

Schachtstraße

Exploration of coal bed methane from virgin areas close to abandoned coal mine

CMM/AMM-Workshop - UNECE , Global Methane Initiative
Stefan Decker, 23 October 2017 Geneva, Switzerland

Background PVG

- The Schmidt, Kranz GmbH & Co. KG was founded in 1885, producing shaft sinking equipment as well as tunneling machines.
- Family Glinz took over SK in 1922
- The mining engineer, Dr. Hans-Karl Glinz, joined the company in 1937 as successor to **add drilling machines for gas drainage and production** to the product portfolio.
- Today SK group supplies different underground mining equipment



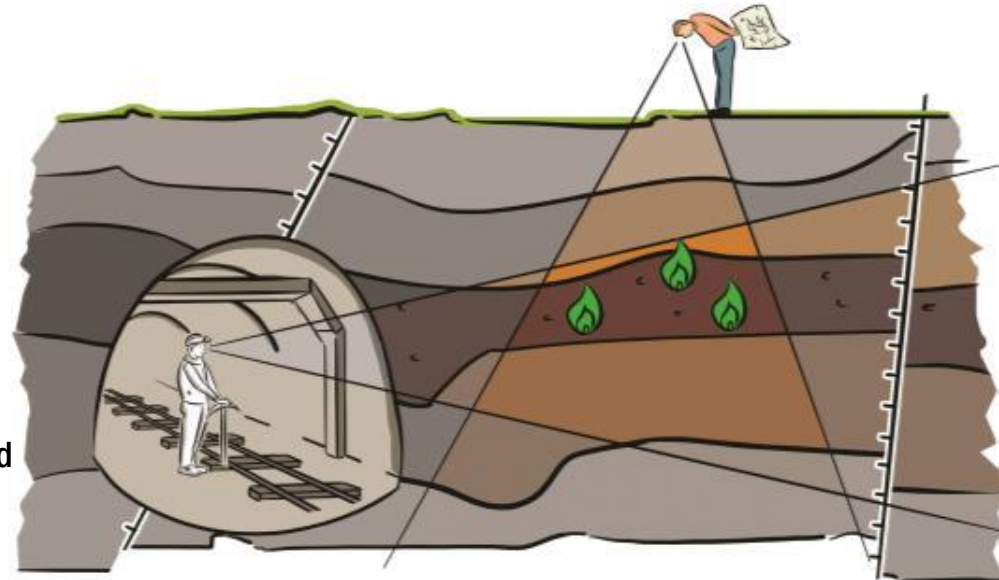
The iron miner
- automatic tunneling machine.
A technical revolution in 1903



Background PVG

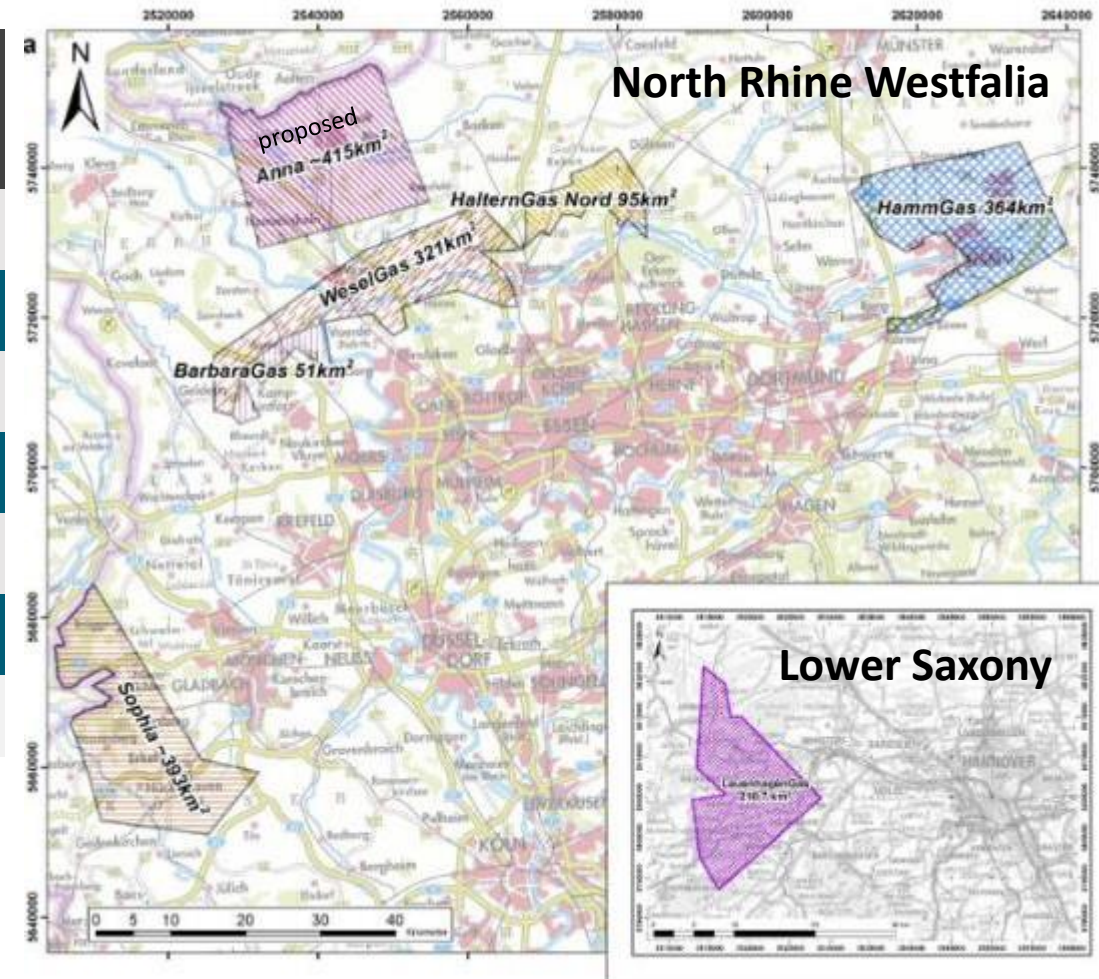
- Tectomechanics was developed in the 1960s in the German hard coal mining industry Ruhrkohle AG (RAG) as a **method to increase extraction efficiency and to avoid gas blowouts and water intrusions.**
- The inventors Ehrhardt and Loos founded the company PVG with the aim of using Tectomechanics for the exploration and production of coalbed methane (CBM) in virgin hard coal deposits in 2003.
- Schmidt Kranz Group acquired PVG in 2013.
- Today PVG provides geological services and is project developer
- PVG-CBM extraction by **using naturally existing fracture networks without fracking** is not hinder by the new German mining law adopted in 2016.

The view from above is been supported from the mining prospective



PVG Concessions in Germany

Fields	Size (km ²)	Gas in Place (Bn. m ³)	Producible Gas (Bn. m ³)	Shares
HammGas	326,2	104	10,4	65,60%
LauenhagenGas	211	46	4,6	49% (100%)
WeselGas	318	55	5,5	49%
BarbaraGas	51	10,5	1	100%
HalternGas	94	13,7	1,37	100%
Sophia	393	168	16,8	100%
Total	1393,2	397,2	39,7	



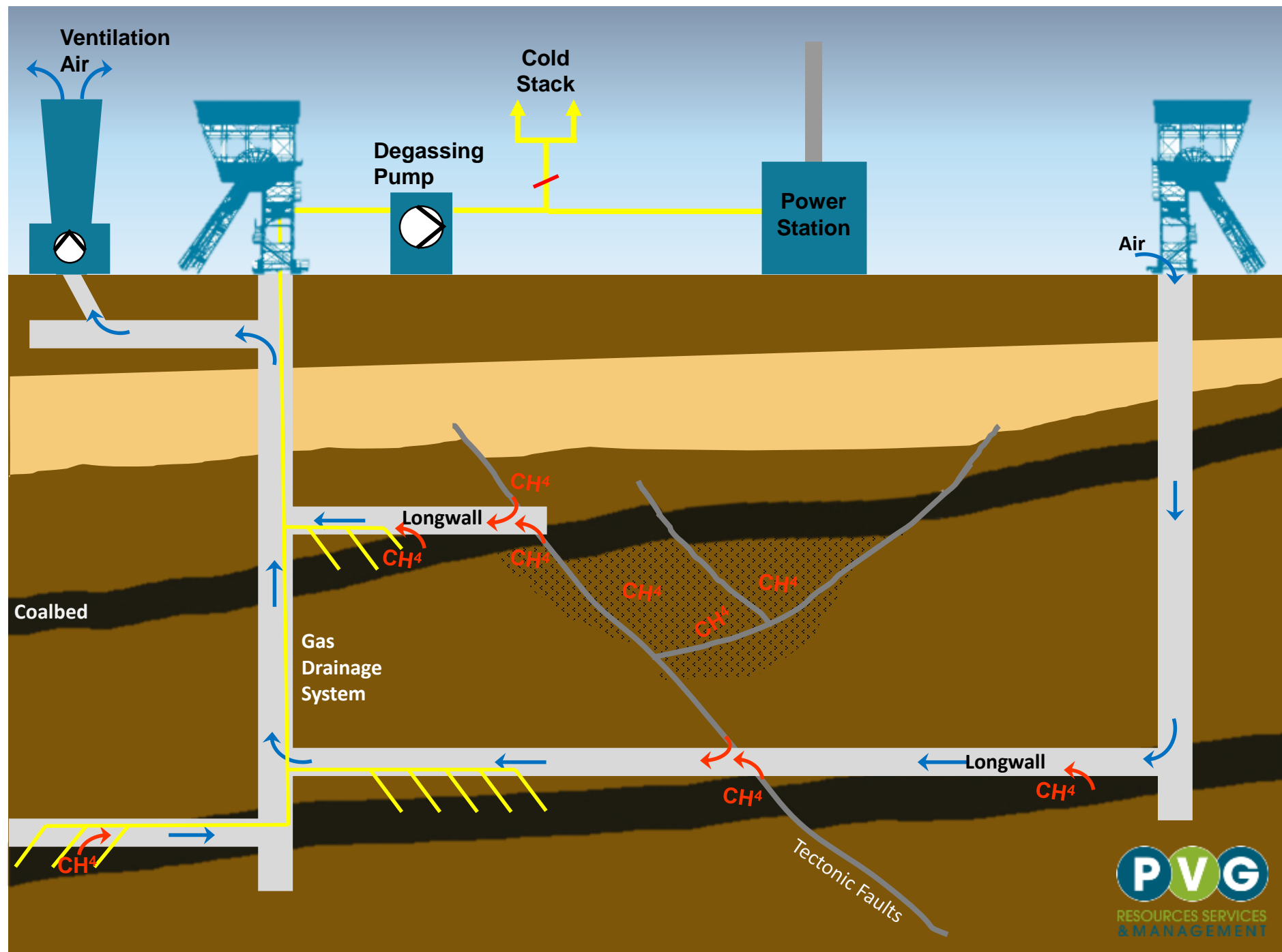
Successful PVG managed by equity to develop CBM projects and the access to 1400 km³ hydrocarbon concessions in Germany.

Coal Mine Methane

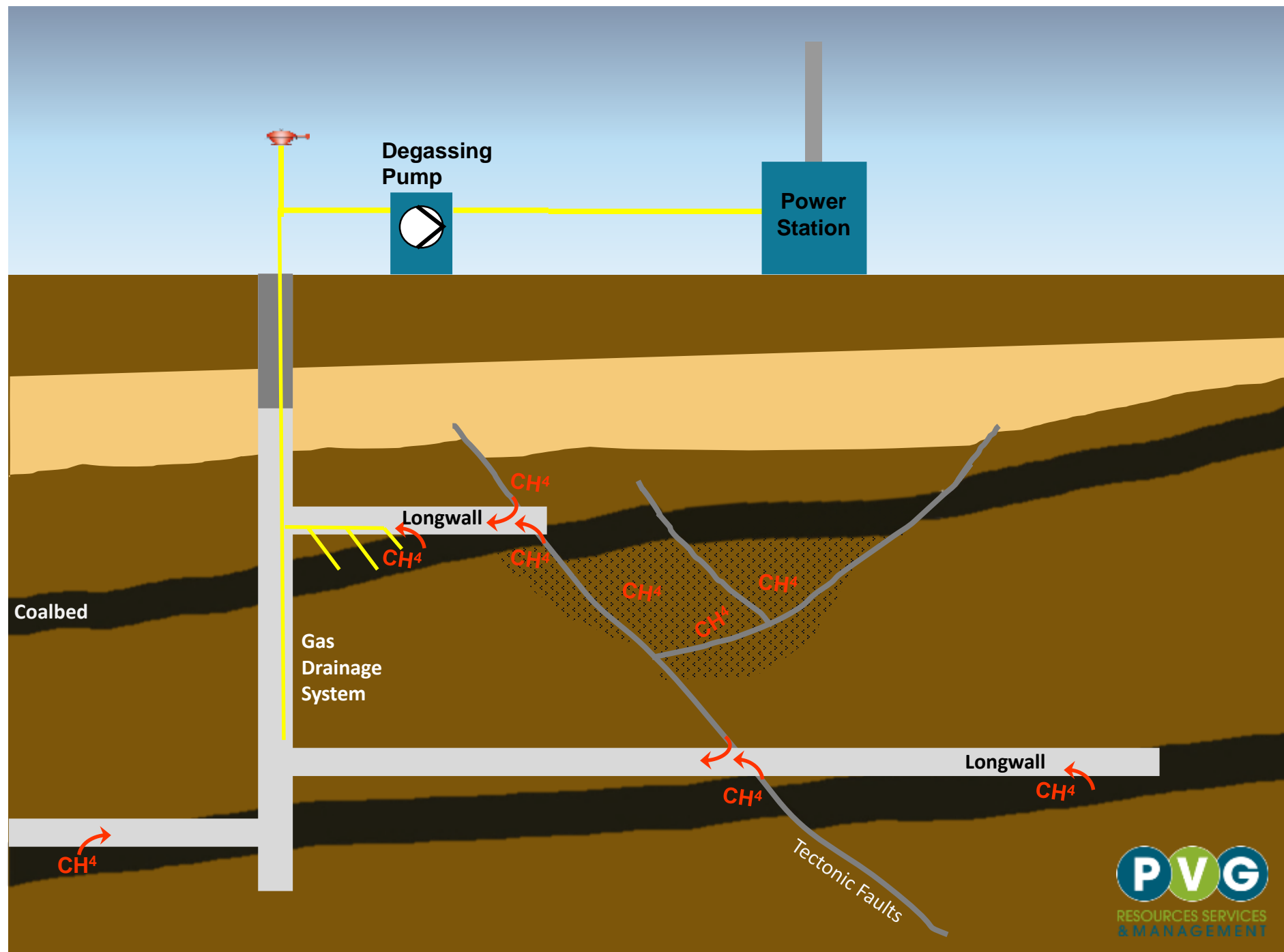
(CMM)

PVG Support for Gas Utilisation

- Evaluation of the best way for methane utilisation according to quality and quantity
- Identification of the most suitable technology for gas treatment according to need and gas quality
- CAPEX and OPEX estimation



Abandoned Mine Methane (AMM)

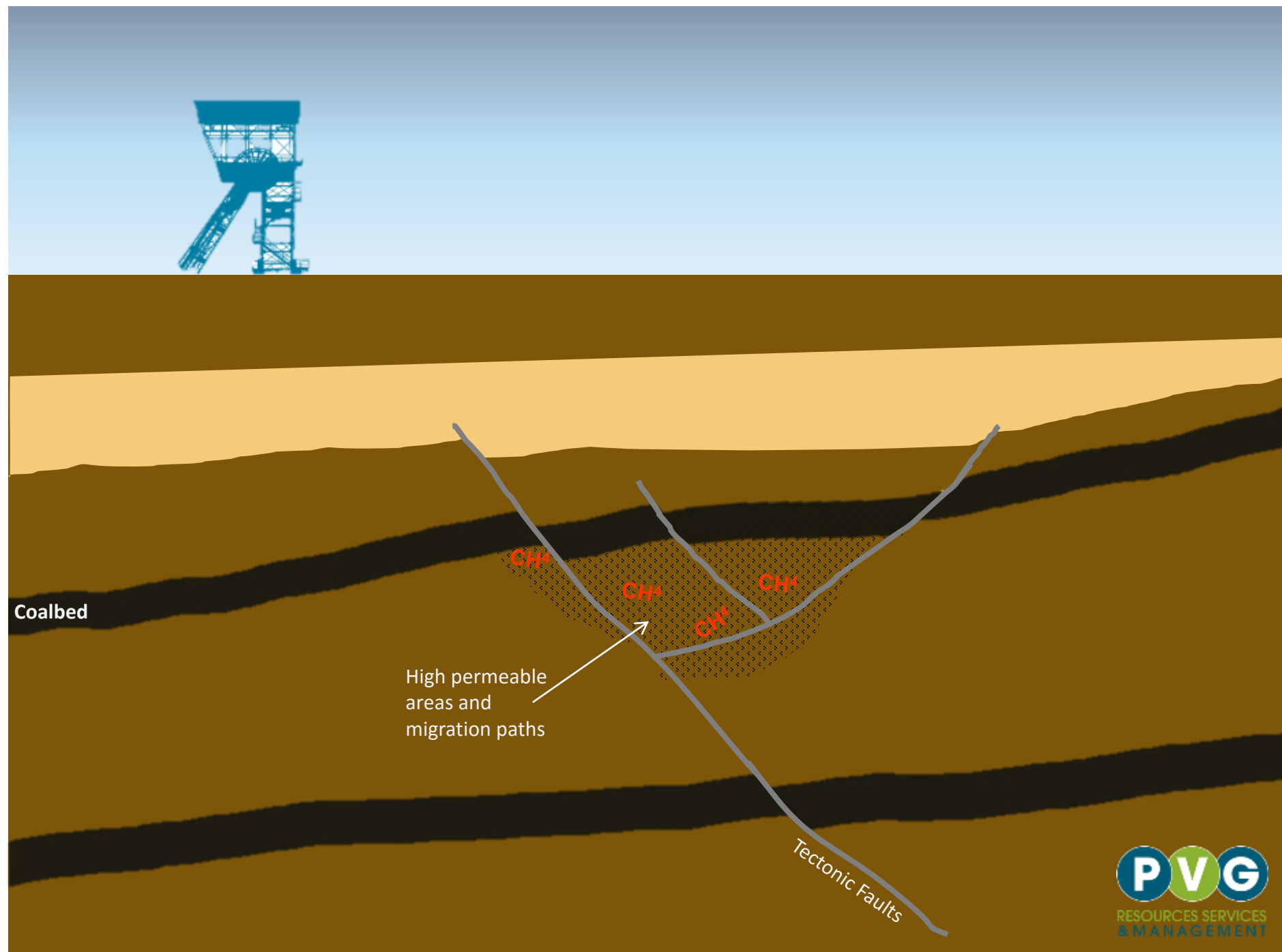


Coal Bed Methane

(CBM)
is the name outside of the mine

PVG Field Design:

- Evaluation of existing exploration data
- Mapping (2D/3D-geological-modell) and pre-feasibility studies of coal basins
- Identification of high permeable areas and migration paths
- Precise forecast of tectonic faults and fractures using the tectomechanical modeling, analysis and prediction tool (TecMAP)
- Determination of ideal locations for gas production wells or for

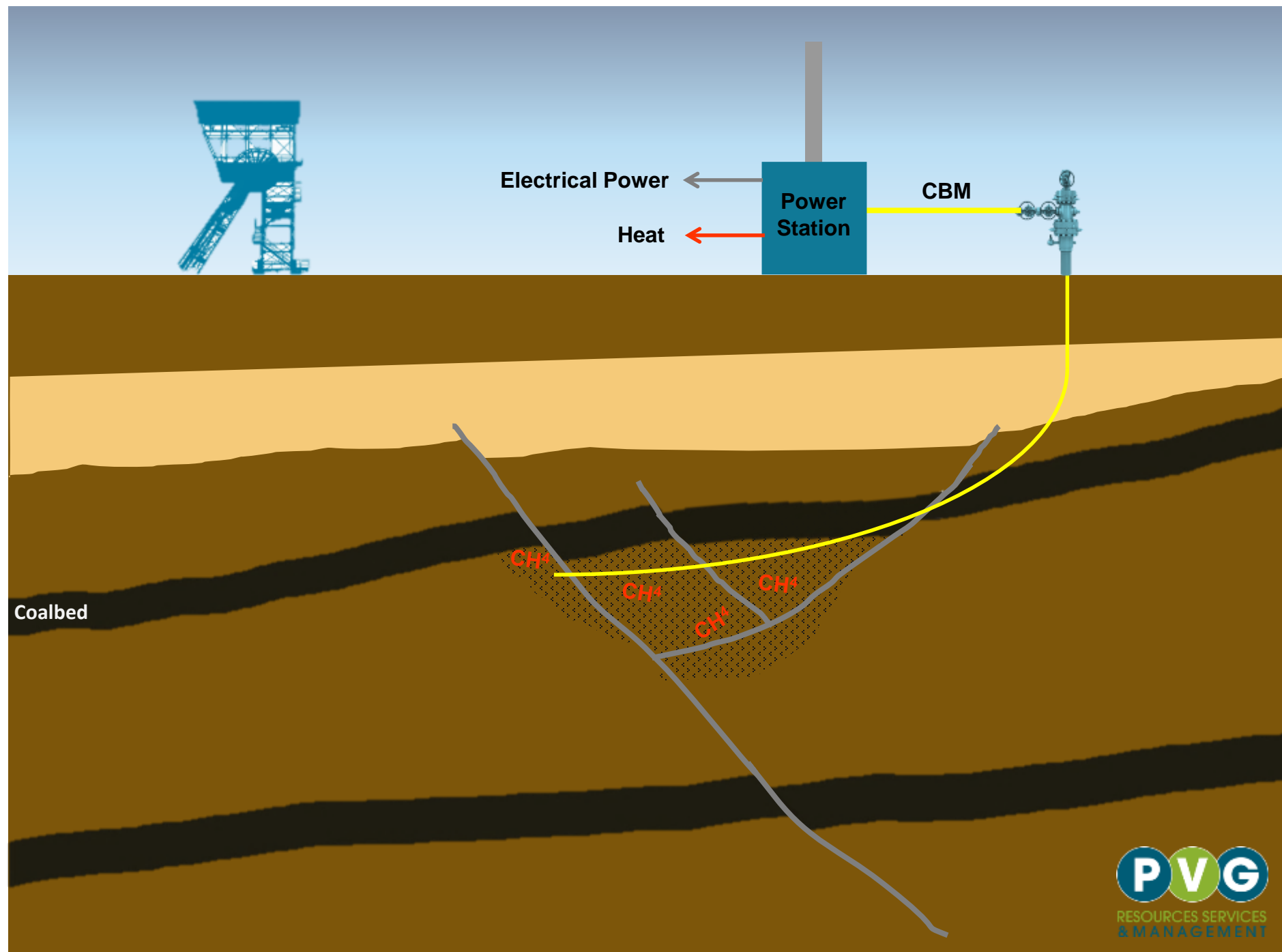


Coal Bed Methane

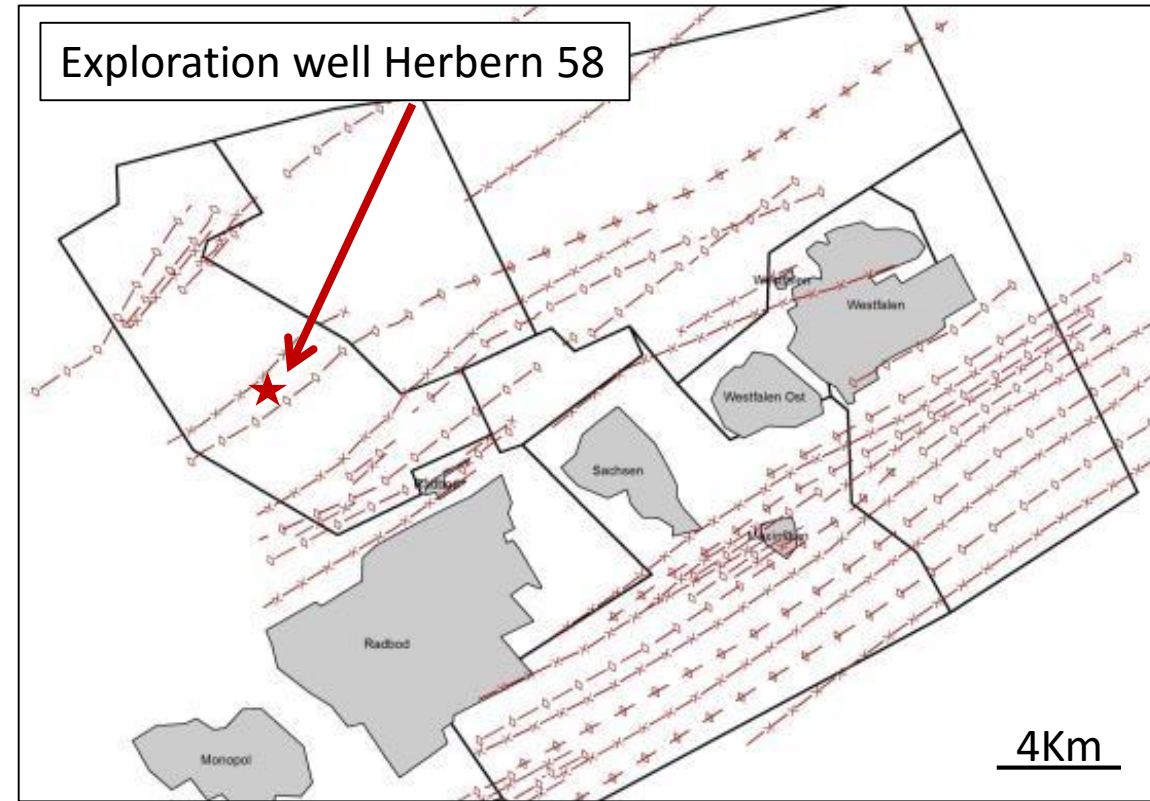
(CBM)

PVG Well Design:

- Preparation of well design including well trajectory, target and completion based on the identified migration paths and expected production rates
- Optimization of well designs and well campaigns based on detailed field design

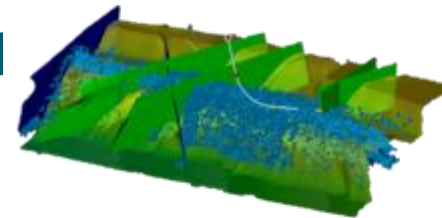


Peer Project HammGas



First CBM exploration well "Herbern 58"

- Located near 7 abandoned coal mines in the north-eastern Ruhr Area
- Drilling is done in 2016
- Localised conditions didn't enable an economic utilisation.



Peer Project HammGas

Key facts "Herbern 58" :

- 4 fracture corridors predicted along the 300m reservoir section
- 8 major fracture corridors identified in the geophysical data (Figure 1)
- Calculated fracture volume of 4 mio m³ accessible with first well
- Potential recoverable gas volume of > 80 mio m³ including desorbed gas
- Reservoir pressure of ~ 10 bar
- Gas with ~ 95 % CH₄ located

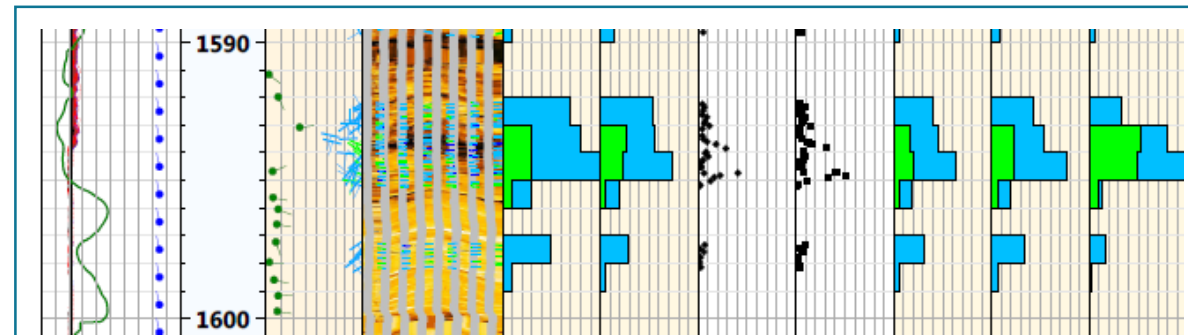
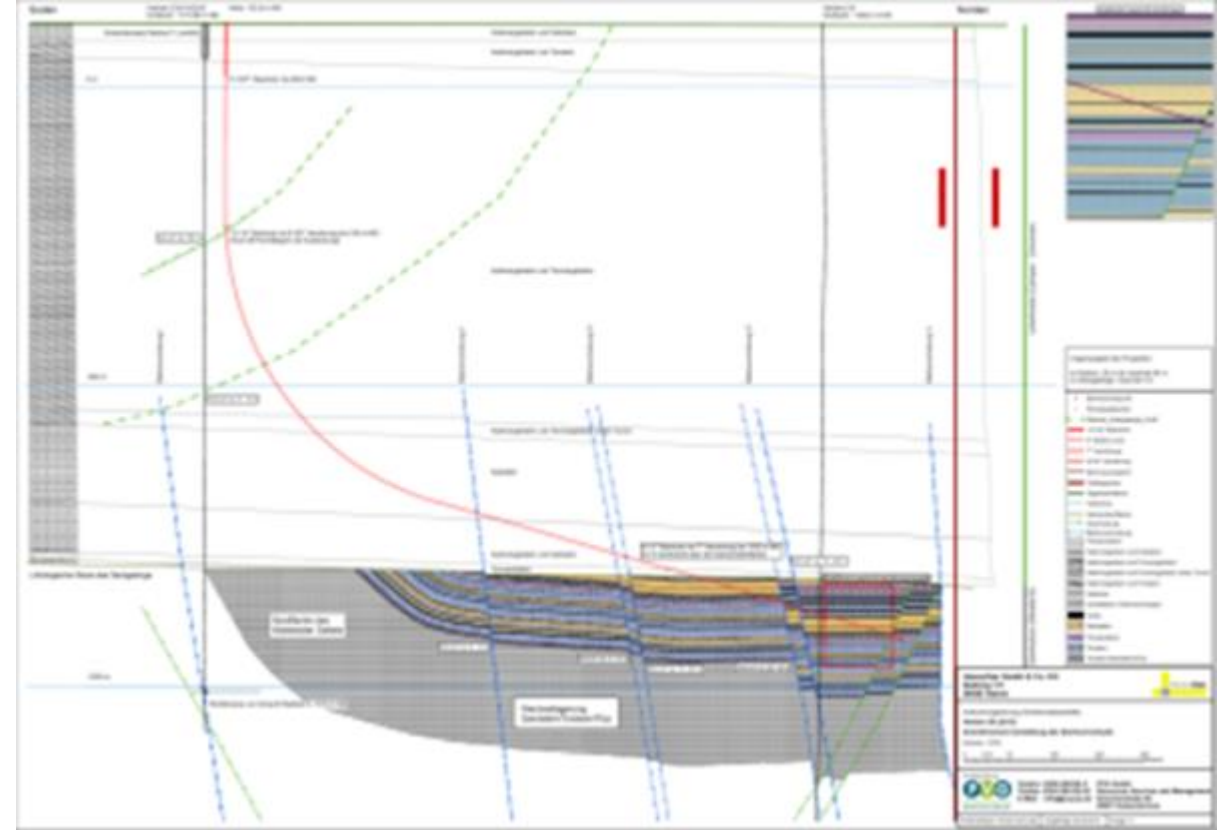


Figure 1: highly fractured corridor – more than 40 fractures > 20 mm width within 3 meters

Peer Project "LauenhagenGas"



Total size of concession block
„Lauenhagen Erweiterung“

Size:

211 km²

Potential recoverable gas:

4,6 Bn. m³

First investigation in former coal mining area

Size:

23,7 km²

Coal reserves:

663 mio. to_v*

Historical produced Gas:

appr. 300 mio. m³**

Potential recoverable gas:

2 Bn. m³

* Wealden and Upper Carboniferous coal

** produced during 8 years of coal mining, stopped with the end of gas utilisation in 1961



Erlaubnisflächen Lauenhagen und Lauenhagen-Erweiterung

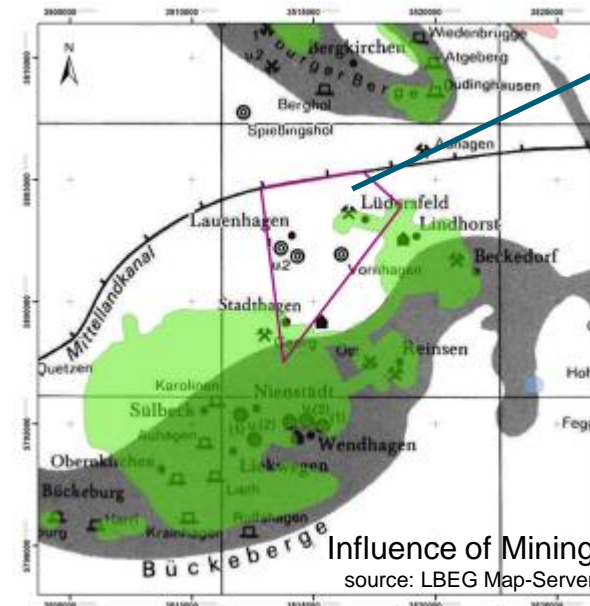
Legende

license area

potash

brine

hardcoal

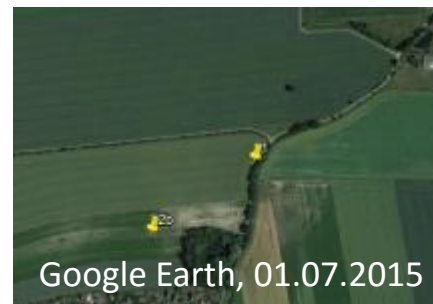
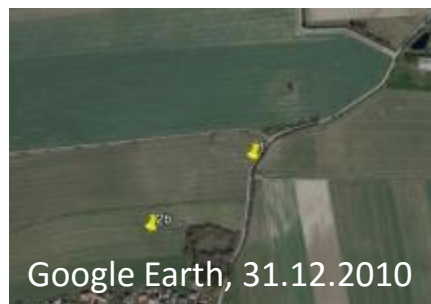
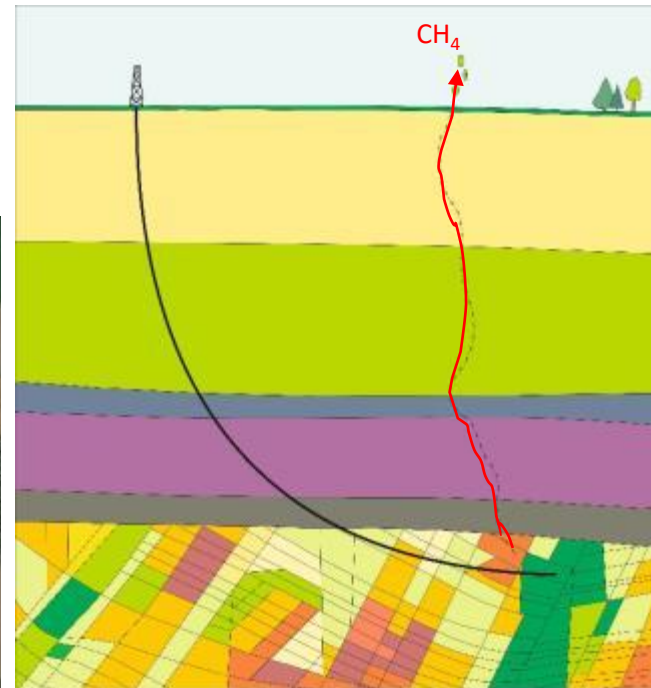
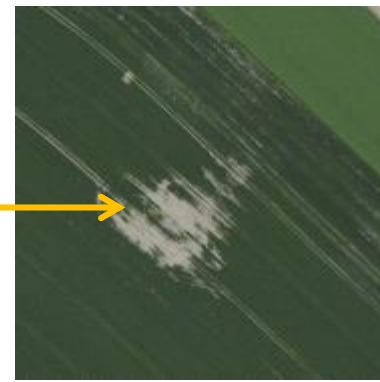
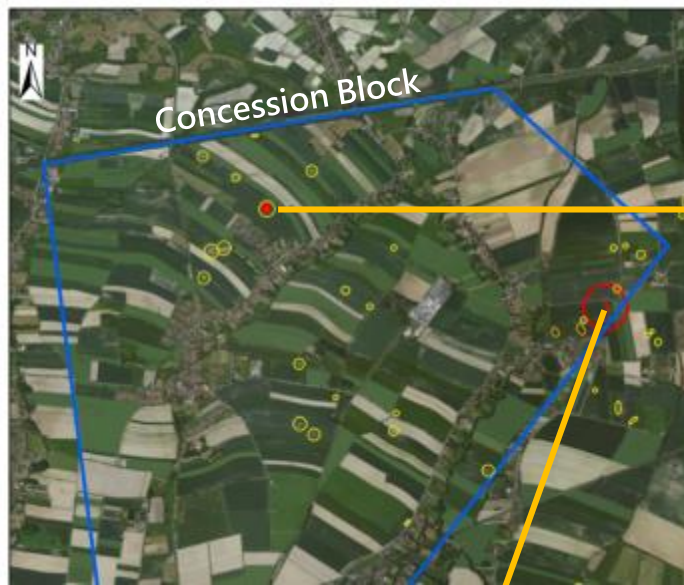


Influence of Mining
source: LBEG Map-Server

- The focus lies on the production of natural gas from coal seams in the Wealden and the deeper Carboniferous.

Peer Project "Lauenhagens s"

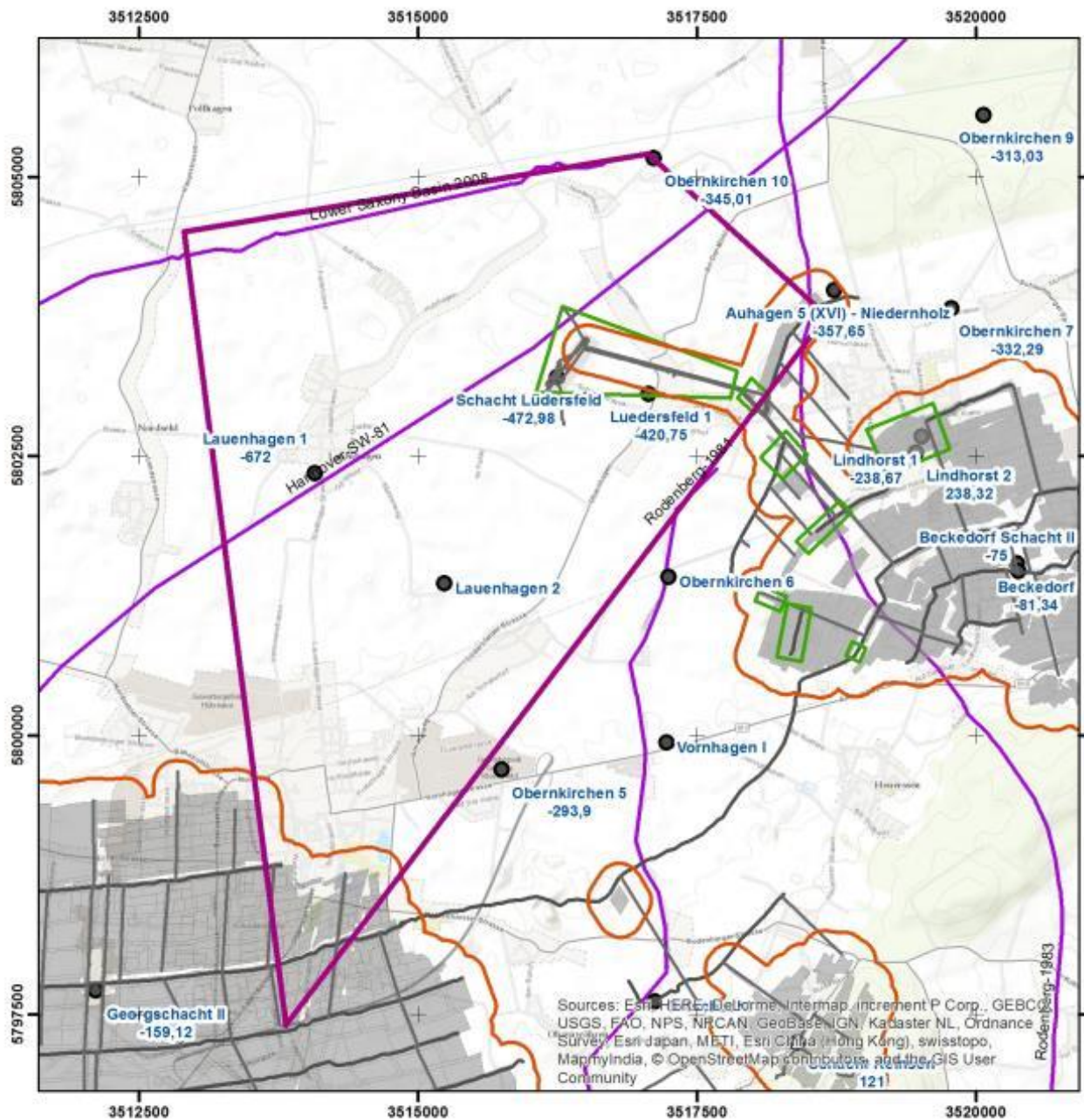
- Geological analysis of potential surficial gas leakages



- Natural CBM migrates to atmosphere, hydrosphere and biosphere throughout faults or former coal mining activities
- Stunted growth - aerial photograph interpretation
- Common gas leaks in the foreland of the concession area

Peer Project "LauenhagenGas"

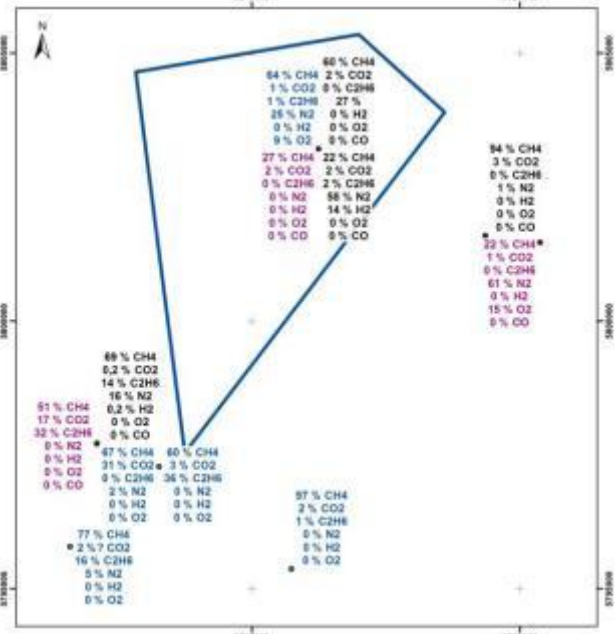
- Evaluation of historical mining data
- Abandoned mines at Schaumburg area
- Former Hard Coal Deposit



Geological data analysis

- license area
- gas suction
- longwall/route
- mining affected area
- mining area
- wells
- seismics

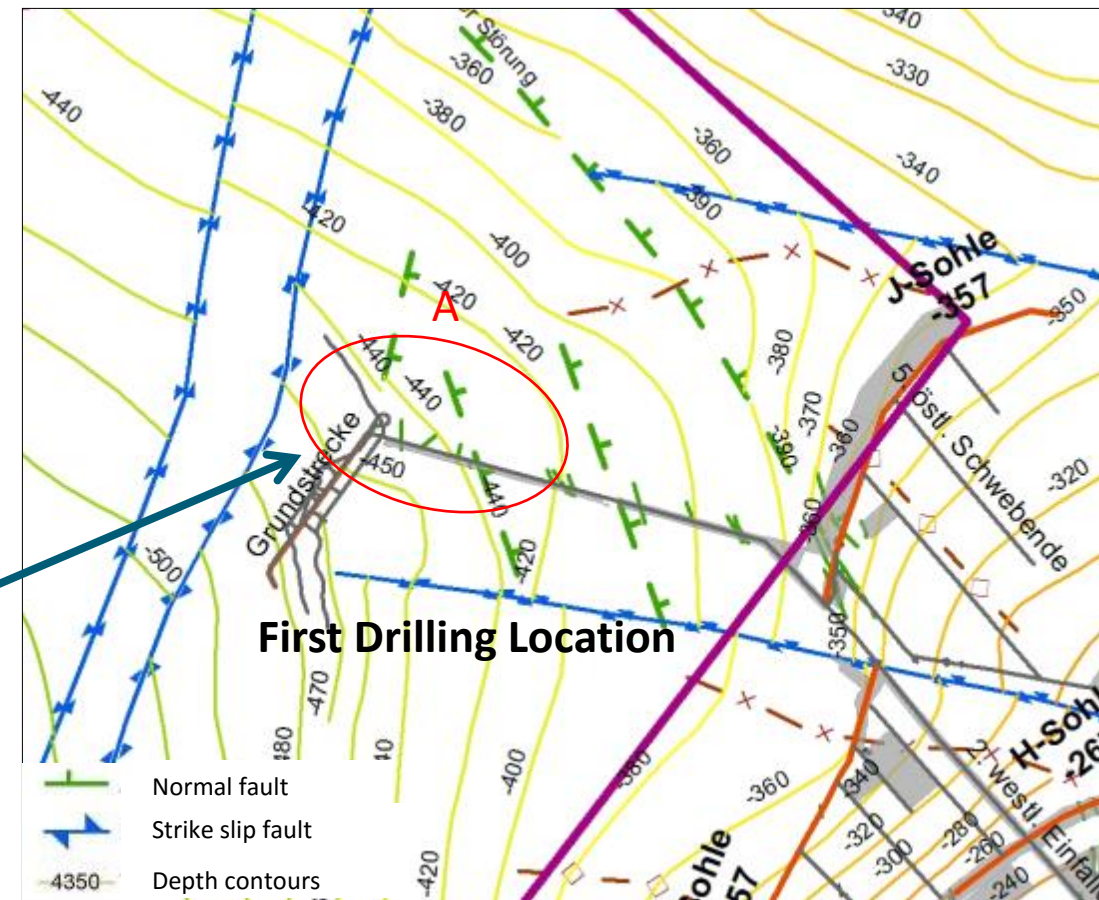
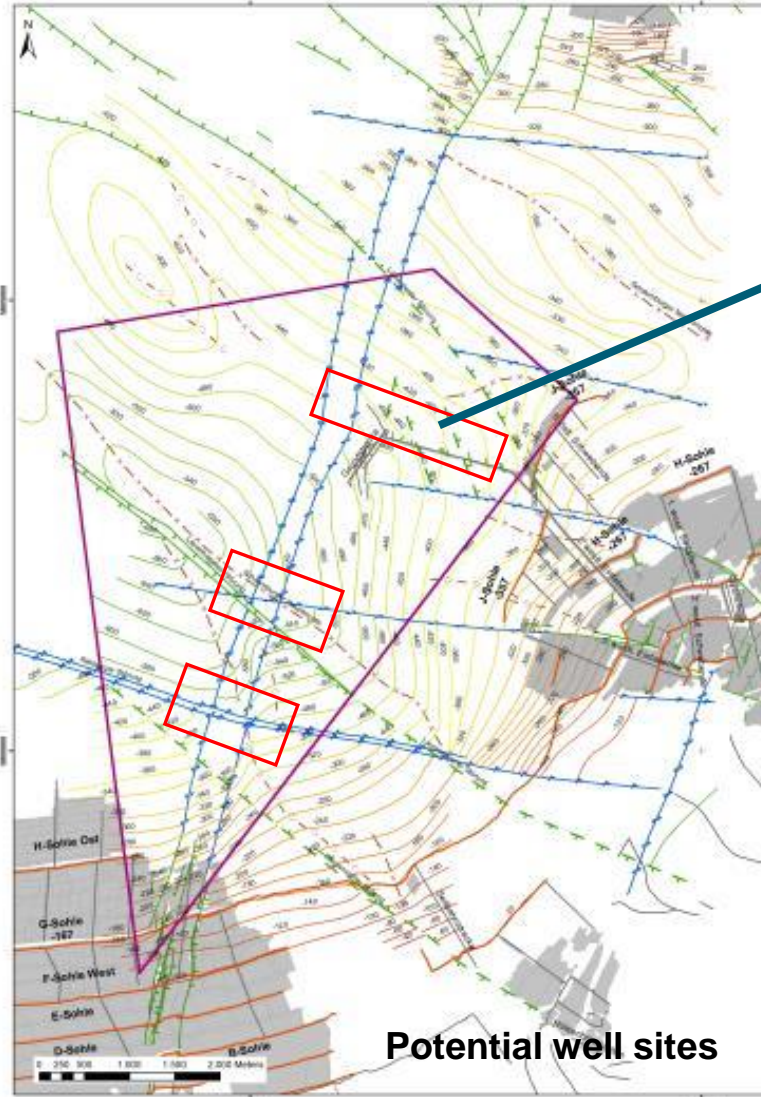
Historical gas measurement



Peer Project "LauenhagenGas"

We look for,

- areas of high fracture density
- connectivity to deeper gas sources
- possible sites for multilateral wells
- with access to energy infrastructure



Reasons for the first well location are,

- proven gas leakages from N-S striking fractures in longwall
- precise tectonic model from mine map
- „loosened“ rock mass through mining activity
- distance from residential area
- no environmental protection area

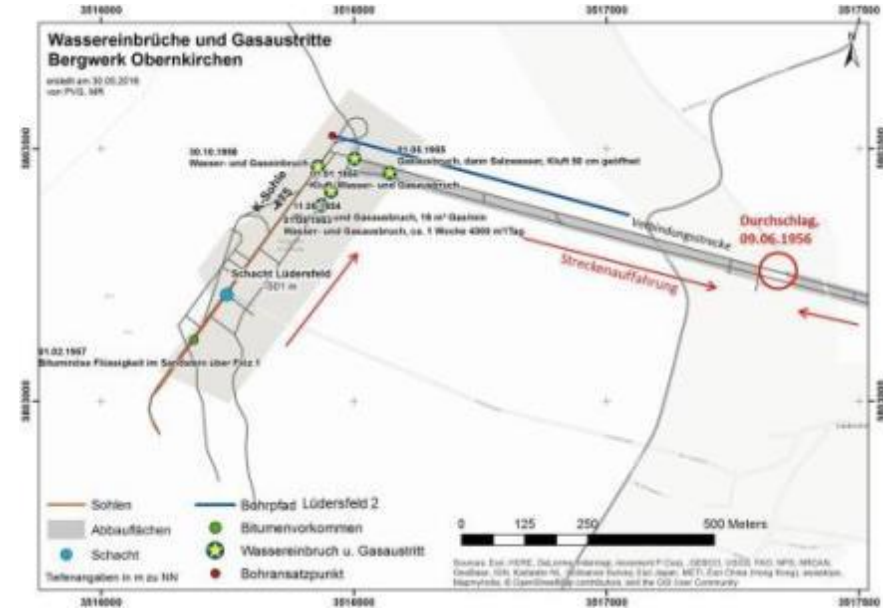
Peer

Project

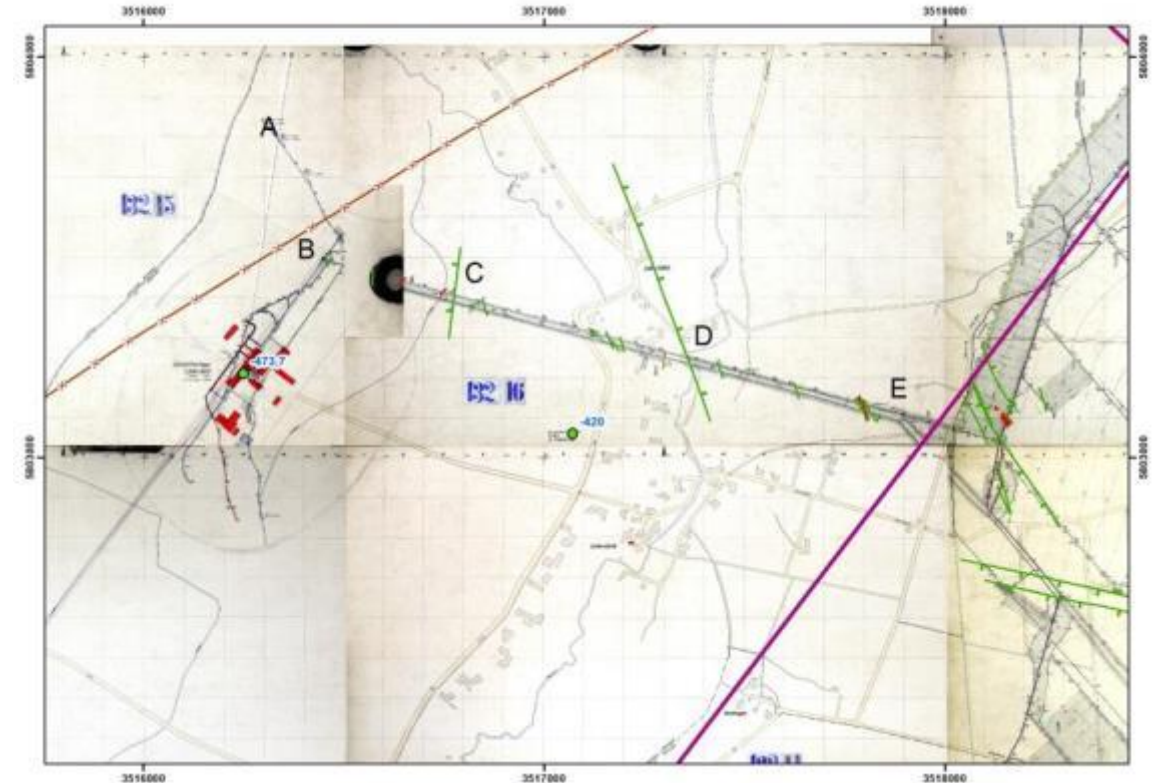
“LauenhagenGas”

- Geological Development
- Evaluation of historical mining data
- Modelling

Documentation of gas blowouts and water intrusions



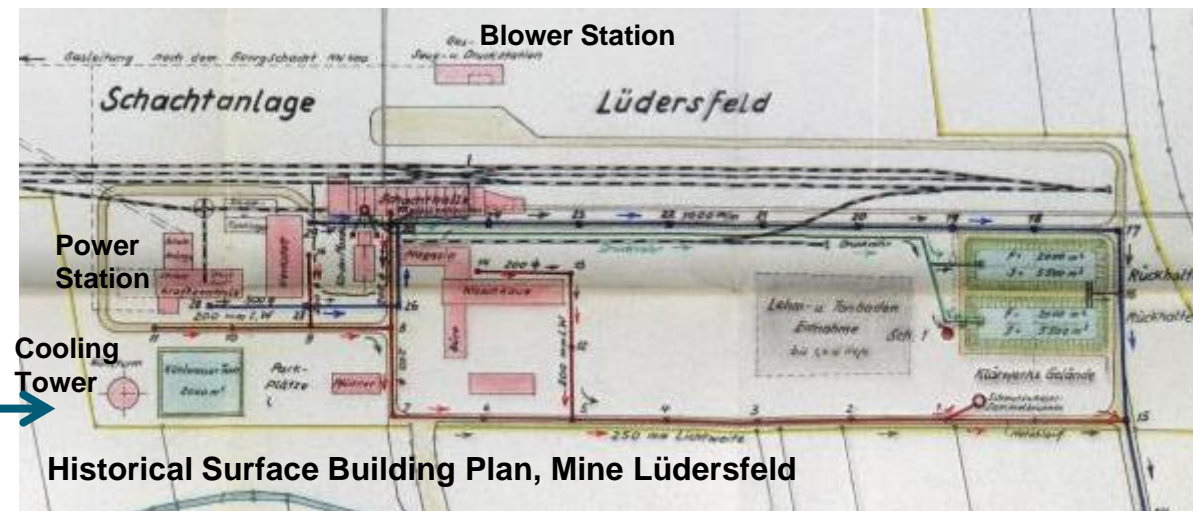
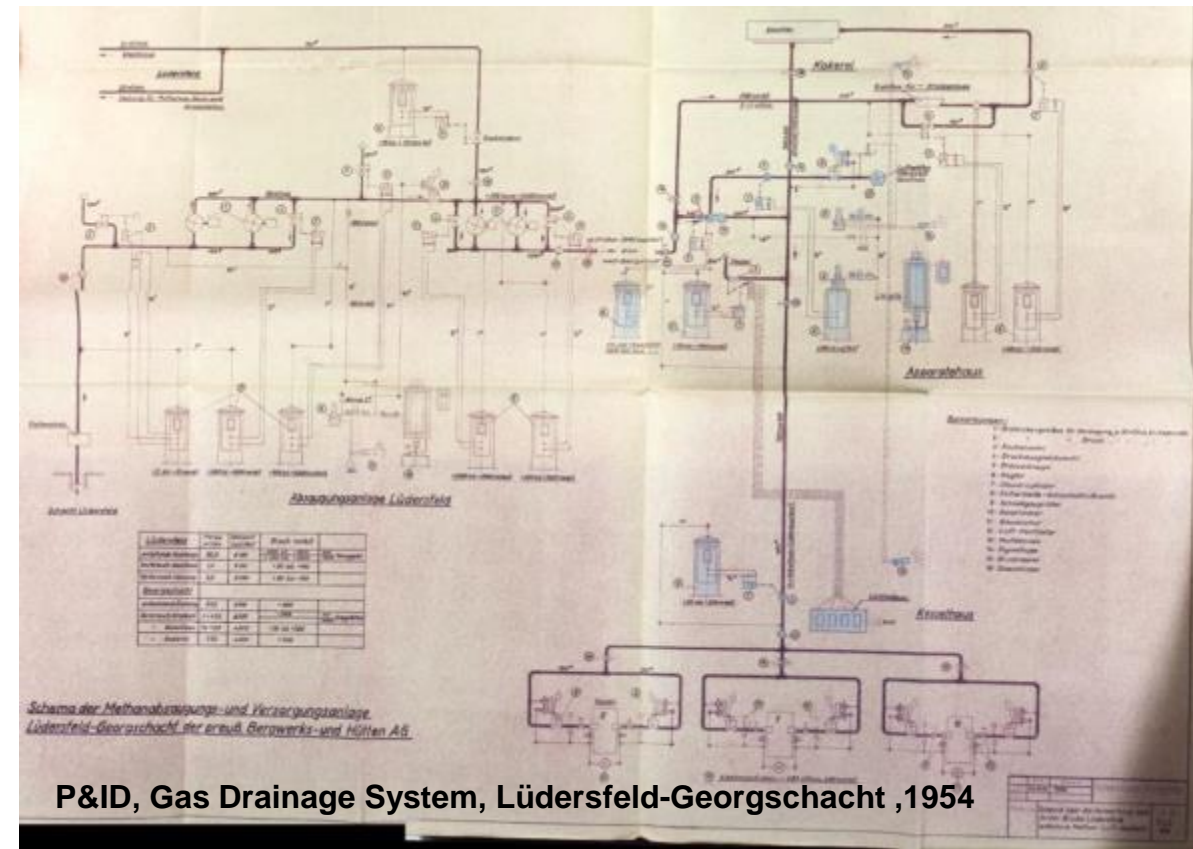
Modelling based on historical data



Peer Project "LauenhagenGas"

Proved Methane Source

- Sunked at the beginning of the 1950s, 550 m depth
- September 1953 enormous methane emissions
- Continuous gas utilisation from 1953 till 1961
40 Mio. cbm/year, total about 300 Mio. m³ (pure methane)
- Shut down of the gas utilisation together with the closing of the coal mining activities in the Schaumburg area in 1961/1962.

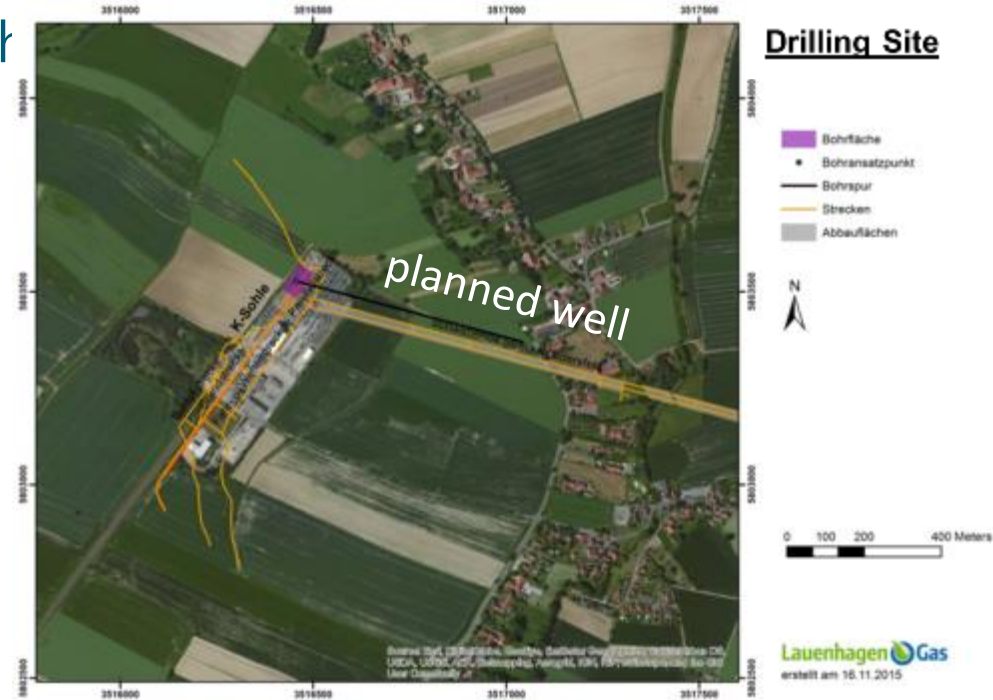


Peer Project "LauenhagenGas"

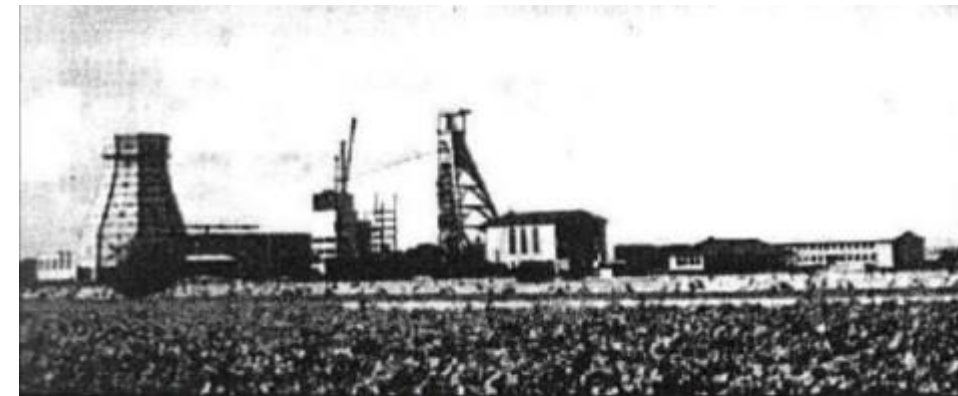
- Suitable location at abandoned coal mine for 1st drilling
- The drilling is designed, EIA is done and the application is still granted from the mining authority.
- In the first phase of the scheduled work program, exploration well

A 950 m long deflected borepath running parallel to the former connecting passage Lüdersfeld-Beckedorf is planned.

LauenhagenGas



Industrial area Lüdersfeld today

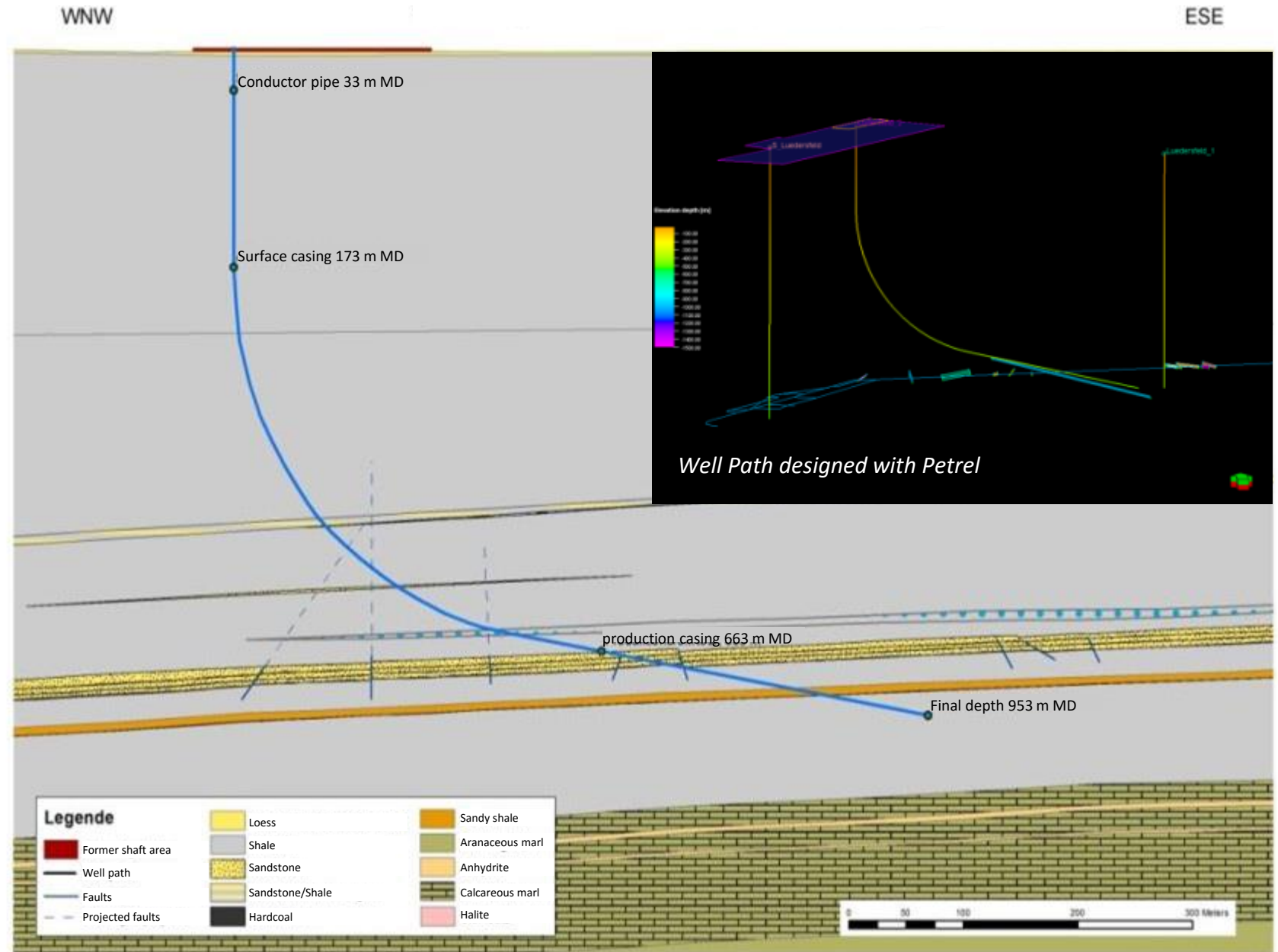


Coal mine Lüdersfeld at 1956 source: Graupner, 1980

Peer Project

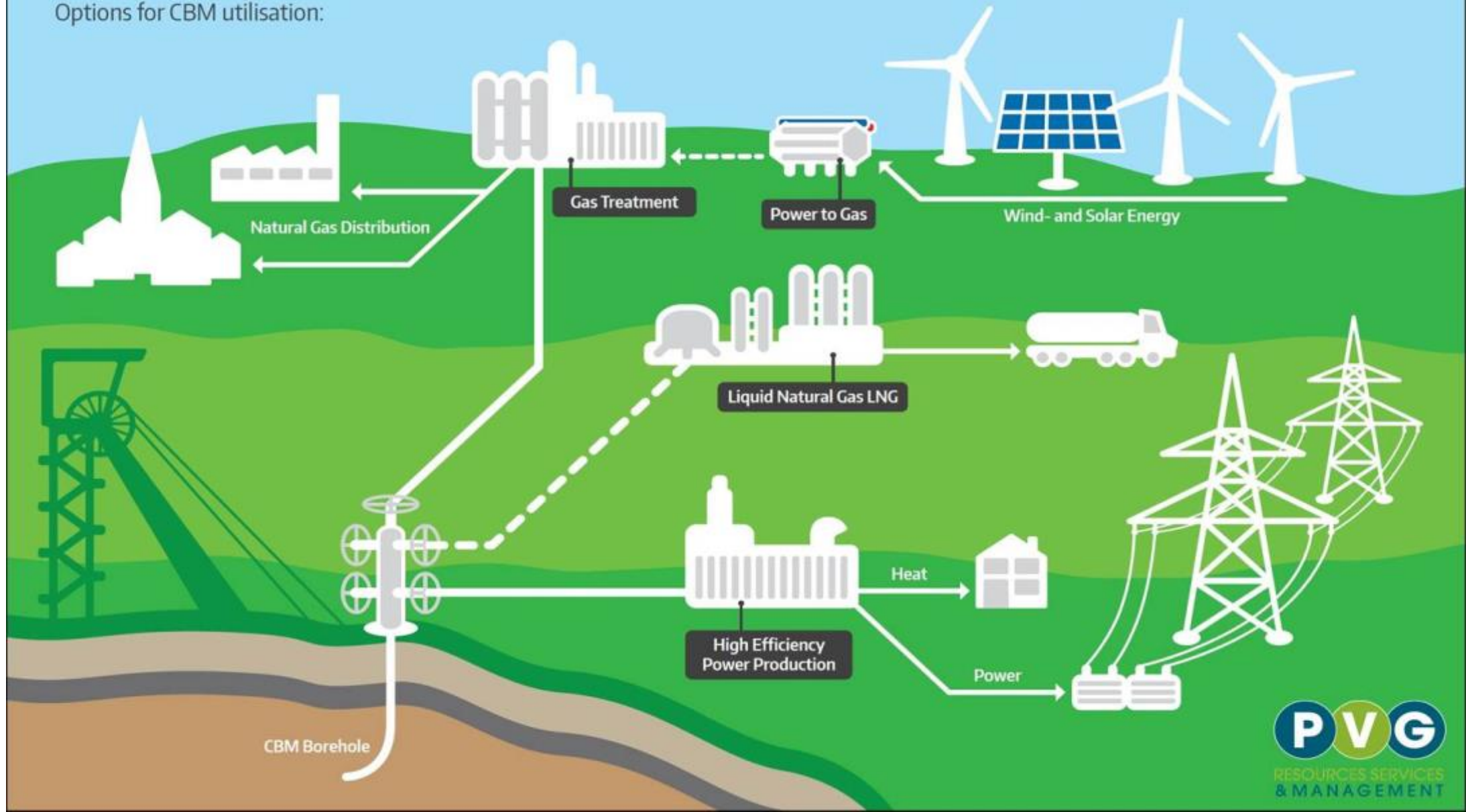
- "LauenhagenGa" The reservoir is expected at a depth of about 450 to 500 m below sea level.
- Expected production rates from the Wealden, the target of the first exploration well, are about 1.500 m³/h with a pressure of up to 10 bar.

Cross section of the planned well "Lüdersfeld 2"



Coal Bed Methane Utilisation

Options for CBM utilisation:



Small Scale LNG Production plants

- Process and equipment is designed in modular compact units
- Containerized and pre-assembled on skid-mounted units
- Independent operation of plant possible
- Gas-Purification
- Standard solutions for capacities from 0,5 t/h -10 t/h (LauenhagenGas 1st well expected about 1t/h)



Example: CRYOTEC, Small Scale LNG Plant for Gazprom, Russia, for 1.5 t/h



Summary

PVG is service provider, project developer and holder of own gas concessions

PVG believes on the sustainable success of CBM utilisation

Next Steps:

- Looking for strategic partnership and investors
- Execution of the exploration well “Lüdersfeld 2”
- Growth strategy for development of existing licensed areas and further exploration and exploitation activities



Thank You

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