

# ENERGY INC.

## Investment Project Analysis

**Fisoye Delano**



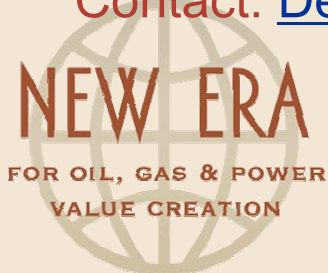
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# Background of Fisoye Delano

- Master, Petroleum Engineering. University of Houston
- Master, Business Administration. (MBA) University of Lagos
- Bachelor, Petroleum Engineering. University of Ibadan
  
- 1978      Joined Shell as a Wellsite Petroleum Engineer
- 1981      Joined Texaco. Worked in Nigeria, Trinidad and Tobago, United States.
- 2000      Senior Researcher, Institute for Energy, Law & Enterprise

Member, Society of Petroleum Engineers (SPE),  
Member, International Association for Energy Economics (IAEE)

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# Outline

- Time value of money
- Economic analysis concepts
- Economic Measures
- Cashflow model



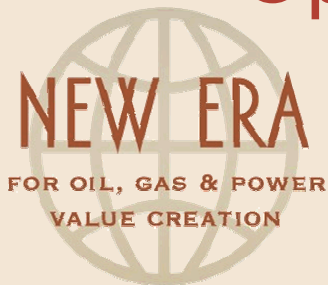
# Investment Project Analysis

- Applicable to all capital projects regardless of the dollar value
- Provides effective and consistent evaluation of investment opportunities
- Determines the most financially attractive projects
- Critical to financial decision-making



# Investment Project Analysis

- The focus is on capital investment analysis
- Also used in:
  - Asset valuation
  - Strategic and Tactical Plan
  - Asset sales
  - Opportunities for improvements



# Investment Project Analysis

- The results of this evaluation process are dependent upon the validity and reliability of the assumptions used in the analysis.
- Therefore, it is critical that the assumptions be carefully and realistically formulated.



## Other Considerations For Financial Decision Making

- Strategic implication of project
- Environmental implication
- Enhancement of the company's reputation



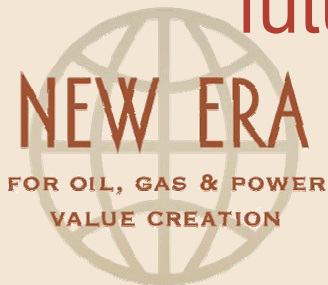
# Investment Project Analysis Concepts

## Time Value of Money

Present value theory.

This concept states that a dollar today is worth more than a dollar tomorrow since the dollar can be invested to earn money in the interim period.

- Future dollars in cash flow schedules are therefore discounted.
- The higher the discount rate, the less the future dollar is worth today.







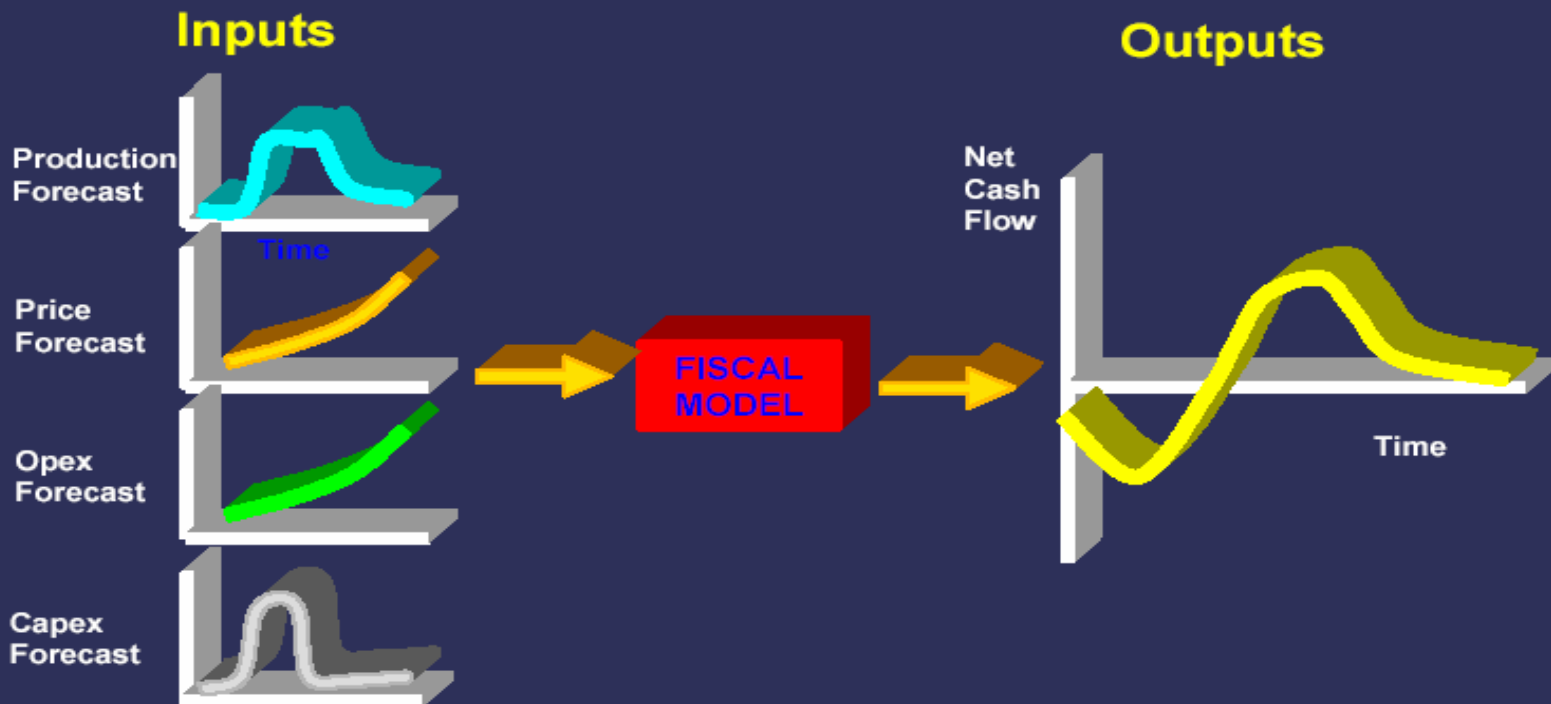
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**Present Value Theory**  
Spreadsheet Demonstration  
Switch to Spreadsheet  
Cashflow Analysis – Basics.xls



# Investment Project Analysis Concepts

## Development of Economics



# Economic Analysis Concepts

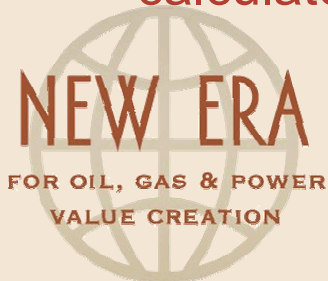
All project economic analysis should be performed based on the following concepts:

## Net cash flow to energy inc.

The cash flow from investment proposals must be analyzed on a comparable basis in order to determine which proposals have the greatest economic value to Energy Inc. Therefore all investments should be evaluated on the basis of after-tax U.S. Dollar cash flow to Energy Inc. A project's cash flow should include all foreign tax effects, such as income and remittance taxes, and any U.S. Income tax effects.

## Weighted average cost of capital (WACC)

This is the rate used to discount future project net cash flow. The cost of capital is the weighted average after-tax cost of debt, preferred and common stock in Energy Inc.'s capital structure. The WACC is calculated by the finance department and issued by the comptroller.



# Economic Analysis Concepts

## Current dollar basis.

All cash flow should be stated in current (nominal) dollars (i.e. actual amounts which are expected to be expended or received each year). Current dollar forecasts represent changes due to inflation and any real price change above or below inflation. The rates used should be consistent with the most recent forecast provided by corporate.

## Foreign currency exchange rates.

Forecasted cash flows based on local currencies should be converted into U.S. Dollars using current currency exchange rates.



# Economic Analysis Concepts

## Full cycle or full life economics.

- Economic value of an asset that was acquired in the past and had its value enhanced through additional investments.
- Results do not represent the current economic value to the firm since the analysis includes prior investment, revenue and expenses.
- Results include the benefit of hindsight and are useful to improve decisions made in the future.



# Economic Measures

The following four measures are commonly used in project analysis. Each one provides important information on the attractiveness of a project.

- Net Present Value (NPV)
- Present Worth Payout (PWP)
- Discounted Cash Flow Return on Investment (DCFROI or IRR)
- Present Worth Index (PWI)



# Economic Measures

## Net Present Value (NPV)

The net present value is the economic value expected to be generated by the project at the time of measurement. It represents the value being added to the Company by making the investment.

### Decision Rule – $NPV > 0$

#### Limitations

- A larger investment will normally have a larger present value. A ranking based simply on net present value would therefore tend to favor large investments over small investments.
- Does not consider length of time to achieve that value.





# Economic Measures

## Present worth index (PWI)

PWI measures the relative attractiveness of projects per dollar of investment. The ratio of the present value of cash inflows to the present value of the cash outflows.

Designed to address the limitation of NPV cited above .

### Limitations.

- It is not a good indicator of the significance of a project.
- Is dependent on cost of capital used. If cost of capital is over or underestimated could result in selection of wrong project.



# Economic Measures

## Present worth payout (PWP)

payout measures the time that the net investment will be at risk. The longer the payout period, the more chance for some unfavorable circumstance to occur.

### Limitation:

- Disregards cash flows received after the payout period. It does not directly measure the value created by the project.
- Is dependent on cost of capital used.



# Economic Measures

## Discounted cash flow return on investment (DCFROI/IRR).

Measures the efficiency of the project in producing value without reference to any predetermined cost of capital. The discount rate which equates the project's discounted net cash inflows with its discounted net cash outflows.

Decision rule –  $IRR > \text{Cost of capital}$ .

Limitation:

- Favors projects with a quick payout or short-term in nature.





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**Present Value Theory**  
Spreadsheet Demonstration  
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# Summary of Economic Measures

Measure	Strength / Purpose	Weakness / Drawback
<b>NPV</b>	Measures the economic value expected to be generated by the project at the time of investment. It represents the value being added to the Company by making the investment.	Does not consider time length to achieve that value. Is dependent on cost of capital used.
<b>PWP</b>	Measures the time that the net investment will be at risk. The longer the payout period, the more chance for some unfavorable circumstance to occur. Is also a value indicator. If a project that is expected to last 10 years has a 3 year payout, then 30% of the project's life is committed to recouping investment and 70% is devoted to creating value for the company.	Only measures the project result up to the time of payback. Disregards any cash flow received after payback. Is dependent on cost of capital used. Is not a measure of risk, only of time.
<b>PWI</b>	Measures the efficiency of invested capital. For every dollar invested, how efficient is it in producing value. Best measure for comparing and deciding between mutually exclusive projects.	Is dependent on cost of capital used. If cost of capital is over or underestimated could result in selection of wrong project.
<b>DCFROI</b>	Measures the efficiency of the project in producing value without reference to any predetermined cost of capital. When compared to the cost of capital DCFROI <i>can be</i> an indication of how effective a particular project is in adding value.	There are many reasons why an investment with a lower DCFROI could be preferred to a higher one. DCFROI assumes that project cash flows are reinvested at the same rate of return as the project generates. Favors projects with a quick payout or short-term in nature. It is a useful indicator when considered with the other 3 for comparing projects.



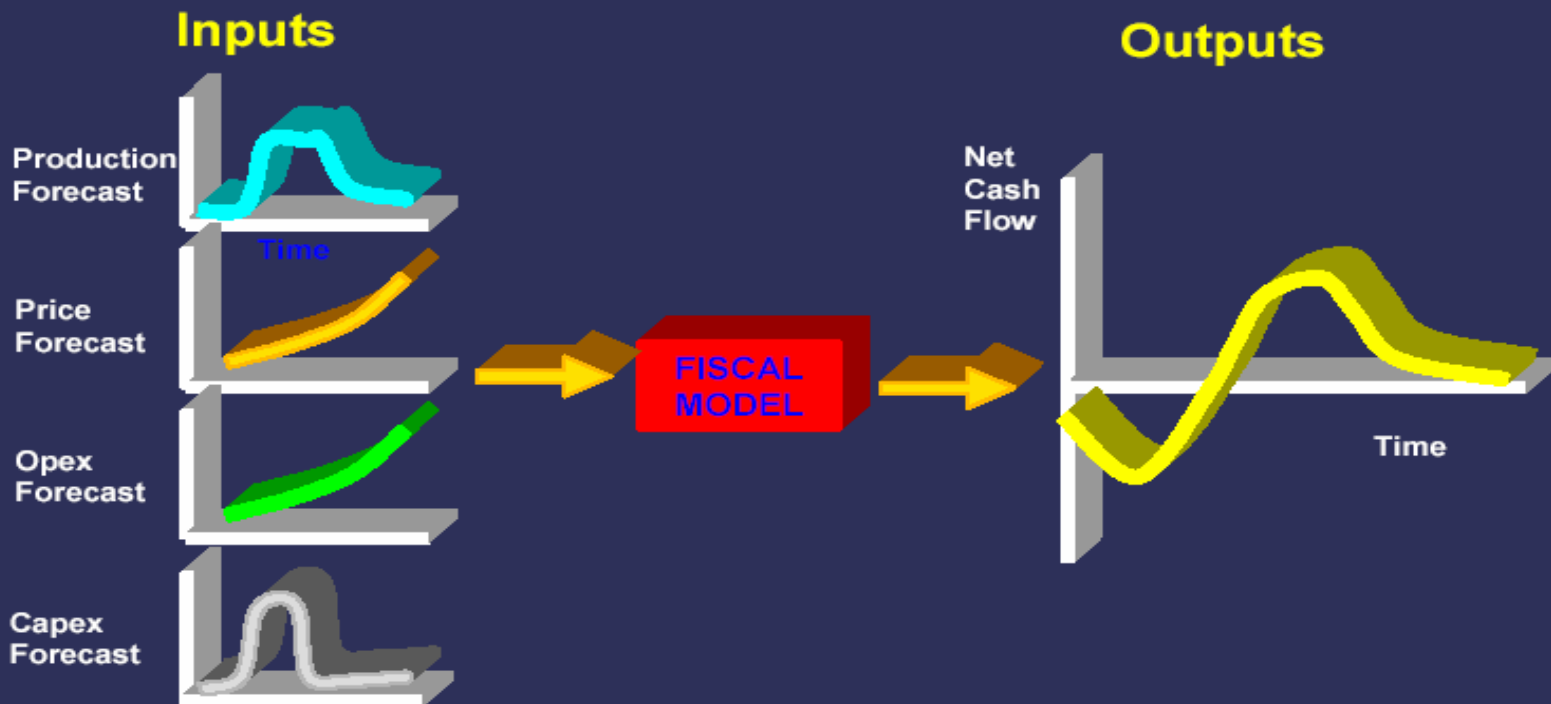
## Economic Measures

Therefore, it is important to use all the four economic measures (NPV, PWI, IRR and PWP) for investment project analysis.



# Investment Project Analysis Concepts

## Development of Economics





# Fiscal Model

## Contracts

- Concession Contract
- Participation Joint Venture Agreement
- Production Sharing Agreement
- Service Contracts



# Fiscal Model

## Royalties & taxes

- Royalties & tariffs
- Federal income tax
- State and local taxes
  - Severance tax
  - Ad Volorem tax
- Foreign tax credit
- Investment tax credit
- Wind fall tax



# Fiscal Model

## Depreciation, depletion & amortization (DD&A).

*Recovery of the cost of a fixed asset by allocating the cost over the estimated life of the asset.*

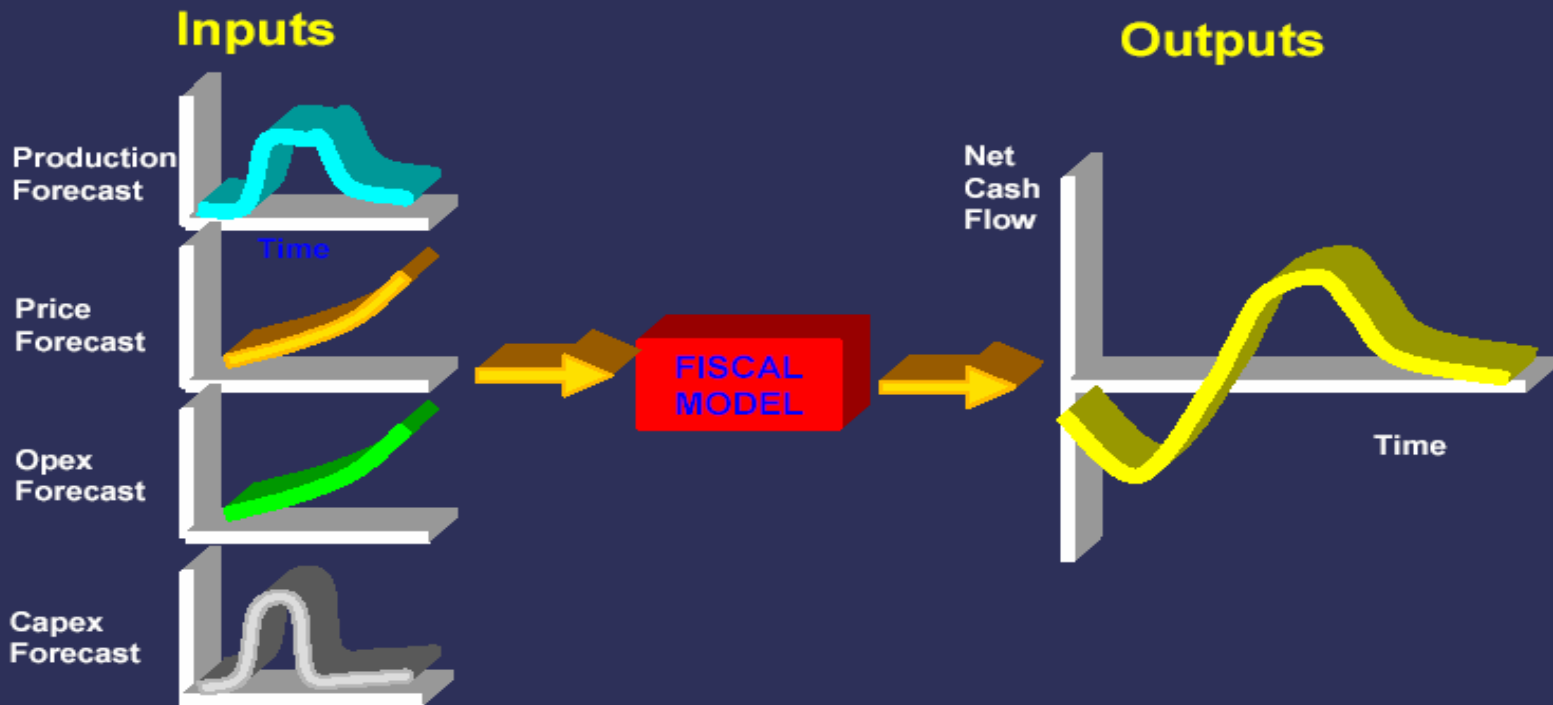
- Methods.
  - Straight-line decline (SLD).
  - Sum-of-the-year's digit (SYD).
  - Declining balance (DB).
  - Double declining balance (DDB).
  - Unit of production. (UOP)

Restoration and abandonment, Salvage value.



# Investment Project Analysis Concepts

## Development of Economics



# Input Elements

## Costs

- Capital cost estimate
- Operating cost estimate over the life of the project

## Revenue

- Production forecast
- Price forecast



# Input Elements

## Capital expenditure

Cash expenditures required to obtain the forecast benefits of a project, e.g., Acquisition of property, plant, and equipment, development costs, construction costs,

## For example oil & gas development

Geoscientists and engineers define and plan and cost out the optimum way to exploit the asset.

- Number of wells to be drilled
- Size of processing facilities
- Pipelines facilities to bring the products to point of sale



# Input Elements

## Operating expenses

- **Fixed operating expenses** - expenses directly attributable to the project's operations but unrelated to the level of activity, e.g., Maintenance, manpower, etc.
- **Variable operating expenses** - expenses directly attributable to the activity level of the project's operations, e.g., Fuel, power, feedstock cost, etc.
- **Overhead expenses** - increases or decreases in expenses in administrative functions which are indirectly attributable to the project, e.g., Research and development, accounting, computer



# Input Elements

## Production forecast.

For example for an oil and gas prospect a multidisciplinary asset development team made up of geoscientists and engineers predict:

- Recoverable reserves.
- Reservoir performance.
- Optimum economic method of development.
- Production profile.
- Time schedule for future investments.





# Input Elements

## Price forecast.

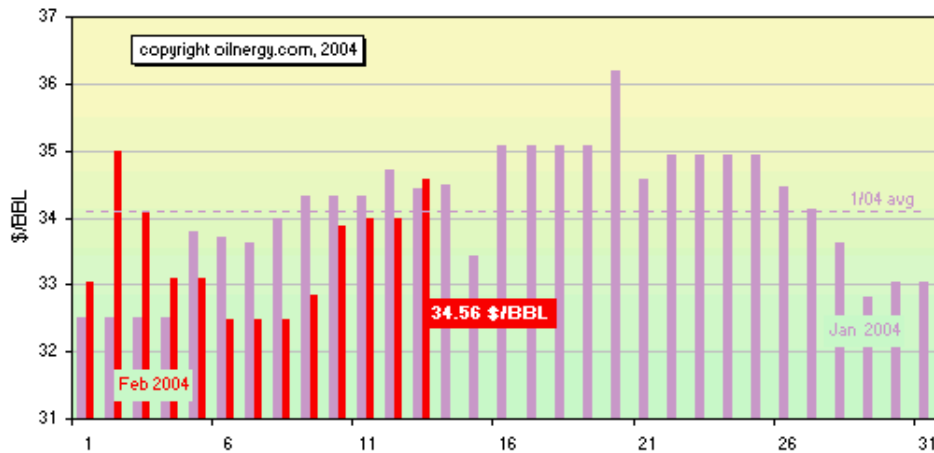
In today's era of price volatility, future price forecast are now as important if not more important than other engineering analysis in producing sound evaluation of projects.

To ensure consistency in project economic analysis prices used in the analysis should be based on prices provided by corporate in its periodic long term price forecast letter or other specific forecasts approved by corporate.

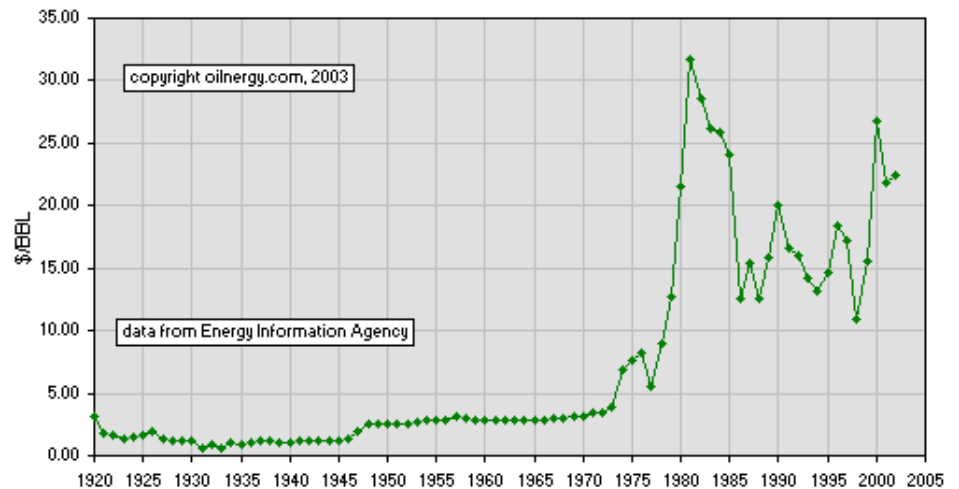


# Crude Oil Price Forecast

**NYMEX LIGHT SWEET CRUDE - DAILY OIL PRICE**  
2/1 → 2/13/04 avg \$33.46/BBL vs. Jan 2004 avg \$34.10/BBL

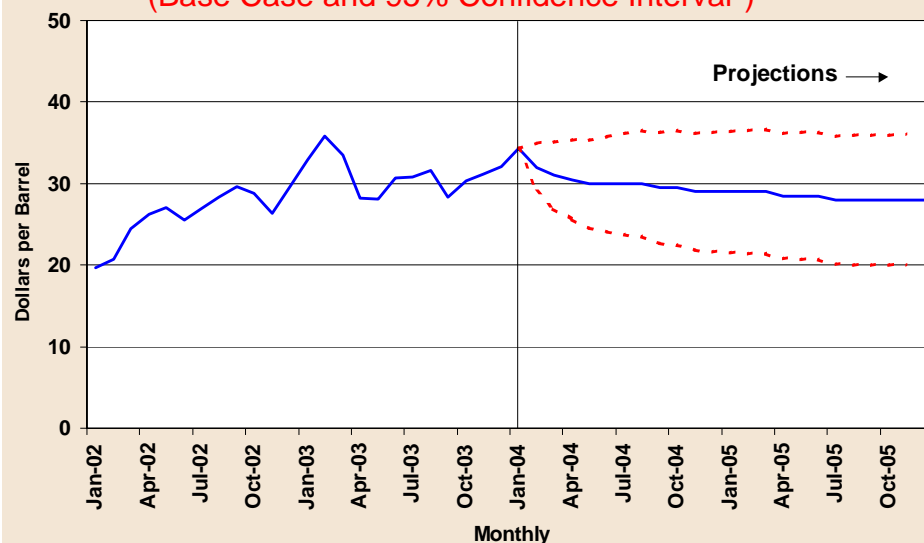


**U. S. First Purchaser's Crude Oil Price**



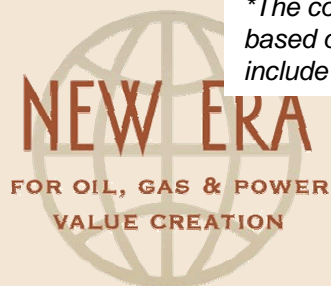
# Crude Oil Price Forecast

**Figure 4. West Texas Intermediate Crude Oil Price**  
(Base Case and 95% Confidence Interval\*)



Short-Term Energy Outlook, February 2004

\*The confidence intervals show  $\pm 2$  standard errors based on the properties of the model. The ranges do not include the effects of major supply disruptions.



## 12-month PETROLEUM FUTURES

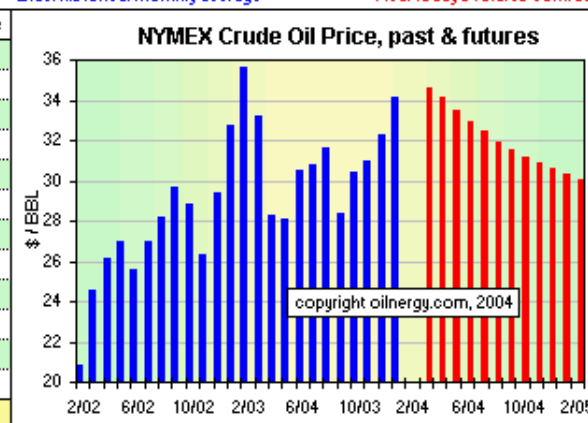
### NYMEX Light Sweet Crude Oil Price (\$/BBL)

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Blue: historical monthly average

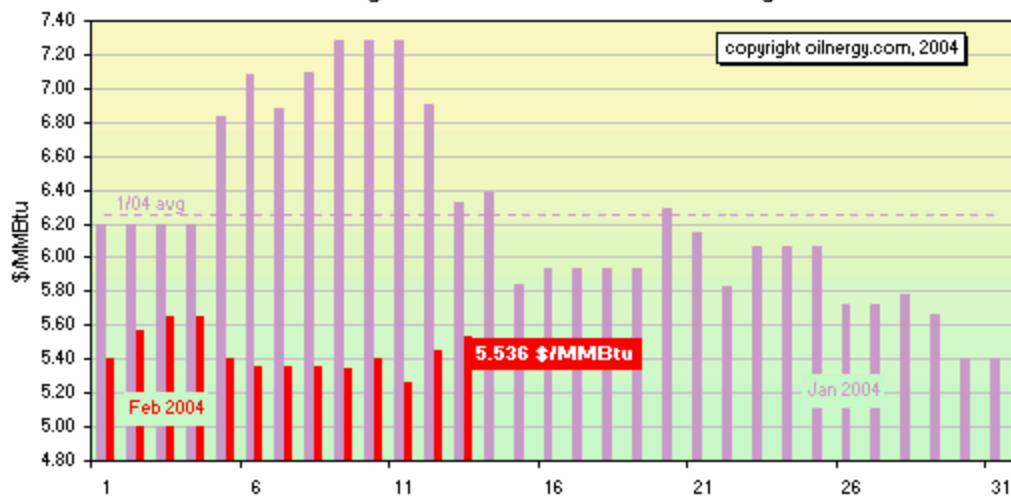
Red: today's futures contract

	2/13/04	2/12/04	Change
Mar-04	34.56	33.98	+ 0.58
Apr-04	34.10	33.38	+ 0.72
May-04	33.53	32.89	+ 0.64
Jun-04	32.96	32.38	+ 0.58
Jul-04	32.42	31.87	+ 0.55
Aug-04	31.92	31.40	+ 0.52
Sep-04	31.49	30.99	+ 0.50
Oct-04	31.15	30.68	+ 0.47
Nov-04	30.85	30.41	+ 0.44
Dec-04	30.60	30.17	+ 0.43
Jan-05	30.29	29.88	+ 0.41
Feb-05	30.03	29.64	+ 0.39
Avg	31.99	31.47	+ 0.52

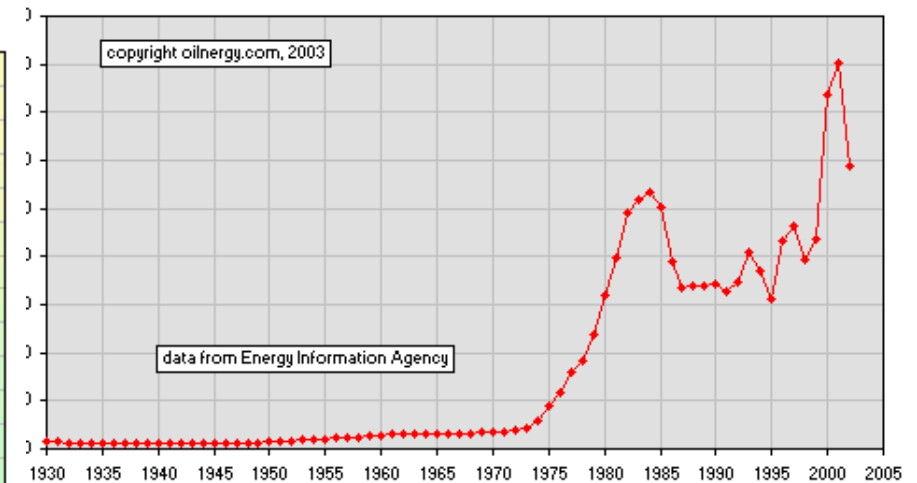


# Natural Gas Price Forecast

**NYMEX HENRY-Hub NATURAL GAS - DAILY PRICE**  
2/1 → 2/13/04 avg \$5.441/MMBtu vs. Jan 2004 avg \$6.253/MMBtu

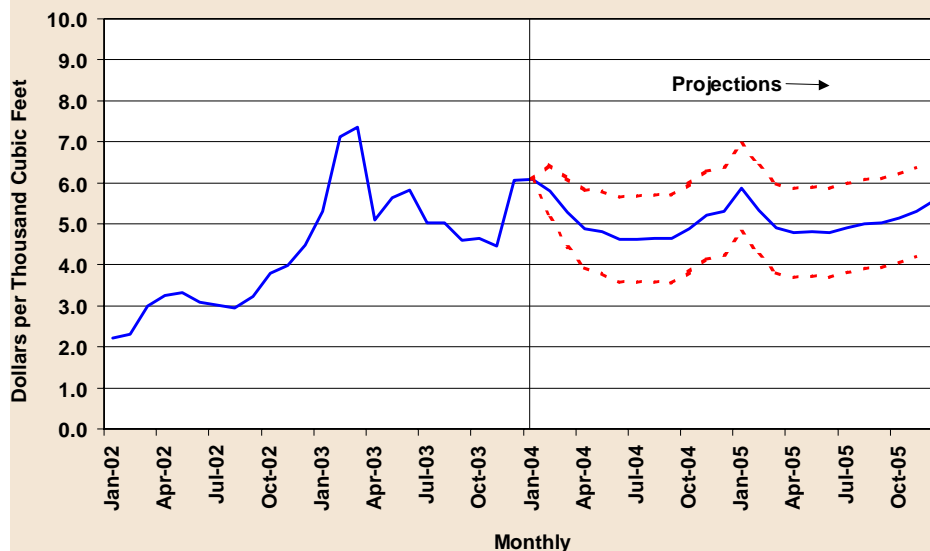


**U. S. Wellhead Natural Gas Price**



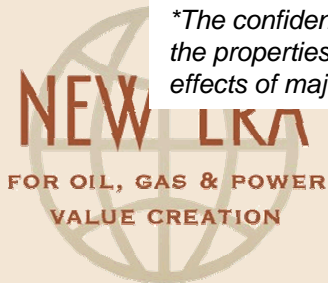
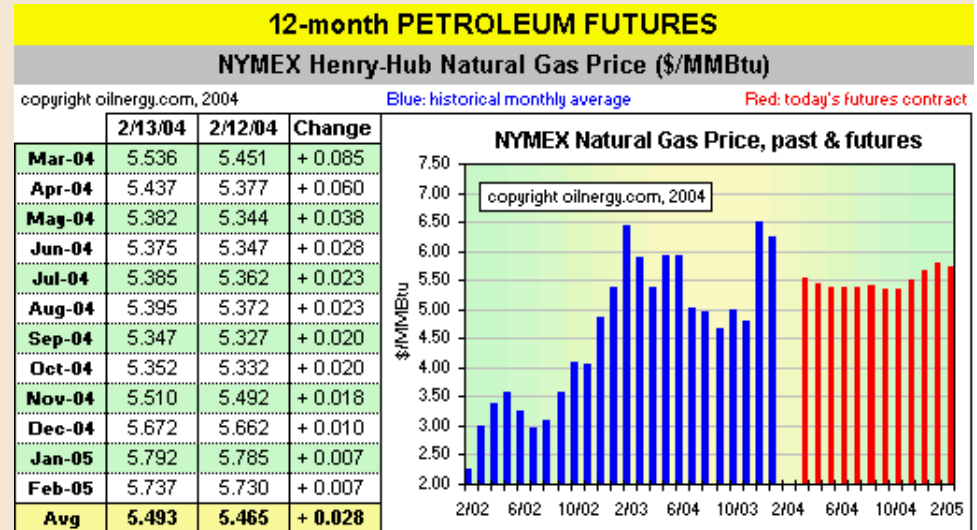
# Natural Gas Price Forecast

**Figure 8. U.S. Natural Gas Spot Prices**  
(Base Case and 95% Confidence Interval\*)



Sources: History: Natural Gas Week; Projections:  
Short-Term Energy Outlook, February 2004.

\*The confidence intervals show  $\pm 2$  standard errors based on the properties of the model. The ranges do not include the effects of major supply disruptions.



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ved.

## Input Elements

- Analysis is based on estimating the expected timing and amount of a project's cash flow elements
- Because it is developed from estimates, contain uncertainties. The uncertainties should be quantified through the use of sensitivity analysis.



# Cashflow Model

## Production Sharing Agreement

Cost recovery

Profit split

Bonuses

Signature Bonus

Production bonus

Term

- Exploratory Period
- Production Period
- Extension
- Termination

Exclusion of Areas (Relinquish Area schedule)

Minimum Work Program

Most of these  
may be  
negotiable







**Economic Models: PSA & Concession**  
**Contract**

Spreadsheet Demonstration  
Switch to Spreadsheet  
Cashflow Analysis.xls

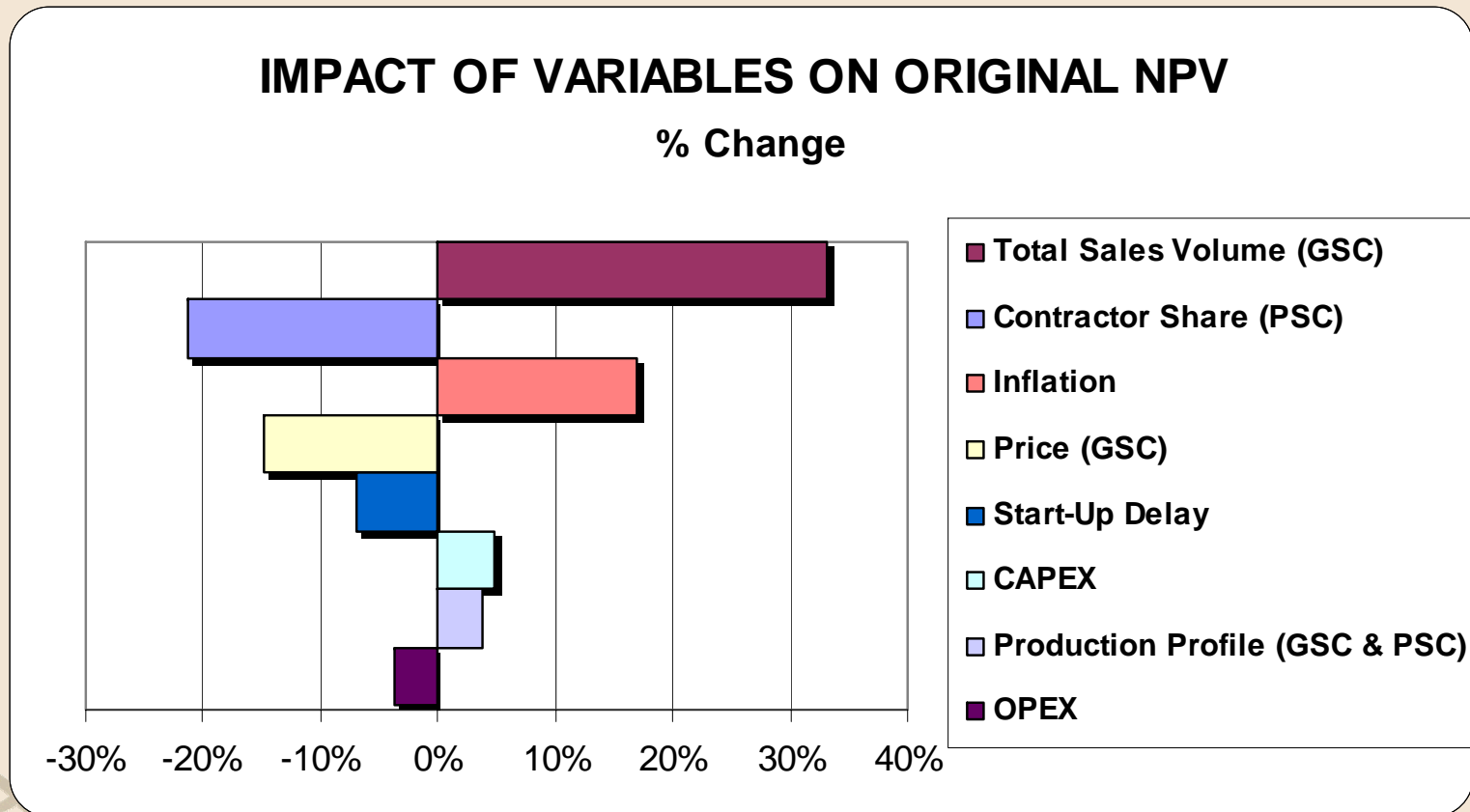


# Sensitivity analysis

- Sensitivity analysis indicates the effect of a change in the magnitude or timing of individual cash flow elements.
  - Sales demand
  - Prices
  - Investment amount and timing.
  - Operating costs.
  - Crude and gas production.
  - Tax rate or other government take.
- A "High" and "Low" case could be included as sensitivity.
- Probabilistic Risk Economics is also a type of sensitivity analysis that may be conducted.



# Principal Factors Impacting the Economics



NEW ERA

FOR OIL, GAS & POWER  
VALUE CREATION

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