

# COAL MINE METHANE PROJECT OPPORTUNITY

## VAM Oxidation Project using Biothermica’s VAMOX® technology (CANADA) at coal mine # 22 “Kommunarskaya” PUBLIC JOINT STOCK COMPANY “COLLIERY GROUP “DONBAS” Donetsk, Ukraine

### OVERVIEW OF COAL MINE METHANE PROJECT:

Ukraine’s coal mine ventilation air methane (VAM) emissions represent more than 40 million metric tons of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) each year, positioning the country as the second largest emitter of VAM emissions worldwide.

The VAM Project on coal mine # 22 “Kommunarskaya” of PUBLIC JOINT STOCK COMPANY “COLLIERY GROUP “DONBAS” (Ukraine, Donetsk) consists in the following: install at one shaft a total of three (3) BIOTHERMICA VAMOX® units with total VAM capacity of 9 300 m<sup>3</sup>/min; special considerations for dust; and production of hot water for mine needs (70°C). The capital cost for the VAM project development will total approximately US\$13,500,000 (€10 million). Total ERUs to be generated: up to 450,000 /Yr (0.9% -1.0% concentration). VAM CH<sub>4</sub> concentration and unit availability rate (i.e., up-time) are the most important factors for achieving predicted profitability.

**ESTIMATED ANNUAL EMISSION REDUCTIONS: 450,000 MTCO<sub>2</sub>E**

### PROJECT DETAILS

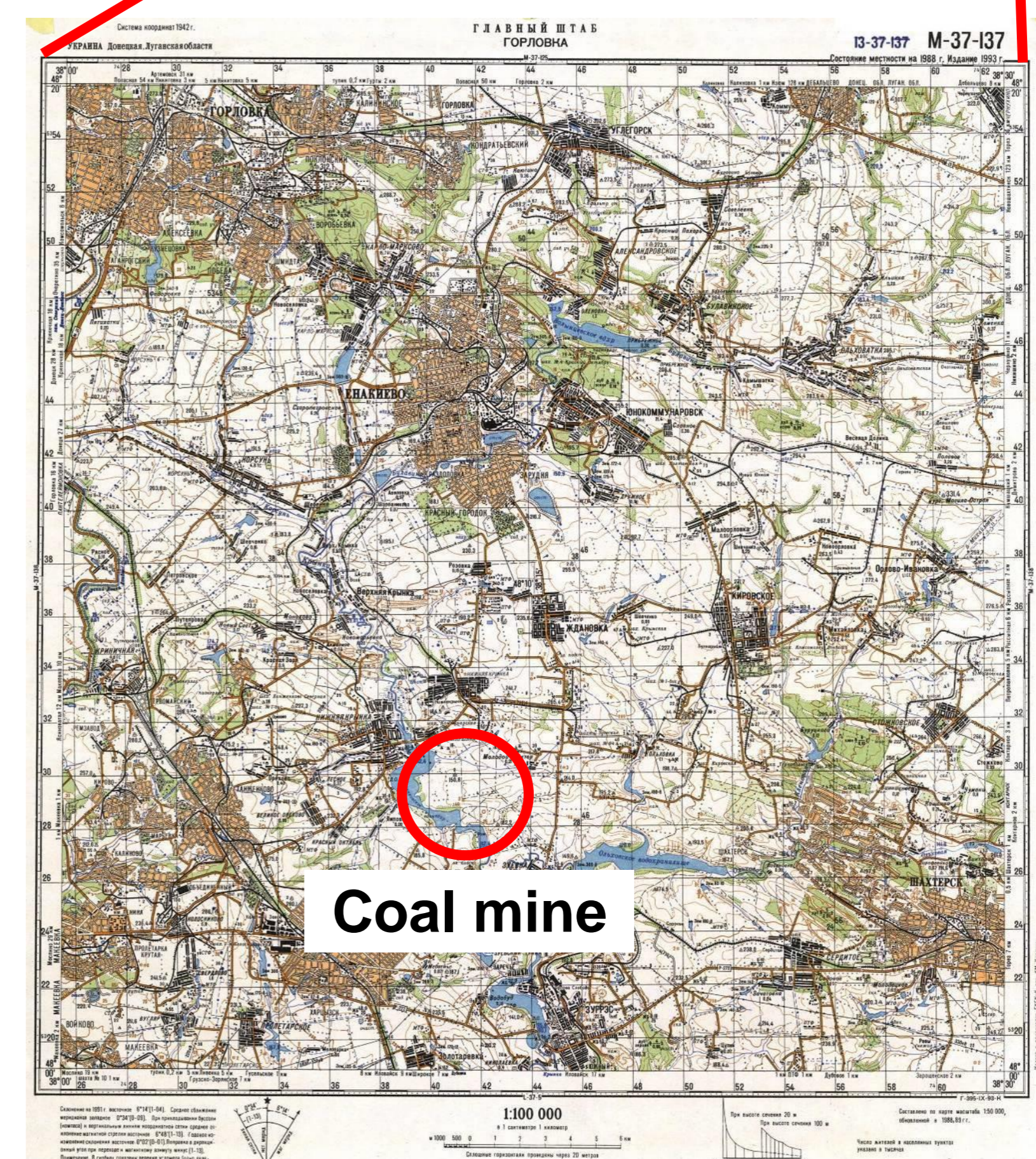
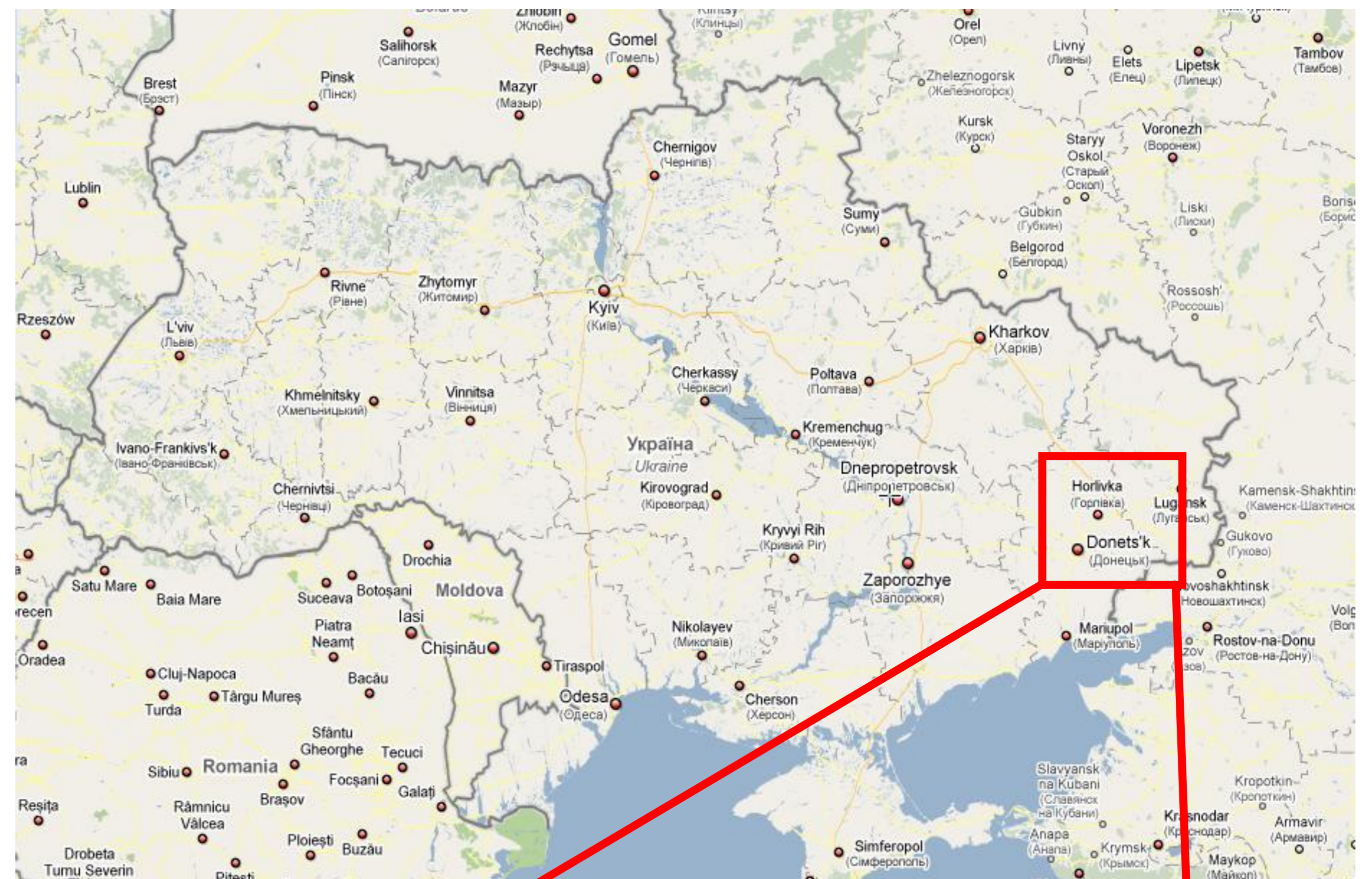
- Name of Project: Ventilation Air Methane (VAM) Oxidation Project using Biothermica’s VAMOX® Technology
- Name of Mine: Coal mine # 22 “Kommunarskaya”
- Type of Ownership: 52% Public, 48% Private
- Type(s) of assessments performed: Pre-feasibility study was made by Biothermica Technologies Inc. in 2011
- Project developed by the Biothermica – Eco-Alliance partnership

### MINE INFORMATION

- Mine owner: PUBLIC JOINT STOCK COMPANY “COLLIERY GROUP “DONBAS”
- Percent ownership: 52% Public, 48% Private
- Parent company: State
- Status and type of mine: Active, underground
- Mining Method: Longwall

### PROJECT FINANCES

- Projected capital costs: +/- US\$13,500,000 (€10 million), including CAPEX for Full Dust Control Equipment
- Estimated Return on Investment (ROI): +/- 6 Years (depends largely on CH<sub>4</sub>% concentration and ERUs price)



**Location Map**

# HISTORICAL AND PROJECTED MINE DATA

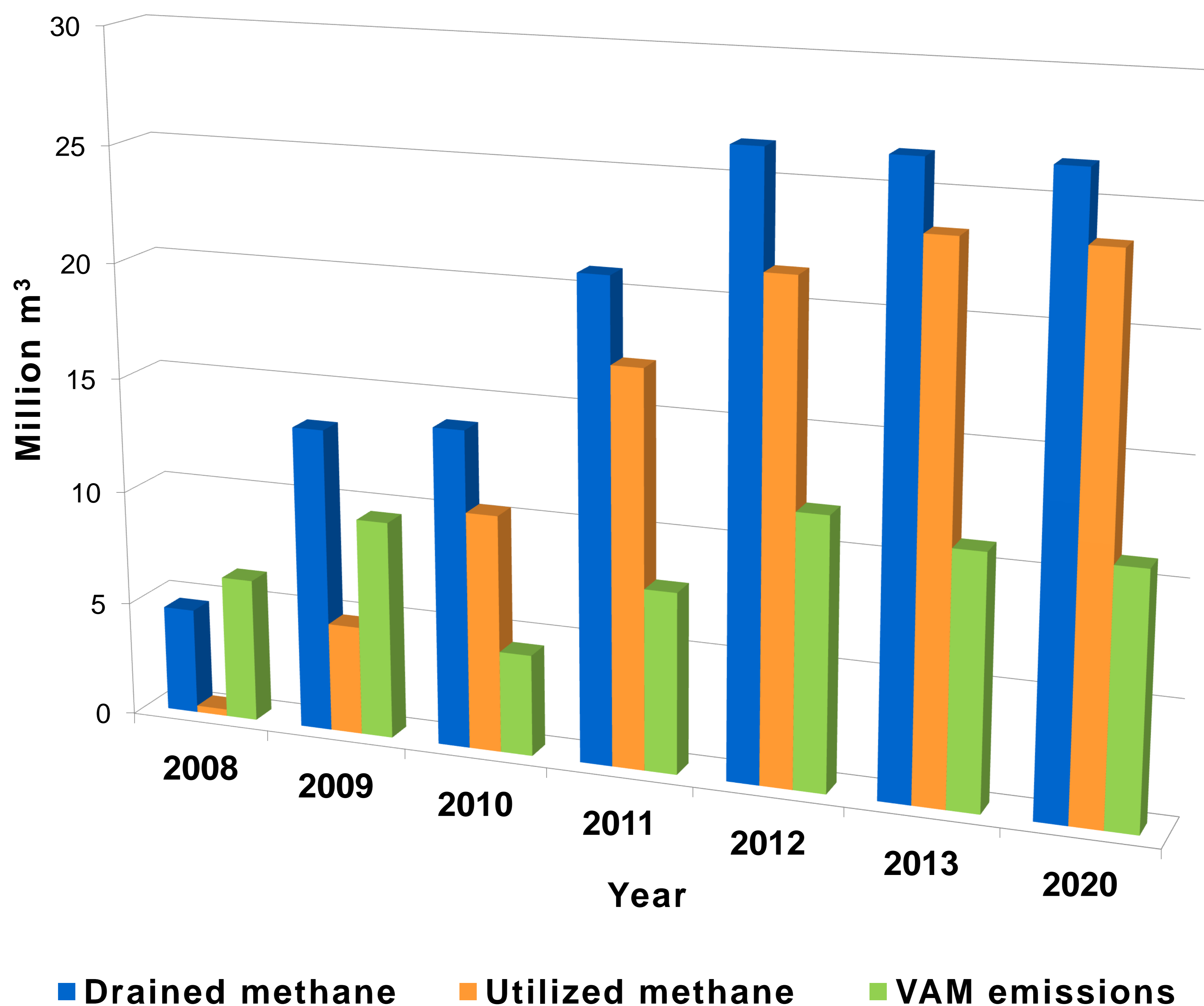
## HISTORICAL COAL PRODUCTION AND METHANE EMISSIONS

YEAR	2008	2009	2010	2011	2012
<i>Coal (tonnes/yr)</i>	0.757	0.623	0.701	0.861	1.03
<i>Methane (Mm<sup>3</sup>/yr)</i>					
Liberated from drainage systems	4.64	13.3	13.89	20.9	26.5
Utilized methane	0.29	4.76	10.35	17.2	21.5
VAM emissions	6.29	9.54	4.43	7.89	11.84
Total methane emissions	10.6	18.08	7.97	11.59	16.84

## PROJECTED COAL PRODUCTION AND METHANE EMISSIONS

YEAR	2013	2014	2015	2016	2017	2018	2019	2020
<i>Coal (tonnes/yr)</i>	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
<i>Methane (Mm<sup>3</sup>/yr)</i>								
Liberated from drainage systems	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Utilized methane	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
VAM emissions	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Total methane emissions	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0

## ANNUAL METHANE EMISSIONS



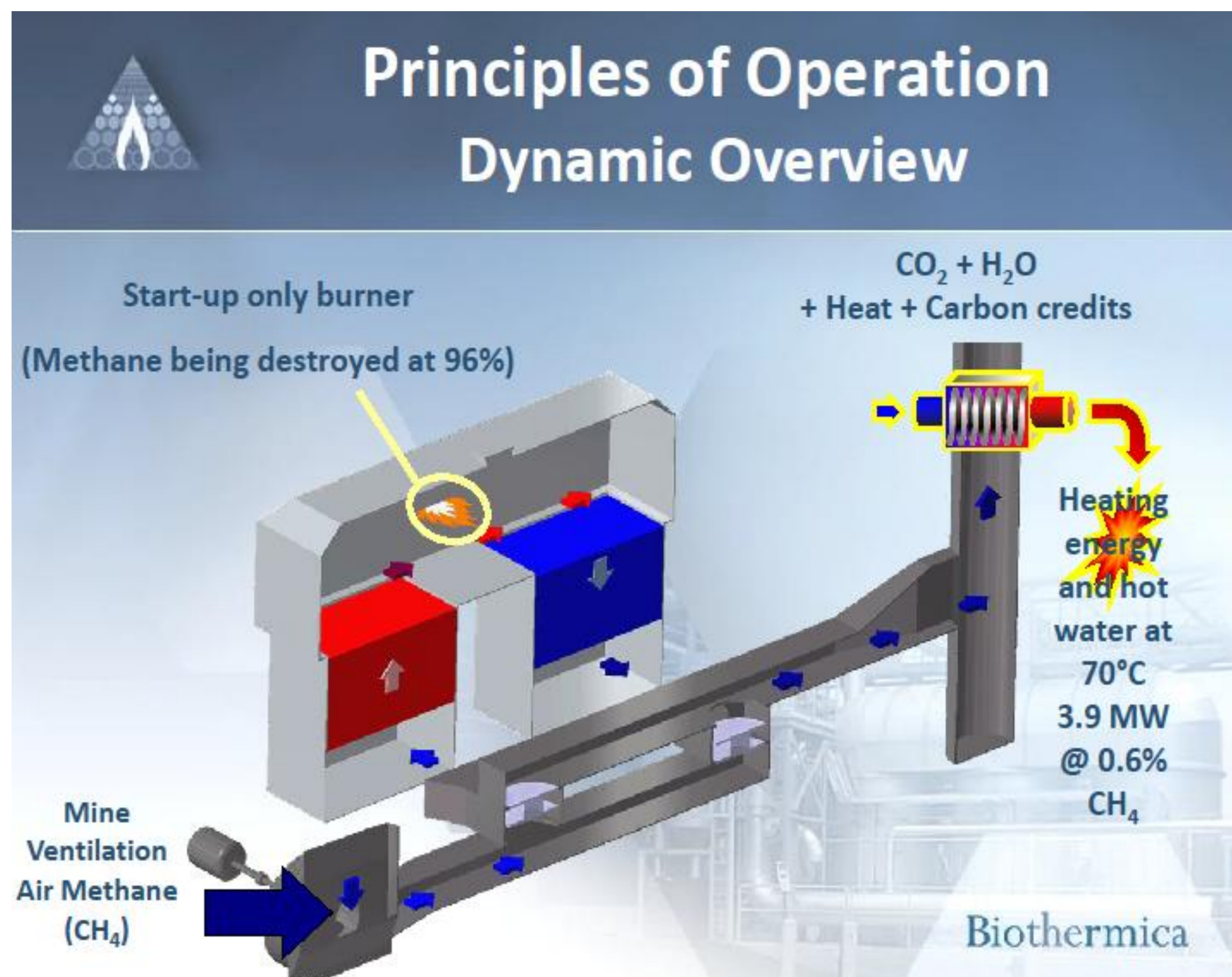
## MARKET ANALYSIS / DEMAND ANALYSIS

Initially, the most effective end-use for the utilized VAM will be producing of heating energy and hot water. Also with CMM enrichment, it is possible to use VAM in power generation.

Thermal Energy Production- MWth-3000 m <sup>3</sup> /min				
CH <sub>4</sub> concentration	0,4%	0,6%	0,8%	1,0%
Hot water 70 °C	3,5	6,6	9,8	12,9
Hot water 150 °C	-	1,8	5,0	8,0

## PROPOSED TECHNOLOGIES

VAMOX® technology is based on Regenerative Thermal Oxidation (RTO) principle. VAMOX® technology also allows mine to utilize VAM with CH<sub>4</sub> concentration of 0,25-1,2%.



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