FLEXLEASING
POWER AND SERVICE

Power: Reliable, Clean, and Simple.

2.5 MW Grid Isolated Microgrid

Case Study

Location: Midland, Texas

Challenge

Expanding oil and gas operations add multi-megawatt (MW) loads to the local utility infrastructure. These megawatts of cyclical and transient demands strain the grid resources. Frequent grid voltage sags and frequency swings cause production equipment shutdowns, driving up operation costs. The expanded production releases increased volumes of wellhead gas which must be gathered and utilized, avoiding flaring, for compliance with the current environmental regulations.

Replacing the utility grid power requires a highly reliable, 24/7, clean power source. The required scheduled maintenance for reciprocating engine gensets forces monthly shutdowns. If the wellhead gas is rich (higher Btu content) or quality inconsistent, the reciprocating engine genset has more unplanned shutdowns and is significantly de-rated due to combustion control issues. When there are genset combustion issues, the power quality (frequency and voltage and phase angle) drops, thus causing operational problems with VFDs driving pumps, ESPs, and other critical equipment.

The producers with unusable wellhead gas, tightening environmental regulations, and an unstable utility grid had to accept increased production cost and frequent equipment repairs due to poor unreliable power.

Solution

The Flex Turbine® from Flex Leasing Power and Service, is built for powering grid isolated microgrids. Its stable, reliable operation on fuel from natural gas to propane (800 Btu/scf to 2500 Btu/scf) has been proven in the harsh conditions of oil patches in North Dakota, Texas, and Canada.

The Flex Turbine delivers high uptime power, requiring only one 8-hour scheduled maintenance per year, even on wet rich gas and H_2S content wellhead gas. The Flex Leasing Power and Service fleet has accumulated over one million operating hours, with proven runtime availability of over 99%. Each Flex Turbine is remotely monitored, 24/7, through a turbine control and data system. Full, 24/7 service coverage is included with any customized lease package.

Flex Leasing Power and Service deploys the modular Flex Turbine to fit the remote power site's needs. Each Flex Turbine has a wide voltage (±10%), frequency (±5%) and phase angle (±3°) tolerance. This wide operating window and embedded controls enables each Flex Turbine to automatically and actively synchronize to other units. Thus, multiple Flex Turbine units operate together seamlessly to run the distributed loads on a microgrid, sharing and shedding power, maintaining stable grid conditions, 24/7.

The cyclical and transient loads do not affect the Flex Turbine performance. Each unit is packaged with the generator braking resistor (GBR) for deploying reserve power and absorbing excess power at the Flex Turbine. The distributed pads on the microgrid see constant, consistent, clean power for ESPs, pump jacks, and pumps, while the GBRs are modulating at the Flex Turbine units to follow the cyclical, transient and spike loads on the isolated grid.

When the producer expands the production and requires more power, additional Flex Turbine units are simply connected to the spare disconnects in the site switchgear, and deployed quickly to run the increased microgrid load. The GBRs automatically operate to maintain the optimum load on each Flex Turbine, so the production loads see steady voltage, frequency, and phase angle.

Using multiple Flex Turbines has built-in redundancy. The microgrid capacity is set up with margin over the maximum peak load scenario. If one unit is shut down, the remaining Flex Turbines increase their output to carry the microgrid load. This microgrid design philosophy provides the automatic backup and adjustments needed so the production equipment is able to operate, 24/7, month after month, without shutdown.

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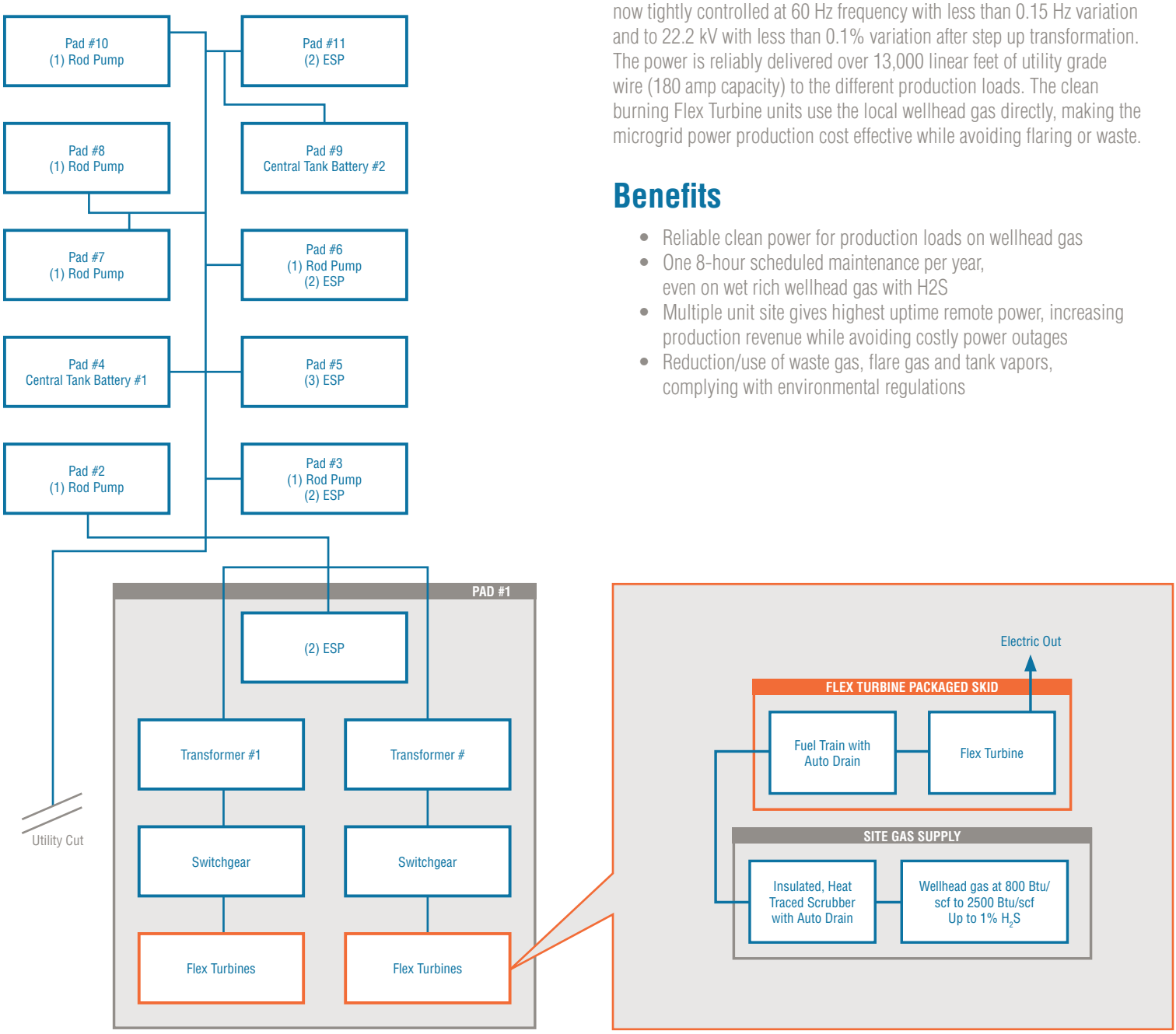
Site Setup

2.5 MW Microgrid Separated from Local Utility Grid, 11 Production Pads – 11 ESPs, 6 Rod Pumps, 2 Central Tank Batteries

The Flex Turbine® is able to use the widest range of oil field gases. The standard system runs on gas with fuel tolerances of 800 Btu/scf to 2500 Btu/scf. The diagrams below illustrate the straightforward connections required to power the microgrid using the existing infrastructure from one pad and the simple connection for each Flex Turbine to use the available wellhead gas.



Results

The Permian oil producer expected their local utility grid voltage for the microgrid site to be tightly regulated at 21.6 kV. The actual utility grid voltage proved to be unstable, dropping to 19 kV and rising to over 23 kV. These wide voltage swings caused numerous equipment shutdowns, especially with the high production flow ESPs which require steady quality power.

The Flex Turbine microgrid has taken the 11 production pads with the combination of ESPs, pump jacks, central tank batteries, and variable speed pumps off the unstable utility grid. The Flex Turbine microgrid voltage is now tightly controlled at 60 Hz frequency with less than 0.15 Hz variation and to 22.2 kV with less than 0.1% variation after step up transformation. The power is reliably delivered over 13,000 linear feet of utility grade wire (180 amp capacity) to the different production loads. The clean burning Flex Turbine units use the local wellhead gas directly, making the microgrid power production cost effective while avoiding flaring or waste.

Benefits

- Reliable clean power for production loads on wellhead gas
- One 8-hour scheduled maintenance per year, even on wet rich wellhead gas with H2S
- Multiple unit site gives highest uptime remote power, increasing production revenue while avoiding costly power outages
- Reduction/use of waste gas, flare gas and tank vapors, complying with environmental regulations

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