As new technologies and operations enhance the economics E&P companies are increasingly looking to the Arctic region to search for new oil and gas reserves. This book reviews the state of play on the Alaska North Slope for new Entrants
I - Introduction
Reintroducing the Potential on the Slope

<table>
<thead>
<tr>
<th>Perceptions</th>
<th>Realities</th>
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</table>
| Mature      | -3 Bbbls developed in the last 12 years  
|             | 10 fields greater than 100 MMbbls       |
| Politics / Fiscal Regime | All the central north slope lands are Alaska State Lands - simple permitting  
|             | State dependent on oil & gas revenues, incentivizes government to act rationally |
| Tax Credits | State substantially subsidizes new company entrants |
| Geologically Complex | Central North Slope is one of the best petroleum provinces in the world with predictable geology and an elegant classic petroleum system  
|             | Structural complexities seen in the Foothills do not occur on the Coastal Plain |
| Harsh Physical Conditions Require Special Equipment | Ice pads & ice roads are unique, but standard practice for many years  
|             | 30+ year industry history of service providers with the North Slope as their primary business  
|             | Drilling rigs require winterization, but no special equipment |
| Logistics / Remote Location | Substantial existing infrastructure has been built in the region  
|             | “Frozen West-Texas” - established oil patch  
|             | Pad drilling limits the logistics demands  
|             | Home to the two largest oil fields in North America  
|             | 6,000+ wells drilled on the slope  
|             | 15.8 Bbbls produced to date |

Alaska is the largest state, twice the size of Texas and one-sixth of the size of the lower 48. The Alaska North Slope (ANS) is located between the Brooks Mountain Range and the Arctic Ocean. The single largest oil field in the US, Prudhoe Bay, is found on the ANS. The ANS continues to offer material oil and gas resource opportunities.
II - Background
The Context of 42 Years of ANS History

- Petroleum potential was recognized as early as 1923 - surface oil pools. Exploration began in 1944.
- First oil discovered by ARCO at Prudhoe Bay 1968; Kuparuk was discovered in 1969 by Sinclair Oil.
- TAPS completed July 1977.
- North Slope oil production peaked in 1988 at 2.01 mmbbls/d; Dec 2010 production 644 mbbls/d.
- Alpine was discovered in 1994 by ARCO.
- Exxon is moving forward with drilling and development activities at Pt. Thomson - production by YE 2014.

In the 1970's oil and gas production in the lower 48 entered a decline and the discovery of oil at Prudhoe Bay offered significant domestic supply on a world class - since then Alaska grew into the nation's most significant supply of domestic oil with two of the largest oil fields in North America.
Central North Slope expands with artificial gravel island fields - most recently Oooguruk, Nikaitchuq and Northstar

Independents arrive (AVCG/Armstrong initiates in early 2000)

Horizontal technology brought up from the lower 48 has a major impact

BP’s Milne Point CHOPS (“Cold Heavy Oil Production with Sand”) project starts up in 2010

Development underway at Pt. Thomson

Statute for royalty reduction for new projects

State provides substantial tax credits for projects

New leases being offered in previously closed areas: NPRA and some MMS lands
A Region Historically Dominated by the Majors

The North Slope’s Central Gas Facility is the largest gas handling facility in the world.

The North Slope operating environment has been historically dominated by the Majors, attributable to the huge capital costs required for infrastructure projects.

Influential events from the Majors

- Prudhoe Bay discovered in 1968 and subsequently developed by ARCO, BP, & Exxon
- Alaska Development Charter in 1999 to improve competition
- State agreed to BP-Arco merger with the condition of the sale of ARCO Alaska to Phillips in 2000
- Conoco returns to the slope with their merger with Phillips in 2002
- BP developed the first offshore field at Northstar, production begins in 2002
- Exxon and other leaseholders have focused on the Point Thomson project - production expected in 2014
- In 2008 Shell returned and dominated an Outer Continental Shelf lease sale with high bids totaling $2.1 billion
- Strong desire to bring gas to Lower 48 - TransCanada/Exxon and BP/ConocoPhillips compete for the Alaska gas pipeline project
## Recent Activity by New Entrants

<table>
<thead>
<tr>
<th>Company</th>
<th>Activity</th>
</tr>
</thead>
</table>
| **Brooks Range** | - Management team with extensive operating history on the slope  
                   - Actively exploring all over the North Slope  
                   - Planning stages of Mustang development program |
| **Armstrong** | - Substantial development project on Colville High with Repsol  
                   - Accumulated acreage position and caused development of Oooguruk, which is being actively developed by Pioneer, as well as Nikaitchuq, which is being actively developed by ENI  
                   - First independent to initiate new field development on the North Slope |
| **ENI**       | - First production from Schrader Bluff in Nikaitchuq Unit (January 2011 estimated peak production of 28 Mbbls/d)  
                   - Acquired Nikaitchuq interest from Armstrong and Anadarko  
                   - Acquired 30% interest in Oooguruk from Armstrong  
                   - Developed standalone processing facilities for Nikaitchuq |
| **Great Bear** | - Secured approximately 500,000 acres on the North Slope, with strong positions in the unconventional play fairway south of the Kuparuk and Prudhoe Bay fields  
                   - Dominant unconventional resource player on the North Slope |
| **Kerr McGee** | - Acquisition of interest in Nikaitchuq project from Armstrong  
                   - Initiated development of the Nikaitchuq field  
                   - After being acquired by Anadarko, all prospects sold to ENI (including Nikaitchuq) |
| **Pioneer**   | - Acquisition of interest in Oooguruk prospect from Armstrong  
                   - Executed development program & drilling continues at Oooguruk field  
                   - Nuiqsut & Kuparuk participation areas approved, Moraine participating area awaiting approval from DNR |

* A handful of independents have built a business on the Slope with substantial running room and upside in sight.
North Slope Production Profile

North Slope production is close to a quarter of its peak in 1988, providing reliable takeaway capacity for new entrants.

Production begins to stabilize with the discovery of new fields.

Peak Rate = 2.01 mmbbls/d

Current Rate = 644 mmbbls/d
Cum to date = 16 Bbbls

Source: Alaska Department of Revenue – Tax Division.
Note: Excludes Cook Inlet
(1) Includes Nikaitchuq and Oooguruk
Major Pipelines

- **Trans Alaska Pipeline**
  - The lifeline for oil export on the slope
  - Has considerable additional capacity
  - All stakeholders - especially the people of Alaska have a vested interest in motivating more development and future production

- **Natural Gas Projects**
  - Ideas for moving Prudhoe Bay’s natural gas off Alaska’s North Slope are plentiful - Will they be built or won’t they?
  - Many different perspectives out there - we provide the facts and the take-away that if and when built there will be a substantial resurgence on the Slope focused on gas.
  - Potential solutions range from trucking small amounts of gas to Fairbanks consumers to constructing a pipe to carry massive amounts to Lower 48 consumers - the most expensive North American private-sector construction project ever
Trans Alaska Pipeline System - Oil Pipeline

Overview

- Trans Alaska Pipeline System (TAPS) transports crude oil 800 miles from the North Slope to the ice-free port of Valdez
- Constructed from March 1975 to May 1977
- $8 billion for construction of entire system
- Alyeska Pipeline Service Company was incorporated in 1970 to design, build, operate and maintain the pipeline
- Owners - BP, ConocoPhillips, ExxonMobil, Koch and Chevron
- Carries ~15% of nation’s domestic oil production and has transported ~16 Bbbls of oil

Parameters

- Throughput
  - 2.136 mmbbl/d maximum with 11 pump stations operating
  - 2.000 mmbbl/d maximum with 7 pump stations operating
  - Peak throughput - 2.055 mmbbl/d in 1988
  - Currently transports ~600 mbbl/d to the Lower 48
- Diameter - 48 inches
- Pressure maximum - 1,180 psi
- 4 pump stations currently operating with an additional pump station in operation as a relief station (12 pump stations with 4 pumps each in the original design)

Implications

- TAPS has considerable additional capacity
- Unless further sources of oil are developed, Alyeska will begin to close pump stations
- The minimum level of throughput is 200,000 bbl/d, which ultimately will create additional incentives for further activity
- Current operators are extending the effective life of the pipeline
- TAPS pipeline is the lifeline of the State of Alaska & existing producers

Source: Alyeska Pipeline Service Company Website.
## Comparison of Proposals for Transporting Natural Gas

<table>
<thead>
<tr>
<th></th>
<th>Pipeline to Alberta</th>
<th>Pipeline to Southcentral</th>
<th>Pipeline to Valdez</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sponsor</strong></td>
<td>Transcanada and Exxon Mobil (minority interest) are operating together - announced July 2009</td>
<td>Alaska Gasline Development Corp., a state agency the Legislature created in 2010</td>
<td>Two separate proposals:</td>
</tr>
<tr>
<td></td>
<td>□ TransCanada and ExxonMobil</td>
<td>□ The Alaska Gasline Port Authority</td>
<td>□ An 803-mile, 48-inch buried pipeline from the Prudhoe Bay field on Alaska's North Slope to Valdez</td>
</tr>
<tr>
<td><strong>Parameters</strong></td>
<td>□ 1,700-mile, 48-inch buried pipeline from the Prudhoe Bay field on Alaska's North Slope to the British Columbia-Alberta border in Canada</td>
<td>□ 737-mile, 24-inch buried pipeline from the Prudhoe Bay field on Alaska's North Slope to the Big Lake area of Southcentral Alaska</td>
<td>□ The pipeline would move up to 3 bcf/d, with Alaskans using some and 2.8 billion arriving in Valdez for export</td>
</tr>
<tr>
<td></td>
<td>□ Designed to have a capacity of ~4.5 bcf/d, but could be expanded to 5.9 bcf/d</td>
<td>□ The pipeline would move up to 500 mmcf/d</td>
<td>□ Estimated cost of between $20 bn and $26 bn for the pipeline and ~$23 bn for the LNG plant and Valdez port</td>
</tr>
<tr>
<td></td>
<td>□ Estimated cost of between $32 bn and $41 bn</td>
<td>□ Estimated cost of $5.3 billion to $9.8 billion (includes a $1.84 billion gas treatment plant at the Prudhoe Bay field)</td>
<td></td>
</tr>
<tr>
<td><strong>Status</strong></td>
<td>Project is in the development stage - Sponsor received multiple bids during its open season in 2010 and is currently in negotiations with major companies; an approved pipeline is scheduled to be in service in 2020</td>
<td>Project is in its very early stages - Feasibility study issued in July 2011 provided a preliminary plan, and the sponsor recommends the state spend $370 million to firm up the design, cost estimates and engineering, acquire permits and seek customers that would ship gas through the pipeline</td>
<td>The project appears to be dormant</td>
</tr>
<tr>
<td><strong>Proposed Timeline</strong></td>
<td>□ October 2012 - Apply to FERC to allow pipeline construction and operation</td>
<td>□ 2011-2015 - Sponsor sharpens engineering and cost estimate, obtains permits, solicits customers</td>
<td>NA</td>
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<tr>
<td></td>
<td>□ 2012 - 2014 - FERC reviews the application and produces an environmental impact statement</td>
<td>□ 2015-2018 - Construction and commissioning</td>
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<td>□ 2014 - U.S. and Canadian approvals issued</td>
<td>□ 2018-2019 - First gas flows</td>
<td></td>
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<tr>
<td></td>
<td>□ 2015-2020 - Construction and commissioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ 2020 - First gas flows</td>
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<tr>
<td><strong>Pros</strong></td>
<td>Short-term economic boost during construction (estimated 7,000 jobs during peak construction)</td>
<td>Short-term economic boost during construction</td>
<td>Valdez gets new industry based on LNG export</td>
</tr>
<tr>
<td></td>
<td>□ Long-term economic boost as billions of dollars in revenue flows to state treasury, the Alaska Permanent Fund and local governments along the pipeline route</td>
<td>Could deliver gas to Fairbanks and Southcentral two years sooner than the larger pipeline to Alberta</td>
<td>Outlet for natural gas now stranded on Alaska’s North Slope should spur oil and gas exploration</td>
</tr>
<tr>
<td></td>
<td>□ Outlet for natural gas now stranded on Alaska’s North Slope should spur oil and gas exploration</td>
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<td></td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>High cost makes project risky for lenders that would supply construction financing</td>
<td>Likely requires state to issue billions of dollars in revenue bonds</td>
<td>Most expensive option</td>
</tr>
<tr>
<td></td>
<td>□ Requires major gas shippers to commit to using the pipeline for at least 20 years</td>
<td>□ The project would produce far less new state revenue than the Alberta pipeline</td>
<td>High cost makes project risky for lenders that would supply construction financing</td>
</tr>
<tr>
<td></td>
<td>□ Long term horizon makes project risky</td>
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Oil Fields of the North Slope

Four Tectonic Sequences

Brookian Sequence - Deltaic sediments

Beaufortian Sequence - syn-rift clastic

Ellesmerian Sequence - Primarily clastics with some carbonates

Basement - Meta-sediments and granite

Lower Cretaceous Unconformity (LCU)

Major Oil-Prone Source Rock

~17 mmbbls developed in the ANS on multiple levels of the stratigraphic column

Note: Recoverable EURs based on extrapolation of current estimates.
**Stratigraphic Unit**

**MEGASEQUENCE DESCRIPTION**

**Brookian:**
- Sediment source is from the south in response to the Brooks Range uplift
- Tectonic setting a foreland basin with active thrusting and uplift of the Brooks Range to the south
- Reservoirs are laterally extensive, strike oriented, shallow marine shelf sands (topsets) and localized slope and basin-floor channel and fan complexes (bottom-sets)
- Trapping style is predominately stratigraphic with regional structural component
- Exploration and development status is immature
- Type Field is Milne Point-KRU Schrader Bluff Trend

**Beaufortian:**
- Sediment source initially from the north through Kup "A" deposition, with locally derived syn-rift sands associated with LCU subcrops deposited in the Kup "C"
- Tectonic setting a south-facing passive margin during Jurassic with a failed rift episode at the end of the Jurassic. Cretaceous also a south-facing passive margin through Kup "A" time, followed by active uplift and rift faulting along Barrow Arch associated with opening of the Beaufort Sea.
- Jurassic and Kup "A" reservoirs are extensive shallow marine, shelf sands with strike lengths of 20 to 40 miles. Kup "C" reservoirs are highly productive, shallow marine, syn-rift sands with variable thickness and areal extent
- Trapping style is structural with a strong stratigraphic and erosional subcrop component, and stratigraphic
- Exploration and development status is predominately immature with mature areas around Prudhoe Bay and Kuparuk River Fields
- Type field is Kuparuk River Field

**Ellesmerian:**
- Sediment source from the north
- Tectonic setting a south-facing passive margin
- Reservoirs are predominately “blanket” sand bodies with some shallow shelf limestone/dolomite
- Trapping style strongly structural with erosional subcrop component
- Exploration and development status mature
- Type field Prudhoe Bay Field

*Modified from Bird, 2001*
Oil and gas trapped along the Barrow Arch in both pre and post LCU sand bodies

- Oil generated in Shublik is expelled into Sag River SS and Ivishak where it migrates updip to LCU truncation
- Oil migrates updip along LCU filling all sand reservoirs within the Colville High closure
- Oil generated in the lower Kingak migrates updip along clinoform surfaces to shelf margin sands
- Oil leaks up along faults and fractures from underlying reservoirs to charge the Nanushuk sands
Approx. 150 wells drilled per decade over an area of ~10 million acres. Vast areas are sparsely drilled, creating world class opportunities.

Source: State of Alaska DNR, Division of Oil and Gas, Alaska Oil & Gas Conservation Commission.
Year by Year North Slope Development

By 1970 - 60 completions

By 1980 - 442 completions

By 1990 - 2144 completions

By 2000 - 3793 completions

By 2010 - 5509 completions on Barrow Arch

Legend

- Pipeline
- Completions

10 miles
Year by Year Permian Basin West Texas Development

By 1940 - 464 Completions

By 1950 - 3,126 Completions

By 1960 - 21,684 Completions

By 1980 - 64,325 Completions

By 2000 - 116,834 Completions

By 2011 - 147,459 Completions

Alaska is expected to continue to expand in a similar fashion to the Permian

Alaska is only in this phase of its development potential
Central North Slope is huge and largely un-exploited

ANS Creaming Curve

Every 50 wildcats discover ~1 Bbbls and ~10 fields

Source: Jean Laherrere 2008.
Alaska North Slope Resource Potential

USGS data on resource potential illustrates that there is substantial remaining oil and gas to be developed, the Colville High accumulates a substantial proportion of the migrating hydrocarbons.

- “The arctic Alaska region is one of the most petroleum productive areas in the United States.” USGS
- Approximately 16 billion barrels of oil have been produced up to date
- This is a geologically target rich environment, with prospective strata located in multiple reservoirs and trapping types
- Multiple source rocks occur. Both extensional and contractional structures and stratigraphic combinations provide traps

- USGS estimate of undiscovered resource is more than 50 billion bbls of oil and NGLs and 230 Tcf of gas. 50% onshore Arctic Alaska. NPR-A is more gassy 0.9 billion of oil and 50 Tcf of gas
- This estimate represents ~ 20% of total US Oil Reserves and 20% of total US Gas Reserves
- Woodmac 2P estimates at 1/1/2011 are of 3.6 billion bbls of oil and 31 Tcf of gas remaining onshore ANS recoverable

Regional Context for the North Slope

Central North Slope offers the most favorable and reasonable cycle time development opportunities in all of Alaska (i.e. Oooguruk sanctioned in 2006 to first production in 2008)
15 fields have been developed since 1990
Field cycle times have been getting shorter
Oooguruk - 2 years from sanctioning to first oil
Mean Well Averages 5 MMbbls

The median well resource is an order of magnitude greater than anticipated from L48 unconventional reservoirs and generates in excess of $216 MM in revenues\(^{(1)}\).

Source: State of Alaska.

\(^{(1)}\) Assuming $90/bbl oil and $10/bbl deduct for transport/quality.
Stand-Alone Field Development

**Advantages for Stand-Alone Facilities**
- More control on capital costs
- Greater flexibility for additional field/reservoir development
- Additional profit stream
- State subsidizes through Loss Carry Forward (“LCF”) and Qualified Capital Expenditure (“QCE”) Credits
- Leverage for FSA negotiations
- Canadian and Alaskan contractors have the expertise
- FERC pipelines - generally in the vicinity
- More efficient sizing of production trains

**ENI’s stand-alone development processing facility at Oliktok Point Nikaitchuq**

**Nikaitchuq Facilities**
- Stand-alone development Implemented by Eni from 2008-2011 - First oil expected in January 2011 peaking at 28,000 bbl/d, viscous oil from Shrader Bluff and future targeting of light oil from Sag River
- 50-80 extended reach producers and injectors drilled from two drilling pads are expected from both an onshore and offshore artificial gravel island
- 40,000 bbl/d processing facility at Oliktok point sends processed oil to the Kuparuk pipeline
- Contractors: INTECSEA for FEED, Nanuq for Gravel Island and roads, Price-Gregory for pipelines, ASRC for services, ATCO for on-site camp
Tie-back Field Development

**Tie-back Facilities**

- Oooguruk is a recent example of a tie-back development by an Independent
- Oooguruk is located 5 miles offshore in Harrison Bay
- Pioneer - Operator with 70% WI, ENI with 30%
- First Oil June 2008
- Over 65 potential locations
- Implements the North Slope Facility Sharing Agreement
- Sanctioned in 2006, onstream by June 2008
- Contractors: 12” multiphase pipeline from Intec, installation by HC Price, Engineering by TriOcean, EEIS, Construction by VECO, Nanuq and Alcan

*Tie-back to nearby legacy infrastructure can be an option in some cases - Pioneer chose this option for Oooguruk*
Access to Facilities and Pipelines

Facility Sharing Access (FSA) Agreements

- Standard Reference Agreement is the Facility Sharing Access Agreement (FSA) facilitated by the Charter Agreement and Ballot 2555
- Only Kuparuk, Prudhoe Bay, Lisburne and Endicott production facilities have existing FSA among related owners, Pioneer’s Oooguruk breaks the monopoly of majors
- Appendix D to Ballot 255 creates template for third party access - although FSA’s remain securely confidential
- Unlike UK or Alberta - government interdiction has not been invoked to date in order to resolve disputes
- Issues of interest to independents are Backout calculations, access fee methodology, timeliness of access negotiations, insurance requirements and operatorship issues
- Agreements aim to maximize total oil production, problem is older high GOR, high WOR wells curtailed first - owners require compensation
- Owner/operators want to run Field Optimization model and also to avoid subsidizing new entrants and extract economic rent

Facility Sharing Access (FSA) agreement have been developed that allow access for third parties - most areas have capacity, and this increases with additional water knock out investment

Pipeline Infrastructure and Capacities

Oct 2010 rate with % change from Oct 2009 in brackets

Extensive infrastructure west of Prudhoe - multi-play opportunities remain within reach of regulated pipe as capacity opens up due to large field declines

Environmental controls reflect concerns regarding oil spills in sea ice environment or damage to sensitive ecosystems – however oil and gas producers in the North Slope are effective working within these controls.

- Not significantly different than working in the Lower 48
- Exploration drilling activity occurs during a three month window when the ice is thick enough to support the facilities without damaging the tundra
- Ice roads built to reduce effects on the environment, ice road construction begins in November
- Pipelines are rarely buried under the surface, generally lifted on Vertical Support Members (VSM) to allow migration of caribou - expect more buried pipelines under gravel roads, preferred by Indigenous peoples
- Run off water from the facilities is collected and disposed of
- Stringent precautions are taken to minimize impact to wildlife; industry is efficient at working within precautions
- Oil-in-Ice industry consortium 2006-2010 examined the challenges of Arctic oil spills
Tax Rebates of Capital Expenditures

Development Capital

- 20% Qualified Capital Expenditure
- 25% Loss Carry Forward
- True Capital Expenditures to the Operator

Exploration Capital

- 40% Qualified Capital Expenditure
- 25% Loss Carry Forward
- True Capital Expenditures to the Operator

$0.45 of every dollar spent is rebated by the Company in the two subsequent years.

$0.65 of every dollar spent is rebated by the State in the two subsequent years.
State tax credits are structured to increase investment in the Alaska North Slope. These are material incentives to New Entrants to the Alaska North Slope.

Qualified Capital Expenditures (QCE) - 20% QCE tax credit for upstream capital expenditures (i.e. exploratory wells and new seismic). 50% of credit can be taken in year 1 (year of tax credit certificate award) and the other 50% of credit can be taken in year 2. These credits do not expire and can be held, sold to third parties or sold back to the state.

Carry Forward Loss (CFL) Credits - 25% credit based on calendar year losses after the end of the calendar year in question. 50% of credit can be taken in year 1 (year of tax credit certificate award) and the other 50% of credit can be taken in year 2. These credits do not expire and can be sold to third parties or sold back to the state.

Small Producer Credit - small producers (less than 50,000 b/d or b/d BOE) are entitled to a $12MM per year production tax credit. This credit is in effect for 10 years after start of production (need to start production by 2016 to qualify).

Exploration Incentive Credits (EIC) - 30% or 40% credit depending on well location and the prospect traits. You can take EIC credit or the QCE credits, but not both. Work needs to be complete by July 1, 2016 to qualify.

New Entrant Development
- Single pad
- 16 producing wells
- $570 million in drilling costs
- $105 million in infrastructure costs
- $10 million in 3D seismic costs

Cash flow positive in year 3

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<tr>
<td>Capex</td>
<td>$57</td>
<td>$162</td>
<td>$175</td>
<td>$140</td>
<td>$140</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>QCE</td>
<td>-</td>
<td>6</td>
<td>22</td>
<td>34</td>
<td>32</td>
<td>14</td>
<td>-</td>
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<tr>
<td>CFL</td>
<td>-</td>
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<td>Small Producer</td>
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<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
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</tbody>
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PV10
- QCE $87
- CFL $43
- Small Producer $61
- EIC $3

Total Tax Credit Contribution $193

Credits in this example provide $190MM PV 10 for a project with $675MM capex

Source: Alaska tax office.
### Fiscal Terms - Taxes

**Alaska's Clear and Equitable Share (ACES)** replaced severance tax. ACES is a tax on net profits. Tax begins at 25% increasing as the profit margin per barrel increases.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost per Barrel</th>
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</thead>
<tbody>
<tr>
<td>Federal Income Tax</td>
<td>~35%</td>
</tr>
<tr>
<td>State Income Tax</td>
<td>levied at 9.4% (maximum)</td>
</tr>
<tr>
<td>Alaska's Clear and Equitable Share (ACES) replaced severance tax</td>
<td>$2.1 / bbl</td>
</tr>
<tr>
<td>Royalties vary between 12.5% to 16.7%</td>
<td></td>
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</tbody>
</table>

**Owner's take**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost per Barrel</th>
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<tbody>
<tr>
<td>$13.6 / bbl</td>
<td></td>
</tr>
<tr>
<td>$4.0 / bbl</td>
<td></td>
</tr>
<tr>
<td>$32.3 / bbl</td>
<td></td>
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<tr>
<td>$90 / bbl</td>
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**State Property Ad Valorem Tax** - levied at 2% of the tax value

**Excluded from above analysis:**

- Royalties vary between 12.5% to 16.7%
- State Property Ad Valorem Tax - levied at 2% of the tax value

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Source: Alaska tax office.
Political Climate Fosters Investment

Increasing TAPS Throughput is a Priority

- The State has been dependent on revenue from oil and gas for the last 30+ years.
- Giant fields on decline and lack of new production to replace reserves puts the State in a critical funding situation.
- Both Democrats and Republicans want to improve fiscal terms as they recognize the need for oil development - 90% of current state revenue generated from oil & gas
  - Parnell has proposed substantially reducing the production tax
  - Parnell has proposed increasing tax credits to oil companies
  - Focus on maintaining Alaska’s fiscal competitiveness with other world-class resource development opportunities

New Entrants Shown Favorable Treatment

- Recent increase in North Slope exploration driven by significant resource and favorable investment environment
  - Up to 45% tax credits for capital invested in North Slope development
  - Up to 65% tax credits for capital invested in North Slope exploration
  - $10 million per year in severance tax offset for small producers (less than 10,000 bbls/d)
- State working to streamline permitting and environmental processes to decrease learning curve of new entrants
III - Arrival of the Independents
It is a New Era on the Slope

**Alaska - Oooguruk**

Innovative technology, access to infrastructure, commodity prices, tax environment - these factors contribute to a new era capitalizing on the forgone opportunities of an old era.

- Prudhoe Bay and Kuparuk fields are **on decline** - opening up capacity in the TAPS pipeline.
- Smaller and more numerous reservoirs are tapping into existing infrastructure at progressively **lower threshold reserve values**.
- This new reality has contributed to the interest of **more Independents** and the refocusing of the Majors.
- Oooguruk field owned by Pioneer and ENI is the first commercial production from an independent - came on stream in 2008.
- The Independents are on the precipice of changing the production profile on the North Slope by providing new thinking and cost synergies.
## North Slope New Entrants

<table>
<thead>
<tr>
<th>Private Companies</th>
<th>Public Independents</th>
<th>Integrated Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong Alaska (70 &amp; 148, LLC)</td>
<td>Anadarko Petroleum</td>
<td>BG</td>
</tr>
<tr>
<td>Arctic Slope Regional Corporation</td>
<td>Apache</td>
<td>ENI</td>
</tr>
<tr>
<td>Brooks Range Petroleum</td>
<td>Linc Energy</td>
<td>Repsol</td>
</tr>
<tr>
<td>GMT</td>
<td>Murphy</td>
<td>Shell</td>
</tr>
<tr>
<td>Great Bear Petroleum</td>
<td>Pioneer Natural Resources</td>
<td>Statoil</td>
</tr>
<tr>
<td>Ocean Energy Resources</td>
<td>Suncor/PetroCanada</td>
<td>Total</td>
</tr>
<tr>
<td>Royale Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renaissance Alaska</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savant Alaska</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrastar Exploration</td>
<td></td>
<td></td>
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<tr>
<td>Woodstone Resources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The new entrants in Alaska will provide the same drive and revitalizing force they did in the North Sea - spurred by tax incentives and opportunities missed by majors.
Lease Sales

- Area-wide lease sales are held annually
- All unleased acreage is available for sale
  - 4 section blocks have 7 year contracts and are closer to infrastructure
  - 9 section blocks have 10 year contracts and are further away from infrastructure
- 129 tracts covering ~600,000 acres were sold in most recent annual lease sale

Lease sale activity for exploration acreage has increased since 2007 - upward trend in leasing is healthy for the region

Source: Division of Oil and Gas.
<table>
<thead>
<tr>
<th>Company</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>bp</td>
<td>Largest investor and taxpayer in Alaska, investing $10bn over 10 years on existing fields, emphasis on gas and heavy oil and optimizing existing fields.</td>
</tr>
<tr>
<td>ConocoPhillips</td>
<td>Largest producer and reserve holder with 240 mboed production and 6.0 Bboe reserves, extended Alpine forward. Searching for satellite opportunities to Alpine and partnering with smaller companies.</td>
</tr>
<tr>
<td>Anadarko</td>
<td>2010 Capital investment has been tied to Arco/ConocoPhillips, explored in NPR-A and Foothills, also researching gas hydrates. Access to more than 4.7 MM gross acres with good satellite potential. Company has participated in over 35 exploration wells and continues to determine the commerciality of multiple discoveries.</td>
</tr>
<tr>
<td>ENI</td>
<td>ENI started the development of the Nikaitchuq oil field in January 2008 obtained from Armstrong. ENI plans to build a significant position in Alaska, leveraging its international project experience.</td>
</tr>
<tr>
<td>Shell</td>
<td>Developing offshore discoveries in Beaufort and Chuckchi (shot 3-D in both areas). $2.2 billion Chuckchi lease program.</td>
</tr>
<tr>
<td>Pioneer Natural Resources</td>
<td>Entered ANS in 2002 through Armstrong at Oooguruk, 70% W.I. and operator, first field developed by an independent operator. Production began in June 2008, expected to peak at 20,000-25,000 gross bbl/d.</td>
</tr>
<tr>
<td>Company</td>
<td>Strategy</td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
<tr>
<td>Brooks Range Petroleum</td>
<td>Completing and testing its North Tarn #1A well, an exploration well drilled last winter. It will likely drill two more wells this winter to delineate its Mustang prospect.</td>
</tr>
<tr>
<td>REPJOL</td>
<td>Talking to regulators and stakeholders about a 5-rig program this winter, drilling up to 15 wells. All the rigs will be on separate ice pads on state acreage - one north of the Colville River unit; two onshore between the Oooguruk and Colville units but drilling to offshore targets; one onshore farther south, adjacent to the Colville unit and drilling to onshore targets; and one southeast of the Kuparuk River unit.</td>
</tr>
<tr>
<td>Great Bear Petroleum LLC</td>
<td>1-rig program, drilling up to four initial vertical wells from which 4,000-foot horizontal production sidetracks will later be drilled along the source rock strata and hydraulically fractured to prove oil can be profitably produced from the Shublik and possibly the HRZ shale.</td>
</tr>
<tr>
<td>LINC Energy</td>
<td>Planning a 1-rig program this winter, drilling a minimum of 4 wells. Drilling its wells at the undeveloped Umiat oil field in the Brooks Range Foothills along the southeastern border of the National Petroleum Reserve-Alaska.</td>
</tr>
<tr>
<td>Ultrastar Exploration</td>
<td>Seeking capital to drill a well at its Dewline unit this winter. If Ultrastar does not find sufficient capital this winter, the project will need to wait another year.</td>
</tr>
</tbody>
</table>

Source: Company filings, IR presentations, websites.
Business Models

**Major Hub**
- Original major Hubs are Prudhoe Bay and Kuparuk
- Major infrastructure project
- Extension of common carrier pipe
- Typified by reserves of >0.5Bbbls and capital costs >$1B
- On decline, but must review capacity limitations
- Some operators still looking for these fields - exploring in the NPR-A, Foothills, and Beaufort Sea, far from existing infrastructure

**Satellite Hub**
- Satellite ties into gathering and processing units of a major or moderate sized hub
- Minimal pad based infrastructure
- Generally limited by 25-30 miles from existing pipe
- Theoretically a win-win situation - owner offsets O&M cost and can provide lighter oil blend
- Typified by reserves of 50-500 mmbbls and capital costs >$300MM
- Both Major and Independent Operators still looking for these size fields - ConocoPhillips, Anadarko & Pioneer
- BP tied in Sag Delta North, Eider, Aurora, Borealis, and Midnight Sun to Prudhoe Bay
- ConocoPhillips tied in Tarn, Palm, and Meltwater to Kuparuk, discoveries in the NPR-A, Moose’s Tooth, Lookout, Rendezvous and Spark tie into Alpine
- BP Liberty to Badami, not Endicott

**Regional Hub**
- Examples include Alpine, Endicott, Milne Point, Point Thompson
- Fixed facilities - barged in
- Ties in to common carrier pipe
- Conventional Technology

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**Diagram: Oil Production (mmbbls/d)**
- **Major Hubs**
- **Regional Hubs**
- **Satellite Hubs**
- Colors represent different hubs: Prudhoe Bay, Kuparuk, Milne Point, etc.
- Years from 1978 to 2010 shown on the x-axis.
North Slope Growth Areas

- Central North Slope - continued tie-in of multi-pay satellite developments, implementation of staged fracs and new resources will ensure Alaska remains a critical source of America’s energy for years to come
- Lisburne Formation - lies beneath Prudhoe Bay, but reservoir quality variable, few horizontal well results are encouraging (only significant carbonate formation in slope)
- Schrader Bluff - technology significantly improved commerciality - BP and COP relying on growing Schrader Bluff production
- Offshore Beaufort Sea - drilling ban in place but expected to be lifted relatively soon
- Chukchi Seas - needs major hub development to establish play - development decade or more away. Major’s see this as the next big growth area
- NPR-A - significant potential (4Bbbls), but requires new EIS’s and extension of pipeline and road infrastructure - requires investment from the Majors

In order of importance the growth areas are expected to be (1) satellite extension in the CNS, (2) Western CNS Jurassic/Cretaceous reservoirs, (3) NPR-A, (4) viscous and heavy oil, (5) offshore Chukchi and Beaufort, (6) unconventional, (7) gas resources and (8) ANWR
Shale Oil Provides Substantial Upside Potential

- USGS estimate the probability that essential petroleum system elements occur in at least part of the assessment unit (AU)
  - Shublik Oil and Gas AU’s: 95% (best set of essential elements)
  - Brookian Oil and Gas AU’s: 90% (risk - do source & reservoir rocks occur together?)

- Shale Oil – USGS mean estimates of undiscovered oil
  - Bakken: 3,645 MMBO
  - North Slope: 940 MMBO
  - Eagle Ford: 853 MMBO
  - Woodford (Anadarko): 393 MMBO
  - Niobrara (Powder River B.): 227 MMBO

Source: Bird and Bader (1987), Houseknecht et al. (2012b).
IV - Typical Field Considerations
The Grass Roots Business Process

1. Well Control - establish reservoirs, well logs are in public domain, identical bypassed zones
2. Leasing - Bid bonus in annual State sales
3. Drilling activity begins
4. Unitization - Pool interests and royalties when prospect has been defined (negotiated with state, 3 well commitment)
5. Plan of Exploration and Development - Contract with the State to optimize efficient operation
6. Participation Area - Prior to production - define limits and rules to production zone
7. Production start-up
8. Production start-up
Proven tight oil/shale play technology employed in the lower 48 can be used to improve the economics of North Slope reservoirs.

New technologies are applied higher up the resource pyramid further improving the economics.
Field Development Process

Fiord Field - satellite to Alpine operated by ConocoPhillips

- Ice roads provide early access, however new developments such as sky crane helicopters, Rolligons from barges and insulated pads for rig storage are recent innovations
- Initial exploration during 90 days (Jan-Mar) on ice pads - site then cleared before ice melts
- Several gravel islands have been built in the Beaufort sea
- Offshore pipelines are trenched to prevent ice gouging and can be buried in up to 200 ft water
- Fiord and other new fields are being developed with horizontal technology
- Fiord and Oooguruk are two fields that were developed in less than 2 years from corporate approval
- Fiord enhances recovery with WAG flood, production is processed at COP's Alpine facility - gas is generally re-injected on the Slope
- Fiord has a permanent gravel airstrip, Oooguruk is accessed via a boat or ice road
- Onshore Pipelines are generally built on VSM although local people have voiced issues relating to snowmobile passage
Alaska Price Netbacks

ANS Differential\(^{(2)}\) = ($2.14)

TAPS tariff = ($5.05)

Common Carrier Transport to TAPS\(^{(1)}\) = ($0.72)

Total Discount to Brent Oil: = $7.91 / bbl

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(1) Alpine common carrier transportation rate.
(2) 1-year average differential to Brent Crude Oil.
## Comparisons with Resource Plays

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>North Slope</th>
<th>Resource Play</th>
</tr>
</thead>
<tbody>
<tr>
<td>OOIP</td>
<td>Resource certainty in conventional plays</td>
<td>Resource certainty from legacy wells</td>
</tr>
<tr>
<td>Geological Character</td>
<td>Top set deltaic sands are laterally contiguous and geologically predictable</td>
<td>Basin center shales are lithologically and stratigraphically consistent across wide areas</td>
</tr>
<tr>
<td>Sizeable aerial extent</td>
<td>Top set marine sands can be elongated over 100 miles</td>
<td>Foreland organic rich basins can be 3-30 million acres</td>
</tr>
<tr>
<td>Multi-zone targets</td>
<td>Multiple stacked transgressive sand bodies provide numerous reservoirs</td>
<td>Generally only one source rock play with conventional mostly exploited overlying sands</td>
</tr>
<tr>
<td>Sweet spot definition</td>
<td>Depositional setting plays the major role in determining the higher quality areas - imaged successfully with seismic, largely defined by existing well control in most cases</td>
<td>Multiple factors determine tiers - dependent on depth, isopach, reservoir quality, pressure, natural fracturing and thermal maturity</td>
</tr>
<tr>
<td>Reservoir producibility</td>
<td>Reservoirs are of moderate to high quality and capable of substantial flow rates of light to heavy oil <em>(without stimulation)</em></td>
<td>Natural fracturing and nanodarcy matrix permeability defines short lived IP’s with hyperbolic flow profile, limited to light oil/condensates <em>(stimulation required)</em></td>
</tr>
<tr>
<td>Recovery efficiency</td>
<td>High recoveries achieved by pattern drilling with waterflood or WAG</td>
<td>Modest recoveries but can be improved with increasing reservoir stimulated volume - ultimately requires large number of wells</td>
</tr>
<tr>
<td>Drill Plan</td>
<td>Logistical and environmental conditions necessitate pad based operations</td>
<td>Legacy leasehold configurations impacts the drill plan - generally a combination of pad and single well drilling</td>
</tr>
<tr>
<td>Operations environment</td>
<td>No urban or historical factors and 30 years of petroleum operations provide an effective operational platform</td>
<td>Services and midstream infrastructure may lag new play development but rapidly becomes sufficient</td>
</tr>
</tbody>
</table>
Resource Plays Commercial Comparison

Economic Comparison at $80/bbl & $5/Mcf flat

<table>
<thead>
<tr>
<th></th>
<th>ANS</th>
<th>Niobrara</th>
<th>Eagle Ford Condensate</th>
<th>Eagle Ford Oil</th>
<th>Bakken Tier 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>D&amp;C CapEx ($MM)</td>
<td>$32.5</td>
<td>$3.5</td>
<td>$7.8</td>
<td>$5.0</td>
<td>$7.0</td>
</tr>
<tr>
<td>LOE ($/boe)</td>
<td>$15.00</td>
<td>$7.24</td>
<td>$5.61</td>
<td>$4.99</td>
<td>$4.77</td>
</tr>
<tr>
<td>Capital / Net Acre</td>
<td>$13.0</td>
<td>$29.2</td>
<td>$64.6</td>
<td>$41.7</td>
<td>$32.8</td>
</tr>
<tr>
<td>NPV10 ($MM)</td>
<td>$97.4</td>
<td>$3.9</td>
<td>$10.2</td>
<td>$3.5</td>
<td>$8.0</td>
</tr>
<tr>
<td>IRR</td>
<td>140%</td>
<td>64%</td>
<td>85%</td>
<td>41%</td>
<td>53%</td>
</tr>
</tbody>
</table>
| F & D ($/boe)    | $5.07 | $15.57   | $9.47                 | $20.87         | $13.19       

1 Burdened with allocated midstream capex

ANS Economics Relative to Resource Plays

- ANS not capital intensive - capital / net acre very low
- ANS high rate of return (140%)
- ANS F & D costs are significantly lower

Aggregate Post Production Costs

Post Production Costs Summary

- Marine shipping and tariffs average $2.05 and $5.32, respectively
- Alaska differential fluctuates from a $2 premium to WTI to a $3 discount to WTI
- Aggregate wellhead post production costs are generally less than the Bakken

Note: ANS base case is modeled on Fiord satellite field to Alpine operated by ConocoPhillips
Producer/Injector Well Economics - Fiord Nechelik

Summary Details

**Total Resource**
- Gross EUR (MMbbl) 7.9
- 5-Yr Cum (MMbbl) 5.0
- 30-day IP (bbl/d) 3,270
- Peak Production (bbl/d) 3,700
- Life (years) 24

**Economics**
- D&C CapEx ($MM)
  - Without allocated midstream $32.5
  - With allocated midstream $40.0
- LOE ($/boe) $15.00
- Oil Diff ($/bbl)
  - ANS discount $0.54
  - Marine shipping $2.05
  - Tariff (excl. Producer’s Pipeline) $5.32

**Results with Allocated Midstream Capex (no QCE Tax Credit)**
- NPV10 ($MM) $97
- IRR (1) 140%
- F & D ($/boe) $5.07

Note: Includes production taxes, but excludes property taxes, state and federal income taxes, and tax credits.

(1) Economics run at $80/bbl flat WTI.
(2) Qualified Capital Expenditures (QCE) - 20% QCE production tax credit for upstream capital expenditures (i.e. exploratory wells and new seismic). 50% of credit can be taken in year 1 (year of tax credit certificate award) and the other 50% of credit can be taken in year 2. These credits do not expire and can be held, sold to third parties or sold back to the state.
V - Conclusion
## Alaska Business Drivers - State of Play

<table>
<thead>
<tr>
<th>Business Driver</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Available</td>
<td>Multiple reservoirs waiting to be developed</td>
</tr>
<tr>
<td>Field Extensions</td>
<td>On-going</td>
</tr>
<tr>
<td>Exploration Potential</td>
<td>Excellent</td>
</tr>
<tr>
<td>Taxation</td>
<td>Significant fiscal incentives for new development</td>
</tr>
<tr>
<td>Land Access</td>
<td>Good</td>
</tr>
<tr>
<td>Maintaining Inventory</td>
<td>Abundant opportunities</td>
</tr>
<tr>
<td>Permitting Process</td>
<td>Streamlined</td>
</tr>
<tr>
<td>Repeatability of operations</td>
<td>Operational efficiency per “shale development” is the new norm</td>
</tr>
<tr>
<td>Cost of operations</td>
<td>New innovations helping to control costs</td>
</tr>
<tr>
<td>Environmental issues</td>
<td>Workable within Central ANS</td>
</tr>
<tr>
<td>Project cycle time</td>
<td>Short relative to International and GOM Deepwater</td>
</tr>
<tr>
<td>Pipeline Access</td>
<td>Common Carrier, State improving ROW permitting process</td>
</tr>
<tr>
<td>Facilities</td>
<td>Tax credits mitigate capex risk</td>
</tr>
<tr>
<td>Contractor community</td>
<td>Long track record on the ANS - Nabors relationship</td>
</tr>
<tr>
<td>Gas influence</td>
<td>When gas line built - growth will be compounded</td>
</tr>
<tr>
<td>State involvement</td>
<td>Very supportive of new entrants and new field development</td>
</tr>
</tbody>
</table>
In Summary

Looking to the next decade operational and technological innovation in the Arctic to sustain oil production is likely to be a pivotal skill set - in many ways similar to the current global trend to building shale expertise.

When we look at the business drivers for Alaska North Slope, this area offers the most attractive and competitive prospects for adding reserves and production.
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