

## **Using Advance Laser Technology in Extended Reach Drilling**

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### **Extended Abstract**

The demand of oil and gas reaches at such extent where the new advancements and new technologies necessary introduce day by day to get optimum recovery. Extended reach drilling (ERD) wells represent some of oil and gas industry's most impressive engineering feats in terms of well bore construction. ERD allow producers to reach deposits that are great distances away from the drilling rig. This may help producers to tap oil and natural gas deposits under surface areas where a vertical well cannot be drilled. The new world record in ERD that was set in April 2013, taking a well to 17,282 m (17.2KM) measured depth. ERD can extend life of mature fields, access reserves in environmentally sensitive areas and ability to drill under lakes & rivers but operational challenges limited to ERD are torque and drag, hole cleaning, barite sag and well control, these are all additional factors that have to be considered at the design phase.

However applying laser technology in petroleum drilling a fairly recent development has the potential of mitigation the limitation of the ERD technique. It drill 100 times faster than conventional drilling, make precisely holes, reduce downtime due to dull bits, no cleaning problem, reducing formation damage and make high aspect ratios (width-depth).

If advance laser technology used in ERD instead of conventional drilling then it will much more economical in facilities, saving time and reducing extra cost of employing and can be new invention in oil gas industry.

Developments in drilling methods and technology are leading to efficiency gains for oil and natural gas producers. ERD allow producers to reach hydrocarbons that are great distances away from the drilling rig and can help the producers to produce hydrocarbons from subsurface areas where a vertical well cannot be drilled.

This ERD technology is the heart of many unconventional resource plays. It is only with a full appreciation of the scope and limitation of directional techniques will drilling teams achieve success and avoid costly and time consuming mistakes.

ERD wells represent some of oil and gas industry's most impressive engineering feats in terms of well bore construction. The new world record in ERD that was set in April 2013, taking a well to 12700.1 m or 12.7 km measured depth.

ERD can extend life of mature fields, access reserves in environmentally sensitive area, ability to drill under lakes and extend the life of mature fields (producers/injectors). This technique has less environmental & ecological disturbance.

Torque and drag, hole cleaning, barite sag and well control are the operational challenges that faces during drilling. Therefore, it is necessary all operational challenges have to be evaluated and contingency planning put in place for proper planning. This is where the selection of the correct downhole drilling technology is critical. The above operational challenges can be control by using laser technology.

Laser drilling can be used to drill holes ranging in diameter from several millimeters to less than one micro-meter. The laser is the tool of choice when holes are required with a diameter of  $< 100 \mu\text{m}$  and a high aspect ratio, machining under difficult operating conditions like defined angle of inclination, for holes in hard materials or for the generation of special geometries. Uses of laser technology in ERD will help in saving time, reducing extra cost of employing and much more economical in facilities.

The setting is not complicated one just like a laser welding. A very important aspect of this is the simplicity in pointing the laser head to the spot to be drilled. However, there is no rotary drilling technique without a drilling system and drilling fluid a purging system plays a similar role in laser drilling technique and the reservoir properties changes during laser technology as shown in table 1. A purging system provide a transparent medium for laser to pass through, clean the hole cuttings and move molten rock into the fractures to seal them as well as sealing the wall of well bore.

**Table-1: Permeability and porosity before and after laser for selected rock types.**

Sample	Permeability (md) Before Lasing	Permeability (md) After Lasing	Porosity (%) Before Lasing	Porosity (%) After Lasing
Berea Yellow Sandstone	7754	7914	0.25	0.40
Berea Gray Sandstone	554	674	0.18	0.35
Sandstone Reservoir	11.1	30.1	0.18	0.40
Limestone	0.02	0.02	0.02	0.02
Shale	0.43	0.55	0.01	0.03

Laser technology can drill 100 times faster than conventional drilling, it makes more precisely holes reduce downtime due to dull bits than conventional drilling as shown in table 2, eliminate waste crated by drilling mud (cutting vaporize), eliminate influx/out flux of fluid hence formation damage has eliminated as well. It is much more economical both in saving time and extra cost of employing than conventional drilling and easily drill cutting removes.

**Table-2: Comparing of saving time of coil tubing drilling with laser technology.**

	<b>Coiled tubing drilling</b>	<b>Laser drilling</b>
Coil size	2 3/8"	1 1/2"
Hole size	3 1/2"	2 1/2"
Rig up (onshore)	24 hrs	12 hrs
Running the whipstock	12 hrs	12 hrs
Milling the window	24 hrs	2 hrs
100 m lateral	25 hrs	20 hrs
Retrieval of whipstock	12 hrs	12 hrs
Rig down	12 hrs	6 hours

Total Savings 45 hours.

Extended reach drilling has many advantages but have some operational challenges that can be control by using laser technology because laser technology