



Energy  
Services

# Experience with C30 Capstone Microturbine on Liquid Waste Fuel

Presented by Dan Boonstra  
2006 Annual Microturbine Applications Workshop  
January 17<sup>th</sup>-19<sup>th</sup>, 2006

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## Executive Mat Service

Project Manager    Kim Caron; Executive Mat Service

Installation Support    Dan Boonstra; Collicutt Energy Services

### ■ Project Scope: Use Microturbine for Waste Solution Disposal

	Planned	vs.	Actual Dates
– Equipment Delivery	12/01/2005		12/28/2005
– System Commissioned	01/02/2006		T.B.D
– Monitoring Underway	Preliminary Testing Completed		

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## Facility Environment



Vapour Extraction Unit

- 24,000 sq.ft. facility.
- 125 lbs of soiled floor mats processed every 4 minutes.
- Dryer processes 300 lbs of laundry every 12 minutes.
- 50 lbs of cleaning solution recycled per hour.

## Produces

- Approximately 420 liters of waste solvent is produced daily.



Industrial Washers



Floor Mat & Coverall Wash System

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Capstone C30 Liquid Fuel Microturbine  
&  
Waste Solvent Reservoir

## Problems

- Large electrical demand from processing equipment.
- Require cost effective solution to dispose of cleaning solvent.
- Environmentally friendly alternatives mandated.

## Eco – Friendly Solution

- Installation of Capstone C30 Liquid Fuel Microturbine.
- Reduces electrical load by 25kW.
- Consumes waste solvents eliminating disposal concerns.

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## Electrical Performance

- 2765 total hours of operation on unit to December 31 2005.
- 65 total hours of operation on Liquid Waste Fuel.
- Net Efficiency with 24kW Load is approximately 24%.
- Estimate 2kW of Parasitic Losses.
- Power Quality
  - There were no power quality issues noticed to date.
- Overall performance has been exceptional for the application.

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# Emissions Performance of Blanket Wash Waste Solvent

## Solvent Fuel Physical Data

### Butyl Acetate

- Kinematic Viscosity
  - @ 20 C is 1.0420 Centistokes
  - @ 40 C is 0.8038 Centistokes
- HHV  
19,180 BTU / lbm

	Test #1	Test #2	Test #3	Average
<b>Date</b>	December 21, 2005			
<b>Time</b>	12:10 – 13:10	13:32 – 14:32	14:55 – 15:55	
<b>Nitrogen Oxides</b>				
ppmv (raw –dry)	6.7	6.8	6.9	6.8
ppmdv (@15%O <sub>2</sub> )	16	17	17	17
g/s (as NO <sub>2</sub> )	0.0030	0.0031	0.0031	0.0030
g/kw-hr (as NO <sub>2</sub> )	0.46	0.48	0.49	0.48
<b>Carbon Monoxide</b>				
ppmv (raw –dry)	2.6	2.4	3.1	2.7
ppmdv (@15%O <sub>2</sub> )	6.1	6.0	7.8	6.6
g/s	0.00069	0.00066	0.00085	0.00073
g/kw-hr	0.11	0.10	0.13	0.12
<b>THC (as CH<sub>4</sub>)</b>				
ppmv (raw –dry)	5.5	2.2	1.0	2.9
ppmdv (@15%O <sub>2</sub> )	13	5.5	2.5	7.1
g/s	0.00084	0.00035	0.00016	0.00045
g/kw-hr	0.13	0.055	0.025	0.070

**Notes:**

1. Reference conditions: 25°C, 760 mm Hg.

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## O&M Performance

- Availability
  - 100 % during the 65 hours of testing on waste fuel.
  - The unit is currently in a ready state awaiting exhaust ducting.
- Approximately 16 hours were required to configure the unit and to refurbish a battery pack for stand alone operation.
- Over the 40,000 hour life cycle of the unit it is estimated that annual O&M costs excluding major hot end replacement will be approximately \$17,775.00 US\$ or \$0.09/kWh based on 24kW output and 98% availability.

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## Institutional Experience

- The installation is being constructed as a temporary generator application.
- The unit is not connected to the grid.
- The equipment load is transferable to the grid if required.
- Allowed the installation of the Microturbine as an appliance following a different set of electrical code guidelines.
- Installation costs including emissions study will come in under \$25,000.00 US.

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## General Experience

- The project has had minor scheduling delays waiting for sub-contractors.
- The installation of the product when treated as an appliance went remarkably smooth.
- Costs associated have not been excessive.
- End user is pleased and is already considering expansion of the project with 2 more units and Grid connectivity.

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# 40,000 Hour C30 Capstone Microturbine on Sour Gas



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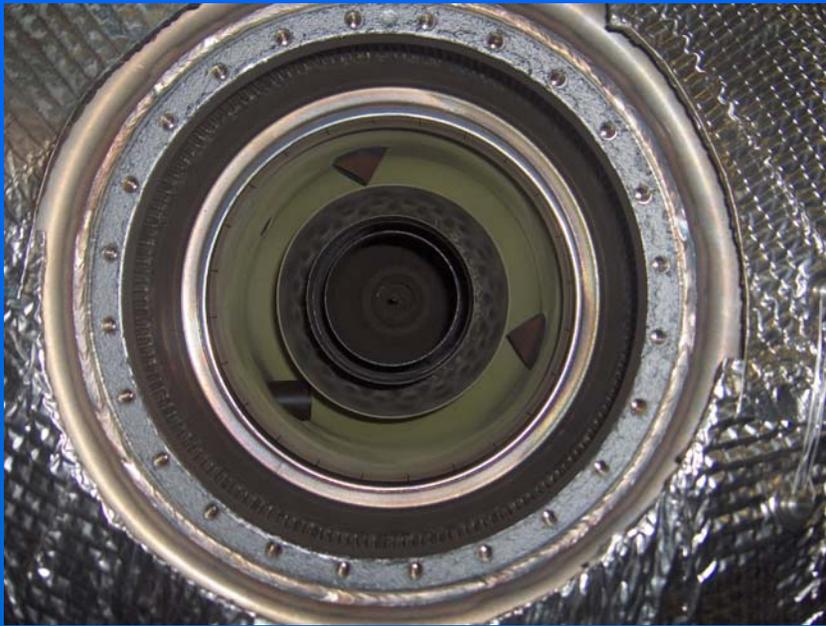
## Canadian Natural Resources Ltd. Buick Creek



- Remote Gas Battery in Northern British Columbia, Canada.
- Requires 24 hour/day stand alone power production.
- Commissioned 2 Capstone C30 Sour Gas Microturbines in November 2002

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## Operational Information



Combustion Chamber of 2% Sour Gas  
C30 Microturbine

- 1 of 2 Capstone C30's operating continuous duty – 24hr/day 365days/year.
- Shares a 13 kW base load.
- Operates on 2% Sour Natural Gas.
- Reached 40,000 hr Milestone in December, 2005

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## O&M Performance

- Availability

- The unit has experienced some downtime related to BCT Power Board issues in 2002.

- The availability has been 90% to January, 2006.

- Over the 40,000 hour life cycle of the unit it is estimated that the annual O&M costs excluding major hot end replacement are approximately \$110,000.00 US\$ or \$0.34/kWh based on kW output and availability.

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## Overview



- Has proven to be a cost effective application.
- Indicates to the industry that there is an economical alternative to recip generation.
- More focus is required in training operations staff as there are issues with accepting new technology.
- The end-user is not opting for a replacement turbine hot section at his time.

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## Contact Information

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