VAM processing and Climate Change

Richard Mattus

M2M EXPO in Delhi March 2010
Reducing VAM emissions

- Is an **opportunity** for significant positive impact on Global Warming.

- Will be very **profitable** when the price of Carbon Credits stabilize.

- Is based on established, **well proven** technology.
VAM processing has been officially demonstrated:

- In total at 6 installations on 4 continents.

- In more than year long operations on 3 continents.

- In a large scale, multiple processing units installation generating electricity since 3 years in Australia.
MEGTEC VAM Abatement so far at coal mine sites around the World

1st DEMO INSTALLATION AT A COAL MINE
abating vent air methane in 1994.
Trial unit at British Coal.

DEMO INSTALLATION LONG TERM ENERGY RECOVERY
-small scale trial unit at BHP in Australia 2001 – 2002,
12 months of utilizing VAM for generating steam.

LARGE SCALE DEMO ABATEMENT
CONSOL ENERGY in the US.

LARGE SCALE COMMERCIAL ABATEMENT
First VAM project in China.
Generation of hot water.

.. and ..
In full operation by April 2007
– the world’s first VAM Power Plant
96% availability

Direct Methane Emissions Avoided (Blue) = 250,000 t CO2-e
Electricity Emissions Avoided (Purple) = 45,000 t CO2-e
Total Emissions Avoided to date = 295,000 t CO2-e
MEGTEC VAM Power Plant in Australia.
By August 2009

- Over 500,000 carbon credits, traded locally
- Over 80,000 MW of electricity
Globally leading supplier

of emission control equipment for

hydrocarbons to air.
MEGTEC Worldwide

Global headquarters

Global head office for the VAM application

MEGTEC Systems Worldwide Headquarters

MEGTEC Systems Regional Offices

De Pere, WI
Columbus, OH
Vero Beach, FL
Manchester, UK
Maidenhead, UK
Evry (Paris), France
Amål, Sweden
Göteborg, Sweden
Maintal (Frankfurt) Germany
Shanghai, China
Pune, India
Singapore
Melbourne, Australia
Göteborg, Sweden
Åmål, Sweden
Maidenhead, UK
Evry (Paris), France

Global head quarters

Global head office for the VAM application
All types of industrial oxidizers.

In total 4000 oxidizers of MEGTEC design supplied to industry.

Over 800 VOCSIDIZERs to different industrial applications.
The Flameless VOCSIDIZER

Flameless: No combustion chamber – therefore flameless
: Oxidation completely in-bed.

No NOx: No flame. Even though temp is high, it is not near where thermal
: NOx is generated.
GLOBAL WARMING
AND CLIMATE CHANGE

- What is happening with climate on Earth?
- What is carbon credits financing?
- Why is VAM of interest?
One thin bubble of atmosphere
One thin bubble of atmosphere

Atmosphere thickness to the Earth is like the skin to the apple
Some heat radiation is reflected back to Earth by the atmosphere, causing the average temperature on Earth to be +15 degr C instead of -15 degr C.
Since the 1800’s, human activities are moving enormous amounts of carbon atoms from Earth to atmosphere.

The composition of atmosphere has changed over its 4 billion year lifetime.
One thin bubble of atmosphere

- changing the composition and characteristics of the atmosphere.
Gases accumulate and reflect more heat back to Earth
One thin bubble of atmosphere

Green House Effect resulting in Global Warming
- All emissions are going into the same thin bubble of atmosphere.
- The recently established trading with Carbon Credits (emission reduction certificates) is an instrument guiding investments to where they most cost efficiently reduce GHG emissions.
CO2 can retain some of the sun’s heat in atmosphere
Methane can retain MUCH MORE heat
**Green House Gas**  **METHANE**

- **CH4**: 14%

**METHANE:**
- Second most important greenhouse gas
- Much more powerful greenhouse gas than CO2
- Short life time in atmosphere, so emission reductions will have a quick, positive impact
- Generates energy when abated (oxidized)

<table>
<thead>
<tr>
<th></th>
<th>CO₂</th>
<th>CH₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming Power</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>(21 in the first Kyoto Period)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life time in atmosphere (years)</td>
<td>20 000 – 50 000</td>
<td>12</td>
</tr>
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CONSIDER Green House Gas METHANE - effect of life time

<table>
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<th>Gas</th>
<th>Life time in atmosphere</th>
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<td>CO$_2$</td>
<td>&gt;&gt;10 000 years</td>
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<tr>
<td>CH$_4$</td>
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CONCLUSIONS ON MAJOR EMISSION REDUCTIONS:

• CO2 continues to accumulate, but at a slower rate.
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- CO2 continues to accumulate, but at a slower rate.
- Methane reductions have full impact quickly - in only 12 years!

Reducing methane emissions CONTRADICT increasing global warming!
Global Methane Emissions - by source

**BIGGEST TOTAL SOURCE:**
Cows, sheep etc

**PROBLEM:**
Each source is very small

- Enteric fermentation: 28%
- Natural gas: 15%
- Solid waste: 13%
- Rice: 11%
- Waste water: 10%
- Coal: 8%
- Biomass burning: 5%
- Biofuel combustion: 4%
- Manure: 4%
- Fuel stat & mobile: 1%
- Oil: 1%

50-100 kg CH4 per cow and year = 1-2 t CO2e
ANNUAL GREENHOUSE EFFECT on Global Warming
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Coal mine VAM
1,000,000 m³/h, 0.8%
(50,000 t CH₄/yr)

1 million t CO₂e
ANNUAL GREENHOUSE EFFECT on Global Warming

1 million t CO₂e

½ million cars =

Coal mine VAM
1,000,000 m³/h, 0.8%
(50,000 t CH₄/yr)
This is a European glacier with skiing all year.

By the early 1990’s it was possible to ski across the mountain ridge, now 40 meters up.

The whole glacier will probably be gone around year 2020.
DEVELOPMENT OF THE MARKETS
CARBON CREDITS TRADING and VAM PROCESSING

1992 Rio Conference
- Agreement to establish the UN Framework Convention on Climate Change, UNFCCC

1997 Kyoto Conference
- Agreement to reduce emissions and to introduce mechanism of Carbon Credits

Launch of Kyoto related Carbon Credits

Kyoto Compliance Period 2008 - 2012

2012
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**Kyoto Compliance Period 2008 - 2012**

**SINGLE UNIT INSTALLATIONS**

- **UK trial at British Coal**
- **Australian trial at BHP**
- **Abatement demo CONSOL, US**
- **Abatement/hot water ZhengZhou, China**
- **Abatement, JWR, US**
- **VAMOX BioThermica**
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Multiple Unit Installation

VAM Power Plant BHP Billiton, Australia

VAMOX BioThermica

SINGLE UNIT INSTALLATIONS

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Globally 1st UNFCC approved VAM project
With WestVAMP, BHP Billiton in Australia has won several prestigious awards, and MEGTEC, for developing the VAM technology and for bringing it to the global market, won the:

**US EPA Climate Protection Award 2008**
MEGTEC VAM in China

Host/Customer is ZhengZhou Coal Mining Group, Henan Province

PDD administrator is EcoCarbone, France

System capacity: 62 500 Nm3/h  VAM concentration: 0.3% to 0.7%
Host/Customer is ZhengZhou Coal Mining Group, Henan Province
The complete installation includes VAM abatement and energy recovery in the form of hot water for local use.

The MEGTEC delivery was fully commissioned and taken over by customer October 2008.

The globally first project to be awarded VAM-based CER’s (Kyoto related Carbon Credits).
Hot water from VAM
Main MEGTEC concept in China

In China typical VAM concentrations are 0.3–0.7%

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- - - For each 125 000 Nm3/h of ventilation air - - -
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Calculations of CERs

Examples:
250 000 Nm³/h @ 0.9 % VAM comes to 240 000 tonnes of CO₂e
125 000 Nm³/h @ 0.9 % VAM comes to 120 000 t CO₂e
125 000 Nm³/h @ 0.3 % VAM comes to 40 000 t CO₂e

<table>
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<th>0.3</th>
<th>0.6</th>
<th>0.9</th>
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<tr>
<td>125 000</td>
<td>40</td>
<td>80</td>
<td>120</td>
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<td>80</td>
<td>160</td>
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<td>160</td>
<td>320</td>
<td>480</td>
</tr>
<tr>
<td>1 000 000</td>
<td>320</td>
<td>640</td>
<td>960</td>
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*Annual emission reductions in thousand tons of CO₂e*
CONCLUSIONS:
• VAM concentrations should be min ½ percent
• Carbon Credits above EUR 10/t
MEGTEC VAM processing concept is modular, based on VOCSIDIZERs, stacked in arrangements of VAM Cubes.
Each VAM Cube can process 250,000 Nm3/h

VAM Cube
20 m x 25 m
International, US based power company AES has announced a major VAM project in China:

- processing 375,000 Nm³/h of ventilation air
- based on MEGTEC VAM technology
- SongZao coal mine, ChongQing Province
- installation in 2010
5 CONCLUSIONS on VAM (Ventilation Air Methane)

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5. Most likely, the VAM market *will boom* *when* there is a political *agreement on post 2012*
MEGTEC VAM VOCSIDIZER

RMATTUS@MEGTEC.SE