Breakthrough Technologies and Incremental Innovation: the Edge of Innovation in Oil and Gas industry, Level of R&D expenditure Versus Results in the Energy Companies

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INTRODUCTION

- 1 Trillion barrels of oil consumed till today
- 1 Tbbl in next 35 years & 3° Tbbl 35-70 years after that

“Greater recovery, Greater discovery, and Greater diversity”, Tony Meggs, BP Group VP for Technology

- Greater Recovery: recovery rates being achieved now are far higher than were envisaged even only 20 years ago
- Greater Discovery: reserves deeper below the surface, in deeper water and in hostile environments like the arctic regions
- Greater Diversity: future hydrocarbons. unconventional resources – heavy oil and bitumen, oil shales, tight gas sands, shale gas, coal bed methane, and gas hydrates

- Ever increasing concerns on environmental issues and stringent restrictions and standards
Challenges

Include CO₂ mitigation costs
(to make CO₂ neutral compared to conventional)

WEO required cumulative need to 2030

Economic price 2004 (USD)

Available oil in billion barrels

Already produced
OPEC ME
Other conv. oil
EOR
Heavy oil Bitumen
Oil shales
Arctic
Deep water
Super deep
Environment

- Intergovernmental Panel on Climate Change (IPCC): “Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations”

- Growing concerns that the climate is warming due to CO2 emissions (use of fossil fuels)

- Focus on Carbon capture and sequestration (CCS) technology (cleaner environment, use in EOR)

- Need of demonstration of fully integrated CCS at commercial scale, along with an established legal and regulatory environment
Exploration

- Subsalt and Sub-basalt reservoirs
- Rich hydrocarbon reservoirs at several volcanic margins, North Atlantic ocean, off the coast of West Africa and offshore India
- High velocity basaltic rocks underlain by low velocity rocks
- Complex setup caused by multiple basalt flows and inter-fingering of sediments within the individual flows
- Severe effects on quality of the conventional seismic data
- Long-offset seismic data acquisition using low frequency sources and making use of locally converted waves
- The integrated Seismic Imaging and Modeling of Margins (iSIMM): processing thorough shot-by-shot signature monitoring allowing waveshaping and careful demultiple
- Magnetotelluric (MT) methods: better resolution and imaging, successfully applied in sub-salts of GoM and sub-basalts of North Atlantic
- Sophisticated acquisition methods that use varying azimuths and offsets: Wide Azimuth (WAZ), multi-azimuth (MAZ) and Rich Azimuth (RAZ)
Drilling

- Deep water Challenges: access to the oil and gas that lies deeper, in dispersed reservoirs or difficult to produce, new global standards for vertical completion systems (EVDT)

- Deep well drilling challenges: drilling deeper wells and completion strategy (expandable tubulars)

- Future drilling technology challenges: managing difficult pressure environments, remotely operated drilling is possible, Automated Drilling System (ADS), dynamic real-time analysis of drilling processes and simulation.
Production

- Historically the elements of the production process has remained relatively constant

- Focus on cost-savings (efficient production systems and maintenance)

- Research and Technological Advancement for increased production (secondary and tertiary recovery techniques)

- Emerging Technologies in Production: NANO Technology (enhanced emulsion separation), In-situ Seismic Wave Stimulation (IOR), Bright Water (EOR), EXCAPE (Simultaneous Dual Well Completion), Teleperf (sand control completion without gravel packing)
R & D Investments and Trends

- R&3D, referring to the Discovery, Development, and Deployment phases

- Low level of R&D spending in oil and gas industry compared to other industries (less innovative, costly and time-intensive, 16 years from concept to commercialization)

- Estimated industry R&D spendings more than $6 billion annually

- Shift of technology and R&D activities from traditional major operators to service companies who now are the major source of innovations in oil industry (resulting technological advancement in exploration, drilling, well completion etc)

- Much of R&D is either being outsourced or decentralized by the companies

- As majors are merging to become super-majors, they are eliminating redundancy in terms of the numbers of labs and research personnel

- Unlike the last two decades, R&D spending increased significantly in many E&P organizations in 2006, 2007, 2008 (especially in Majors)
Future of Investments in R&D

- Focus on alternative energy, frontier hydrocarbons and advanced end-use technologies

- High global demand for electricity and transportation fuels, rapidly growing sectors within the energy field: renewables, solar power & wind turbine systems, most prominently in bio-fuels and oil-exploration technologies.

- Environmental regulations an added effect on investments, resulting diversification (focus on greener fuels, zero-carbon emissions, CCS)

- Decelerating world economy will always have an effect on global research and development (R&D), with some global R&D growth absorbed by the inflation rate for a net result of flat R&D spendings consequently diminishing the resources available for new R&D investments.

- One of the major research area evolving is the development of processing technologies (eg. GTLs an innovation)

- Notwithstanding, R&D spending likely will be a work in progress with unforeseen changes affecting the amount of money available, much of that hinging on the eventual price of oil