Terra Incognita –
A Navigation Aid for Energy Leaders

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Terra Incognita – A Navigation Aid for Energy Leaders

1. Global energy complex is entering its third phase change
2. Demand trends are not sustainable - China and India rise to materiality changes everything
3. IOCs want to produce but have limited access; NOCs have access but want to conserve their resource
4. Society’s ascent of the Maslow hierarchy increases expectations of energy companies – security and climate must be addressed
5. Previous shareholder value propositions are unpersuasive
   • But IOC capex has barely increased from depressed 1990s levels
6. Old strategies are threatened
7. The industry must reframe its purpose and boundaries
8. New business models will emerge and old ones will be discarded
9. This will require new strategies, execution and leadership
   • And this will affect deeply the Gulf Coast Refining business
10. The “phase change” demands a different approach to strategy development
Global energy complex is entering its third phase change.

U.S. Energy Consumption

Year

Percentage of Total Market

Coal Era

Oil Era

Next Era

Total Coal
Wood Waste Alcohol
Liquids
Gases, Nuclear, Renewable Energy
Electricity Net Imports
The conventional investment cycle may be overridden by the phase change

World Oil Prices 1965 – 2030
(This is not a forecast!)
China and India rise to materiality changes everything

**World Population (Billion in 2005)**
- China: 2.8
- India: 1.3
- More Developed: 1.2
- Less Developed: 1.1

**Oil Consumption (MMBD in 2005)**
- China: 49.3
- India: 7.0
- More Developed: 23.7
- Less Developed: 2.5
IOCs want to produce but have limited access; NOCs have access but want to conserve their resource

**Liquids Output**

- **INOC**: 14.3%
- **LOC**: 7.6%
- **IOC**: 27.2%
- **NSC**: 10.8%

**Liquids Reserves**

- **INOC**: 6%
- **LOC**: 3%
- **IOC**: 8%
- **NSC**: 13%

Top 50 Share of Global Total = 79%

Top 50 Share of Global Total = 84%

Source: PIW’s Top 50: How the Firms Stack Up (www.energyintel.com)
Society requires attention to two big externalities

• 61% oil reserves in Middle East
• 67% natural gas reserves in Middle East and Russia
• 50% of coal reserves in North America, China and India
Old strategies are threatened

IOCs have lost competitive position to INOCs and NOCs for mature conventional resources in traditional places

Competitive position
- Clear leader
- Strong
- Favorable
- Defendable
- Weak

Maturity
- Embryonic (Unproven)
- Growing (Unconventional)
- Mature (Conventional)
- Aging (Depleting)

Response
- Develop
- Selective investment
- Prove viability
- Divest/close

Competitive intensity:
- High: 🔴
- Medium: 🟢
- Low: 🔵

Develop Selective investment Prove viability Divest/close

IOCs
- New Entrant
- IOCs
- NOCs
- INOCs
- NOCs

Consolidator Depleter
Prior shareholder value propositions are unpersuasive

Production growth has replaced ROACE as a predictor of shareholder returns

99-05 ROACE vs TSR

\[ R^2 = 0.0077 \]

99-05 Production vs TSR

\[ R^2 = 0.6662 \]
IOC Capex has barely moved from depressed 1990s levels

Real Capex per barrel of production or refinery runs for XOM, BP, Shell and Chevron
“If a problem cannot be solved, enlarge it.”

Dwight D. Eisenhower
The industry must reframe its purpose and boundaries...

The diagram illustrates the interconnections between various energy sources and technologies, including:

- **Crude Oil**
  - Refining
  - Fischer Tropsch
  - Gasoline & Diesel

- **Natural Gas**
  - Gasification
  - Syngas

- **Coal**
  - Gasification
  - Syngas
  - Combined Cycle

- **Hydrogen**
  - ICE
  - Fuel Cell

- **CO₂**
  - Chemical Separation

- **Flue Gas**
  - PC

- **Societal Needs**
  - Personal Mobility
  - Transportation
  - Emissions Control

- **Hydrocarbons**
  - Hydrogen
  - Syngas
  - Combined Cycle
  - CO₂

- **Carbon Neutral**
  - Nuclear
  - Gasification
  - Combined Cycle

- **Bi-fuels**
  - Chemical Processing
  - Bio-refining

- **Wind, Tides, Currents, Waves, Solar**
  - Transmission

- **Engineered Crops**
  - Bio-refining

The industry must reframe its purpose and boundaries...
The new map opens up new business model possibilities.
The refinery of the future will be more flexible to achieve lowest variable costs

The New Refinery Extends its Product Markets into Chemicals and Power

- Ethylene Cracker Complex
- Aromatics Complex
- FCC Coking Refinery
- Hydro-treating/cracking Complex
- Gasification Complex
- Fischer Tropsch

Inputs:
- Natural Gas
- Bitumen/Hy Crude
- C1

Outputs:
- Ethylene/Propylene
- Aromatics
- Gasoline
- Diesel
- Lubes

Processes:
- Syngas
- H2
- Raffinate
- Wax

EOR/Sequestration

Source: CRA International
Global refining must be retooled to accommodate oil sands and convert more resid to transportation fuels.

The JV between ConocoPhillips and EnCana is the first announced to integrate previously un-integrated players.

High oil prices will cause residual fuel oil demand destruction.

Un-Integrated
Integrated to refineries

Projected Canadian Bitumen Production

Residual Fuel Oil Consumption

Un-Integrated
Integrated to refineries

High oil prices will cause residual fuel oil demand destruction.
Distributed manufacturing will challenge commodity refiners

Major Uncertainties

- Crude oil price
- Natural gas price
- Light-heavy spreads
- Refinery investment cycle
- Vehicle efficiency
- Public transportation
- Plug-in hybrids
- Ethanol subsidies
- Cellulosic ethanol
- Greenhouse gas limits
- FT/CTL learning curve
- Sequestration costs
- Product flows/blending
Organization Design will need to balance functional excellence with integration benefits

ILLUSTRATIVE

CEO

Supply and Trading
- Risk Management
- Supply Chain Integration
- Trading

Traditional Mature
- Basin Ops
  - OECD Basins
  - Other mature operations
- Refinery Ops
  - "Non-integrated" refineries (Europe/NA)
- Established Market Retail
  - Retail in OECD, other established markets
- M&A
  - Acquisitions and Divestitures

Deepwater
- Exploration
- Development/Offshore Project
- Offshore Production

Emerging Country Development
- Traditional
  - Nigeria
  - Algeria
- Expanding NOC’s
  - Norway
  - China
- Self Sufficient
  - Saudi Arabia
- Russia

Unconventional Resources
- Resource Development
  - Heavy Oil
  - Coal
  - Shale
  - Stranded Gas
- Renewables
  - Solar
  - Wind
  - Biomass
- Integrated Chains
  - Integrated Refineries
  - Storage, Transport, Processing, etc
  - LNG
The “phase change” demands a different approach to strategy development

**Implications**
- Explore multiple futures
- Challenge mental models
- Seek new insights
- Apply multiple lenses
- Develop leadership alignment
- Establish clear direction
- Deal with ambiguity
- Plan for experimentation
- Rigorously test business logic
- Articulate strategic metrics
- Embed learning processes
- Emphasize organizational capability

**Direction:**
- Position downwind of major trends; redefine corporate boundaries; Refine business model

**Execution:**
- Secure commitment; access opportunities; deploy resources; organize; address stakeholder needs

**Leadership:**
- Convey purpose; shape values & culture; establish decision rights; motivate and renew people
“The winds and waves are always on the side of the ablest navigators.”

Edward Gibbon, Decline and Fall of the Roman Empire