VAMOX® Projects at Walter Energy’s Coal Mines

GMI Methane Expo
Vancouver | March 14, 2013
1. Biothermica

2. VAMOX® carbon project at Walter Energy Mine No.4, Alabama, USA

3. Moving forward – upcoming projects
Biothermica
What we do

- Canadian group founded in 1987
- Develop **patented technologies** applied to industrial emissions control and methane destruction/utilization
- Finance, build, own and operate **carbon credit** and **energy** production facilities
- Based on destruction/utilization of **methane** from **landfills** and **coal mine** ventilation systems
Industrial Emissions Control

BIOTOX® Technology
Regenerative Thermal Oxidation (RTO)
Non-conventional industrial emissions
> 10 industrial processes since 1990
9 patents
Award winner from the U.S. AWMA

BIOTOX® unit
Presque Isle, Maine, USA
Food industry
100,000 cubic feet per minute (cfm)
COC\(^1\) emissions

\(^1\) Condensable Organic Compounds
Landfill Methane
Selected Projects

Gazmont 25 MW Power Plant
Montreal landfill (Canada)
Finance, Build, Own, Operate
2 billion kWh of electricity since 1996

El Salvador CDM Project
Nejapa landfill
Finance, Build, Own, Operate
100% equity
215,000 carbon credits over 2006-2008
Major interest in project sold in 2008
MIGA insurance
VAM Project Development
Natural Evolution

Industrial Emissions Expertise

Landfill Methane Project Development

VAMOX® unit at Walter Energy No. 4 Mine
Alabama, USA
Finance, Technology, Build, Own, Operate
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Leading producer and exporter of metallurgical coal

Headquartered in Birmingham, Alabama (USA)

Operations in the U.S., Canada and the UK

2012 revenues of $US 2.4 billion

Over 4,000 employees
VAMOX® Project Overview

- JWR Bleeder shaft 4-9, No. 4 Mine, Brookwood, AL
- First of its kind (MSHA) at active U.S. coal mine
- Financed by Biothermica, 100% equity
- **Objective 1:** Demonstrate VAMOX® RTO technology
- **Objective 2:** Assess key factors for financial viability
- Full operation over March 2009 – February 2013
- Registered with the Climate Action Reserve
VAMOX® Project Specifications

- 2 ceramic bed RTO
- Medium size unit - 1,400 ft² footprint (40*35)
- 30,000 cfm nominal flow rate, 10% of VAM flow
- 0.3% - 1.2% range of CH₄ level accepted
  - Dilution with fresh air if incoming VAM > 1.2%
- VAM destruction only
  - Revenues from carbon credit generation
Operating Principle
Start-up
Operating Principle
Cycle 1
Operating Principle
Cycle 2
VAMOX®
Carbon Project Cycle

Monetization

Project Listing

Issuance of CRTs

Monitoring

Verification

CAR CMM Protocol

Climate Action Reserve

Ruby Canyon Engineering
Project results
Since March 2009

- > 27,500 hrs Operation hrs
- > 80,000 tCO\textsubscript{2}e emission reductions
- 93% availability\textsuperscript{1}
- 70,387 CRTs issued

\textsuperscript{1} Excluding external events such as Electricity supply outages or \([\text{CH}_4]\) < 0.3%
Monthly Availability
Reporting period # 4

Average\(^1\): 98.7 %

\(^1\) Excluding external events – most essentially [CH\(_4\)] < 0.3%

Until Feb. 8
Methane Level At Shaft Since March 2009

Min: 0.2 %

Max: 1.5 %

Operational experience over wide range of fluctuating concentrations
Financial Viability
Key Factors

COSTS

• CAPEX
• Electricity
• Operation & Maintenance

REVENUES

• VAM concentration
• Carbon credit price
• VAM flow rate
• System availability
• Destruction efficiency
Carbon price triggers

For a typical US VAMOX® project
1. Biothermica

2. VAMOX® project at Walter Energy Mine No.4, Alabama, USA

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Moving Forward

- Partnership with WALTER ENERGY
- Long term commitment to VAM
- Mitigate VAM from all economically suitable shafts
VAMOX® standard unit

- 130,000 cfm nominal flow rate
- 5,000 ft² footprint (100*50)
- Design optimized based on proprietary model
- Designed for facilitated relocation
- 0.3% - 1.2% range of CH₄ level accepted
- Fully automated operation
  - Auto-adjustment of operating conditions
Bleeder shaft of Mine No. 7

- Shaft: 300,000 cfm, \( \geq 1\% \text{ CH}_4 \)

- VAMOX\textsuperscript{®} systems
  - 2 large scale standard units
  - Air flow processed: 260,000 cfm
  - \( \pm 400,000 \text{ tCO}_2\text{e/yr} \)
Project Status Summary

- Design completed
- Approved by MSHA District 11 (May 2012)
  - As addendum to mine ventilation plan
- Green light when framework certainty (California)
California Regulatory Status

- December 2010: Cap & Trade Regulation adopted
- 4 Offset Protocols currently adopted + Early Action
  - ODS\(^1\), Forestry, Urban Forests and Livestock
- CMM Offset Workshop on March 28, 2013
- Adoption of CMM Protocol expected by end of 2013

\(^1\) Ozone Depleting Substances
FORECAST OFFSET SUPPLY: Compliance + Rice + Coal Mine Methane (CMM)
Carbon Offset Prices
California Market

$/tCO2e

févr.-13

CAR CRTs
Non ARB Eligible

CAR CRTs
Early Action

Compliance Offset Forwards
2013 delivery
Thank You

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