

WESTERN **ENERGY SYSTEMS** Power Systems Specialists

Gaseous Fueled Power Generation Systems
Co-Generation • Landfill • BioGas

November 28, 2012

Mr. Ken Ahmann
Colusa Indian Community Council
Colusa, CA
kahmann@colusa-nsn.gov

Re: Quotation – New Generator Set

Dear Ken:

Western Energy Systems (WES) is pleased to submit the following proposal for your new Generator Set project located in the Colusa, CA area. We understand the fuel source to be pipeline natural gas.

This proposal is for one (1) GE Jenbacher JGS 320 engine generator rated at 1059 kW, 480 volt, 3 phase. Jacket Water heat recovery is not included.

Pricing is FOB job site and includes all ocean and inland shipping costs and U.S. Custom duties. The engine is equipped for natural gas operation. The following presents our proposed equipment and services scope, performance and pricing.

1.0 Scope of Equipment and Performance

One (1) JGS 320 engine generator rated at 1059 kW, 480 volt, 3 phase, 1.0PF

- 1.00 Generator Set
 - 1.01 Spark ignited gas engine
 - 1.01.01 Engine design
 - 1.01.02 Engine accessories
 - 1.01.03 Standard tools
 - 1.02 Self-excited self-regulated three phase low voltage generator
 - 1.03 Module accessories
 - 1.03.01 Engine jacket water system
 - 1.03.02 Automatic lube oil replenishing system incl. extension tank (300 liter)
 - 1.05 Gas train (1.2 -2.9 psi; minimum LHV as specified in this quote)
 - 1.07 Painting
 - 1.11 Engine generator control panel – DIANE XT incl. single synchronizing
 - 1.11.03 Remote Data Transfer with DIANE XT
 - 1.20.01 Starting system



JW Heat Recovery HEX not included in this quotation.

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- 1.20.03 Electric jacket water preheating
- 1.20.04 Flexible connections
- 5.01 Limits of delivery
- 5.02 Factory tests
- 5.03 Documentation

Generator set ratings

J 320 93°F ambient temperature up at sea level. Above 93F unit will derate 0.89% per deg F until 104F when it will derate 1.11% for every deg F thereafter.

Additional GE/Jenbacher Supplied Equipment and Services:

1. Vibration Sensor
2. Seismic 4 Restraints
3. C/Ts for Measurement and Protection
4. Generator Condensation Heaters
5. Low voltage switchgear (480/600V) with UL certification including breaker

Additional Western Energy Supplied Equipment and Services supplied loose:

6. Pump Braid
7. Expansion Tank H/T 40 gallon and L/T 24 gallon John Wood with pressure reducing valve, air/water separator, and seismic clips.
8. Thermostatic Valves H/T FPE 2.5" AF2510-155 and L/T FPE 2.0" AF2012-140
9. Circulation pump L/T 5hp, 110gpm, and 70 ft TDH.
10. Motor disconnects, non-fused, for pump and radiator
11. Initial Lube Oil Fill
12. 100 OPH service interval
13. Startup and commissioning services
14. Field Follow Services
15. Technical support services
16. Training on site

System Performance

Ratings are per ISO-ICFN continuous power with the following standard reference conditions

- Barometric pressure 14.5 PSI,
or 328 feet above sea level
- Air temperature 77 ° F
- Relative humidity 30 %

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Jenbacher JGS 320 System Performance and Guarantees		
Electric Output	1059 kW @ 480 volt, 3 phase 60 Hz, 1.0 PF	0% tolerance
Fuel Input-	9,482,000 BTU/HR @ LHV of 868 BTU/CF	+5% tolerance
Electric efficiency	38.1%	-5% tolerance

Guaranteed Emissions Limits Per Engine At Startup (natural gas)	
Emission	Untreated
NOx	0.6 grams/bhp-hr
CO	2.5 grams/bhp-hr
NMHC	0.43 grams/bhp-hr

NOTE:

The above technical information and guarantees are based on the gas analysis provided.

The GE Jenbacher equipment is proposed with GE’s standard limited (1) year warranty.

1.3 General Specifications of the Type 3 Engine Generator Package

- a. GE Jenbacher JGS 320 four (4) stroke LEANOX® gas engines incorporate state of the art technology, are designed specifically for gaseous fueled, stationary non-intermittent operation, and are characterized by extremely high degrees of efficiency, low exhaust gas emission rates, durability and a high level of reliability.
- b. GE Jenbacher generator sets are highly efficient machines. The **JGS 320** exhibits an electrical efficiency of 38.1% on natural gas.
- c. A single piece crankcase and cylinder block constructed of a special high tensile casting with individual removable crankcase covers for inspection of the crankshaft, connecting rod, and crankshaft bearings.
- d. A drop-forged precision ground, surface hardened, statically and dynamically balanced crankshaft with drilled oil passages for pressurized lubrication of connecting rods. Main crankshaft bearings are high quality, three-component friction bearings.
- e. Pistons are of single piece, light metal alloy construction with piston ring carriers and oil passages for cooling. Individually replaceable wet cylinder liners are of chromium alloy gray cast iron construction. Engine piston and liner technology incorporates a scraper ring integrated in the cylinder liner. This design prevents carbon deposit on the piston crown, improves combustion and engine performance, provides stabilized lube oil consumption, reduces the risk of piston seizures, leads to reduced piston skirt, crown, and cylinder liner wear, and improves partial load performance. Connecting rods are of drop forged, heat treated design with diagonally split, serrated crankshaft journal ends for high load bearing capacity.
- f. The engine incorporates individual, water cooled four (4) valve crossflow cylinder heads. Valve seats, valve guides, and spark plug sleeves are individually replaceable.
- g. The valve train camshaft, with replaceable bushings, is driven off the crankshaft intermediate gear train and splash lubricated via the rocker arms.

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- h. The combustion air-fuel gas system includes a GE Jenbacher designed and engine mounted gas mixer featuring low-pressure losses and high efficiency at full load operation. The motorized carburetor adjusts automatically according to fuel characteristics and is integrated into the engine control system.
- i. The exhaust gas system includes a dry exhaust manifold, easily accessible for maintenance, and individual cylinder thermocouples. High efficiency turbochargers with electronically controlled turbocharger bypass valves. The electronic bypass valve provides for dynamic control throughout the operating range including isolated operations. This results in improved capacity for load add-load shed during varying load conditions.
- j. LEANOX® lean mixture combustion controls, developed and patented by GE Jenbacher, guarantees the correct air/gas ratio throughout operating ranges in order to provide lowest achievable gas emission rates while enabling stable engine performance at the same time.
- k. Microprocessor controlled ignition systems are connected from the engine to the GE Jenbacher DI.ANE control system via CAN bus. Firing points can be controlled and directed depending upon operating conditions and/or the type fuel used.
- l. Knock control systems are integrated between engine and DI.ANE controls to adjust engine performance and provide system protection through a series of specific firing point, engine output, and fuel mixture temperature controls.
- m. Engine-generator sets are skid mounted on heavy-duty base frames and provided with integral vibration isolation between the engine-generator assembly and the base frame. Machinery isolation pads are shipped loose for installation between the base and foundation.
- n. Engine jacket water preheating systems will be preinstalled with isolation valves.
- o. Electric starters are provided with engine starting batteries, battery racks, battery cables, and float-equalize battery chargers shipped loose for installation by others.
- p. The engine lube oil system includes a gear-type oil pump; pressure control valve, pressure relief valve, and full flow lube oil filters. Lube oil level inspection gauges will be installed with a float valve, minimum/maximum level switches, and a sight glass.

1.4 DIA.NE XT Engine Generator Control System

- 1. The GE Jenbacher generator set is equipped with a DIA.NE XT controls system. This systems works in conjunction with GE patented LEAN NOX® emission control system to provide stable engine operation while maintaining NOx emissions. The system works with the owners supplied electrical equipment, i.e. breakers, MCC panel and switchgear. Installation, wire, cables, and terminations are by others. Below is a typical controls sequence utilizing the DIA.NE XT control system and customer's electrical equipment.

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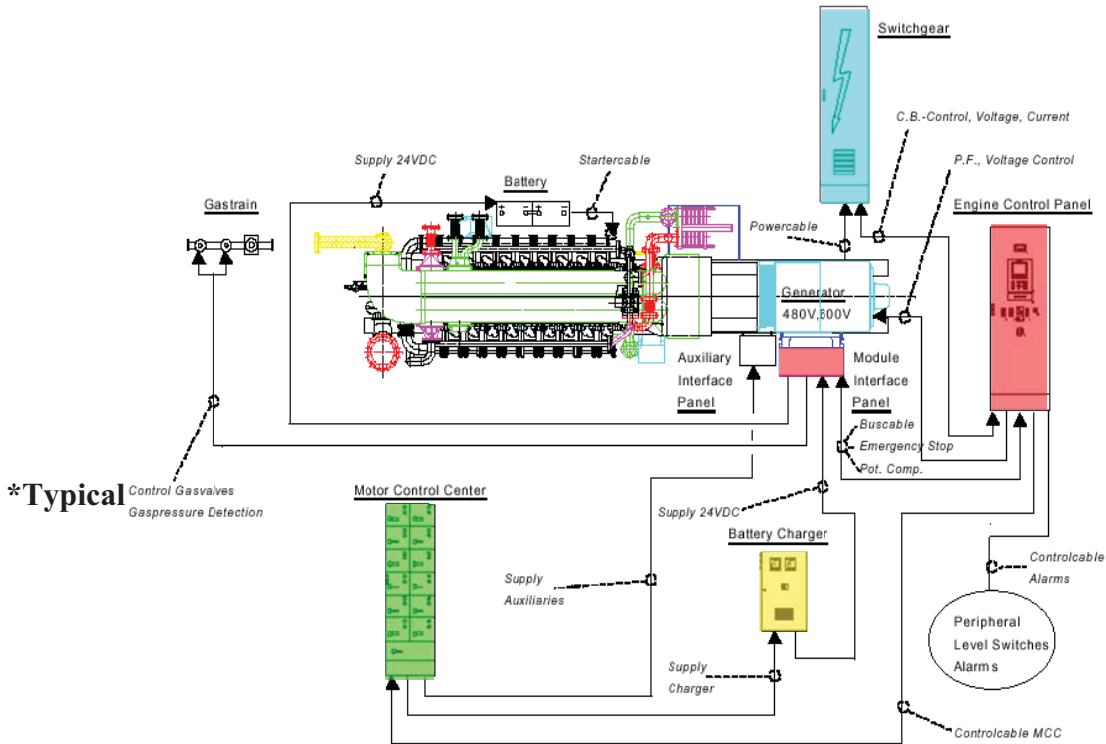
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1.5 DIA.NE XT Engine Generator Control System

The DIA.NE (Dialog-Network) freestanding control panel provides an engine-generator management system featuring a membrane touchpad display for interface and operation of the generator set equipment.

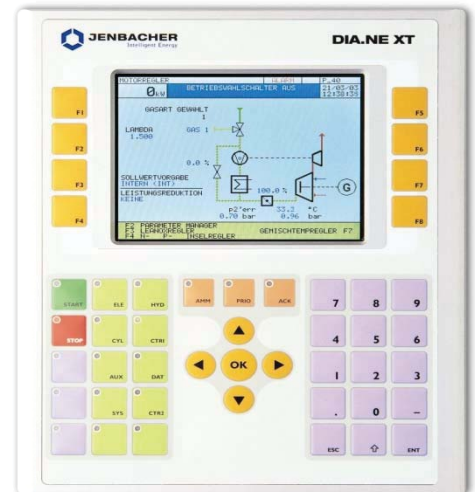
The DIA.NE system includes:

- Central engine and control module.
- An industrial grade computer with 5.7" VGA TFT color graphics display, 10 function keys, display selection keys, 10-key numeric keyboard for input of operating parameters, auxiliary keys for START, STOP, lamp test, and special functions. A RS485 serial port interfaces to the central computer and multi-transducer.

Dimensions for the DIA.NE panel are 87" high x 32" wide x 24" deep.

Main displays available from the DIA.NE panel include:

- Generator set interconnection electrical values:



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- Phase current
- Neutral current
- Voltage (Phase-to-Phase and Phase-to-Neutral)
- Active power
- Reactive power
- Apparent power
- Power factor
- Frequency

(Options are available for generator winding temperature and generator bearing temperature display.)

- Engine oil pressure and temperature
- Jacket water circuit pressure and temperature
- Exhaust gas temperatures
- Engine controller
- Auxiliary PID controller
- Auxiliary status
- Operational data such as operating hours, service hours, number of starts, active power demand (kWh), reactive power demand (kVArh), and measured values required for the operational logbook.
- System set-up
- Graphical data logging and trending for up to sixteen (16) measured values
 - Long term trending of data for 30 second intervals up to one (1) month duration
 - Short term trending provides data for troubleshooting
- PLC base central engine management which controls the following:
 - Speed control in no load and isolated operation
 - Power output control in a parallel operation.
 - LEANOX® control system for control of boost pressure relative to generator terminal output and fuel mixture temperature via the GE Jenbacher engine driven air-gas mixer.
 - Knocking controls enable adjustment of the ignition point, power output, and potentially the mixture temperature in the event of a knocking condition.
 - Proportional power reduction as a result of a fault
 - Generator set logic control
 - Generator monitoring of up to eight (8) functions simultaneously:
 - Overload/short-circuit [51], [50]
 - Over voltage [27]
 - Undervoltage [59]
 - Asymmetric voltage [64], [59N]
 - Unbalance current [46]
 - Failure Excitation [40]
 - Overfrequency [81>]
 - Underfrequency [81<]
- One (1) position lockable operation mode selector switch
 - “OFF”- Unit is disabled
 - “MANUAL”- unit is manually operable

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- “AUTOMATIC”- Full automatic operation is enabled via remote signal. A remote stop is enabled with a cooldown period following signal. Auxiliary equipment will continue to operate for a period following engine shutdown.
- One (1) position demand switch
 - External demand OFF
 - External demand
 - Override external demand
- The following shut down functions are displayed:
 - Low lube oil pressure
 - Low lube oil level
 - High lube oil level
 - High lube oil temperature
 - Low jacket water pressure
 - High jacket water pressure
 - High jacket water temperature
 - Overspeed
 - Emergency stop
 - Gas train failure
 - Start failure
 - Stop failure
 - Engine start blocked
 - Engine operation blocked
 - Misfiring
 - High mixture temperature
 - Measuring signal failure
 - Overload/output signal failure
 - Generator overload/short circuit
 - Generator over/under voltage
 - Generator over/under frequency
 - Generator asymmetric voltage
 - Generator unbalanced power
 - Generator reverse power
 - High generator winding temperature (Optional)
 - Synchronizing failure
 - Knocking failure
- The following alarms are displayed:
 - Low jacket water temperature
 - CPU battery failure
- Operational functions displayed:
 - Ready to start
 - Operation
 - Generator circuit breaker “ON”
- Four (4) auxiliary contacts are available for remote start, shut down, operation, and a common alarm.

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- Additional contacts are optionally available for start/stop controls, thermal processes, and electrical synchronization.

2. Technical Support Services

- a. Development of sequence of electrical operations in association with GE Jenbacher and Colusa for operation of the generator set.
- b. Develop and customize engine, generator, and associated mechanical-electrical equipment drawings for all equipment outlined in this scope. Installation and interface drawings along with technical data will be prepared by others to develop integrated installation and point-to-point wiring diagrams required for installation of equipment.
- c. Coordinate with and provide engineering assistance for integration of the DIA.NE XT
- d. Provide emissions data and support for air permitting and certified emission testing (by others)
- e. Develop and customize DIA.NE panel operating systems for site specific conditions and parameters.
- f. Develop and provide one (1) set of submittal documentation in hard copy and CD format for review by construction managers and sub-contractors.
- g. Develop and provide one (1) set of as-built documentation, following final startup and commissioning, in hard copy and CD format for the owners use.

3. Startup and Commissioning and Training Services

WES and GE Jenbacher will jointly provide startup and commissioning services. Startup personnel will include a factory startup engineer and service technician provided by WES. Services will be scheduled after receipt of completed installation checklists. A complete startup and commissioning work scope will be provided 14 days prior to start up date. Startup and commissioning will include all required travel and lodging. Eight (8) hours of on-site training for the plant operator is also included and will immediately follow commissioning.

4. Commercial Proposal

All prices are quoted F.O.B. jobsite on a truck with rigging and removal required by others. No provisions are made for local sale taxes, bonds, permits, or fees. The following presents our clarifications and exceptions.

4.1 Clarifications & Exceptions

1. WES/GE Jenbacher supplied equipment will have a one year warranty manufacturer limited warranty.
2. WES will provide complete shop drawings and equipment data sheets 70 days after receipt of approved purchase order.
3. Proposal does not include radiator, utility interconnection switchgear, or exhaust aftertreatment. Jenbacher's very low raw gas emissions may meet your specific local requirements.

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All prices are FOB jobsite with rigging and removal by others. Price is valid for 90 days. All US Customs duties are pre-paid. Local, state, and Federal taxes, permits and fees are by others. Delivery is 6-7 months after date of order.

We sincerely appreciate the opportunity to submit this proposal for your review. Jenbacher is one of the world's leading manufacturers of gaseous fueled engines with over 6,000 in operation worldwide. As part of the Penn Detroit Diesel organization, Northeast Energy Systems brings over 50 years of experience in reciprocating engine power applications and product support and services. If you have any questions please don't hesitate to call me at 619-741-4088 or email shall@weesys.com. WES looks forward to working with Colusa on this exciting project.

Sincerely Yours

Steven Hall
Sales Engineer
Western Energy Systems

cc Fred Farrand, National Sales Manager
cc Al Clark, President and General Manager

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