

Mengelola Proyek Drilling Geothermal

ASPERMIGAS SEPTEMBER 2021



AGENDA



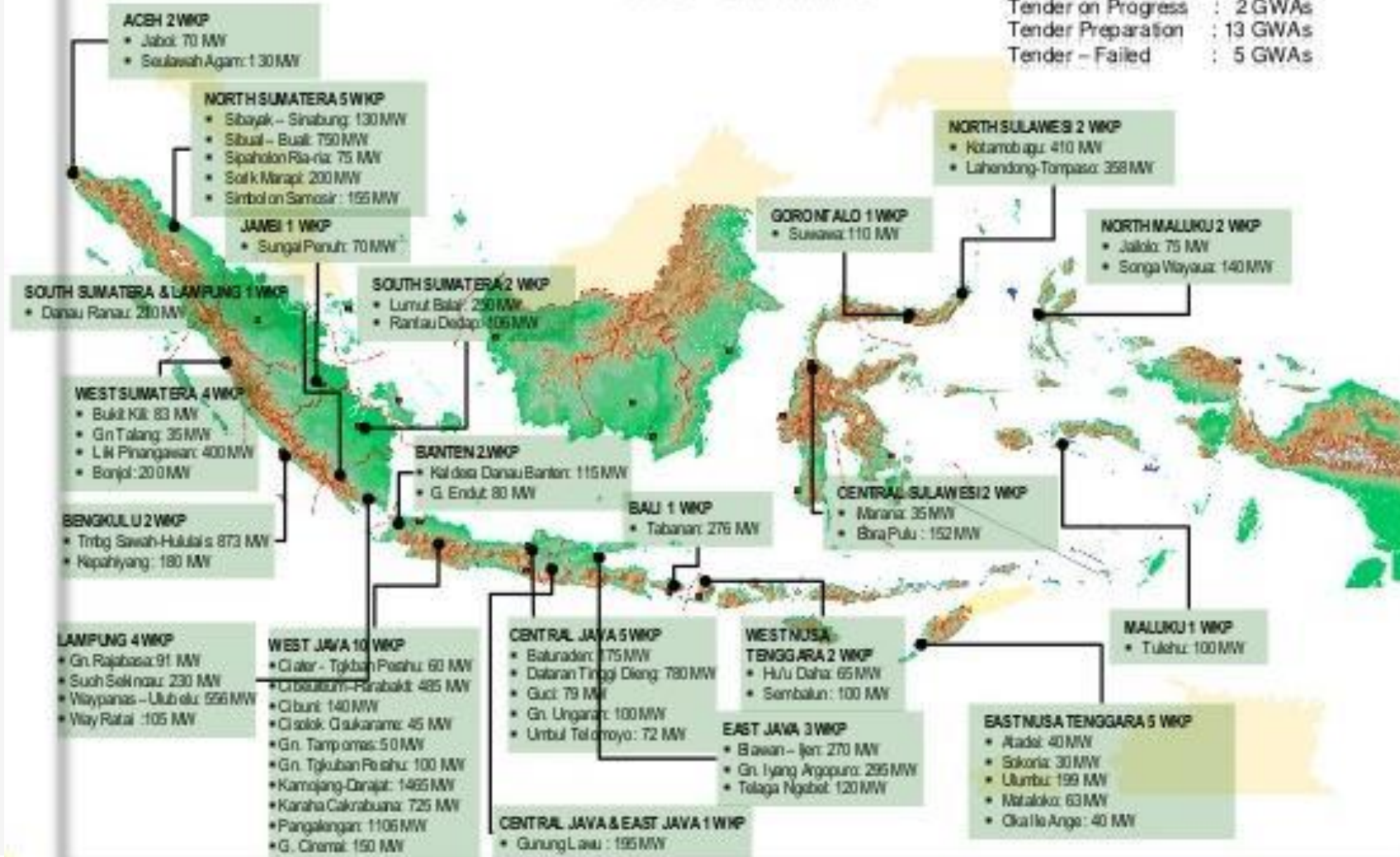
- Drilling Activities
- Drilling Work Location
- Drilling Operation
- Drilling Cost
- Drilling Personnel



Geothermal Working Area

Total : 58 GWAs

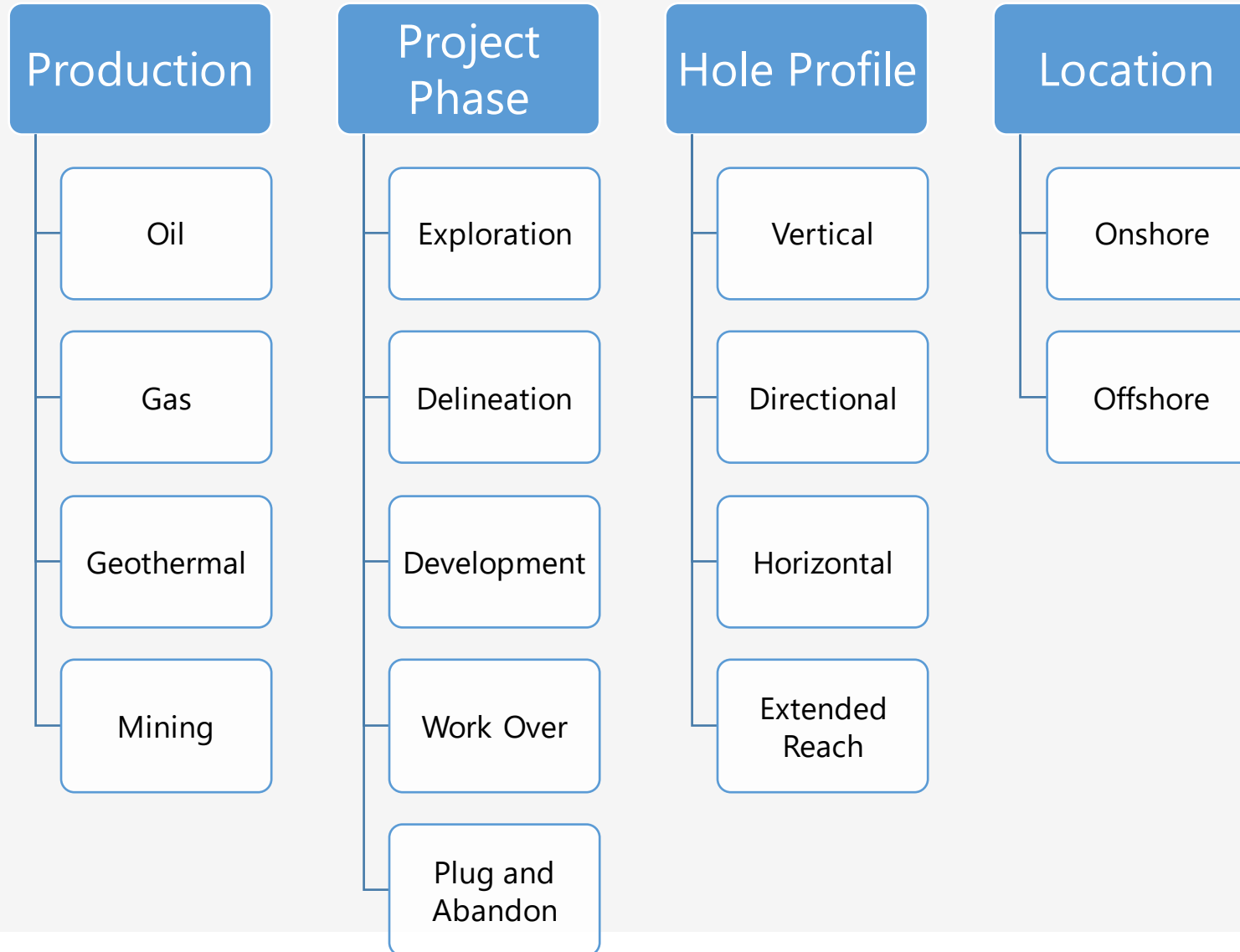
Licence - Issued : 39 GWAs
 Tender on Progress : 2 GWAs
 Tender Preparation : 13 GWAs
 Tender - Failed : 5 GWAs



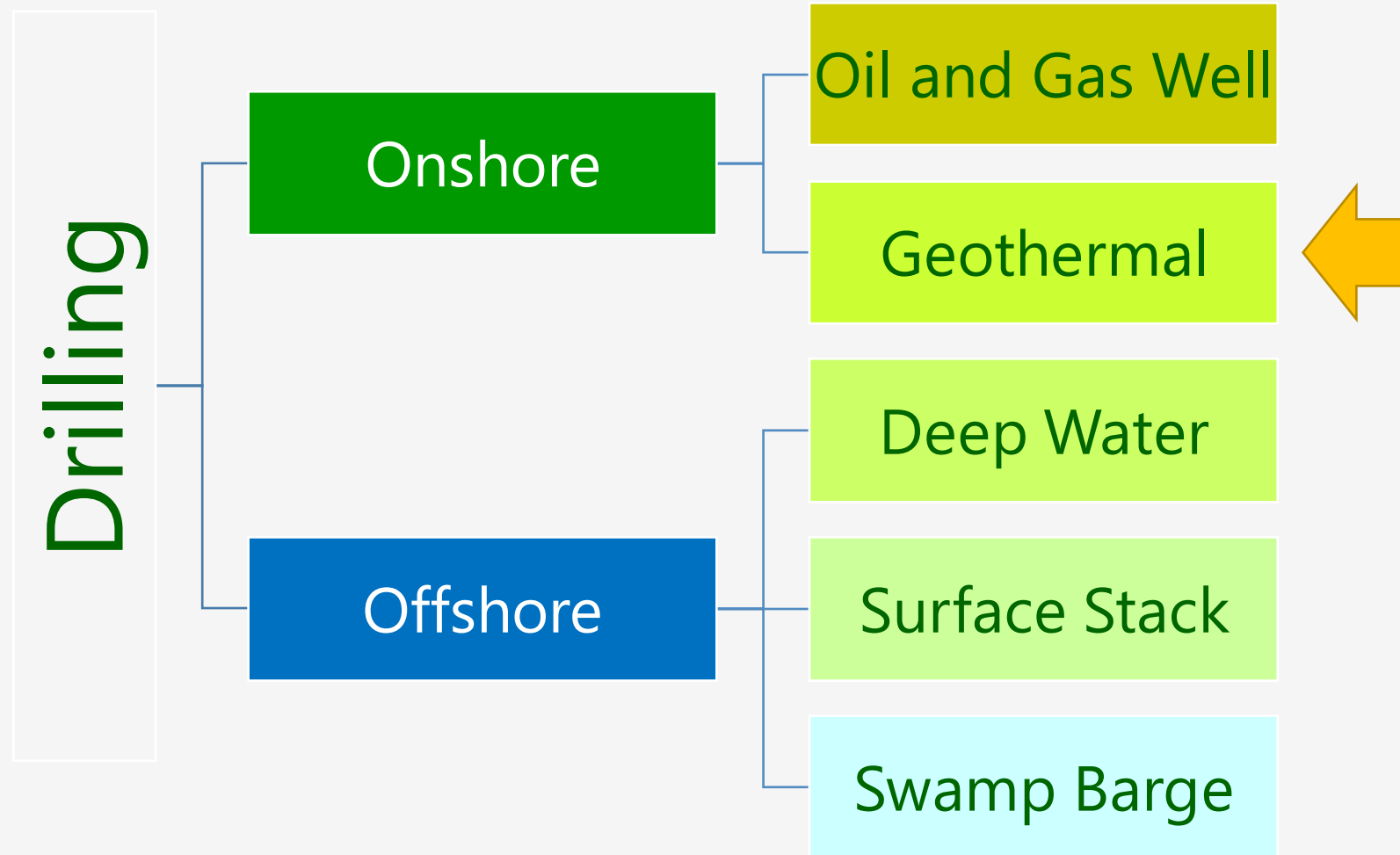


- Land Rig
- Swamp Barge Rig
- Offshore:
 - Shallow Water
 - Deep Water
 - Ultra Deep Water

DRILLING OPERATION TYPE OF WELLS

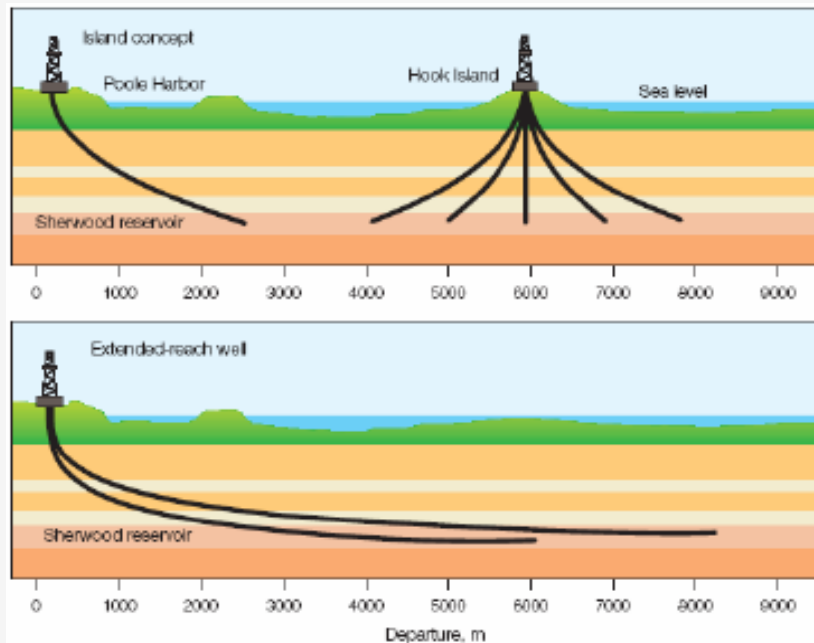
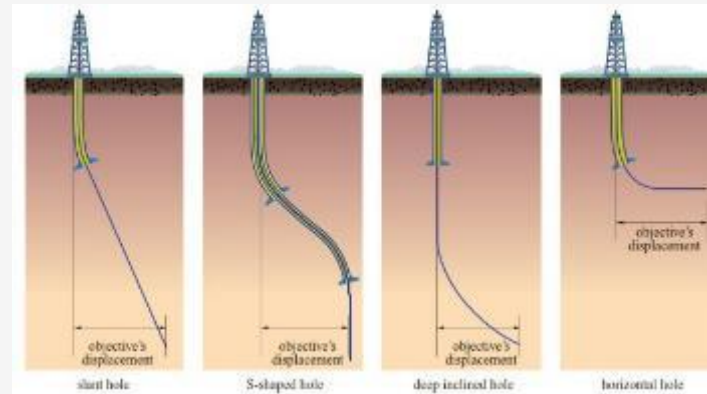


DRILLING OPERATION DRILLING LOCATION

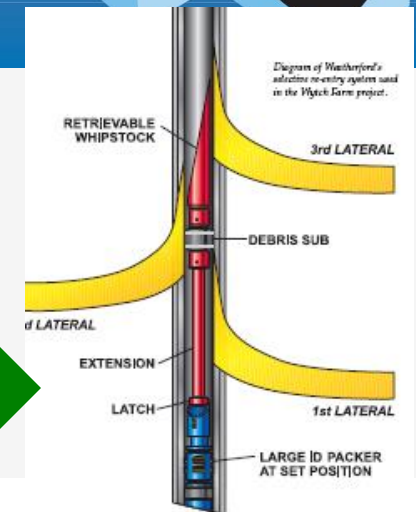
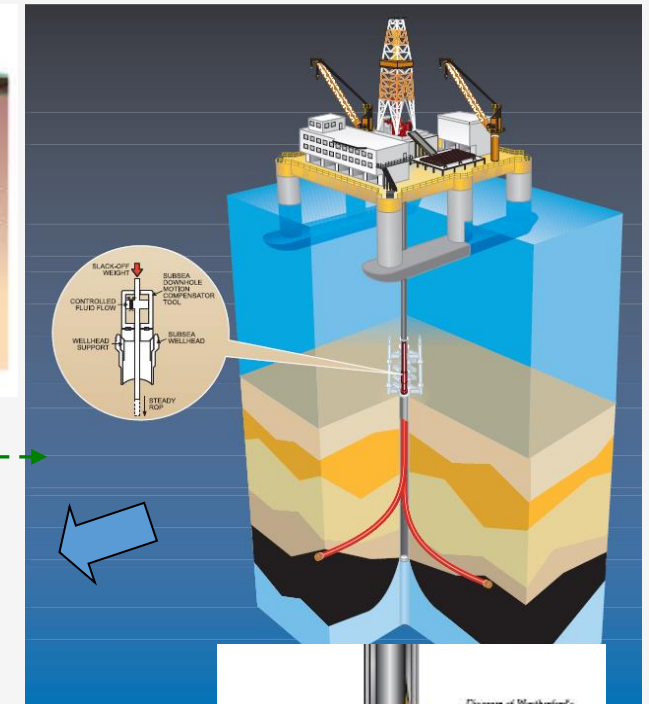
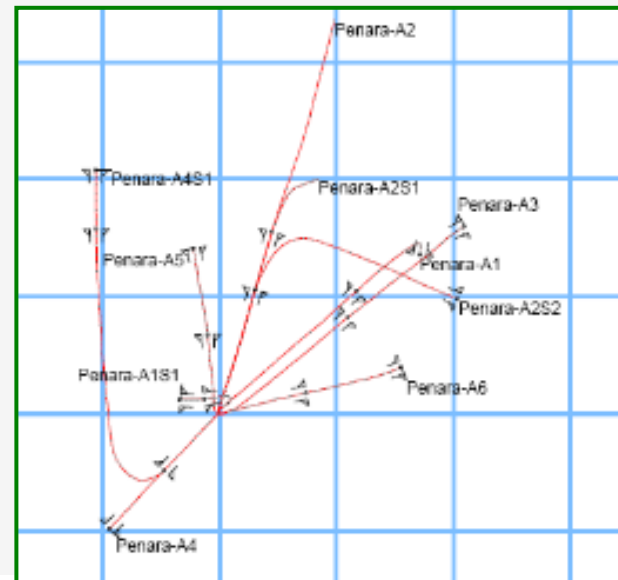


DRILLING OPERATION HOLE GEOMETRY TYPE

- Vertical (Lurus)
- Directional (Berarah)
- Horizontal (Datar)
- Multi Lateral



Horizontal Drilling



Weatherford Multilateral

DIRECTIONAL DRILLING



DRILLING BHA TYPE

BHA - DRILLING

ROTARY

STEERABLE

ROTARY
STEERABLE

Slick BHA

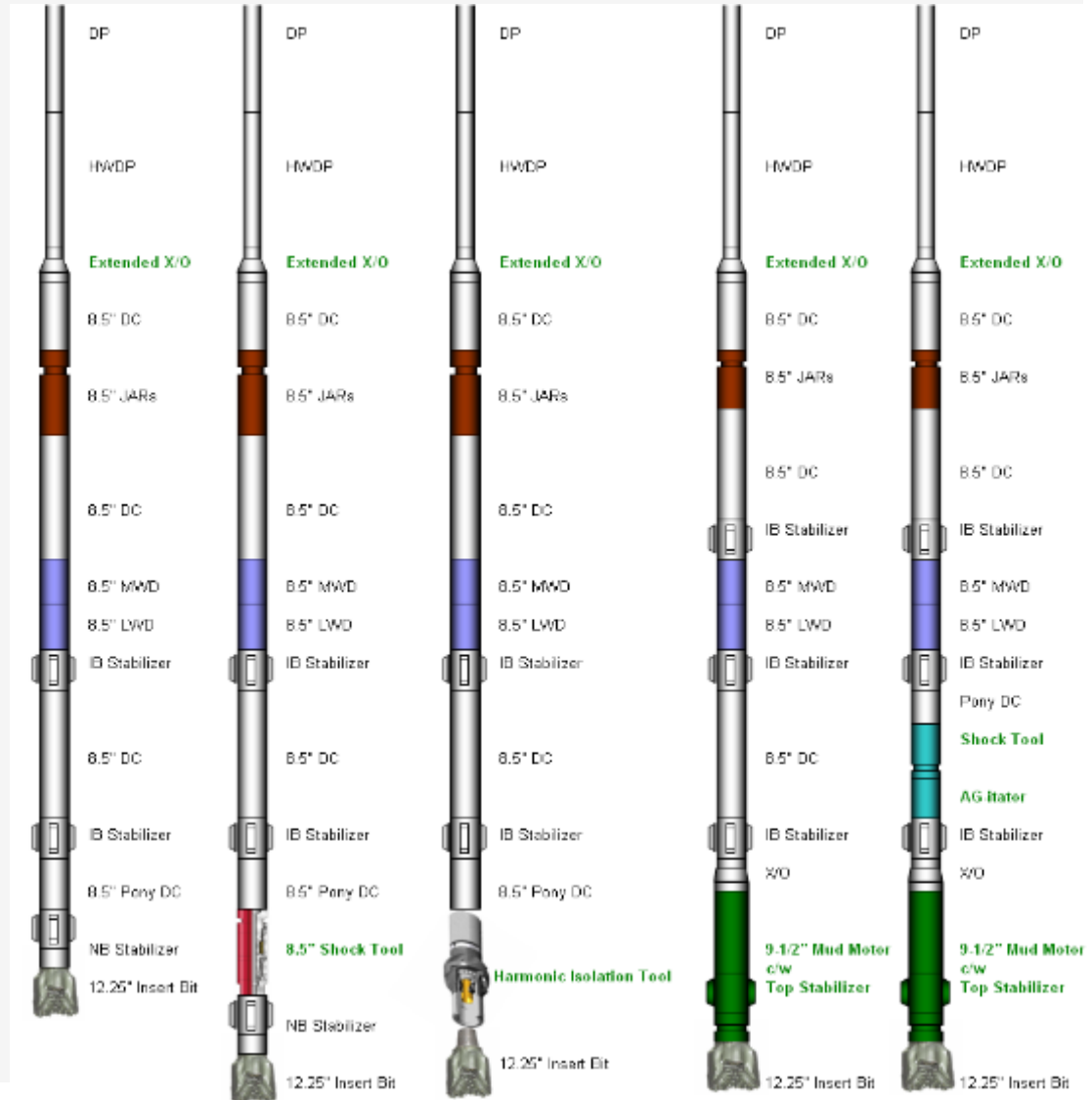
Drop BHA

Hold BHA

Build BHA

Point the Bit

Push the Bit



Wellsite Location

Geothermal Drilling Work Location



Geothermal Wellsite view

Muara Laboh – Supreme Energy



Karaha Bodas



Wayang Windu



KS Orka – Sorik Marapi

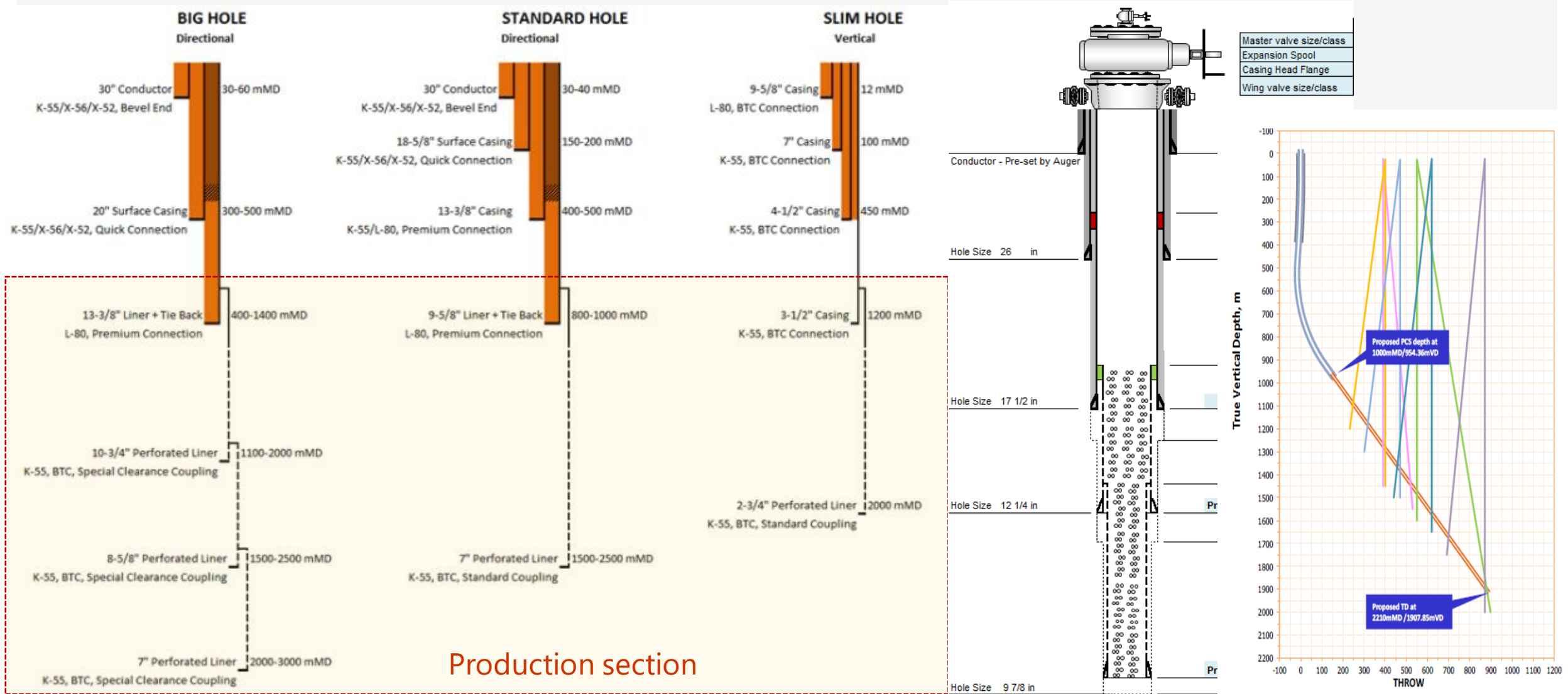


KS-Orka - Sokoria



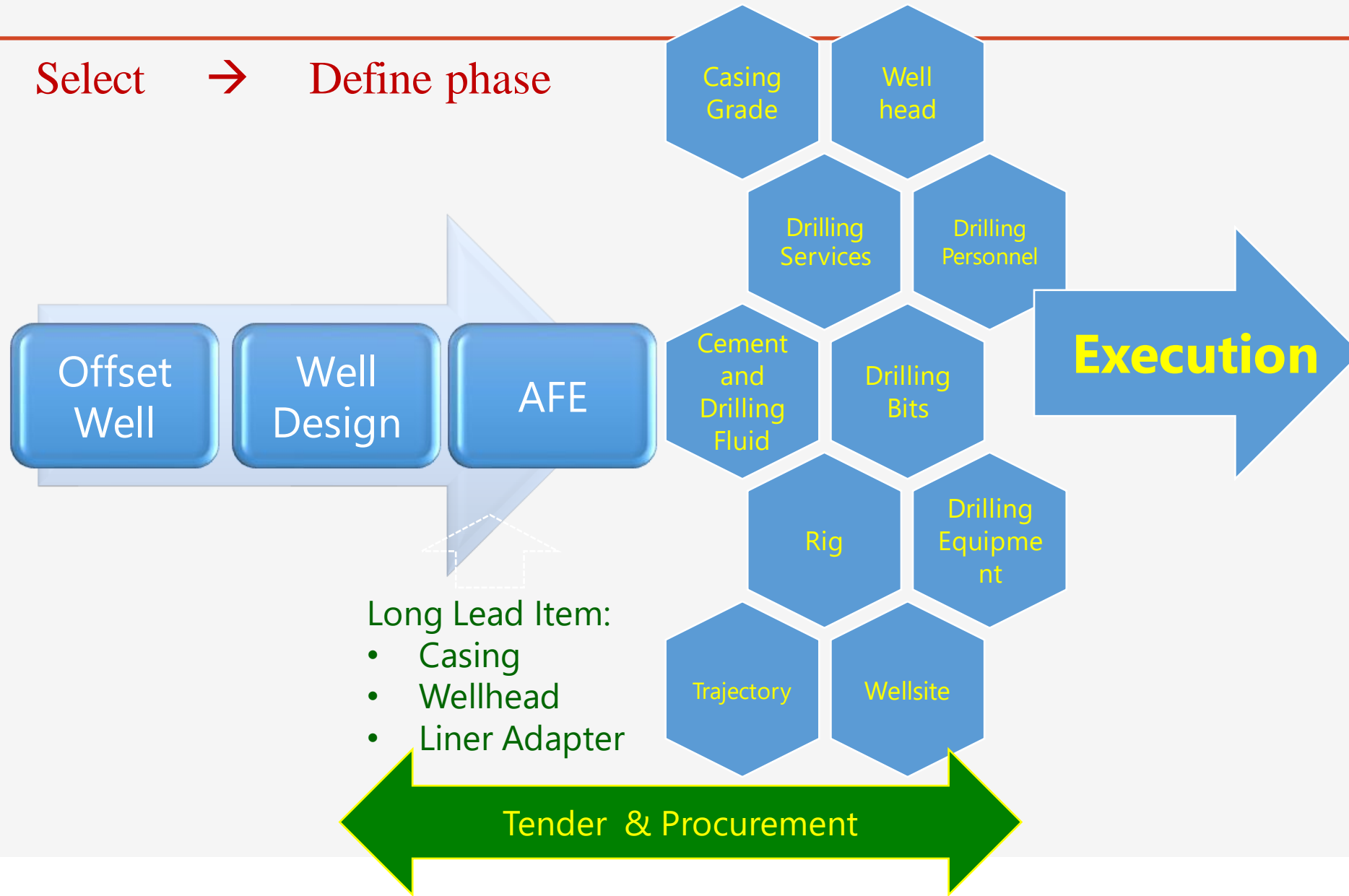
Process Of Drilling Project

TYPICAL DESIGN OF GEOTHERMAL WELL



PROCESS OF DRILLING PROJECT

Select → Define phase



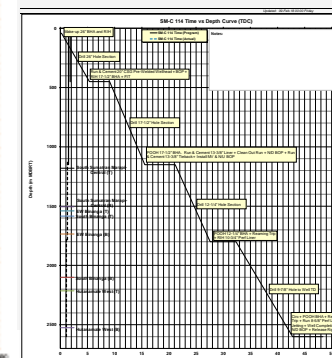
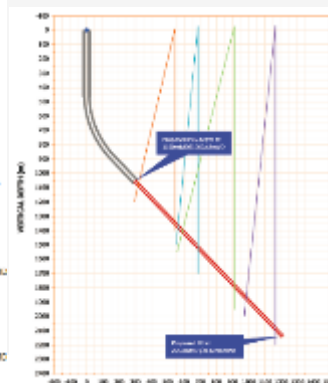
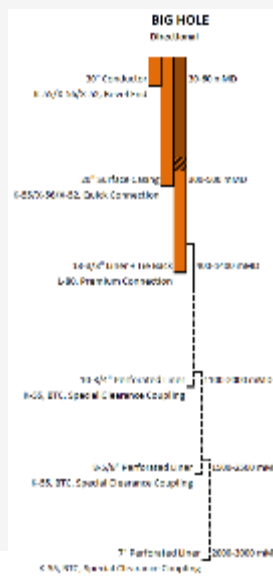
WELL COST COMPONENT

Line	DESCRIPTIONS
1	TANGIBLE COSTS
2	+ CASING
3	+ CASING ACCESSORIES
5	+ WELL EQP. SURFACE
7	+ OTHER TANGIBLE COSTS
10	INTANGIBLE COSTS
11	PREPARATION AND TERMINATION
12	- SURVEYS
13	- LOCATION STACKING & POSITIONING
14	- WELLSITE & ACCESS ROAD PREP.
15	- SERV. LINES & COMMUNICATIONS
16	- WATER SYSTEMS
17	- RIGGING UP/RIGGING DOWN/ MOB & DEMOB
20	DRILLING/WORKOVER OPERATIONS.
21	- CONTRACT RIG
22	- DRLG RIG CREW/CONTRACT RIG CREWS
23	- MUD, CHEMICAL & ENGINEERING SERVICES
24	- WATER
25	- BITS, REAMERS AND CORE HEADS
26	- EQUIPMENT RENTAL
27	- DIRECTIONAL DRILLING & SURVEYS
28	- DIVING SERVICES
29	- CASING INSTALLATION
30	- CEMENT, CEMENTING AND PUMP FEES
31	- NON CONTROLLABLE MATERIALS
33	FORMATION EVALUATION
34	- CORING COST
35	- MUD LOGGING SERVICES
36	- DRILL STEM TESTS
37	- OPEN HOLE ELECT. LOGGING SERVICES
38	- GEOLOGICAL STUDIES
40	COMPLETION.
41	- CASING, LINER & TUBING INSTL
42	- CEMENT, CEMENTING AND PUMP FEES
43	- CASED HOLE ELECT LOGGING SERVICES
44	- PERFORATING & WIRELINE SERV.
45	- STIMULATION TREATMENT
46	- PRODUCTION TESTS
49	GENERAL
50	- SUPERVISION
51	- INSURANCE
52	- PERMITS & FEES
53	- MARINE RENTAL & CHARTERS
54	- HELICOPTER & AVIATION CHARGES
55	- LAND TRANSPORTATION
56	- OTHER TRANSPORTATION
57	- FUEL AND LUBRICANTS
58	- CAMP FACILITIES
59	- ALLOCATED O/HEADS - FIELD OFF
60	- JAKARTA OFF
61	- OVERSEAS
62	- TECHNICAL SERV FROM ABROAD

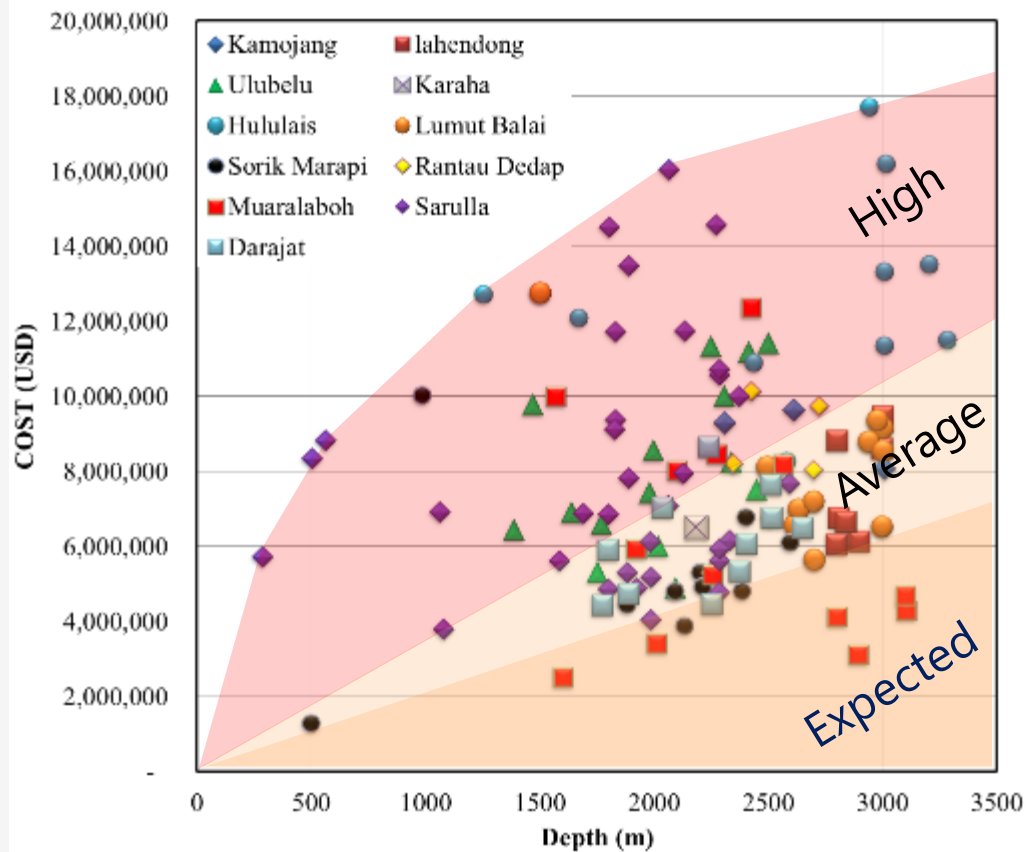


Drilling Cost :

- **30% - 60% Geothermal Project Cost**
- **USD 60-80 K / Day**
- **USD 1500 – 5400 / m**

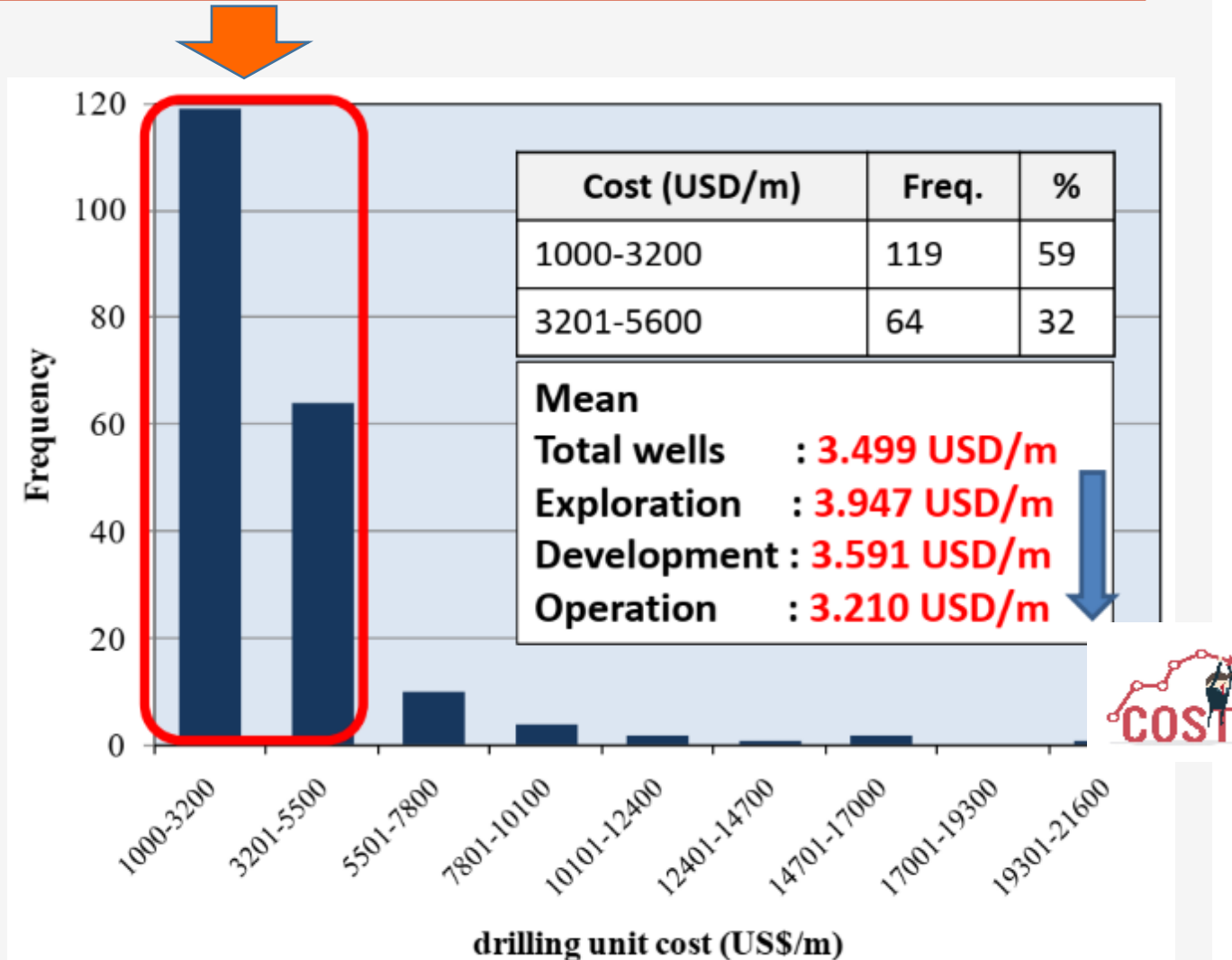


Geothermal Well Cost Statistic



Well Cost vs Total Depth

- USD 1.8 – 11 Million
- 300 – 3300 mMD



MAJOR WELL COST COMPONENT



Mud and
Cementing



Drilling Bit



Fuel
Consumption



Stuck Pipe



Heavy Equipment



Rig Type Selection



Casing & Installation



Directional Drilling



Water Supply

Drilling Service Company

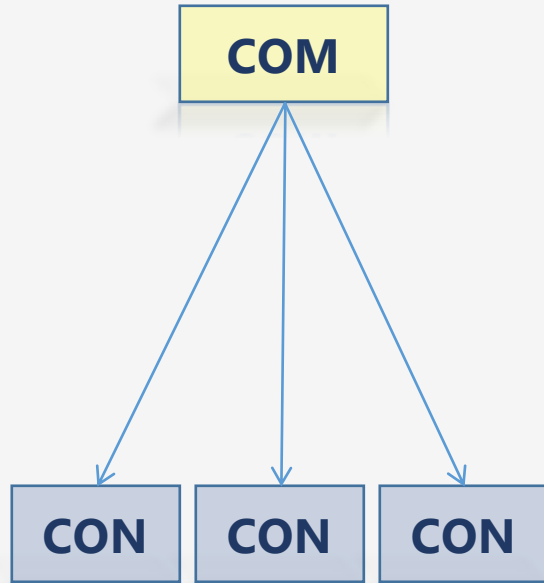


Purchase	Services	Support
<ol style="list-style-type: none"> 1. Casing 2. Wellhead 3. Liner Adapter 4. Drilling Bits 5. Casing Accessories 6. DSA and X/O 	<ol style="list-style-type: none"> 1. Drilling Rig 2. Cement and Mud 3. Directional Drilling 4. Air Drilling 5. Mud Coller 6. Wellhead Installation 7. Drilling Personnel 8. Heavy Equipment 9. Drilling Waste Handling 10. VSAT 11. Drilling Report 12. Casing Handling 13. H2S Service 14. Mud Logging 15. Drill String Inspection 16. Hard Bending 17. Solid Control Services 18. Fishing Tool Services 19. Coring Services 20. E-Line & Explosive 	<ol style="list-style-type: none"> 1. Drilling Site Construction 2. Diesel Fuel 3. Water Pump Services 4. UKL / UPL 5. Security Services 6. Road Survey 7. Tubular Inspection 8. Explosive Handling 9. Permits 10. Perforated Liner 11. Logistic Services 12. General Services

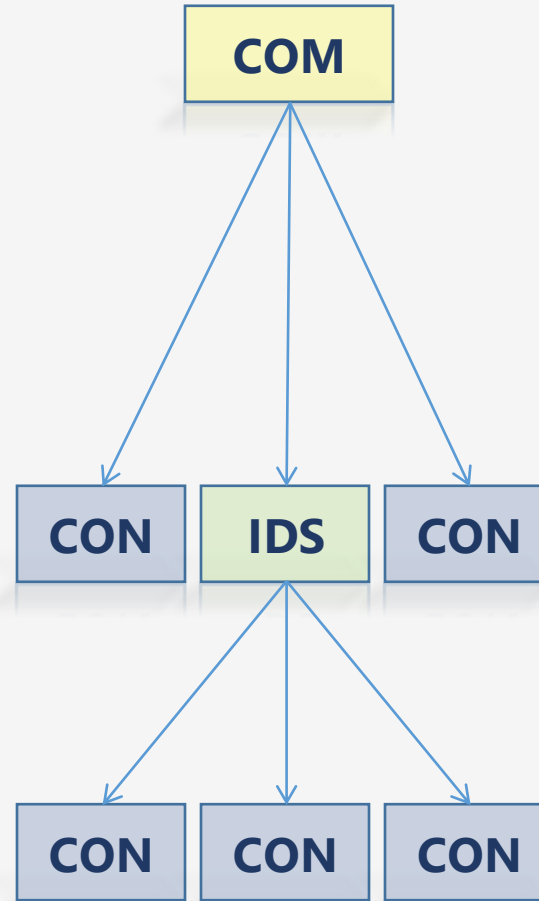
Drilling Procurement

TYPE OF CONTRACT for Procuring Drilling Services

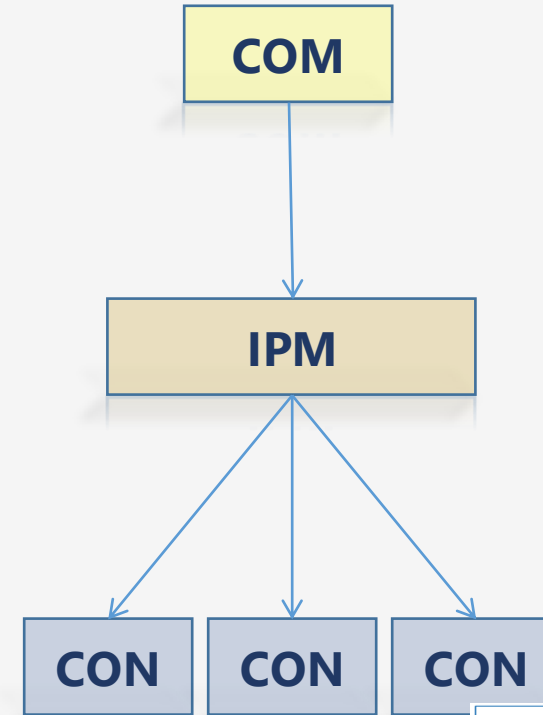
Discrete



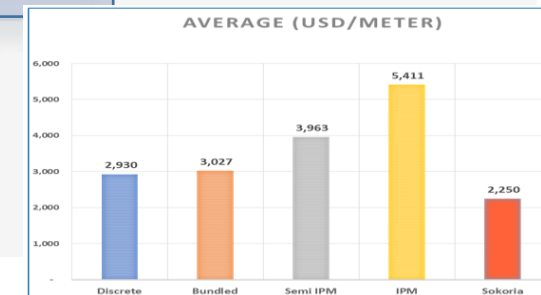
Bundled



IPM / Turnkey

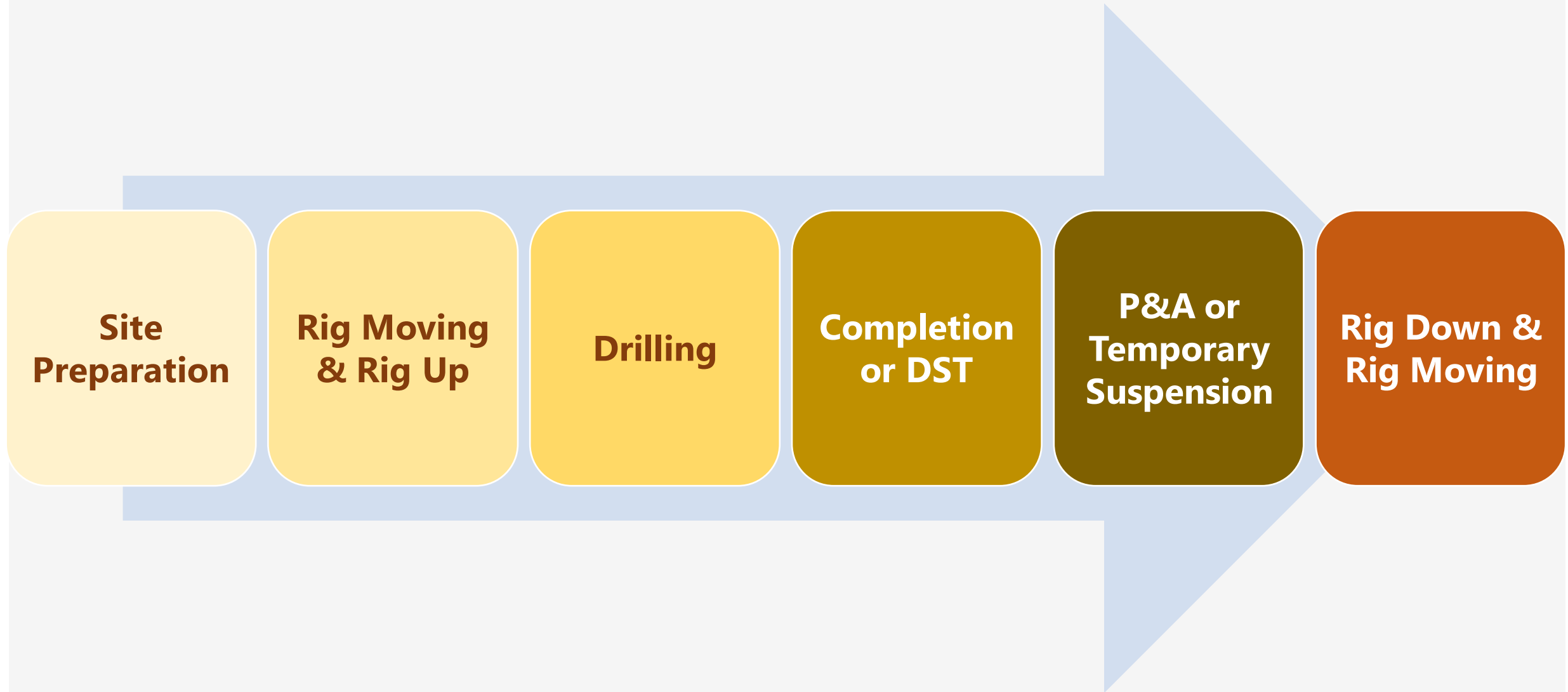


- **COM: Company**
- **CON: Contractor**
- **IDS: Integrated Drilling Services**



Drilling Operation

Drilling Operation General Sequences



Onshore Drilling Rig Overview – Main Rig Component



Drawwork

Top Drive System



Rig Mast

Sub Structure

Heavy Equipment



Mud Pumps



Hawk Jaw



Rotary Table



Drill Pipe



Rig Skid System



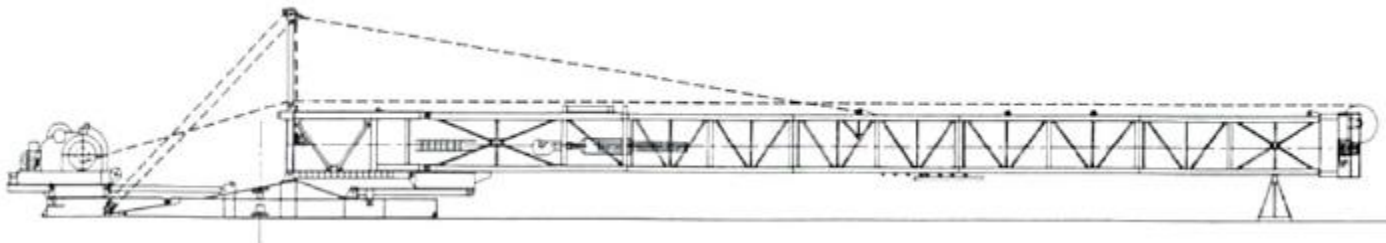
Rig Walking System

PRE – DRILLING: WellSite Construction

Site Construction



- 1000 – 1500 HP Rig:
- 1 – 1.2 Ha.
 - 6000 – 8000 m³



Lowering Rig Mast

Heavy Equipment for Access Road



Dump Truck



Land Rig Mobilisation To Mountain

Identify Rig Location



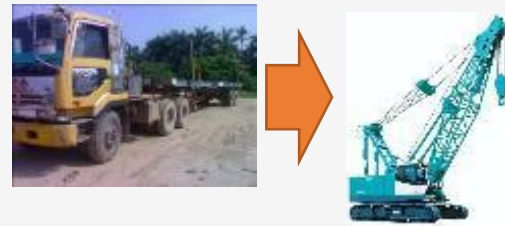
Onshore Rig Moving Type

Try it yourself with these two simple “planets”:

1 First Rig Mobilization.



2 Rig Moving Between Wellpad



3 Rig Moving (Skid, Walking, RD+RU) Between Well



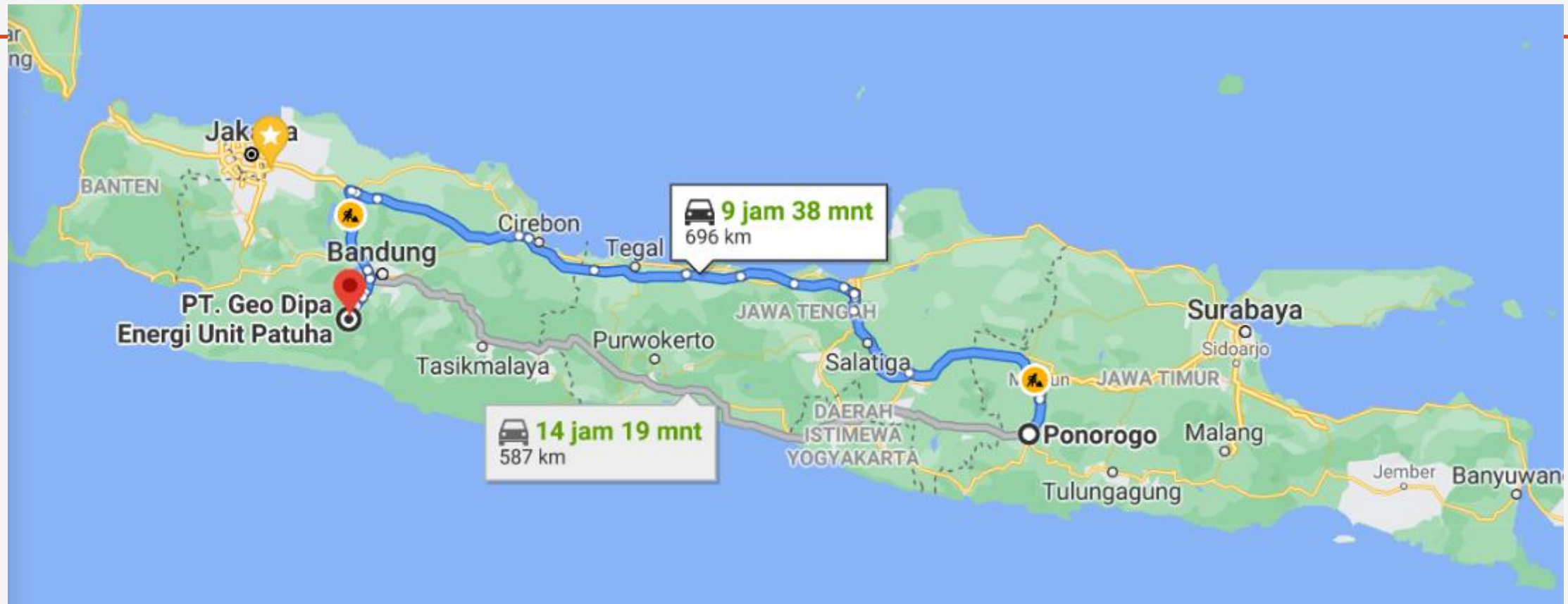
Rig Skid System



Rig Walking System



Rig Arjuno-88 (APS – ADA JV): Mobilization Route



Rig Mob Route: Ngebel → Ponorogo → Madiun → Tool Road → Soreang → Patuha:

1. Ngebel (mountain) → Ponorogo (public road). Using 10 of 6X6 Lowbed + Trailer
2. Ponorogo → Madiun → Tool Road → Soreang. Using 40 of 6X6 and 6X4 Lowbed + Trailer
3. Soreang → Patuha (mountain). Using 20 of 6X6 Lowbed + Trailer

Rig Moving - Truck & Trailer



Heavy Equipment for Rig Moving



Roughter Crane









Crawler Crane



Forklift

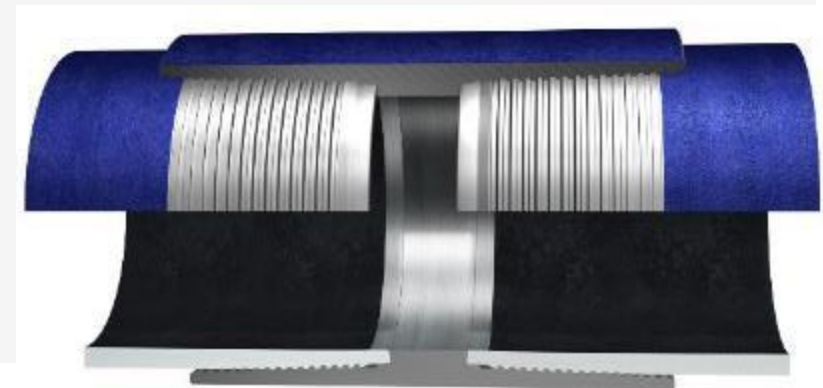
Rig Skid vs Walking System

Rig Skid and Walking System	Days to spud
<div><p>Rig Skid System</p></div> <div>+</div> <div></div> <div><ul style="list-style-type: none">• Without Drill string stand up the rig mast</div>	<p>Rig Release and ready to spud the next well:</p> <ul style="list-style-type: none">• 5 days (additional rig time to LD drill pipe and Re-MU (2 day)• USD 370 K
<div><p>Rig Skid System</p></div> <div>+</div> <div></div> <div><ul style="list-style-type: none">• With Drill string stand up the rig mast</div>	<p>Rig Release and ready to spud the next well:</p> <ul style="list-style-type: none">• 3 days• USD 210 K
<div><p>Rig Walking System</p></div> <div>+</div> <div></div> <div><ul style="list-style-type: none">• With Drill string stand up the rig mast</div>	<p>Rig Release and ready to spud the next well:</p> <ul style="list-style-type: none">• 0.5 days• USD 35 K

Drilling Equipment and Services

CASING SPECIFICATION

Manufacture	Grade	Lenght	Weight	Connection	Others
<ul style="list-style-type: none"> • ERW • SAW • LSAW • DSAW • SPIRAL SAW • Seamless 	<ul style="list-style-type: none"> • X-52 • X-56 • K-55 • L-80 • N-80 • C-90 • C-95 • P110 • Cr13 	<ul style="list-style-type: none"> • R-2 • R-3 	<ul style="list-style-type: none"> • 310 ppf • 133 ppf • 129 ppf • 72 ppf • 68 ppf • 53.5 ppf • 47 ppf • dll 	<ul style="list-style-type: none"> • Bevel End • Quick Connector • BTC, STC, LTC • Semi Premium • Premium 	<ul style="list-style-type: none"> • Complete with Protector • Special Drift • SCC (Special Clearance Coupling) • Pup Joint • X/O (Cross Over)



API BUTRESS CASING CONNECTION DEVELOPMENT

**BUTTRESS with
Spacer RING**

**PREMIUM Connection
with BUTTRESS Compatibility**

NS CONNECTION TECHNOLOGY

1

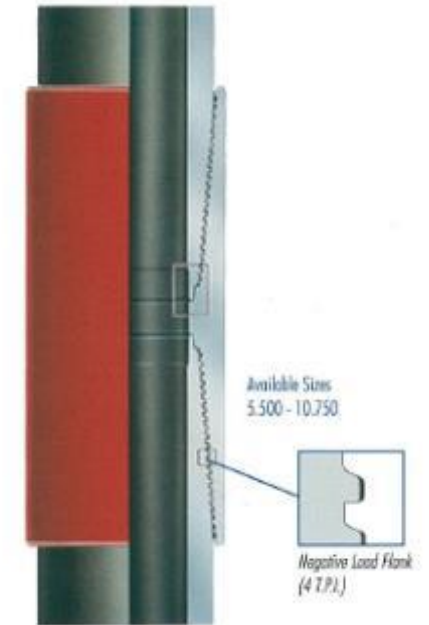
**NS Connection Technology for
Casing (NS-CC)**



**NS Connection Technology
for Tubing (NS-CT)**



**NS Connection Technology
for Heavy Wall
Thickness Casing (NS-HC)**



Gap

**No
Gap**

BUTTRESS

Drilling Bit Technology



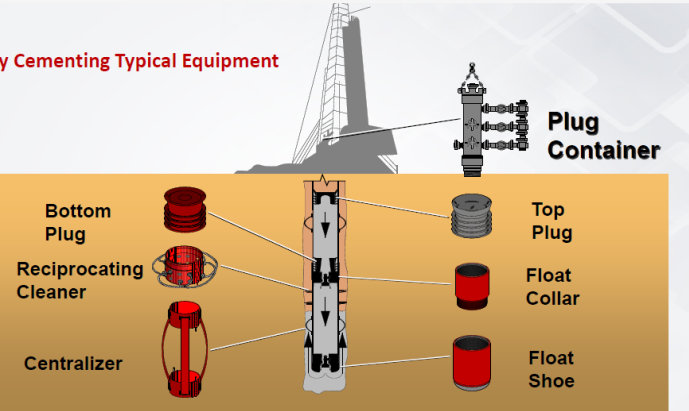
- ← PDC Bit:
- Sting Blade, Axe Blade
 - Fusetec

Kymera Hybrid Bit →

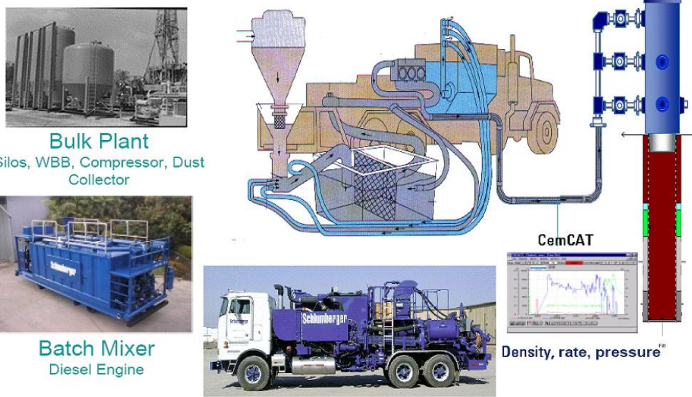
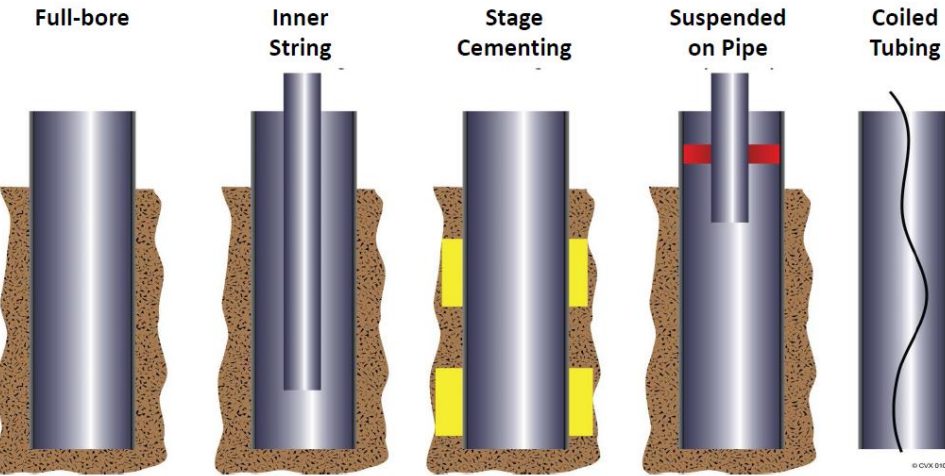


Cementing Technology

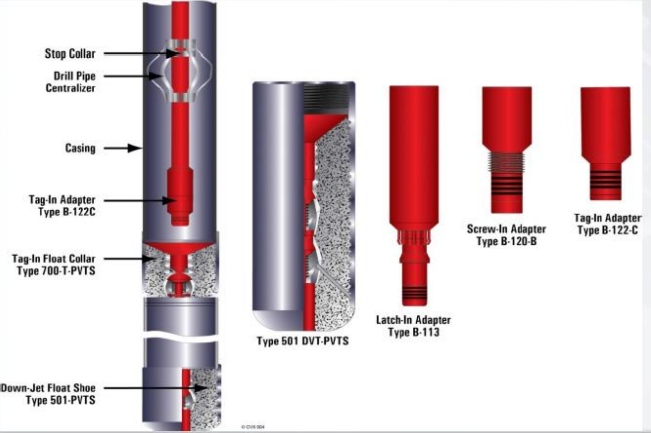
Primary Cementing Typical Equipment



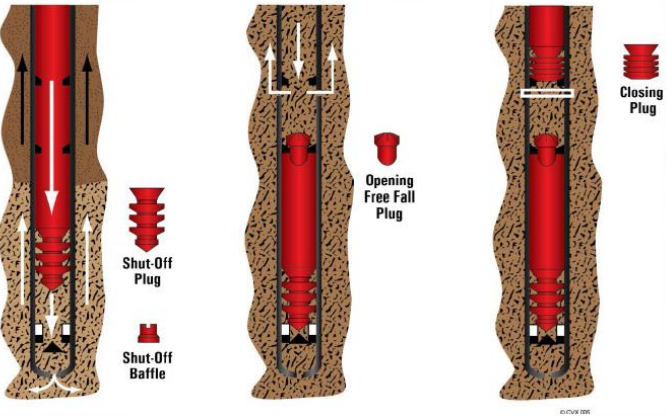
Types of Cement Jobs Pipe Geometry



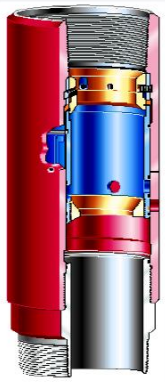
Inner String Cementing



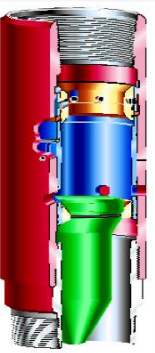
Multi-stage Cementing Tool with Free Fall Plug Set



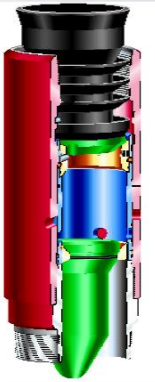
Running In Ports Closed



2nd Stage Ports Open



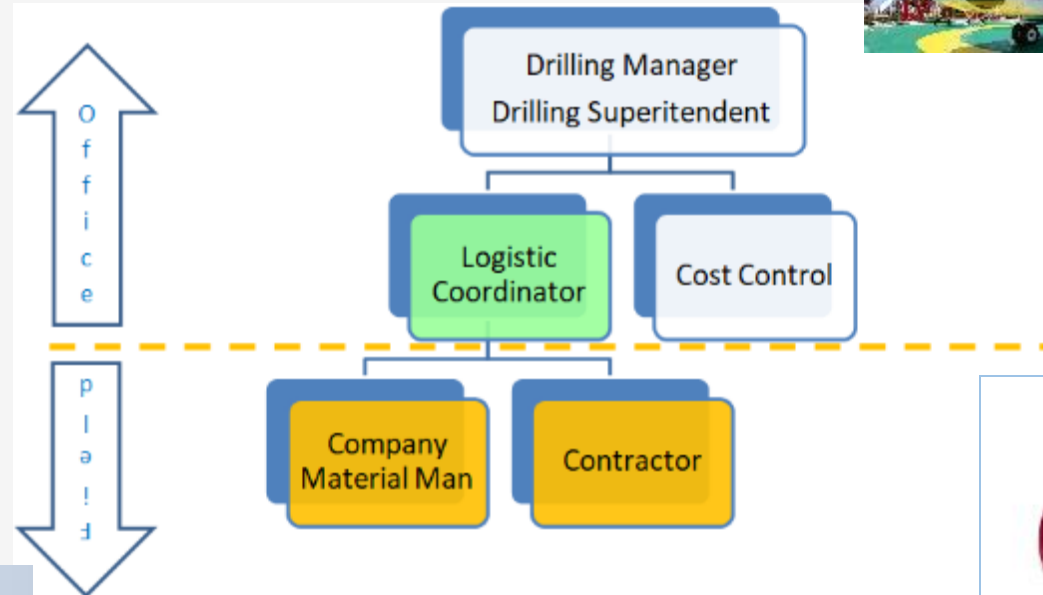
Job Finished Ports Closed



Courtesy of Weatherford

Drilling Logistic

Drilling Logistic



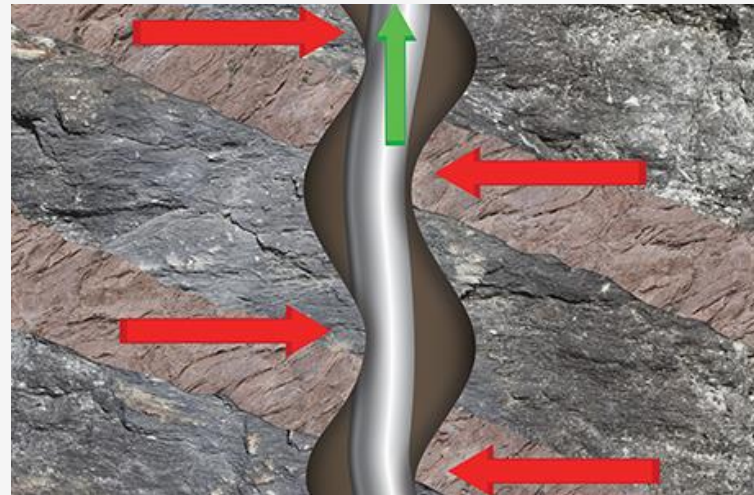
- Supply Boat
- LCT
- Barge
- Crew Boat

DRILLING RISK



Stuck Pipe

- Stuck pipe Mechanism and prevention
- Fishing Operation
- Pipe Recovery
- Sidetrack Option



DRILLING SAFETY

- Drilling Safety Manual
 - Job Safety Analysis
 - Drop Object
 - Hygiene Inspection
 - Lifting Gear and Color Code
 - Heavy Lift
 - Heavy Equipment Inspection
 - H2S Drill
 - Evacuation Drill
 - Fire Drill
 - STOP Cards



- Drilling Environment
 - Oil Spill
 - Waste Handling
 - Drill Cutting
 - Explosive Handling
 - Hazardous Material
 - Band wall and Containment

- SIMOP (Simultaneous Operation)
- MOC (Management Of Change)
- Journey Management Plan
- PPE (Personal Protective Equipment)
- Convince Space Procedure
- Covid-19 Protocols
- Ambulance and Medic



RIG MOVING RISK



Why 

STEAM KICK



Oklahoma Oilfield Drilling Rig Accident



LeNorman Ruth 87-2H Fracking Accident – Hemphill County, TX, 2013



Top Drive System Dropped



Landslide



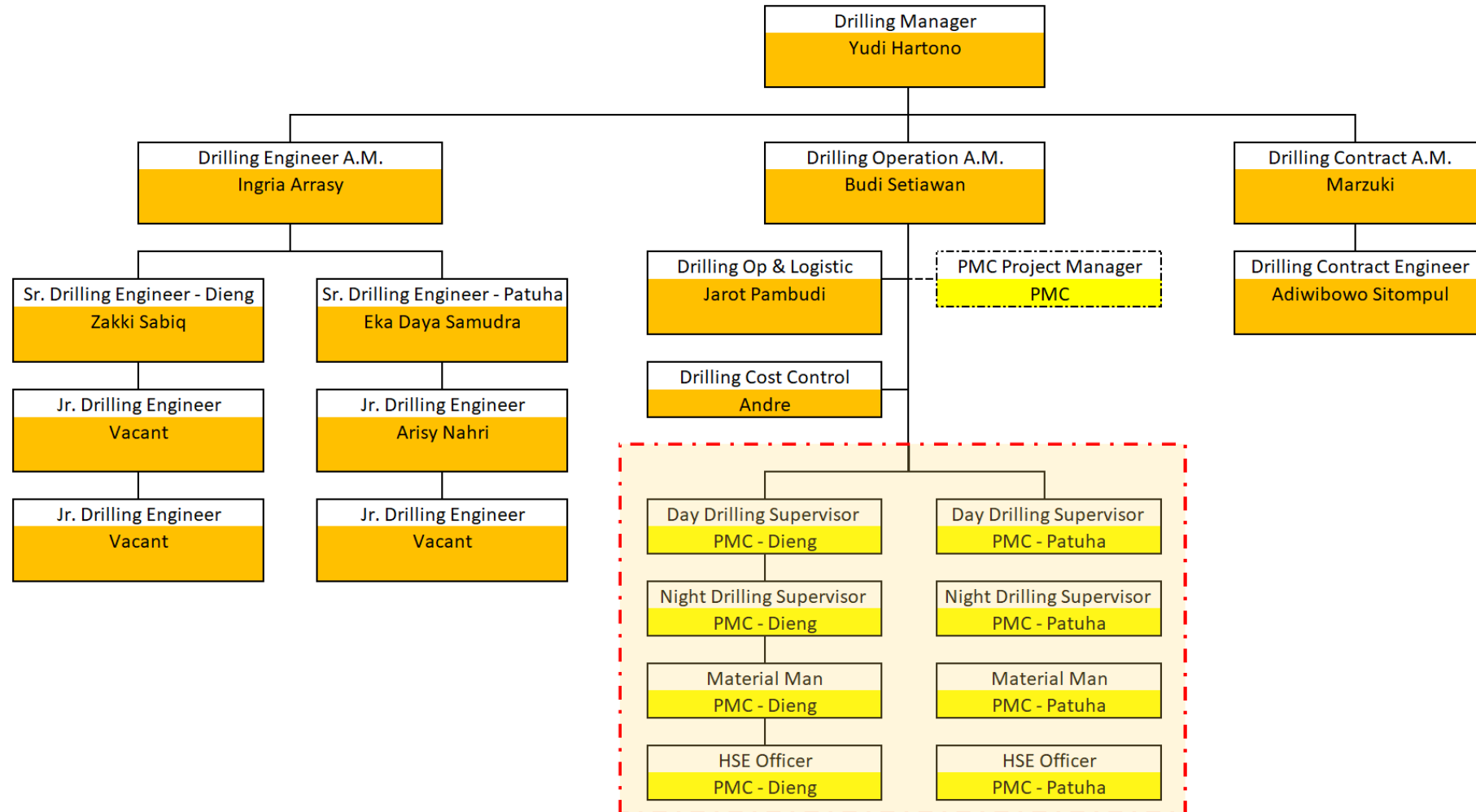
COMMUNITY ISSUE



Drilling Personnel

DRILLING ORGANIZATION CHART

DRILLING ORGANIZATION CHART - DIENG AND PATUHA PROJECT



DRILLING PERSONNEL

Company Personnel

(Office + Site):

1. Drilling Manager
2. Drilling Admin
3. Drilling Specialist
4. Drilling Fluid Specialist
5. Drilling Superintendent
6. Sr. Drilling Engineer
7. Drilling Engineer
8. Completion Engineer
9. Drilling Accountant
10. Logistic Coordinator
11. Procurement
12. Civil Engineer

13. Day Drilling Supervisor
14. Night Drilling Supervisor
15. HSE Site Officer
16. Material Man

Rig Company (Office)

1. Manager
2. HSE Manager
3. Warehouseman

Rig Personnel (Rig Site)

1. Toolpushers (Sr)
2. Toolpushers
3. Rig Superintendent
4. HSE Supervisor
5. Drillers
6. Assistant Drillers
7. Derrickman
8. Floorman
9. Roustabouts
10. Rig Mechanics/Electricians
11. Welders
12. Storekeepers
13. Crane /Forklift Operators
14. Drivers/Helpers (truck/cars)
15. Catering
16. Security

SERVICE COMPANY PERSONNEL

Directional Drilling, MWD, LWD	Drilling Fluid	Cementing	Casing Handling	Mud Logging	H2S
Sr. DD Engineer DD Engineer MWD Engineer LWD Engineer	Sr. Mud Engineer Mud Engineer Solid Control Mud Boy Helper	Cmt. Engineer Operator Mechanic Helper	Casing Crew Torque Turn Eng.	Pressure Eng Mud Logger Sample Catcher Technician	H2S Engineer Sweeper

Heavy Equipment	Air Drilling	Electric Logging	Drilling Equipment	Well Test
Forklift Operator Crane Operator Hi-Boy / Low Boy Trailer Driver Foco Truck Driver Vacuum Truck Driver + Operator Tronton Truck Driver Truck Pusher Flag Man Light Vehicle Driver	Engineer Operator Helper	3-5 Personnel	Liner Hanger Engineer Down Hole packer Engineer Completion Engineer Fishing Engineer Wellhead Engineer Tool Engineer Coring Engineer VSAT Engineer Drilling Bit Engineer QA/QC Engineer	15-20 Personnel (specialist)



+62-813 988 66556



Thank You!



Drilling in My Mind

Drilling
Engineering

Drilling
Operation

Drilling Support



**GEOHERMAL
DRILLING**



Drilling HSE

Drilling Cost
Control

Drilling Admin

Drilling Operation Knowledge

Wellhead

Casing
Handling

Rig

AFE

E-Log

PO
SO

Casing

Bit

Directional
Program

Well Test
Program

Other
Services

Cementing

Mud

