

Senate Resources

Technology Impact on North Slope Fields

Scott Jepsen, VP External Affairs

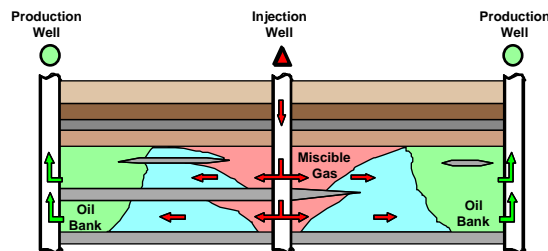
Bob Heinrich, VP Finance

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ConocoPhillips Alaska

February 8, 2013

NS Development Evolution



1981: Kuparuk
Waterflood
Pressure
Maintenance

**1988: SSEOR and
MWAG startup**

**1998: Tabasco and
Tarn startup**

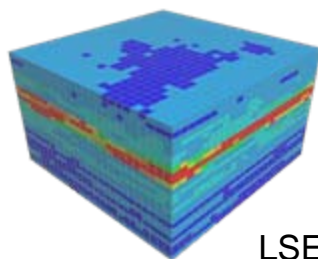
**2001: Meltwater
startup**

2000: Alpine startup



2012: CD5 Sanction

1981 1986 1991 1996 2001 2006 2011 2012



**1996: NGL
import and
LSEOR startup**

**1997: West
Sak startup**

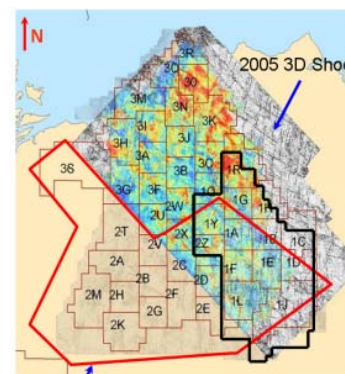
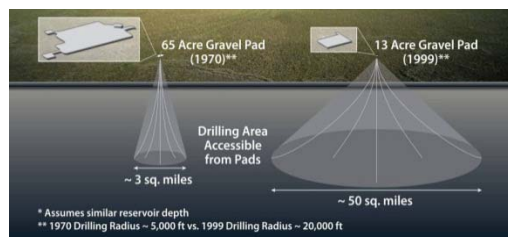
**2005 and 2011:
3D and 4D seismic**

**2009+: Coil
Tubing Drilling rig**

**1981-1986:
Gas storage**

**1985: STP, IWAG,
& Frac'ing startups**

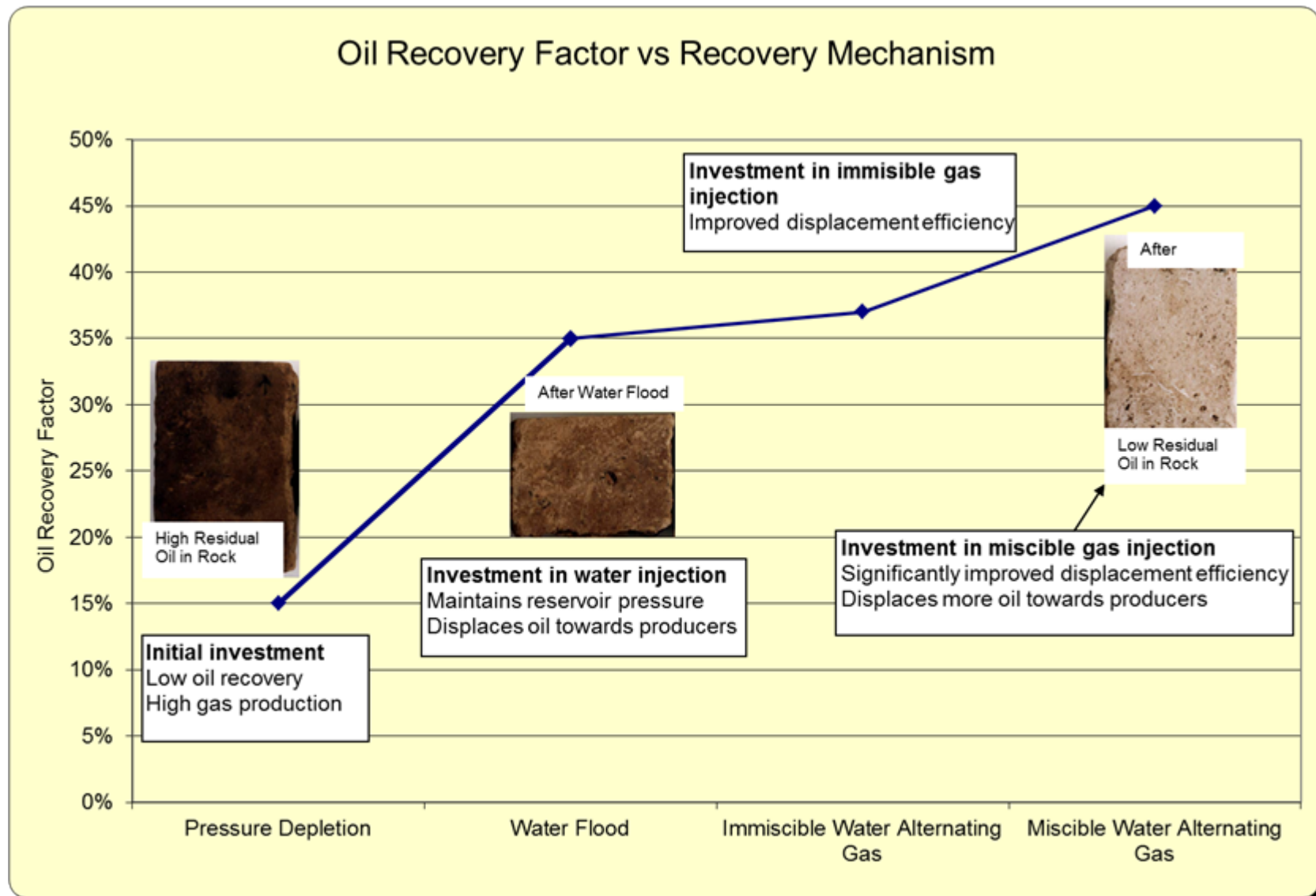
**1999+: DS footprint
reduction and Extended
Reach Drilling**



**Future: Viscous,
Low Perm, EOR+,
Heavy**



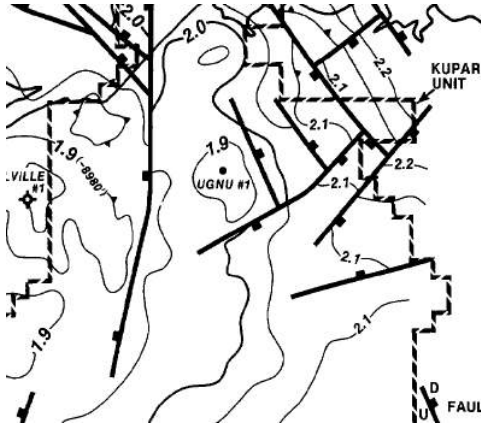
Recovery Efficiency Evolution



Seismic Evolution

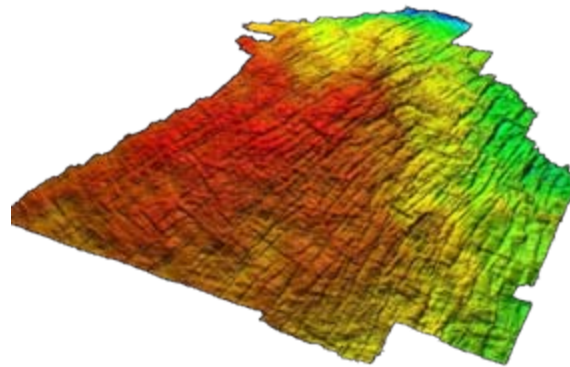
GKA Legacy Asset

Field Discovery 1967



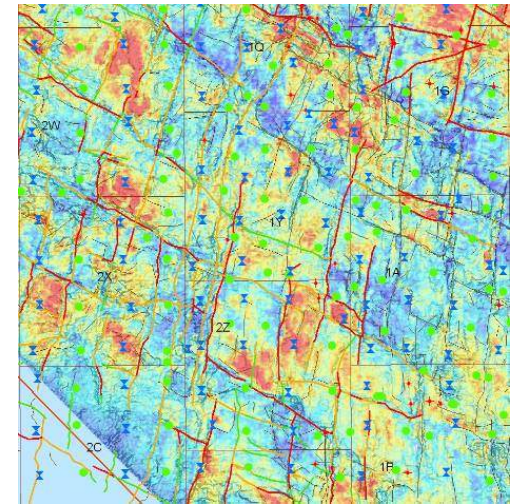
Sparse 2D seismic
Faulting believed to be simple
Few wells drilled

3D Seismic 1988-2011



Improving 3D Technology
reveals 1000's of faults -
Reservoir Compartments
1000+ wells drilled

4D Seismic 2005 - forward



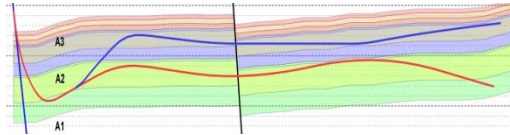
Emerging 4D Seismic
Technology reveals field
changes and more infill
targets/unswept oil

Coil Tubing Drilling Evolution

GKA Legacy Asset



2006: Slimhole resistivity

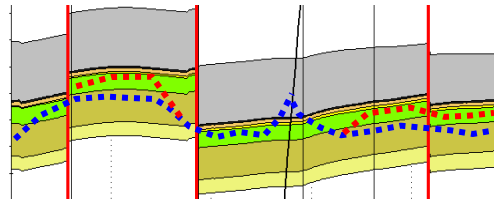


2004 through
December 2012:
232 CTD laterals,
470,196' drilled

2009: Directional

Aug. 2004: 1st
lined multi-lat

2005: 1st quad-lat;
KWS 3D seismic

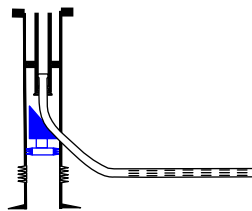


Jan. 2010:
WK 3D survey

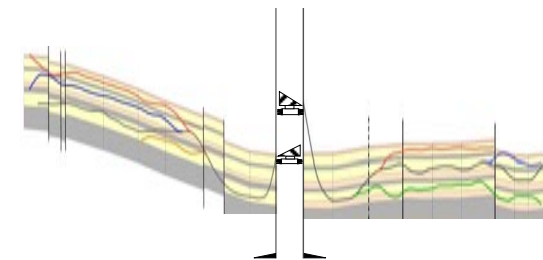
2012: 1st octa-lat

1998: CTD BHAs
downsized

1998-2004:
single-laterals

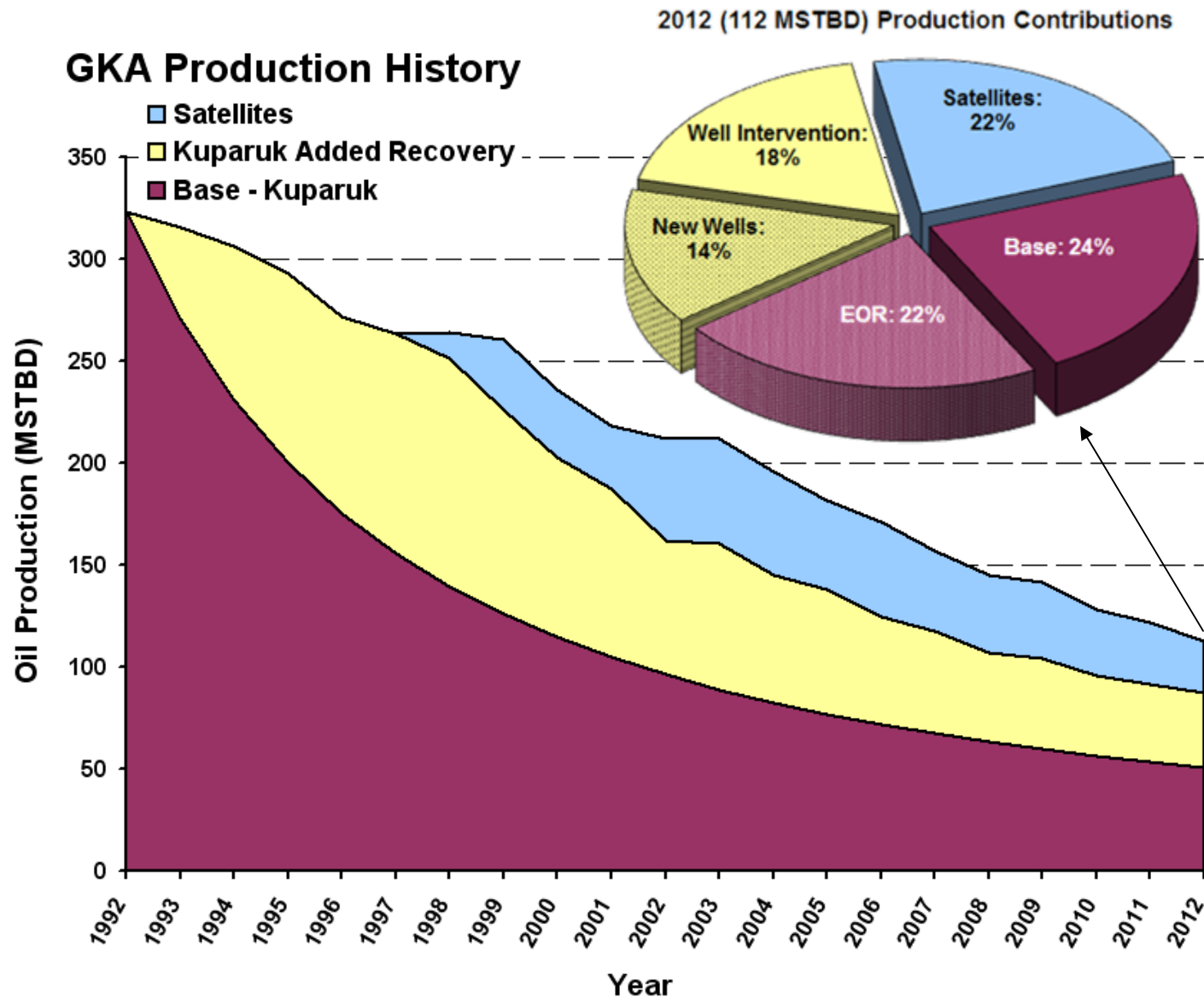


May 2009: Dedicated,
purpose-built rig

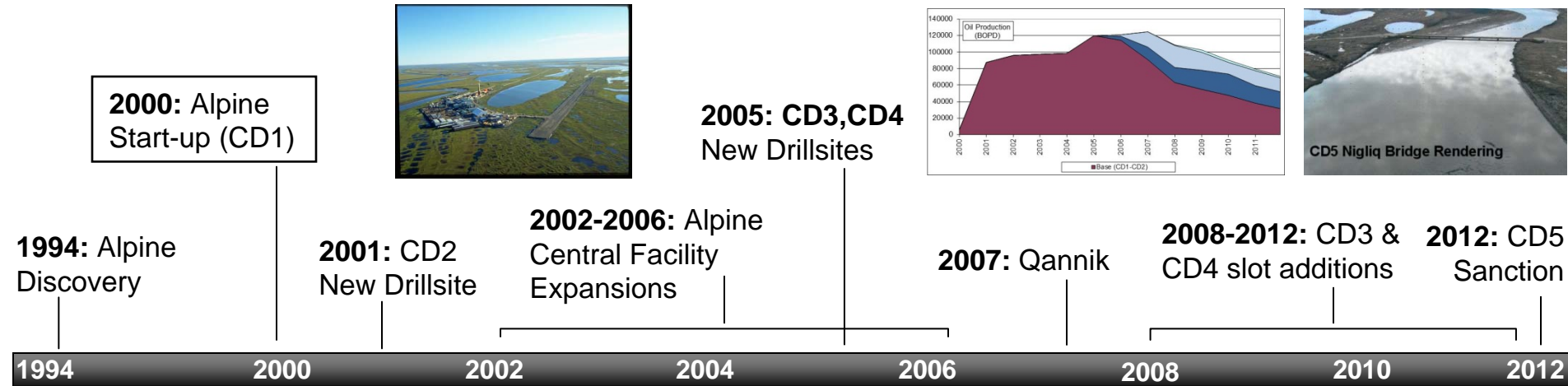


GKA Legacy Asset

Production History



WNS Development Evolution

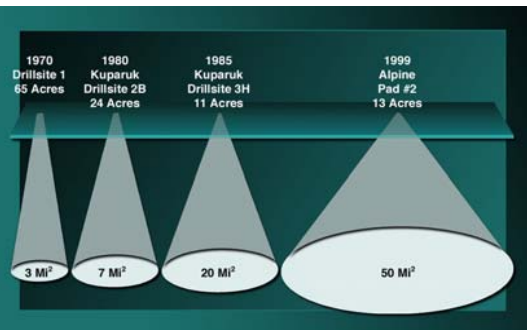


2000+: Optimized Field Development
-1st horizontal well development on NS
-Extended Reach Drilling

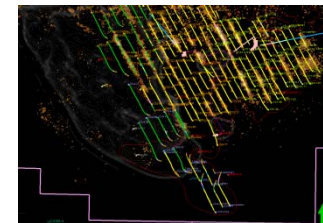
Remote Operations
-Alpine Resupply Ice Road
-CD3 Remote Operations

2010: 3D&4D seismic

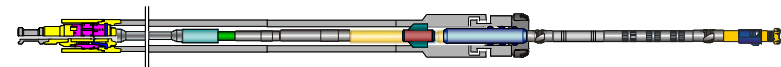
2012+: Steerable Liner Drilling



2000+: Improved Recovery
-Waterflood (incl. seawater)
-Enriched gas injection



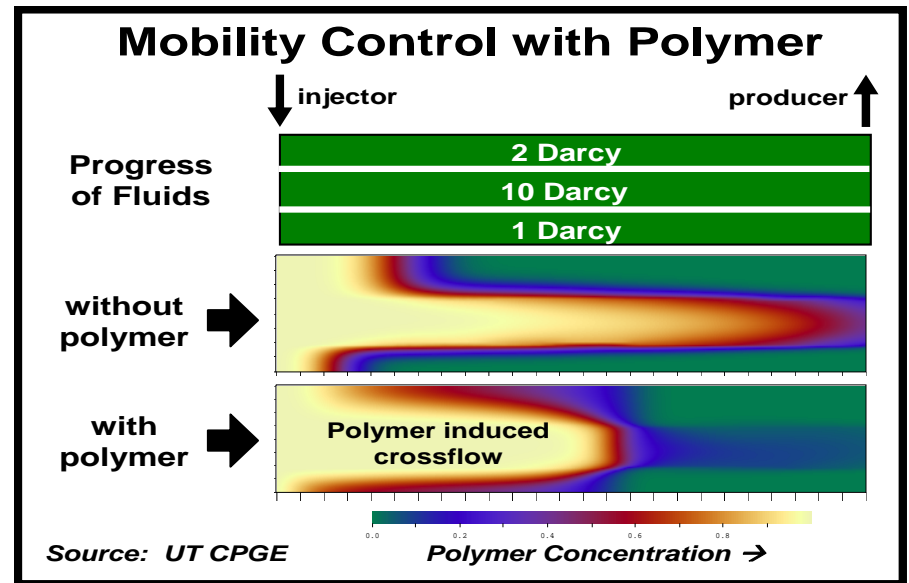
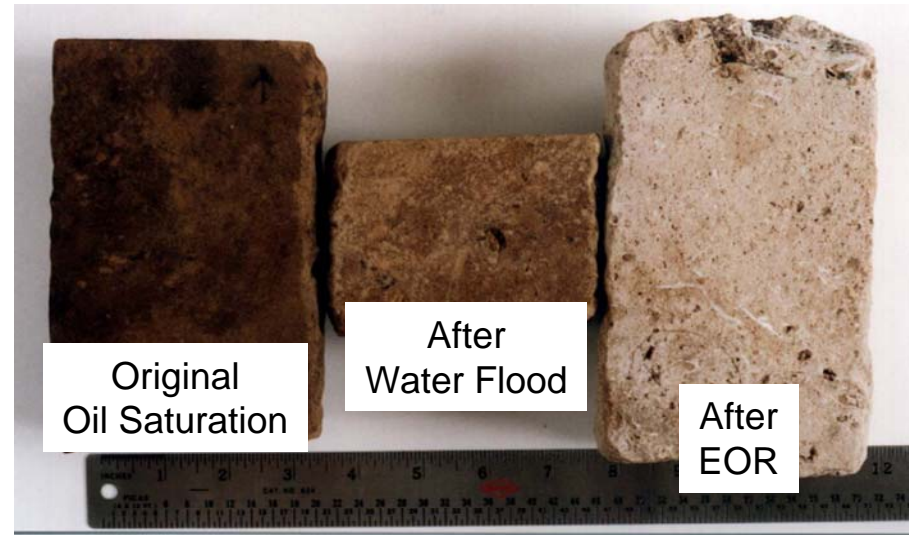
2008+: Well drilling in ultra thin sands



2000+: Near zero discharge facility

Future EOR Technology Opportunity

- Chemical EOR
- Flood Conformance Polymers
- Thermal & Non-Thermal Heavy Oil Recovery



“Easy Oil” In the Legacy Fields Is Gone

- Challenged oil remains
 - Complex, high cost wells
 - Smaller reserve targets
 - Fault blocks, flank oil
 - Satellites, viscous oil
 - Most new wells produce oil AND water
 - Facilities handling ~ three times as much water as oil
- **A billion dollars does not go as far as it used to...**
 - 2000 Alpine development ~80,000 BOPD
 - 2012 CD-5 Drillsite ~18,000 BOPD

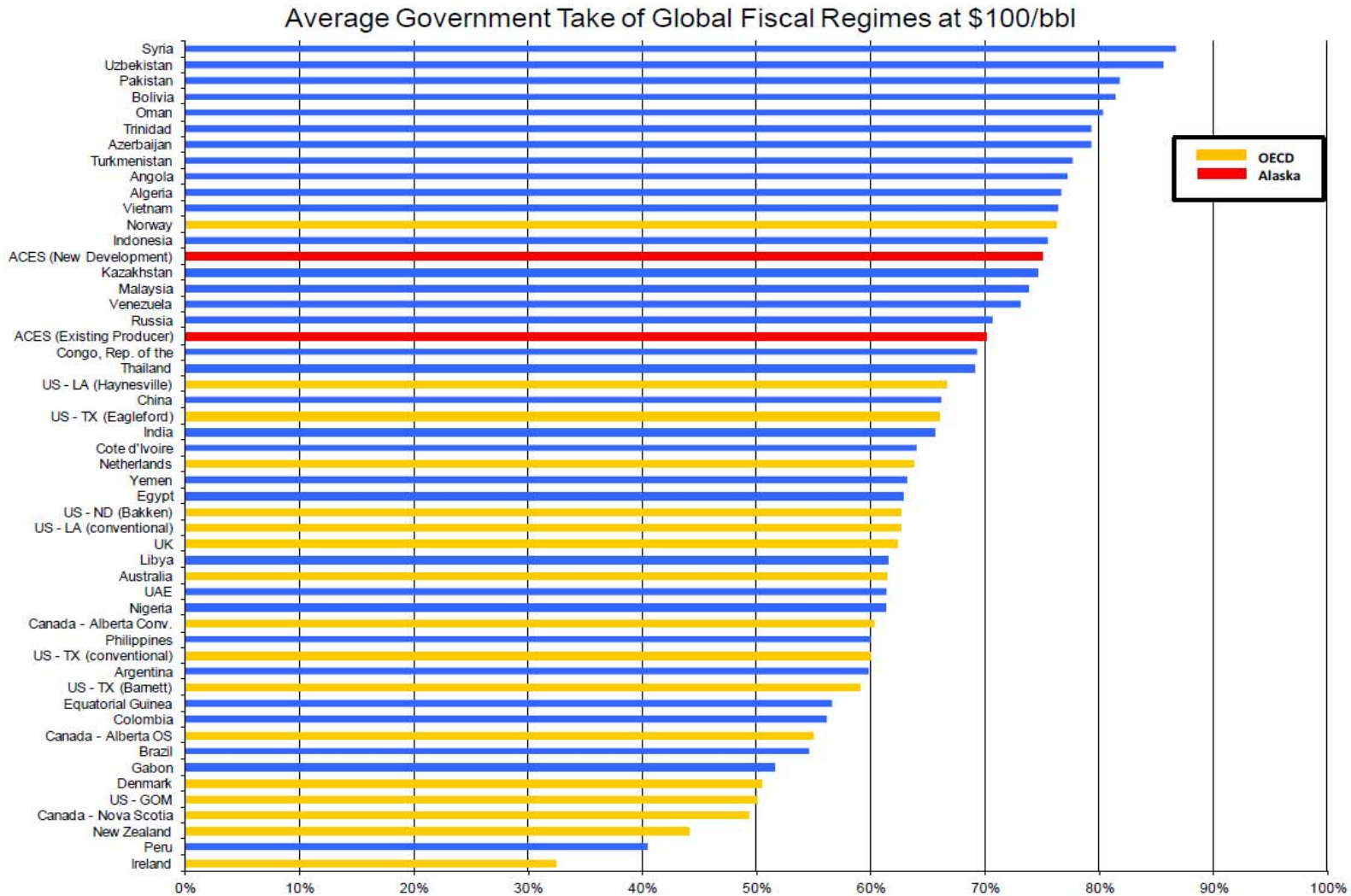


Initial Alpine Development



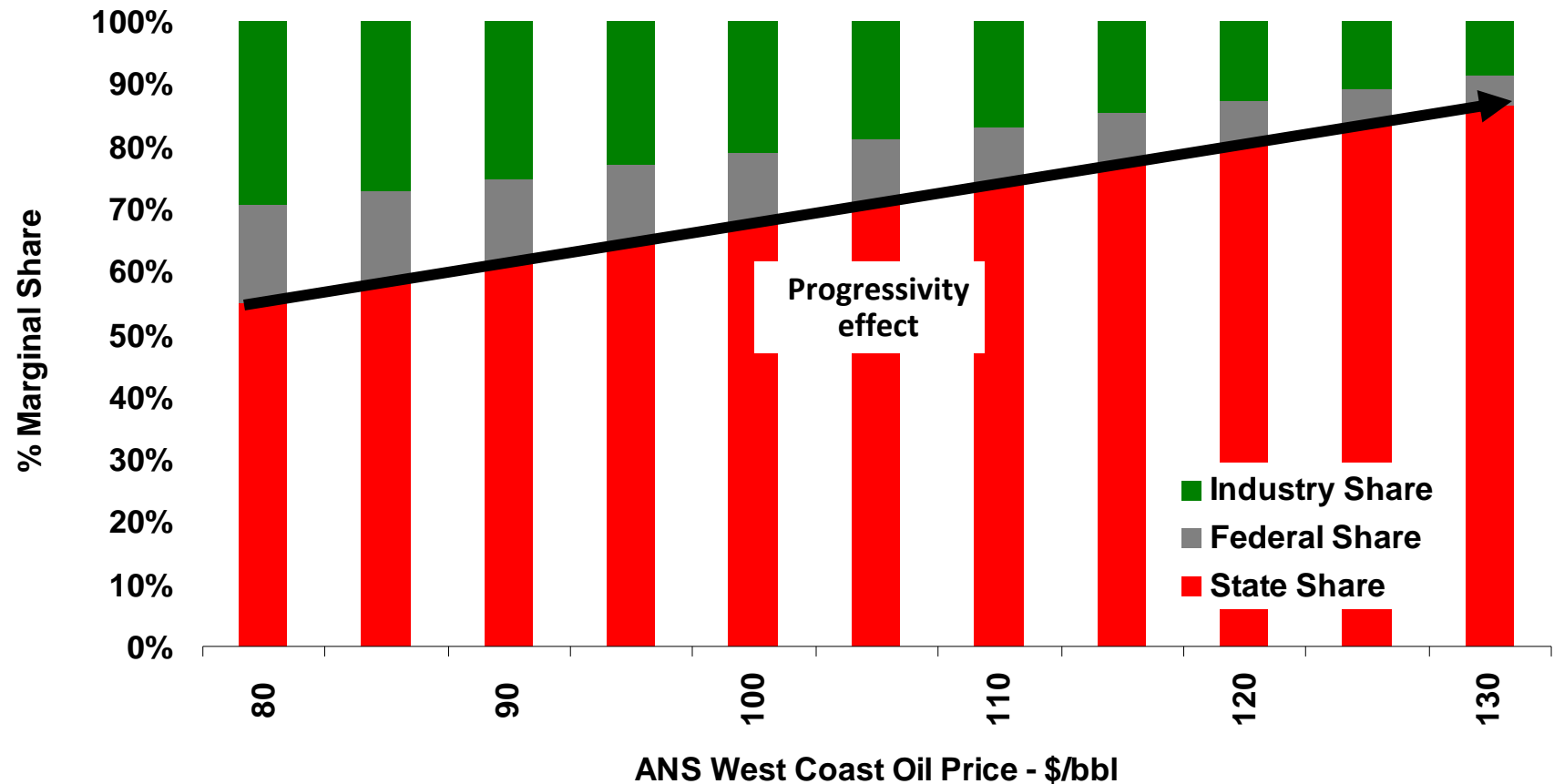
CD-5 Type Development

Regime Competitiveness: Average Government Take at \$100/bbl



ACES Marginal Industry Share

Government and Industry Marginal Share in Alaska



- Technology and innovation have played a key role in the development and increased recovery of North Slope legacy fields and satellites
- The legacy fields provide the resource base to continue development and implementation of new technology
- Application of new technologies is not inexpensive – costs can be high
- Alaska's oil tax system puts the North Slope business climate at a disadvantage

Acronyms

- BHA = Bottom Hole Assembly
- BOPD = Production rate in Barrels of oil per day
- CTD = Coil Tubing Drilling
- DS = Drill Site
- EOR = Enhanced Oil Recovery
- GKA = Greater Kuparuk Area
- ICD = Injector Control Device
- IWAG = Immiscible Water Alternating Gas
- KWS = Kuparuk West Sak Survey
- LSEOR = Large Scale Enhanced Oil Recovery
- MMBO = Million barrels of oil
- MSTBD = Production rate in 1000's of stock tank barrels of oil per day
- Multi-lat = Multilateral well
- MWAG = Miscible Water Alternating Gas
- NEWS = North East West Sak
- NS = North Slope
- NGL = Natural Gas Liquids
- Octa-lat = Octalateral well
- Perm = Permeability
- Quad-lat = Quadralateral well
- SSEOR = Small Scale Enhanced Oil Recovery
- STP = Seawater Treatment Plant
- WAG = Water Alternating Gas
- WK = Western Kuparuk Survey
- WNS = Western North Slope