CBM Gilowice Project – Applied Fracturing Technology and the Obtained Results

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Agenda

1. New seismic interpretation data
2. Fracturing treatments
3. CBM pads development
Structural Interpretation of the Międzyrzecze CBM License Area

✓ Previous interpretation of the 510 coal seam structure contour as of 2016:
  • fault system concept limited to multi-well correlation,
  • high level of uncertainty regarding faults geometry.

✓ Previous experience in the Upper Silesian basin demonstrated that the fault network of mature mining areas is generally much more complicated than it was predicted based on pre-mining interpretations.

✓ New challenge – 3D seismic interpretation is critical for the understanding of structural setting in this tectonically complicated area.

Source: „Międzyrzecze” geological data package, based on PGI case study (Jureczka et al., 2016).
Source: Processing and interpretation of seismic data - 3D Międzyrzecze (Geofizyka Toruń, 2018).
Structural Interpretation of the Recently Acquired 3D Seismic Data

✓ The new geological model differs from the previous interpretation.
✓ New insight into coal seams geometry based on structural interpretation.
✓ Existence of many normal and reverse faults, almost perpendicular to previously inferred faults (western part of Międzyrzecze block).
✓ New interpretation of fault polygons for the 350 and 510 coal seams.


Seismic Cross-section Through Gilowice-1 and Gilowice-2H wells
Seismic Cross-section Through Gilowice-3K and Gilowice-4H wells
Gilowice-3K and Gilowice-4H wells

Well Gilowice-3K
- final depth – 1360 m (TVD 1062.8 m)
- vertical displacement – 774 m
- max. inclination ~ 45°

Well Gilowice-4H
- final depth – 2200 m (TVD 752.2 m)
- vertical displacement – 1570 m
- maximum inclination ~ 95°
- length of horizontal section – 1070 m
Hydraulic Fracturing

**Gilowice-2H**

- **5 stages** with Hybrid technology
- Fluid: 20-30# linear gel avg 390 m³/stage + 30# X-link avg 125 m³/stage. Total over **2580 m³**
- Sand: 100 mesh avg 6,8 tons/stage + 40/70mesh avg 74 tons/stage (at the last stage 30/50mesh 40,5 tons instead of 40/70mesh). Total over **404 tons**
- Flow rate avg 6,7 m³/min
- Plug&Perf with 6 clusters/stage
- **1 stage/day**

**Gilowice-4H**

- **9 stages** with Hybrid technology
- Fluid: 20-25# linear gel avg 240 m³/stage + 25-30# X-link avg 114 m³/stage. Total over **3186 m³**
- Sand: 40/70 mesh avg 39 tons/stage + 30/50mesh avg 29 tons /stage. Total over **612 tons**
- Flow rate avg 7,9 m³/min
- Plug&Perf with 4 clusters/stage
- **2 stage/day**
Hydraulic Fracturing Microseismic Mapping

**Diagram Description**

- **Stages (STAGE):**
  - I: 11.75 m (UP) and -34.25 m (DOWN)
  - II: 18.50 m (UP) and -46.50 m (DOWN)
  - III: 25.50 m (UP) and -23.50 m (DOWN)
  - IV: 12.50 m (UP) and -42.00 m (DOWN)
  - V: 14.00 m (UP) and -27.00 m (DOWN)

- **Maximum depth (up/down) of seismic events:**
  - Maximum up
  - Maximum down

- **Avg depth of seismic events:**
  - Green dots

- **Geological Layers:**
  - **Seria mułowcowa**
  - **G.S.P.**
  - **G.H.**
  - **Seria paraliczna**

- **Wellbore Locations:**
  - Gilowice-1
  - Gilowice-2H

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Hydraulic Fracturing - Results

downhole pressure [bar]
- water production [m$^3$/day]

gas flow rate [m$^3$/day]
Pads Development: Gilowice-1, Gilowice-3K, Miedzyrzecze-3 and Międzyrzecze-4
Gilowice-1 Pad Development

- Installing the Caterpillar Power Station CG170-12 – electrical power 1000 kW.
- Preparing gas on the installation and transfer to the Power Station.
- Transferring power to Tauron S.A network.
Gilowice-3K Pad Development

✓ Construction of surface infrastructure and pipeline to PSG network
✓ Surface infrastructure:
  • Pre-separation system
  • Heating and measuring system
  • Filtering system prior to compression
  • Installation of gas compressor with acoustic shield
✓ Pipeline:
  • Connection to PSG DN65 (350 m from G-3K)
  • Connection to DN 150 with pipeline passing near G-1 well (approx. 1150 m)
  • Conversion to electricity of excess gas volume using G-1 infrastructure
Międzyrzecze 3 and Międzyrzecze 4 Pads Development

✓ Collecting gas on the Christmas tree.
✓ Transferring to separation system.
✓ Pressure reduction and transferring to the surface infrastructure on Gilowice-3 Pad.
✓ Transferring to PSG gas pipeline network.
Thank you for your attention