Long-Term Experience of VAM Processing

Presented by Michael J. Hager, Vice President, Engineering

MEGTEC Systems

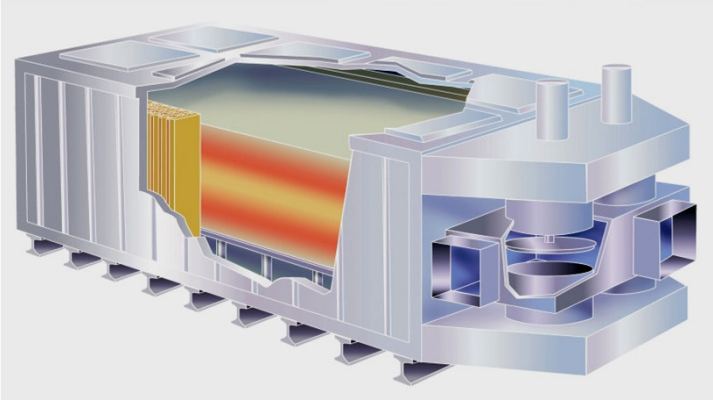
for the Methane Expo 2013

MEGTEC Locations Worldwide

MEGTEC Regenerative Thermal Oxidizers

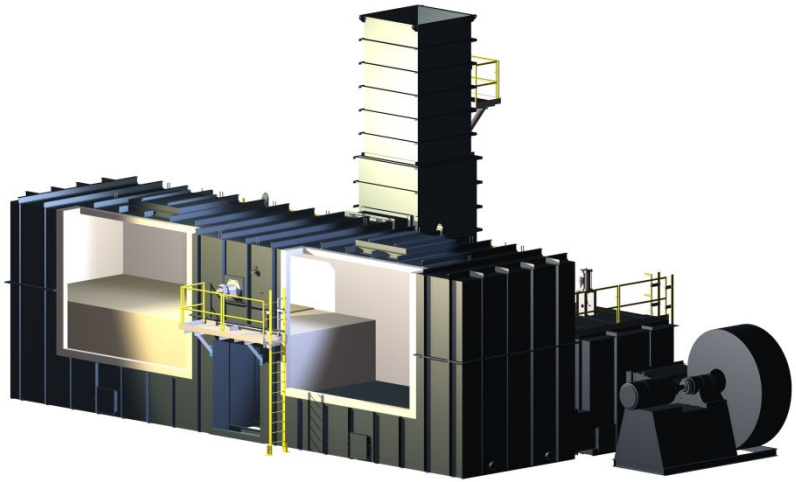
- Over 4,000 RTOs installed worldwide
- Sizes ranging from 500 to 90,000 scfm
- Single & multiple can designs

MEGTEC Regenerative Oxidizers for VAM Processing



VOCSIDIZER

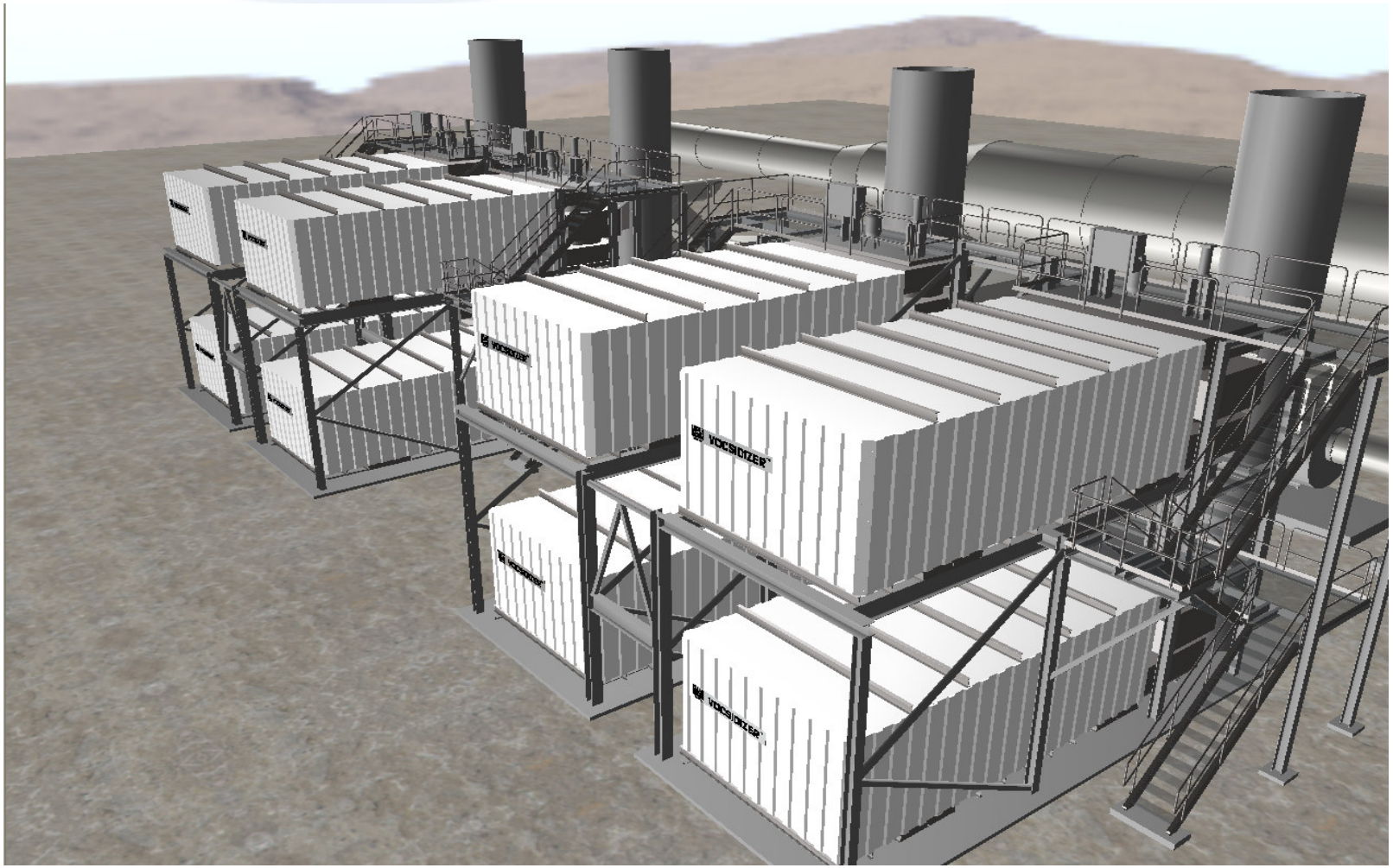
- Single bed design – no combustion chamber
- Electric pre-heat, eliminates need for fuel source
- Modular-stackable design minimizes footprint



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

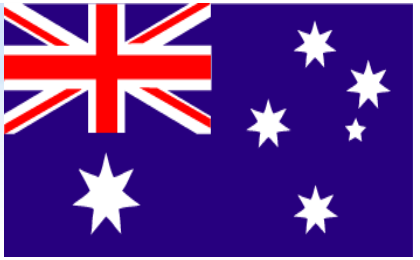
- **2007 – BHP Billton, West Cliff Mine**
  New South Wales, Australia
  Flow capacity: 250,000 Nm^3/hr

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

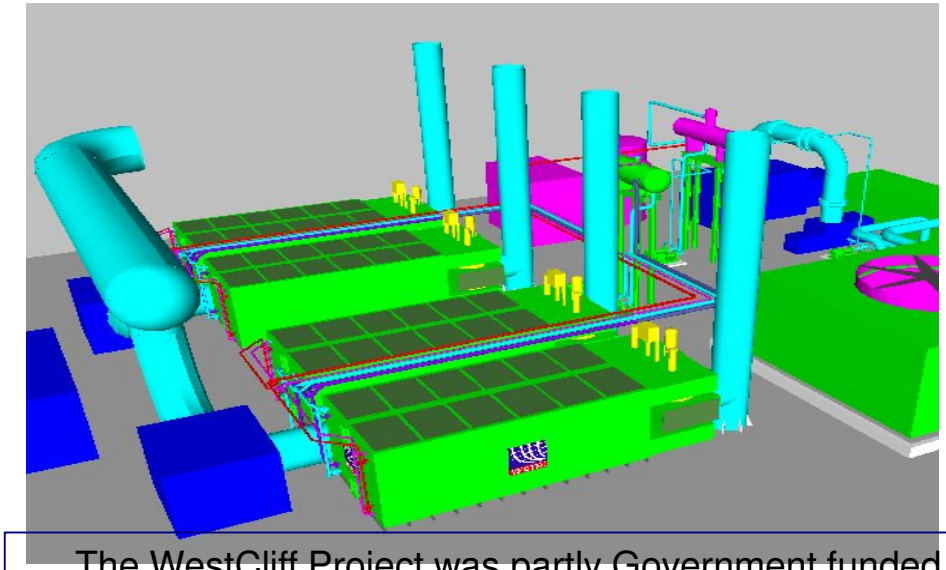
- **2011 - DaTong Coal Mine**
  ChongQing Province, China
  Flow capacity of 375,000 Nm^3/hr

- **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

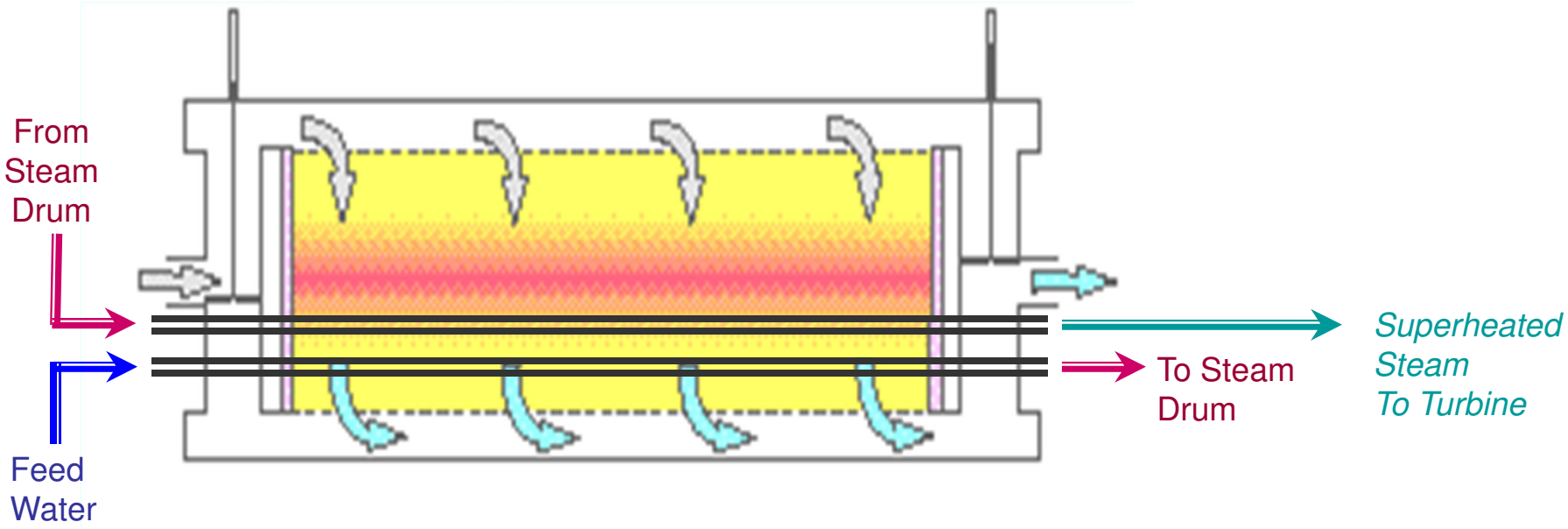


- **Four VOCSIDIZERS installed in 2007**
- **Steam heat recovery drives 6 MW turbine**
- **Total flow capacity: 250,000 Nm^3/hr (only 20% of shaft flow)**
- **Methane concentration: 0.9 – 1.0 % CH_4**
- **Availability on demand:>99%**



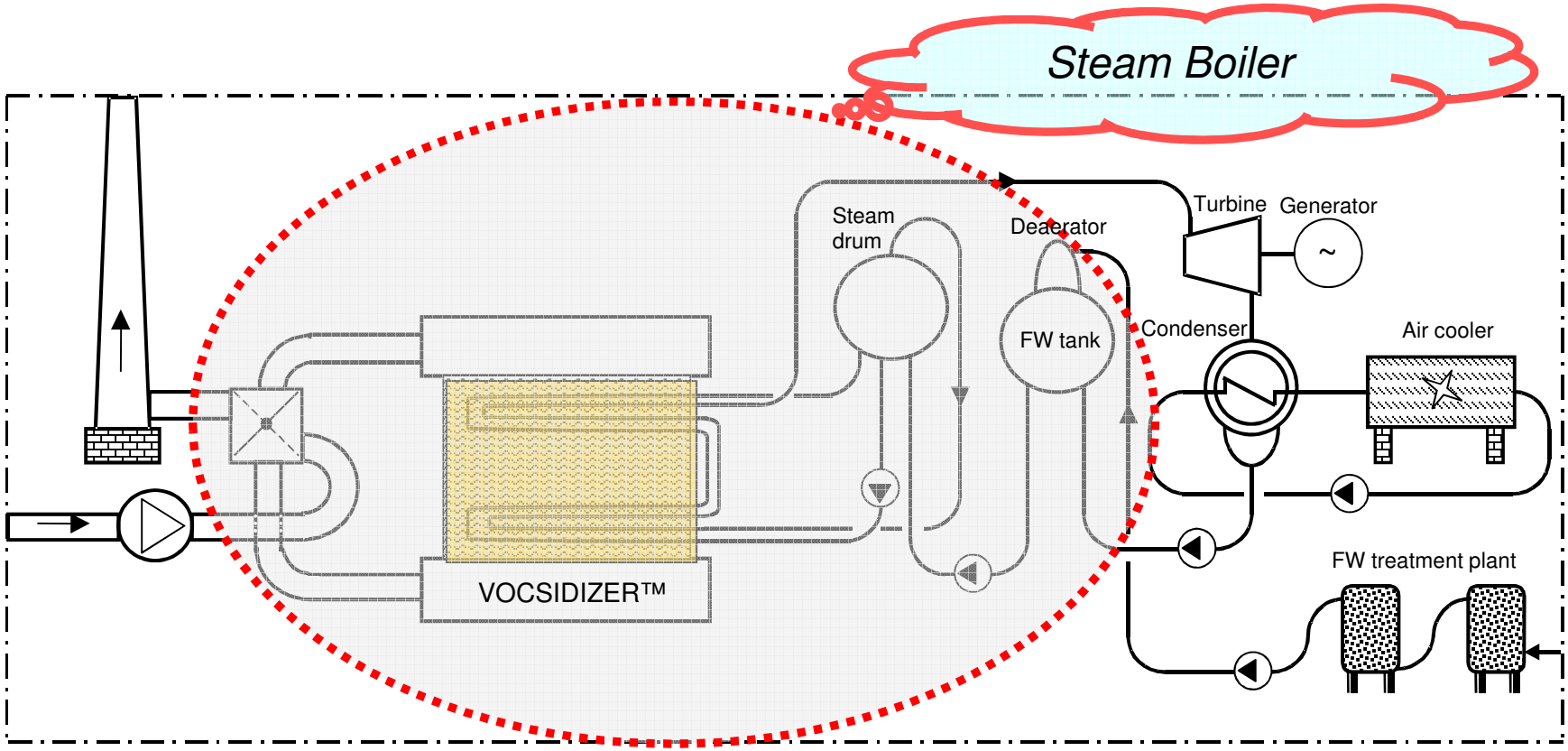
The WestCliff Project was partly Government funded by AGO – Australian Greenhouse Office

VOCSIDIZER Energy Recovery as Superheated Steam

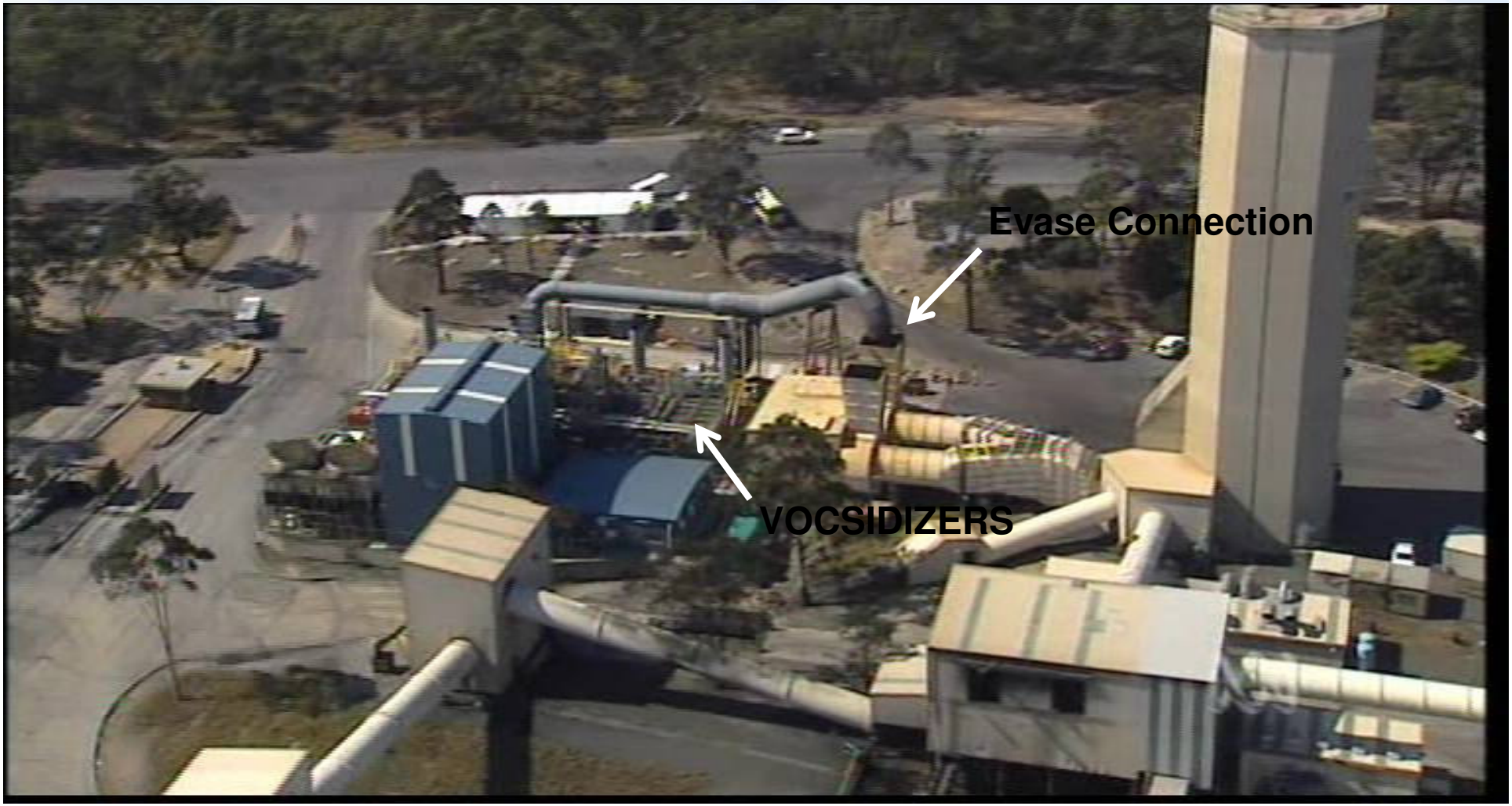


- **Peak media bed temperatures: 1185 – 1200 ºC**
- **Thermal steam power: 17.8 MWth**
- **Electrical output Average: 120 MWh/d**

VOCSIDIZER STEAM CYCLE FOR POWER GENERATION

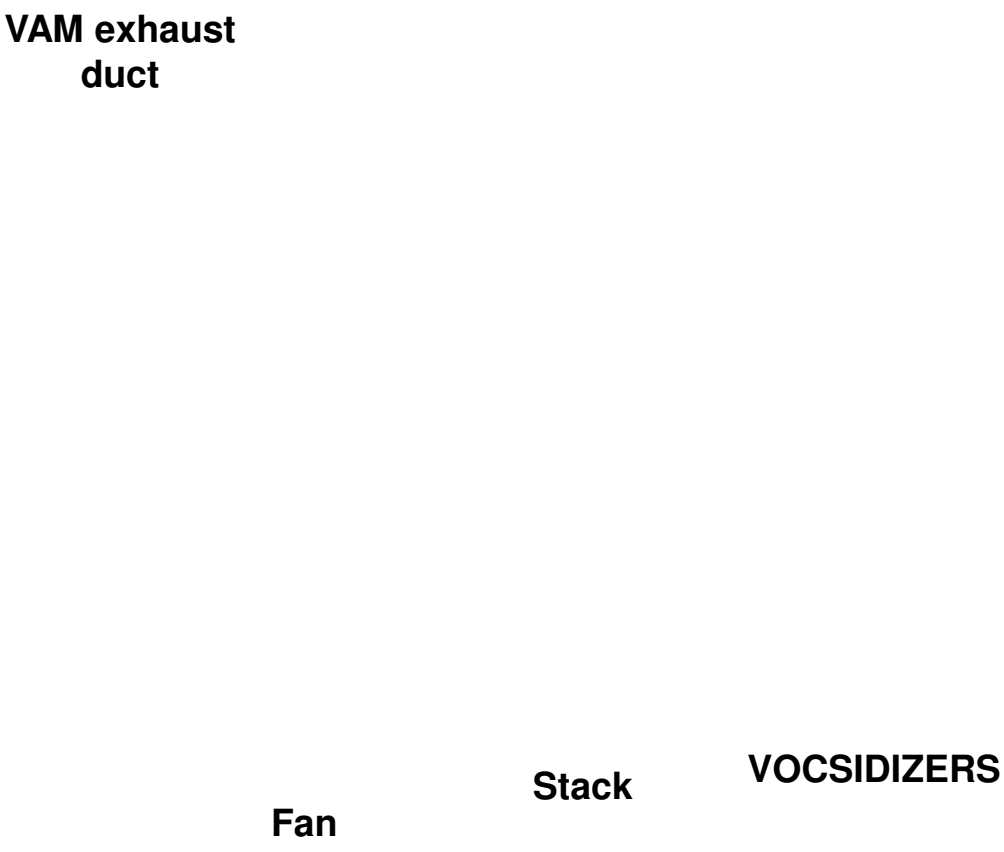


MEGTEC VAM Power Plant at BHP Billiton in Australia

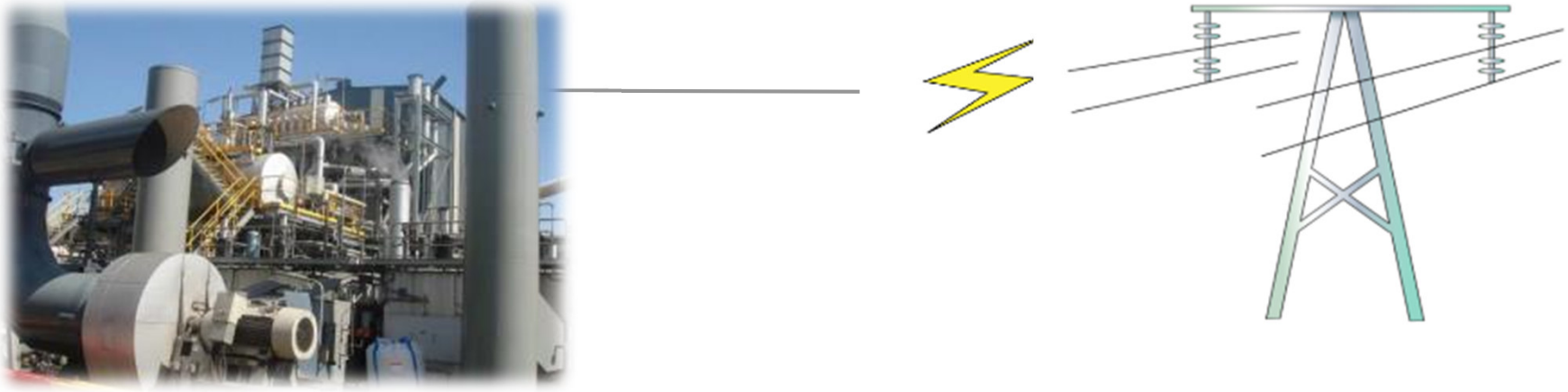


In full operation since 2007

MEGTEC VAM Power Plant at BHP Billiton in Australia



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 m^3/h*, *1 % CH_4* → *72 MW(th)* → *21 MW(el)* *(at 30% efficiency)*

Example: *800 000 m^3/h*, *0.6 % CH_4* → *36 MW(th)* → *10 MW(el)* *(at 30% efficiency)*

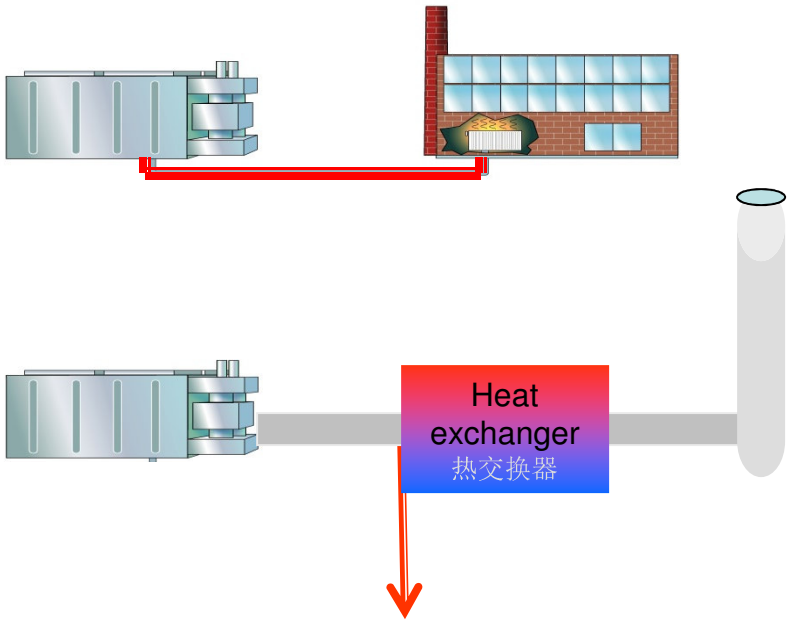
MEGTEC VAM in China
ZhengZhou Coal Mining Group, Henan Province

- **PDD administrator is EcoCarbone, France**
- **Commissioned in 2008**
- **One (1) VOCSIDIZER installed – capacity of 62,500 Nm^3/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

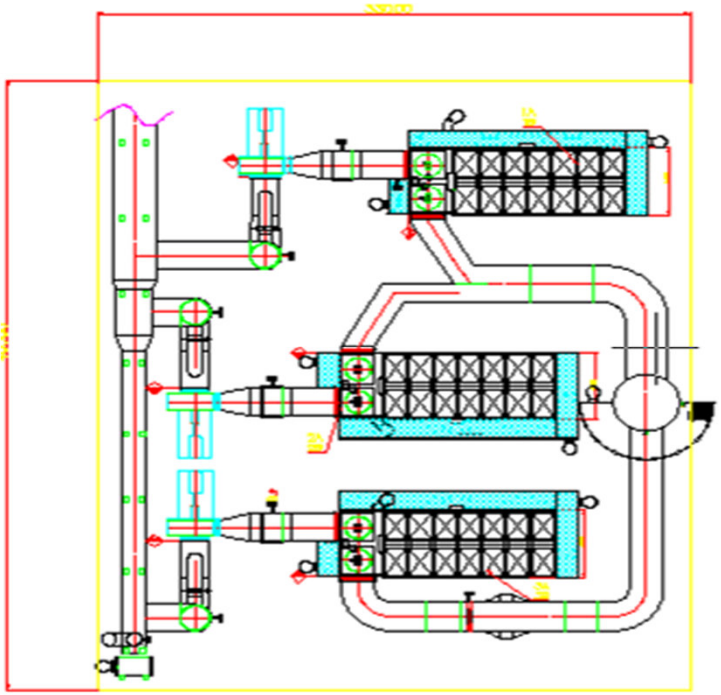
In China typical VAM concentrations are 0.3 – 0.7%

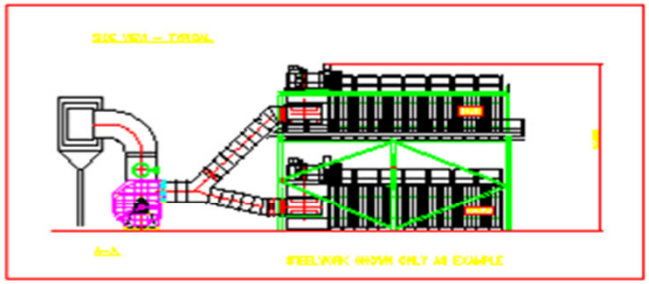


	0.3%	0.5%	0.7%
Heat straight from bed. **Water at 70 - 150°C**	1.5 MW	3.8 MW	6.1 MW
- - - For each 125 000 Nm3/h of ventilation air - - -			
Secondary heat-exchanger. **Water at 70oC**	0.5 MW	2.7 MW	5 MW
Secondary heat-exchanger. **Water at 150oC**	-	-	1.5 MW

MEGTEC VAM in China
at the Da Tong Mine, ChonQing Province, China

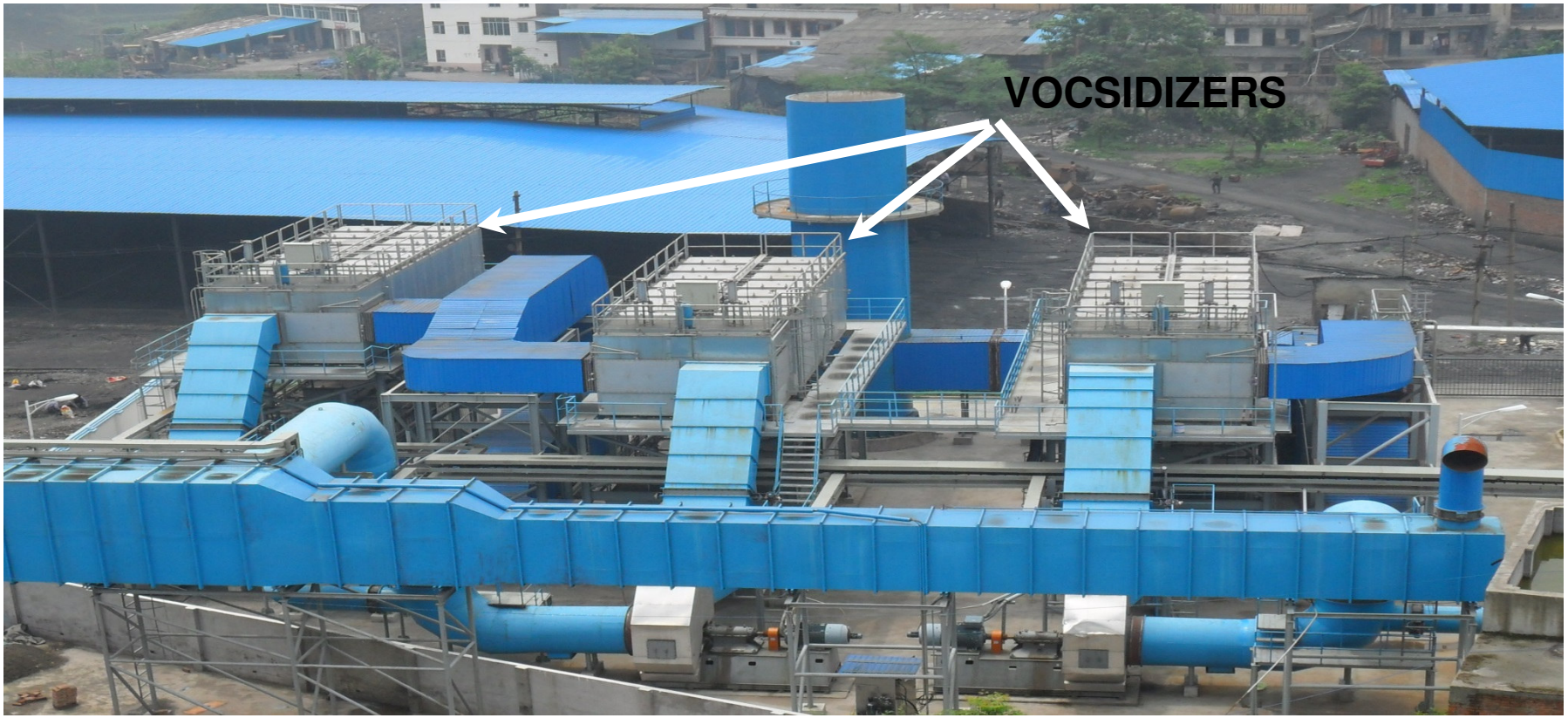
- **Commissioned in 2011**
- **Six (6) VOCSIDIZERS installed as three stacked pairs**
- **VAM flow capacity of 375,000 Nm^3/hr**
- **Methane concentration: 0.3 – 0.5 %**





MEGTEC VAM in China

at the Da Tong mine, ChonQing Province, China



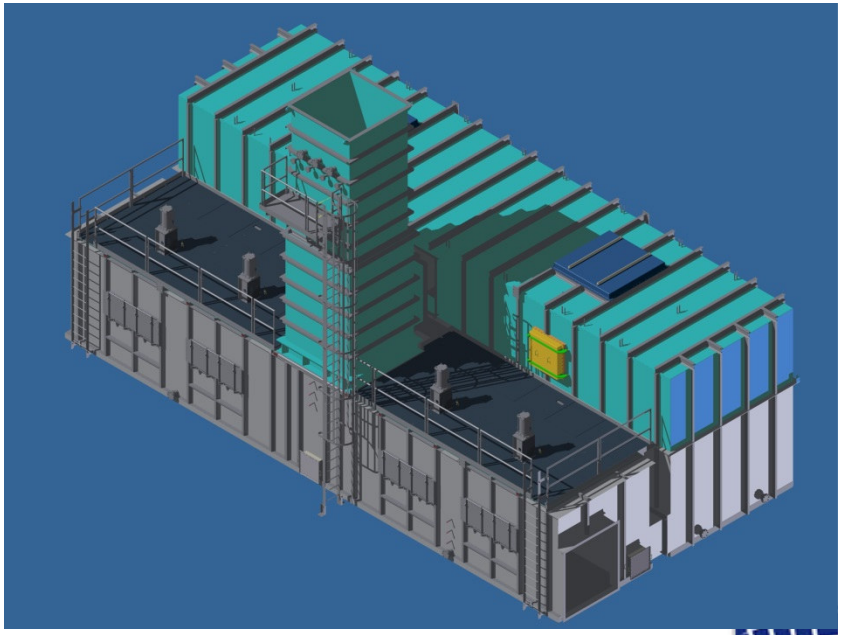
❖ **Includes hot water generation for local use**

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 Nm^3/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 CH_4 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
- CH_4 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!

- ✓ Contact information:
- ✓ Michael J. Hager, Vice President, Engineering
- ✓ mhager@megtec.com
- ✓ Visit www.megtec.com
- ✓ Inquire at: info@megtec.com