Effective cogeneration solutions for mines and other special gas sources
CMM & VAM in Polish mines

- CMM (Coal Mine Methane)
  VAM (Ventilation Air Methane)
  they are a very large source of methane in Poland.
  Total mine methane emissions of more than
  **2 billion m³ per year.**

- This corresponds to approximately **8 000 GWh**
  of fuel energy.

- The mine methane utilisation is only about **12%**
  (i.e. approx. 250 mln m³)

*Source: report of USEPA 2015*
The environmental effect of mine methane

• The unutilized mine methane amount corresponds to approximately 11% of natural gas consumption in Poland (16 billion m³).

• The release of unutilized mine methane into the atmosphere will have an impact on the greenhouse effect equivalent to the emission of almost **37 million tons of CO₂**. It is the same as the annual CO₂ emission from the Belchatów power plant in 2015.

• Burning of unutilized mine methane in flares will reduce the impact on the greenhouse effect to only 4 million tons of CO₂. However, it still involves the loss of energy contained in the fuel.

Source: report of USEPA 2015 and EEA 2017
CHP solutions for mine metane utilization

- CHP gensets equipped with piston engines, fuelled with currently unutilized methane can produce about **2800 GWh of electricity** and additionally heat or cold at the same time.

- The limitation in the common use of this type of solutions is **the minimum methane content** in the fuel required by the engine manufacturers (usually **50% -40%**) and the minimum calorific value of the fuel (most often about **18 MJ/m³**).

CHP – Combined Heat and Power
CHP solutions for mine metane utilization

Distributed energy is a solution based on smaller generating units located in the direct vicinity of the energy consumer

- **availability** - independent from the condition of the power grid
- short **time needed to implement the investment** as opposed to traditional large power plants
- **high reliability and high efficiency**
- **high quality of energy** without deliveries disruptions
- **energy sources diversification**
- positive impact on the environment - **lower pollutants emission**
Our solutions for mine metane as the fuel

- the dedicated **engine control system** that continuously monitors the combustion process and corrects the settings from **cycle to cycle**
- **simple configuration** that allows to adopt the solution to a given fuel and its parameters variation range
- **an innovative, specially designed gas-air mixing system** that continuously adjusts the fuel dosage to maintain proper air-fuel mixture
- the solution can also be successfully used for gensets that are already in operation, as the retrofit by consumer request
HE-MUZG - principle of operation

Air-fuel mixture composition
Missfire
Knocking
Power

Air-fuel mixture composition correction
Ignition advance angle
etc.
Methane content enabling start-up and operation with nominal power

- Horus-Energia genset: 29%
- Biogas fuelled genset: 40%
- Typical methane fuelled genset: 80%
Rapid decrease of methane content

![Graph showing the rapid decrease of methane content over time. The graph indicates a significant drop from 65% to 28% methane content within a 12-minute time frame.]
Rapid increase of methane content

Graph showing the change in methane content over time. The graph indicates a rapid increase from 28% to 65% CH4.
Mine ventilation is a significant operating cost.

Thanks to the use of a gas engine fuelled with mine gas, that directly drives the air compressor, this cost can be reduced.
Coal methane use as a fuel for air compressor driving
Horus – Energia company has been operating on the genset market since 1984 and is now one of the largest, most technically advanced and most reputable genset companies in Poland.

Test bed

Fuel gas mixing station – allows to test gensets fueled with gas fuel of required composition
Wide range of fuels

Our gensets can be powered with typical **liquid and gas fuels**.
Our development projects allows us to introduce **new fuels** into our portfolio.
Currently, we can use the majority of fuels available on the market, including various **special fuels**.
Examples of references – Nigeria (30MW)

**Klient:**
GENTEC J.V. NIGERIA

**Genset type:**
17 x HE-CG1750-GZ

**Engine:**
CUMMINS QSV91G

**Fuel:**
Natural gas

**Total power:**
17 x 1750 kW

**In service since:**
2013
Customer: MACHINERY SERWIS

Genset type: 16 x HE-CG1160-GZ

Engine: CUMMINS QSK60G

Fuel: Gaz ziemny

Total power: 16 x 1160 kW

In service since: 2015

Examples of references – Kazakhstan (18,5MW)
Przykładowe referencje – Anglia (44MW)

Customer:
CUMMINS
UKPR

Genset type:
22 x HE-CG2000-GZ

Engine:
CUMMINS QSK91G

Fuel:
Gaz ziemny

Total power:
22 x 2000 kW

In service in:
2016
Summary

- The **mine methane** is a significant **source of energy**, which is currently utilized only in small amount.

- The **mine methane** can be used for power generation **distributed energy systems**.

- **Horus-Energia generating sets**, equipped with the HE-MUZG engine control system are capable to be fuelled with **mine methane of methane content below 30%**.

- The HE-MUZG engine control system allows the use of fuel with **significant and rapid gas composition fluctuations (over 5% CH₄ per minute)**.

- **Horus-Energia generating sets fuelled with mine methane** can also be used to ensure ventilation of the mine.

- The HE-MUZG system can also be used in **other branches of industry**, where fuel gas with a **low methane number** or **low calorific value** is difficult to be efficiently used.

- The Horus-Energia company has many years of experience in the use of special fuels.
Dziękuję za uwagę