Alaska’s 10-year Oil Production Outlook And Potential Future Developments Report

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Division of Oil and Gas, DNR
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Overview

- Introduction and Background
- Fall 2016 Forecast
  - Past and Current Forecast Methods
  - Review of Production Tranches
- Potential Future Production
  - Projects within the DOG’s Public Report
  - New Discovery Announcements
- Summary
The Place of Oil and Gas in Alaska’s Economy

FY 2016 Total State Revenue
By restriction and type, in billions of dollars

Unrestricted
$1.5
27%

Restricted
$4.2
73%

Investment
$0.02 (1%)

Non-Petroleum
$0.4 (26%)

Petroleum
$1.1 (72%)

Investment
$0.6 (13%)

Non-Petroleum
$0.6 (15%)

Petroleum
$0.5 (12%)

Federal
$2.5 (59%)

Revenue Sources Book, 2016
DOR Fall 2016 Forecast

Source: Fall 2016 Revenue Sources Book
Motivation for Change in Forecast Methodology
Forecast Uncertainty

Variance in Forecasted Production vs Actual Production

Actual Production vs Forecasted Production

 Thousands BOPD


Variance in Forecasted Production vs Actual Production
Forecast-vs-actual variance increases into the future

Average ANS variance by years out (2001-2014)
Expected Production from Future Projects Has Driven Over-estimation in the Past.

- Forecast will be too conservative if no expected production is considered.
- Forecast will be overly optimistic if all anticipated production is included.
- Expected Production must discount estimated year-on-year historical base production activity.
Reasons For Differences in Forecast vs Actual Production

- Previously, a ten-year window was used for projects in the under development (UD) and under evaluation (UE) portions of the forecast.
  - Leading to more uncertainty in the forecast

- This resulted in more projects (expected production) being included that didn’t go into production within the expected time frame.
  - For example: Mustang, Liberty, OCS production

- All expected production was added to the forecast as UD and UE.
  - No price dependency, or risk of occurrence applied until recently
  - Historical drilling activity was not properly accounted for.
Reducing Outlook Time to Improve Accuracy of the Forecast.

- It is more challenging looking far out.
- Typically operators wouldn’t have a set plan and will be open to changes in market conditions that do affect their plans.
- Including projects with first oil farther out reduces the accuracy of the forecast.
## Differences Between Forecast Methods

<table>
<thead>
<tr>
<th></th>
<th>Previously (1990-2015)</th>
<th>2016 - Present</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forecast Level</strong></td>
<td>Pool Level, Well – by-Well Forecast</td>
<td>Pool Level forecast</td>
</tr>
<tr>
<td><strong>Uncertainty Handling</strong></td>
<td>Deterministic</td>
<td>Probabilistic</td>
</tr>
<tr>
<td><strong>Risking</strong></td>
<td>Unrisked CP not risked. First UD/UE risking in 2013 Fall forecast</td>
<td>Probabilistic technical and Non-technical risk</td>
</tr>
<tr>
<td><strong>Oil Price dependency</strong></td>
<td>None</td>
<td>Dependence on oil price</td>
</tr>
<tr>
<td><strong>UD Production</strong></td>
<td>10 year outlook</td>
<td>1 year outlook</td>
</tr>
<tr>
<td><strong>UE Production</strong></td>
<td>10 year outlook</td>
<td>5 year outlook</td>
</tr>
</tbody>
</table>
Current Production Forecasting Method
Production Categories

- **Currently Producing**
- **Under Development (1yr)**
- **Under Evaluation (2-5yrs)**
- **Excluded Projects (5+yrs)**

Potential Future Development Category
Production Category: Currently Producing (CP) Tranche.

Characteristics:

- All currently producing pools in ANS and Cook Inlet
  - Examples: Legacy fields and other fields in production
- Decline Curve Analysis forecast at pool level acknowledges some level of ‘background’ or ongoing development activity, facility maintenance, well intervention and turn-around events.
Production Category:
Future Production (UD/UE): 5-Year Outlook Window

Under Development

+ New fields 1yr out.
+ Wells in fields undergoing development.
+ Projects considered above inherent development activity included in CP.

Under Evaluation

+ Facilities (access) in Place
+ Significant Sunk Cost.
+ Funding secured.
+ Permitting completed/in progress.

Excluded Projects

+ Unknown first-oil date/estimated greater than 5 years
+ Discovery (contingent resource) or just prospects (prospective resource)
+ Uncertain finances
+ Facilities incomplete or nonexistent
First Oil Estimated in 2018-2021
- Projects in Blue Have Been Postponed -

<table>
<thead>
<tr>
<th>Project</th>
<th>Reservoir Formation</th>
<th>Peak Rate Est, BOPD (From Public Sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add’l CD5 wells, Colville River Unit</td>
<td>Alpine sands, Kuparuk Fm</td>
<td>n/a</td>
</tr>
<tr>
<td>Greater Mooses Tooth 1</td>
<td>Alpine sands (Lookout)</td>
<td>30,000</td>
</tr>
<tr>
<td>Greater Mooses Tooth 2</td>
<td>Alpine sands (Spark-Rendezvous)</td>
<td>25,000 – 30,000</td>
</tr>
<tr>
<td>Nuna Project, Oooguruk Unit (postponed)</td>
<td>Torok Fm (same horizon as Moraine)</td>
<td>20,000 – 25,000</td>
</tr>
<tr>
<td>Nuiqsut Expansion, Oooguruk Unit (postponed)</td>
<td>Nuiqsut sand</td>
<td>n/a</td>
</tr>
<tr>
<td>Mustang Project, S Miluveach Unit (postponed)</td>
<td>Kuparuk Fm</td>
<td>12,000 – 15,000</td>
</tr>
<tr>
<td>Add’l wells, Nikaitchuq Unit (postponed)</td>
<td>Schrader Bluff Fm</td>
<td>n/a</td>
</tr>
<tr>
<td>Moose Pad, Milne Point Unit</td>
<td>Schrader Bluff Fm</td>
<td>10,000</td>
</tr>
<tr>
<td>Moraine Project, Kuparuk Unit</td>
<td>Torok Fm (same horizon as Nuna)</td>
<td>n/a</td>
</tr>
<tr>
<td>1H NEWS, Kuparuk Unit (postponed)</td>
<td>Schrader Bluff Fm (West Sak sands)</td>
<td>8,000</td>
</tr>
</tbody>
</table>

Decker, P., (2017b)
How Probabilistic DCA Works

- Decline Curve Analysis (DCA) develops trends based on historical production data to forecast future production. It incorporates an understanding of reservoir and operational performance of producing fields/wells.

- Probabilistic DCA includes uncertainty analysis to produce a range of future production rather than a single deterministic forecast profile.

- Software used:
  - Schlumberger’s Oil Field Manager (OFM) alongside a probabilistic suite.
  - Uncertainty analysis in excel used @Risk by Palisade
Statewide Production Forecast Range

Mean Future Decline Rate: 4 %
Historical Decline Rate: ~5%
The biggest share of production forecast (CP) still requires wellwork and facility upgrade, optimization services from Alaska’s support industry.
Longer Term Outlook
Potential Future Development Projects

Why undertake a task to develop ‘speculative’ profiles?

- Not to provide a technical or economic project-by-project assessment.
- To contribute to the framing of conversations in the public space while acknowledging the technological and commercial challenges faced by these projects.

How were profiles developed?

- Type curves from analogous reservoir rocks and potential well performances.
- Using public presentations, reports and statements from project operators.

Projects discussed in report:

- Fiord West Project
- Placer Project
- Pikka Project
- Tofkat Kuparuk C Project
- Liberty Project
- Point Thomson Major Gas Sales Project
- Smith Bay Project
- Ugnu Project
First Oil Potentially 2022 or Later
- Some Projects May Not Occur -

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<tr>
<td>Fiord West Project</td>
<td>Kuparuk Fm and Nechelik sand</td>
<td>n/a</td>
</tr>
<tr>
<td>Placer Project</td>
<td>Kuparuk Fm</td>
<td>n/a</td>
</tr>
<tr>
<td>Pikka Nanushuk Project</td>
<td>Nanushuk Fm &amp; Alpine sands</td>
<td>Up to 120,000</td>
</tr>
<tr>
<td>Tofkat Kuparuk C Project</td>
<td>Kuparuk Fm</td>
<td>n/a</td>
</tr>
<tr>
<td>Willow Project</td>
<td>Nanushuk Fm</td>
<td>40,000 – 100,000</td>
</tr>
<tr>
<td>Liberty Project</td>
<td>Kekiktuk Fm</td>
<td>60,000</td>
</tr>
<tr>
<td>PTU Major Gas Sales Project</td>
<td>Thomson sands</td>
<td>Up to 70,000</td>
</tr>
<tr>
<td>Smith Bay Project</td>
<td>Torok Fm</td>
<td>Up to 200,000 (?)</td>
</tr>
<tr>
<td>Ugnu</td>
<td>Prince Creek Fm (Ugnu sands)</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Decker, P. (2017b)
Potential Impact on Long term North Slope Production

- North Slope profile showing possible impact of potential future projects.
- Production profiles are unrisked and actual timing remains uncertain.
- Projects could help prolong the operational life of TAPS.
Recent Discovery Announcements

Finding the big one 10/9/2016
Caelus discovery at Smith Bay could add 200,000 barrels per day to TAPS

Success at Horseshoe 4/12/2017
Repsol and Armstrong make largest US onshore oil find in 30 years

Another big find 1/22/2017
ConocoPhillips announces Willow oil discovery to west of Mooses Tooth

Armstrong extols new oil play
Accumulations in the youngest major rock sequence on the North slope (Decker, P., 2017a)

According to Petroleum News (2017):
- Pikka: 1.2 BBO Recoverable
- Willow: 0.3 BBO
- Smith Bay: 1.8-2.4BBO (Caelus Energy, 2017)

Total Contingent Resource: ~3.5 BBO

Decker, P., (2017b) modified after D. Houseknecht, USGS

Several Nanushuk and Torok Formation discoveries are at different stages of delineation and development.
Official state production forecast applies standard accepted engineering and production risk assessment techniques in determining future production.

Recent new discoveries show that there is still a strong future for oil production in Alaska.

Maintaining base production and bringing on new production is impossible without Alaska’s Oil and gas support companies.

Oil prices play a vital role in what resources are ultimately produced.
References

- Petroleum News Reports
Back Up
North Slope Exploration and Development: A snapshot of activity and operator footprint on the North Slope of Alaska.