Long-Term Experience of VAM Processing

Presented by Michael J. Hager, Vice President, Engineering

MEGTEC Systems

for the Methane Expo 2013
MEGTEC Regenerative Thermal Oxidizers

- Over 4,000 RTOs installed worldwide
- Sizes ranging from 500 to 90,000 scfm
- Single & multiple can designs
MEGTEC Regenerative Oxidizers
for VAM Processing

VOCSIDIZER
- Single bed design – no combustion chamber
- Electric pre-heat, eliminates need for fuel source
- Modular-stackable design minimizes footprint

VOX-II
- Two bed design
- High flow capacity minimizes valves/parts
- Chamber bypass facilitates heat recovery
Modular VOCSIDIZER Design for VAM Processing
MEGTEC VAM
Proof-of-Concept Sites

1994 - Thorseby Coal Mine, British Coal, UK

2001 - Appin Colliery, BHP, Australia

2008 - Windsor mine, CONSOL Energy, USA
MEGTEC VAM
Commercial Installations

- **2007** – BHP Billton, West Cliff Mine
  New South Wales, Australia
  Flow capacity: 250,000 Nm\(^3\)/hr

- **2008** - ZhengZhou Coal Mining Group
  Henan Province, China
  Flow capacity: 62,500 Nm\(^3\)/hr

- **2011** - DaTong Coal Mine
  ChongQing Province, China
  Flow capacity of 375,000 Nm\(^3\)/hr

- **2013** - Xishan Coal & Electricity, Duerping Middle Station
  Shanxi Province, China
  Flow capacity: 450,000 Nm\(^3\)/hr
MEGTEC VAM Power Plant at BHP Billiton in Australia

- Four VOCSIDIZERS installed in 2007
- Steam heat recovery drives 6 MW turbine
- Total flow capacity: 250,000 Nm³/hr (only 20% of shaft flow)
- Methane concentration: 0.9 – 1.0 % CH₄
- Availability on demand: >99%

The WestCliff Project was partly Government funded by AGO – Australian Greenhouse Office
VOCSIDIZER Energy Recovery as Superheated Steam

- Peak media bed temperatures: 1185 – 1200 °C
- Thermal steam power: 17.8 MWth
- Electrical output Average: 120 MWh/d
VOCSIDIZER STEAM CYCLE FOR POWER GENERATION

Steam Boiler

VOCSIDIZER™

Steam drum

Distributor

FW tank

Condenser

Air cooler

Turbine

Generator

FW treatment plant

FW treatment plant
MEGTEC VAM Power Plant at BHP Billiton in Australia

In full operation since 2007
MEGTEC VAM Power Plant at BHP Billiton in Australia

VAM exhaust duct

Fan
Stack
VOCSIDIZERS
Electricity from VAM Power Plant

0.2 % methane needed to maintain oxidation. Energy of concentrations above 0.2 % can be recovered. Interesting combinations of electricity and thermal generation can be achieved.

**Example:**

- **800 000 m³/h**
- **1 % CH₄**
- **72 MW(th)** → **21 MW(el)** (at 30% efficiency)

**Example:**

- **800 000 m³/h**
- **0.6 % CH₄**
- **36 MW(th)** → **10 MW(el)** (at 30% efficiency)
MEGTEC VAM in China
ZhengZhou Coal Mining Group, Henan Province

- PDD administrator is EcoCarbone, France
- Commissioned in 2008
- One (1) VOCSIDIZER installed – capacity of 62,500 Nm³/hr
- Energy recovery in the form of hot water for local use
- 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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<th>0.3%</th>
<th>0.5%</th>
<th>0.7%</th>
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<td>Heat straight from bed.</td>
<td>1.5 MW</td>
<td>3.8 MW</td>
<td>6.1 MW</td>
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<td>Water at 70 - 150°C</td>
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- - -  For each 125 000 Nm3/h of ventilation air  - - -

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<th>0.5 MW</th>
<th>2.7 MW</th>
<th>5 MW</th>
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<td>Secondary heat-exchanger.</td>
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MEGTEC VAM in China
at the Da Tong Mine, ChonQing Province, China

- Commissioned in 2011
- Six (6) VOCSIDIZERS installed as three stacked pairs
- VAM flow capacity of 375,000 Nm³/hr
- Methane concentration: 0.3 – 0.5 %
MEGTEC VAM in China at the Da Tong mine, ChonQing Province, China

- Includes hot water generation for local use
MEGTEC VAM in China
at the Da Tong mine, ChonQing Province, China
Xishan Coal and Electricity Duerping Middle Station Project

- Development by **Sindicatum Sustainable Resources**

- Total VAM flow capacity of 450,000 Nm³/hr – 85% of shaft flow

- Project to be executed in two phases with 4 oxidizers

- MEGTEC **VOX-II** technology utilized: 2-bed design with gas burner

- Average CH₄ concentration of 0.57 vol%

- MEGTEC providing full turnkey scope

- Operation to begin in the 2nd Qtr 2013
Xishan Coal and Electricity
Duerping Middle Station Project
Xishan Coal and Electricity
Duerping Middle Station Project
Xishan Coal and Electricity Duerping Middle Station Project

- Oxidizer pre-heated with a nozzle mix burner
- LPG fuel supplied from one of two cylinder manifolds

LPG cylinder storage

Vaporizer
VAM Processing Site Evaluation

- Evase geometry
- Evase flow rate & fraction to be treated
- Estimated shaft life
- CH₄ concentration
- Fuel type/availability
- Potential needs for heat recovery
- Road access
- Civil requirements
- Power supply – V/Hz
- Local codes
- Altitude
- Seismic zone
VAM Processing Safety

(VAM exhaust transit time) > (LEL sensor response time) + (Isolation damper actuation time)

- Critical to install fast acting LEL sensors
- Requires long duct run from evase to oxidizer
Thank you!

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