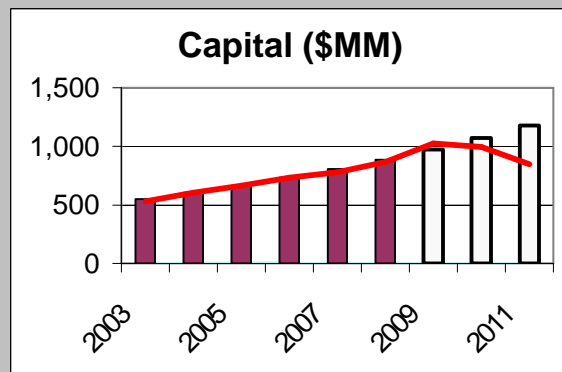


Portfolio Model Description

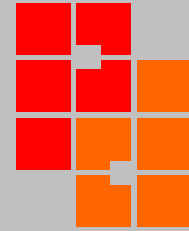
Goals, Constraints

Initial Reference Portfolio

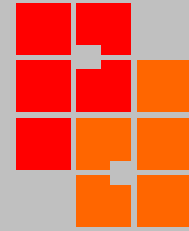
Reference Price (WTI = \$19.50)



Methodology



- Background
- Portfolio Model Description
- Methodology – Applied Portfolio Analyses
- Conclusions

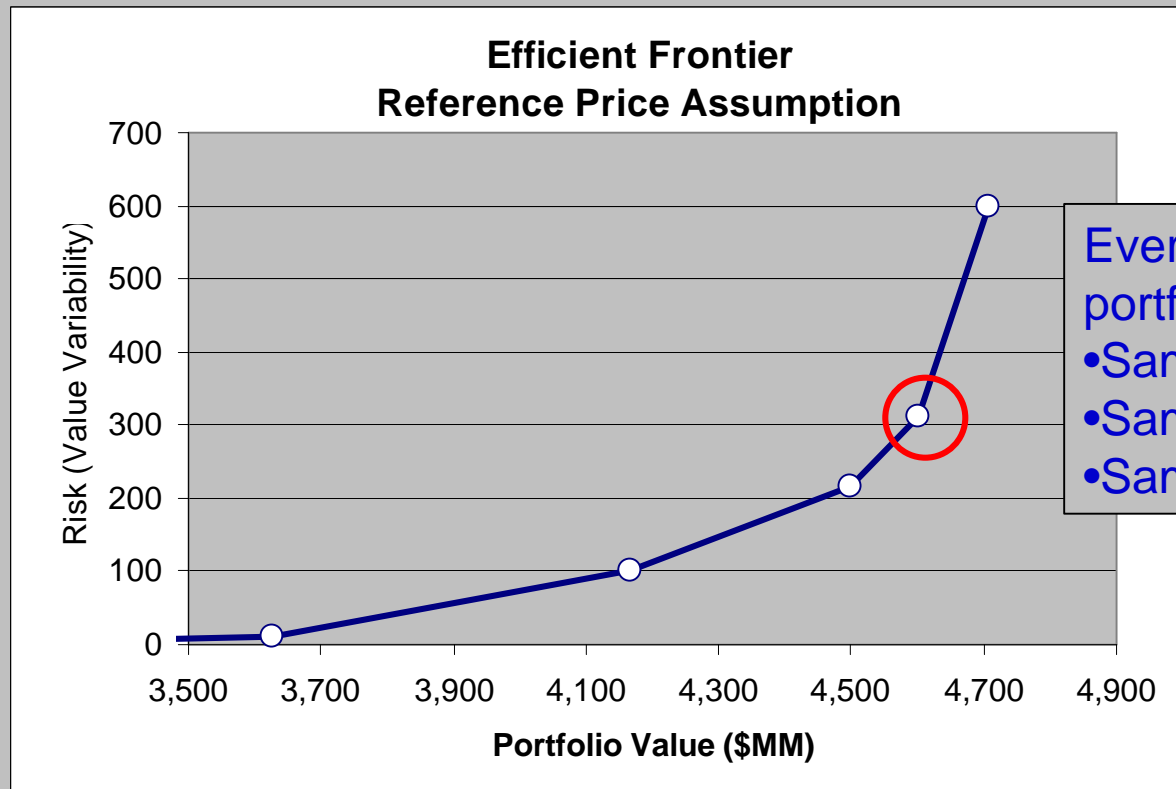


Methodology

Developed Efficient Frontier for Reference Strategy
Evaluated portfolio trade-offs for this strategy

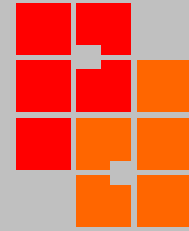
Initial Reference Strategy

Reference Price (WTI = \$19.50)



Every point represents a unique portfolio combination:

- Same inventory of opportunities
- Same goals
- Same constraints



Methodology

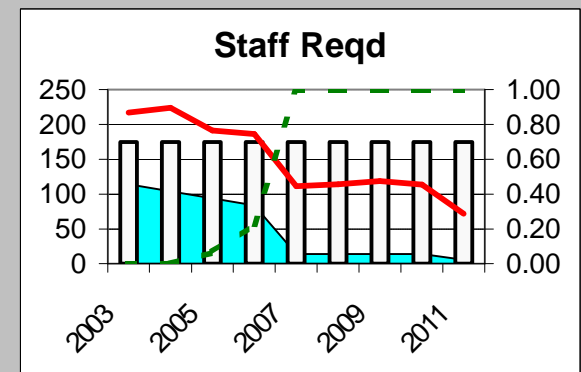
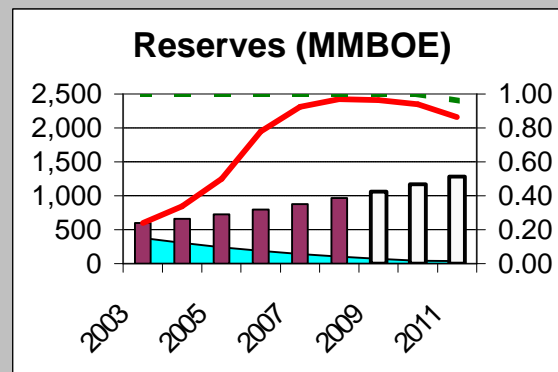
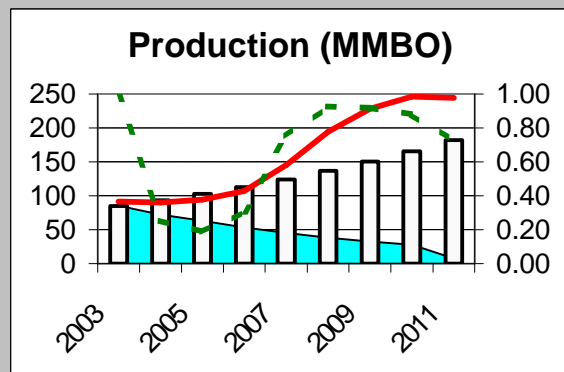
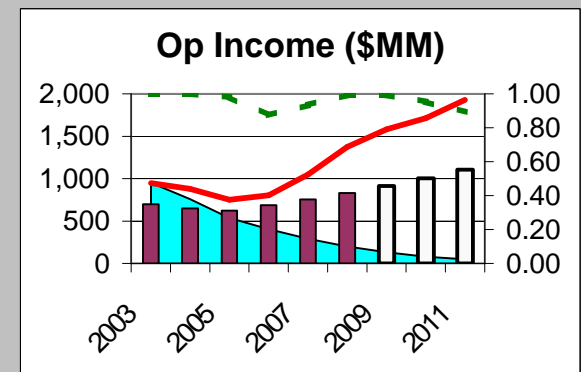
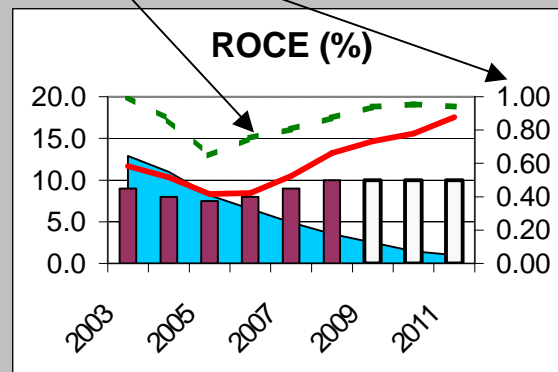
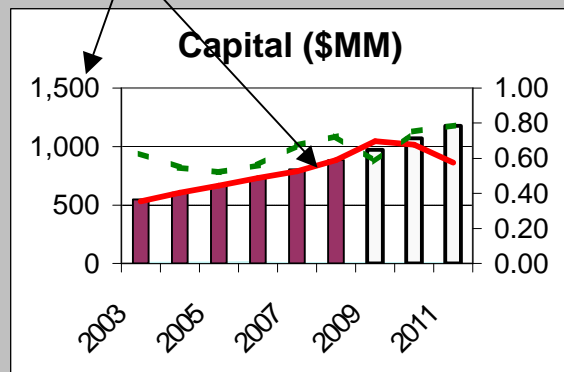
Evaluated specific portfolios

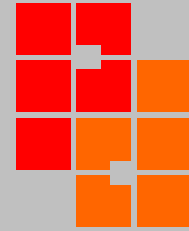
Expected Value

Probability of Achieving

Reference Portfolio

Reference Price (WTI = \$19.50)





Methodology

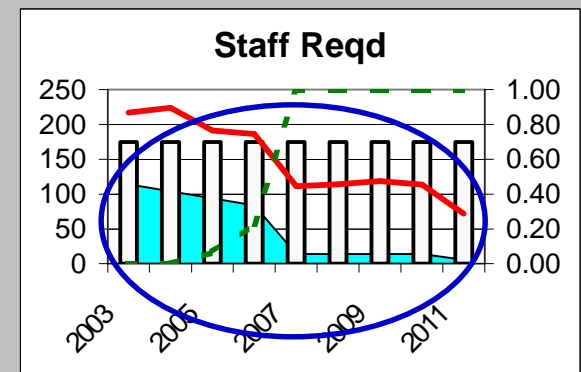
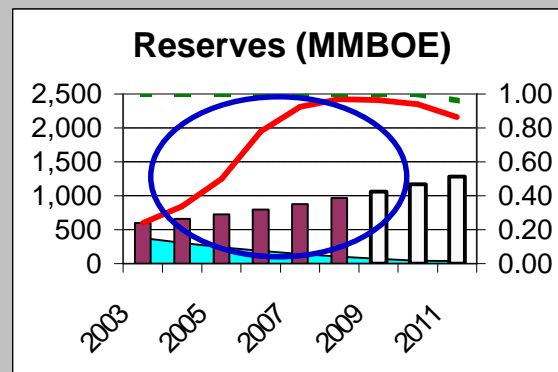
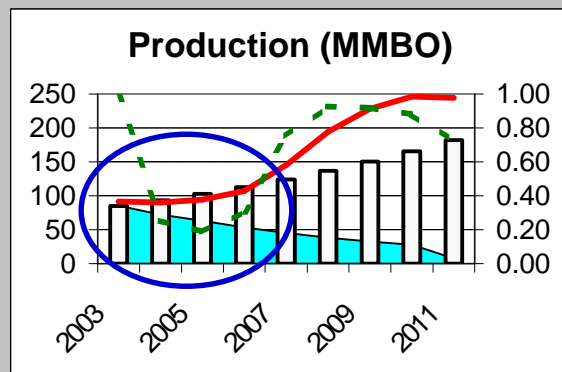
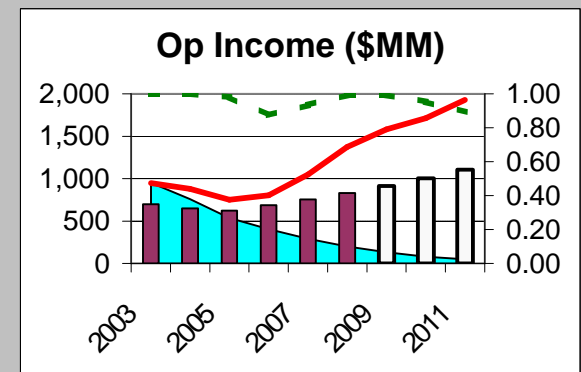
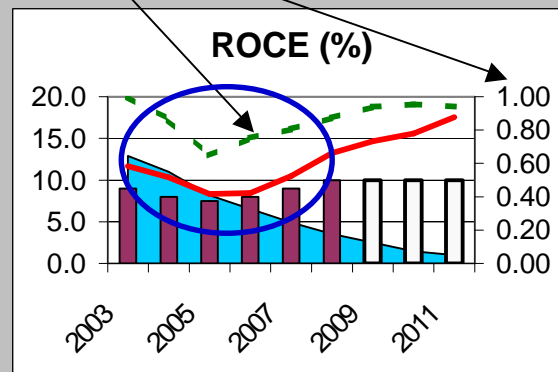
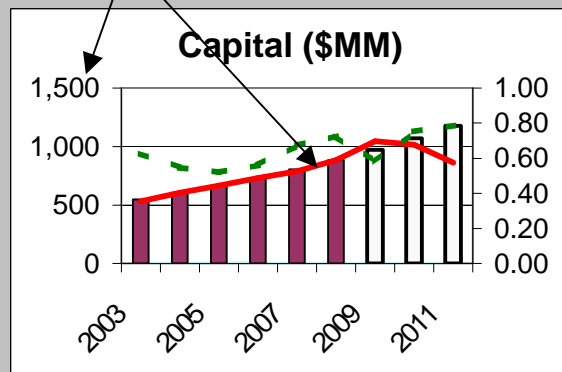
Evaluated specific portfolios

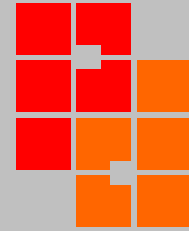
Expected Value

Probability of Achieving

Reference Portfolio

Reference Price (WTI = \$19.50)





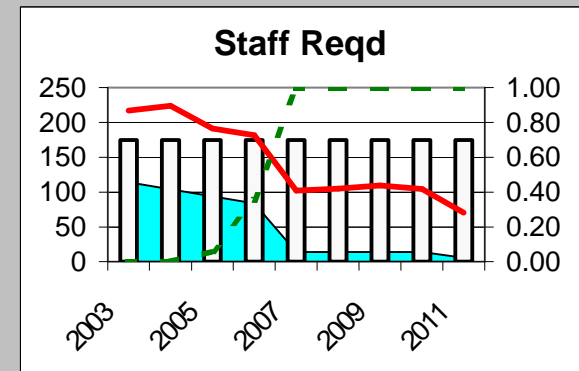
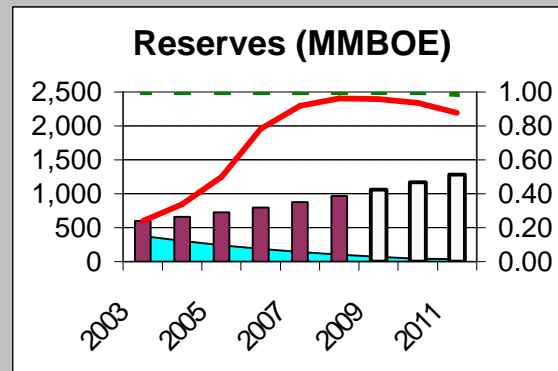
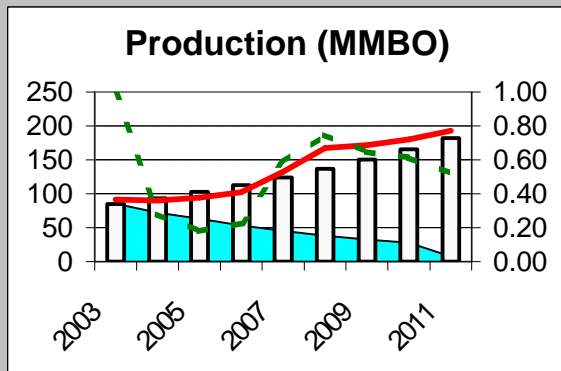
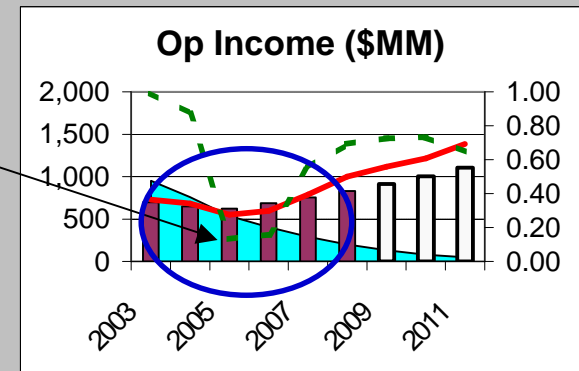
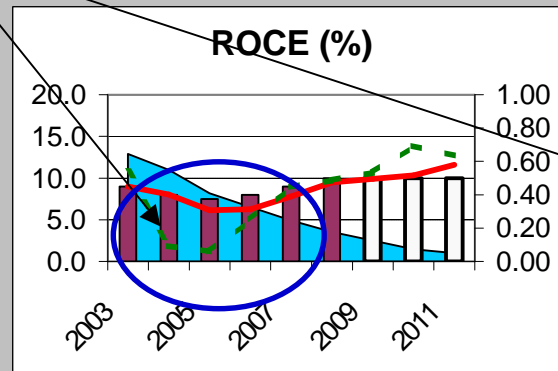
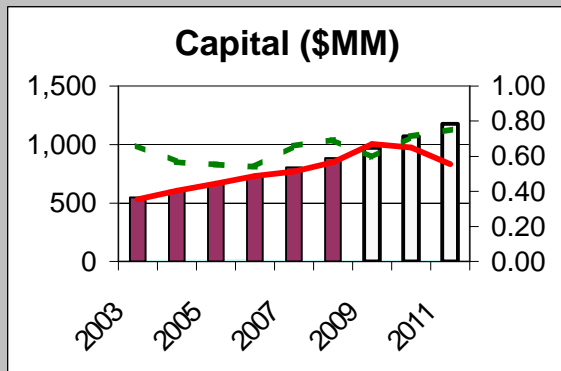
Methodology

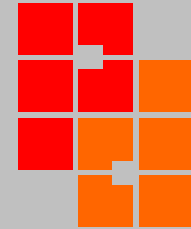
Reference Portfolio:
Unacceptable when Low Price applied

Probability < 10%

Reference Portfolio

Low Price (WTI = \$17.00)





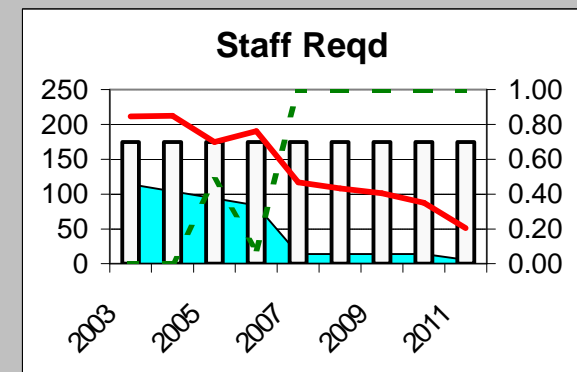
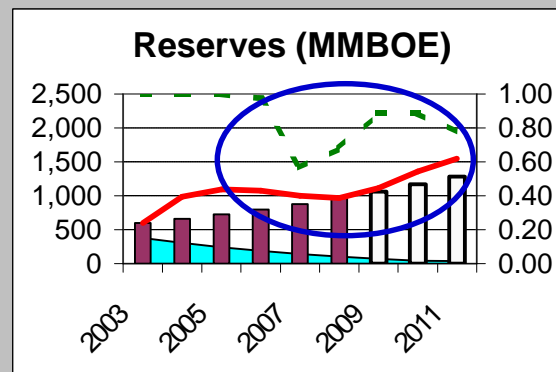
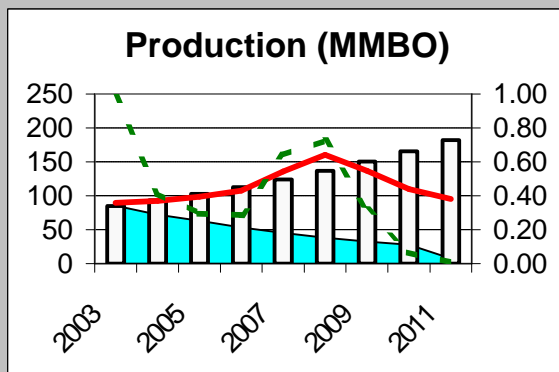
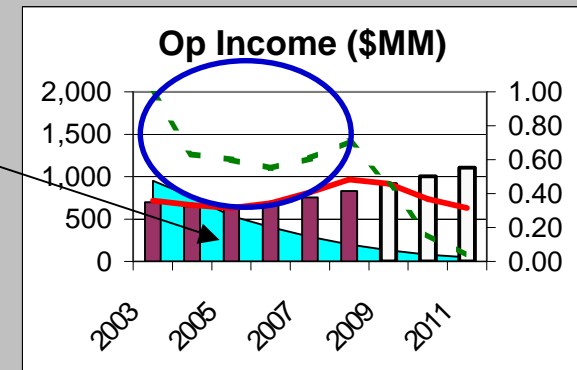
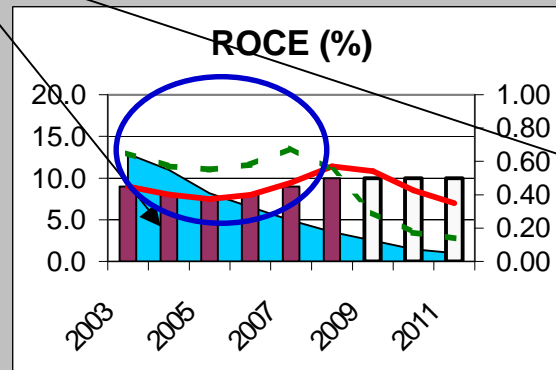
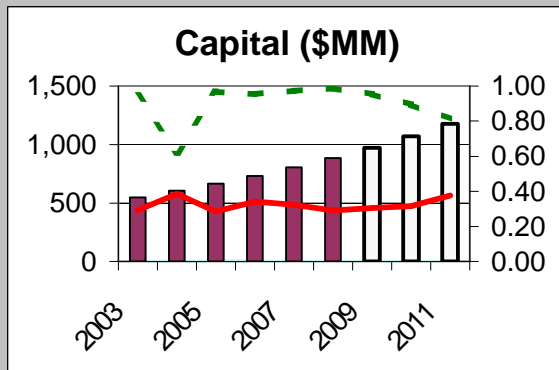
Methodology

When optimized under the Low price:

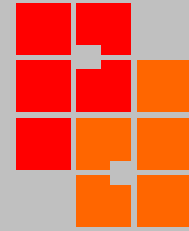
Probability from < 10% to over 55%

Low Price Optimized Portfolio

Low Price (WTI = \$17.00)



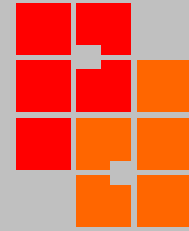
Methodology



Using Low Price assumption: Compared Low price optimized portfolio to the Reference portfolio

- Significant improvement in the probability of achieving the ROCE and Operating Income goals
 - Still met Reserves targets, but much lower growth in reserves
- A negligible difference between the portfolios (Low price and Reference price optimized) would have indicated insufficient project variety for hedging purposes

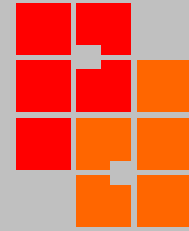
Methodology



Identified strategic projects: Low price optimized portfolio

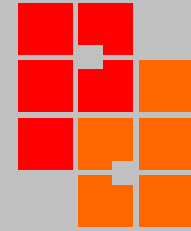
- **Beneteau** and **Baltic** project types not selected in Reference Price optimized portfolios – But, crucial to delivering performance in the Low price environment
- Evaluated **specific characteristics** that made these projects attractive under the low price assumption
 - These projects included PSC's, marginal return projects, and small production deals with low value, but rapid development

Methodology



Biased selection to include Low price performers

- **Beneteau** and **Baltic** projects forced into the portfolio
 - Projects locked 'on' prior to optimizing the portfolio at the reference price
- Low Price Biased portfolio delivers protection from the impacts of the low price scenario...at a cost



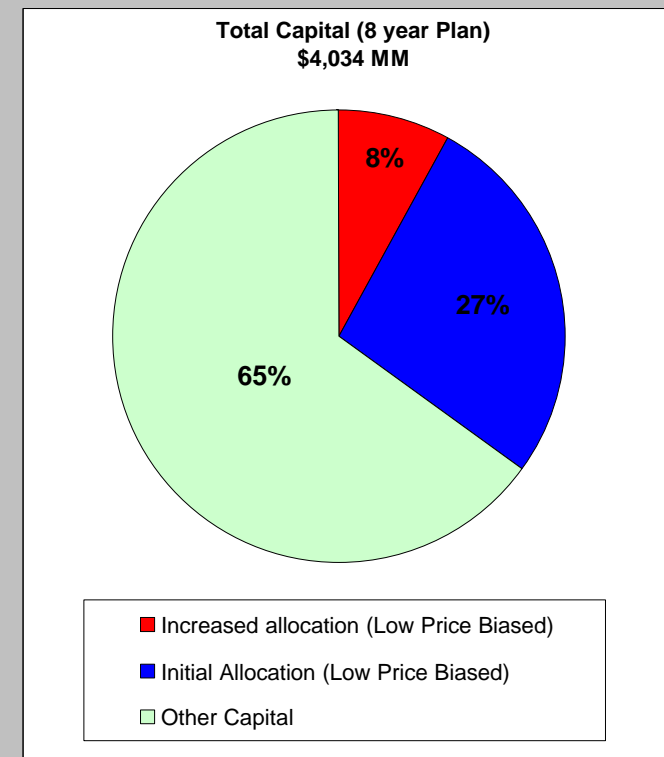
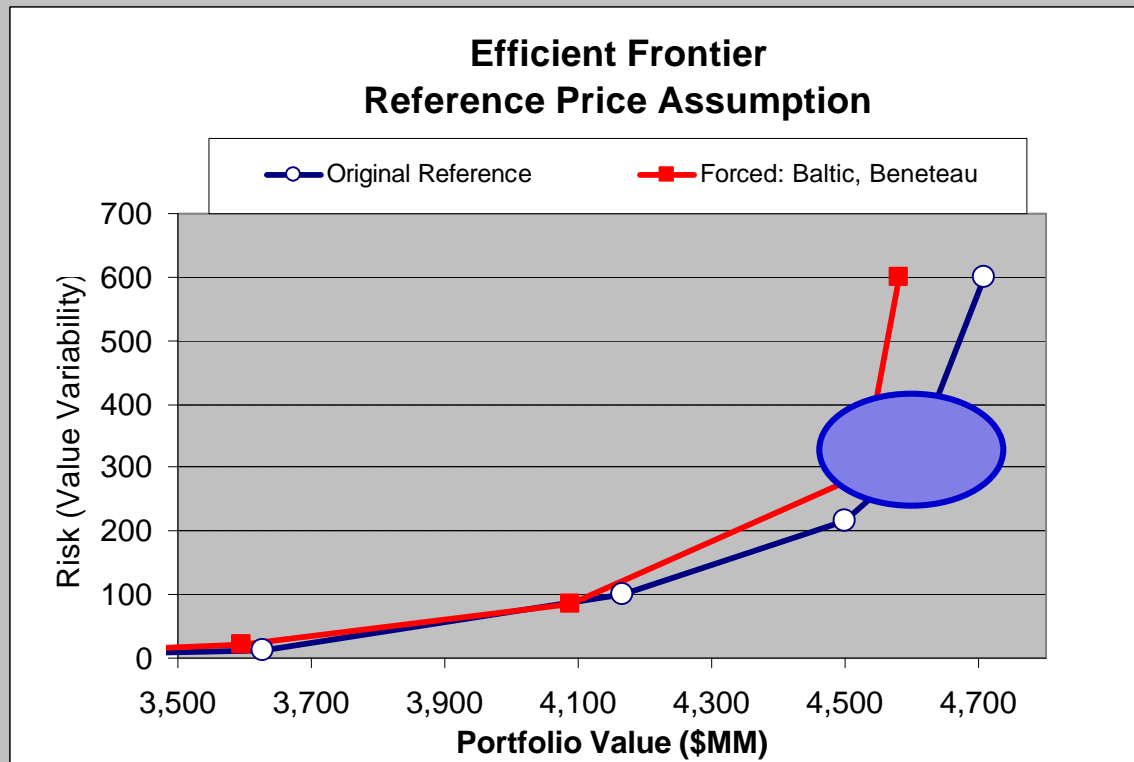
Methodology

Comparison between:

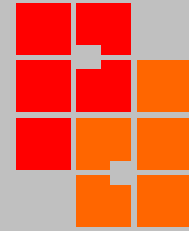
- Original Reference portfolio
- Low price biased portfolio

Reference Strategy

Reference Price (WTI = \$19.50)



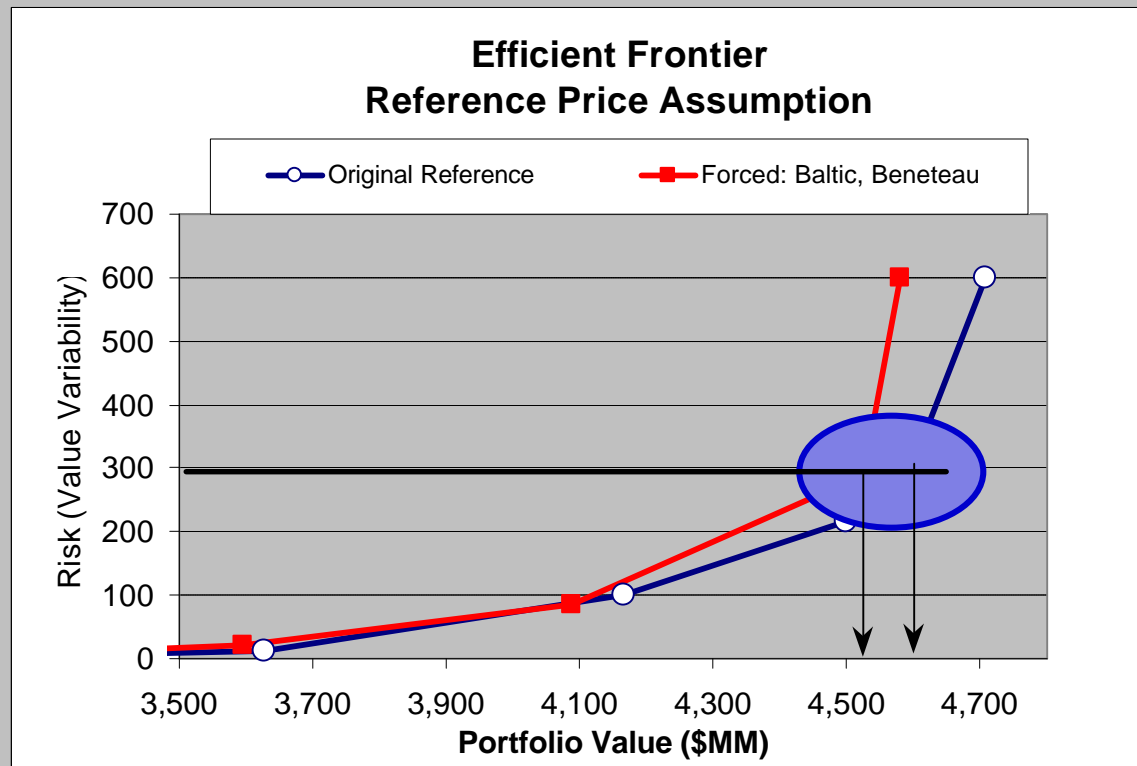
Methodology

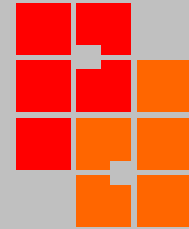


Difference represents the portfolio cost of applying the project 'hedge'

Reference Strategy

Reference Price (WTI = \$19.50)



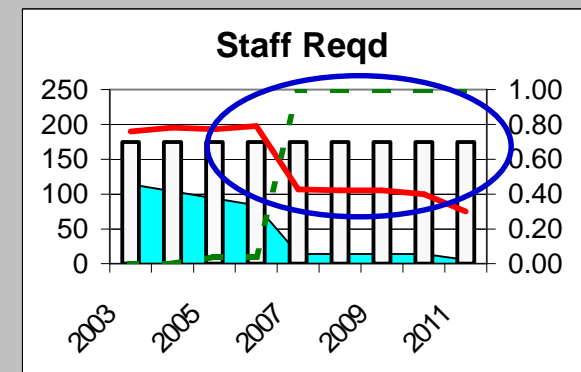
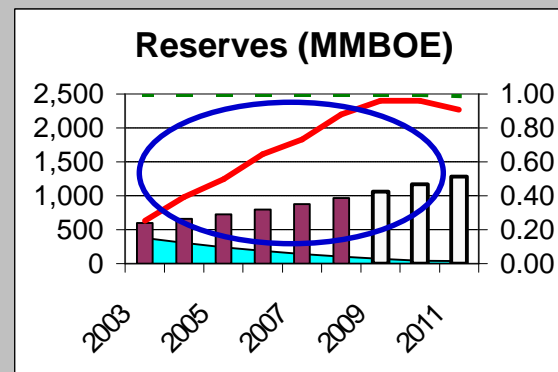
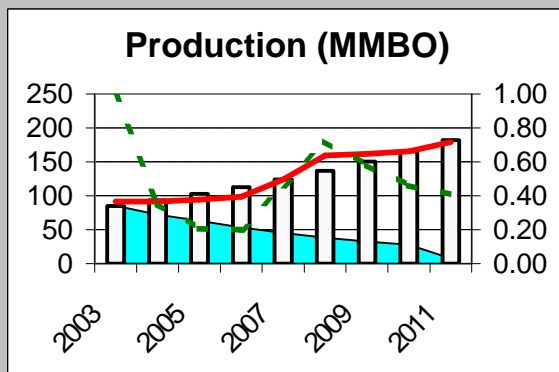
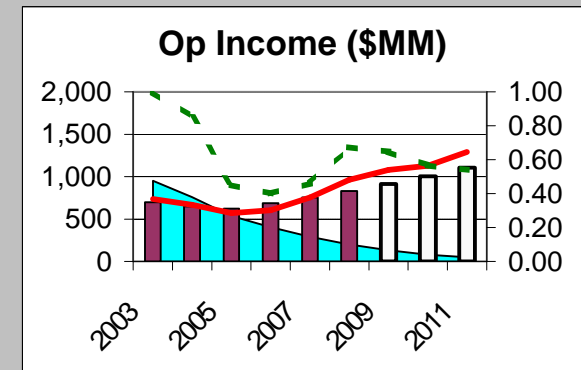
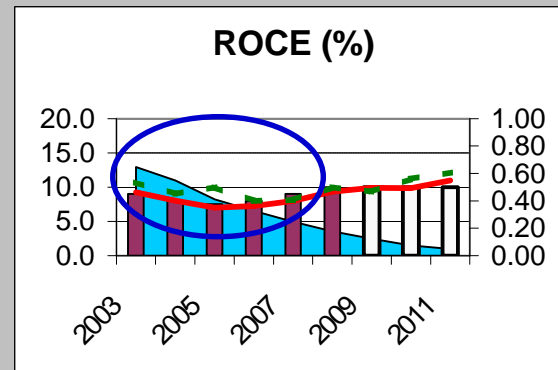
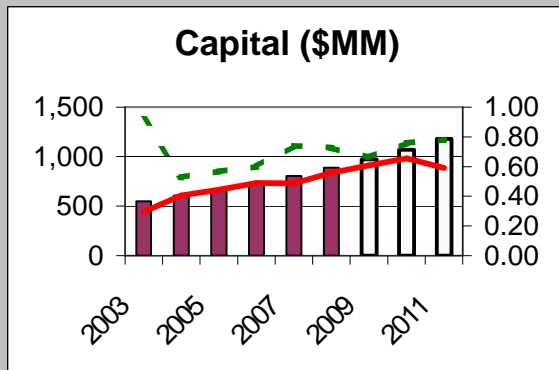


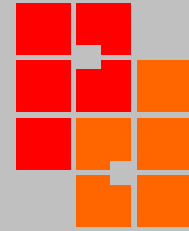
Methodology

Performance gain when portfolio
evaluated in the Low price environment

Low Price Biased Portfolio

Low Price (WTI = \$17.00)

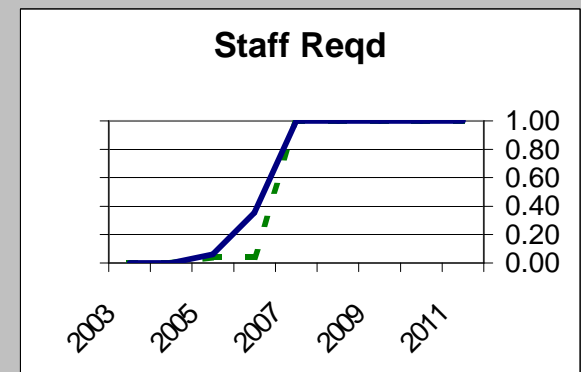
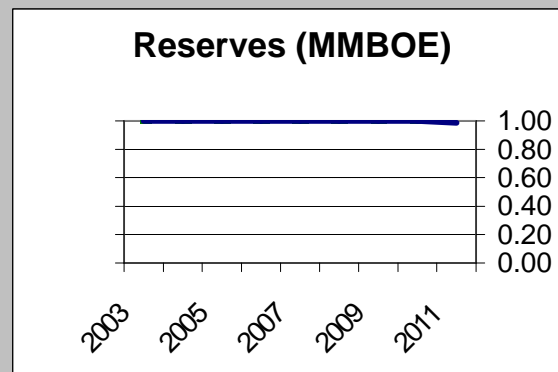
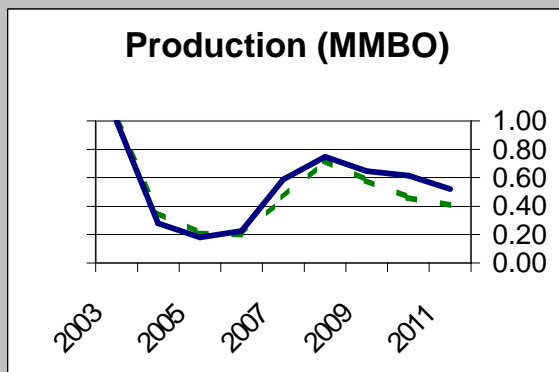
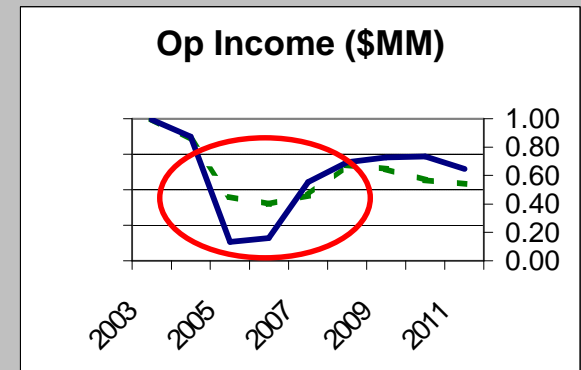
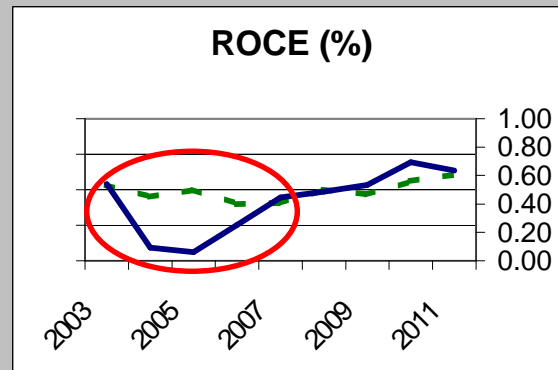
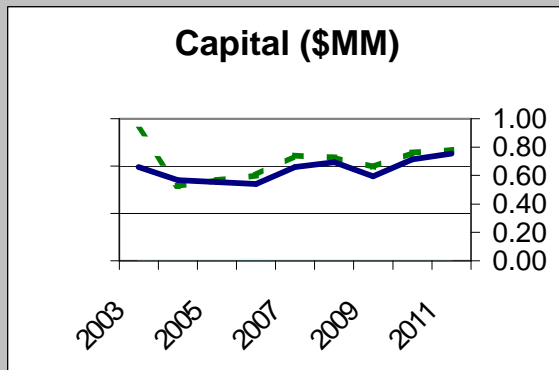


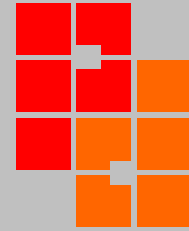


Methodology

Performance gain when portfolio
evaluated in the Low price environment

Reference Portfolio / Low Price Biased
Low Price (WTI = \$17.00)



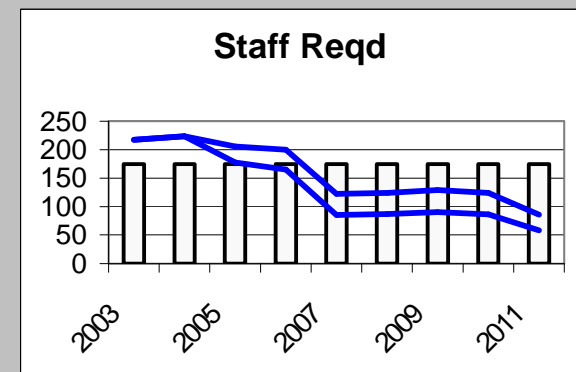
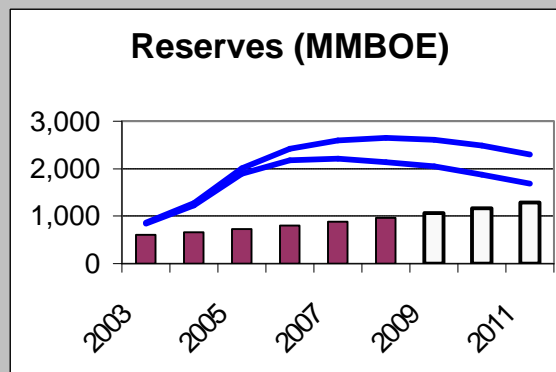
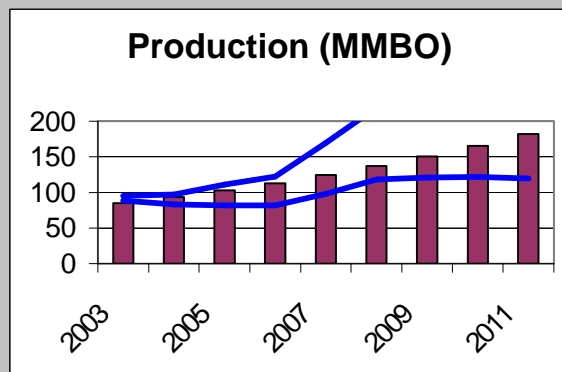
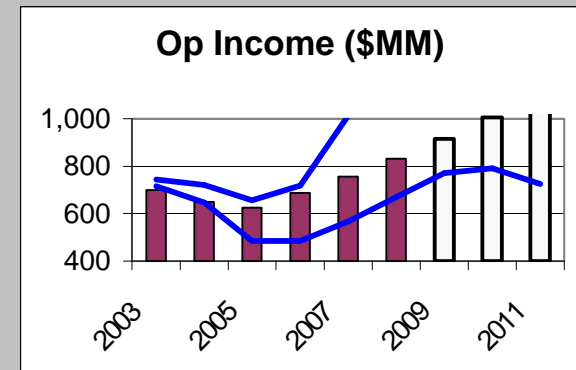
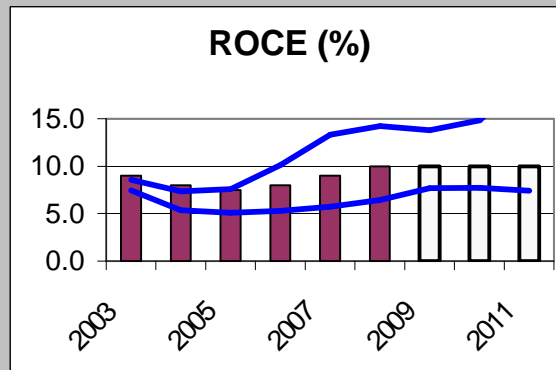
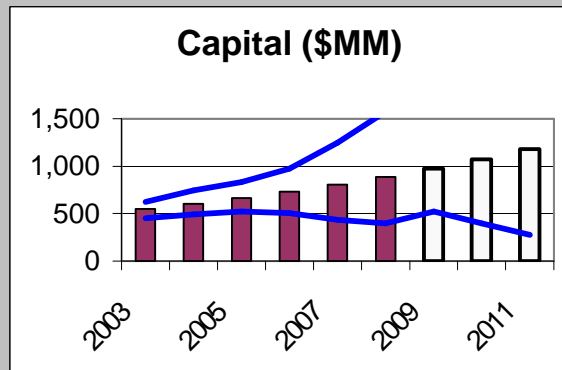


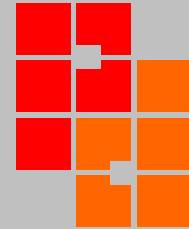
Methodology

Evaluated the range of outcomes for the:

Reference Portfolio

Low Price (WTI = \$17.00)



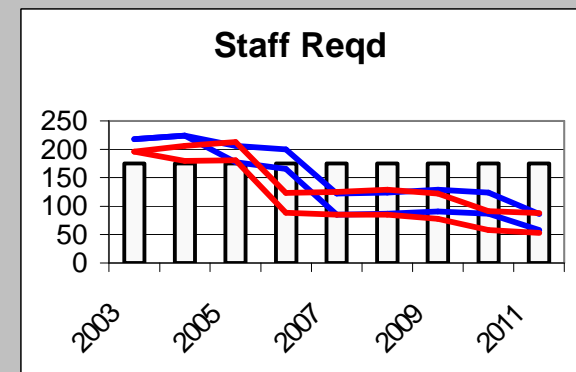
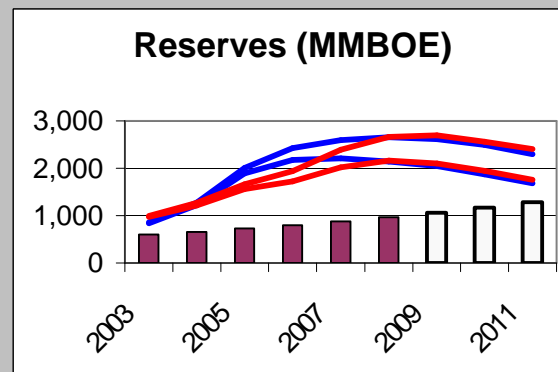
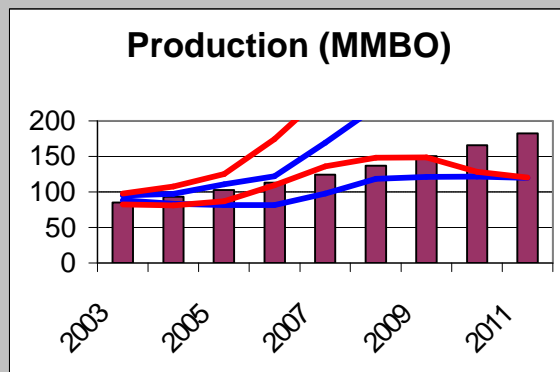
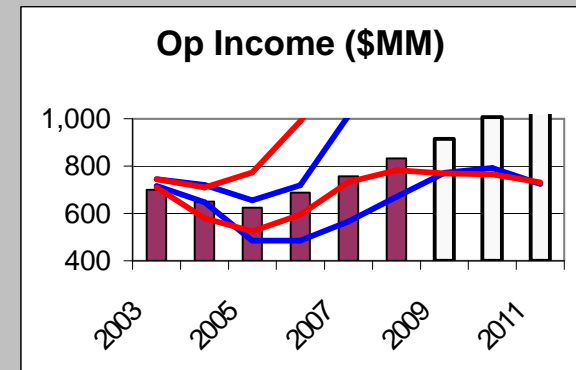
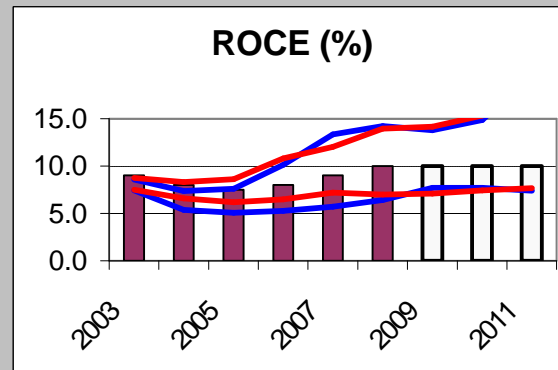
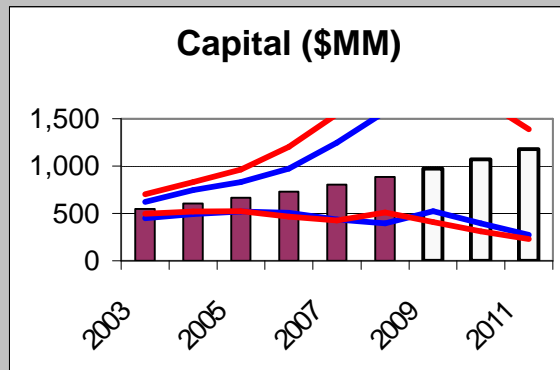


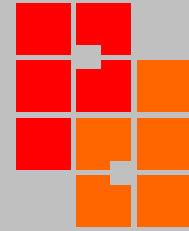
Methodology

Evaluated the range of outcomes for the:

Reference Portfolio / Low Price Biased

Low Price (WTI = \$17.00)



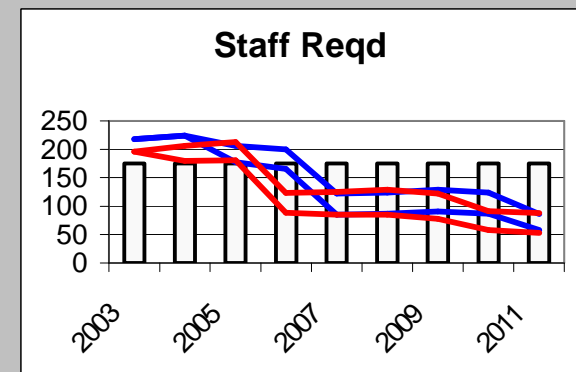
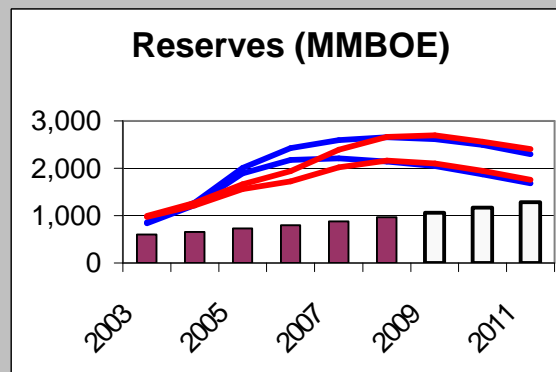
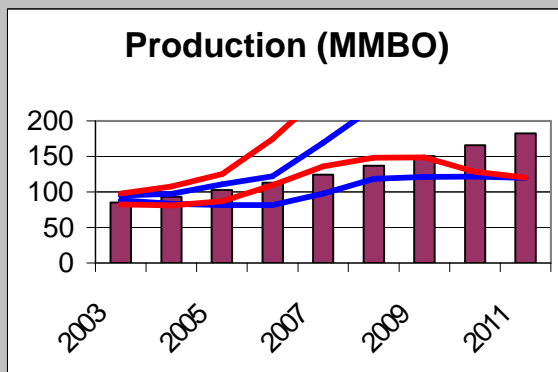
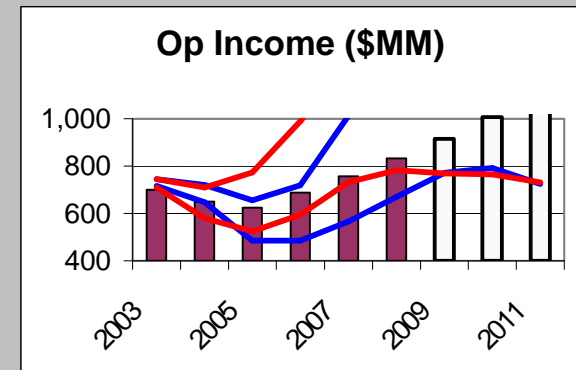
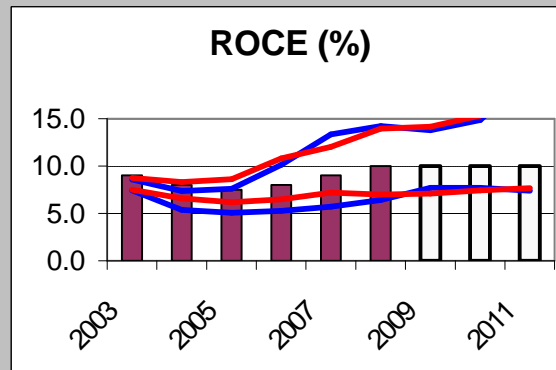
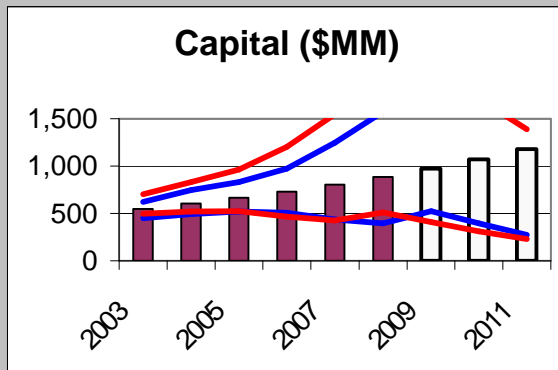


Methodology

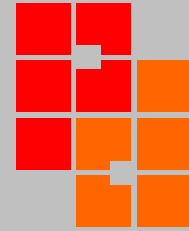
SIGNIFICANT ?

Reference Portfolio / Low Price Biased

Low Price (WTI = \$17.00)

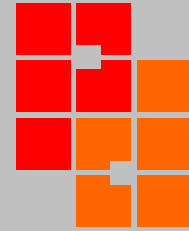


Methodology



Also Evaluated typical hedge (forward sell)

- Applied stochastic pricing model (Monte Carlo w/ price environment as a variable)
- Production volume sold forward at Reference price to equal project hedge impact (ROCE)?
 - Required 50% of production sold forward at Reference price
 - Significant lost opportunity when stochastic price assumption used (Reduced exposure to upside)



Conclusions

- Portfolio analysis techniques useful in evaluating project hedging potential.
- Biasing the portfolio selection can provide an effective tool for mitigating the impacts of price uncertainty.
- Thorough understanding of goals (level of confidence required and tolerance of outcomes) needed to fully evaluate hedging trade-offs.
- Pricing assumptions and alternative scenarios can have a significant impact on the types of projects selected.