OPERATING A RIG ON ELECTRIC POWER IN ELK CITY, OK

ABE DABBS
AADE, OKC
11 FEB 2015
RIG OPERATION ON UTILITY POWER

Operation Video

2518 MWH hours, 155 Days, 272k gallons of diesel avoided, $650k saved
Apache 20-11-21
- Marmaton Wash
- 12960 TVD
- 4880 Lateral
- 18500 TD

Apache 21-11-21
- Marmaton Wash
- 13010 TVD
- 4880 Lateral
- 17720 TD
BACKGROUND

Original Pad design

2 Drilling Rigs to be operated simultaneously on PSO utility power.

Cactus 135 batched drilled 2 wells on the Elk City pad site from March 10th to August 11th 2014
CACTUS 135

Rig Layout
ELECTRIC INFRASTRUCTURE

- Transfer Switch between grid power and diesel engine power
- Power Supply/Harmonic Filter/metering equipment
- Elk City easement, new build Apache poles
- Dedicated high line circuit for rig power
PROTECTIVE EQUIPMENT
TRANSFER SWITCH ONE-LINE

Source

Generators

Power Supply 600V

Switch

G1
G2
G3
U1
U2
U3

Load

SCR G1
SCR G2
SCR G3
**Metering and Fuel Tracking**

**kW vs. kWh**

kW is *power*, the rate at which energy is generated or used (MPH, joules/second, etc.)

kWh is *energy*, fuel contained or consumed (Calorie, BTU, gallon of diesel, etc.)

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The image shows a close-up of an electricity meter. The meter displays the following information:

- **Multifunction Meter**
- **FITZALL™**
- **General Electric kV**
- **Model KV2c**
- **Address:** AEP-GNNA1
- **Serial Number:** V9D454092963GNNA1
- **USA 0312 E5**
- **Indicator:** 454092963

The meter also provides the following details:

- **Multiplier:** 2800
- **VTR:** 70:1
- **CTR:** 200:5
- **Service Element:** 4Y, 3, 3N, 3W, 2N, 2W
- **Service:** CL20
- **Voltage:** 120-480V
- **Transformer:** 4W
- **Amperage:** TA 2.5
- **Kilovolt-Ampere:** Kt 0.3

The text highlights:

- Indicates Top Row
- Indicates Middle Row
- Indicates Bottom Row
- Multiplier to get KWH
POWER USAGE

[Graph showing power usage over time with labels for KWH and Diesel]
COSTS SAVED VS. DIESEL

Graph showing costs over time with labels for 'Rigging up', 'Running Diesel', and 'Rigging down'.
PSO ENERGY MIX

PSO FACT SHEET - 2014
(Date for Public Service Company of Oklahoma as of December 31, 2013)

Operating Information
Total customers: 536,000
- Residential: 462,000
- Commercial: 62,000
- Industrial: 6,500
- Other: 7,500

2013 electric sales in megawatt-hours: 11,238,394
Average use per residential customer: 10,902 kilowatt-hours per year
Average cost per kilowatt-hour (residential): 8.4 cents
System peak: 4,419 megawatts (August 2012)
Size of service area: 30,000 square miles
Cries and towns served: 232
Population of service area: 1.9 million
Plant in service: 4.2 billion
Size of distribution system: 22,193 miles
Size of transmission system: 3,818 miles
Total number of Oklahoma employees: 1,300

2013 Financial Information
Operating Revenues: $1,295.2 million
Net Income for Common: $ 97.8 million
State and Local Taxes paid: $ 46.5 million
Franchise fees paid: $ 17.5 million

PSO Generating Stations
<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th># units operating</th>
<th>Total megawatt (MW) capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tulsa Power Station</td>
<td>Tulsa</td>
<td>2</td>
<td>309</td>
</tr>
<tr>
<td>Northeastern Station Units 1 &amp; 2</td>
<td>Okmulgee</td>
<td>2</td>
<td>684</td>
</tr>
<tr>
<td>Northeastern Station Units 3 &amp; 4</td>
<td>Okmulgee</td>
<td>2</td>
<td>941</td>
</tr>
<tr>
<td>Riverside</td>
<td>Jenks</td>
<td>4</td>
<td>1,048</td>
</tr>
<tr>
<td>Comanche</td>
<td>Lawton</td>
<td>1</td>
<td>241</td>
</tr>
<tr>
<td>Weleetka</td>
<td>Weleetka</td>
<td>3</td>
<td>155</td>
</tr>
<tr>
<td>Southwestern Station</td>
<td>Anadarko</td>
<td>5</td>
<td>913</td>
</tr>
<tr>
<td>Oklahoma (PSO’s share)</td>
<td>Vernon, TX</td>
<td>1</td>
<td>102</td>
</tr>
<tr>
<td>Total generating capacity</td>
<td></td>
<td></td>
<td>4,274 MW</td>
</tr>
</tbody>
</table>

PSO Energy Mix
Natural Gas: 25%
Coal: 40%
Wind: 15%
Purchased Power: 20%
Total: 100%
*Wind generation under long-term contract: 680 MW

PSO General Office
212 E. Sixth St., Tulsa, OK 74119 | Customer Service 1-888-216-3523
GREENHOUSE GAS (GHG) EMISSIONS

\[
GHG_{\text{Project genset}} = \int \text{Avoided Fuel Rate (L/s)} \, dt \times 1 \text{m}^3 / 1000 \text{L} \times 2.808 \text{tCO}_2e / \text{m}^3
\]

\[
GHG_{\text{Project High-line}} = \int \text{HighLinePower (kW)} \, dt (\text{hours}) \times 1 \text{MWh} / 1000 \text{kWh} \times 0.88 \text{tCO}_2e / \text{MWh}
\]

<table>
<thead>
<tr>
<th></th>
<th>(t CO\textsubscript{2}e / 6 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
</tr>
<tr>
<td>B 6 Electricity Supplied by Diesel-Fuelled Generator</td>
<td>0.00178</td>
</tr>
<tr>
<td>( \sum ) Emissions Baseline</td>
<td>0.00178</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td></td>
</tr>
<tr>
<td>P 6 Electricity from Grid</td>
<td>0.00158</td>
</tr>
<tr>
<td>( \sum ) Emissions Project</td>
<td>0.00158</td>
</tr>
<tr>
<td><strong>Net GHG Reduction</strong> = <strong>Baseline</strong> – <strong>Project</strong></td>
<td>0.00020</td>
</tr>
</tbody>
</table>

Assuming 155 days of drilling operations at 95% utility uptime, the rig reduced GHG emissions by 424 tonnes CO\textsubscript{2}. 
Must remain below the Border Line of Visibility (Exhibit 1), can be permitted to above the Border Line of Visibility unless complaints from other customers are received as long as it does not exceed Border Line of Irritation.

Corrective action must be taken within two (2) hours after notice.
# DEMAND RESPONSE PROGRAMS

- Peak demand reduction through curtail of electric load
- Provides benefits to electric customers who can reduce electric rate (power) during demand reduction events

**PSO Peak Performers Program**
- 2hr – 4hr events
- $32/kW reduction

## ESTIMATE OF SAVING NOT ACTUAL ECONOMICS BASED ON 2014 NUMBERS

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual kWh</th>
<th>Highest Peak Demand</th>
<th>Potential Incentive Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Aug-14</td>
<td>190,400</td>
<td>978</td>
<td>$296</td>
</tr>
<tr>
<td>Jul-14</td>
<td>576,800</td>
<td>1,066</td>
<td>$3112</td>
</tr>
<tr>
<td>Jun-14</td>
<td>473,200</td>
<td>1,066</td>
<td>$43112</td>
</tr>
<tr>
<td>May-14</td>
<td>344,400</td>
<td>961</td>
<td>$30752</td>
</tr>
<tr>
<td>Apr-14</td>
<td>112,000</td>
<td>1,523</td>
<td>$48736</td>
</tr>
<tr>
<td>Mar-14</td>
<td>375,200</td>
<td>1,306</td>
<td>$41792</td>
</tr>
<tr>
<td>Feb-14</td>
<td>389,200</td>
<td>873</td>
<td>$27936</td>
</tr>
<tr>
<td>Total kWh</td>
<td>2,461,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection for annual kWh Total</td>
<td>4,219,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average kW/month</td>
<td>1,110</td>
<td>35520</td>
<td>17760</td>
</tr>
</tbody>
</table>
PRODUCTION
QUESTIONS?
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