Reducing Methane Emissions with Microturbines

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Why a Microturbine?

- Low Life Cycle Cost
  - Competitive first cost
  - Low maintenance
  - Longer life
  - Smaller foot print for offshore applications
- High Reliability
  - Four to five percent improvement versus recip
- High Efficiency
  - Fuel efficiencies over 30 percent
- Low Emissions
  - Compared to recip engines

First Offshore Application

- Increased Platform Load
- Unmanned Operation
- Over 3 Years Running
- 99+% Runtime

20 kW Recip

60 kW MTG

Grand Isle Tank Battery - Original

Associated Gas Sent to Flare

Purchased Power and Natural Gas

Oil Sold to Pipelines

Oil from Offshore

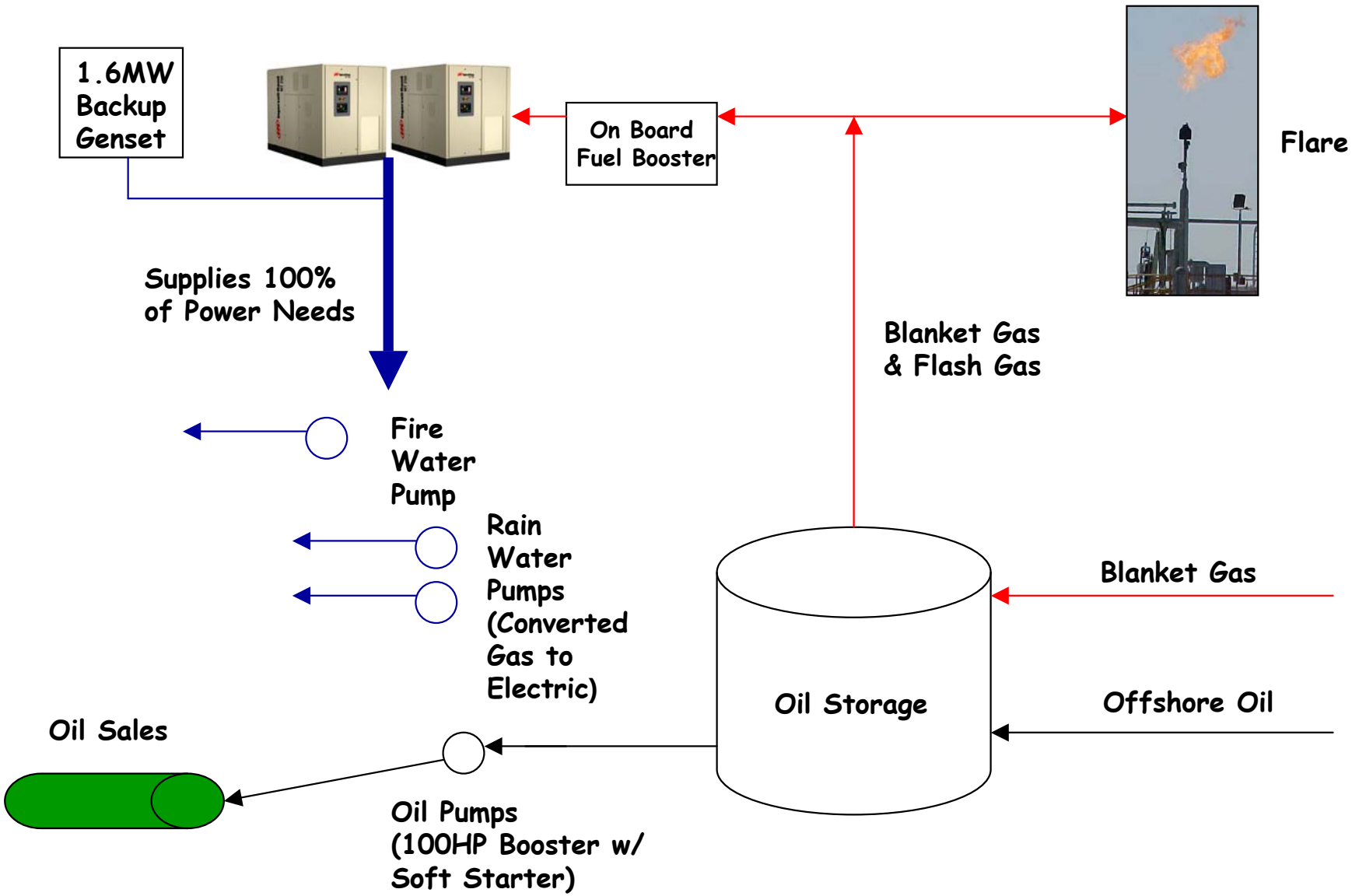
Grand Isle Tank Battery - Now

Purchased Power and Natural Gas

Oil Sold to Pipelines

Oil from Offshore

Grand Isle Tank Battery - Flow Scheme



Grand Isle Tank Battery - Benefits

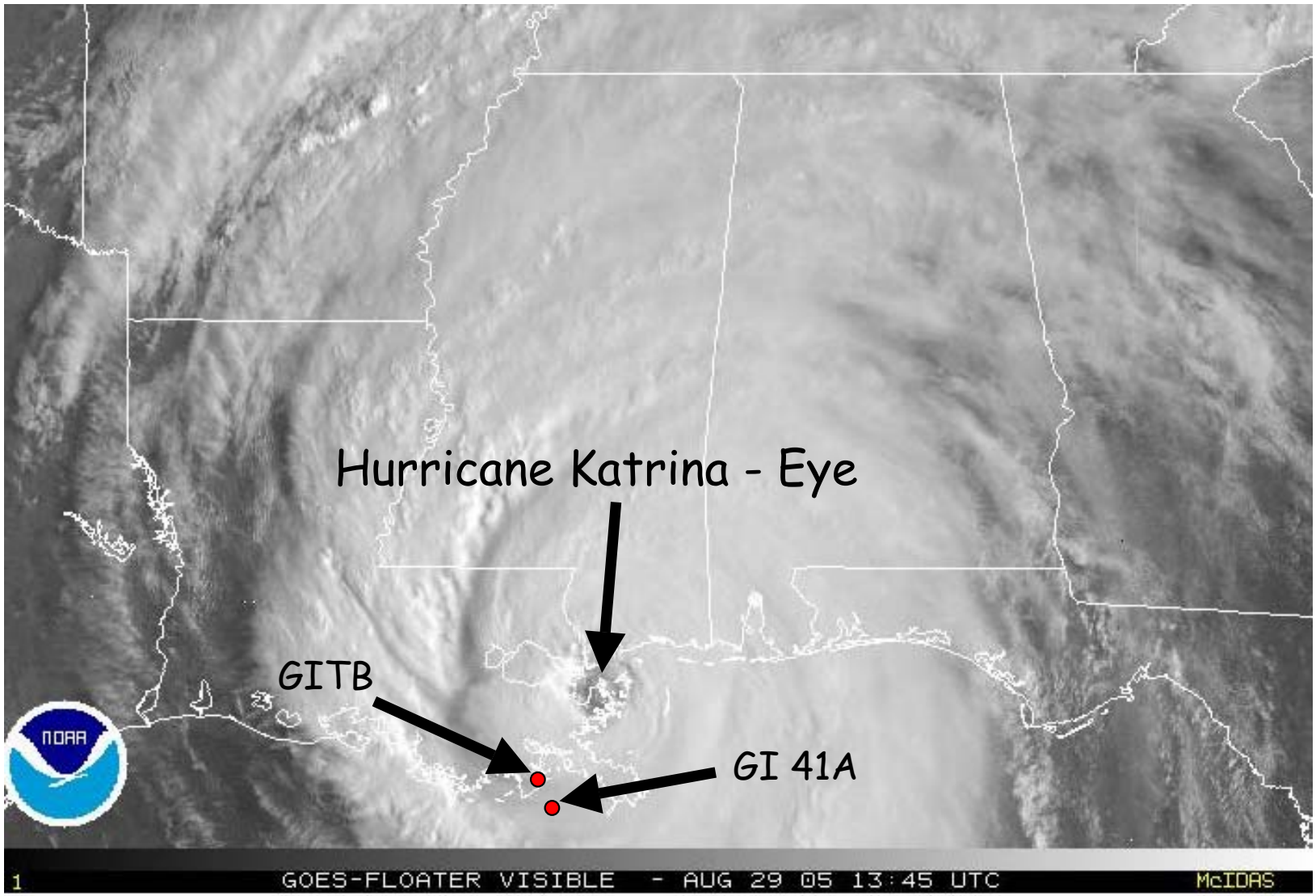
Removed Purchase Power

Reduced Flaring

- Benefits
  - Associated Gas Fuel Input
  - Flare Reduction
  - Eliminate Purchase Power
  - Reduce Natural Gas Purchase
  - Emissions Reductions

- 500kW
- 9600 Tons / Yr CO2 Reductions
- Over $250,000 / Yr Savings

Current Status - GOM Units



Next Offshore Application – GI 41B

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Opportunity

- Increase Turbine Efficiency
- Reduce Fuel Consumption
- Lower Emissions
- Improve Life-Cycle Cost
- Reduce Power Cost

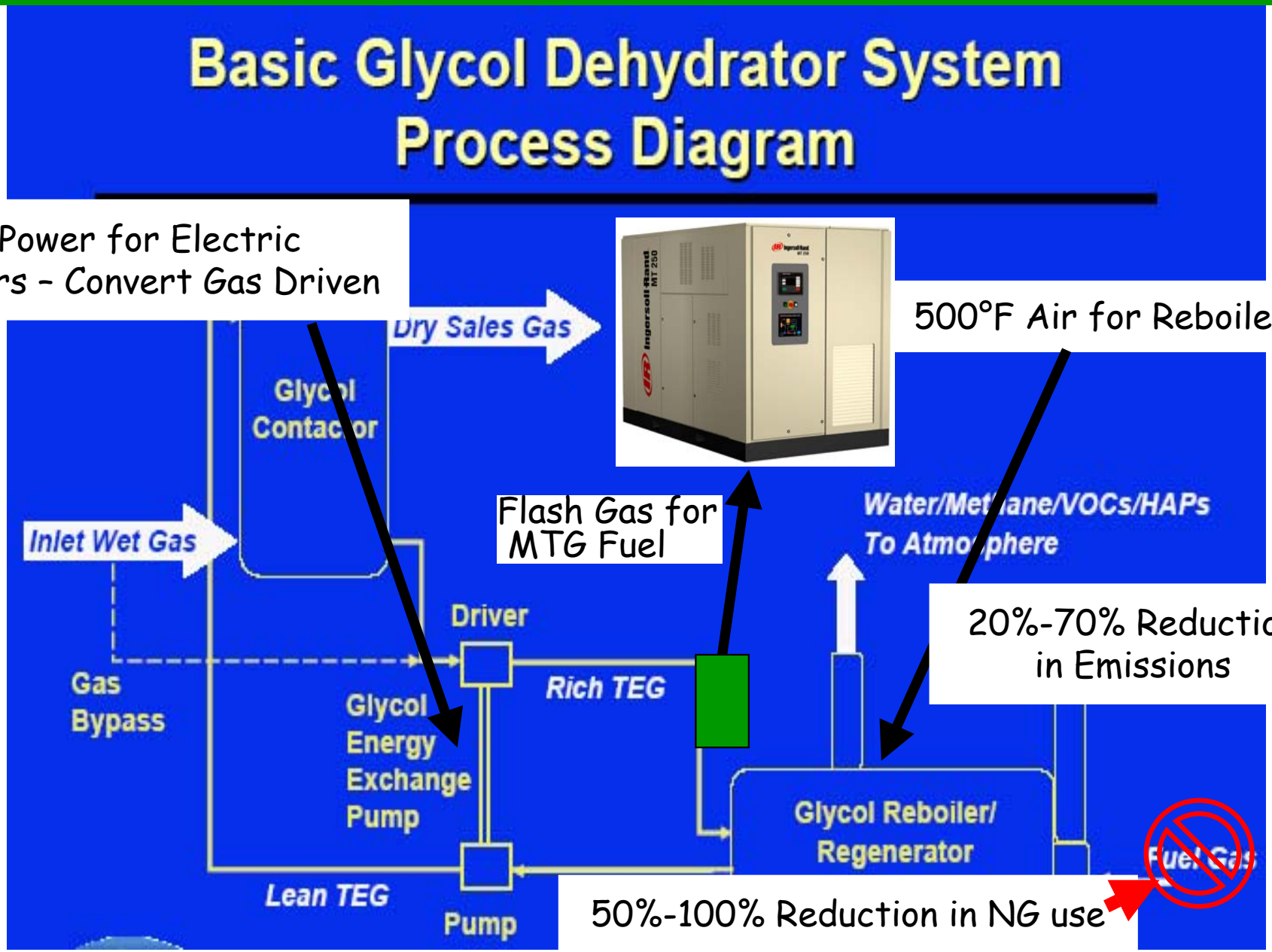
Solution

- Replace Turbine with Microturbine
- Increase Fuel for Sale
- Enhanced Environmental Performance
- Reduced Maintenance Costs
- Low Cost Power

Results

- $300,000+ per year savings
- Lower emissions:
  - NOx - 98% reduction = over 20 tons / yr
  - CO - 97% reduction = over 15 tons / yr
  - UHC - 95% reduction = over 6 tons / yr
- The savings generate positive cash flow
  - Ex. – Results in 3 Year Payback

Additional Opportunities Being Studied



Compressor Station Opportunities

70 and 250 kWMicroturbines

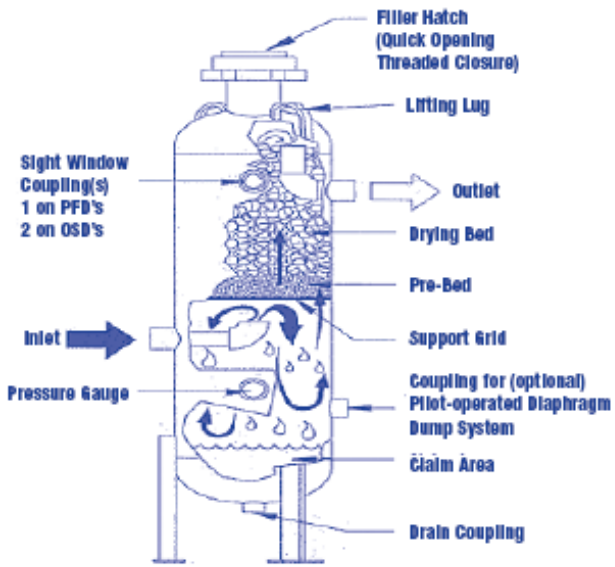
- Using Gas from Packing and Distance Pieces
- Use for On-Site Power Generation and Back-up Power
- Heating Requirements
- Lower Fugitive Emissions

Latest Opportunity to Investigate

Method for Reducing Gas Loss[1]	Annual Methane Emission Savings (Mcf)[2]	Annual Gas Savings (Mcf)[3]	Value of Gas Saved ($)[4]	Capital and Installation Cost ($)[5]	O&M Cost ($)[6]	Payback (Years)
Replacing a Glycol Dehydrator with a Desiccant Dehydrator	564	1,063	3,189	12,750	(1,214)	2.9

Based on a 1 MMcfd dehydrator operating at 450 psig and 47°F.
Difference between methane vented from the glycol and desiccant dehydrators.
Sum of net gas emissions reduction and fuel gas savings.
Based on $3 per Mcf price of gas.
Installed cost of desiccant dehydrator minus surplus equipment value for the replaced glycol dehydrator.
Difference between glycol and desiccant dehydrators O&M costs.

Exhibit 1: Schematic of Single Vessel Desiccant Dehydrator



Source: Van Air

Option – Utilize Desiccant Dehy with Microturbine Waste Heat to Regenerate the Desiccant While Providing Site Power