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## 2013년도 제1차 해외전문교육 개요

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1. **교육명** : 「Petroleum Economics & Risk Analysis」
2. **교육수준** : Intermediate to Advanced
3. **교육기관** : CWC School for Energy (영국)
4. **장 소** : 해외자원개발진흥재단(역삼동)



5. **일 시** : 2013.4.15-19(5일간, 9:00-17:00)
6. **교육목표** : For all those operating in the Oil and Gas industry effective project economics, a true understanding of risk and successful decision analysis are fundamental to the ultimate success of the business. The current and future opportunities are both technically and commercially more demanding and challenging. Therefore, all individuals working in the industry need to be fully aware of the economic consequences of their day-to-day decisions. The practical exercises and hands on approach of this course will ensure participants have a more informed decision making process.

## 7. 세부내용

### (1) Day 1

#### 1) Pre Course Assessment

#### 2) Introduction

- ✓ Objective of the course
- ✓ Why economic evaluation?
- ✓ Typical oil and gas company objectives
- ✓ Typical oil and gas industry activities
- ✓ Capital expenditure plans
- ✓ Basic process of economic evaluation and risk analysis

#### 3) Inflation

- ✓ Inflation defined
- ✓ Types of inflation
- ✓ Consumer price index
- ✓ Historical cost trends

#### 4) Simple and Compound Interest

- ✓ Compound interest formula
- ✓ Nominal and effective interest rate

#### 5) The Time Value of Money

- ✓ Interest tables
- ✓ Future value of present sum
- ✓ Present value of present sum
- ✓ Ordinary annuity and annuity due
- ✓ Loan amortisation schedule

#### 6) Spreadsheet Applications: Excel financial functions

#### 7) Problems and Solutions: Inflation, interest and time value of money

### (2) Day 2

#### 1) Before-Tax (BTAX) Cash-Flow Models

- ✓ Cash-flow (CF) defined

- ✓ Forecasting cash-flow
  - ✓ Basic data requirement
  - ✓ Gas processing flow diagram
  - ✓ Typical oil production facilities
  - ✓ Total cost of ownership
    - ◆ Capital expenditure (CAPEX)
    - ◆ Operating expenditure (OPEX)
  - ✓ Economies of scale
  - ✓ Types of cost estimates
  - ✓ Criticality of cost estimates
  - ✓ Cross revenue
  - ✓ Sample before-tax cash-flow
- 2) After-Tax Cash-Flow Models
- ✓ Depreciation methods
  - ✓ Interest during construction
  - ✓ After-tax cash-flow
- 3) Nominal and Real Cash-Flow
- 4) Spreadsheet Applications: Excel financial functions
- 5) Case Study - Building BTAX economics model
- (3) Day 3
- 1) Profitability/Economic Indicators/Capital Budgeting Techniques
- ✓ Cumulative net cash-flow
  - ✓ Typical profitability indicators
    - ◆ Payback period
    - ◆ Net Present Value (NPV)
    - ◆ Internal Rate of Return (IRR)
    - ◆ Profitability Index (PI)
    - ◆ Long-Range Marginal Cost (LRMC)
    - ◆ Maximum sustainable risk
- 2) Review of Economic Evaluation Models

- ✓ Oil field development
- ✓ LNG plant
- ✓ Power plant
- ✓ Refinery

### 3) Funds Flow and Discounting

### 4) Limitation of Profitability Indicators

- ✓ Payback period
- ✓ Inherent problems with IRR
- ✓ The NPV/IRR conflict
- ✓ Don't confuse IRR with ROI
- ✓ Multiple rates of return

### 5) Weighted Average Cost of Capital (WACC)

### 6) Relationship between Cash-Flow and WACC

### 7) Netback Pricing

- ✓ NetBack Value(NBV)
- ✓ Methods used to calculate NBV
  - ◆ Base year and ROR approach
  - ◆ LRMC approach
- ✓ Indexed netback pricing
- ✓ Dependence on NBV

### 8) Problems and Solutions - Profitability indicators & ATAX cash-flow

## (4) Day 4

### 1) Advanced International Petroleum Economics

- ✓ The need for collaboration
- ✓ Parties to agreement
- ✓ Typical contract terms
- ✓ Efficient fiscal systems
- ✓ Fees and bonuses
- ✓ Sliding scale tranches

- ✓ Relinquishment
  - ✓ Ring fencing
  - ✓ Uplift
  - ✓ Crafting fiscal terms
    - ◆ What to look for?
    - ◆ Production sharing agreement/contract (PSA or PSC)
    - ◆ Concessionary systems (royalty/tax systems)
  - ✓ Flexible fiscal regime
- 2) Economic Assessment of International Contracts
- 3) Investment Selection Decision Making
- ✓ Screening economics
  - ✓ Mutually exclusive investment analysis
  - ✓ Non-mutually exclusive investment analysis
  - ✓ Lease versus buy decisions
  - ✓ Service producing systems
    - ◆ Using PV of costs
    - ◆ Using IRR
    - ◆ Unequal lives
- 4) Decision Analysis
- ✓ Why decision analysis?
  - ✓ Typical industry risks
  - ✓ Handling uncertainty in capital investments
  - ✓ Sensitivity analysis
    - ◆ Tornado graph
    - ◆ Spider diagram
  - ✓ Scenario analysis
  - ✓ Application of decision analysis
- 5) Probability Concepts
- ✓ Probability definitions
  - ✓ Widely used probability distributions

- ◆ Discrete probability distributions
  - Binomial
  - Multinomial
  - Other discrete probability distributions
- ◆ Continuous Probability Distributions
  - Normal
  - Lognormal
  - Uniform
  - Triangular

6) Spreadsheet Applications: Excel Probability Functions

7) Problems and Solutions - PSA, Royalty/Tax Systems,  
Decision-Making

(5) Day 5

1) Expected Value Concepts

- ✓ Expected value of random variables
- ✓ Standard deviation of random variables
- ✓ Expected monetary value (EMV)
- ✓ Expected opportunity loss

2) Decision Trees

- ✓ Probability tree
- ✓ Terminology used in decision trees
- ✓ Solving decision tree
- ✓ Expected profitability index
- ✓ Performance index
- ✓ Advantages of decision trees

3) Value of Information

- ✓ Value of Perfect Information (VOPI)
- ✓ Value of Imperfect Information (VOII)

4) Simulation in Decision Analysis

- ✓ Designing simulation models

✓ Probability distributions leading to reserves

✓ Analysing results from simulation

#### 5) Case Studies

✓ Fitting probability distribution to existing data

✓ Monte Carlo simulation of:

- ◆ Volumetric reserves calculation

- ◆ Refinery maintenance budget

- ◆ Cash-flow model

#### 6) Problems and Solutions - Expected Value and Simulation

#### 7) Post Course Assessment

### **8. 강사이력**

(1) 강 사 명 : Jenny B. Spalding

(2) 요 약 : Ms Spalding has 33 years of diversified experience in petroleum engineering and corporate project economics. She had been involved in evaluating multi-billion dollar oil and gas field development projects, economic impact of energy pricing policies, oil and gas reserves, and economics research.

Her academic background includes degrees from world class educational institutions such as Harvard, Tulane and Princeton Universities in United States. Her research includes Energy Pricing Policies for Egypt, Eastern European Global Environmental Fund Outlook, the future of Non-OPEC Oil, the Developing Business and Politics of Oil in Latin America, Saudi Arabia's domestic Gas Policies (Cross subsidy effects and product price elasticity), and Oil and Gas Price Relationships for the 1990's. She was engaged in policy discussions with the Indian Government to reconcile domestic fuel and feedstock pricing and electricity pricing subsidies, led a task force to Egypt to address cross subsidies between fuel substitutes and energy pricing policies.

Jenny is currently working as a Petroleum Engineer in the

Upstream Professional Development Center with Saudi Aramco. In this capacity, she has developed and delivered an International Oil Economics course, Project Economics course for field development, and technical upstream E&P workshop. She has previously worked as energy economist with World Bank, economist with Cambridge Energy Research Associates (CERA), and reservoir engineer with Shell Oil Company. She has authored several papers on global economic policies for Society of Petroleum Engineers (SPE), World Bank, Saudi Aramco and CERA. She is a registered Professional Engineer in the state of Louisiana, USA.

(3) 학 력

- 1) Harvard University, Cambridge, Massachusetts, USA : MS in Public Policy - International Finance & Trade
- 2) Tulane University, New Orleans, Louisiana, USA : MS in Petroleum Engineering & Economics
- 3) Princeton University, Princeton, New Jersey, USA : BS in Geological Engineering

(4) 경 력

- 1) Saudi Arabian Oil Company (Saudi ARAMCO)
  - ✓ 1992. 7 ~ 현재, 사우디아라비아 다란
  - ✓ Sr. Petroleum Engineer-Exploration and Producing Center of Continuing Excellence
    - ◆ Seconded to new Upstream Training Center which has a mandate to develop national manpower resources in the upstream petroleum business by reshaping metrics and processes to drive capacity development.
    - ◆ Developed and delivered an International Oil Economics course, Project Economics course for field development
    - ◆ Developing technical upstream E&P workshop for Non E&P



Senior Management. Direct request of Sr. VP of E&P business line. Workshop finalized and delivered 2nd quarter 2011.

- ✓ Reservoir Management Business Analysis Division
  - ◆ Coordinated preparation of annual Business and Operating Plan analysis for Petroleum Engineering; detailed analysis for all producing oil fields in Saudi Aramco
  - ◆ Handle all the PR work for the Dept including Manager's trips to Washington to address concerns about peaking Saudi Arabian oil reserves
  - ◆ Ghawar Task Force member: part of effort to increase ultimate oil recovery across Ghawar field areas.
  - ◆ Created Well Status Report which analyzed all producing and shut in wells in Saudi Aramco producing field to deduct water encroachment and production profile trends. Report for Senior E&P Management.
  - ◆ Prepared trend analysis of all new oil and gas production, evaluated onstream production across fields and reservoirs to optimize production.
- ✓ Economist - Corporate Planning Department
  - ◆ Part of the Task Force for the Kingdom's Energy Proposal. Task force assessed economic impacts of energy pricing policies, customer demand, cross subsidy effects and product price elasticity.
  - ◆ E&P Liaison for annual corporate Business Plan-coordinated and evaluated all E&P submissions; for two years also served as the overall coordinator of the entire Saudi Aramco Business Plan submission.
  - ◆ Wrote the Annual Assessment of International Oil Outlook for Saudi Aramco's Board Meeting
  - ◆ Analyzed the Local Economy's energy needs on a yearly

basis for purpose of highlighting future Kingdom domestic energy development; price strategies and cross-substitution and population growth patterns were analyzed as part of the Joint Venture initiation process

- ✓ Petroleum Engineer-Reserves Assessment Analysis Division
  - ◆ Part of reserves assessment team responsible for complete updated reserves assessment for entire Kingdom's oil and gas for 1992-994
  - ◆ Prepared Cost Benefit Analyses of new oil field increments to prioritize development sequencing

## 2) World Bank

- ✓ 1989 ~ 1992, 미국 워싱턴 D.C.
- ✓ Energy Economist & YP - Middle East & Eastern Europe
- ✓ Selected as a YP (Young Professional) for World Bank—35 students chosen from over 5,000 applicants
- ✓ Engaged in policy discussions with the Indian Government to reconcile domestic fuel and feedstock pricing and electricity pricing subsidies.
- ✓ Led a task force to Egypt to address cross subsidies between fuel substitutes and energy pricing policies
- ✓ Coordinator of the Global Environmental Fund (GEF) for Eastern Europe

## 3) Cambridge Energy Research Associates - CERA : Oil and gas consultant firm (originally affiliated with Harvard University)

- ✓ 1987-1989, 미국 메사추세츠주, 케임브리지
- ✓ Economist
- ✓ Wrote private economic reports:
  - ◆ The Future of Non-OPEC Oil
  - ◆ The Developing Business and Politics of Oil in Latin America - written for Shell Oil in exploring downstream options in

## South America

- ◆ Oil and Gas Price Relationships for the 1990's

### 4) Arabian American Oil Company (ARAMCO)

- ✓ 1980-1987, 사우디아라비아 다란
- ✓ Petroleum Engineer (Oil Allocation Coordinator)
- ✓ Responsible for coordinating the allocation of oil production among oil fields and crude grades to maximize revenue
- ✓ Authored the annual Oil Field Technical Report and other Ministry of Petroleum Documents.
- ✓ First Western woman engineer in Aramco

### 5) SHELL Oil

- ✓ 1987-1980, 미국 루이지애나주, 뉴올리언즈
- ✓ Reservoir Engineer responsible for Shell's Galveston Gas fields
- ✓ Worked as a petro-physicist for six months on offshore oil rigs

### (5) 기타(1991 ~ 현재)

- 1) Chairman, Princeton Alumni Schools Committee (1994-2011)
- 2) Board member-Harvard Club of Saudi Arabia (2003-2011)
- 3) Member, Society of Petroleum Engineers (SPE) standing committee, Middle East Women in Science, Engineering and Technology (2005-2010)
- 4) Registered Professional Engineer in the state of Louisiana, USA.