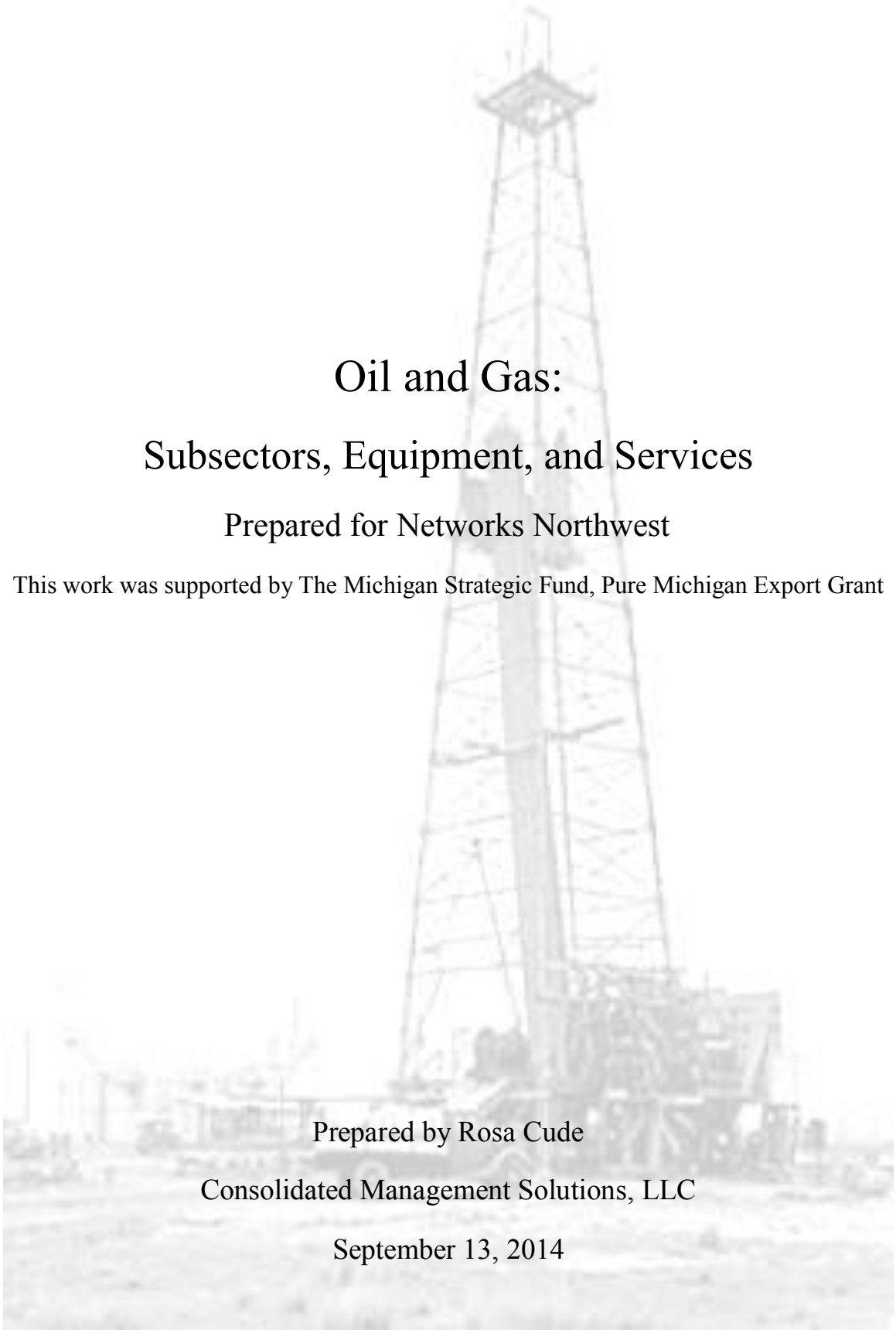

Oil and Gas:

Subsectors, Equipment, and Services

Prepared for Networks Northwest

This work was supported by The Michigan Strategic Fund, Pure Michigan Export Grant

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September 13, 2014

ABSTRACT

The scope of this report will classify upstream subsectors in the oil and gas industry. Following will be a listing of services and equipment within the subsectors. Upstream activities are stages in oil and gas exploration and production. Part I will address activities in oil and gas location, and initial and essential activities. Part II will address products and services in exploratory drilling. Lastly, Part III will identify activities in the recovery process. Also included will be products used in unconventional methods of extraction. Conventional methods are deemed as standard industry methods. The report will include products and services utilized in hydraulic fracturing and horizontal drilling methods of extraction. These methods are recognized as unconventional methods. Tar sands, oil sand, oil shale, and offshore drilling are excluded in this report.

The report will assist Michigan companies in identifying opportunities in needed products and services in the oil and gas industry.

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EXECUTIVE SUMMARY

This report identifies upstream oil and gas subsectors and business opportunities. The purpose of this report will be to identify products and services within each subsector. This report does not include offshore drilling, tar sands, oil sands or oil shale.

Upstream activities are stages in oil and gas exploration and production. Part I will address activities in oil and gas location and initial and essential activities. Part II will address exploratory drilling and Part III will address recovery.

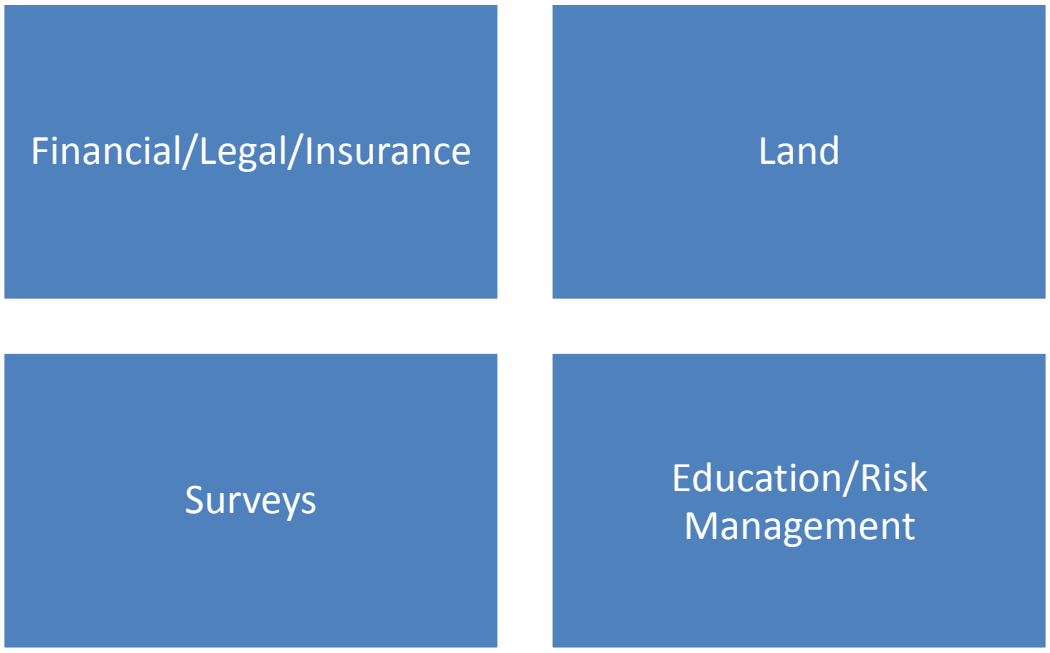
The four subsectors in Part I: Financial/Legal/Insurance, Land, Surveys, and Education/ Risk Management. The four subsectors in Part II: Site Preparation/Infrastructure, Exploratory Drilling/Rig Set-Up, Auxiliary Equipment, and Staffing. Part III subsectors: Equipment, Maintenance, Distribution, Plug and Abandonment.

This report will include products used in conventional and unconventional methods of extraction. Conventional methods are deemed traditional and standard industry methods. Unconventional methods are for example, methods utilized in hydraulic fracturing and horizontal drilling. Hydraulic fracturing is a process by which a water solution is pumped down a well and into formations under high enough pressure to cause the formation to crack open, forming passages through which oil can flow into the wellbore.

The report will assist Michigan companies in identifying opportunities in needed products and services in the oil and gas industry for both domestic use and for export.

Part I- Fundamental Actions and Location Activities

Subsectors



Part I- Subsector Equipment and Services Needs

Part I subsectors address the initial and essential activities in oil and gas exploration.

Financial / Legal / Insurance / Land

After the site location has been determined, numerous steps are taken to further the exploration process.

- Commercial Banking
- Contracts, Purchases Agreements, Royalty Agreements, Lease Agreements.
- Joint Ventures
- Land Purchase
- Leased Land
- Mineral Rights
- Novel Financial Arrangements
- Private Equity

- Production Sharing Contract
- Public Investment: Subsidies, Credits
- Right of Ways/Easements
- State and Local Ordinances
- Surety Bonds
- Surface Rights
- Unitization

Surveys

Surveys are conducted prior to drilling a test well. The survey results will help to determine whether exploratory drilling is warranted.

The types of surveys that are or can be conducted to answer these questions are:

- Geological- Geologists evaluates area formations, surfaces, outcropping for insight in the probability that oil and gas are present.
- Seismic- Survey measuring the earth's energy and vibration. For this type of survey *geophones* are used. An artificial seismic event is caused underground and geophones measure seismic activity at the surface from the impact below. A vibration truck pounds the earth and the information is gathered by the geophone. The information is a two dimension grid. Current technology allows for information to be processed and detailed in three dimensions for greater detail.
- Magnetic- Use of a *magnometer* is used to measure magnetic properties and strength formations and determine whether the data is consistent with oil and gas discoveries.
- Gravimetric- Use of *gravimeter* to measure the earth's gravitational fields. Such information also gives insight into the likelihood of finding oil and gas.
- Aerial Sensing- Aerial landscape imagery for surface mapping.

Survey Equipment/Technology

- Computer Technology
- Explosives
- Geophones
- Gravimeter
- Magnometer
- Satellite Technology
- Sniffers
- Vibration Truck

Survey Services

- Consultants
- Engineers
- Geologists
- Geophysicists

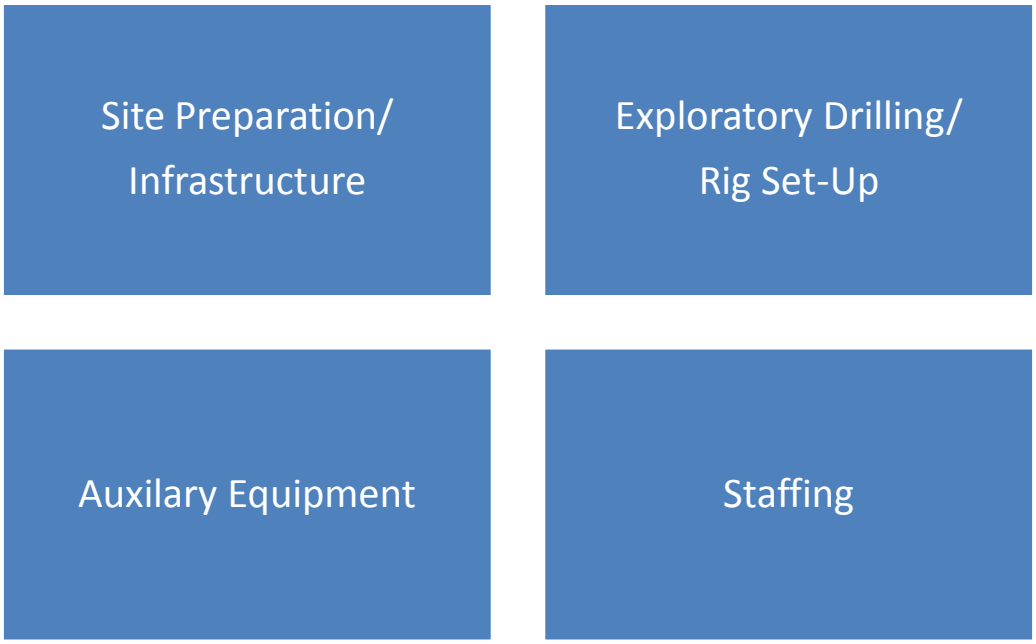
Education/Risk Management

Permits and agency approval are obtained and implemented.

- Assessment of Stakeholder Risk/Minimizing Stakeholder Risk
- Emergency Response: EPA, Fire Department, Police Department
- Government Agencies: EPA, DEQ, DNR, OSHA
- Media Outreach- Local/National
- Permits
- Stakeholder Education

Part II- Exploratory Drilling

Subsectors-



Part II- Equipment and Service Needs

Once a decision has been reached to proceed with a test well, the drilling site is prepared. Along with the site work, equipment is brought in and services are contracted for the rig set-up.

Site Preparation/Infrastructure

- Access/Road Construction
- Building Construction
- Bulldozer
- Excavation and Leveling
- Excavation of Reserve Pit (Water Discharge)
- Generators
- Land Clearing
- Paving
- Permits
- Signage

- Trailers: Offices/Housing/Food
- Tractor
- Truck

Exploratory Drilling/Rig Set- Up

Exploratory drilling refers to the drilling of the main well hole. The information gathered from the exploratory well and from coinciding testing will determine the viability of the well.

Drilling rig components found on and around rig.

- Accumulator
- Annulus
- Additives
- Blender- Mixes liquids and sand.
- Blowout Controller
- Blowout Preventer (BOP)
- Blowout Preventer Stack
- Breaker House
- Bulk Mud Components Storage
- Casing
- Catline Boom and Hoist Line
- Catwalk
- Choke Manifold
- Collar
- Console
- Crown Block
- Degasser
- Derrick Board
- Diesel Engines- Powers the electric generator.
- Doghouse
- Drawworks
- Drill Bit- Steel Tooth Rotary Bit, Insert Bit, Polycrystalline Diamond Compact Bit, Diamond Bit
- Drill Line
- Drill Pipe
- Drill String- Consist of: Drill Pipe, Heavy Collar, Stabilizer, and Drill Bit.
- Electric Cable Tray
- Electric Control House

- Engine Generator Sets
- Fuel Tanks
- Hydraulic Hoist
- Iron Roughneck
- Kelly
- Kelly Bushing
- Mast- Lifting Unit
- Monitoring Equipment- SCADA (Supervisory Control and Data Acquisition)
- Monkeyboard
- Mud Gas Separator
- Mud- Liquid solution used in preventing drill from overheating
- Mud Pit
- Mud Pump
- Mud Pump Separator
- Mud Return Line
- Mud System
- Personnel
- Pipe Racks
- Pipe Ramp
- Rig Platform
- Rotary Hose
- Rotary Table
- Sand
- SCR House/Top Drive
- Separator
- Shale Shaker
- Slips
- Stabilizer
- Standpipe
- Swivel
- Tong
- Top Drive
- Traveling Block
- Turntable
- Weight Indicator

Auxiliary Equipment

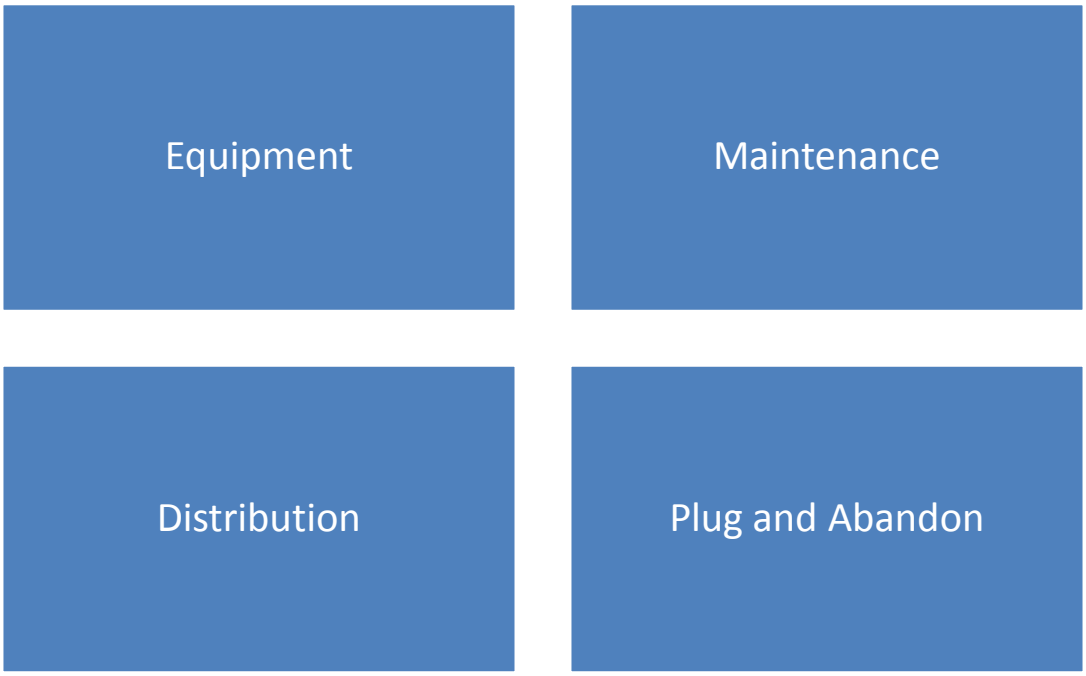
- Cameras
- Cement Truck
- Cranes
- Drill Stem Testing
- Fire Extinguishers, Medical Supplies
- Flowback Monitoring and Analysis
- Health Risk Assessment
- Heater
- Hydraulic Fluids and Additives
- Lighting
- Monitoring Wells
- Oil Tanks
- Pipe Racks
- Safety: Harnesses, Hard Hat, Clothing, Gloves, Safety Glasses
- Spill Clean-Up: Dry Chemical, Foam and Gas Extinguishing System
- Trucks- Transportation of Equipment, Power Supplies, Drilling Equipment
- Waste Removal
- Water Storage Tank
- Water Tank
- Water Well
- Welding Equipment
- Well Logging

Staffing

- Personnel: Skilled and Unskilled
- Personnel: Training

Part III- Recovery

Subsectors-



Part III- Equipment and Services Needed

Based on the exploratory well information, the well is *completed*. Completion refers to a well moving from the exploratory phase to the production phase.

Equipment

- Casing: Conductor Casing, Surface Casing, Production Casing
- Chromatography
- Christmas Tree
- Downhole Pressure Sensors
- Drill String:- Consists of Drill Pipe, Heavy Collar, Stabilizer, and Drill Bit
- Enhanced Oil Recovery (EOR) Evaluation: Chemical Injection, Gas Injection, and Thermal
- Electric Submersible Pump
- Expanders
- Gas Lift

- Hydraulic Pump
- Packer
- Perforated Liner
- Perforated Pipe
- Perforating Gun
- Pumpjack
- Safety/Fire Equipment: Extinguisher, First Aid, First Responders
- Solar Panel- Energy/Power for Monitoring Equipment
- Tubing

Maintenance

- Pumpjack Technician Services
- Recompletion
- Security/Monitoring Service
- Well Monitoring
- Well Workover Maintenance

Distribution

- Pipeline
- Pipeline Integrity
- Trucks
- Rail

Plug and Abandonment

When it has been determined that the well is no longer producing, it is capped and abandoned.

- Cement Plugs
- Cement
- Coiled Tubing

References

Breitling Energy. (2012). Drilling Into Oil-Field Equipment. Retrieved from http://www.breitlingenergy.com/drilling-into-oil-field-equipment/

Deutsche Bank Market Research. (2013).Oil and Gas for Beginners. Retrieved from http://www.wallstreetoasis.com/forums/db-oil-gas-primer-2013 .

Energy From Shale. (2014). Retrieved from http://www.energyfromshale.org/

Freudenrich, Ph.D., C.& Strickland, J.(n.d.). Retrieved from http://science.howstuffworks.com/environmental/energy/oil-drilling.htm

Hilyard, J. (2012). *The Oil and Gas Industry: A Nontechnical Guide.*Tulsa, OK: Penn Well

Investopedia. (n.d.). *The Industry Handbook: The Oil Services Industry*. Retrieved from http://www.investopedia.com/features/industryhandbook/oil_services.asp

King, Ph.D., H. (n.d.). *Hydraulic Fracturing of Oil & Gas Wells Drilled in Shale.* Retrieved from http://geology.com/articles/hydraulic-fracturing/

Northern Territory: Department of Mines and Energy. (2012). Unconventional Oil and Gas. Retrieved from http://www.nt.gov.au/d/Minerals_Energy/?header=What%20is%20the%20difference%20between%20Conventional%20and%20Unconventional%20Gas?

Shale Stuff. (n.d.). Process of Fracking. Retreived from http://shalestuff.com/education/fracking/fracking