Refining Technology to Meet the Challenges of Future Trends in Global Oil Supply

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Chevron Lummus Global

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Agenda

- Appreciation and Introduction
- CLG Technologies
- Chevron Past to Present
  - Legacy of Technology and Innovations
- Future Trends and Challenges
- Conclusions

Introduction

- Appreciation
- Kenny Peinado
- BSChE – Cal Poly Pomona in 1987
- Designs Engineer – Richmond Refinery
- Process Engineer – Richmond Refinery
- Chevron Technology Marketing

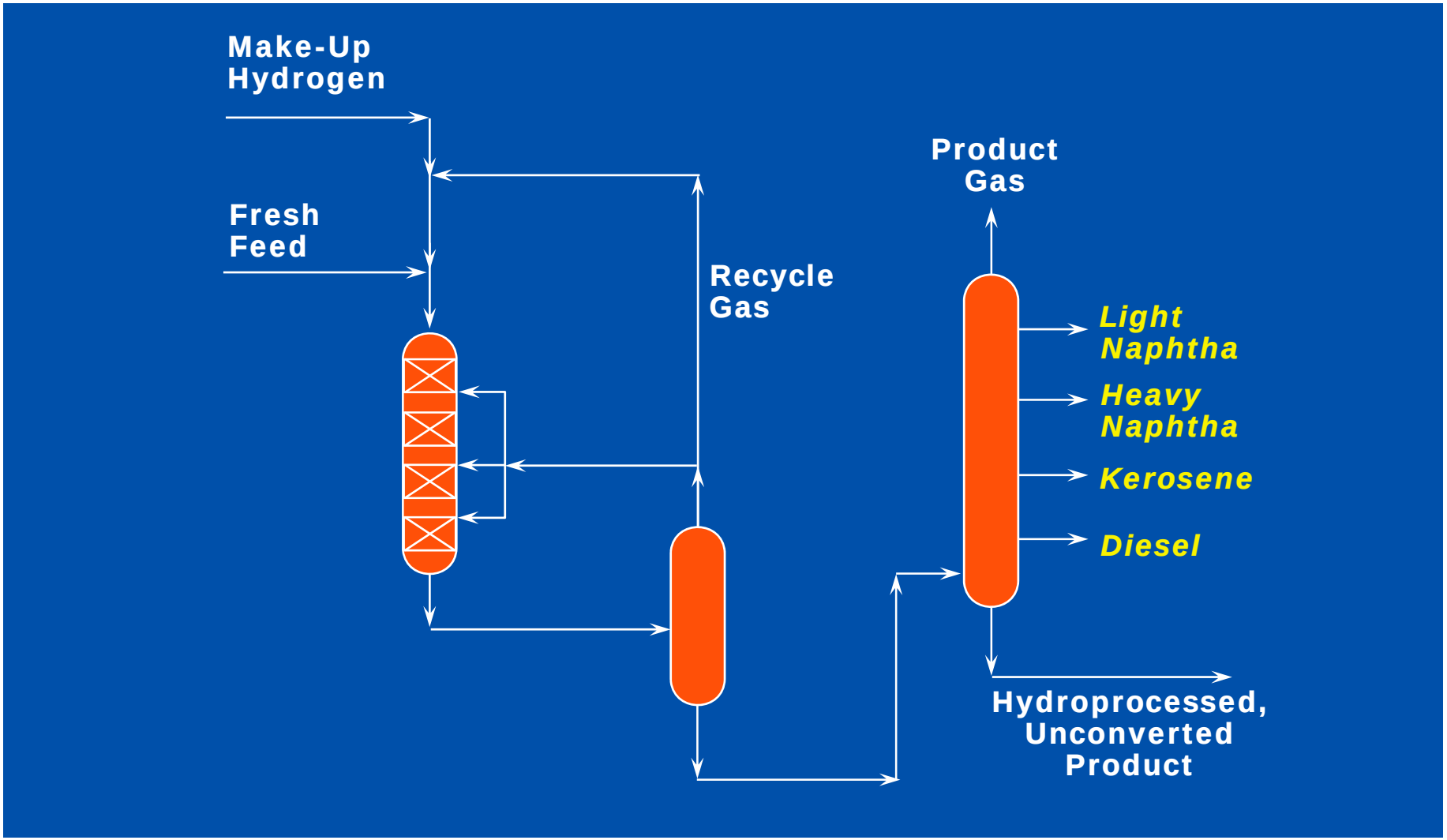
CLG Technologies

Chevron Lummus Global

All Hydroprocessing:

- Distillate Hydrotreating (ISOTREATING)
- Distillate Hydrocracking (ISOCRACKING)
- Residuum Hydrotreating
- Residuum Hydrocracking (LC-FINING)
- Base Oils (Lube ISOCRACKING, ISODEWAXING, ISOFINISHING)

Basic Hydroprocessing Flow Scheme



Chevron History

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Chevron History - Overview

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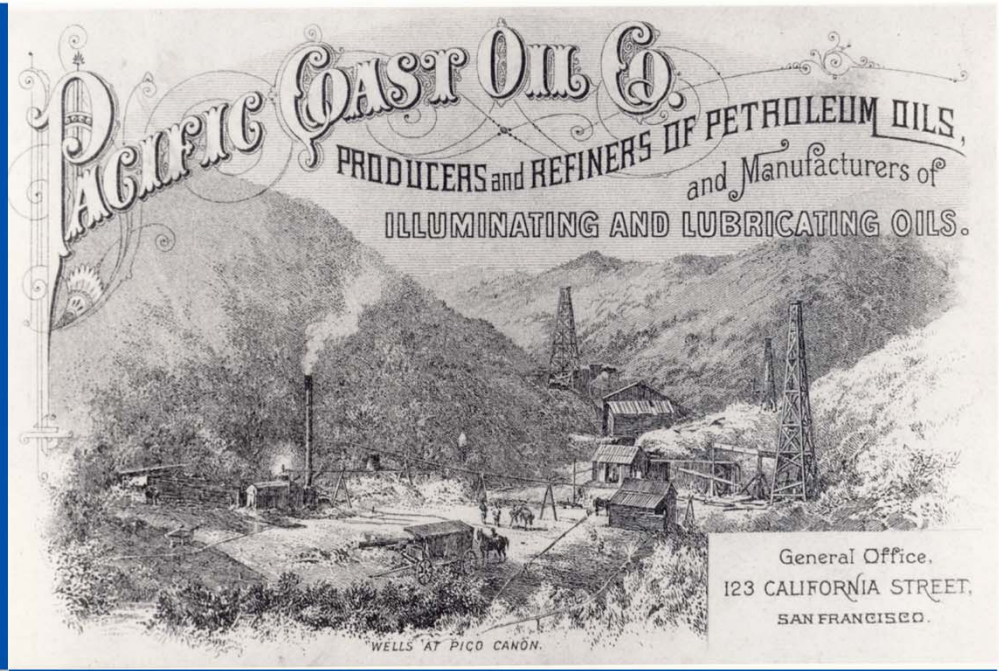
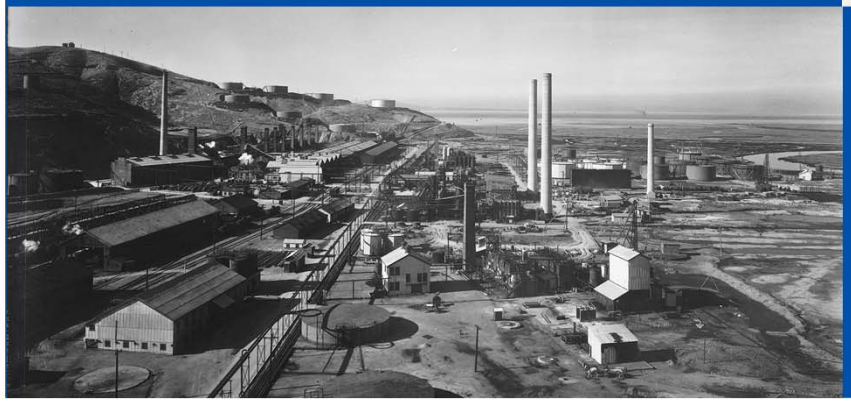
1879 oil discovered at Pico Canyon, California and Pacific Coast Oil Co. formed

1902 Richmond Refinery began

1906 became Standard Oil of California (SOCal)





1984 Gulf merger - became Chevron

2001 Texaco merger

2005 Unocal merger

Source: Chevron

Chevron Upstream History – Technology, Innovations and Discoveries

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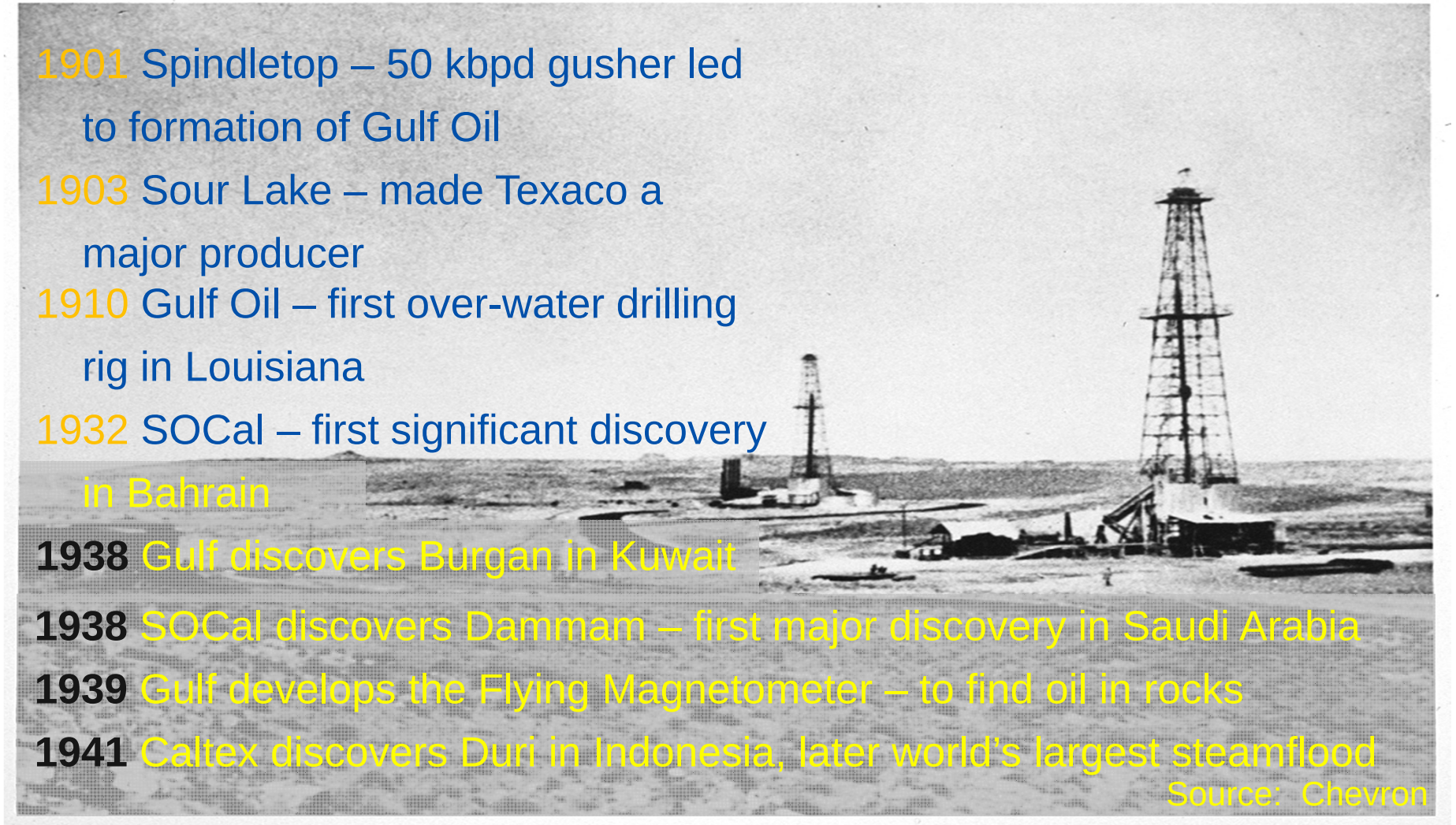

1901 Spindletop – 50 kbpd gusher led to formation of Gulf Oil

1903 Sour Lake – made Texaco a major producer

1910 Gulf Oil – first over-water drilling rig in Louisiana

1932 SOCal – first significant discovery in Bahrain

1938 Gulf discovers Burgan in Kuwait

1938 SOCal discovers Dammam – first major discovery in Saudi Arabia

1939 Gulf develops the Flying Magnetometer – to find oil in rocks

1941 Caltex discovers Duri in Indonesia, later world's largest steamflood

Source: Chevron

Chevron Upstream History – Technology, Innovations and Discoveries

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1944 Caltex discovers Minas in Indonesia – largest in SE Asia

1946 SOCal discovers Boscan in Venezuela

1959 Unocal discovers first natural gas field in Alaska

1967 SOCal begins steam injection in SJV California and later Duri

1978 Gulf and Texaco develop 3-D Seismic data processing method

1982 SOCal uses Cray super-computer to process seismic data

Source: Chevron

Chevron Downstream History – Technology and Innovations

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1913 Gulf Oil opens first drive-in service station

1919 Texaco patents Holmes-Manley thermal cracking process

1959 SOCal develops ISOCRACKING - modern hydrocracking process

1984 Chevron starts up RLOP – world's first all-hydroprocessing Base Oil plant

1993 Chevron commercializes its ISODEWAXING technology to isomerize wax in Base Oil feeds

Source: Chevron

Chevron Today

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Chevron Today - Overview

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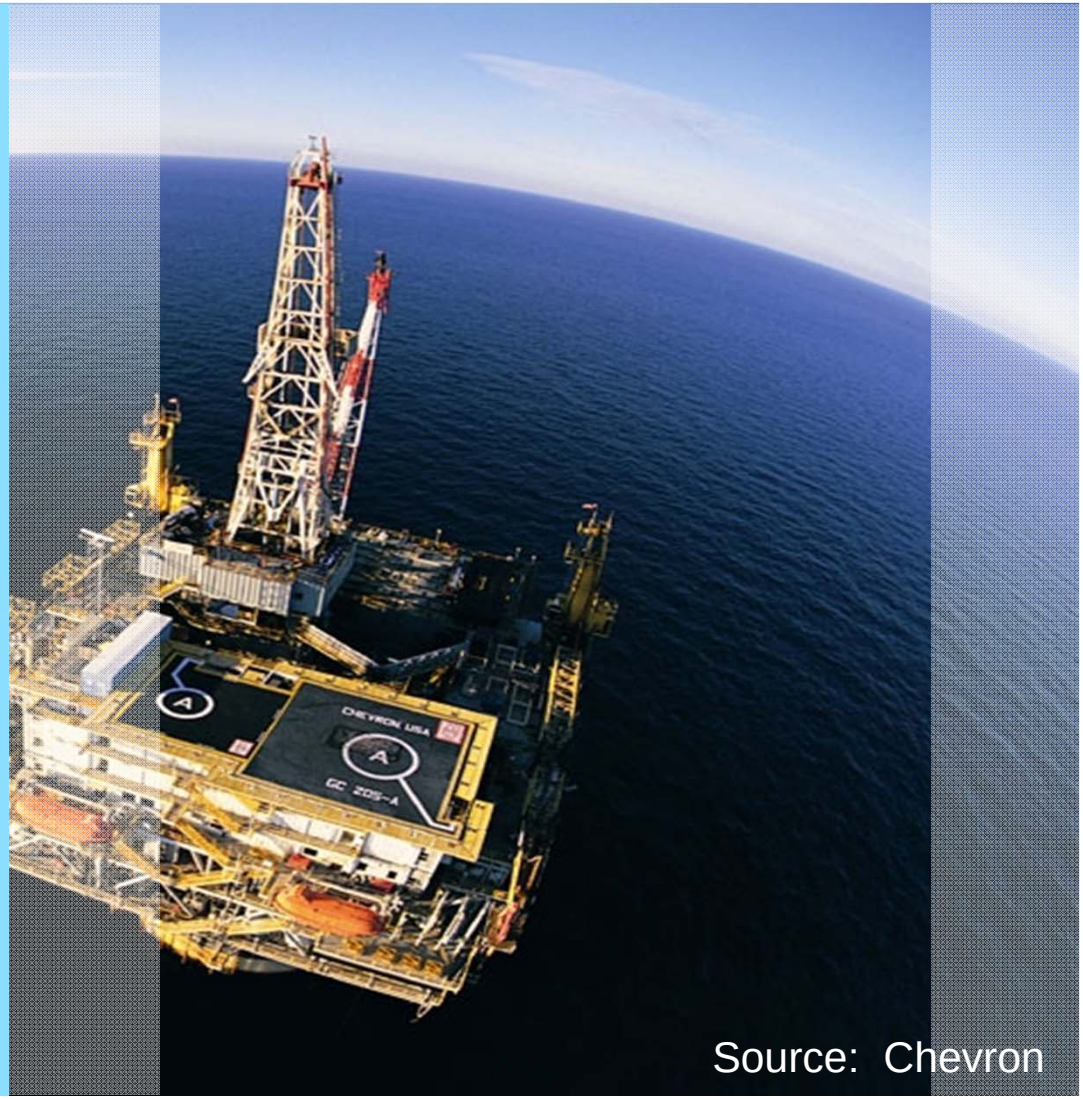
60,000 employees

2nd largest US energy company

$26 billion budgeted for investment in 2011

Fully integrated oil company:

- upstream
- downstream
- chemicals, lubes
- research & development
- corporate expertise



Source: Chevron

Chevron Today - Upstream

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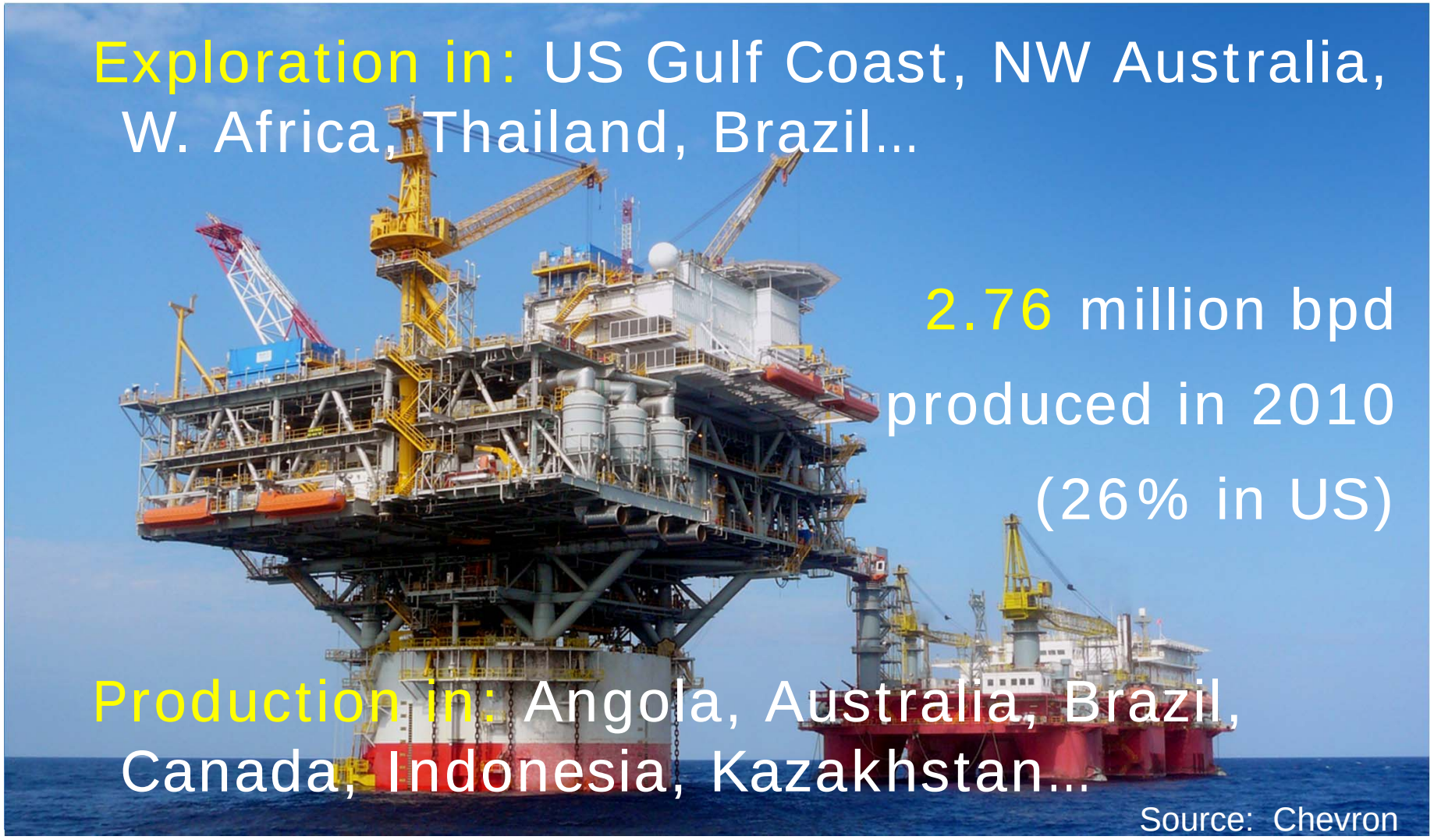

Chevron Today – Production Portfolio

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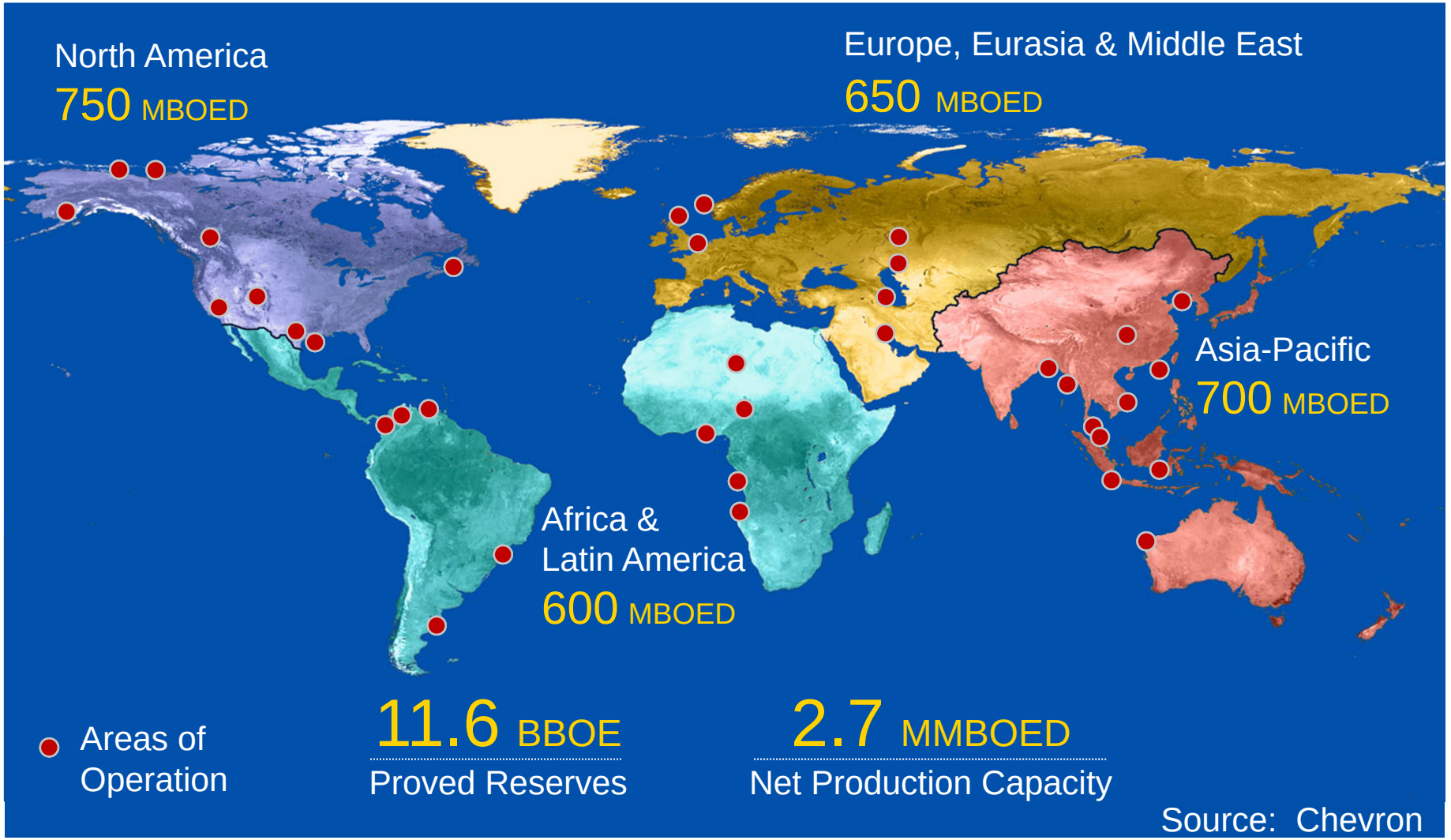

Chevron Today - Downstream

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Refining in: US, Canada, South Africa, Pacific Rim...

1.9 million bpd crude processed in 2010

Marketing in: US, Canada, Latin America, Asia, Africa...

3 brands: Chevron, Texaco, Caltex

Source: Chevron

Chevron Today – Refining

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7 wholly operated refineries

- California – 2
- Mississippi
- Utah, Hawaii
- British Colombia
- South Africa

8 joint venture refineries

- South Korea, Singapore, Thailand
- Australia – 2, N. Zealand, Pakistan, Martinique

2 joint venture upgraders: Venezuela, Canada

Source: Chevron

Chevron Today – Chemicals

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Chevron Phillips Chemical Company LLC

4600 employees

35 manufacturing sites in US, Brazil, Colombia, Asia, Middle East…

- Olefins, Polyolefins, Alpha Olefins
- Aromatics, Styrenics

Chevron Oronite

2000 employees

4 wholly owned plants in Brazil, France, Louisiana, Singapore

- Lubricant Additives
- Fuel Additives

Source: Chevron

Chevron Today – Other Key Groups

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Chevron Global Lubricants

Base oil manufacturing sites in California, South Korea *(and Mississippi)*

Products sold worldwide

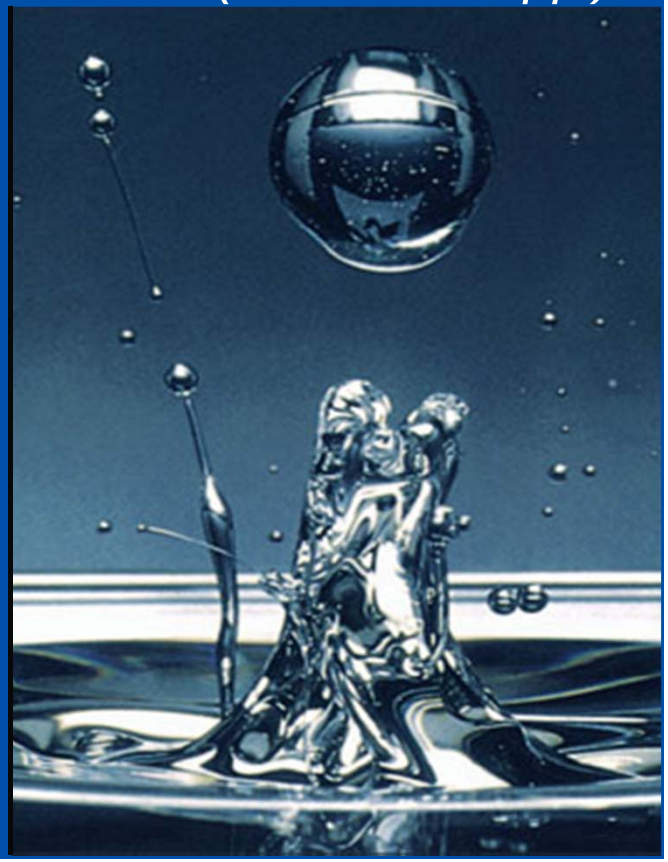
Chevron Engineering Technology Company

Upstream Research & Development

Downstream Research & Development

Corporate Expertise:

- Environmental, Safety
- Metallurgy, Equipment
- Civil/Structural, Instrumentation…



Chevron Legacy – Changes and Technology

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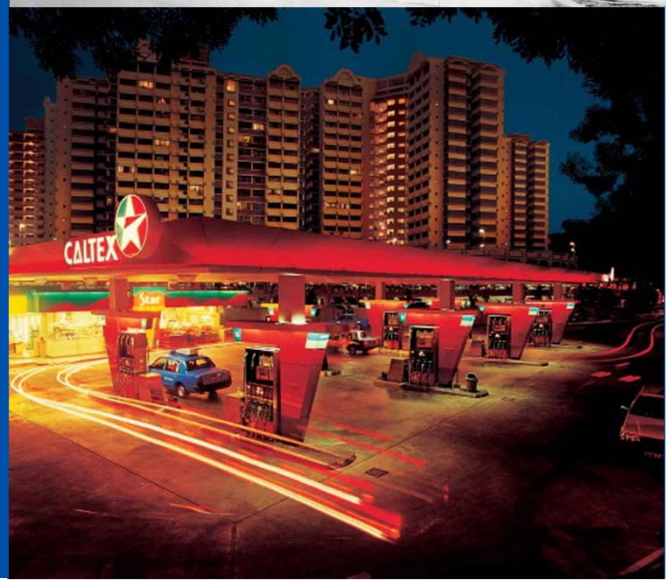
- Our industry has seen lots of Changes and Challenges
- Opportunities for Technology, Innovation and Growth
- Throughout Chevron's history, we have used our Technology and Innovation to meet these Challenges and Changes and Grow our Business
- Our focus on Technology and Innovation will shape our Future



The Future

Chevron's View of the Future – Opportunities and Technologies

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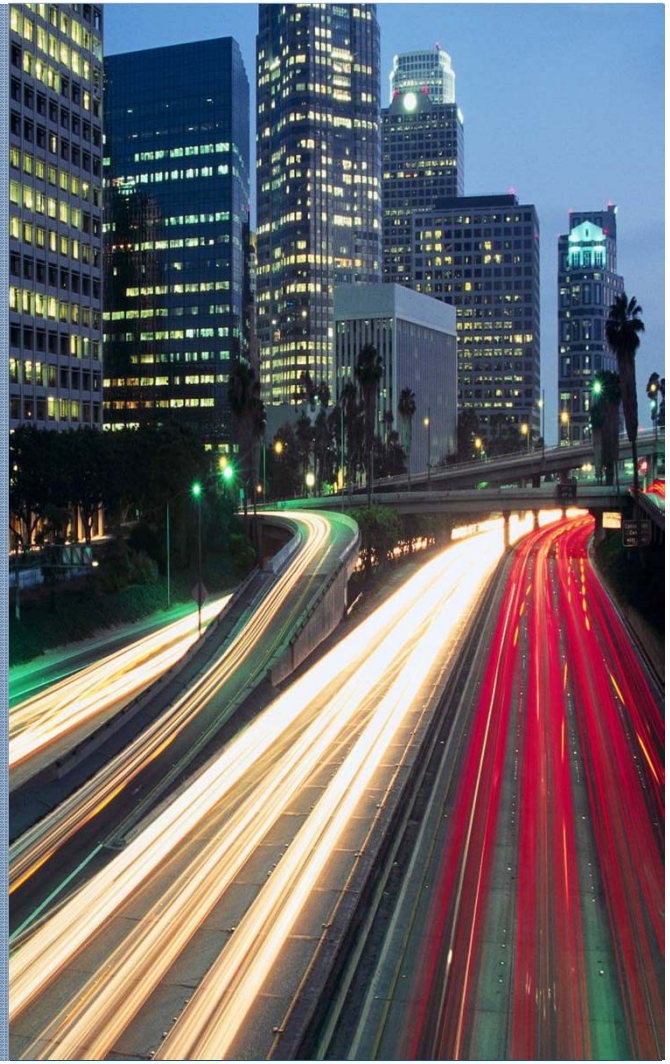
- Changes and Challenges are coming fast
- This brings opportunities for Technology, Innovation and Growth
- Chevron is committed to using Technology and Innovation to create Superior Value
- We Partner with governments, companies, customers, universities and communities to leverage technology and grow the business



Demand is Growing
All Sources will be Needed

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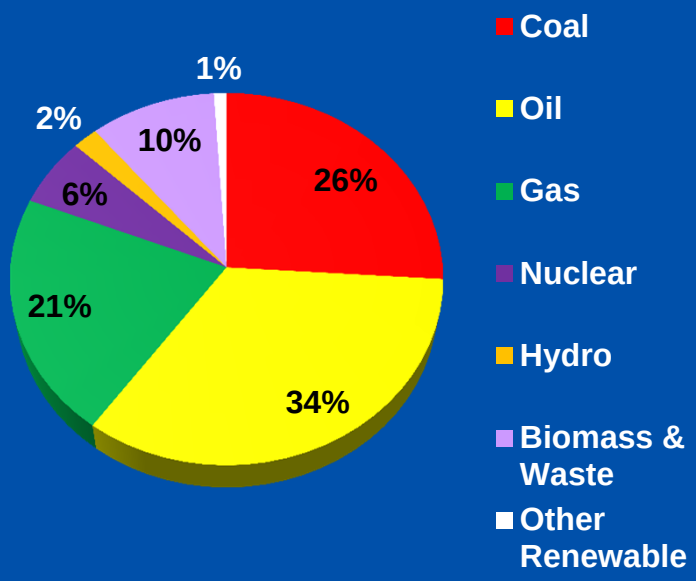
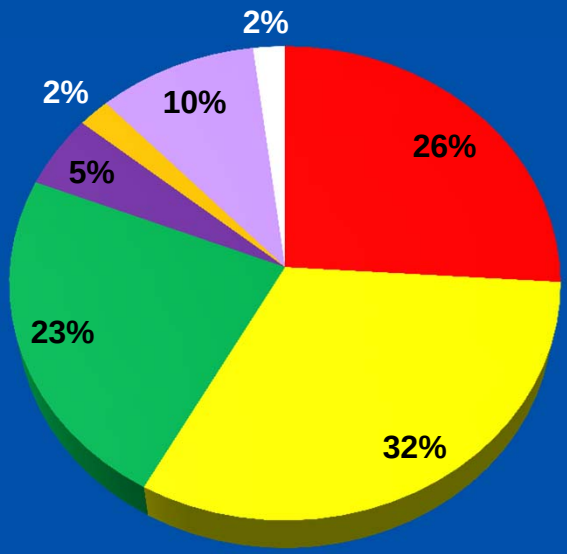
2010

12,842 Million Tons of Oil Equivalent
240 MMBOE/D



2030

17,095 Million Tons of Oil Equivalent
320 MMBOE/D



Source: Chevron

Types of Crude Oil

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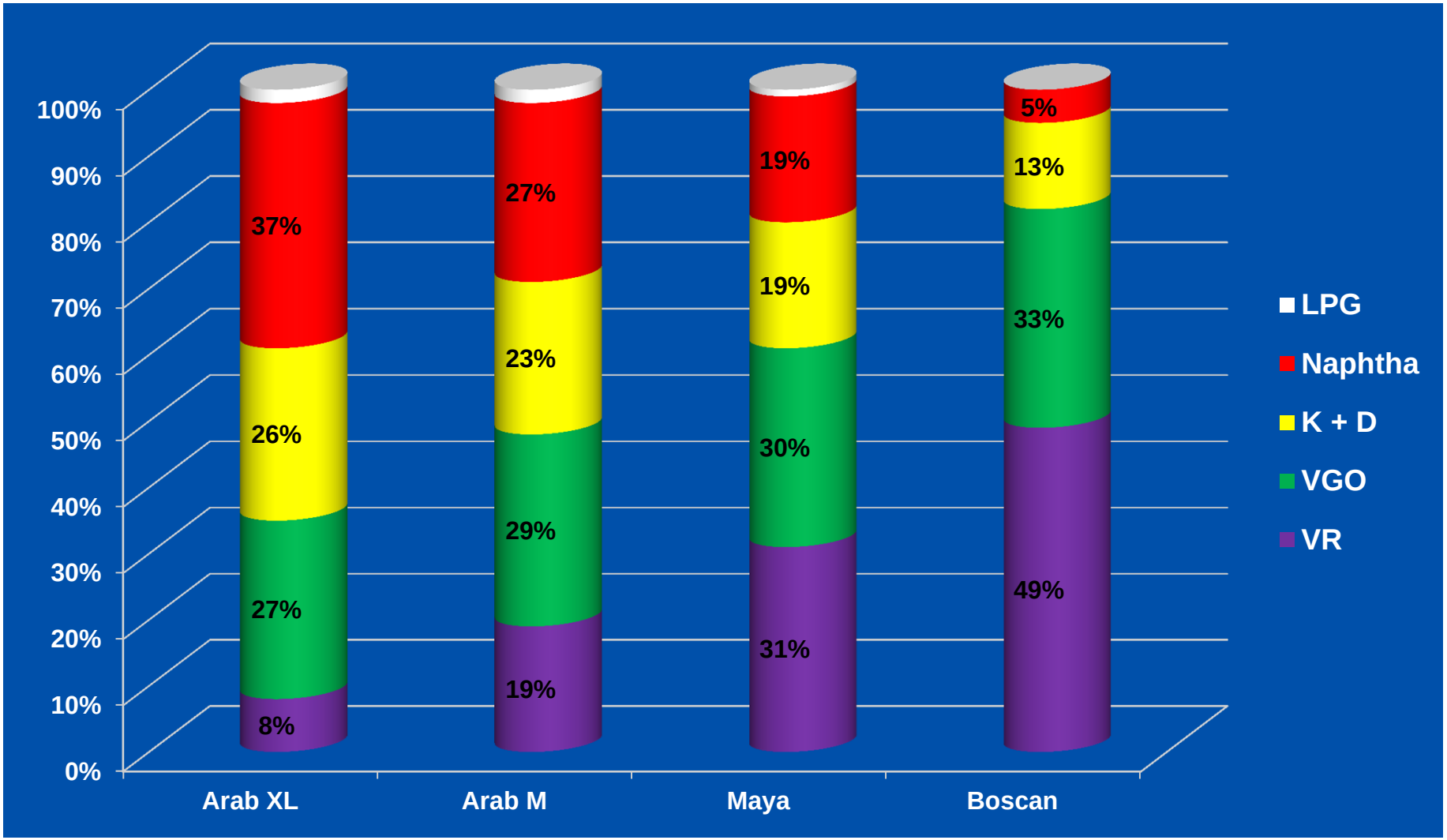

Global Heavy Oil Resources

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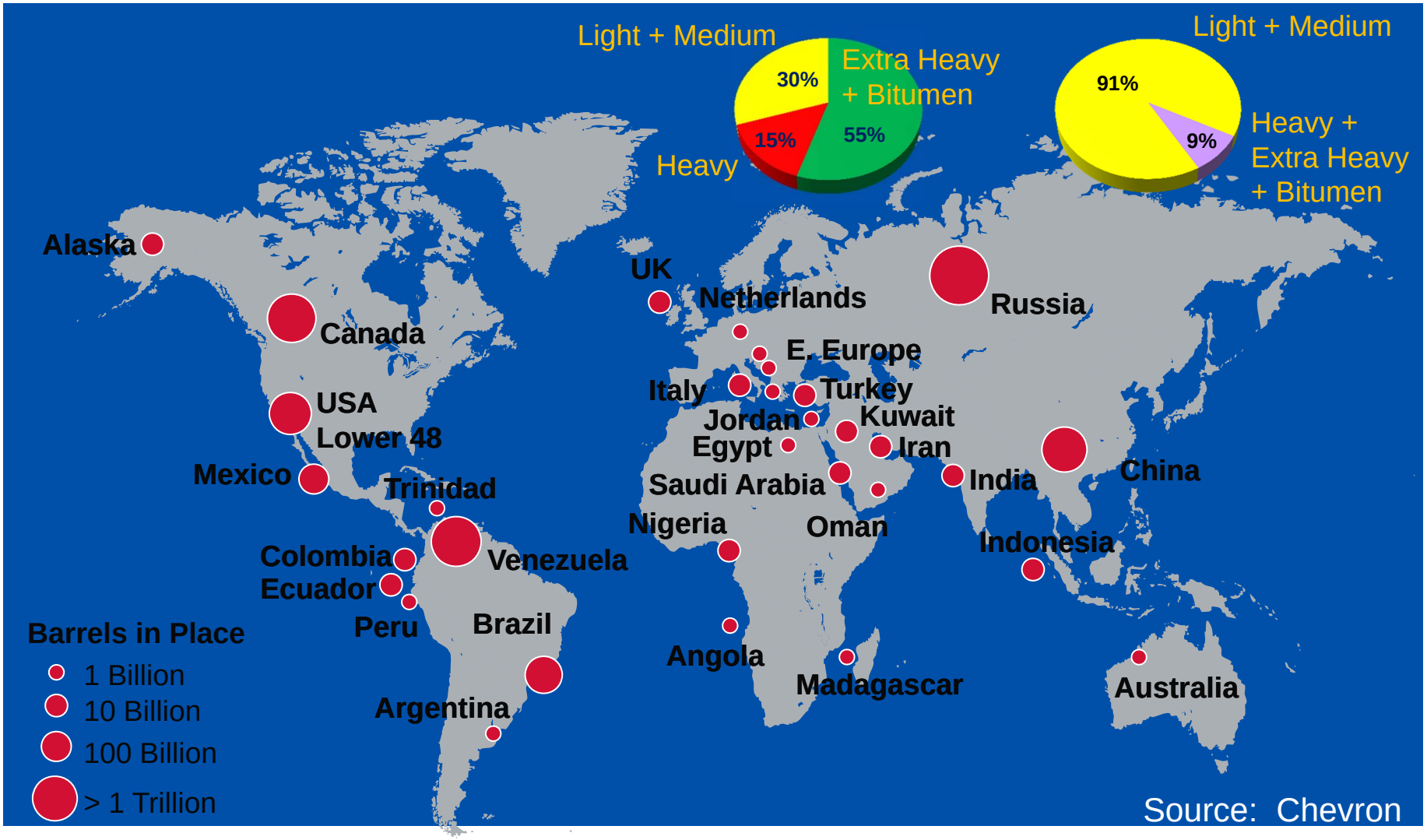
Oil-in-Place **Oil Production**



Upstream Challenges - Chevron Development of Heavy Oil Reserves

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- ~ 500,000 BPD (net) = largest among International Oil Companies.
- Accounts for almost half of the world's thermal heavy oil production.

Alberta Canada

San Joaquin Valley California

North Sea

Partitioned Zone Arabian Gulf

China

Venezuela

Boscan Hamaca

Chad

Duri Indonesia

Angola

Brazil

Mining
Offshore
Primary
Thermal

Source: Chevron

Heavy Oil Technology Options
Thermal Recovery – Most Successful

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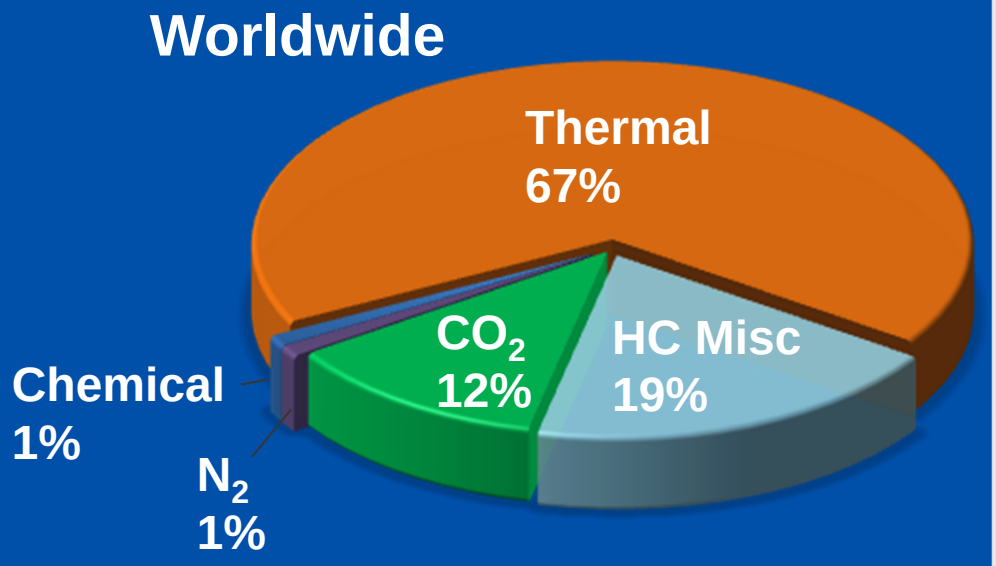
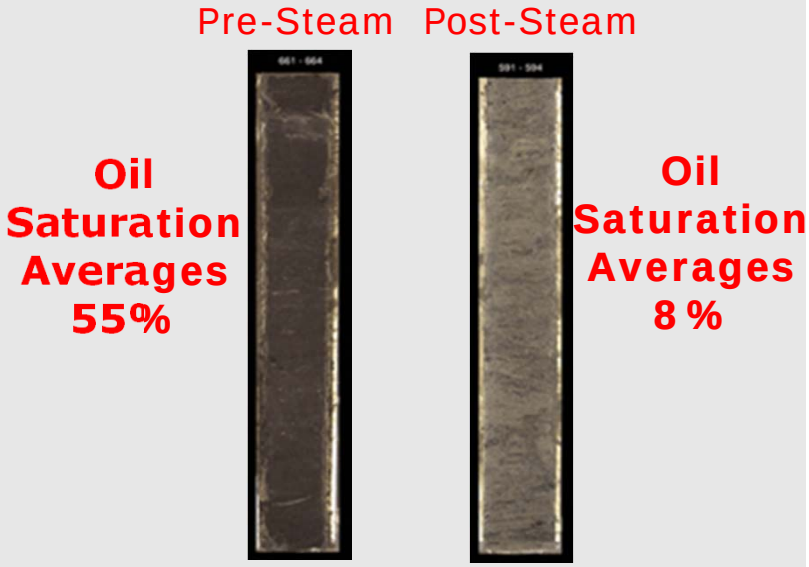


Steamflood – Increases reserves by a factor of 2-10 times compared to primary heavy oil recovery

Mechanism	Heavy Oil Recovery
Primary	5 - 15 %
Steam Flood	50 - 80 %



Typical oil saturated core in Duri Field, Indonesia

Source: Chevron

Future Downstream Challenges

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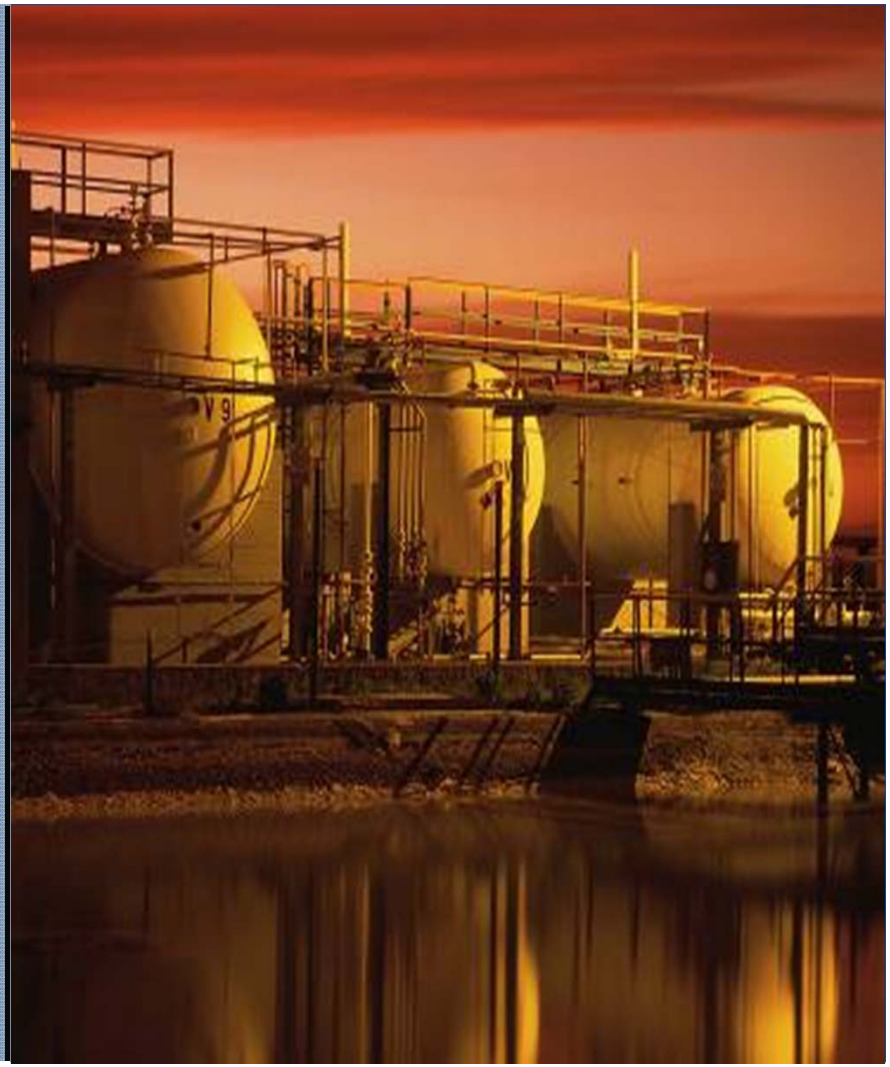
- Available crude oils are becoming heavier with higher contaminants
- Diesel demand growing
- Environmental concerns make product specifications more difficult
- Very heavy crudes favor upgraders close to fields
- Bio-renewables, F-T wax (from GTL plants) need upgrading



CLG Downstream Technology
Hydroprocessing for the Future

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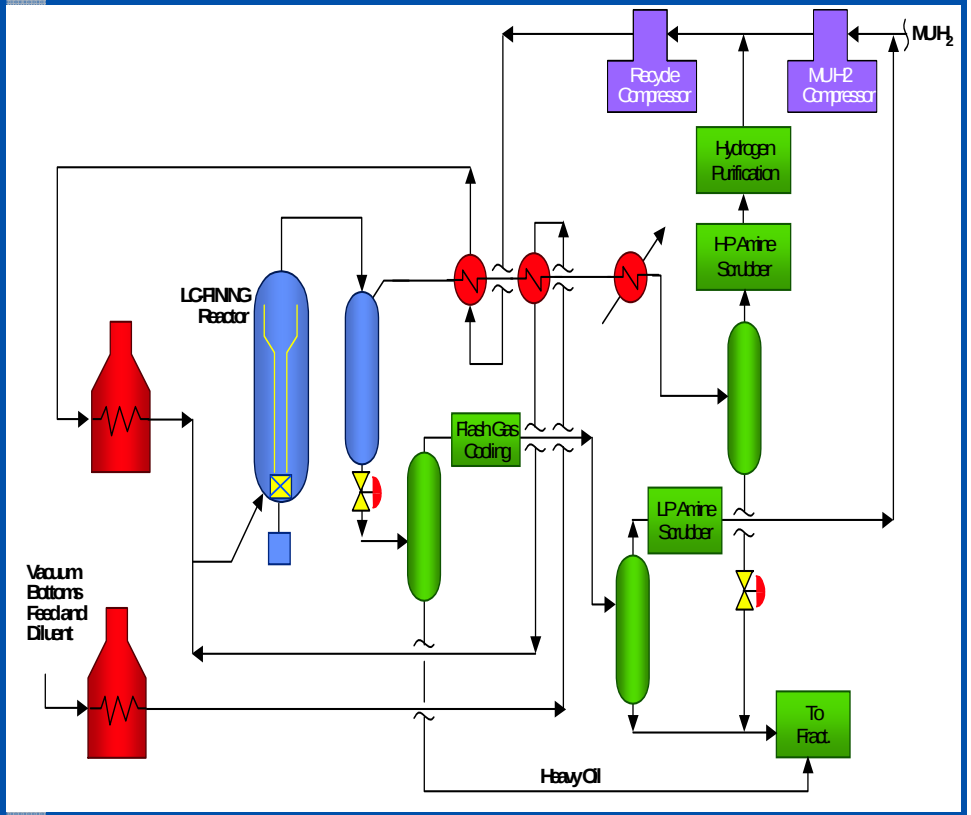
- Hydrotreating cleans up contaminants
- Hydrocracking converts heavy oils to high quality jet and diesel
- Chevron hydroprocessing developed 50 years ago to handle SJV crudes – heavy and high in nitrogen
- LC-FINING hydrocracks vacuum resid



Chevron Cycle of Technology Development

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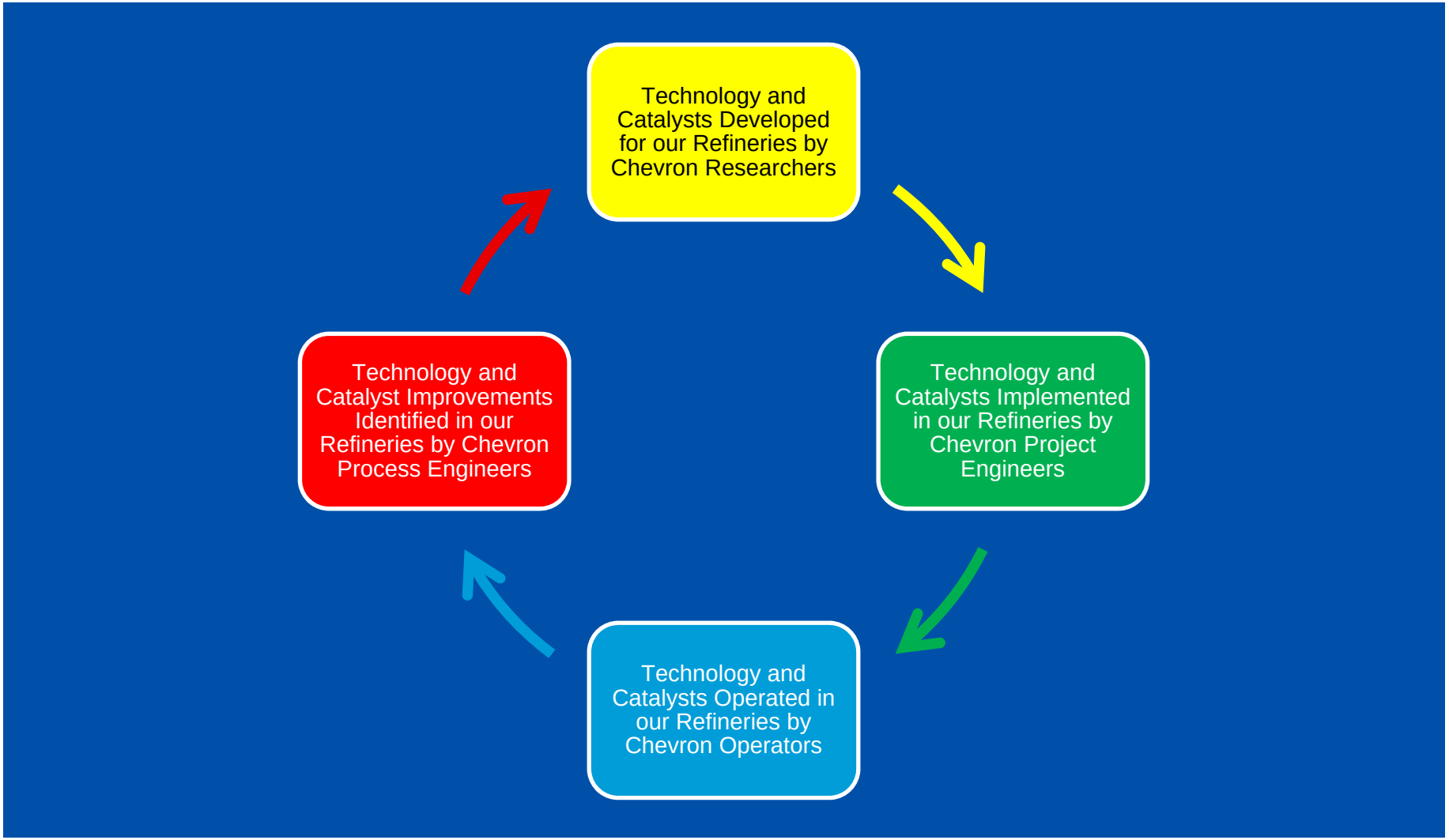

Chevron Future – Technology Application

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- Apply technology in E&P to increase Non-conventional (Heavy oil, Gas)
- Integrate Bio-renewables into core business, apply refining assets to upgrade
- Apply CLG Hydroprocessing as enabling technology for clean products

Conclusions

- The world is changing at an accelerating rate
- Changes bring challenges but also opportunities
- Throughout our history, Chevron and CLG have responded by developing and relying on technology
- We are committed to developing and using Technology to meet the Challenges of the Future