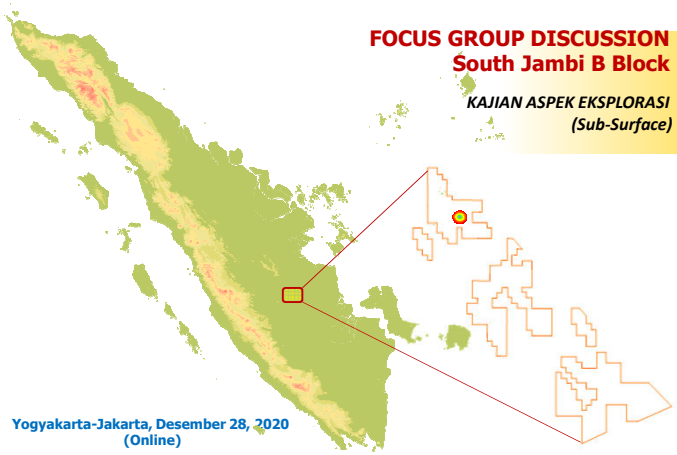


FOCUS GROUP DISCUSSION
South Jambi B Block

KAJIAN ASPEK EKSPLORASI
(Sub-Surface)

Yogyakarta-Jakarta, Desember 28, 2020
(Online)

Jindi South Jambi B Co. Limited

OUTLINE

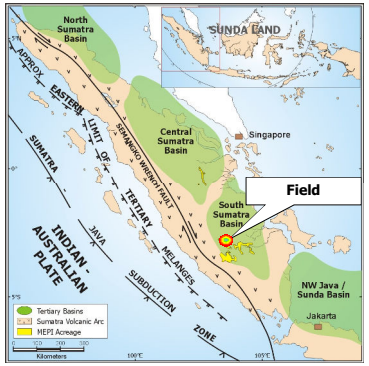
I. INTRODUCTION

II. KAJIAN EKSPLORASI

Jindi South Jambi B Co. Limited

2.1. REGIONAL GEOLOGY

OVERVIEW



- Discovered 1984; appraised 1998
- POP approved in 2010 to tie in Hari-2 well
- Located 16 km NE of Geger Kalong and 10 km SE of Teluk Rendah gas fields and 6 km from existing Teluk Rendah Plant (low production)
- New subsurface map for Hari Field using existing 2X2 km grid 2D seismic data; Three wells on Hari feature tied into the seismic interpretation
- Tested Reservoirs:
  - ✓ **Pre-Tertiary (Paleo High)**: Quartzite, Phyllite (fractured basement); Hari-1, Hari-3: 2.3 mmcfd
  - ✓ **TAF/Lemat Formation**: Fluvial-deltaic sand; Hari-2: 3 mmcfd (after frac)
- DST Tests in three Wells confirmed the presence of Gas and Oil less than 5% of CO_2

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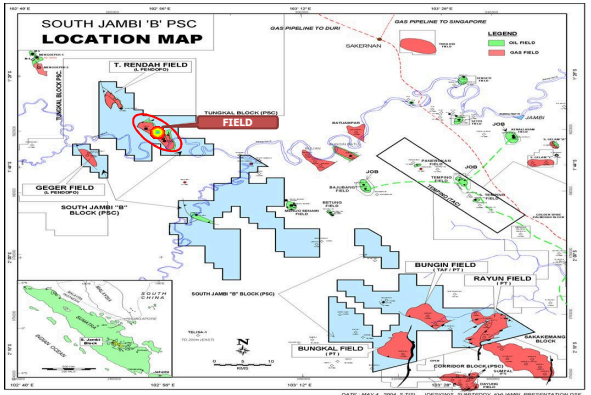
2.1. REGIONAL GEOLOGY

Field Location



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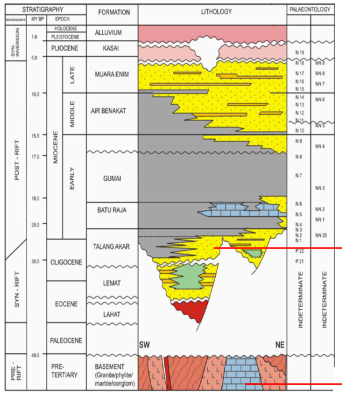
2.1. REGIONAL GEOLOGY

2.1.1. Regional Stratigraphy

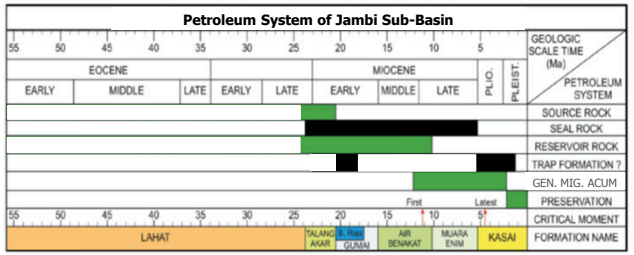


UTAF and LTAF as Potential Reservoir
Shallow Marine Sandstone and Sandstones Conglomerates and Shale of the Fluvial fan

Pre-Tertiary Basement as main Target Reservoir
Metamorfic Rock-Quartzite and Meta-quarzite

2.1. REGIONAL GEOLOGY

2.1.2. Regional Petroleum System



Petroleum System of Jambi Sub-Basin

KAJIAN EKSPLORASI

JENIS DATA EKSPLORASI :

1) **Dokumen *Post Mortem Analysis***
2) **Dokumen Laporan Kajian Manajemen Resiko***
3) **Dokumen Laporan Akhir Sumur (*Final Well Report*)**
4) **Dokumen Penentuan Status Eskplorasi (PSE)**
5) **Dokumen Daily Driling Report***
6) **Dokumen Well Test (DST, PBU)***
7) **Dokumen Analisa Fluida Reservoir***
8) **Dokumen Analisa Sampel Batuan (Core)***

Kajian *Post Mortem Analysis*

1. **Analisa Struktur Geologi dan Model Pengendapan**
   - Geological setting analysis (konsep struktur geologi)
   - Stratigrafi regional
   - Konsep Pengendapan
2. **Analisa Stratigrafi dan Lapisan Potensial** :
   (sikuen stratigrafi, fasies dan lingkungan pengendapan)
3. **Analisa Petrofisik**
4. **Analisa Geofisika**
5. **Analisa Model 3D (geomodeling)**
6. **Analisa Petroleum Sistem**
   (*source rock, reservoir rock, seal rock, trap, timming/migration*)
7. **Perhitungan in Place**

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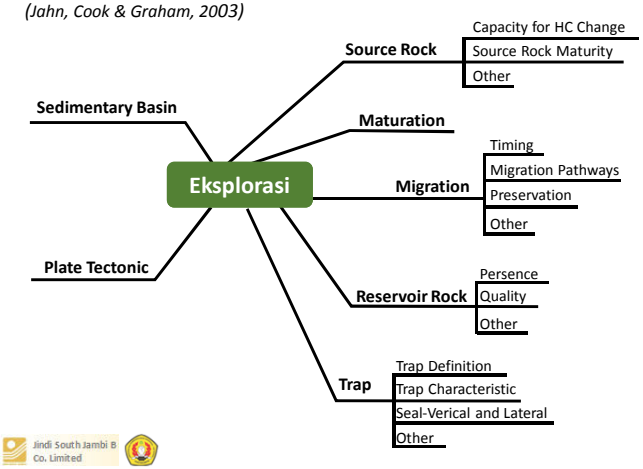
Bagan Objek Eksplorasi

(Jahn, Cook & Graham, 2003)



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Ketersedian Data, Analisa & Output

Input (Ketersediaan Data)	Analisa	Output
Studi Pustaka dan referensi (tektonostratigrafi)	Tektonostratigrafi dan Model Pengendapan	Geological Setting; Stratigrafi Regional; Konsep Pengendapan
Data Sumur • Header log • Log Sumur (track litologi, resistivity, porosity) • Lintasan sumur • Petrografi • Core • Analisa Air • Cutting • Biostratigrafi • Mud Log • Checkshout & Time-Depth Log **Data Seismik** • Lintasan Seismik (2D/3D) • Velocity Data **Data Geokimia** • TOC (Total Organic Carbon) • HI (Hydrocarbon Index) • Kerogen • Temperature • Ro (Vitrinite Reflectance)	Analisa Stratigrafi dan Lapisan Potensial	Sikuen Stratigrafi; Fasies dan Lingkungan pengendapan
	Analisa Petrofisika	Identifikasi intersest zone; Indikator Fracture Reservoir & Properti Petrofisik (Vshale, Phie, Sw dan K)
	Analisa Geofisika	Wavelet Extraction (misde analysis); Interpretasi pola struktur (patahan) & lapisan prospek; Model Velocity; Atribut Seismik; Fracture Basement; Upside Potensial
	Analisa 3D Model (Geomodeling)	3D Grid Structural Modeling; Geometri Reservoir (distribusi fasies, distribusi petrofisik (Vshale, Phie, Sw & K))
	Analisa Sistem Petroleum	Pemodelan 3D sistem petroleum; Source Rock; Reservoir Rock; Seal Rock; Trap; Timming/Migration (migrasi & akumulasi)

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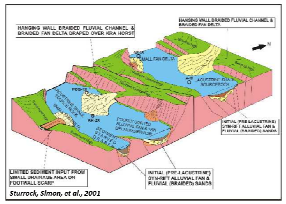
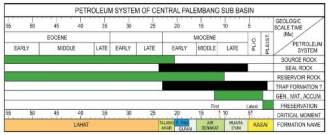
Tektonostratigrafi & Petroleum Sistem Regional

Model Tatanan Tektonik

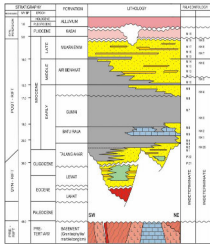
Model Pengendapan



Petroleum Sistem



Stratigrafi Regional



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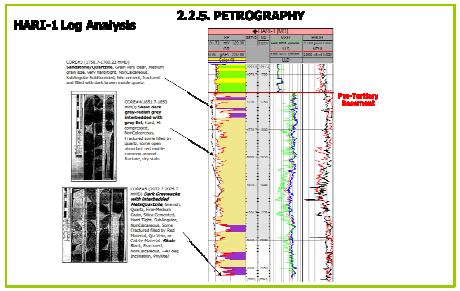
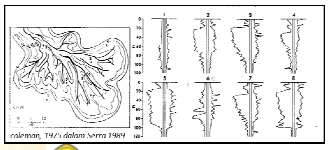
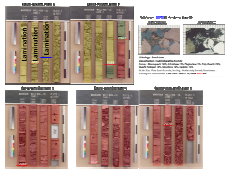
Stratigrafi Lokal dan Lapisan Prospek

Integrasi Sikuen Stratigrafi, Lingkungan Pengendapan & Analisa petrografi



Model Fasies dan Lingkungan Pengendapan





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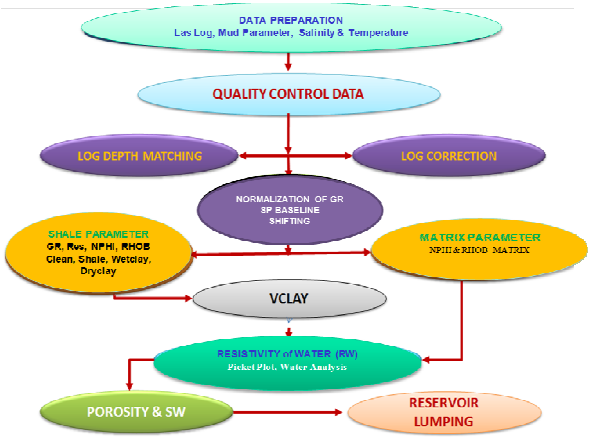
Kajian Petrofisika

Bagan Alir Kajian Petrofisika



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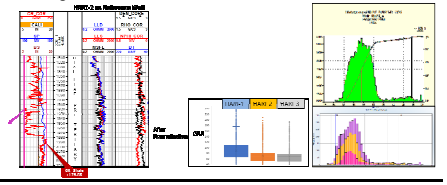
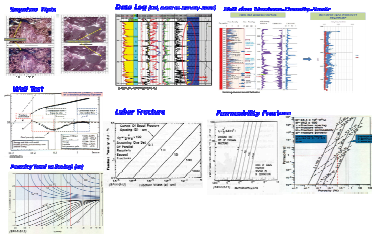
Kajian Petrofisika

Analisa	Output
Quality Conntrol • Depth Macthing • Normalisasi • Koreksi Log	Log Correction  Normalisasi
Identifikasi Fracture • Sayatan Tipis (petrografi) • Well Test • Porositas Total vs Litologi (m) • Log Cal, Neutron-Density-Sonic • FMI • Chart	Identifikasi Fracture 

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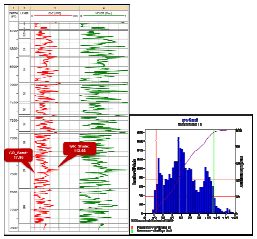
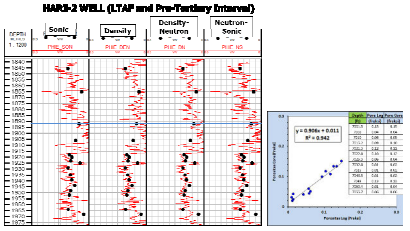
Kajian Petrofisika (Properti Petrofisik)

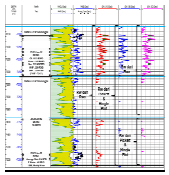
Penentuan VShale



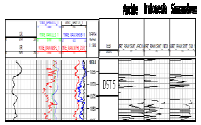
Penentuan Porositas Efektif (phie) dan Validasi



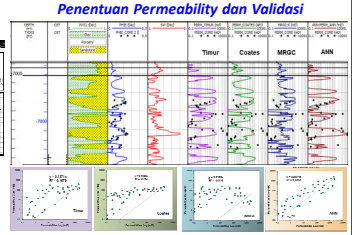
Penentuan Rw



Penentuan Sw



Penentuan Permeability dan Validasi



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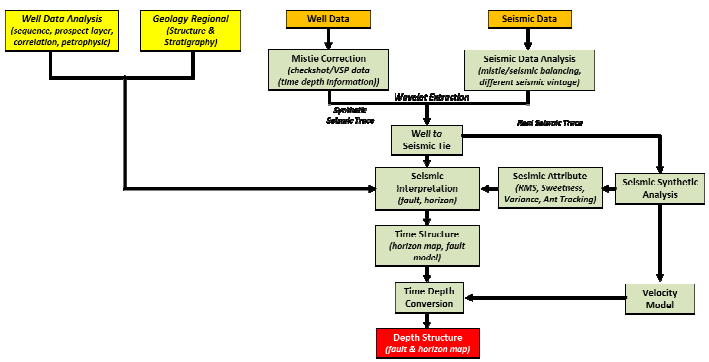
Kajian Geofisika

Bagan Alir Kajian Geofisika



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Kajian Geofisika

Analisa	Output
Wavelet Extraction • Well Data • Well Seismic Tie	Analisa Mistie Well Seismic Tie
• Interpretasi Seismik • Time to Depth Conversion	Pola Patahan & Lapisan Timt to Depth Conversion
Seismik Atribut	Sweetness RMS Instataneous Freq. Variance

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Kajian 3D Model (Geomodeling)

Analisa	Output
Strctural Modeling • Fault Modeling; • Pillar Gridding; • Horizone Modeling; • Make Zone; • Layering	(a) Fault Modeling & Pillar Gridding (b) Horizon Modeling (c) Make Zone (d) Layering

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Kajian 3D Model (Geomodeling)

Analisa	Output
Property Modeling • Scale up Well logs; • Analisa Data; • Distribusi Fasies • Properti Petrofisik **Realisasi Distribusi Properti**	(e) Scale up Well Logs (f) Data Analysis (g) Fasies Modeling (h) Property Modeling

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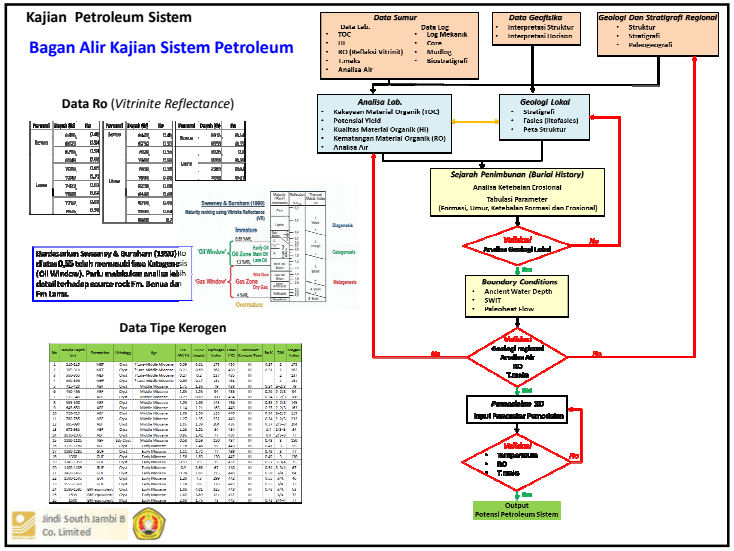
Kajian Petroleum Sistem

Bagan Alir Kajian Sistem Petroleum



Data Ro (*Vitrinite Reflectance*)

Skomovorkum Sweeney & Burnham (1990) Ro effektas 0,55 telah memasuki fase Katagenesis (Oil Window). Perlu melakukan analisa lebih detail terhadap source rock Fm. Benua dan Fm Lama.

Data Tipe Kerogen

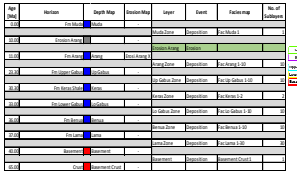
Kajian Petroleum Sistem

Analisa

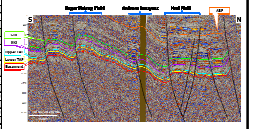
Boundary Condition
- Paleoheat Flow
- SWIT (Sediment Water Interface Temperature)
- Acient Water Depth/Paloewater Depth

Output

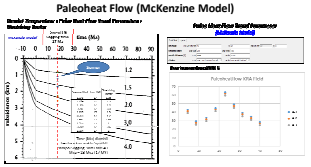
Formasi Batuan



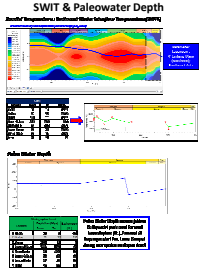
Bidang Erosional



Paleoheat Flow (McKenzine Model)



SWIT & Paleowater Depth



Kajian Petroleum Sistem

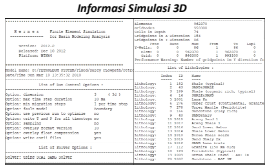
Analisa

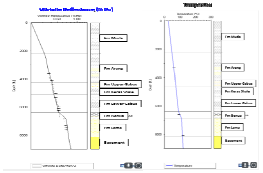
Pemodelan 3D

Element Petroleum Sistem (Source Rock , Reservoir Rock, Seal Rock, Trap & Timming/ Migration)

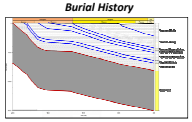
Output

Informasi Simulasi 3D

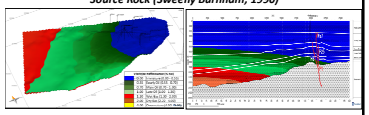




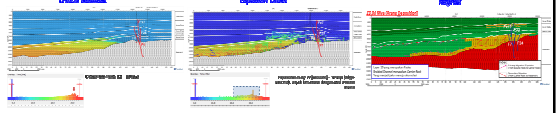
Burial History



Source Rock (Sweeny Burnham, 1990)



Timming/Migration



Kajian Manajemen Resiko

(Metode Otis & Schneidermann, 1997)

Manajemen Resiko

Identifikasi risiko meliputi **keberadaan** dan **karakteristik petroleum sistem** yang diteliti dalam suatu objek eksplorasi, tujuannya untuk **meminimalisir ketidak-yakinan** dalam **konsep play**.

Kebutuhan Data

Data korelasi log sumur :
Logging
Core
Cutting
Ichnofacies

Metode eksplorasi magnetometer :
Basin framework
Pelamparan reservoar
Data geokimia
Data regional
Peta geologi permukaan maupun bawah permukaan

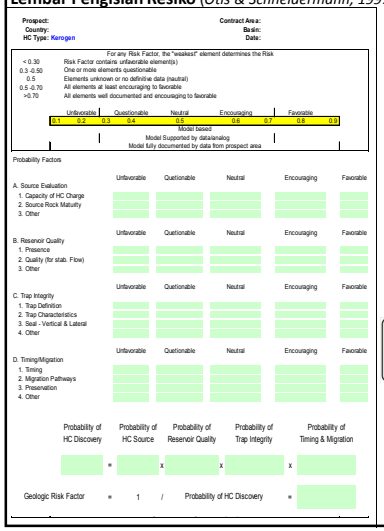
A. SOURCE ROCK
1. Capacity for HC charge (within fetch area)
   Presence and volume of source rock
   Thickness
   Areal extent
   Number of distinct source horizons
   Continuity
   Known HCs in area (fields, wells, seeps)
   Organic richness (TOC, S_1+S_2, etc.)
   SPI
   Kerogen type
   Type I - lacustrine, oil prone
   Type II - marine, oil & gas prone
   Type II - gas prone
   Type IV - Inert
2. Source rock maturity
   Source rock data (R_o, T_{max}, EI)
   Determine whether source rock in fetch has generated HCs

B. RESERVOIR
1. Presence
   Lithology
   Distribution
   Depositional model (sequence stratigraphic framework)
2. Quality (Capacity for stabilized flow)
   Lateral continuity and extension
   Thickness and vertical cyclicity
   Heterogeneity
   Porosity ranges and types
   Permeability ranges and types
   Fracture potential and preservation
   Diagenetic characteristics

C. TRAP
1. Trap definition (confidence in data)
   Number and location of seismic lines
   Quality (resolution) of seismic data
   Reliability (velocity complications, misties)
   Lateral velocity gradients
   Integration of gravity, magnetic, seismic and well log information
2. Trap characteristics
   Type of trap (anticlinal, fault, etc.)
   Amount of four-way closure
   Amount and type of other closure
   Compartmentalization by faulting
   Alternate non-closing interpretations
3. Seal
   Top seal
   Lithology and ductility
   Thickness
   Continuity
   Curvature over trap
   Degree of fracturing or faulting
   Fault seal
   Fault type
   Amount of throw
   Time(s) of movement
   Depth and pressure
   Lithologies juxtaposed
   Dip of beds across fault
   Potential for sealing gouge
   Stratigraphic seal - bottom or lateral
   Other seals - diagenetic, pressure, etc.

D. TIMING AND MIGRATION
1. Timing
   Timing of reservoir, seal and trap development relative to that of HC generation and migration
   Maturation model (burial history, paleogeothermal regime)
   Thermal gradients (BHT, heat flow, lithology)
2. Migration Pathways
   Position of trap with respect to kitchen/fetch area
   Amount of source rock in the oil window within fetch area
   Migration style (vertical or lateral)
   Migration distance required (vertical and lateral)
   Migration conduits and barriers/migration style
   Connection of pathways to reservoir
3. Preservation/Segregation
   Post entrapment tectonism or faulting
   Displacement of oil by water or gas
   Biodegradation
   Thermal cracking
   Preferential migration of gas

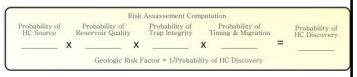
Lembar Pengisian Resiko (*Otis & Schneidermann, 1997*)



Kriteria Faktor Resiko dan Nilai Resiko

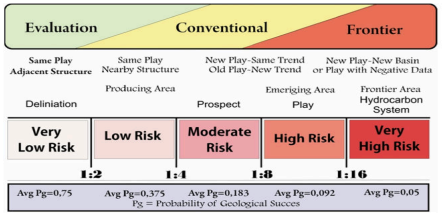
Faktor resiko	Kriteria	Nilai
Unfavorable	Keterbatasan data, tanpa didukung pemodelan	0,01-0,3
Questionable	Data secara tidak langsung tanpa kuantitatif dan didukung pemodelan	0,3-0,5
Neutral	Netral	0,5
Encouraging	Data kualitatif dan kuantitatif tanpa didukung pemodelan	0,5-0,7
Favorable	Data kualitatif dan kuantitatif dan didukung pemodelan.	0,7-0,99

Kemungkinan Keberhasilan Geologi *(Probability of Geological Success/Pg)*



- Resiko sangat rendah (very low risk) ***1.0***
- Resiko rendah *(low risk)*
- Resiko menengah *(moderate risk)*
- Resiko tinggi *(high risk)*
- Resiko sangat tinggi *(very high risk)* ***0.1***

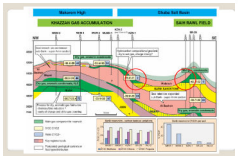
Nilai Kelompok Resiko (*Otis & Schneidermann, 1997*)



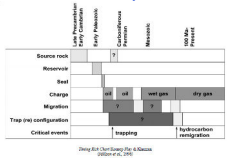
No	Kelompok Resiko	Nilai Keberhasilan (Pg)	Kemungkinan Keberhasilan	Faktor Resiko	Jarak Sumur Terdekat dalam Satu Cekungan
1	Sangat Rendah (*Very Low Risk*)	0.5-0.99	1:2	Meyakinkan (favorable)	< 5 km
2	Rendah (*Low Risk*)	0.25-0.5	1:4-1:2	Meragukan (encouraging)-Meyakinkan (favorable)	5-10 km
3	Menengah (*Moderate Risk*)	0.125-0.25	1:4-1:8	Meragukan (encouraging), Netral (neutral), Meyakinkan (favorable)	>10 km
4	Tinggi (*High Risk*)	0.063-0.125	1:8-1:16	Meragukan (encouraging)-Netral (neutral)	>20 km
5	Sangat Tinggi (*Very High Risk*)	0.01-0.063	1:16-1:100	Meragukan (encouraging), Netral (neutral), Tidak Meyakinkan (unfavorable), Dipertanyakan (questionable)	>50 km

Studi Kasus Manajemen Resiko

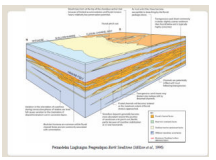
Play Concept



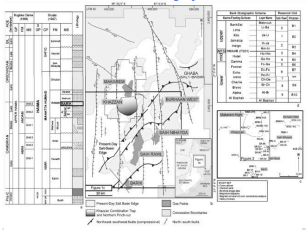
Petroleum System Chart



Model Pengendapan

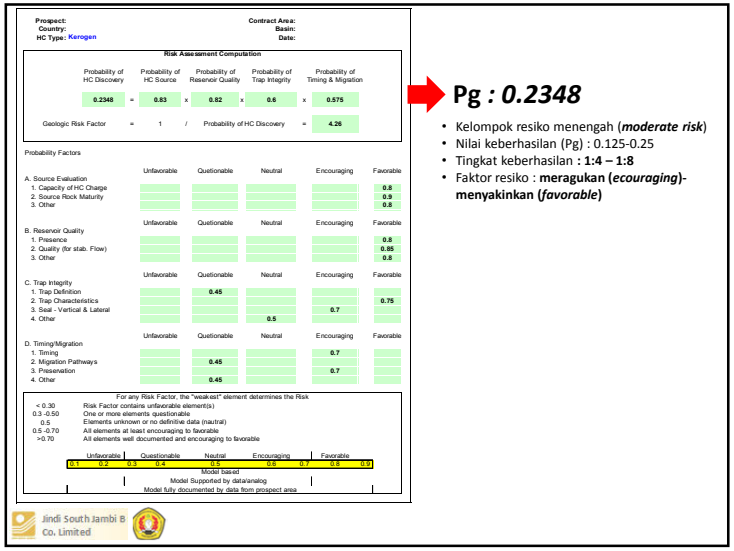


Tektonostratigrafi



Petroleum Sistem
a) Batuan Sumber : batulanau dan batulempung, serta batupasir (*Upper Cambrian-Lower Ordovician)*. Terletak pada kedalaman 4-5 km,merupakan satu kesatuan dengan *play* yang dibentuk pada daerah cekungan *Ghaba-Salt (Ghaba-sat Basin)*
b) Batuan Reservoir : batupasir Barik dan batugamping yang terbentuk pada Neo-Proterozoik.
c) Trap : batulempung dan batulanau dengan sifat *impermeable*. Terbentuk pada kedalaman 200 m diatas Formasi Batupasir Barik. jebakan kombinasi antara jebakan stratigrafi dan struktural berupa *sinistral strike-slip fault* .

Konsep Play
a) Konsep *play* yang dibangun merupakan integrasi dari *petroleum system*, *basin framework* dan waktu pembentukan *(timing)* akumulasi hidrokarbon.
b) *Play concept* yang ada pada daerah Khazzan terletak pada Formasi Batupasir Barik yang terletak dikedalaman 4-5 km.
c) Reservoir batupasir yang terbentuk merupakan bagian dari *Haima Play* yang berumur batuan Neo-Proterozoik. Distribusinya cukup luas dengan tebal lapisan 100-200 m. Kualitas Batupasir Barik baik dengan heterogenitas komposisi mineralogis yang didominasi kuarsa dengan sifat porositas dan permeabilitas tinggi, serta adanya rekahan-rekahan batuan akibat perlipatan yang menyebabkan porositas batuan bertambah (*John and Robert*,1992).



Prospect:
Country:
HC Type: Kerogen

Contract Area:
Basin:
Date:

Risk Assessment Computation

Probability of HC Discovery		Probability of HC Source		Probability of Reservoir Quality		Probability of Trap Integrity		Probability of Timing & Migration
0.2348	=	0.83	x	0.82	x	0.6	x	0.575

Geologic Risk Factor = 1 / Probability of HC Discovery = 4.26

Probability Factors

	Unfavorable	Questionable	Neutral	Encouraging	Favorable
A. Source Evaluation					
1. Capacity of HC Charge					0.8
2. Source Rock Maturity					0.9
3. Other					0.8
B. Reservoir Quality					
1. Presence					0.8
2. Quality (for stab. Flow)					0.85
3. Other					0.8
C. Trap Integrity					
1. Trap Definition		0.45			
2. Trap Characteristics					0.75
3. Seal - Vertical & Lateral				0.7	
4. Other			0.5		
D. Timing/Migration					
1. Timing				0.7	
2. Migration Pathways		0.45			
3. Preservation				0.7	
4. Other		0.45			

For any Risk Factor, the "weakest" element determines the Risk

< 0.30	Risk Factor contains unfavorable element(s)
0.3 -0.50	One or more elements questionable
0.5	Elements unknown or no definitive data (neutral)
0.5 -0.70	All elements at least encouraging to favorable
>0.70	All elements well documented and encouraging to favorable

Unfavorable | Questionable | Neutral | Encouraging | Favorable

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

Model based
Model Supported by data/analog
Model fully documented by data from prospect area

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Pg *: 0.2348*

- Kelompok resiko menengah (***moderate risk***)
- Nilai keberhasilan (Pg) : 0.125-0.25
- Tingkat keberhasilan **: 1:4 – 1:8**
- Faktor resiko : **meragukan (*ecouraging*)-menyakinkan (*favorable*)**

Thank You

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