Advances in Artificial Lift

SALT Creates Energy Savings of 20%

Energy Savings and Operating Efficiently

More and more, companies are forced to operate in an environment of increased energy consumption and high electricity rates. The ability to reduce base energy requirements is important for companies that want to save money and be champions in the "green" movement.

Energy efficiency can be achieved in several ways. Using more efficient pumps, incurring less drag on rods, and optimizing speed to match intended production are a few techniques for saving energy. Another significant, but less frequently employed method, is to reduce electrical losses.

In 2002, a system was patented[1] that uses a variable frequency drive (VFD) to reduce beam pump electrical losses. This system is Sensorless Artificial Lift Technology, also referred to as SALT.

The patented[1] SALT system is designed to both eliminate regenerative losses and reduce overall system losses.

Field tests conducted by several large and independent oil companies, along with two power companies, revealed an average energy savings of 20%. Demand charges were also reduced by an average of 30%.

The Technology

By design, a beam pump requires excess electrical power in some parts of the stroke. When the pump begins the down stroke, the weights are at the bottom and the plunger is at the top, providing little counter balance. A great deal of power is required to begin lifting the weights. Then, when the pump has passed the middle of the stroke and the weights have too much inertia, the weights over speed the motor, converting the motor into a generator and regenerating the electrical power back to the power grid. The same energy waste happens on the up-stroke.

In addition, losses are incurred when converting electrical power to mechanical power and back to electrical power. Gearboxes, belts and sheaves, motors, converters, and transformers all reduce the amount of power drawn and returned to the grid.

As an example, a 40 horsepower (20kW) beam pump loses approximately 20% of the 20kW required to operate. Converting excess power back to the power grid consumes 4kW of every 20 used for the stroke. Avoiding this conversion results is a 20% improvement in energy efficiency – more if the pumping system is unbalanced.

SALT does not convert regenerative power back to the grid. Instead the excess power is harnessed as kinetic energy in the system, requiring less energy from the power grid on the next stroke. This method reduces peak electrical demand charges by approximately 30%, and contributes to the overall reduction in electrical power use.

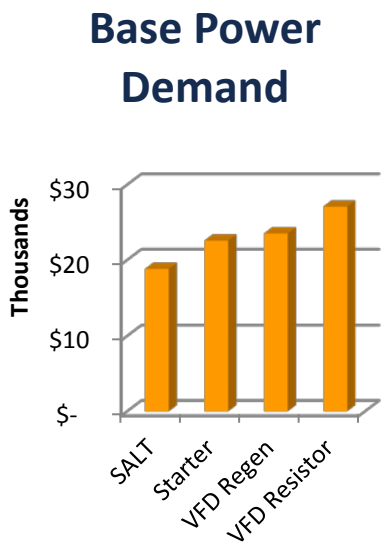
SALT is equipped with an internal control algorithm that determines "pump-off" and varies the speed to match production; further reducing losses in energy efficiency and lowering electrical demand charges. Some power companies now offer rebates for pump-off capability.

SALT eliminates regenerative losses and reduces overall system losses.

Annual savings of $3,154 per well. ROI realized in 18-24months.

Annual Savings Formula:

Savings = $ x kW x % x 8,760



The Savings

A typical beam pump requiring a 40 horsepower motor and 20kW of electrical power to operate Incurs electricity costs of $15,768 per year[2].

The SALT system, however, only requires 16kW to operate, reducing electricity costs to $12,614 per year. This results in an annual savings of $3,154.

Return on investment in a SALT system is realized in less than 18 months from energy savings alone. This does not include the savings that are a result of reduced original power demand.

Other Alternatives

Companies have tried to emulate the SALT success by marketing VFDs that use resistors to dissipate the regenerative energy. Unfortunately, this type of product uses 20-24% more energy than an across-the-line starter and 42% more energy than the SALT system. This leads to increased power costs of $3,784 per year compared to an across-the-line starter and $5,298 per year compared to SALT VFD systems. Resistor-based products are also known to have an increased base electrical demand when compared to other systems.

Another product class, known as regenerative VFDs, convert excessive power back to the grid. Tests have shown that the SALT system saves approximately 25% more electrical power than a regenerative VFD system and incurs 30% less base electrical demand.

Other Features

- SALT is equipped with a four-quadrant control that helps reduce rod compression, rod float, gear box loading and allows operation under four strokes per minute - without the need for gear box oilers or jack shafts.
- SALT will automatically vary the pump speed to match the well's productivity.
- SALT has two torque settings to protect the rods and gear box and to help identify and reduce the harmful effects of waxing, solids, and a stuck pump.
- SALT is easily installed and operator friendly. Physical installation and programming can be accomplished in under 2 hours.
- SALT comes with Modbus RTU standard. Several other protocols are available.
- SALT interfaces with existing Pump-Off controllers to provide a Pump Card.
- SALT is designed for ultra-low harmonics.
- SALT has a 2-year extended warranty that covers all failures – including lightning.

[1] U.S. Patent No. 6414455
[2] Assumes a cost of $0.09 per hWh

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