Unlocking Knowledge Through Global Analogs

SKK MIGAS
INDONESIA

OGTU EVENT
March 29th 2017
Agenda

• Introduction
• Proof-of-Concept Recap
• DAKS IQ Overview
  Unlocking Knowledge Through Global Analogs
• DAKS IQ in E&P Lifecycle Application
• DAKS IQ Use Studies & Demo
DAKS IQ POC Summary (14th – 30th Sept 2016)

C&C Reservoirs in collaboration with ITB and SKK Migas conducted a Proof-of-Concept (POC) exercise to prove the feasibility and value of using DAKS IQ for a National Fields and Reservoirs Integrated Knowledge Management System.

1. Conducted a 5 days intensive training followed by 13 days of extended trial evaluation of the DAKS IQ system. A total of 15 attendees were provided access to the DAKS IQ instance created for POC.
2. 25 hands-on exercises were structured from navigation, analogs search, search results analyses, knowledge capture and benchmarking of fields and reservoirs against internal and global best practices/ analogs to identify opportunities to optimize exploration leads and prospects, accelerate field rejuvenation, enhance hydrocarbon recovery.
3. DAKS IQ Workflow instruction was provided to enable participants to undertake production based benchmarking.
4. Participants also input real reservoir data and worked within DAKS IQ.
5. All access and data was deleted and purged at the end of the POC.
POC RECOMMENDATIONS

1. The POC was successfully conducted via a detailed and intensive workshop environment where SKK Migas participants worked through DAKS IQ features and functionality.

2. The key value of DAKS IQ analytical tools has been verified and tested hands-on to gain deeper insight into field and reservoir characterization, benchmarking and production performance.

3. C&C strongly recommends SKK Migas to utilize DAKS IQ in their day to day E&P operations and work practices.
Using analogs is essential, but...

- They are difficult to find
- They have not been standardized
- Knowledge is not synthesized
- Often geographical, not geological
- Analysis tools are lacking
C&C Reservoirs and DAKS IQ

Since 1995
DAKS IQ makes finding analogs easy
Everything in DAKS IQ has been standardized
Synthesized reports written and data collected by experts
Capture your proprietary knowledge in DAKS IQ
Analysis and Benchmarking

Andrew - Lista (Andrew Sandstone) Production Curve

- Oil Daily Rate (BOPD)
- Water Daily Rate (BOPD)

Production year:
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
E&P Lifecycle

Where do analogs add value?
DAKS IQ: Value Proposition Across the E&P Lifecycle

**DAKS IQ Value Proposition**
- Know the discoveries
- Study basin genesis and regional controls
- Calibrate uncertainty
- Be aware of alternative global plays

- Further your understanding of global producing reservoirs
- Which primary field development decisions were the most successful?
- Support reserves booking

- How have others improved recovery?
- What is top quartile Rf performance?

**Value Drivers**

**Portfolio Level Decision Making**

- **Risked Portfolio of Investment Opportunities**

**E&P Lifecycle Phase**

- **Exploration**
- **Development**
- **Production**

**Unit Finding Costs**

**Unit Development Costs**

**Unit Operating Costs**

**Portfolio of Producing Assets**
DAKS IQ Value: E&P Life cycle

Value Drivers

Phase

Stage

Maturation

Purpose / Deliverable

Unit Finding Costs

New Ventures

Opportunity Definition

Appraisal

Pre-sanction

Characterize Reservoir

Reservoir Simulation Model and Field Development Plan

Unit Development Costs

Play Concept

Play Evaluation

E Well DST

A Well

Feasibility

Concept Selection

Concept Definition

Detailed Design

Procure & Supply

Construct

Execution

Unit Operating Costs

Characterize Reservoir

Reservoir Simulation Model and Field Development Plan

Production

Dynamic Model History Match

Project Milestones

Approval to Evaluate Play / Region

License Award

Discovery

Pre-sanction Project

Project Sanction / Reserves Booking

First Gas/Oil investment

IOR Investment

EOR Investment
• Exploration teams are measured on:
  – Discoveries (reserve add)
  – Unit finding costs
  – Getting into the right basins is key

• Analogs supports this by:
  – Generating new basin insight and exploration concepts
  – Providing detailed geological models and geological controls for each discovery
  – Permitting analysis of trends to calibrate uncertainty
  – Classifying exploration opportunities
  – Consistently benchmark resource ranges, Rf and production assumptions across the Exploration portfolio
Development

- Development teams are measured on:
  - Unit development costs
  - Speed to first oil
  - Comprehensive evaluation of future reservoir performance

- Analogs supports this by:
  - Efficiently validating development concepts
  - Calibrating reservoir parameters for simulation
  - Quickly calculating likely range of production profiles and forecasting Rf
  - Understanding learnings and best practice from similar developments
  - Highlighting primary value drivers
Production

• Production teams are measured on:
  – Unit production Costs
  – Maximizing and improving recovery
  – Reducing down time

• Analogs supports this by:
  – Validating incremental improved recovery techniques
  – Forecasting EUR and Rf potential for each IR/EOR technique
  – Providing learnings and best practice from similar developments
  – Highlighting primary value drivers
Exploration Applications with Analogs

Part 1: New Venture Application

Part 2: Prospect Assessment Application (Proximal Analogs)

Part 3: Prospect Assessment Application (Global Analogs)
Part 1: New Venture Application

Understand your region quickly and efficiently

• I am a new venture geologist working for the first time in Indonesia.

• How can I use DAKS IQ to accelerate my knowledge of this region, basin genesis, geological controls and existing discoveries?
New Venture Application
New Venture Application
Define trends and reduce uncertainty in estimating resource parameters

- I am an exploration geologist working on Niger Delta prospects.
- I have limited information but there are proximal discoveries.
- I wish to assess the volumetrics and rank a number of analogous prospects.
Exploration Prospect Assessment Application
Exploration Prospect Assessment Application

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Reservoir Unit Name</th>
<th>Basin Name (Tellus)</th>
<th>Country</th>
<th>Region</th>
<th>Hydrocarbon Type</th>
<th>Production Curve</th>
<th>Table of Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agbada</td>
<td>D5 20x Sand</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Agbami</td>
<td>Akata (13my-18my)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Bonga</td>
<td>Akata (702 Sand)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
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<td>Akata (710-740 Sa...</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Delta South</td>
<td>G2 Sand (Agbada)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Delta South</td>
<td>G3 Sand (Agbada)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Meren</td>
<td>Agbada</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Meren</td>
<td>Agbada (E-01/m-0...</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Obagi</td>
<td>Agbada (Level Ix)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Okan</td>
<td>Agbada</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Oso</td>
<td>Agbada (1y1-2y2)</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Gas-condensate</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Ubit</td>
<td>Agbada</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Gas with oil</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Zafiro</td>
<td>Bonito (Qua iobo)</td>
<td>Niger Delta</td>
<td>Equatorial Guinea</td>
<td>Africa</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
</tbody>
</table>
Prospect Assessment: Petroleum Systems Documented

Figure 1-1: Regional geological setting of the Niger Delta (Corridor et al., 2000). The delta lies on a monocline-triple junction. Two arms of this junction developed into the Atlantic margins of Nigeria and Cameroon; the third, the Benin Trough, flowed The Delta South) Feed area in the proximal, incised zone of the delta.

Figure 1-2: (a) Major fault systems and half-craton of the Niger Delta petroleum province (Sawang and Eigbe, 2002). An intruded continental and on the shelf. The offshore area is characterized by five major depositional basins (Deltas A-E). The marginal shelf and shoreline is divided into four main Normal fault zones along the reactivation of a compressional regime of tectonic tectonic (b) Location of Niger Delta basins relative to the depositional (Doss and Onoagha, 1996) for section A-A and Figure 1-3, Figures 1-4, Figure 1-5 and C-C, Figure 1-6.

Figure 1-3: The regional section A-A crosses the central Niger Delta showing the continental and shelfal environments and displays the changed depositional environments and the depth of shelfal and slope (Figure 2-3) for sections location see Figure 1-2.

Figure 1-4: SME-A schematic regional stratigraphic section across the Niger Delta (Corridor et al., 2000). The regional stratigraphic and dihalomorphic formations have been deposited as the delta progressed. The northeastern margin is characterized by the large shelfal basin (SME-A) and the wedge-shaped basin (SME-B). This basin includes the basal reservoirs of the Delta South (DS) and the continental sediments of the Benin Formation.

Figure 1-5: SME-BE well correlation section across the Niger Delta showing the three major stacking and dihalomorphic formations representing the complex asymmetrical faults (Figure 1-2). The location of sections see Figure 1-2.

Figure 1-6: SME-A regional stratigraphic section across the northern eastern Niger Delta (Doss and Onoagha, 1996).
Prospect Assessment: Detailed Key References

KEY REFERENCES

AGBADA FIELD

Prospect Assessment: Detailed Key References


### Prospect Assessment: Detailed Searchable TOP

#### Table of Parameters (TOP) for D5.20x Sand (Agbada)

**Thursday, March 9, 2017**

**1. FIELD**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Agbada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude (degrees)</td>
<td>4.9326</td>
</tr>
<tr>
<td>Longitude (degrees)</td>
<td>6.9791</td>
</tr>
<tr>
<td>Country</td>
<td>Nigeria</td>
</tr>
<tr>
<td>Region</td>
<td>Africa</td>
</tr>
<tr>
<td>Basin Name (Tellus)</td>
<td>Niger Delta</td>
</tr>
<tr>
<td>Basin Alias</td>
<td>Niger Delta</td>
</tr>
<tr>
<td>Basin Type (Tellus)</td>
<td>Passive margin</td>
</tr>
<tr>
<td>Year</td>
<td>1960</td>
</tr>
<tr>
<td>Well Name</td>
<td>Agbada-1</td>
</tr>
<tr>
<td>Well IP Oil (BOPD)</td>
<td>2081</td>
</tr>
<tr>
<td>First Production Year</td>
<td>1965</td>
</tr>
<tr>
<td>Current Status Year</td>
<td>2001</td>
</tr>
<tr>
<td>Current Status</td>
<td>Primary recovery</td>
</tr>
</tbody>
</table>

**7. RESERVOIR**

| Age - Reservoir     | Miocene Middle, Miocene Early |
| Tectonic Setting - Reservoir | Passive margin, Delta         |
| Depositional Environment - Reservoir (Main) | Mixed-influence delta |
| Sandbody Type for Clastics (Main) | Barrier bar |
| Sandbody Type for Clastics (Subordinate) | Distributary channel |
| Fluid Flow Restriction | Macro-Scale |
|                       | Shale          |
|                       | Meso-Scale     |
|                       | None           |
| Reservoir Flow Unit Count | 4             |
| Single Reservoir Flow Unit Thickness | 25 Average (ft) |
| Minimum (ft)          | 15             |
| Maximum (ft)          | 35             |
| Gross (Average) (ft)  | 110            |
| Gross (Minimum) (ft)  | 80             |
| Gross (Maximum) (ft)  | 140            |
| Lithology - Reservoir (Main) | Other sandstone |
| Depositional Composition for Clastics | Quartz arenite |
| Clay Mineral Component | Kaolinite, Smectite, Illite |
| Porosity Types (Main) | Primary intergranular |
Prospect Assessment: Validate Geo. Model (depositional env.)

All text parameters are ranked by frequency.
Prospect Assessment: Validate Geo. Model (depositional env.)

- Example of the textural parameters stored in DAKS IQ
- All are based on the C&C Reservoirs proprietary classification system
One or multiple bars can be selected on the histogram to drill down the search.
Prospect Assessment: Volumetrics

Statistical distribution of all numerical parameters
Prospect Assessment: Volumetrics

Ability to create customized characterization templates

Exploration volumetrics Template
Prospect Assessment: Forecast Porosity (Numerical)

All numerical parameters can be quickly viewed as histograms.
All numerical parameters can be X-plotted and used for regression analysis.
Part 3: Prospect Assessment (Global Analogs)

• With DAKS IQ, I can easily extend my search to global analogs and see what different results I get compared to just looking at proximal analogs.
The Search for Global Analogs

Search Criteria:
Hydrocarbon Type: Oil
Reservoir Depositional
Environment (Main): Delta
The Search for Global Analogs

Fluvial-dominated delta - Deposited at river mouths, with little redistribution by shallow-marine processes. Single rivers build digitate or lobate deltas, while prograding braidplains build a broad coast-parallel front.

Wave-dominated delta - Deltas constructed at high wave-energy, microtidal coasts, where tide energy is low. Cuspate to coast-parallel depositional prisms, with few distributaries. Often capped by beach-ridge/strandplain deposits.

Tide-dominated delta - Deposited at macrotidal coasts, where tide currents are strong. Funnel-shaped river mouths, with tide-parallel sand-ridges, bars and channels. Associated with tidal flat deposits.
Global Analogs: Search Results (150 Analogs)

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Reservoir Unit Name</th>
<th>Basin Name (Talus)</th>
<th>Country</th>
<th>Region</th>
<th>Hydrocarbon Type</th>
<th>Production Curve</th>
<th>Table of Parameters</th>
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<tbody>
<tr>
<td>Abu Gharadig</td>
<td>Abu Roash C</td>
<td>Western Desert</td>
<td>Egypt</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
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<tr>
<td>Agbara</td>
<td>GS 29x Sand</td>
<td>Niger Delta</td>
<td>Nigeria</td>
<td>Africa</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Ahwaz</td>
<td>Asmari</td>
<td>Zagros Foldbelt</td>
<td>Iran</td>
<td>Middle East</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
</tr>
<tr>
<td>Alwyn North</td>
<td>Brent</td>
<td>Northern North Sea</td>
<td>United Kingdom</td>
<td>Europe</td>
<td>Oil with gas-condensate</td>
<td>Production Curve</td>
<td>TOP</td>
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<td>Ankleshwar</td>
<td>Ankleshwar 52 Sand</td>
<td>Cambay</td>
<td>India</td>
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<td>Oil with gas</td>
<td>Production Curve</td>
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<td>Ankleshwar</td>
<td>Ankleshwar S3+4 Sa</td>
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<td>India</td>
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<td>Apay</td>
<td>K-2 and K-1 Ure en</td>
<td>Llanos</td>
<td>Colombia</td>
<td>Latin America</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
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<td>Arjuna-B</td>
<td>Cibulakan B-206 G-</td>
<td>Northwest Java</td>
<td>Indonesia</td>
<td>Asia-Pacific</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
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<td>Asgard (Smorbuk)</td>
<td>Gam</td>
<td>Voring</td>
<td>Norway</td>
<td>Europe</td>
<td>Oil only</td>
<td>Production Curve</td>
<td>TOP</td>
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<tr>
<td>Ataka</td>
<td>Batikpan</td>
<td>Kulei</td>
<td>Indonesia</td>
<td>Asia-Pacific</td>
<td>Oil with gas</td>
<td>Production Curve</td>
<td>TOP</td>
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<tr>
<td>Bachaquero</td>
<td>Laguna (Blocks ii)</td>
<td>Maracaibo</td>
<td>Venezuela</td>
<td>Latin America</td>
<td>Oil with gas</td>
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<td>Production Curve</td>
<td>TOP</td>
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<td>Badr El Din-1</td>
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<td>Africa</td>
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<td>Production Curve</td>
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### Global Analogs: Volumetrics

#### Characterization

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<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Units</th>
<th>Count</th>
<th>Mean</th>
<th>Min</th>
<th>P10</th>
<th>P50</th>
<th>P90</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>Trap</td>
<td>Productive Area (Original)</td>
<td>ac</td>
<td>137</td>
<td>64,719.85</td>
<td>280</td>
<td>2044.8</td>
<td>8648.69</td>
<td>64,000</td>
<td>5,830,000</td>
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<tr>
<td>Reservoir</td>
<td>Reservoir Thickness - Gross (Average)</td>
<td>ft</td>
<td>121</td>
<td>1402.79</td>
<td>16.4</td>
<td>99.37</td>
<td>450</td>
<td>3060</td>
<td>16,000</td>
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<tr>
<td>Reservoir</td>
<td>Net/Gross Ratio (Average)</td>
<td></td>
<td>99</td>
<td>0.66</td>
<td>0.08</td>
<td>0.21</td>
<td>0.6</td>
<td>0.86</td>
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</tr>
<tr>
<td><strong>Reservoir</strong></td>
<td>Porosity - Matrix (Average)</td>
<td>%</td>
<td>144</td>
<td>23.04</td>
<td>9</td>
<td>14.45</td>
<td>24</td>
<td>30</td>
<td>38</td>
</tr>
<tr>
<td>Fluid</td>
<td>Formation Volume Factor - Oil (Average)</td>
<td>RB/STB</td>
<td>103</td>
<td>1.34</td>
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<td>1.04</td>
<td>1.24</td>
<td>1.79</td>
<td>2.85</td>
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<tr>
<td>Fluid</td>
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<td>%</td>
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<tr>
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<td>Recovery Factor Ultimate - Oil</td>
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<td>6.7</td>
<td>21.85</td>
<td>41.3</td>
<td>61</td>
<td>78.4</td>
</tr>
</tbody>
</table>

[Image of the spreadsheet showing various parameters and their statistical measures such as mean, minimum, and percentiles for different categories like Trap, Reservoir, Fluid, and Resource. The Reservoir Porosity - Matrix (Average) is highlighted.]
Global Analogs: Porosity Range

<table>
<thead>
<tr>
<th>Min</th>
<th>P10</th>
<th>P50</th>
<th>P90</th>
<th>Max</th>
<th>Arithmetic Mean</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>14.45</td>
<td>24</td>
<td>30</td>
<td>38</td>
<td>23.04</td>
</tr>
</tbody>
</table>
Porosity Forecast: Global vs. Proximal Analogs

Proximal Analogs

Global Analogs

Affecting Factors:
- Overpressure
- Diagenesis
- Maximum Depth of Burial
Summary

• For Explorers DAKS IQ can:
  – Help you to understand the region quickly and efficiently
  – Provides detailed field-specific reports to help you understand the discoveries
  – Provides a detailed bibliography enabling you to search for additional data
  – Provides a robust and consistent classification scheme
  – Provides all numeric and textural parameters in Tabular format for searching
  – Provides statistical distribution of all numerical parameters and ranking by frequency for all text parameters
  – Analysis tools allow you to inspect the data and identify trends
  – Trends can be used to forecast parameter values for your prospect and reduce uncertainty
Doing Useful Things with DAKS

FIELD DEVELOPMENT PLANNING FOR ANALOGS
Value Proposition

• DAKS IQ can help operators and regulatory agencies to:
  • Benchmark proposed and/or current development plans
  • Identify development best practices
  • Analyze the decisions that were taken to maximized ultimate recovery of oil and gas resources* in proven fields
  • Identify key drivers for development success across a population of analogs

* The highest $R_f$ / EUR is not always the best economic decision.
Problem Objective

• First oil in Banyu Urip was produced 9 years ago. A new development manager is in place and based on his global experience the EUR for this asset appears to be conservative.

• He/She has requested that the current development plan in the Banyu Urip Field be benchmarked against proven reservoir analogs.
  – Describe the target Banyu Urip Field using the DAKS IQ Knowledge Capture Module.
  – Benchmark key parameters: geologic, fluid and engineering to describe the key challenges and opportunities in the target.
  – Identify the analogs with best performance
  – What development decisions did they take?
  – How does their field differ?
  – What is development best practices are observed in the top performing analogs
Banyu Urip Field Overview

• **General & Resources:**
  – Original In Place: 1000 MMBO
  – EUR (Reservoir): 445 MMBO
  – Productive Area: 1500 acres

• **Fluid:**
  – API Gravity (Average): 32˚
  – Oil Saturation (Average): 82%*

• **Geology:**
  – Depositional Environment: Organic Buildup
  – Porosity Matrix (Average): 26%
  – Porosity Types (Main): Interparticle, moldic, vuggy*
  – Permeability Air (Average): 100 mD

• **Engineering:**
  – Onshore
  – Drive mechanism: Gas cap expansion (main) and weak aquifer (subordinate)
  – Deviated wells completed with a perforated liner*
  – Secondary recovery by*:
    ▪ Continuous water injection
    ▪ Gas recycling

* Knowledge Capture Module Parameters.
## Initial FDP in Banyu Urip

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Target value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Initial Plateau Rate (BOPD)</td>
<td>165,000</td>
</tr>
<tr>
<td>Total Number of Producers</td>
<td>33 oil producers (24 new plus nine existing wells)</td>
</tr>
<tr>
<td>Total Number of Water Injectors</td>
<td>16 (15 new plus one existing)</td>
</tr>
<tr>
<td>Total Number of Gas Injectors</td>
<td>2 (1 new plus one existing)</td>
</tr>
<tr>
<td>Well Spacing (ac)</td>
<td>23-40 ac is planned in areas of greatest hydrocarbon pore feet (&gt;150 ft), with a wider spacing of 40-52 ac in areas of lower hydrocarbon pore feet (&lt;150 ft)</td>
</tr>
<tr>
<td>Injection Well Pattern</td>
<td>Crestal Circle</td>
</tr>
<tr>
<td>Improved Recovery</td>
<td>Continuous water injection and Gas recycling</td>
</tr>
<tr>
<td>Expected Water Injection Rate at Plateau (BWPD)</td>
<td>280,000</td>
</tr>
<tr>
<td>Distance Between Producer and Injector (ft)</td>
<td>2680</td>
</tr>
</tbody>
</table>
Capture FDP Knowledge in DAKS IQ

Reservoir lithology and porosity type should be mutually consistent. Each of carbonates, clastics/other sedimentary, basement and igneous intrusive/volcanics has its own unique set of porosity types. When micro pore (≤20μm) is identified as the main porosity type, there is no need to specify the types of microporosity, such as intercrystalline, interparticle, intraparticle etc. Reservoirs with micro porosity as the main porosity type always have a very low air permeability, commonly ≤10 mD.

Well development method
Reservoir Management Practices - Drilling - The drilling activity that increases production and improves hydrocarbon recovery.

Initil drilling - Drilling of new wells between existing development wells to reduce the well spacing.
Step-out drilling - Drilling of new wells in an unstratified area of a field, usually at a similar well spacing as in the adjacent drilled area.
Pad drilling - Drilling of multiple wells from a single surface location. Commonly used to exploit onshore fields (western plays).
Sidetracking - Drilling of a new wellbore that branches off from an existing wellbore in order to:
- increase/improve production where the parent well has failed,
- further develop the same reservoir as the parent; or
develop an entirely different reservoir.
Search for Global Analogs
Benchmark Target

Banyu Urip
## DAKS IQ Benchmark – Numerical Parameters

### Characterization

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>Well Count - Total All Wells (&quot;Field&quot;)</td>
<td></td>
</tr>
<tr>
<td>Fluid</td>
<td>API Gravity - Oil (Average)</td>
<td>°API</td>
</tr>
<tr>
<td>Trap</td>
<td>Depth to Top of Reservoir</td>
<td>ft TVD</td>
</tr>
<tr>
<td>Field</td>
<td>Well Count - Current Producers (Field)</td>
<td></td>
</tr>
<tr>
<td>Well</td>
<td>Well Count - Total Producers</td>
<td></td>
</tr>
<tr>
<td>Well</td>
<td>Well Count - Total All Wells</td>
<td></td>
</tr>
<tr>
<td>Trap</td>
<td>Productive Area (Original)</td>
<td>ac</td>
</tr>
<tr>
<td>Well</td>
<td>Well Count - Total Injectors</td>
<td></td>
</tr>
<tr>
<td>Fluid</td>
<td>Gas - Hydrogen Sulphide (Average)</td>
<td>%</td>
</tr>
<tr>
<td>Fluid</td>
<td>Initial Water Saturation (Average)</td>
<td>%</td>
</tr>
<tr>
<td>Fluid</td>
<td>Oil Saturation - Original (Average)</td>
<td>%</td>
</tr>
<tr>
<td>Resource</td>
<td>Recovery Factor Ultimate - Oil</td>
<td>%</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Reservoir Flow Unit Count</td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Original In-Place - Oil</td>
<td>MMBO</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Permeability - Air (Average)</td>
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<tr>
<td>Well</td>
<td>Well Spacing (Current) - Oil</td>
<td>ac</td>
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<tr>
<td>Well</td>
<td>Well EUR - Oil</td>
<td>MBO</td>
</tr>
<tr>
<td>Well</td>
<td>Well Rate (Initial) - Oil</td>
<td>BOEPD</td>
</tr>
<tr>
<td>Fluid</td>
<td>Gas - Carbon Dioxide (Average)</td>
<td>%</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Reservoir Thickness - Gross (Average)</td>
<td>ft</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Porosity - Matrix (Average)</td>
<td>%</td>
</tr>
<tr>
<td>Resource</td>
<td>Resource Density - Oil</td>
<td>MBO/ft3</td>
</tr>
</tbody>
</table>

### Diagram

- **Plot 1:** Correlation between Porosity - Matrix (Average) and Depth to Top of Reservoir (ft TVD).
- **Plot 2:** Scatter plot showing the relationship between Resource Density - Oil and Recovery Factor Ultimate - Oil.

---

52
# DAKS IQ Benchmark – Text Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Count</th>
<th>Target</th>
<th>Frequency</th>
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<tbody>
<tr>
<td><strong>General</strong></td>
<td>Gas-Cap Development</td>
<td>16</td>
<td>Oil rim only</td>
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<tr>
<td><strong>Well</strong></td>
<td>Well Type</td>
<td>81</td>
<td>[1, 2, 6]</td>
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<tr>
<td>[Image 814x13 to 897x38]</td>
<td>[Image 32x19 to 206x35]</td>
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<td>[2]</td>
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<tr>
<td>Improved Recovery</td>
<td>Techniques to Characterize Remaining Hydrocarbons</td>
<td>49</td>
<td>Reservoir simulation, Wireline log analysis, Production logging tool (PLT)</td>
<td>1,2,6</td>
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<td>Improved Recovery</td>
<td>Secondary Recovery - Methods</td>
<td>55</td>
<td>Continuous water injection, Gas recycling</td>
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<td>Reservoir Management Practices - Production Optimization</td>
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<td>Re-perforation</td>
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<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Completion</td>
<td>68</td>
<td>[Image 32x54 to 894x458]</td>
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<tr>
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<td>Reservoir Management Practices - Drilling</td>
<td>59</td>
<td>Tail drilling</td>
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<td>EOR - Methods</td>
<td>24</td>
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<tr>
<td>Improved Recovery</td>
<td>Conformance Improvement</td>
<td>29</td>
<td>[Image 32x54 to 894x458]</td>
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<tr>
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<td>Reservoir Management Practices - Perforation</td>
<td>15</td>
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<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Stimulation</td>
<td>48</td>
<td>[Image 814x13 to 897x38]</td>
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<td>Improved Recovery</td>
<td>Reservoir Management Practices - Artificial Lift</td>
<td>34</td>
<td>[Image 814x13 to 897x38]</td>
<td></td>
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<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Well Treatment</td>
<td>7</td>
<td>[Image 814x13 to 897x38]</td>
<td></td>
</tr>
</tbody>
</table>
Secondary Recovery Methods

Target Banyu Urip Reservoir

Frequency

Secondary Recovery Methods

Continuous water injection
Gas recycling
Hydrocarbon gas injection
Water alternating gas (WAG) immiscible injection
Dump flood

Kujung Formation
Well Type

Target Banyu Urip Reservoir

Kujung Formation

Vertical or deviated well: 79
Horizontal well: 21
Multilateral well: 6
Slim-hole well: 1
Extended-reach well: 1
Production Optimization Practices

Target Banyu Urip Reservoir

Reservoir Management Practices - Production Optimization

- Recompletion
- Re-perforation
- Selective perforation
- Additional perforation
- Shut-in well reopening
- Gas-cap blowdown
- Flowing rate control
- Gas well deliquification
- Pump size optimization
- Individual well cyclic gas injection
Carbon Dioxide (%)
DAKS IQ Report

ZAMA TREND
Middle Devonian Keg River Formation: Pinnacle Reefs

Executive Summary

The Zama Trend is located in the NW corner of Alberta, in the north-central part of the Western Canada Sedimentary Basin (Figs 1 and 2). The trend, which comprises 298 pinnacle reef pools, has a combined STOIIP of 512 MMBO, with URR of 108 MMBO representing an average recovery factor of 21%. The first Zama pool was discovered in 1966 and brought onstream in 1968. The pinnacle-reef build-ups that form the reservoir occur in the Middle Devonian Keg River and Zama members of the Keg River Formation, where light oil (33-37 °API) is trapped by Middle Devonian evaporites that form both the top and lateral seals. The hydrocarbons were sourced from contemporaneous offreef Middle Devonian bituminous carbonates. The reservoir consists of reef limestones, which are variably dolomitized, and supergene laminated grainstones, which are extensively dolomitized. The limestones and dolomites have a similar average porosities (~7%-8%), but strongly differing average permeabilities (7.3 mD versus 156 mD, respectively). The principal natural production mechanism is solution-gas drive with weak aquifer support. Oil production from the trend peaked at 18,308 BOPD in 1969 under primary drive. Most of the smaller pools were developed using a single well and produced by primary drive. Secondary and enhanced recovery projects were implemented in the larger pools. Initially, water and gas injection were used to maintain reservoir pressure, but met with limited success. Hydrocarbon miscible flooding was considered, but ultimately proved impractical owing to the small size of the reefs and the absence of a reliable source of miscible hydrocarbon solvent. The use of acid gas (CO₂ and H₂S-rich residue gas from the field gas plant) as a miscible solvent was introduced in the 1990s and has been a success. Acid gas injection not only increases incremental oil recovery, it also sequesters greenhouse gases within the reservoir and eliminates need to remove H₂S from the produced gas, lowering operating costs. Acid gas flooding, aided by horizontal drilling that began in the early 2000s, has yielded incremental recoveries of ~10-15% of STOIIP. As of 2009, the Zama Trend was producing 2000 MBO/yr, and cumulative production stood at 106 MMBO.

Explanation History

Seismic exploration, conducted by Hudson's Bay Oil and Gas Company, led to the 1956 discovery of the Zama Trend located in the NW corner of Alberta (Figs 1 and 3). The discovery was the culmination of a play concept developed after the 1955 discovery of oil and gas in the Rainbow Trend, ~50 mi SW of the Zama Trend (Evans, 1972). The hydrocarbon reservoirs at both Rainbow and Zama are contained within pinnacle reefs and grainstone shoals of the Upper Elk Point Subgroup (Middle Devonian).

Following the discovery of the Rainbow Trend, Hudson's Bay recorded several miles of five-fold common-depth-point (CDP) Vekroses data to be used as a template for further exploration in the Middle Devonian of NW Alberta. The Rainbow Trend data were picked and plotted on a time section for comparison with several hundred miles of preexisting non-CDP, non-tape recorded seismic data, collected by Hudson's Bay in 1948-62. After patterns indicative of the presence of Middle Devonian reefs were identified in the template, a study of the 1948-62 data revealed similar patterns in the general Zama area. The pattern similarly prompted a 3D-channel reconnaissance seismic
Ultimate Recovery Factor PDF
Isolate Top Performers
DAKS IQ Benchmark – Numerical Parameters

Characterization

Numerical Parameters

Category | Parameter | Units
--- | --- | ---
Fluid | API Gravity - Oil (Average) | API
Field | Total Well Count (Field) | Count
Resource | Recovery Factor Ultimate - Oil | %
Trap | Total Productive Area (Original) | ac
Reservoir | Gas - Hydrogen Sulphide (Average) | %
Reservoir | Reservoir Flow Unit Count | Count
Fluid | Oil Saturation - Original (Average) | %
Fluid | Initial Water Saturation (Average) | %
Reservoir | Permeability - Air (Average) | md
Resource | Original In Place - Oil | MMBO
Well | Total FUR - Oil | BBL
Well | Well Rate (Initial) - Oil | BOPD
Well | Well Spacing (Current) - Oil | ac
Reservoir | Reservoir Thickness - Gross (Average) | ft
Reservoir | Porosity - Matrix (Average) | %
Fluid | Gas - Carbon Dioxide (Average) | %
Resource | Resource Density - Oil | MBOe/ac
## DAKS IQ Benchmark – Text Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Count</th>
<th>Target</th>
<th>Frequency</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
<th>Fourth</th>
<th>Fifth</th>
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<tbody>
<tr>
<td>General</td>
<td>Gas-Cap Development</td>
<td>10</td>
<td>Oil rim only</td>
<td>1</td>
<td>Oil rim only (60%)</td>
<td>Oil rim first followed by gas cap (10%)</td>
<td>Coremont oil rim and gas cap (10%)</td>
<td>Multilateral well (2%)</td>
<td></td>
</tr>
<tr>
<td>Well</td>
<td>Wet Type</td>
<td>1</td>
<td>Vertical or deviated well</td>
<td>1</td>
<td>Vertical or deviated well (76%)</td>
<td>Horizontal well (50%)</td>
<td>Extended-reach well (2%)</td>
<td>Multilateral well (2%)</td>
<td></td>
</tr>
<tr>
<td>Improved Recovery -</td>
<td>Techniques to Characterize Remaining</td>
<td>28</td>
<td>Reservoir simulation, Wireline log analysis, Production logging tools (97%)</td>
<td>[1, 2, 7]</td>
<td>Reservoir simulation (30%)</td>
<td>Trace survey (13%)</td>
<td>Cased-hole logging (11%)</td>
<td>Core analysis (11%)</td>
<td>Wireline log analysis (11%)</td>
</tr>
<tr>
<td>Improved Recovery -</td>
<td>Secondary Recovery - Methods</td>
<td>12</td>
<td>Continuous water injection, Gas recycling</td>
<td>[1, 2]</td>
<td>Continuous water injection (48%)</td>
<td>Gas recycling (26%)</td>
<td>Hydrocarbon-gas injection (17%)</td>
<td>Water alternating gas (WAG) miscible injection (5%)</td>
<td>Dump fluid (2%)</td>
</tr>
<tr>
<td>General</td>
<td>Drive Mechanisms - Main</td>
<td>18</td>
<td>Gas cap expansion</td>
<td>2</td>
<td>Gas cap expansion (65%)</td>
<td>Gas cap expansion (14%)</td>
<td>Weak aquifer (14%)</td>
<td>Strong aquifer (12%)</td>
<td>Gravity drainpipe (1%)</td>
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<tr>
<td>Improved Recovery -</td>
<td>Reservoir Management Practices - Production Optimization</td>
<td>16</td>
<td>No participation</td>
<td>2</td>
<td>Re-completion (38%)</td>
<td>Re-perforation (11%)</td>
<td>Selective perforation (12%)</td>
<td>Additional perforation (9%)</td>
<td>Gas cap blowout (8%)</td>
</tr>
<tr>
<td>Improved Recovery -</td>
<td>Reservoir Management Practices - Completion</td>
<td>10</td>
<td>Perforated liner</td>
<td>5</td>
<td>Perforated casing (41%)</td>
<td>Baseboot completion (24%)</td>
<td>Perforated liner (9%)</td>
<td>Dual completion (9%)</td>
<td>Multiple completion (8%)</td>
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<tr>
<td>Improved Recovery -</td>
<td>Reservoir Management Practices - Drilling</td>
<td>28</td>
<td>Past drilling</td>
<td>8</td>
<td>Mill drilling (39%)</td>
<td>Horizontal well (32%)</td>
<td>Sidetracking (11%)</td>
<td>Step-out drilling (9%)</td>
<td>Multilateral well (2%)</td>
</tr>
<tr>
<td>Improved Recovery</td>
<td>EOR - Methods</td>
<td>10</td>
<td></td>
<td></td>
<td>Hydrocarbon miscible flood (51%)</td>
<td>CO2 miscible flood (30%)</td>
<td>Water alternating gas (WAG) miscible flood (13%)</td>
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<td></td>
</tr>
<tr>
<td>Improved Recovery</td>
<td>Conformance Improvement</td>
<td>10</td>
<td></td>
<td></td>
<td>Coremont oil rim and gas cap (10%)</td>
<td>Oil rim first followed by gas cap (10%)</td>
<td>Coremont oil rim and gas cap (10%)</td>
<td></td>
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</tr>
<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Perforation</td>
<td>5</td>
<td></td>
<td></td>
<td>Waveline-conveded perforation (20%)</td>
<td>Coiled tubing-conveded perforation (10%)</td>
<td>Through-lead perforation (TPF) (10%)</td>
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<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Stimulation</td>
<td>10</td>
<td></td>
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<td>Main acidization (72%)</td>
<td>Hydraulic fracturing single-stage (12%)</td>
<td>Acid fracturing (13%)</td>
<td>Acid diversion fracturing (H 4%)</td>
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</tr>
<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Artificial Lift</td>
<td>10</td>
<td></td>
<td></td>
<td>Electric submersible pump (ESP) (35%)</td>
<td>Rope pump (32%)</td>
<td>Gas lift (25%)</td>
<td>Hydraulic jet pump (5%)</td>
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</tr>
<tr>
<td>Improved Recovery</td>
<td>Reservoir Management Practices - Well Treatment</td>
<td>10</td>
<td></td>
<td></td>
<td>Wax removal (50%)</td>
<td>Asphaltene inhibitor treatment (20%)</td>
<td></td>
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</tr>
</tbody>
</table>
DAKS IQ Production Performance
Banyu Urip expected Plateau Rate ~165,000 BOPD
DAKS IQ Well Performance

7500 BOPD Well rate in Banyu Urip
DAKS IQ Injection Performance

~280,000 injected BWPD are planned from the 16 injector wells
# DAKS IQ Numerical Characterization

## Characterization

- **Data Source:** Public
- **Hydrocarbon Type:** Oil
- **Onshore/Offshore:** Onshore
- **Depositional Environment - Reservoir (Main):** Organic buildup
- **API Gravity - Oil (Average):** 23...
- **Recovery Factor Ultimate - Oil:** 42.53...

## Numerical Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Units</th>
<th>Count</th>
<th>Target</th>
<th>Rank</th>
<th>Mean</th>
<th>Min</th>
<th>P10</th>
<th>P50</th>
<th>P90</th>
<th>Max</th>
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<tbody>
<tr>
<td>Well</td>
<td>Well Count - Total Producers</td>
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<td>28</td>
<td>9</td>
<td>37 %</td>
<td>199</td>
<td>2</td>
<td>2</td>
<td>49</td>
<td>489.1</td>
<td>1770</td>
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<tr>
<td>Well</td>
<td>Well Count - Total Injectors</td>
<td></td>
<td>17</td>
<td>2</td>
<td>38 %</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>42</td>
<td>172</td>
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<td>Well</td>
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<td>ac</td>
<td>29</td>
<td>226</td>
<td>96 %</td>
<td>70.48</td>
<td>7</td>
<td>11.2</td>
<td>40</td>
<td>160</td>
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<td>BOPD</td>
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<td>7500</td>
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<td>188.26</td>
<td>758.06</td>
<td>6651.2</td>
<td>20,214</td>
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</table>

Target: Banyu Urip - Kujung Formation
DAKS IQ Numerical Characterization

33 Producers planned in the Plateau Stage
DAKS IQ Numerical Characterization

18 Total Injectors planned at Plateau Stage
DAKS IQ Numerical Characterization

23-52 acres planned Plateau Well Spacing
### DAKS IQ Characterization

**Target**

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Count</th>
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<th>Frequency</th>
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<tr>
<td>Well</td>
<td>Well Pattern (Current)</td>
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<td>Improved Recovery</td>
<td>Secondary Recovery - Methods</td>
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</tr>
<tr>
<td>Improved Recovery</td>
<td>EOR - Methods</td>
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<td>Conformance Improvement</td>
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<td>Improved Recovery</td>
<td>Reservoir Management Practices - Drilling</td>
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<td>Improved Recovery</td>
<td>Reservoir Management Practices - Completion</td>
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<td>Reservoir Management Practices - Stimulation</td>
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<td>Reservoir Management Practices - Artificial Lift</td>
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<td>Reservoir Management Practices - Well Treatment</td>
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</table>

**Examples of Parameters**

- **Well Pattern (Current)**: Crestal circle
- **Secondary Recovery - Methods**: Continuous water injection, gas recycling
- **EOR - Methods**: Water alternating gas (WAG) miscible flood
- **Conformance Improvement**: High GOR well shut-in
- **Reservoir Management Practices - Drilling**: Perforated casing
- **Reservoir Management Practices - Completion**: Re-perforation
- **Reservoir Management Practices - Perforation**: Re-completion
- **Reservoir Management Practices - Stimulation**: Wax removal

**Frequency Examples**

- **Crestal line**: 21%
- **Irregular**: 18%
- **Peripheral circle**: 12%
- **Square grid**: 12%
- **Crestal circle**: 5%

**Additional Details**

- **Data Source**: Public
- **Hydrocarbon Type**: Oil
- **Depositional Environment - Reservoir (Main)**: Organic buildup
- **Reservoir**: Banyu Urip - Kujung Formation
- **API Gravity**: Oil (Average) 23
- **Recovery Factor Ultimate - Oil**: 42.4

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**C&C Reservoirs**

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**Page 72**
Primary Recovery Factor (%)
Incremental Recovery (%) by Continuous Water Injection
Incremental Recovery (%) by Gas Recycling
Relationship in Incremental Recovery by CWI and GR

The chart displays the relationship between Incremental Recovery and Continuous Water Injection, with data points for different reservoirs. The chart includes the following reservoirs:

- Ekofisk - Tor-Ekofisk: Incremental Recovery - Continuous Water Injection: 28%, Gas Recycling: 3%
- Eridal - Hod-Tor-Ekofisk: Incremental Recovery - Continuous Water Injection: 6.7%, Gas Recycling: 4.5%
- Rainbow Trend - Rainbow: Incremental Recovery - Continuous Water Injection: 11.4%, Gas Recycling: 11%
DAKS IQ Analog Case Study

- Intisar ‘D’ Field
  - Similar geology, fluid and engineering parameters when compared to the Banyu Urip Field.
  - The ‘D’ Field was developed in three stages: (1) Bottom water injection and crestal gas injection, with production averaging 210,000 BOPD; (2) Crestal gas injection; with production constrained to <60,000 BOPD; and (3) tertiary recovery with crestal gas injection.

<table>
<thead>
<tr>
<th>Production phase</th>
<th>Developing</th>
<th>Plateau</th>
<th>Decline</th>
<th>Mature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary recovery methods (starting date)</td>
<td>Continuous water injection</td>
<td>Continuous water injection</td>
<td>Gas injection &amp; recycling</td>
<td>Gas injection &amp; recycling</td>
</tr>
<tr>
<td>Enhanced oil recovery methods (starting date)</td>
<td>NA</td>
<td>Hydrocarbon miscible</td>
<td>Hydrocarbon miscible</td>
<td>Hydrocarbon miscible</td>
</tr>
<tr>
<td>Other improved recovery methods</td>
<td>NA</td>
<td>NA</td>
<td>Gas coning control</td>
<td>Water coning control</td>
</tr>
<tr>
<td>Best improved recovery practices</td>
<td>NA</td>
<td>Hydrocarbon miscible</td>
<td>Hydrocarbon miscible</td>
<td>Hydrocarbon miscible</td>
</tr>
</tbody>
</table>

---

![Graph showing production performance](image-url)
# DAKS IQ Analog Case Study

## 1 - PRODUCTION PERFORMANCE

<table>
<thead>
<tr>
<th>Phase</th>
<th>Developing</th>
<th>Plateau</th>
<th>Decline</th>
<th>Mature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well pattern</td>
<td>Crestal circle (gas) Bottom water injection</td>
<td>Crestal circle (gas) Bottom water injection</td>
<td>Crestal circle (gas) Bottom water injection</td>
<td>Crestal circle (gas)</td>
</tr>
<tr>
<td>Total number of producers</td>
<td>11</td>
<td>13</td>
<td>13 (1979)</td>
<td>26 (1990)</td>
</tr>
<tr>
<td>Total number of injectors</td>
<td>19 (water) + 3 (gas)</td>
<td>19 (water) + 7 (gas)</td>
<td>11 (water) + 7 (gas) (1975)</td>
<td>7 (gas) (1998)</td>
</tr>
<tr>
<td>Number of casing-damaged wells</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Daily production rate</td>
<td>233,333 BOEPD</td>
<td>277,400 BOEPD</td>
<td>42,263 BOEPD</td>
<td>15,940 BOEPD</td>
</tr>
<tr>
<td>Daily injection rate</td>
<td>0.13 MMCFGPD, 316.636 BWPD</td>
<td>329 MMCFGPD, 269.145 BWPD</td>
<td>216 MMCFGPD, 29.993 BWPD</td>
<td>356 MMCFGPD, 0 BWPD</td>
</tr>
<tr>
<td>Production rate per well</td>
<td>21,203 BOEPD</td>
<td>21,335 BOEPD</td>
<td>11,927 BOEPD (1975)</td>
<td>N/A</td>
</tr>
<tr>
<td>Cumulative production</td>
<td>95 MMBO</td>
<td>300 MMBO</td>
<td>901 MMBO</td>
<td>1,215 MMBO</td>
</tr>
<tr>
<td>Cumulative injection</td>
<td>0.05 BCFG</td>
<td>206 BCFG</td>
<td>1,407 BCFG</td>
<td>4,116 BCFG</td>
</tr>
<tr>
<td>Cumulative injection to production ratio</td>
<td>0.08 Gas: 0.66</td>
<td>0.81 Gas: 1.01</td>
<td>0.53 Gas: 1.40</td>
<td>0.99 Gas: 1.21 (2005)</td>
</tr>
<tr>
<td>Annual injection to production ratio</td>
<td>0.08 Gas: 0.90</td>
<td>0 Gas: 1.44</td>
<td>0.46 Gas: 1.00</td>
<td>1.42 Gas: 1.21 (2005)</td>
</tr>
<tr>
<td>Decline rate</td>
<td>-44%</td>
<td>2.6%</td>
<td>15%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Annual recovery</td>
<td>0.5-0.6% (STOIP)</td>
<td>0.7-0.8% (STOIP)</td>
<td>0.5-0.6% (STOIP)</td>
<td>0.7-0.8% (STOIP)</td>
</tr>
<tr>
<td>Recovery to date</td>
<td>11.3-17.2% (STOIP)</td>
<td>14.7-22.1% (STOIP)</td>
<td>22.1-31.2% (STOIP)</td>
<td>20.7-35.5% (STOIP)</td>
</tr>
<tr>
<td>Remaining reserves</td>
<td>1262 MMBO</td>
<td>1055 MMBO</td>
<td>454 MMBO</td>
<td>140 MMBO</td>
</tr>
<tr>
<td>Remaining reserves to annual production ratio</td>
<td>15</td>
<td>10</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>Reservoir pressure</td>
<td>3516 psi</td>
<td>3782 psi</td>
<td>4187 psi</td>
<td>4428 psi</td>
</tr>
<tr>
<td>GOR or condensate yield</td>
<td>657 SCF/MMBO</td>
<td>626 SCF/MMBO</td>
<td>294 SCF/MMBO</td>
<td>15.200 SCF/MMBO (2005)</td>
</tr>
<tr>
<td>Water cut</td>
<td>0%</td>
<td>0.1-1.1%</td>
<td>0.2-13.1%</td>
<td>13.9-72.1%</td>
</tr>
</tbody>
</table>
Conclusions: Production Performance

• The Initial Field Development Plan in the Banyu Urip Field is in line with the best practices worldwide in reservoir analogs.

• The estimated ultimate recovery in Banyu Urip (45%) is on the conservative side relative to top performing analogs considering the high productivity per well and high porosity.

• DAKS IQ helped to identify **Intisar D case study** which has similar fluid, geological and engineering criteria and a higher recovery factor [67-89%].
How DAKS IQ can help SKK Migas

• **Cost efficiency and Process simplification**
  Improving your time to do research and evaluate prospects and plans, find valuable new ideas and alternatives to consider especially for exploration and new ventures.
  Able to QA/QC POD of operators and validate recommendations and identify anomalies and gaps.

• **Project Execution**
  Holding oil & gas operators in Indonesia accountable through E&P technical proposals validation and performance metric comparisons through local & global analogs.

• **Technology as a Differentiator**
  Providing a robust knowledge capture repository system and best-practices global analog analyses
  Combating the natural tendency for “confirmation bias” of staff

• **Rethinking Talent**
  Providing tools for your staff that assist with new employee ramp-up, staff education and training
C&C Reservoirs’ support for SKK Migas

**Expanding Global Team:** Asia-Pacific regional office set-up in KL with Regional Director to facilitate easier communication with customers and eliminate time zone delays.

**Technical Services:** Dedicated Technical Services resources to support DAKS IQ transition. Experienced team who can support partnership goals: training of ITB/ SKK Migas team and knowledge capture of Indonesian fields.

**Support:** Online and telephone support using best-in-class process and technology to capture, escalate and address all support issues to solve your problems and answer your questions quickly.

**Research & Development:**
- Continuously evolving and improved reservoir classification system
- Continued, significant investment in software development to improve your user experience and add more functionality to support better decision making.
- Developed a robust pipeline of new products and features that will continue to be rolled out over the next 18-24 months

**Content:** Streamlined content management and report writing process 50 new and 200 updated reports per annum; producing high quality content providing valuable analogs in your knowledge base.
Selected C&C Reservoirs Customers

IOCs
- bhp billiton
- Chevron
- Shell
- eni
- Galp
- Statoil
- Total

NOCs and Governments
- CNH
- PETROL
- ONGC
- PEMEX
- Saudi Aramco
- CNPC
- NOC
- PGNiG
- PetroChina
- PTTEP
- Sinopec

Independent E&P Companies
- Anadarko
- devon
- HESS
- MAERSK
- Murphy Oil Corporation
- Premier Oil
- Tullow
- Wintershall