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Ventilation Air Methane emissions reduction – challenges for the mining industry

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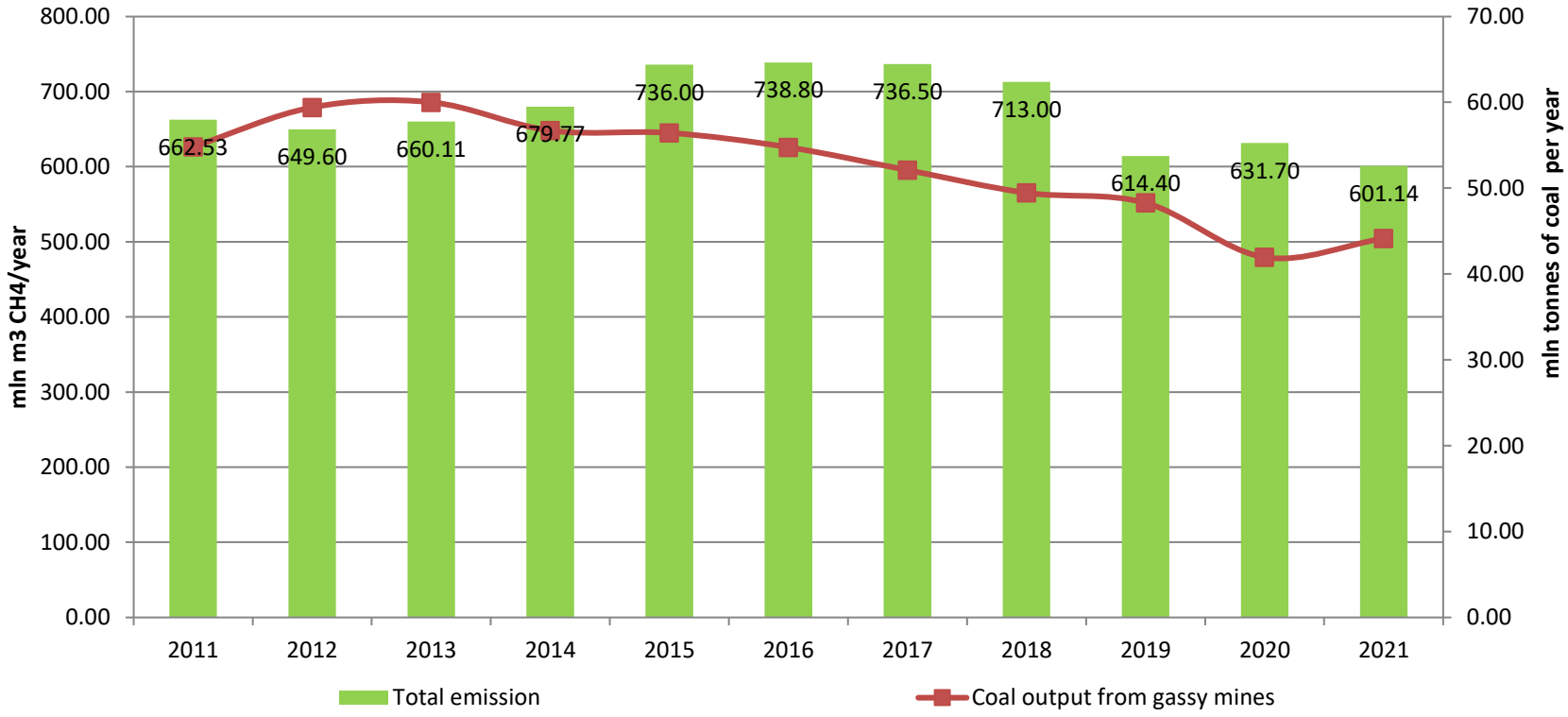
Evolution of methane emissions from underground hard coal mines in Polish mines in the years 2011 - 2021 in relation to total methane emissions and extraction

(Global Trend in General)



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Estimating Future AMM Emissions

Nazar Kholod [1], Meredydd Evans [1], Raymond C. Pilcher [2]

[1] Pacific Northwest National Laboratory; [2] Raven Ridge Resources

Capture and Use of Abandon Mine Methane and Mine Reclamation and Revitalization of Post Mining Areas
Cracow, Poland, 26 February 2020

Global Methane Initiative

Conclusions

- Global methane emissions from coal mining to continue growing even with declining coal production
- AMM emissions will remain significant through the end of the century
- Policy makers should be aware of future CMM and AMM emissions to utilize this energy resource and mitigate emissions
- Utilization of CMM and AMM is important because of their many co-benefits, including mine safety and improved air quality
- There is a need for better data from key coal-producing countries

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Coal mine methane – definitions

CBM	Coalbed methane is recovered from virgin (unmined) coalbeds by drilling wells from the surface, sometimes prior to underground mining
CMM	Coal mine methane is methane gas which is captured by drilling drainage boreholes underground before or during mining operations. Typically, 30% of coal mine methane can be drained and is often used for heat and power generation.*
VAM	Ventilation air methane is the methane desorbed from coal seams or released from voids during mining, not captured by drainage but diluted with fresh air for safety reasons before venting the mixed gas to atmosphere via mine roadways and exhaust shafts. Typically, 70% of mine methane leaves an underground mine in the ventilation air.*
AMM	Abandoned mine methane is the methane gas remaining (and in some instances newly generated by microbes) in closed coal mines. Methane held in voids, coal seams and other gas-bearing strata that have been disturbed or intercepted by mining operations can escape to atmosphere, but quantities vary from mine to mine. AMM emissions change with atmospheric pressure and will eventually stop when mines flood.
SMM	Surface mine methane is the methane released during opencast or open-pit mining. Emissions from surface lignite mines in Europe are reported to be low and marginal, at the limits of detection, because little or no thermal methane is present from the coalification process in these shallow, geologically young seams.

* Creedy, David P., A. Saghafi and R. Lama (1997), *Gas Control in Underground Coal Mining*, IEACR/91, prepared by Wardell Armstrong in collaboration with CSIRO, Australia on behalf of IEA Coal Research – The Clean Coal Centre, London, April 1997.

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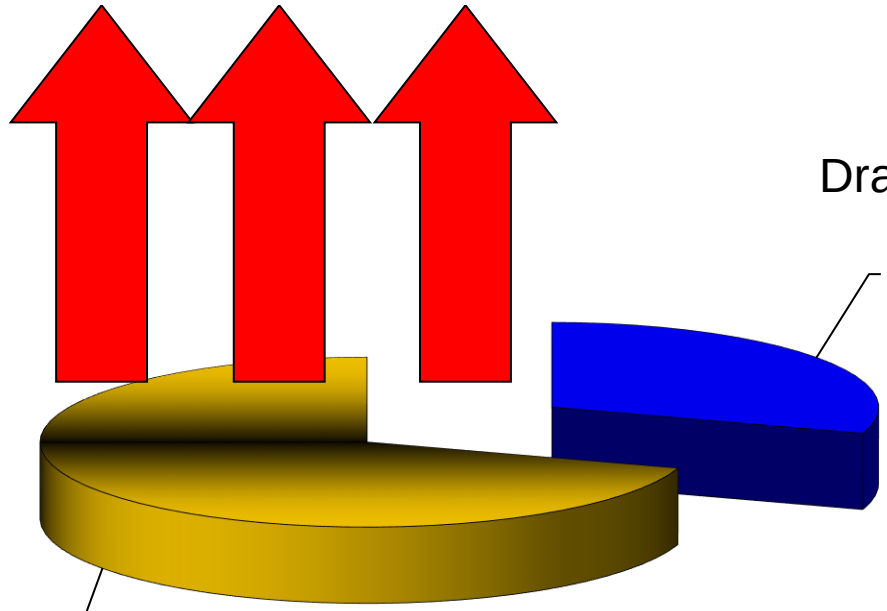
Total gas released during mining operations (Global Trend)



Drainage gas
~30 %

Ventilation **A**ir
Methane (VAM)
~70 %

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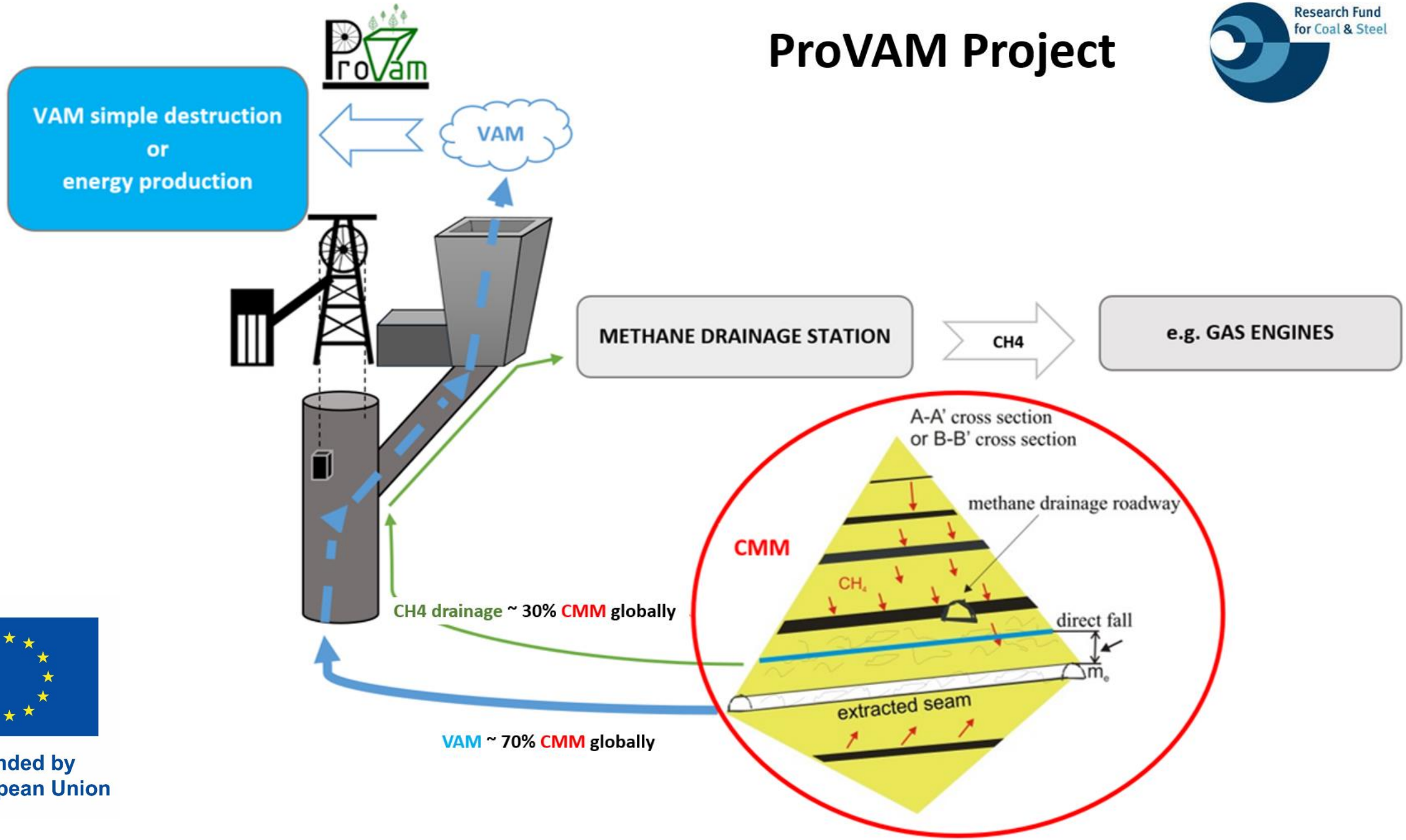
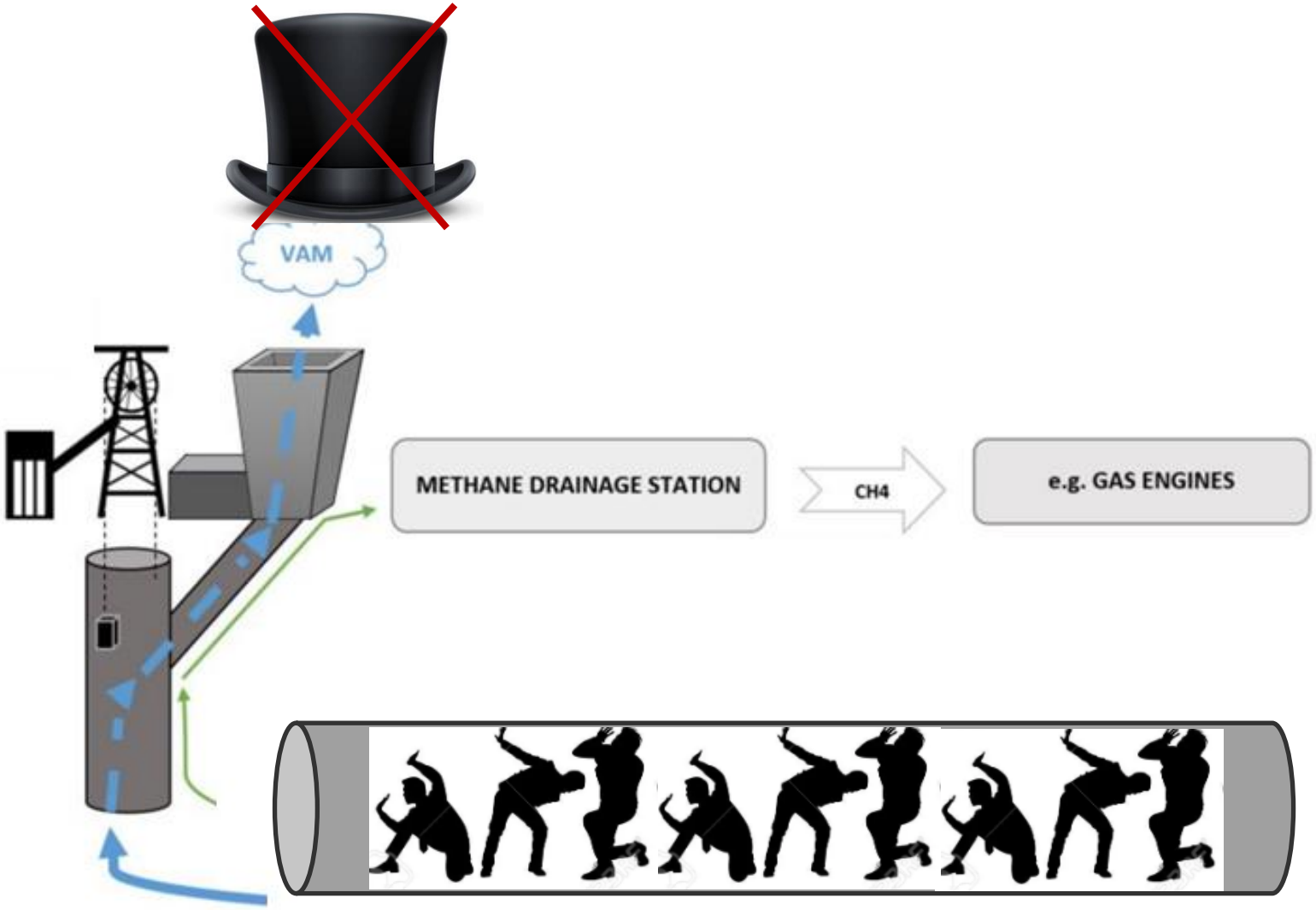
ProVAM Project



Co-funded by
the European Union



VAM – methane, not captured by drainage
but diluted with fresh air for safety reasons
before venting it to the atmosphere via mine roadways and then the exhaust shafts

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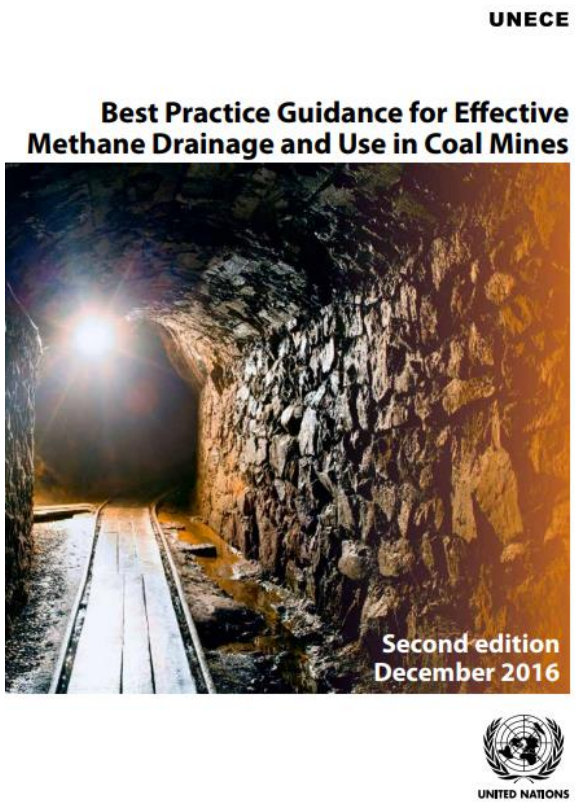
Are there technologies to capture VAM and utilise/destruct it ?



Yes, but not widely used and facing a lot of challenges.... See above reports

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What are the main challenges for VAM ?

There are **four major obstacles**, which create unfavourable conditions for efficient implementation of VAM utilisation technologies:

- **Variable VAM flow rate** (10,000 – 20,000 m3/min) – it is like a strong wind with a speed of several dozen km/h through the hole of about 10meters diameter exhaust shaft outlet !!!
- **Low methane content** (0.75% is admissible but in practice below 0.5%) – low oxidation value !
- **Humidity** (> 90%) – tropical conditions ???
- **Dust load** (coal fines, Ca and SiO_2 particles) – tendency to produce ash – in high oxidation temperature

Unfortunately, either individually or jointly they effectively prevent implementation of VAM utilisation technologies in EU underground gassy coal mines

How can we reduce VAM emissions ?

- by minimising impact of a.m. 4 major obstacles on effective implementation of existing technologies

  (this is major goal of R&D ProVAM project - *„Reduction of Ventilation Air Methane Emissions in the Coal Mining Transformation Process”*

- by increasing CMM drainage efficiency and thus reducing CMM inflow into VAM (major goal of DD-MET pilot & demonstration project – *„Advanced methane drainage strategy employing underground directional drilling technology for major risk prevention and greenhouse gases emission mitigation”*

- by „Reduction of methane emissions from post mining goafs to minimise their inflow into VAM” - REM pilot & demonstration project

All of them are kindly co-financed by REA and local governments of project partners and industrial partners

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What is our realistic target for the forthcoming years ?

Reduce VAM emissions from about 41 exhaust shafts in 23 operating gassy coal mines in EU

by their 1/4 -1/3 volume

Using simple VAM destruction or using it for energy production if technically & economically feasible

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THANK YOU FOR YOUR ATTENTION

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