Solar Powered Pumps and Microturbine Generators

Lessons Learned from Natural Gas STAR

Producers and Processors Technology Transfer Workshop

New Mexico Oil and Gas Association and EPA's Natural Gas STAR Program
Farmington, NM
February 21, 2006

1

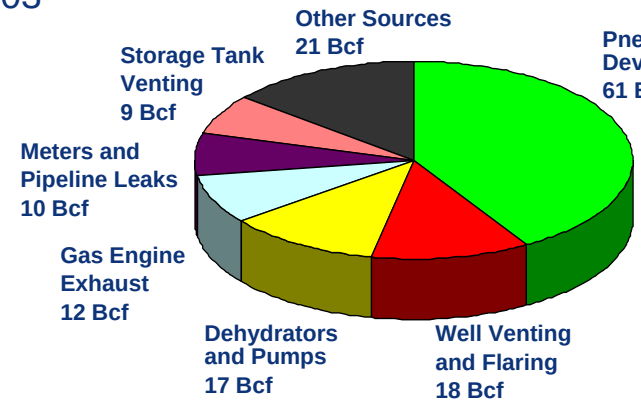
Agenda

- Solar Powered Pumps
  - Methane Losses
  - Methane Recovery
  - Industry Experience
- Microturbine Generators
  - Methane Losses
  - Methane Recovery
  - Industry Experience
- Discussion Questions

2

Dehydrators and Chemical Injection Pumps: Methane Losses

- Dehydrators and chemical injection pumps contributed over 17 Bcf of methane emissions in 2003



Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2003

3

Methane Recovery: Replace Dehydrators with Methanol Injection

- Gas hydrate formation presents a serious problem to gas pipelines
- Hydrate formation can be avoided by removing water (dehydration) or lowering water's dew point (inhibition)
- Glycol dehydrators may not operate effectively at low temperatures
  - Methanol injection can be a more simple cost-effective method for managing hydrate formation problems

4

Methanol Injection Pumps

- Chemical injection pumps are used to inject methanol and other chemicals at the well site
- Injection pumps are often gas-powered at remote production locations
  - Solar injection pumps can replace gas-powered pumps to save gas losses, reduce methane emissions
- Solar injection pumps can handle a range of throughputs and injection pressures
  - Max output 38 – 100 gallons per day[1]
  - Max injection pressure 1200 – 3000 psig[1]

1 - Values based on various SunPumper injection pump models

5

Solar Powered Chemical Injection Pump Applications

- Methanol injection for hydrate inhibition
- Foaming agent injection to reduce well unloading
- Corrosion inhibitor injection
- O_2/H_2S Scavenger injection

6

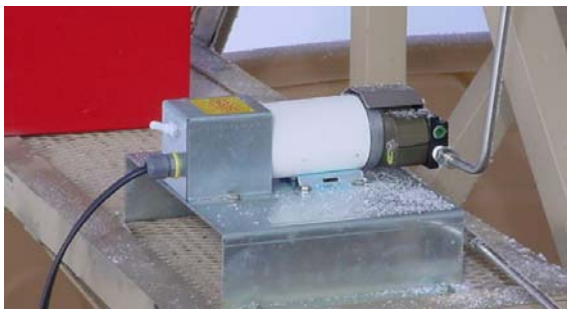
Industry Experience: Western Gas Resources

- Cold winter temperatures and low gathering pressure led to hydrate formation and downtime when glycol pumps froze up
- Solar powered methanol injection pumps were installed at 70+ locations

7

Western Gas Resources: Methane Savings

- Replacing dehydrators with methanol injection saved an average of 800 Mcf/yr
- Methanol injection pumps were installed at an average cost of $2,250 per installation



8

Western Gas Resources: Is Recovery Profitable?

- Methanol injection pump replacing a 2 MMcf/day glycol dehydrator

Installation Cost:	$2,250
Annual Methanol Cost:	$2,519
Annual Gas Savings (Mcf):	800
Value of Gas:	$8,000
Payback (Months):	5

- Methanol costs are estimated at $1.15/gal with 3 gallons injected/MMcf gas
- Gas price at $10/Mcf

9

Microturbine Generators

- Microturbines can be used to generate electric power on-site for oil and natural gas operations
  - Receive gaseous fuels with a wide range in heat content
    - 350 – 2500 Btu/scf
  - Receive gaseous fuels at a wide range of pressures
    - 4” WC to 75 psig
  - Optional waste heat recovery systems
  - Can be set up in parallel for custom power solutions

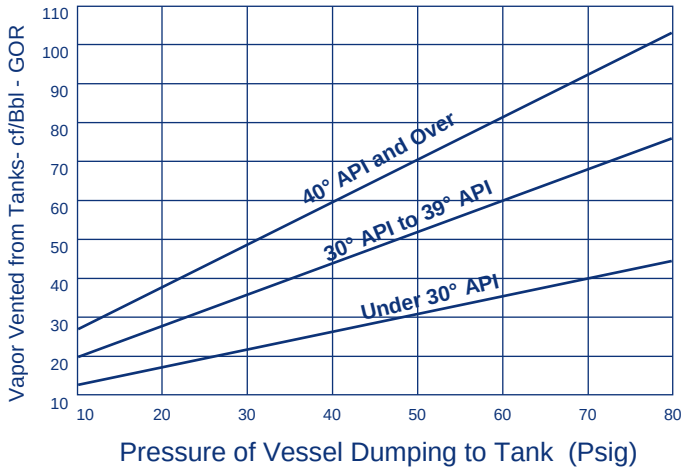
10

Methane Losses: Flash gas venting

- Gas flashing off crude oil in atmospheric tanks is often vented to the atmosphere or flared
- Estimate losses from chart based on oil characteristics, pressure and temperature at each location (± 50%)
- Estimate emissions using the E&P Tank Model (± 20%)
- Measure losses using recording manometer and well tester or ultrasonic meter over several cycles (± 5%)
  - This is the best approach for facility design

11

Estimated Volume of Tank Vapors



12

Methane Recovery: Route flash gas to microturbine generators

- Gas can be routed to microturbine generators for on-site power generation
- Power can be used to operate on-site equipment
  - Replace gas-powered pumps with electrical pumps

70 and 250 kW Microturbines

13

Industry Experience: BP – Grand Isle Tank Battery

Associated Gas Sent to Flare

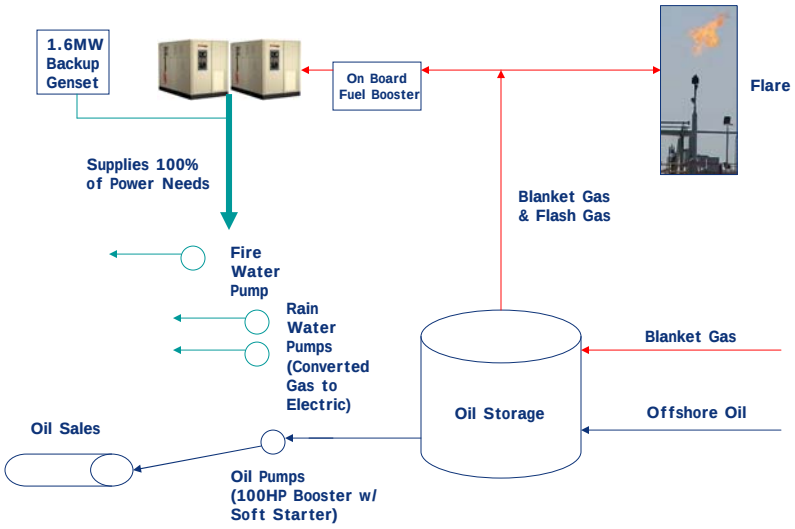
Purchased Power and Natural Gas

Oil Sold to Pipelines

Oil from Offshore

14

BP: Grand Isle Flow Scheme



15

BP: Microturbine Generator Benefits

- Two 250 kW microturbine generators supply 100% of electricity needed on-site
  - Eliminates purchased electricity
  - Gas-powered pumps replaced with electric pumps
    - Reduces natural gas purchases
  - Reduced emissions
  - Microturbine installations may qualify for a tax credit of 10% of the cost, up to $200 per kW of power produced

16

BP: Is Recovery Profitable?

- Savings at this site in excess of $250,000 per year
  - $12,000 per month in blanket and instrument gas purchases
  - $8,000 per month in electricity purchases
  - 8,500 tonnes CO2 equivalent emission reduction on site
  - 750 tonnes CO2 equivalent emission reduction estimated at power plant that previously supplied power

17

BP: Additional Microturbine Applications

- Offshore power generation
  - Microturbines require little maintenance
    - One check per year
- Glycol dehydrator integration
  - Flash gas from rich glycol routed to microturbine
    - Replace gas powered circulation pump with electric pump
- Compressor integration
  - Route gas from distance piece and packing to microturbine
    - Reduce fugitive methane emissions

18

Discussion Questions

- To what extent are you implementing these opportunities?
- Can you suggest other applications for these technologies?
- How could these opportunities be improved upon or altered for use in your operation?
- What are the barriers (technological, economic, lack of information, regulatory, focus, manpower, etc.) that are preventing you from implementing these technologies?

19