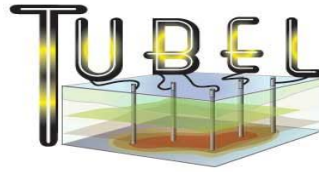


Tubel Energy
25907 Oak Ridge Dr.
The Woodlands, Texas, 77380 USA
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www.tubelenergy.com



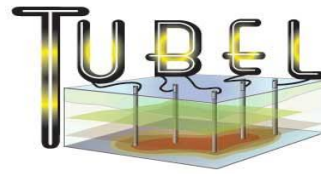
Tubel Energy Downhole Power Generator

The deployment of gauges and flow control systems requires the use of electrical cables and hydraulic lines mounted on the outside of the production tubing. This task requires a significant amount of time and effort with additional equipment placed on the rig floor. The risk involved for accidents and delays in the deployment of the tubing is significant. The use of packers creates another challenge to the deployment of cables while wellhead manufacturers are limited in the ability to provide connectors for interfaces into the well.

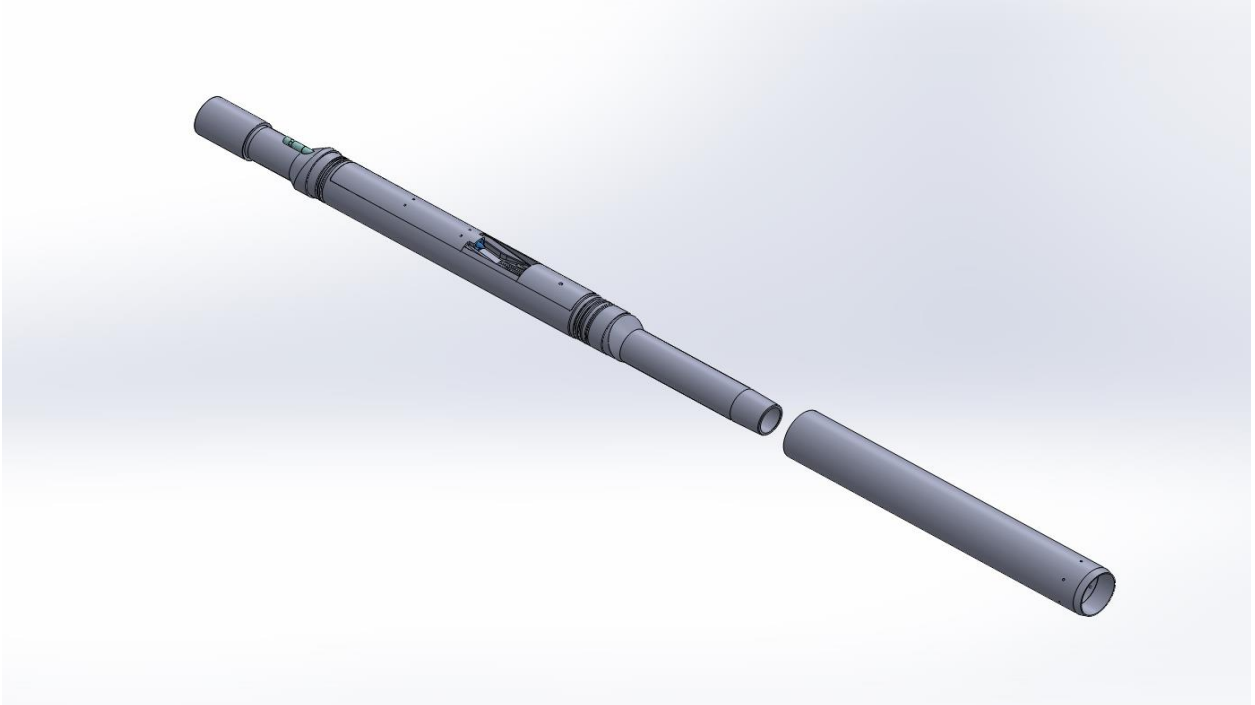
The use of downhole power generators as part of systems will change the way operators monitor and control the production of hydrocarbons. Standard packers can be used since there is not a need to provide feedthrough connectors to accommodate the cables and lines. Multiple gauges deployment becomes a simple task since they are independent. Flow control systems can now be deployed inside the laterals since no cables are required. This approach will provide a much more efficient way to control the lateral production and shut in the individual laterals when producing water. Sensors can now be deployed near the sandface for production surveillance.

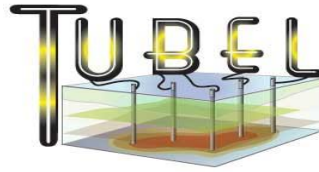
The downhole power generator is deployed as part of the production tubing and can generate up to 20 Watts of power from the flow of fluid from downhole.

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2.875" DOWNHOLE GENERATOR





Electrical Specifications for the Generator

System Description – The Electrical System comprises of basically 5 main building blocks:

- 3 \emptyset Electrical Generator producing a sinusoidal output phased at 120° separation
- High Power 3 \emptyset AC-DC Rectifier
- Filter & Storage Capacitors
- High Voltage to Low Voltage Logic Regulator
- Over Voltage Protection

Generator Characteristics:

- 3 \emptyset AC
- Expected output Max V (3 \emptyset Rectified) \rightarrow 50V
- Speed Constant \rightarrow 145 rpm/Voutput
- Constant Current \rightarrow 600 – 900mA
- Operating Temperature \rightarrow 125°C (max Winding T \rightarrow 155°C)
- Maximum Speed 6000 rpm
- Generator Dimensions: 22mm O.D. x 48.6mm L

High Power 3 \emptyset AC-DC Rectifier:

- 3 \emptyset AC-DC Full Wave Rectifier
- 100V @ 5A AC input Rectifiers
- 100V @ 1A DC Output
- 150°C Operation
- High Temp Polyimide Construction
- Dimensions: .9" w x 5.125" w

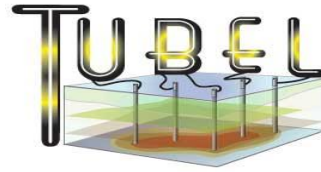
Filter & Storage Capacitors:

- 150°C Operation
- 100V DC Max

High Voltage to Low Voltage Logic Regulator:

- 100V DC Input Max
- +5V @ 3A \rightarrow 15W Output
- 150°C Operation
- High Temp Polyimide Construction
- Dimensions: .9" w x 3.5" w

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Over Voltage Protection:

- Protection for High Generated Voltage and Varying Power Requirements
 - Light Load- Ø1 Ø2, OFF, Ø3-ON
 - Medium Load- Ø1, OFF, Ø2 Ø3-ON
 - Heavy Load- Ø1 Ø2 Ø3-ON