MEGTEC Systems

VAM Processing – September 9-10, 2011

KEY CONTENT OF PRESENTATION

- ✓ MEGTEC MARKET LEADING ACTOR SERVING GLOBAL INDUSTRIES
- ✓ CLIMATE CHANGE AND METHANE

GLOBAL VAM MILE STONES

- ✓ UN APPROVED VAM CER's
- ✓ WORLDS LARGEST VAM PROCESSING PLANT
- ✓ OVER 100,000 MWh FROM VAM POWER PLANT

MEGTEC Locations Worldwide

Industry Applications

- ✓ Battery Separators
- ✓ Extrusion Laminates
- ✓ Flexible Packaging
- ✓ Foil Laminates
- ✓ LCD Screens
- ✓ Medical Products
- ✓ Membrane Manufacturing
- ✓ Metal Coil Coating
- ✓ Photovoltaic Cells
- ✓ PSA Label Stock
- ✓ Rechargeable Battery Foils
- ✓ Solar Films

- ✓ Bakery & Food
- ✓ Biofuels Production
- ✓ Biogas Generation
- ✓ Chemical Processes
- ✓ Coal Mines
- ✓ Electronics
- ✓ Fiberglass Processes
- ✓ Flexible Packaging
- ✓ Gas & Diesel Engines
- ✓ Landfills
- ✓ Odour Market
- ✓ Pharmaceutical
- ✓ Wood Products

- ✓ Commercial Printing
- ✓ Semi-commercial Printing
- ✓ Newspaper Printing
- ✓ Digital Printing
- ✓ Insert Printing
- ✓ Direct Mail
- ✓ Book Printing
- ✓ Label Printing
- ✓ Flexible Packaging
- ✓ Carton Packaging

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Environment, Climate & Energy

Environment, Climate & Energy

- ✓ Regenerative Thermal Oxidizers (RTO)
- ✓ Catalytic Oxidizers
- ✓ Solvent Recovery Systems
- ✓ Distillation Systems
- ✓ Heat Recovery Systems
- ✓ Bioscrubbers / Bioreactors
- ✓ Ventilation Air Methane (VAM) to Energy
- ✓ Greenhouse Gas Abatement (GHG)

Regenerative Thermal Oxidizers, RTO

RTO's: In total over 4,000 installed - whereof ..

Sizes ranging from
500 to 90,000 scfm capacity,
single & multiple can designs

.. over 800 Vocsidizers

Waste to Energy – Ventilation Air Methane (VAM) Processing

MEGTEC's proven VAM processing technologies destroy methane while generating high quality carbon credits and electricity for coal mines.

Since 2007, VAM Power Plant WestVAMP at BHP Billiton in Australia is oxidizing Ventilation Air Methane, using the energy released to generate high grade steam, driving a conventional steam turbine.

Environmental Responsibility

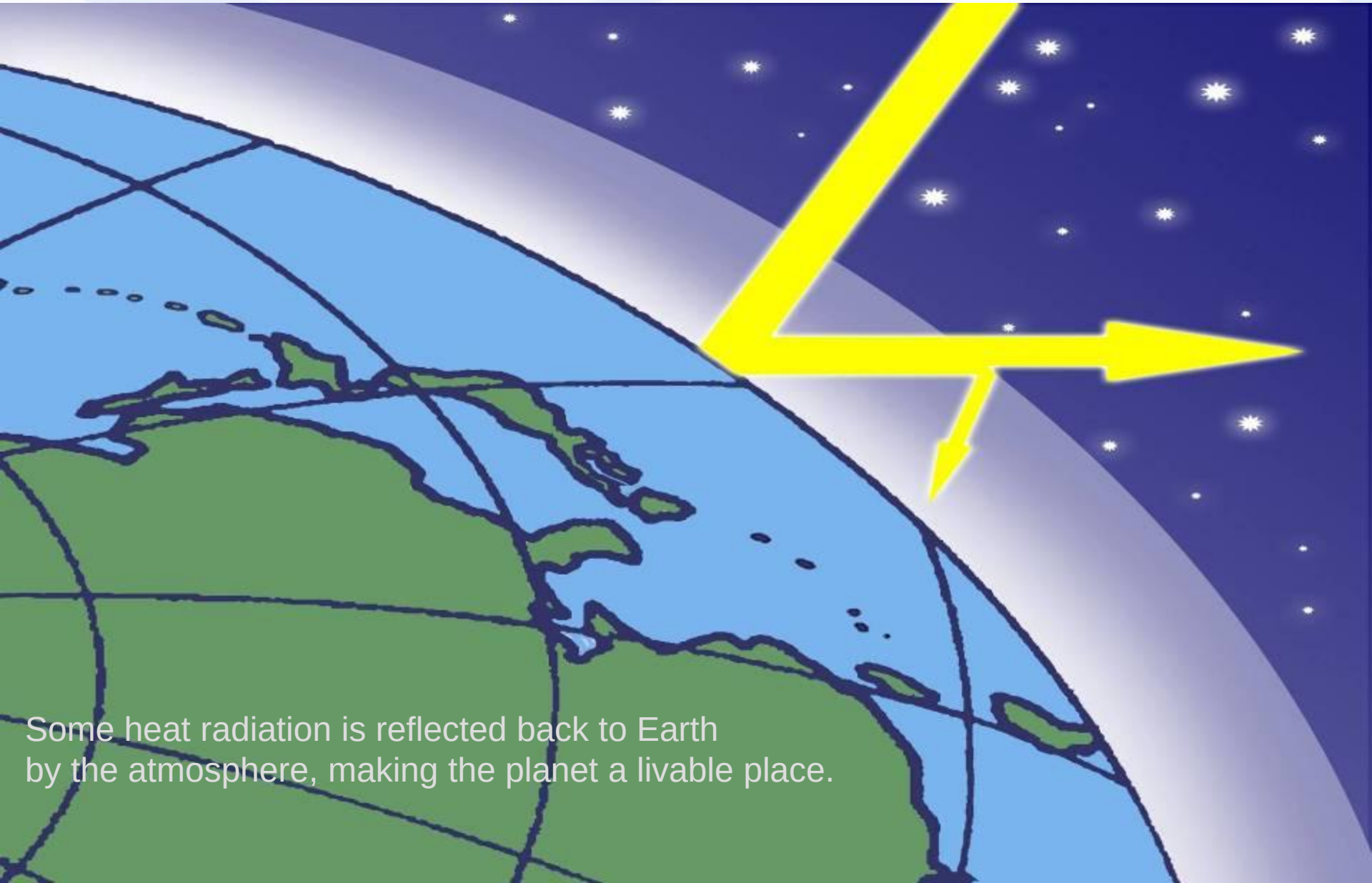
- ✓ MEGTEC was awarded the prestigious EPA Climate Protection Award for 2008.
- ✓ MEGTEC is the only manufacturing company in the world to receive this award in 2008.

GLOBAL WARMING AND CLIMATE CHANGE

-Why is VAM of interest?

One thin bubble of atmosphere

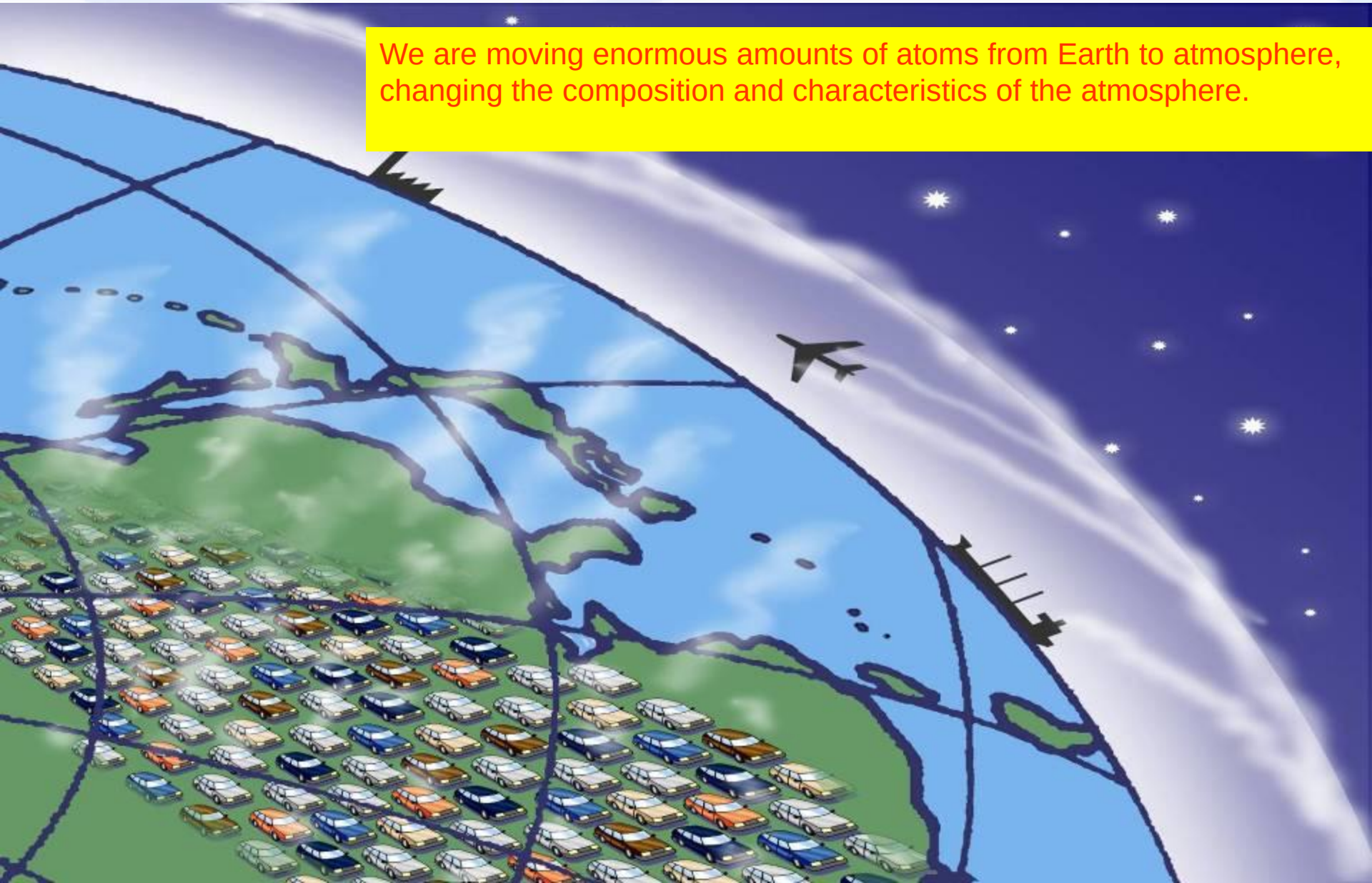
One thin bubble of atmosphere



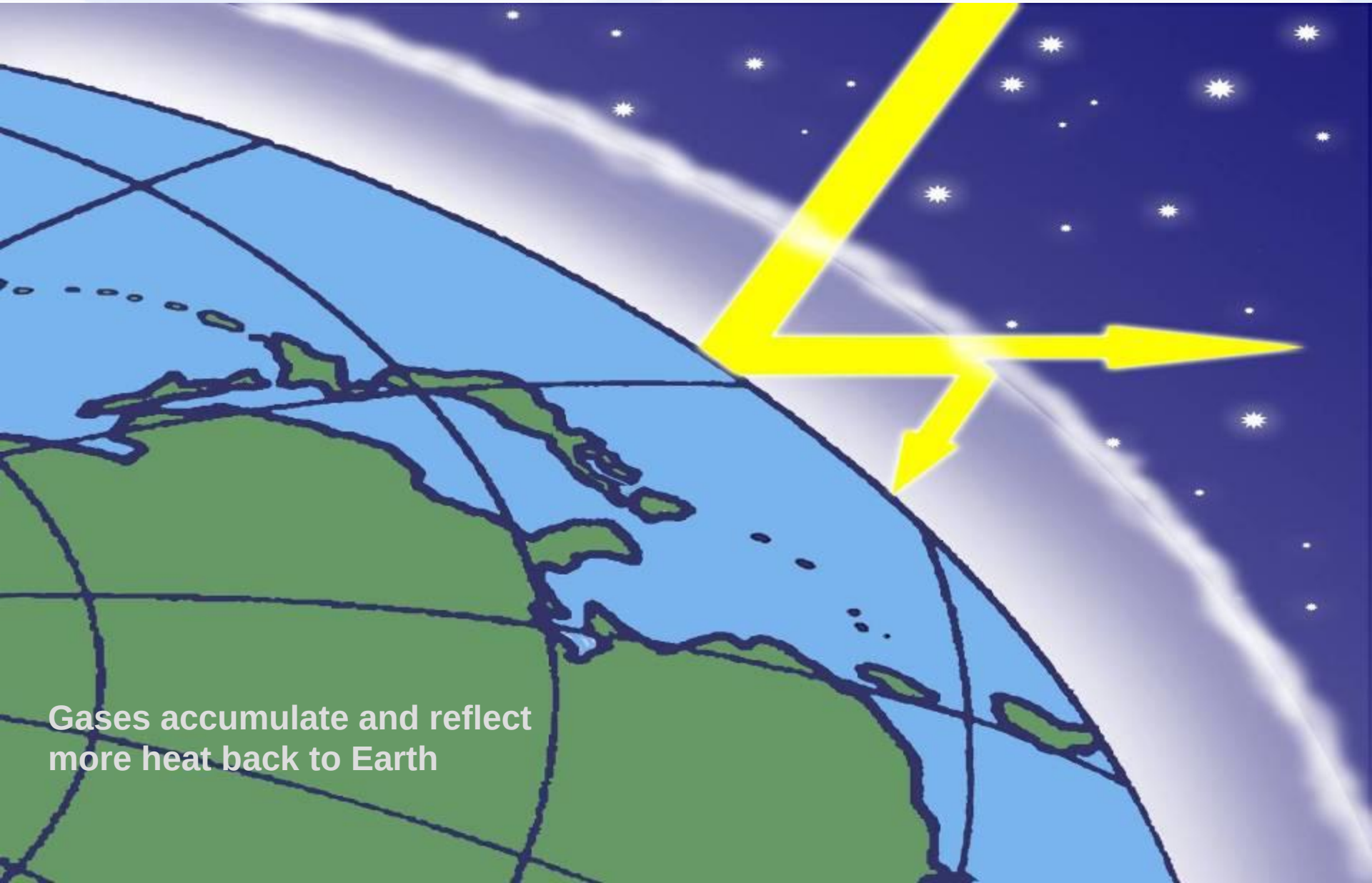
Some heat radiation is reflected back to Earth
by the atmosphere, making the planet a livable place.

One thin bubble of atmosphere

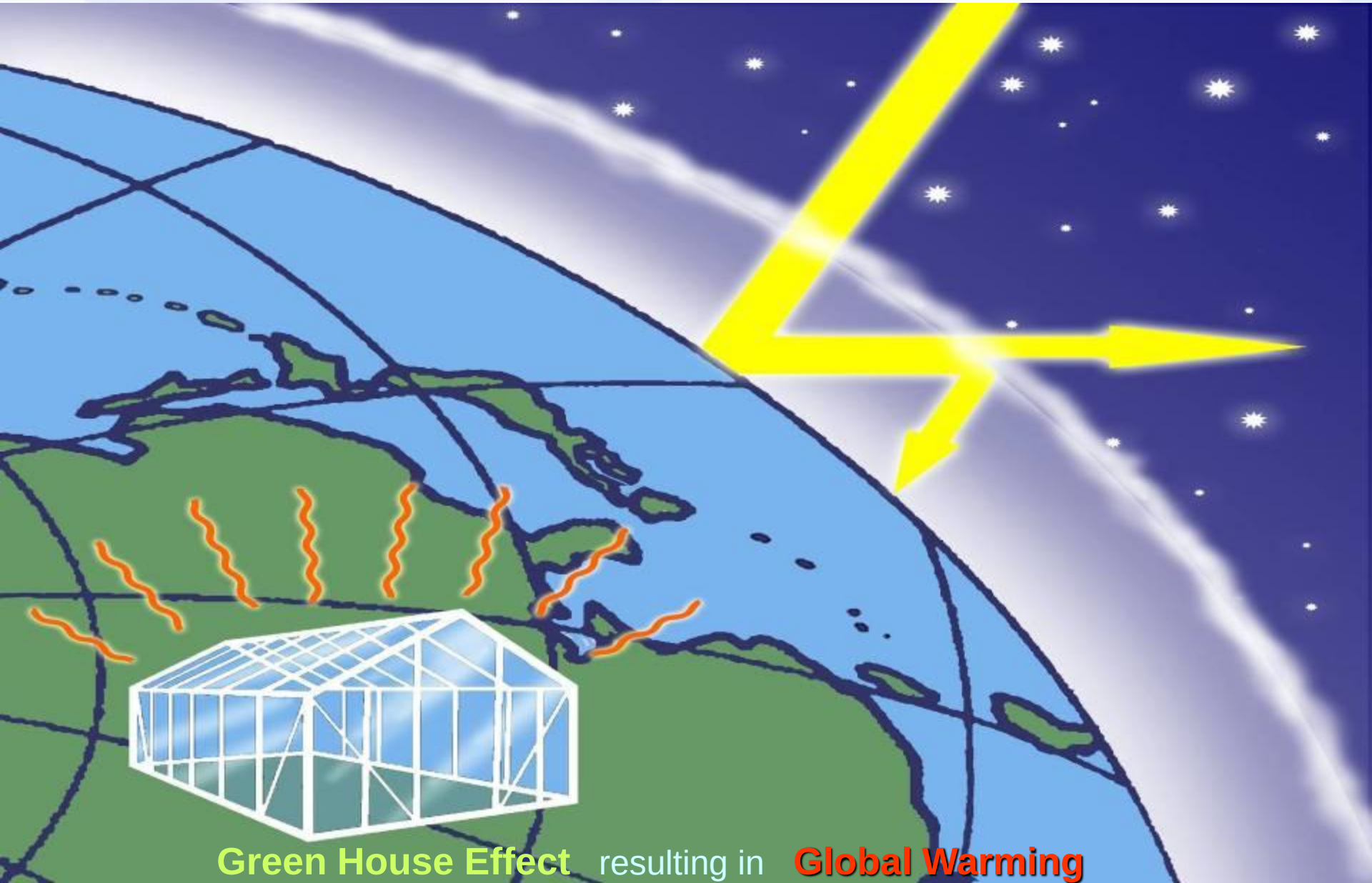
We are moving enormous amounts of atoms from Earth to atmosphere, changing the composition and characteristics of the atmosphere.



One thin bubble of atmosphere



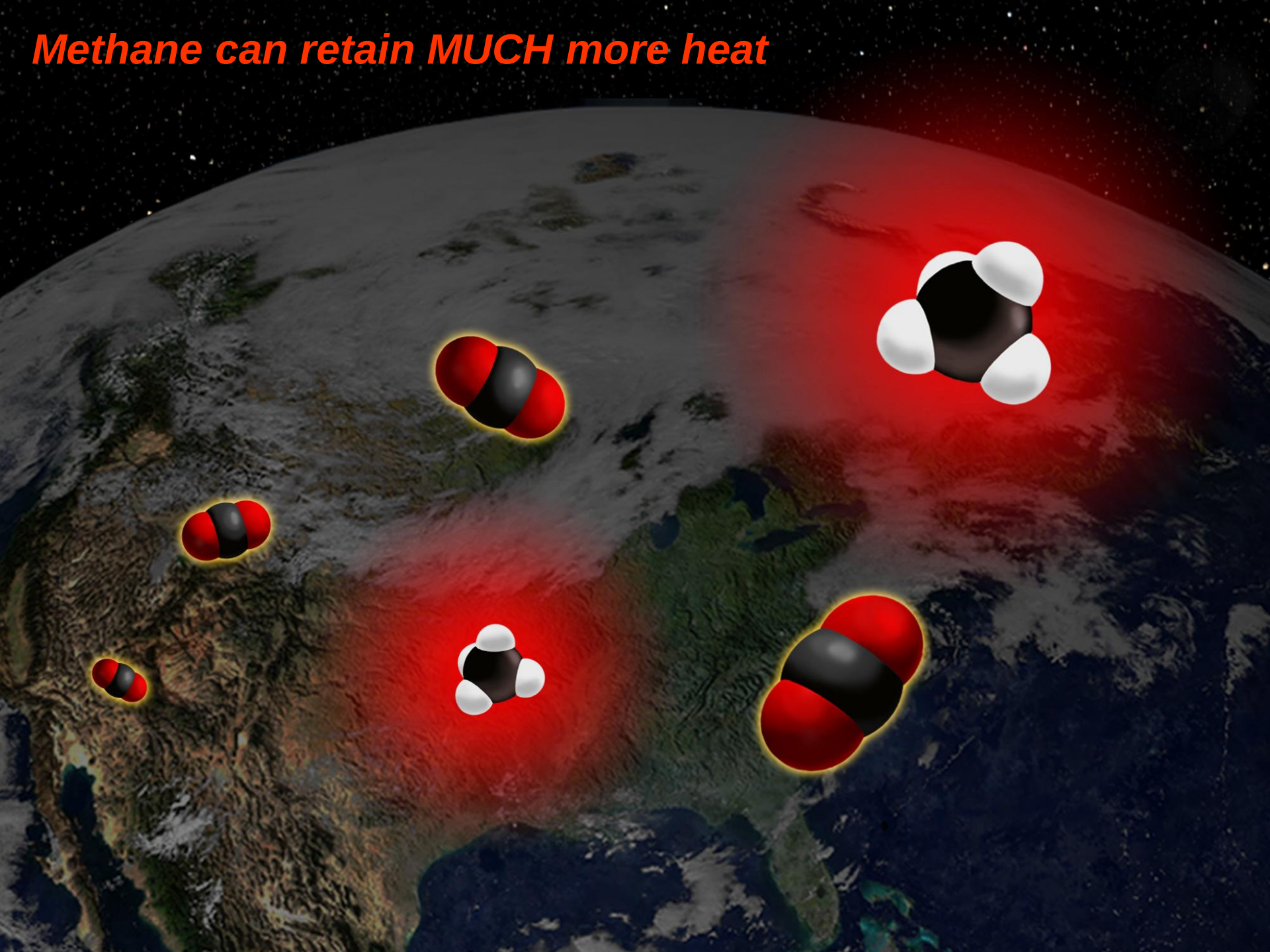
One thin bubble of atmosphere



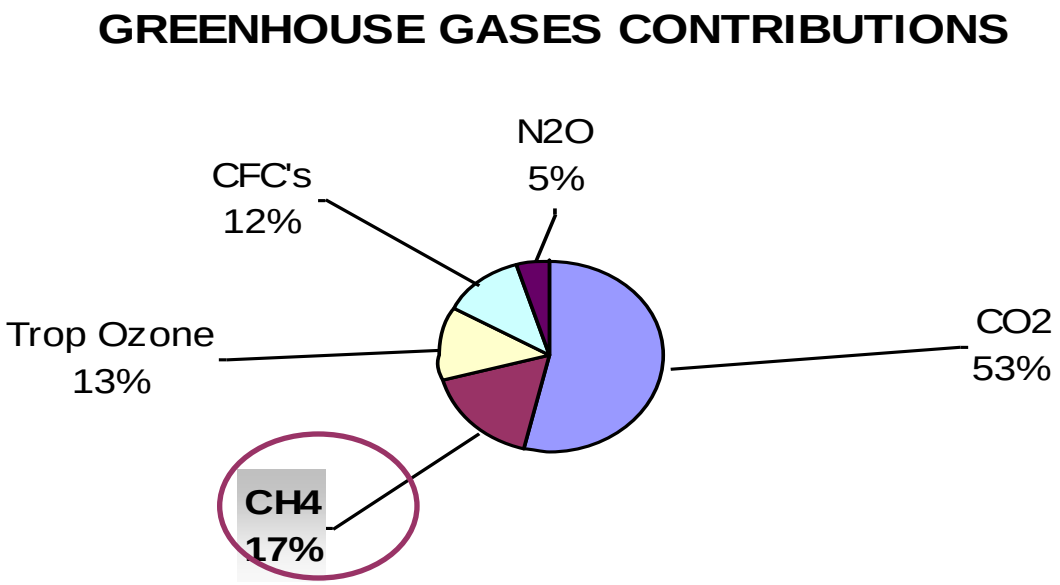
Green House Effect resulting in **Global Warming**


CO2 can retain some heat in atmosphere

Methane can retain MUCH more heat



Green House Gas METHANE



	CO_2	CH_4
Global Warming Power	1	25 (21 in the first Kyoto Period)
Life time in atmosphere (years)	20 000 – 50 000	12

- ✓ 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)**

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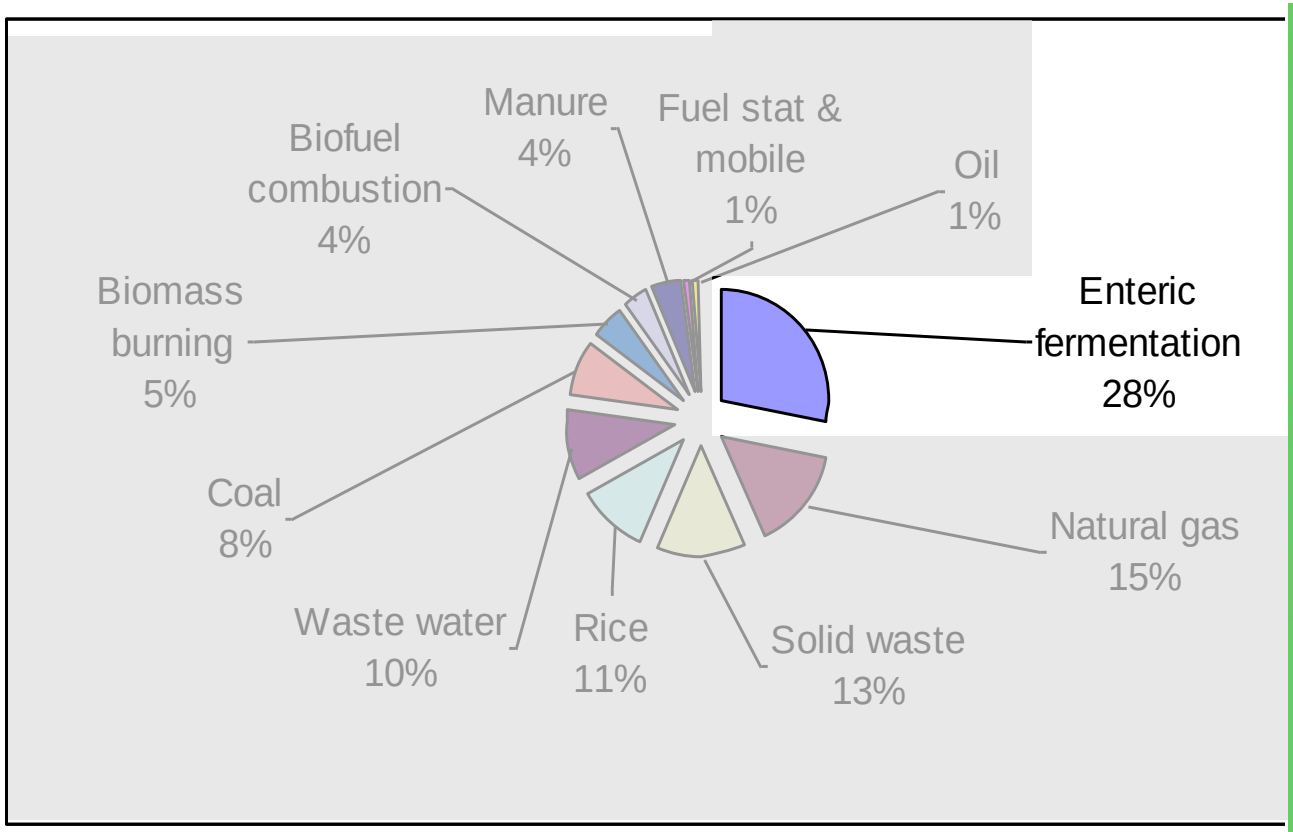
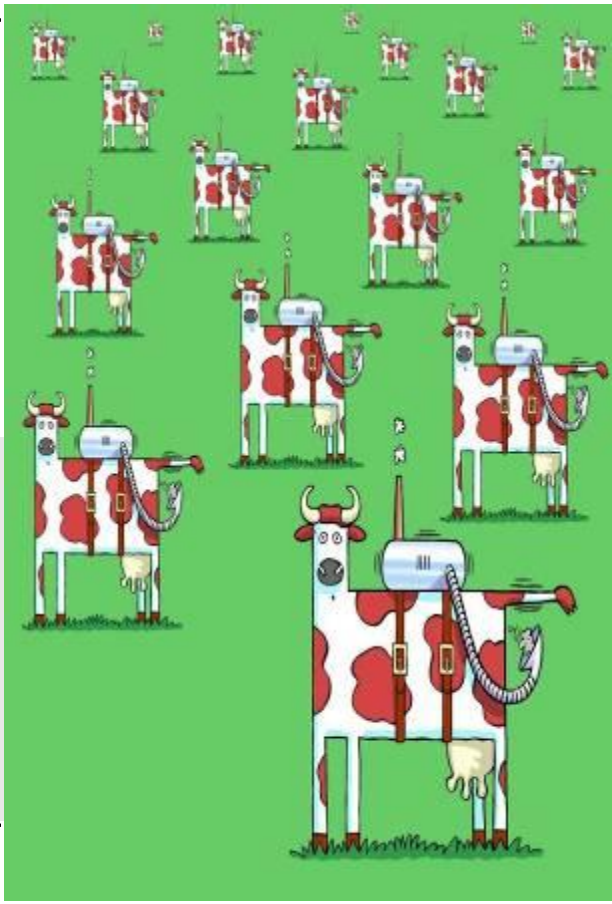
Global Methane Emissions - by source



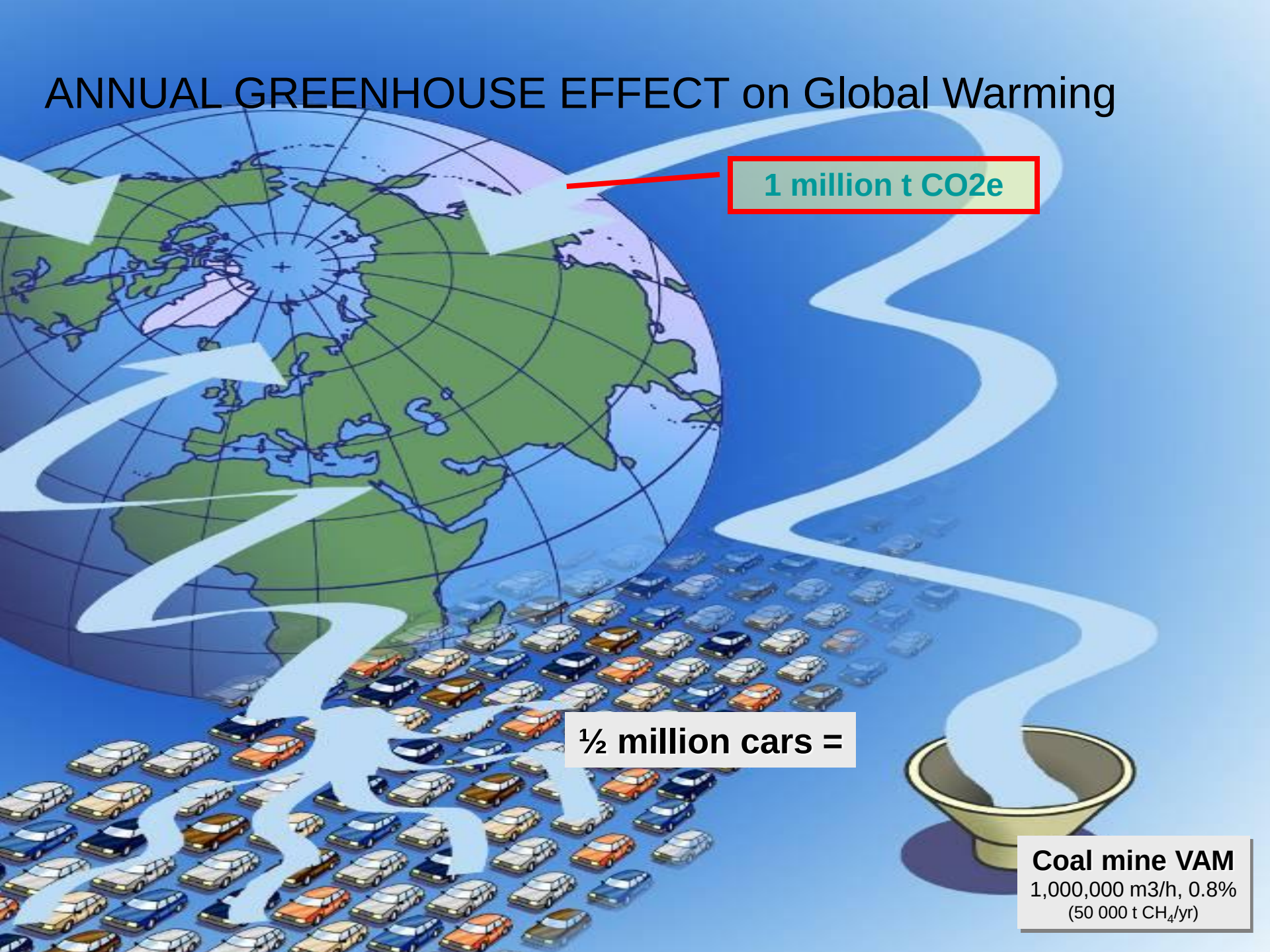


BIGGEST TOTAL SOURCE: Cows, sheep etc

50-100 kg CH4 per cow and year = 1-2 t CO2e

PROBLEM: Each source is very small

ANNUAL GREENHOUSE EFFECT on Global Warming



One thin bubble of atmosphere

- All emissions are going into the same thin bubble of atmosphere.

- Trading with Carbon Credits is an efficient instrument to guide investments to where they most cost efficiently reduce GHG emissions.

- VAM processing is such a type of investment. It is totally dependent on allocation of Carbon Credits, which at sufficient value make it a profitable investment and likely to happen. It is therefore an excellent example of the Rule of Additionality!

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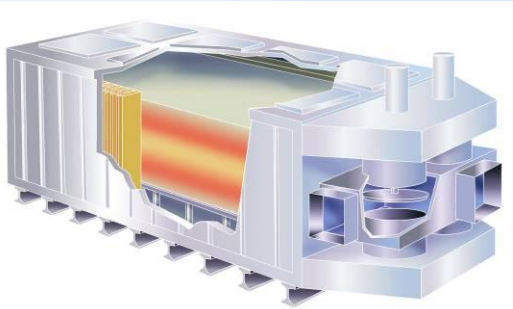
Calculations of VAM based CERs

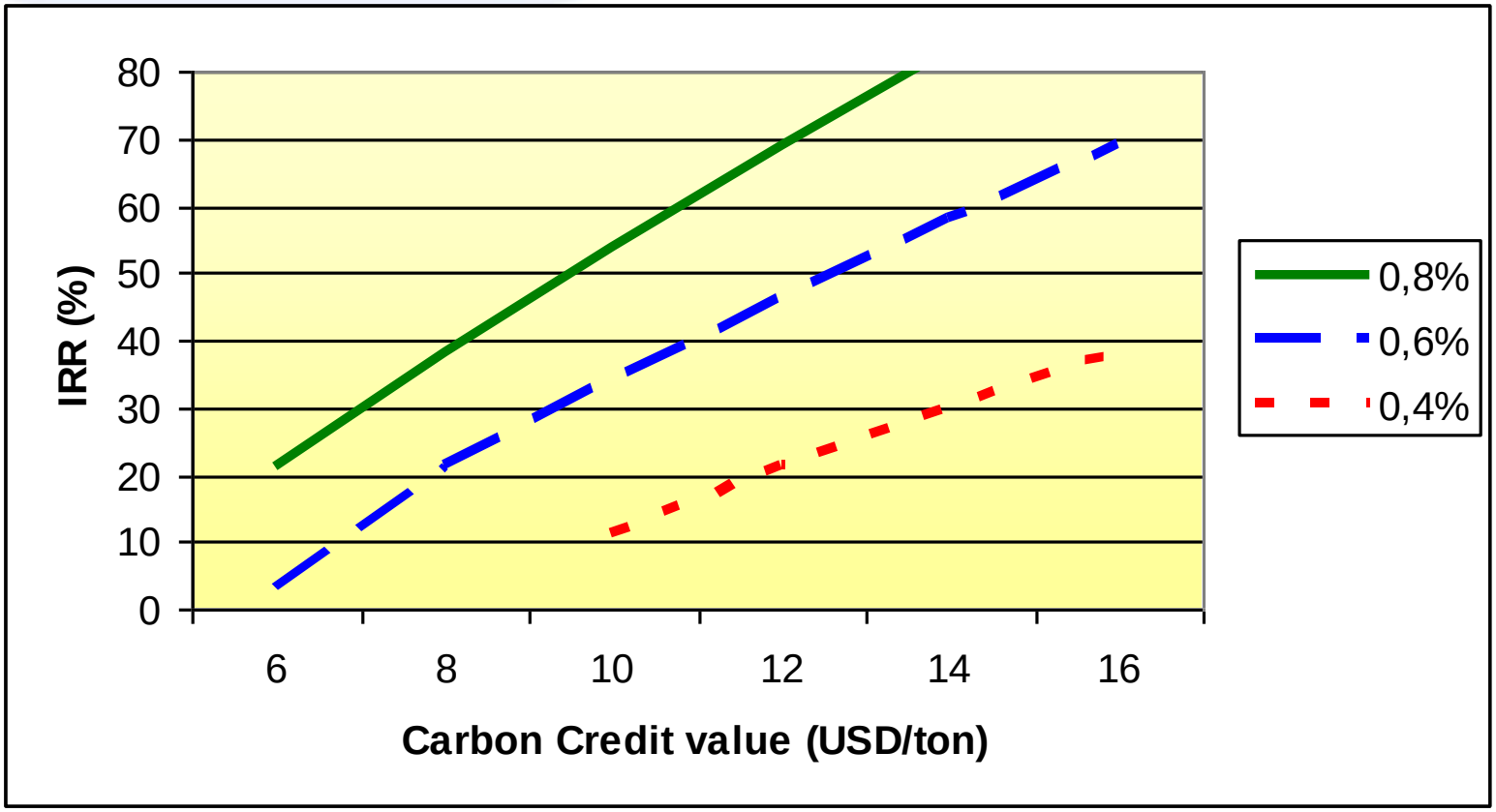


Examples:
250 000 Nm3/h @ 0.9 % VAM comes to 240 000 tonnes of CO2e
125 000 Nm3/h @ 0,9 % VAM comes to 120 000 t CO2e
125 000 Nm3/h @ 0,3 % VAM comes to 40 000 t CO2e

VAM conc'n / Nm3/h vent air	0.3 %	0.6 %	0.9 %
125 000	***40***	***80***	***120***
250 000	***80***	***160***	***240***
500 000	***160***	***320***	***480***
1 000 000	***320***	***640***	***960***

Annual emission reductions in thousand tons of CO2e

VAM project economics indication



CONCLUSIONS for short pay back:

- VAM concentrations should be min ½ percent
- Carbon Credits should be minimum USD 10/t
- Failure in international climate talks create uncertainty about post 2012 credits
- Present values of most carbon credits do not support VAM project economics

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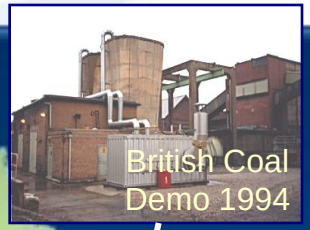
MEGTEC VAM installations Worldwide

- Demos



MEGTEC Worldwide Headquarters

MEGTEC Regional Offices

MEGTEC VAM installations Worldwide

- Demos
- **Commercial**

MEGTEC Worldwide Headquarters

MEGTEC Regional Offices

Waste to Energy – Ventilation Air Methane (VAM) Processing

By 2010 over 100,000 MWh of electricity and 625,000 carbon credits generated.

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 %

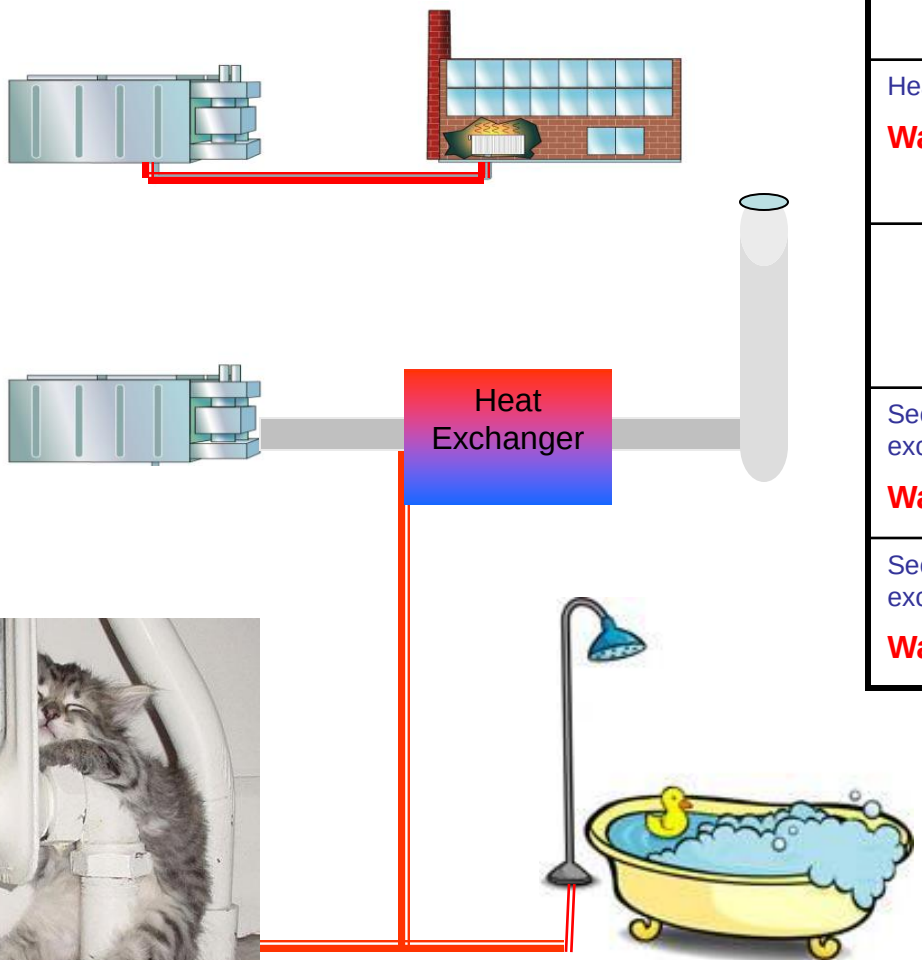
MEGTEC VAM in China

The complete installation includes VAM abatement and energy recovery in the form of hot water for local use

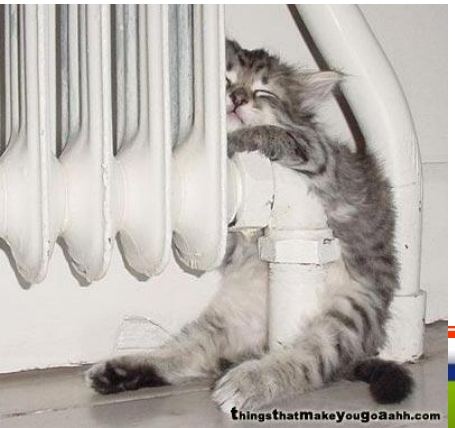
The MEGTEC delivery was fully commissioned and taken over by customer October 2008.

The globally first project to be awarded VAM-based CER's (Kyoto related Carbon Credits).

Hot water from VAM



	0.3%	0.5%	0.7%
Heat straight from bed. **Water at 70 - 150^{oC}**	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

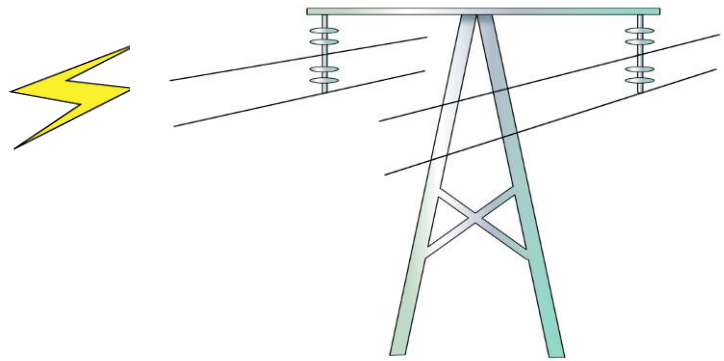


Electricity from VAM Power Plant

	0.3%	0.5%	0.7%
Heat straight from bed. -Water at 70 - 150^{oC} -**Steam at chosen T**	1.5 MW	3.8 MW	6.1 MW
- - - For each 125 000 Nm3/h of ventilation air - - -			

For large size plant, conversion from thermal to electrical energy can be expected to be around 30%.

Electricity from VAM Power Plant

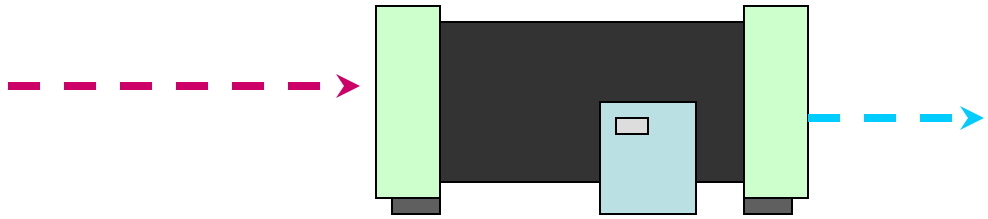


0.2 % methane needed to maintain oxidation. Energy of concentrations above 0.2 % can be recovered. Interesting combinations of electricity and thermal generation can be achieved.

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)*

Electricity from VAM Power Plant

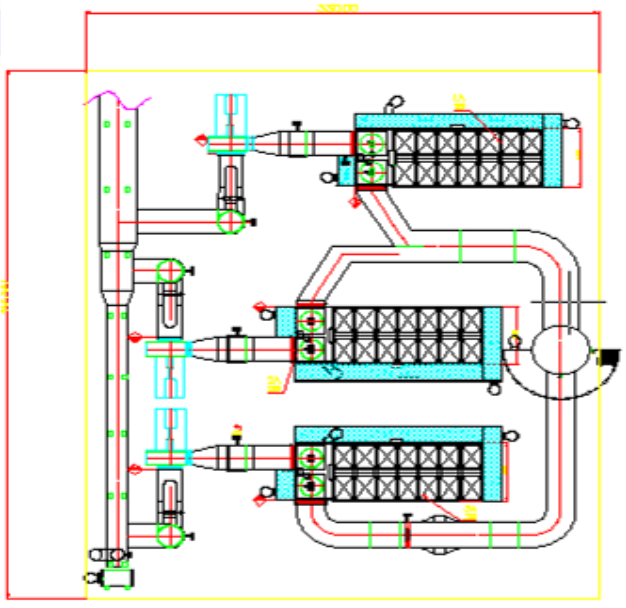


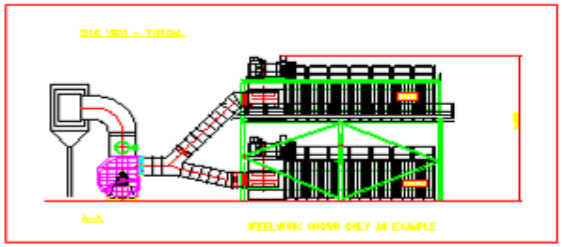
Hot water from electricity generation can drive an absorption chiller generating cooling for deep level coal mining.

Example:

800 000 m3/h
1% methane → *72 MW(th)* → *21 MW(el)* → *19 MW(el) + 38 MW(cool)*

MEGTEC VAM in China





- Installed at the DaTong coal mine, ChongQing Province
- Supplied by MEGTEC
- Investor is a joint venture owned by:
  - Shenzhen Dongjiang Environmental Renewable Energy Co Ltd
  - SongZao Coal & Electricity Co Ltd
  - AES Corp (US-based global power generation company)

VAM PROCESSING

at the Da Tong mine, ChonQing Province, China

- The 6 Vocsidizer units were produced in China
- Processing capacity is 375,000 Nm3/h of ventilation air
- Includes hot water generation for local use

VAM PROCESSING STATUS 2011

VAM MARKET ISSUE

- Failing Climate Talks and low value of carbon credits are holding VAM investment projects back.

VAM MARKET HIGH LIGHTS

- Globally first VAM based CERs approved by the UN.
- Major VAM processing plant in operation in China.
- VAM Power Plant has generated more than 625,000 carbon credits and over 100,000 MWh of electricity.

Thank you!

MEGTEC