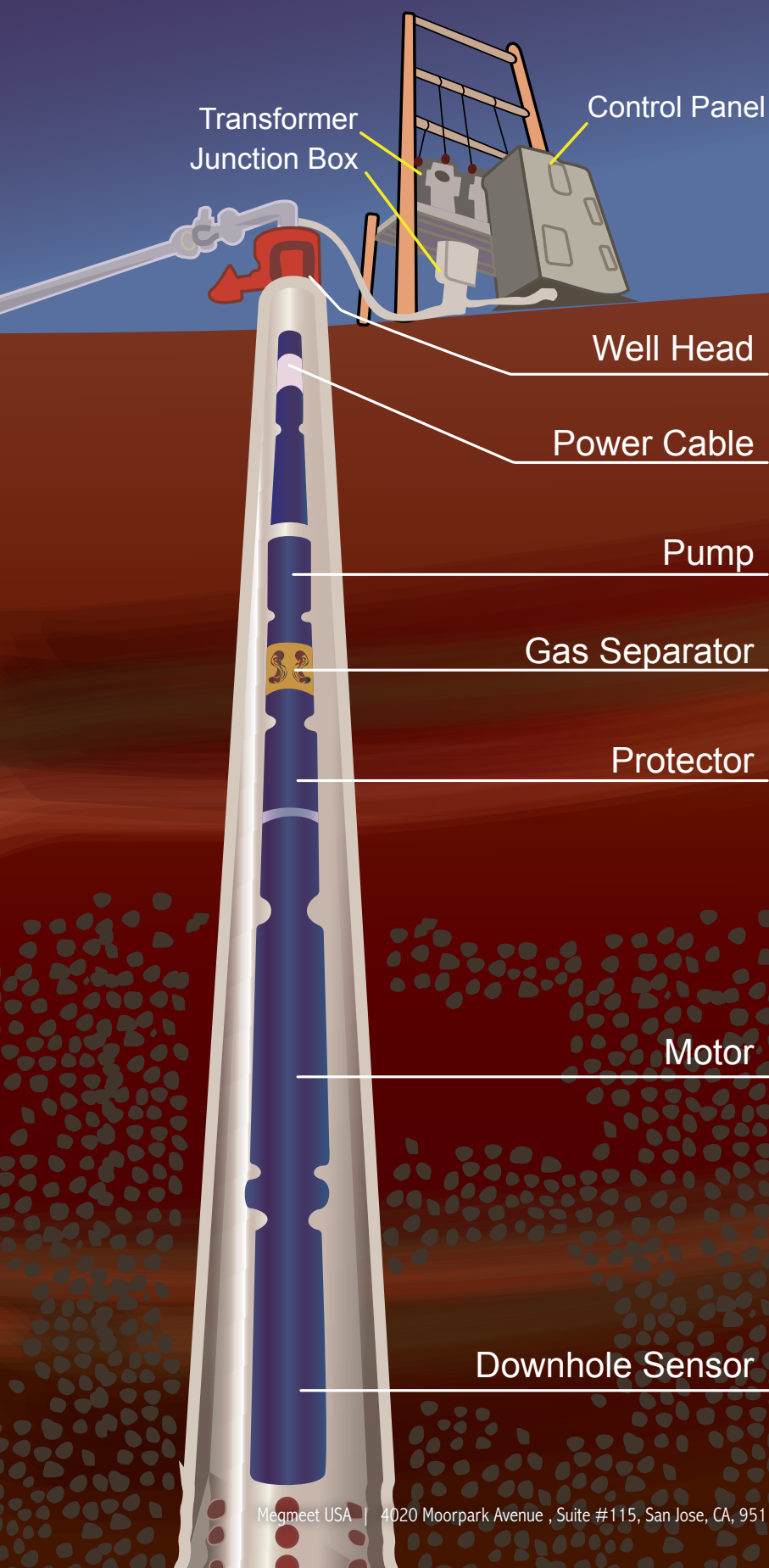


Electric Submersible Pump



The Electrical Submersible Pump (ESP) Manufacturing Plant was established in 1989 and we have been expanding and perfecting the ESP offering over the last 30 years. The technology has evolved to improve performance in a wide range of oil conditions.

Benefits

- Good sand resistance
- Rust and stain resistance
- Individualized Electrical Submersible Pump design using Well Selection software
- High temperature resistance
- High production rates up to 28,000 b/d

Applications

- Deviated and horizontal wells
- High-gas well applications
- High-temperature downhole conditions
- High-production rate wells

Specifications

Production Rate:
15 m³/d to 4500 m³/d

Max Downhole Temperature:
90°C, 120°C, 150°C, 180°C

Maximum Vertical Setting Depth:
5000 m

Gas Content by Volume:
Up to 90%

Motor Outside Diameter:
95mm, 98 mm, 107 mm,
114 mm, 138 mm, 143 mm,
187mm

Electric Submersible Pump Component Highlights

Variable Speed Drive

The variable speed drive optimizes system operation and protects the Electrical Submersible Pump (ESP) components. Accurate control of the motor speed allows for optimal motor temperature, which can extend the life of the ESP in addition to improving gas handling capabilities. Well conditions can be monitored and the ESP adjusted to control the well drawdown rate and also adjusted to match changing well conditions. The VSD protection scheme protects against short circuit, under load, over load, over voltage, phase loss, and current imbalance. The IP54-rated cabinet is designed to withstand the harsh outdoor environments of oilfields.



Submersible Centrifugal Pump

Megmeet pumps are designed for reliable downhole operation. The pump shaft is made from Monel-K500, an alloy known for its excellent corrosion resistance, strength and hardness. The number of pump stages is determined by the required lift. The pump includes a strong magnetic scale remover that can effectively prevent scale from depositing in the pump and extends pump life. Nickel-iron plating provides the pump with strong wear resistance and corrosion resistance. The impeller and diffuser geometries are designed to fit a wide range of well conditions, including viscous crude, and operate at high efficiency.

Gas Separator and Gas Handler

Well fluid enters the gas separator (where free gas is separated) and then into the gas handler where the remaining gas is compressed to a one-phase liquid prior to entering the submersible centrifugal pump. The gas separator can separate up to 90% of free gas. Multiple separators can be configured in tandem to improve the gas separation capability. For wells with sand content, some gas separator models include a high-strength sand-resistant sleeve to prevent casing fracture and pump failure.



Submersible Motor

The submersible power motor is an inductive motor that drives the multi-stage centrifugal pump. The design is optimized to fit a range of well diameters and environmental temperatures. The temperature of the motor is regulated with a high-strength, dielectric oil that aids lubrication and thermal conductivity. The heat generated by the motor is transmitted to the well fluid through the motor housing.

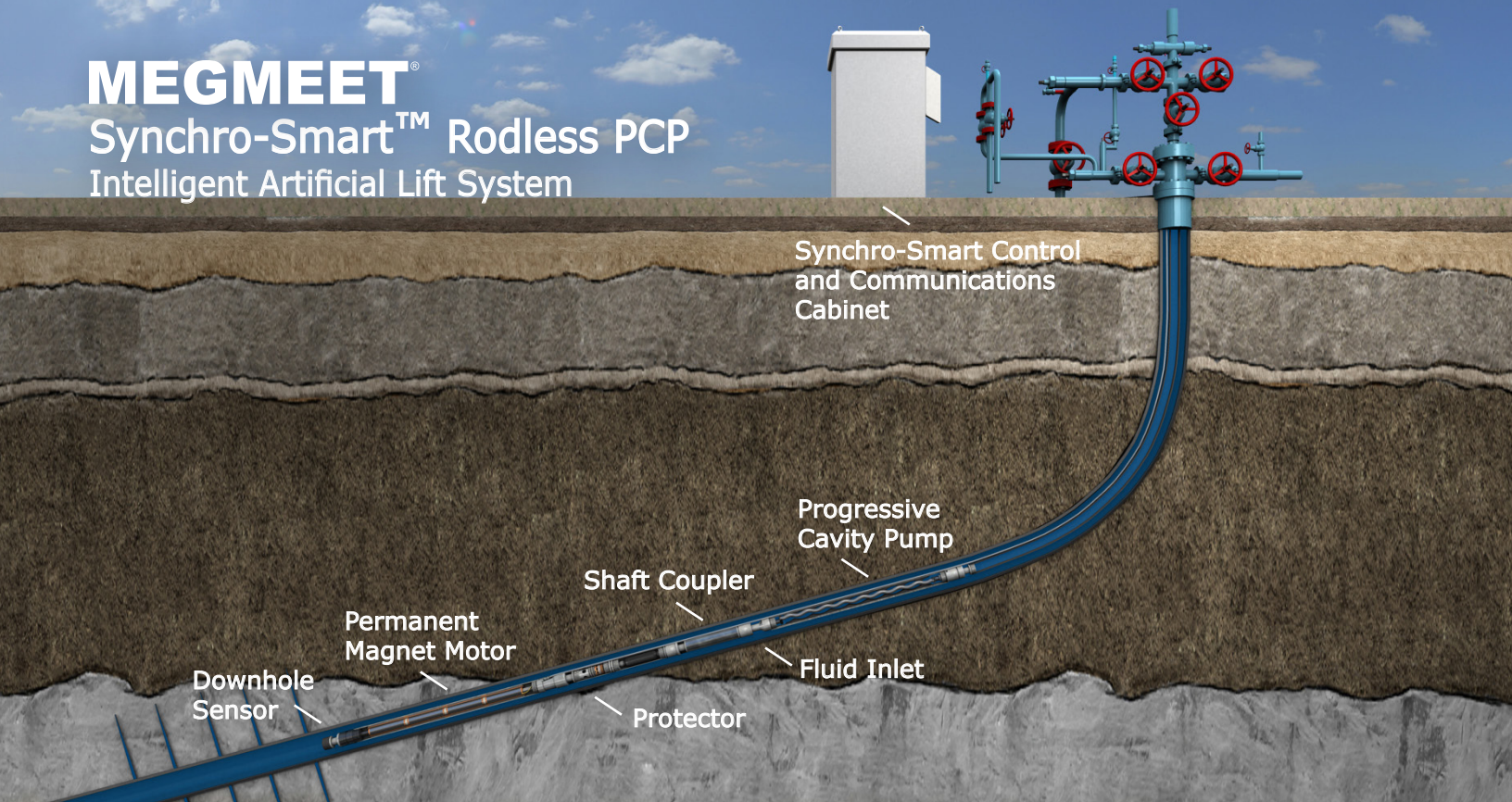
Megmeet offers seven series of motors with outer diameters of 95mm, 107mm, 138mm, 143 mm, and 187 mm to meet a variety of casing diameters.

Motors may be specified with one of four temperature ratings: 90°C, 120°C, 150°C, or 180°C.

MEGMEET[®]

Synchro-Smart[™] Rodless PCP

Intelligent Artificial Lift System



Benefits

- Maximizes profits with lower power consumption and higher efficiency
- Decreases downtime from rod and tubing wear
- Increase production with dynamic fluid level management
- Eliminates manual well interventions using web based monitoring and control
- Improves aesthetics by eliminating noise from moving parts and decreased surface equipment

Applications

- High viscosity wells
- Directional and horizontal wells
- Low-flow wells
- Wells with rod restrictions or tubing wear or wax problems
- High sand-cut-wells
- High dogleg-severity wells

Features

- Web-based monitoring and control platform accessible with mobile devices
- Synchronous permanent magnet motor (PMM) down-hole drive
- Integrated down-hole sensor
- Constant torque in the full PCP speed range
- Variable speed drive motor control and communications cabinet

Synchro-Smart[™] Rodless PCP

The Synchro-Smart[™] Rodless PCP downhole permanent magnet motor and pump system is an energy-efficient pump, which combines both the advantages of a downhole driven system and the benefits inherent to PCP technology. The Synchro-Smart[™] permanent magnet motor increases the overall lifespan of the system eliminating the maintenance of surface equipment. The PCP enables operation in a wide range of conditions including high viscosity, sandy and high gas-to-oil ratio wells.

Changing Pump Technology to Offset Declining Wells

Wells transitioning from high volume production utilizing ESP's or other artificial lift methods can transition to the Synchro-Smart[™] Rodless PCP maintaining the above ground low-profile aesthetics for production rates up to 600 bbl/d. The flexibility of the rodless system enables continuous production at lower depths with remote manual speed adjustment for evolving well conditions.

Lower OPEX with Synchro-Smart[™] PMM Technology

Permanent magnet motors are synchronous machines utilizing rare earth magnets in their rotor design, which produce the rotor flux. These advanced motors have higher power density and are shorter than conventional induction motors providing flexibility in well placement. The synchronous operation and higher efficiency results in lower energy usage and lower operating cost. The Synchro-Smart[™] variable speed drive motor control cabinet supports automatic control of production rate and fluid level to safely make full use of available pump capacity.



Synchro-Smart™ eliminates all surface moving equipment

MEGMEET®

Synchro-Smart™ Rodless PCP

Specifications

Production Rate

6.5 to 600 bbl/d (1 to 95 m3/d)

Max Downhole Temperature

250 deg F (120 deg C)

Maximum Vertical Setting Depth

8000 ft (2440 m)

Min Fluid API Gravity

10 degrees

Operational Speed Range

60 to 250 rpm

Max Sand Content by Volume

2.5%

Max Gas Content by Volume

30%

Rated Torque

110 to 590 lbf*ft (150 to 800 N*m)

Dynamic Flow Level

350 to 6500 ft (107 to 1980 m)

Rated Motor Power

4 to 22 kW

Min casing size, in (mm)

4.8 (121.4)

Synchro-Smart™ Control and Communications Cabinet

The above-ground cabinet houses the Synchro-Smart™ intelligent control system, the variable speed drive and the wireless communications module. The system on/off and operation parameters are set at the cabinet with LED's displaying operation status. The sophisticated digital closed loop control system can be set to maintain constant dynamic fluid level or constant pump speed, detect pump off conditions and monitor equipment performance. Synchro-Smart™ control achieves precise control by compensating for signal transmission degradation in the submersible cable. The wireless communications module supports web based access to all well and pump operation data. Remote on/off and constant dynamic fluid level settings can be controlled.

Permanent Magnet Motor

The workhorse of the Synchro-Smart™ system, the energy efficient and compact, Synchro-Smart™ permanent magnet motor lowers OPEX by reducing energy consumption and avoiding work over costs. Designed for long downhole operation, the motor speed can be adjusted to match maturing well conditions while maintaining operations. The patented anti-demagnetization design extends the life of the permanent magnet rotors for high reliability production. Unlike traditional ESP induction motors the Synchro-Smart PMM does not utilize a gear reducer eliminating a common point of failure and increasing reliability.

Progressive Cavity Pump

Progressive cavity pumps suit a wide range of conditions including low volume wells with unstable inflow, wells with viscous, abrasive fluids, high GOR wells, and wells with scale and high asphaltenes. PCP's are especially well matched for heavy oil production. The Synchro-Smart™ system offers a wide range of PCP rotors and stators to cover the widest range of applications.

Downhole Sensor

The Synchro-Smart™ downhole sensor provides operators the ability to fully capture the information from their artificial lift systems to help minimize downtime, increase equipment run life and optimize production. The downhole sensor detects temperature, pressure, and vibration data which is transmitted via power line coding-carrier-decoding technology through submersible cable to the Synchro-Smart™ Control and Communications cabinet. The autonomous dynamic fluid level control is made possible using the sensor data inputs.

Synchro-Smart™ Rodless PCP Saves Operator 75% In Energy Usage

MEGMEET Rodless PCP System Replaces ESP In Dagang Oil Field

BENEFITS

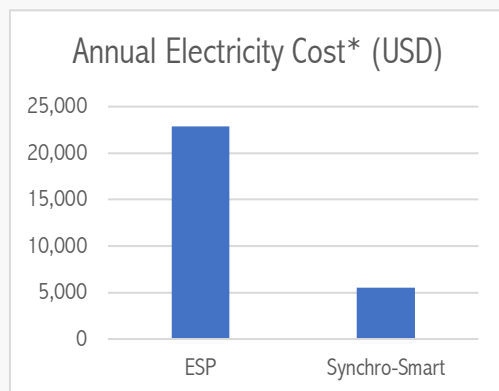
- Reduced OPEX
- Maintain production rate
- Small surface footprint

WELL BACKGROUND AND CHALLENGES

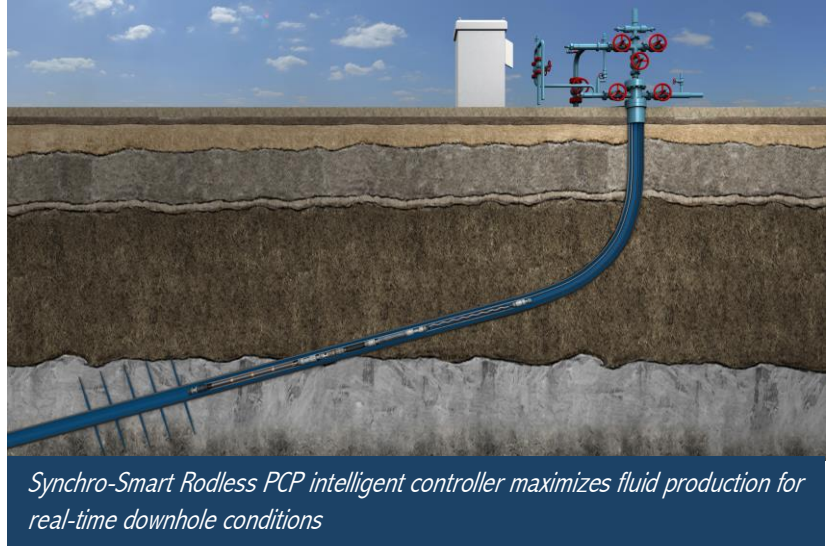
- Deviated well with 62.5° Inclination
- Producing 158 BOPD with ESP

RESULTS WITH SYNCHRO-SMART™ RODLESS PCP

- Daily electricity consumption reduced from 1254 kWh per day to 304 kWh per day
- Saved \$17,000 per year electricity cost*
- Daily output maintained at 160 BOPD
- Achieved 365+ day runtime without maintenance



*assumes electricity cost \$.05 per kWh



Dagang field is located in Northern China, where in December 2017, Megmeet installed the Synchro-Smart™ Rodless PCP system to replace an operating ESP.

This well has a 62.5° inclination that was initially installed with an ESP (electric submersible pump) set at 4,750 ft. The well had been operating for 635 days with an average output of 158 BOPD. The output level was below the optimal range for an ESP and alternative artificial lift systems were considered.

The Synchro-Smart system was able to provide a higher efficiency due to the permanent magnet motor technology and the variable speed drive system which optimally controls the pumping system. The 8kW permanent magnet motor was sufficient to maintain the output at 160 BOPD and operate at a sixth of the energy usage. Using only 204kWhr per day, the Synchro-Smart system has saved energy costs by 75%.

The system has been operating for 365 days with no maintenance required. The Synchro-Smart intelligent control system provides the operator with real-time downhole conditions and motor performance data. With remote access from any Internet connected device to the Synchro-Smart system, the pump speed can be set manually, set to maintain constant dynamic fluid level or set to run intermittently for low flow wells. Abnormal operating conditions generate an alert enabling immediate response.

Replacing the ESP with the Synchro-Smart system which is also a similar submersible motor system allowed the site to maintain a small surface footprint, low acoustic noise and eco-friendly operation.

Synchro-Smart™ Rodless PCP Restarts Production in Inactive Well

OPEX reduction brings well to profitability

BENEFITS

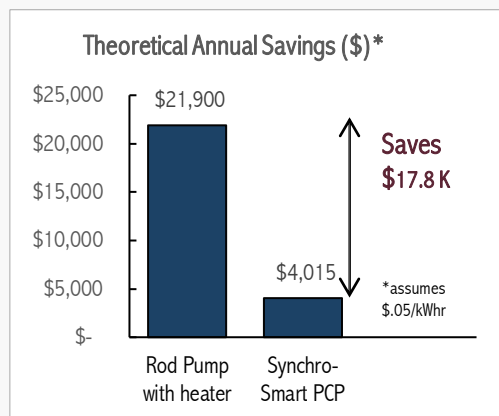
- 90 BOPD from formerly inactive well
- 80% reduction in power consumption
- Low-profile aesthetics
- Environmentally friendly with low acoustic noise

WELL BACKGROUND AND CHALLENGES

- Heavy oil in conventional well
- Formerly utilized rod pumping with Electric heating to reduce viscosity
- 1200 kWhr/day power consumption
- Well inactive for two years

RESULTS WITH SYNCHRO-SMART™ RODLESS PCP

- Daily electricity consumption reduced from 1200 kWh/day to 220 kWh/day
- Daily output increased to 90 BOPD
- Achieved 600+ days runtime



Dagang field is located in Northern China, where in May 2017, Megmeet installed the Synchro-Smart™ Rodless PCP system.

This was an inactive well that was initially installed with a rod pump that consumed 1200 kWhr per day. The well went inactive in 2015 due to unfavorable economic feasibility due to high operational and maintenance costs in relation to well output.

The Synchro-Smart™ system returned this well to profitability by producing 90 BOPD, with one fifth of the former energy costs. Several other wells in this field have been re-activated using the Synchro-Smart™ system.

The Synchro-Smart™ system was able to provide a higher efficiency due to the permanent magnet motor technology and the variable speed drive system, which optimally controls the pumping system. The 9kW permanent magnet motor was sufficient to maintain the output at 90 BOPD and operates at a fifth of the energy usage. The progressive cavity pump enabled cold heavy oil production avoiding the cost for heating to reduce the fluid viscosity. Using only 220 kWhr per day, the Synchro-Smart™ system has saved energy costs by 80%.

The system has been operating for 600+ days with no maintenance required.

The Synchro-Smart™ Rodless PCP system is made up of eight components: the downhole sensor, submersible permanent magnet motor, seal section, flex-shaft assembly, pump, submersible cable, the Synchro-Smart™ Control and Communications Cabinet, and remote monitoring. The permanent magnet motor enables higher efficiency than induction motors, eliminates the gear reducer as a point of failure, and provides constant torque for smooth start up.

Synchro-Smart™ Rodless PCP Increases Production 90%

MEGMEET Rodless PCP System Increases Production with 96% Lower Energy Cost

BENEFITS

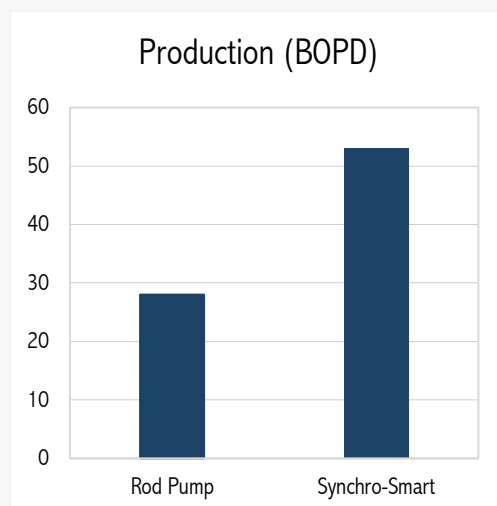
- 90% production Increase
- Low profile aesthetics
- 96% reduction In energy cost

WELL BACKGROUND AND CHALLENGES

- Well producing with rod pump
- 1,512 kWh/day power consumption
- Heavy oil in conventional well
- High well fluid viscosity 12.7 cP

RESULTS WITH SYNCHRO-SMART™ RODLESS PCP

- Daily electricity consumption reduced from 1,512 kWh/day to 53 kWh/day
- Daily output increased from 28 to 53 BOPD
- Achieved 365+ days runtime



Dagang oilfield is located in Northern China, where in February 2017, Megmeet installed the Synchro-Smart™ Rodless PCP system.

This well was initially installed with a rod pump set at 4,600 feet depth that produced on average 28 BOPD. The operator had concerns about the well profitability due to the low production volume and the energy cost for the rod pump system that consumed 1,512 kWh per day. The viscosity of the well fluid was very high at 12.7 centipoise which is suitable for progressive cavity pumps.

The rod pump had been operating for 245 days, when it was replaced with the Synchro-Smart rodless PCP system. The PCP was able to be set at 4,600 ft depth and produce 53 BOPD. Due to the moderate depth of the well, a 2kW permanent magnet motor was selected which reduced the daily energy usage down to 53kWh/day. The submersible motor driven PCP eliminated the large frictional forces acting on the rod string due to the high fluid viscosity, resulting in higher production efficiency. Additionally, the Synchro-Smart permanent magnet motor's high efficiency contributed to the power consumption reduction. The well production was nearly doubled while the OPEX was reduced by \$27.6K per year in lower electricity.

The Synchro-Smart system has been in operation over one year bringing increased production and higher profitability.

Synchro-Smart™ Rodless PCP Lifts Heavy Fluid at 6,900 ft Depth

Reliable control of submersible permanent magnet and PCP operation

BENEFITS

- Low maintenance production for pump set at 6,900 feet (2,100m)
- Low profile aesthetics
- Environmentally friendly with low acoustic noise and low soil contamination

WELL BACKGROUND AND CHALLENGES

- Deep well with 35° inclination
- Heavy oil with 80% water cut
- Local authorities request system with low environmental impact

RESULTS WITH SYNCHRO-SMART™ RODLESS PCP

- Daily output of 57 BOPD



Megmeet production facility where the Synchro-Smart permanent magnet motor and subsystems are assembled.

Xinjiang field is located in Northwestern China, where in September 2018, Megmeet installed the Synchro-Smart™ Rodless PCP system in a new well.

The operator desired to use the Synchro-Smart system for a new well with heavy oil based on its suitability in directional wells, eliminating rods which are susceptible to wear out. The well fluid was relatively heavy with 80% water cut. The well depth was 7,000+ feet with a 35° inclination and kick-off point at 4,600 feet. Megmeet performed analysis on the Synchro-Smart Variable Speed Drive to confirm that the filtering was effective to manage any reflected wave and leakage current phenomena for use with the 7,000 feet of cabling. Upon confirmation that the system could reliably operate and receive the sensor data, the Synchro-Smart Rodless PCP system was installed with the pump set at 6,900 feet depth.

Additionally, the local authorities desired a system that would have low environmental impact on the area. With no surface moving parts, the Synchro-Smart system operates with no soil contamination and no audible noise. The submersible motor driven system eliminates the odor, the soil contamination and the noise associated with stuffing box leaks common to other lift methods. The small surface footprint of the system is also valued for improved aesthetics.

The Synchro-Smart system configuration for this application is driven with a 15 kW permanent magnet motor and is successfully operating to produce 57 BOPD. The constant torque characteristic of the motor enables motor start up and speed control for optimized production.

Synchro-Smart™ Rodless PCP Enables High Density Well Placement

Compact downhole system enables 18 closely located wells

BENEFITS

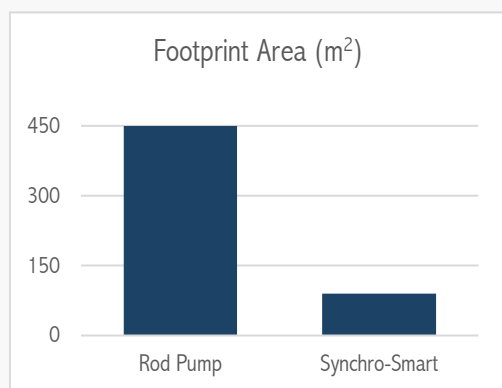
- High density well placement
- Environmentally responsible low soil contamination
- Remote monitoring and control
- Low energy consumption

WELL BACKGROUND AND CHALLENGES

- Planned 18 new directional wells
- Wells of varying depths and directions
- Desire for low OPEX

RESULTS WITH SYNCHRO-SMART™ RODLESS PCP

- High density well placement as close as 6 m
- 18 close proximity directional wells
- Real-time visibility to well and pump conditions for entire fleet
- Low noise and low profile operation



An operator in Dagang field, located in Northeastern China, desired a compact artificial lift solution to enable high density well placement for 18 directional wells. In October 2018, Megmeet installed the Synchro-Smart™ Rodless PCP system for 18 adjacent wells.

The wells were drilled at varying depths and directions to optimize the oil production. A key decision factor in the artificial lift selection for this site was the ability to locate the wells in close proximity, as low as 6 m well to well spacing. The artificial lift surface area requirements range from 25 m² for a rod pump to the 5 m² for the Synchro-Smart Rodless PCP system. The Synchro-Smart system enabled the desired high density well placement.

Production from these wells is managed remotely utilizing the web-based Synchro-Smart monitoring and control portal. The operator has real time and historic data on the pump speed and well conditions, enabling remote programming of the pump to optimize output. The system may also be set to self-adjusting mode which optimizes the pump speed to maintain a pre-selected constant dynamic fluid level or intermittent operation for very low flow wells. Real-time reporting of well conditions has reduced well-site maintenance visits.

The downhole PCP alleviates the surface oil leakage common with rod pumping systems to meet stringent environmental agency requirements. With no above ground moving parts, the Synchro-Smart operates silently and with no odor, making it a very eco-friendly artificial lift system.

The proven success of this site led the operator to install Synchro-Smart systems at a second site with 20 high density wells.