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Prepare for the Future: Innovate

Leo Roodhart
Shell International E&P
A New Way to Innovate

Free Your Mind

Bring Your Ideas

Change the Game

GameChanger
Outline

• The need for radical Innovation
• A Simple Process to accelerate Innovation and fill the R&D funnel
• Some statistics
• Some Examples
• How to implement
• Discussion
Growing Energy Demand

Growing Energy Demand

An Example Future: Energy Diversification

Shell Long Term Energy Scenario "Dynamics as Usual"
Availability of Oil

Include CO$_2$ mitigation costs
(to make CO$_2$ neutral compared to conventional)

WEO required Cumulative need to 2030

Economic Price 2004 (US $)

Available Oil in Billion Barrels

Source: IEA
Options for the Long Term

Resources Volume

- Conventional
- Stranded Resources
  - Marginal (vol. Rate)
  - Remote
  - Contaminated (H₂S, CO₂)
- Tight Gas
- Gas Shales
- Gas Hydrates
- Coal-bed Methane
- Coal Gasification
- Low perm. oil
- Heavy Oil
- Tar & Bitumen
- Oil Shales
- Increased pricing
- Improved technology

Adapted from Holditch & Hart’s E&P
The pace of innovation in E&P has been slow relative to that in other industries.
Link Long Term Scenarios to Mid-term Strategy.

- Energy rather than molecules
- Being the most sustainable company
- Monetizing more difficult hydrocarbons sustainable
- Capture a larger part of new energy markets
- Access to customers rather than access to reserves

Domains:
- Ocean Energy
- Solar
- Sulphur
- CO₂
- Uncongas
- Clean Tar
- BOP
- Up-Stream Bio-Energy
- Urban Energy
- Clean Coal
- Differentiated Products & Services
- Energy Efficiency

Now

Monetizing more sustainable hydrocarbons.
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Fill the Domains with projects

- **GameChanger**
- Exploratory research.
- Technology development
  - In-House
  - Universities
  - Research Institutes
- Deployment
  - In-House
  - Spin-out
  - Partnerships
A new way to Innovate

- Put some money aside: Seed Funding
  - 10% R&D Budget
- Establish a Company wide process +
- Create Cross-Business Innovation platform
- Stimulate and nurture radical ideas.
  - Technical and business ideas
- Rejuvenate R&D
- Create new Options
The Process

- Ideas can be submitted at any time
- A panel of peers decides in a week
- If needed some budget is given to mature the idea
- Decision to continue is made by extended panel
- The first tollgate is a value proposition
- and followed by technical feasibility
- Another innovation

GameChanger Process
The Criteria

Size of the Pie
- Total Value Created
- Value Captured by company

Why us?
- Core competencies
- Strategic Fit

Go Forward Plan
- Leadership Team
- Implementation Plan
- Resources Being Requested

Strategic Control
- Protecting the Business Opportunity

How Much Does it Change the Game?
- Unique CVP
- Is it really revolutionary?
- Other Players

Sustainability
- Robustness in Changing World
- Environmental Impact
- Fit to Society’s expectations
“Essential Elements for Success”

- Speed and focus on implementation
- Grass roots approach
- Simple, effective, recognised process
- Relevant, business-oriented metrics
- Accept failure as part of the process
- Full time GameChanger team only accountable to themselves
- Senior Management commitment and support
- Group of “Peers” holding the budget
Where do ideas come from?
The Web

"I HAVE AN IDEA"
Where do the ideas come from?

Innovation Website

Ad-hoc submission of ideas from anywhere in the company and external

Themed Workshops

External Contacts

Universities

Inventors, start-ups
Where do ideas come from? Workshops

Petroleum Development Oman
Sultanate of Oman

Woodside, W. Australia
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New Science: Discovering with Academia
Options for the Long term

Adapted from Holditch & Hart’s E&P
GameChanger Examples

Drill Smart

• A new concept combining Through-bit Logging and rotary steerable drilling technology (RST)

• Aimed at an ability to drill and evaluate designer deviated wells for substantially reduced costs over today’s technology.

Offers in single trip:
• Through Bore Rotary Steering,
• Through Bore Mud Motors,
• Retrievable MWD,
• Through Bore Bits,
• Through Bore logging tools
• and more...
GameChanger Examples

Greening the Desert
• In a desert environment, scarcity of water provides an opportunity to look at re-using produced water for agriculture purposes.
• A cost-effective alternative to the current practice of deep water re-injection
• Reed bed technology is the most promising clean-up technology
• A pilot test at the Rahab farm in Oman is being executed
GameChanger Examples

**Bubble breaker**

- Simple wireline-run device
- Counter-intuitive: place a restriction in the well to reduce pressure loss!
- Breaking-up large bubbles improves flow regime in the tubing: less gas slippage
- Applications in:
  - Naturally producing wells with associated gas
  - Gas-lifted wells
  - Deep-water risers
GameChanger Examples

Light Touch
- A mobile hydrocarbon ‘sniffer’ using probably the world’s most sensitive ethane gas sensor
- measure tiny amounts of ethane naturally seeping from hydrocarbon reservoirs
- Correlate emission locations to the subsurface hydrocarbon accumulations
- screens large areas for oil and gas – at less than a few percent of the cost per square kilometre of seismic surveys

Now taken up by medical science
For early detection of lung cancer
GameChanger Examples

Reactive Liner Perforating

- New perforating technology developed in conjunction with QinetiQ
- Next generation in shaped charge systems using a reactive liner
- Perforation liner creates secondary explosion within the perforation tunnel by using a bimetallic liner material
- The reactive properties of the charge creates a self-cleaning action that results in open, debris-free hole.
- Radically new charge design, based on military technology
- Selected as finalist for world oil 2007 awards in “best completion technology” category
  - Winner to be announced oct 17
GameChanger Examples

**EZIP**

- Reduced water and increased oil inflow in mature fields
- Polymers that swell when contacted by water - well heals its own leaks!
- Idea stimulated by child’s bath toy
- First trial Jan 2005 reduced water cut from 90% to 20% and increased net oil production by >500%
- Over 200 already run in PDO
- STV Company SwellFix established and growing rapidly
GameChanger Examples

Lighter than air technology

- Use large zeppelins to transport pipelines, heavy equipment etc. into hostile environments
- Thereby avoid the costs of building roads, bridges etc...

Status of the project

- State of the art in zeppelins mapped
- Retrofit study on the Sachalin project on hindsight
- Commercialization with third party being investigated
Adhesive bonding of pipelines

- Glue pipes together instead of weld or flange or screw
- Thereby avoid the harm that welds do to corrosion resistant materials,
- Allow internally coated pipe to be used

Status of the project

- Principle proven
- New joint designed and calculated through
- Patents granted on connection
- Looking for funds for final full scale testing
GameChanger Examples

**Bio-Consolidation**

- A method aimed at consolidating dikes, dunes, foundations etc. by means of microbiological calcium carbonate deposition at sand grain interfaces.
- Develop the downhole sand consolidation technology simultaneously with the civil engineering application.
- This represents a radically new method of sand management.
- If successful in competing with gravel packing, cost reductions and productivity improvements could be tremendous.
GameChanger Examples

Biological desalination

- Select and cultivate or genetically engineer microorganisms
- to absorb and store sodium chloride in a salty environment

If successful, this would be a totally new approach to water desalination
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Slow pace of innovation & adoption in E&P

Can we speed-up more?

- Consumer products (US average)
- Medicine (Merck-average)
- ADSL (broadband telecom)
- E&P industry (15 tech. cases)

Source: McKinsey
Venturing: accelerate deployment

- In-House development takes too long
- Spin-out innovation Projects

- Set-up Global Venture Capital Investment Fund
  - Invested US$ ~270mln since 2001
  - 25 Investments with ~800 staff
Many Projects Become Companies

Spin-in

Gamechanger

Welldog
AGL
I3
Tubel
S-Fix

RFID Technology

Solar
coolenergy
XACT
sensornet
P/GSI
WellDynamics

GEOdynamics

dynamic dinosaurs
innovation team

Monitor

ENVENTURE
Global Technology

balance

SWELL

Triax

TubeFuse

Commercial Intro

Market Rollout
Many Projects Become Companies

Spin-in

RFID Technology
EMBaffle™ Technology

Spin-out

Welldog
AGL
I3
Tubel
S-Fix

Gamechanger

GC

GC

GC

GC

GC

GC

GC
It can be done faster!!

Consumer products
(US average)
Medicine
(Merck-average)
ADSL
(broadband telecom)
E&P industry
(15 tech. cases)
Expandable casing

Source: McKinsey Survey
In Summary

• **Identify** potential New “Play Grounds”
• Stimulate and connect entrepreneurial people within your company: **Collect ideas**
• **Sponsor** disruptive technology ideas with small bets,
• Take away the risk of “crazy ideas”: **Proof the Concept**

• **Fills the R&D Funnel** with new technology one can keep in-house

Or

• **Spin-out** projects as new business for fast implementation
40% of the core EP Research program based on former GameChanger projects

30% of STV companies include one or more graduated GameChanger projects