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NATURAL RESOURCES

Meeting Power Requirements in the Eagle Ford Shale

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Purpose and Agenda

Purpose of Presentation: Discussion for the Gas/Electric Partnership attendees regarding the nature and scope of the power supply challenges Pioneer faces in the Eagle Ford development, the power supply options we are assessing and testing, and what our experiences could mean for other similarly situated oil & gas operators in the Eagle Ford trend.

Agenda:

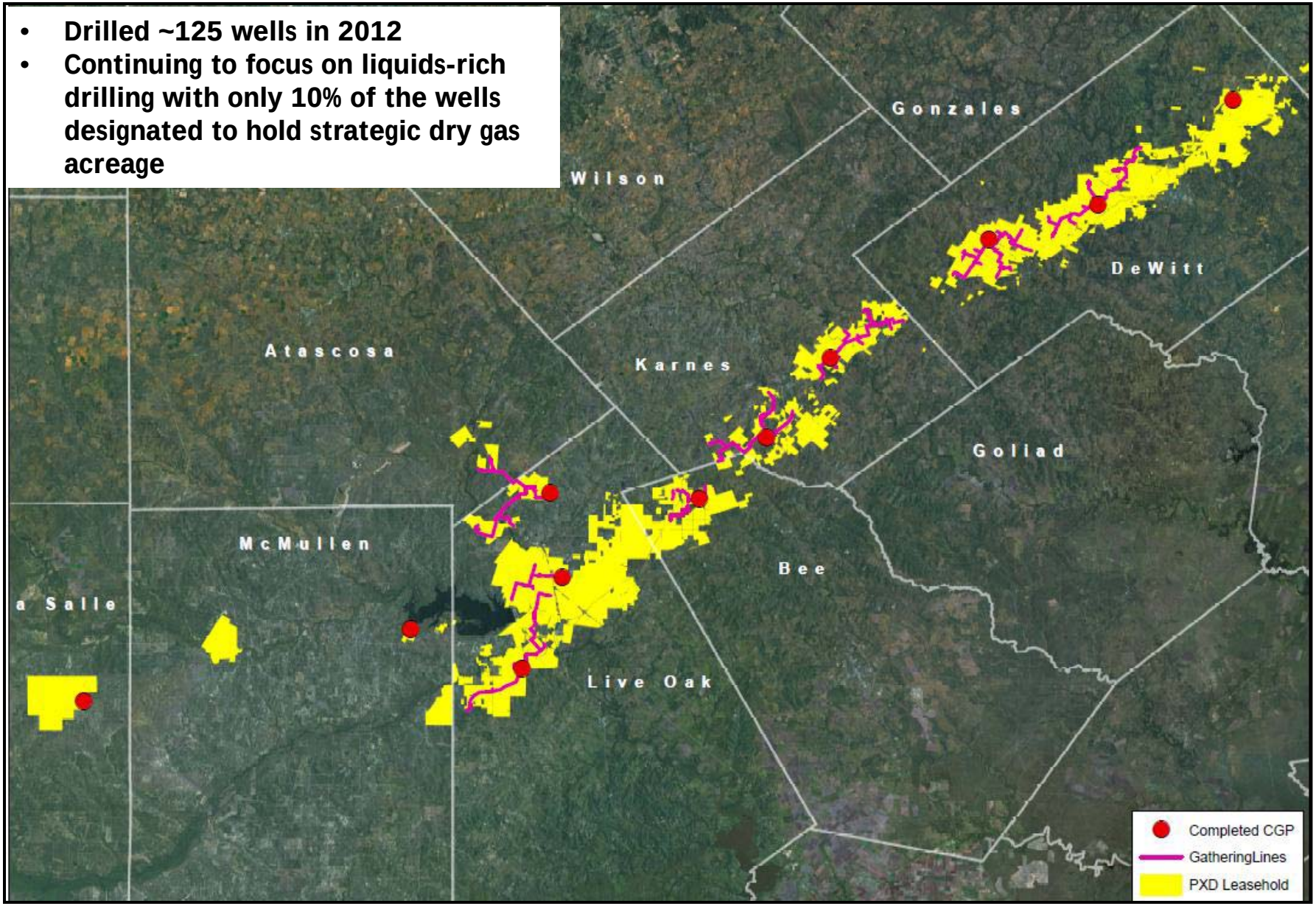
- **Pioneer Area of Operations**

- **Nature of Pioneer Eagle Ford Loads for:**
  - Central Gathering Point ("CGP") Facilities – Gas Processing at Market Sales Points
  - Artificial Lift for Wells (Initial Phase)
  - Compressors – Well Production Assistance and Transportation

- **Power Supply Options Under Consideration (Advantages and Disadvantages):**
  - Generators:
    - Diesel-Fueled Conventional Genset
    - Natural Gas-Fueled Conventional Genset
    - Natural Gas-Fueled Microturbine Genset
    - Natural Gas-Fueled Engine
  - Commercial Power

Pioneer Area of Operations

- **Drilled ~125 wells in 2012**
- **Continuing to focus on liquids-rich drilling with only 10% of the wells designated to hold strategic dry gas acreage**



Nature of Pioneer Eagle Ford Loads

- **Central Gathering Point ("CGP") Facilities**
  - CGPs are used for processing and separation of hydrocarbon product prior to delivery to market
  - Processing needs are difficult to predict until gas composition is known
  - Typical load for 1 CGP = ~150 KW

- **Artificial Lift ("AL") for Wells (Initial Phase)**
  - Motor-driven beam pumping units used for lifting oil, condensate, and water
  - Typical AL motor size for 1 well = Nominal (60-75 HP); Actual (30-50 HP)
  - Gas lift options are under consideration (reservoir behavior will dictate requirements)

- **Compressors**
  - Reciprocating natural gas-fueled engines are preferred driver for compressors
  - Compressors are used for:
    - Gas production assistance = inlet compression
    - Transportation = off-gas compression to pipeline
  - Typical size for 1 compressor = Nominal 500-1,500 HP
  - Air emission requirements may limit use of engine-driven compression in the future

Gensets

Gensets are generally a higher cost alternative to commercial power

1. **Conventional diesel-fueled genset (Bridge to a More Economic Alternative)**
   - Readily available, reliable
   - High maintenance burden
   - Fuel cost is exorbitant

2. **Conventional natural gas-fueled genset**
   - Readily available, generally reliable
   - Fuel cost is lower than diesel but fuel composition must be considered
     - Non-spec NGL with limited market value can be an economically attractive fuel source (must be vaporized through pre-heating)
     - Increased altitude above sea level results in deration of genset capacity

3. **Natural gas-fueled microturbine**
   - Readily available but fairly new technology
   - Waste heat can be captured for beneficial purposes
   - No deration for rich fuel (altitude and air inlet temperature affect performance)
     - Nominal output based on 59°F at sea level
   - Cannot serve dynamically varying loads
   - Battery reliability issues are a problem with multiple-module units

Microturbine Spec Sheet

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- High electrical efficiency over a very wide operating range
- Low maintenance air bearings require no lube oil or coolant
- Ultra-low emissions
- High availability – part load redundancy
- Proven technology with tens of millions of operating hours
- Integrated utility synchronization and protection with a modular design
- 5 and 9 year factory protection plans available
- Remote monitoring and diagnostic capabilities
- Internal fuel gas compressor available for low fuel pressure Natural Gas applications

C1000 Power Package

Electrical Performance[1]	
Electrical Power Output	1000kW
Voltage	400 to 480 VAC
Electrical Service	3-Phase, 4 wire
Frequency	50/60 Hz, grid connect operation 10-60 Hz, stand alone operation
Maximum Output Current	1,450A RMS @ 400V, grid connect operation 1,200A RMS @ 480V, grid connect operation 1,550A RMS, stand alone operation[2]
Electrical Efficiency LHV	33%

Fuel/Engine Characteristics[1]	
Natural Gas HHV	30.7 to 47.5 MJ/m³ (825 to 1,275 BTU/scf)
Inlet Pressure[3]	517-552 kPa gauge (75-80 psig)
Fuel Flow HHV	12,000 MJ/hr (11,400,000 BTU/hr)
Net Heat Rate LHV	10.9 MJ/kWh (10,300 BTU/kWh)

Exhaust Characteristics[1]	Standard	CARB Version
NOx Emissions @ 15% O_2[4]	9 ppmvd (18 mg/m³)	4 ppmvd (8 mg/m³)
NOx/Electrical Output[4]	0.14 g/bhp-hr (0.4 lb/MWhe)	0.05 g/bhp-hr (0.14 lb/MWhe)
Exhaust Gas Flow	6.7 kg/s (14.7 lbm/s)	6.7 kg/s (14.7 lbm/s)
Exhaust Gas Temperature	280°C (535°F)	280°C (535°F)
Exhaust Energy	7,100 MJ/hr (6,750,000 BTU/hr)	7,100 MJ/hr (6,750,000 BTU/hr)

Microturbine Deration Table

Performance for EagleFord Shale

Site performance based on 500 ft elevation

C65					
Ambient Temp	65 °F	75 °F	87 °F	95 °F	105 °F
Output Power	65 kW	62 kW	57 kW	55 kW	52 kW

C200					
Ambient Temp	65 °F	75 °F	87 °F	95 °F	105 °F
Output Power	200 kW	194 kW	182kW	174 kW	165 kW

C600					
Ambient Temp	65 °F	75 °F	87 °F	95 °F	105 °F
Output Power	600 kW	584 kW	546 kW	523 kW	495 kW

C800					
Ambient Temp	65 °F	75 °F	87 °F	95 °F	105 °F
Output Power	800 kW	779 kW	729 kW	698 kW	660 kW

C1000					
Ambient Temp	65 °F	75 °F	87 °F	95 °F	105 °F
Output Power	1000	974 kW	911 kW	872 kW	825 kW

Note: Values are nominal power output for a high pressure natural gas system at the stated elevation.

Pioneer Microturbine Performance Data

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Facility Name	Unit #	Model	Heat Rate (MMBtu per MWh)	Nominal Capacity @ Sea Level & 59°F (kW)	Derated Capacity @ 500' & 105°F (kW)	Energy Generated Annually (kWh)	Average Generator Power Output (kW)	Generator Power Output as a % of Derated Capacity (%)	Generator Capital Cost Amortized over 20 Years ($/kWh)	Periodic Generator Maintenance Cost ($/kWh)	Approx. Fuel Cost ($/MMBtu)	Approx. Fuel Component of Energy Cost ($/kWh)	Total Unit Cost of Energy ($/kWh)
CGP 31	1	C1000	10.3	1000	825	1,366,560	156	18.9%	$0.048	$0.029	$6.00	$0.062	$0.139
CGP 31	2	C1000	10.3	1000	825	1,410,360	161	19.5%	$0.046	$0.028	$6.00	$0.062	$0.136
CGP 31	3	C1000	10.3	1000	825	1,252,680	143	17.3%	$0.052	$0.032	$6.00	$0.062	$0.146
CGP 41	1	C1000	10.3	1000	825	2,260,080	258	31.3%	$0.029	$0.018	$6.00	$0.062	$0.108
CGP 51	2	C1000	10.3	1000	825	1,147,560	131	15.9%	$0.057	$0.035	$6.00	$0.062	$0.153
CGP 52	2	C1000	10.3	1000	825	981,120	112	13.6%	$0.066	$0.041	$6.00	$0.062	$0.169
CGP 81	2	C1000	10.3	1000	825	793,455	91	11.0%	$0.082	$0.050	$6.00	$0.062	$0.194
Pawnee Office	1	C1000	10.3	1000	825	536,112	61	7.4%	$0.121	$0.075	$3.25	$0.033	$0.229
Pawnee Office	2	C1000	10.3	1000	825	560,640	64	7.8%	$0.116	$0.071	$3.25	$0.033	$0.221
Pawnee Office	3	C1000	10.3	1000	825	559,202	64	7.7%	$0.116	$0.072	$3.25	$0.033	$0.221

Engines

Engines are also generally a higher cost alternative to commercial power. Suitable for an asset where the loads do not have to be motor-driven.

1. **Natural gas-fired engine**
   - Readily available and relatively low cost
   - No deration for rich fuel (altitude affects performance)
     - Fuel inlet pressure must be varied to accommodate differing Btu content of fuel
   - Higher noise emissions relative to gensets and motors
   - Engines cannot tolerate a wide range of loading (will run poorly outside optimal range)
   - Engines must run at least 30 minutes between starts in order to avoid excessive burden on battery
   - Gas engines are not inferior to gensets!

Engine Spec Sheet

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SPECIFICATIONS	2 CYCLE ENGINE
Model	L-795
Rated continuous HP at max continuous RPM	65 HP 600 RPM 45 KW
Bore & stroke (mm)	7 1/2"x9" (190.5x228.6)
Displacement (liters)	795 C.I. (13.0)
Compression ratio	5.3:1
RPM range	300-600
WR² (Kg-M2)	1750
P.T.O. shaft size (mm)	3" (76.2)
Oil capacity (liters)	7 gal.* (26.5)
Water capacity (liters)	14 gal. (53)
Spark plug size	7/8"-18
Exhaust connection	
Fuel gas pipe size	1" NPT
Mounting bolts: no./size	4-1"
Shipping weight (kg)	4500 (2041)
Truck load quantity	10
Safety controls	Standard: water level, oil temperature, oil pressure & overspeed
Ignition	Solid state standard
Fuel	Gaseous
Fuel system	Impco type carburetor
Lubrication	Full pressure
Filtration - oil	Replaceable - full flow filter
Clutch - P.T.O.	SPE-114-P1
Starting equipment	12-volt or Air valve std. Air motor opt.

*For oil filter changes add 2 qts.

L-Series 795 Gas Engine

Commercial Power (Lower Cost Source)

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- **Commercial Power Considerations:**
  - Primary Eagle Ford trend commercial power providers to Pioneer:
    - Karnes Electric Cooperative ("KEC")
    - Guadalupe Valley Electric Cooperative ("GVEC")
    - San Patricio Electric Cooperative ("SPEC")
  - Current Eagle Ford trend infrastructure history to date:
    - Pioneer began major operations in 2010
    - Coop infrastructure is limited in capacity (improving)
    - KEC has evolved from 2 electrical crews in 2010 to 22 today
    - GVEC has more resources, construction personnel, and capability in-place
  - Current Coop tariff structures:
    - Coop tariffs are not ideally suited for oil and gas loads:
      - Example 1: KEC 3-Tiered energy cost structure penalizes stand-by motor capacity
      - Example 2: Coops do not recognize flat oil and gas load shape
        - » (ERCOT flat profile for scalar loads exists [BUSOGFLT profile segment] but is not recognized by coops. Coops have been unregulated in Texas since 1995.)
    - Coop policies are often cumbersome

Initial 10 Billing Months of Pioneer Commercial Load

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Karnes Electric Cooperative: (Pioneer Actual Demand 133 KW [1 CGP] as of July 2011)

Basic Charge ($/Mo)	Installed HP for Billing Purposes	Unit Demand Charge ($/Inst HP)	Metered Energy Usage (kWh)	Tier 1 Energy Rate ($/kWh)	Energy Potentially Charged at Tier 1 Rate (kWh)	Energy Usage Actually Charged at Tier 1 Rate (kWh)	Tier 2 Energy Rate ($/kWh)	Energy Usage Actually Charged at Tier 2 Rate (kWh)	Tier 3 Energy Rate ($/kWh)	Grand Total Charge ($/Mo)	Unit Cost of Energy ($/kWh)
$25.00	500.0	$2.85	44,800	$0.115984	75,000	44,800	$0.087434	0	$0.058584	$6,259.56	$0.1397
$25.00	500.0	$2.85	51,360	$0.115984	75,000	51,360	$0.087434	0	$0.058584	$7,089.87	$0.1380
$25.00	441.5	$2.85	58,960	$0.115984	66,225	58,960	$0.087434	0	$0.058584	$7,544.57	$0.1280
$25.00	441.5	$2.85	38,960	$0.115984	66,225	38,960	$0.087434	0	$0.058584	$5,856.99	$0.1503
$25.00	441.5	$2.85	50,560	$0.115984	66,225	50,560	$0.087434	0	$0.058584	$6,351.48	$0.1256
$25.00	441.5	$2.85	59,040	$0.115984	66,225	59,040	$0.087434	0	$0.058584	$7,351.39	$0.1245
$25.00	441.5	$2.85	60,640	$0.115984	66,225	60,640	$0.087434	0	$0.058584	$7,270.09	$0.1199
$25.00	441.5	$2.85	79,840	$0.115984	66,225	66,225	$0.087434	13,615	$0.058584	$8,644.84	$0.1083
$25.00	441.5	$2.85	76,240	$0.115984	66,225	66,225	$0.087434	10,015	$0.058584	$8,062.33	$0.1057
$25.00	441.5	$2.85	70,240	$0.115984	66,225	66,225	$0.087434	4,015	$0.058584	$7,418.80	$0.1056

Lessons Learned

- It's easy to end up oversizing your equipment requirements
- Oversized electric load requirements result in higher costs paid to commercial power suppliers and longer delays to receive service
- When you're developing areas with unknown reservoir characteristics, it's difficult to make the perfect load service decision the first time
- Be prepared to adapt your operations as conditions change but don't wait until all data are known before making a commitment to do something
- Expect to wait at least 6 months from notice date to receive commercial power supply
- Commercial power costs imposed by the cooperatives are rarely competitive
- Excess or oversized motor capacity will almost always result in higher cost for commercial power
- Try to redeploy excess or oversized equipment and generation capacity at other development sites before your development plans are complete and there is no other place to put them
- Consultants often recommend more capacity than you need

QUESTIONS?