AMM project development in Germany: regulations, financing, examples of projects

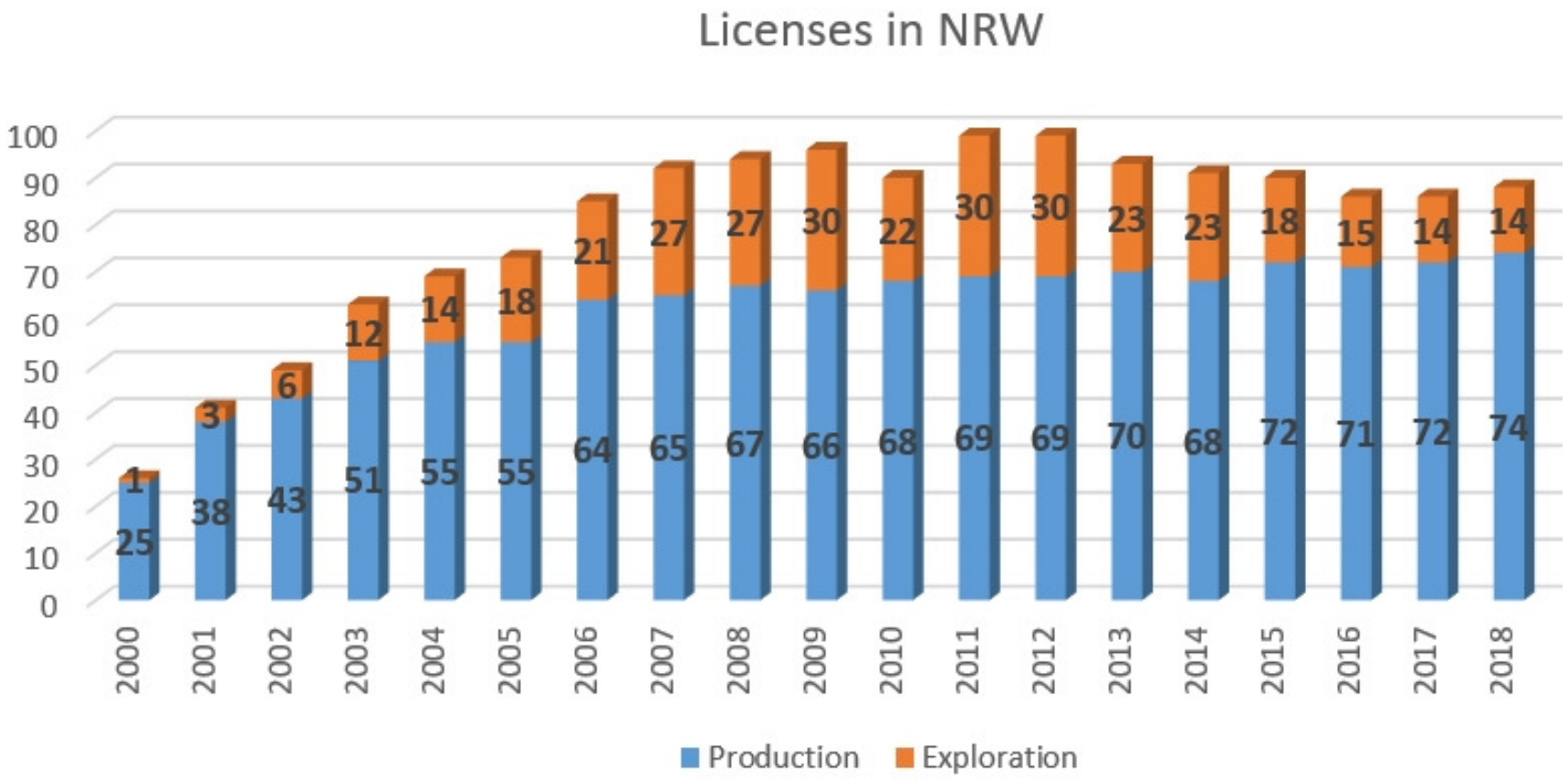
History of coal mining in Germany

- **Industrial coal mining started in the 19th century in Germany**
- **The peak was reached in the middle of the 1950th**
- **Some data:**

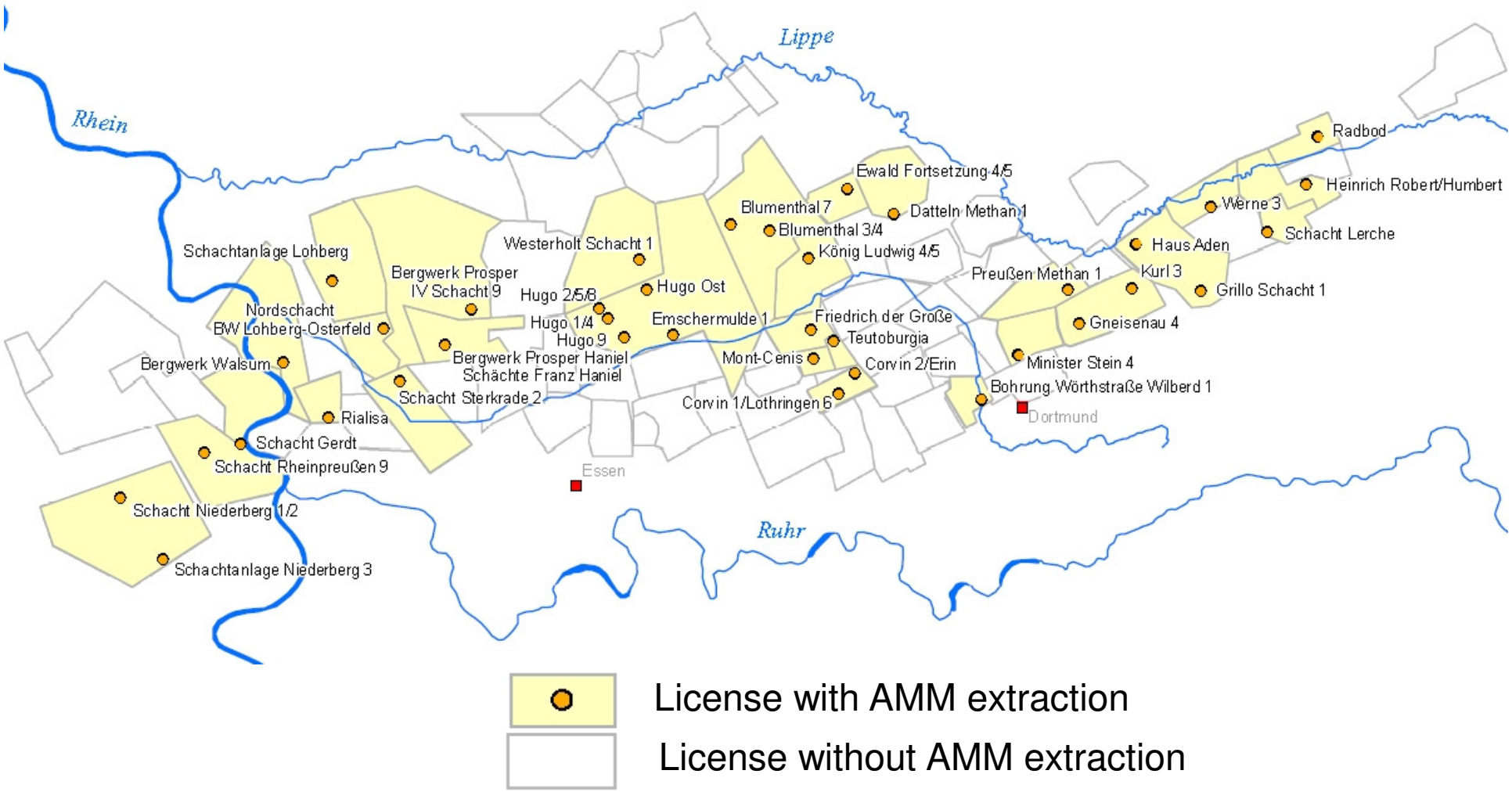
	1956	2015	2018
Coal extraction in tons (t)	***150 mil.***	***12 mil.***	***0***
Number of employees	***> 600.000***	***12.000***	***??***
Number of mines	***183***	***3***	***0***

- **The coal resource would last for approx. 500 to 600 years**

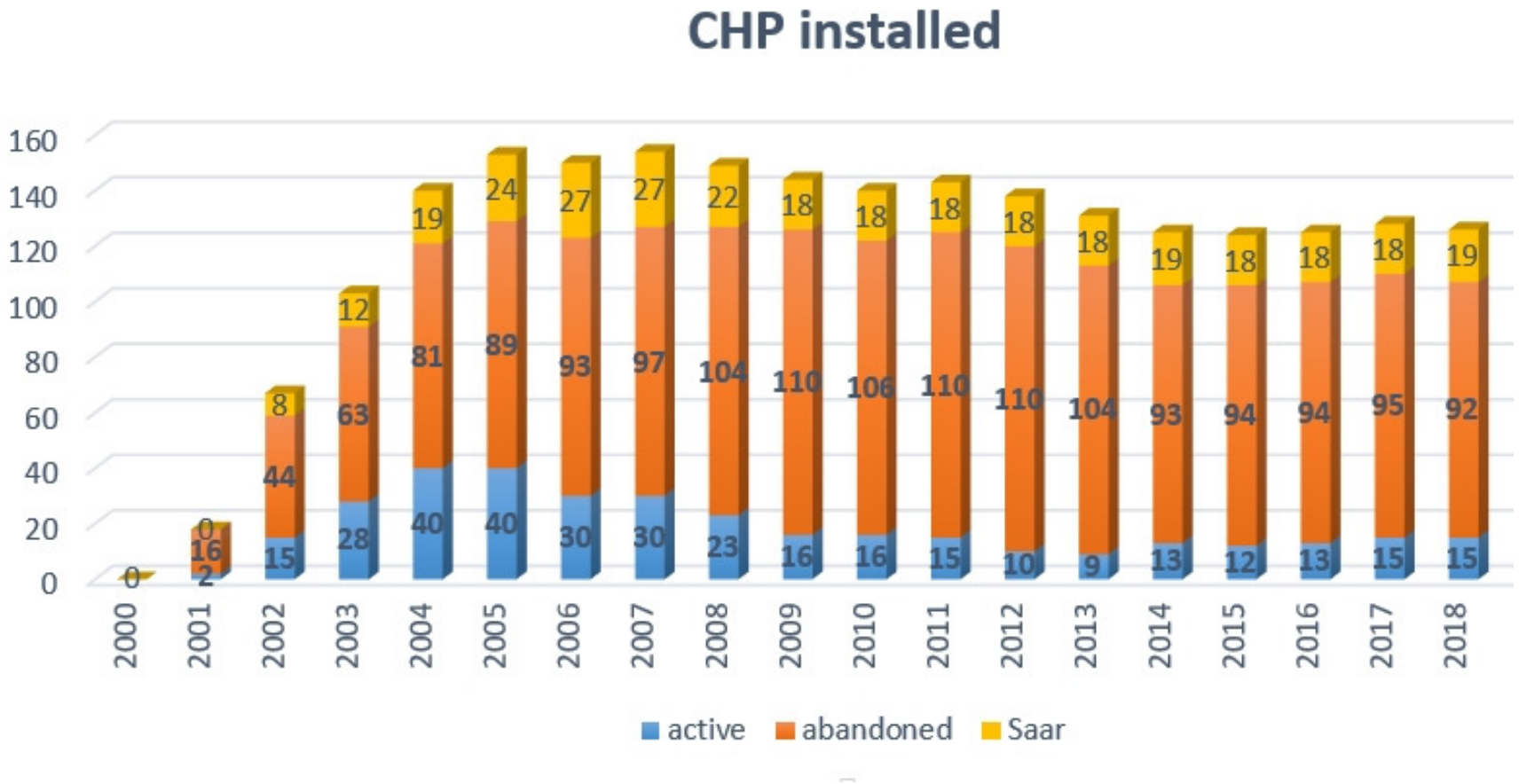
Licenses extraction and exploring



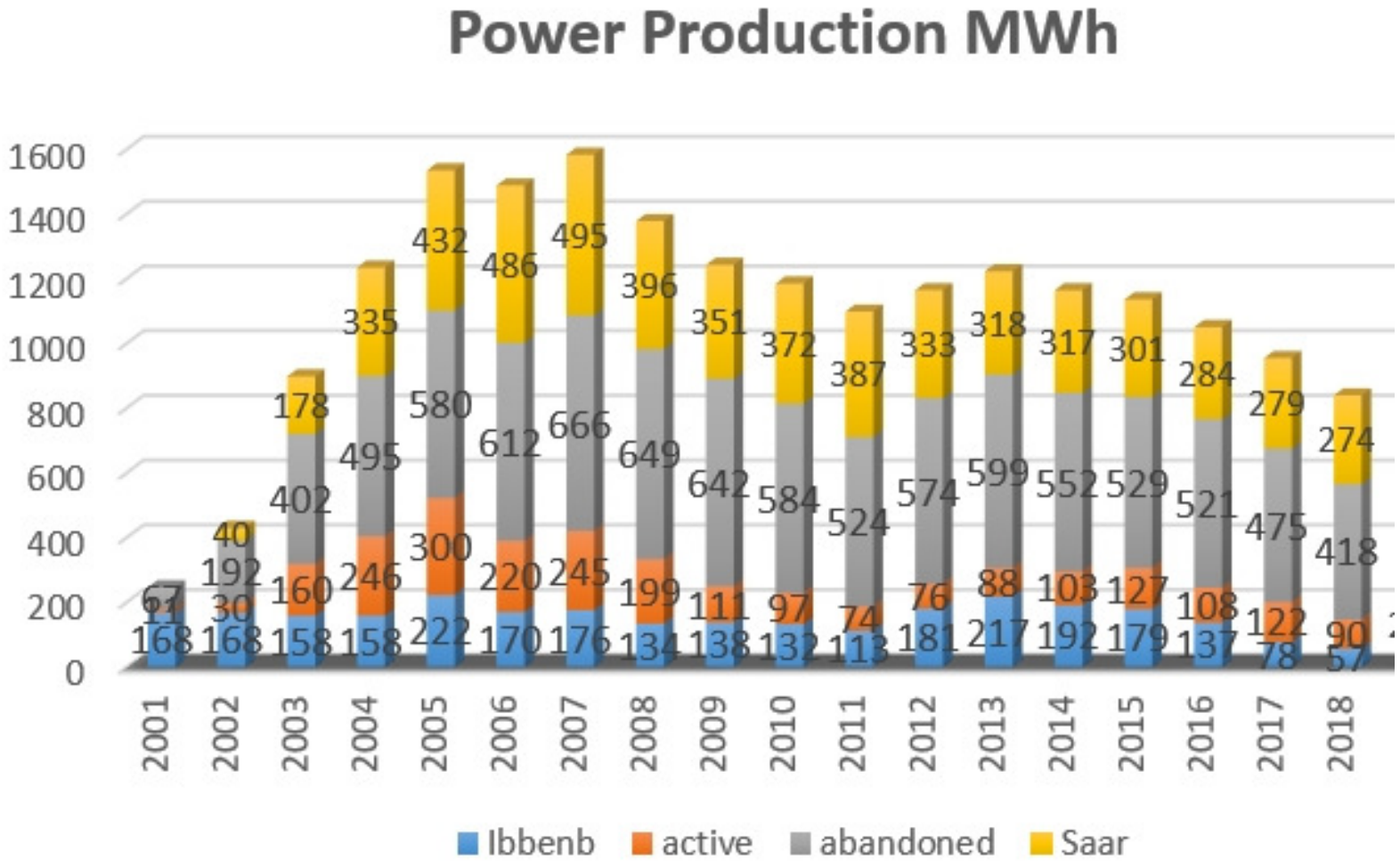
Licenses extraction and exploring



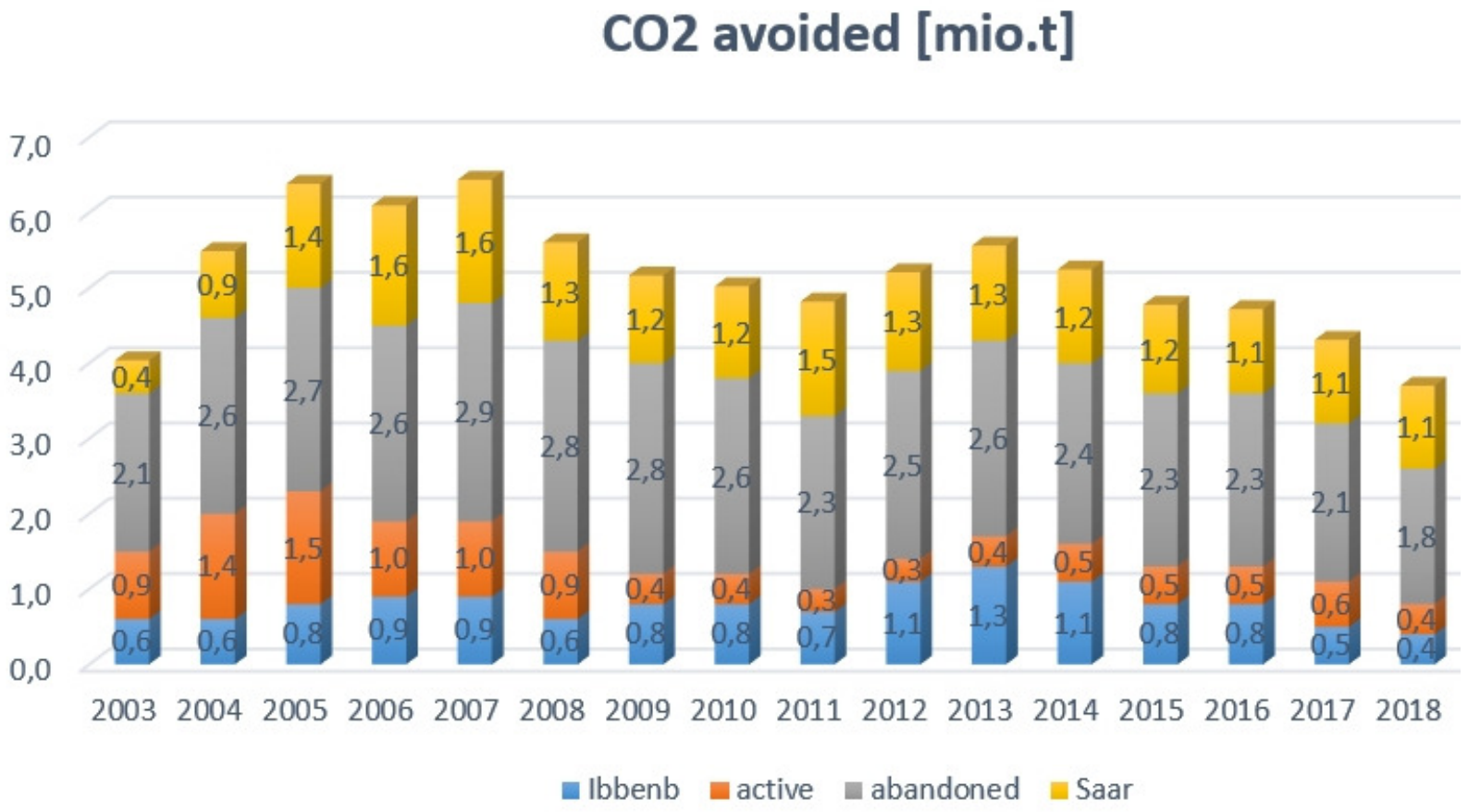
Number of CHP



Power Production

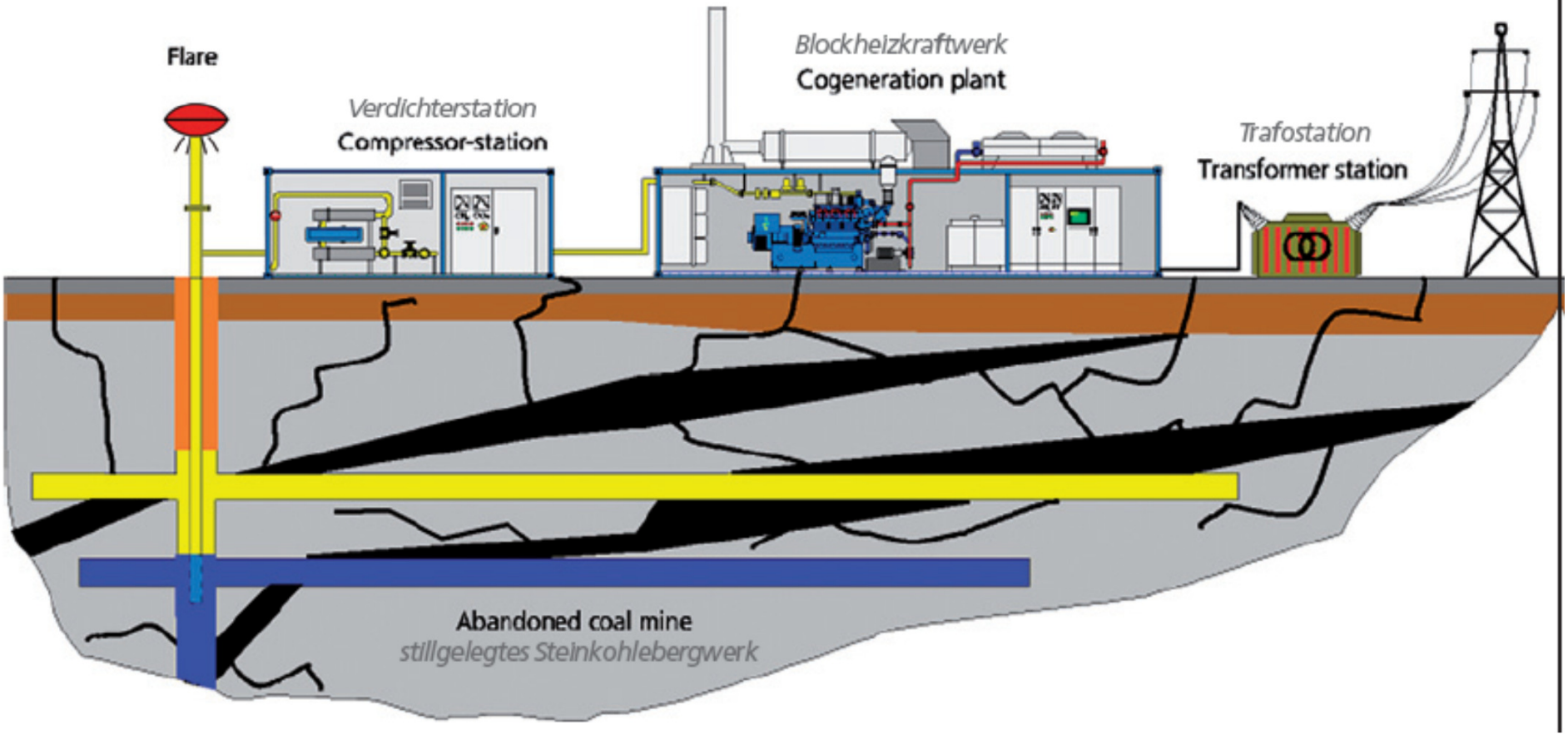


Avoided Emissions



Investments

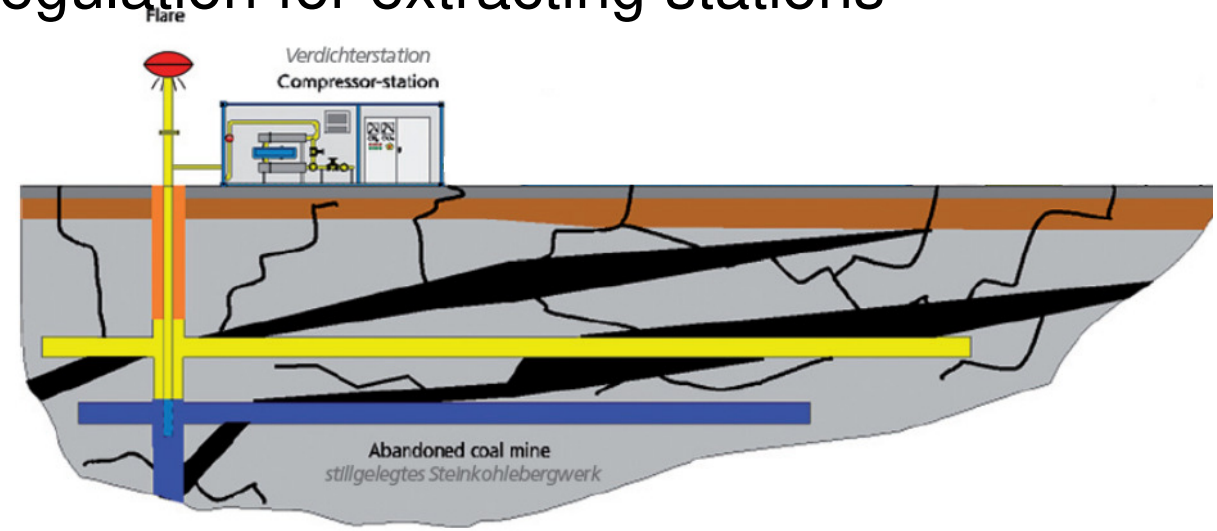
mobile plant for AMM capture



Regulations for AMM Extraction

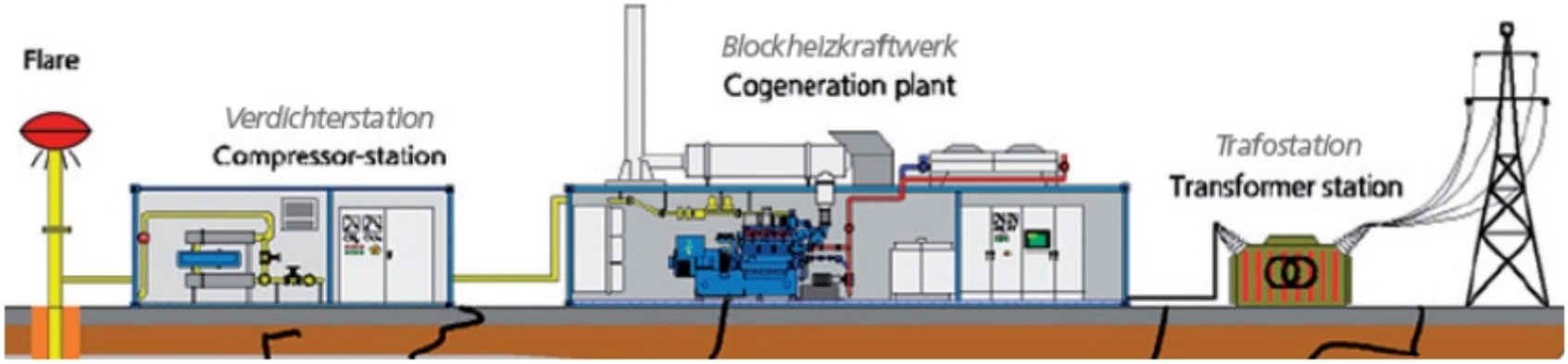
Main Criteria

- Licenses are given by the regional coal authority
- Every qualified company can apply for a license
- Existing facilities can be used by the new license owner (specially mine venting pipes, old mine roads)
- Fixed technical regulation for extracting stations



Financing

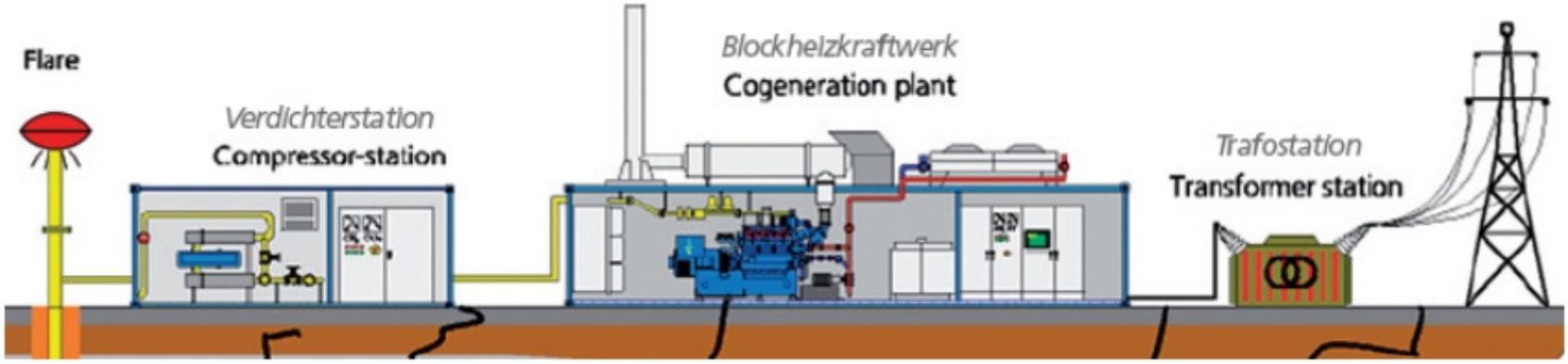
- Operator get a fixed tariff for fed in power for 20 years
- Power grid has to take the whole production
- The operator does not receive any grand for the installation
- Rights from avoided emissions fall to the state,
  no green certificates or similar



Financing

Feed-in tariff for power is regulated by renewable Law (EEG)

Year	< 0,5 MW	< 1MW	>1 MW	> 5MW	Degression
2000	7,67	7,67	6,65	6,65	
2004	7,67	6,65	6,65	(6,65)	
2008	7,16	7,16	5,16	4,16	1,50%
2012	6,84	6,84	4,93	3,98	1,50%
2016		6,74	4,30	3,80	1,50%
2020	--	--	--	--	--

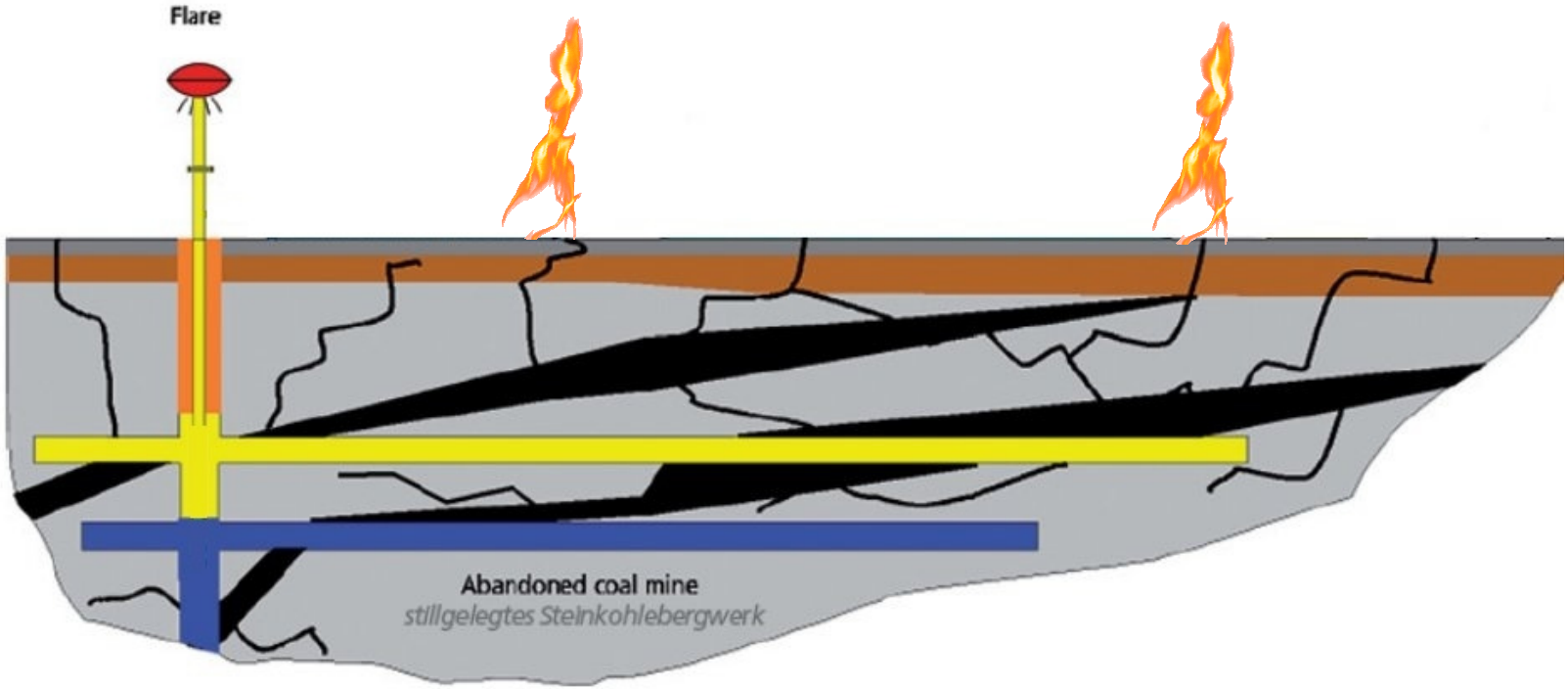


Financing

Tariffs for fed in power regulated by renewable Law (EEG)

After 2020 - current status (Feb. 2020)

- No fed-in tariff
  the installations will be dismantled when there 20 year living time will be reached. There is then no economic basis for operating the systems. According to today's expectations, feeding the electricity is not economical



AMM Powerproduction Case 1

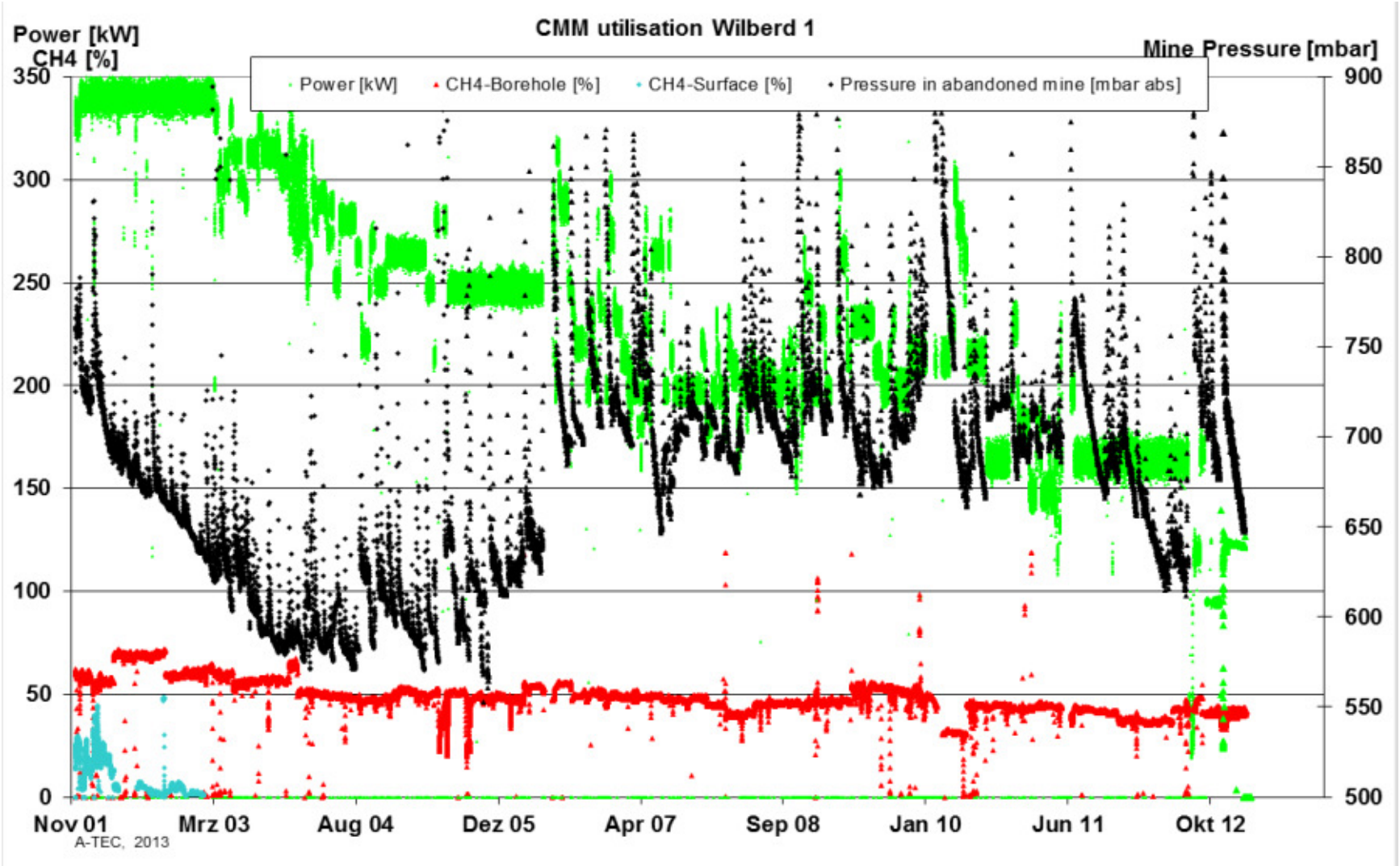
Borehole Degassing Plant

Surface Degassing Plant

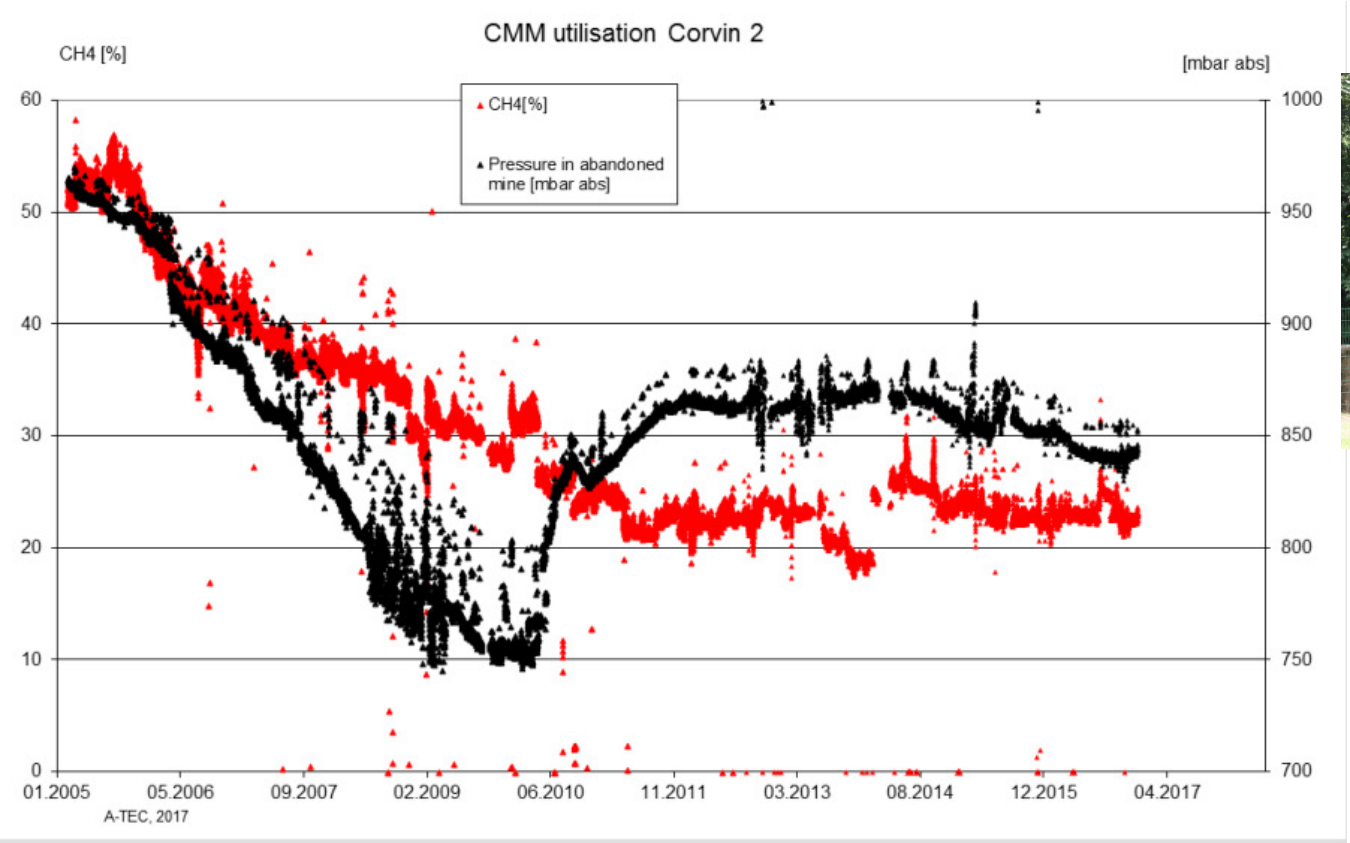
Surface Borehole 30 m

Borehole Gob 106 m

AMM Powerproduction Case 1

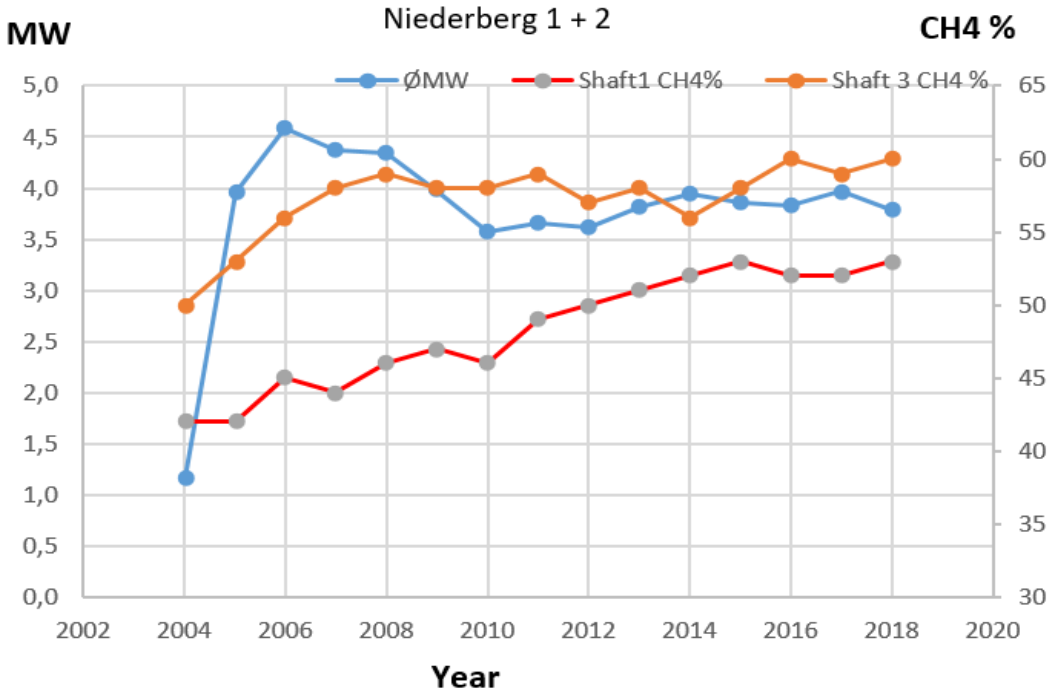


AMM Powerproduction Case 2



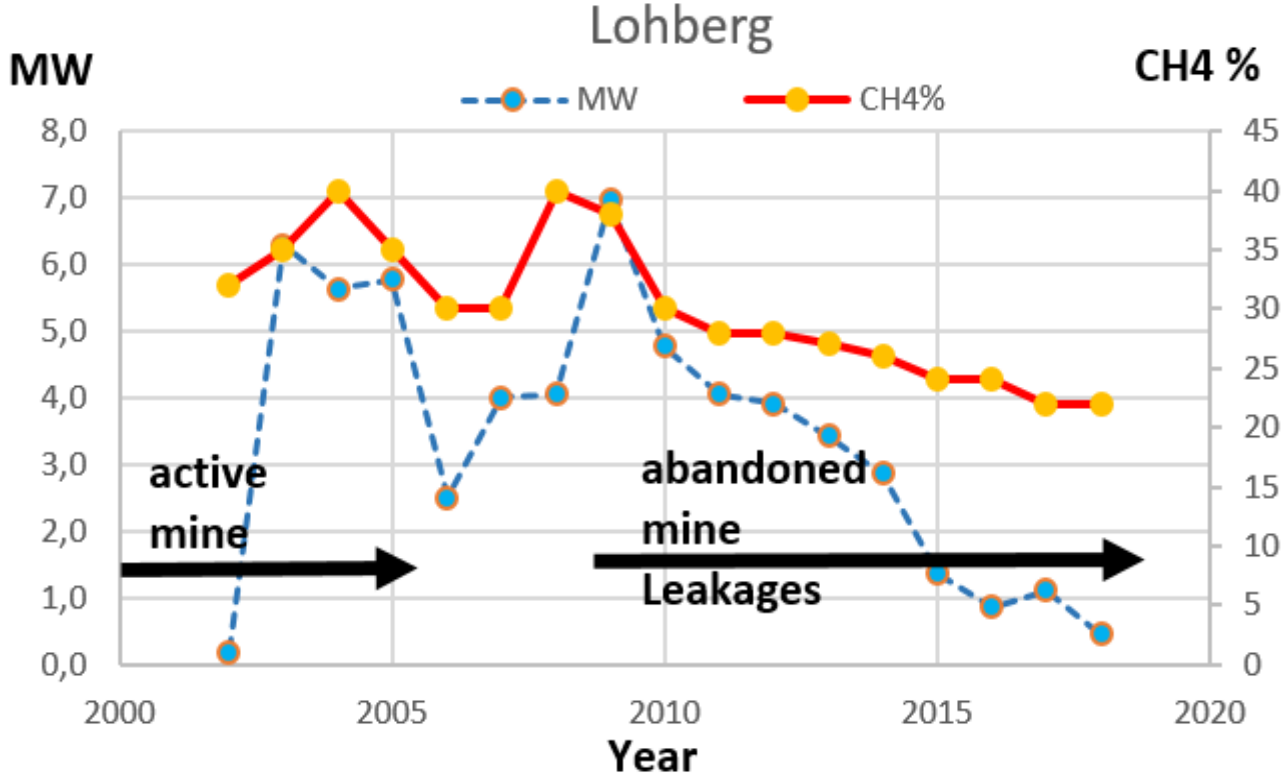
In the beginning 2.5 MW of electricity was generated. The underground pressure fell constantly in the next 4 years, so did the methane concentration in the gas. Electricity production was reduced to around 1.0 MW and the methane content stabilized at a low level (19-23%).
The disused mine is located in the southern part of the Ruhr district, where the coal comes to the surface and where are many old poorly filled shafts.

AMM Powerproduction Case 3



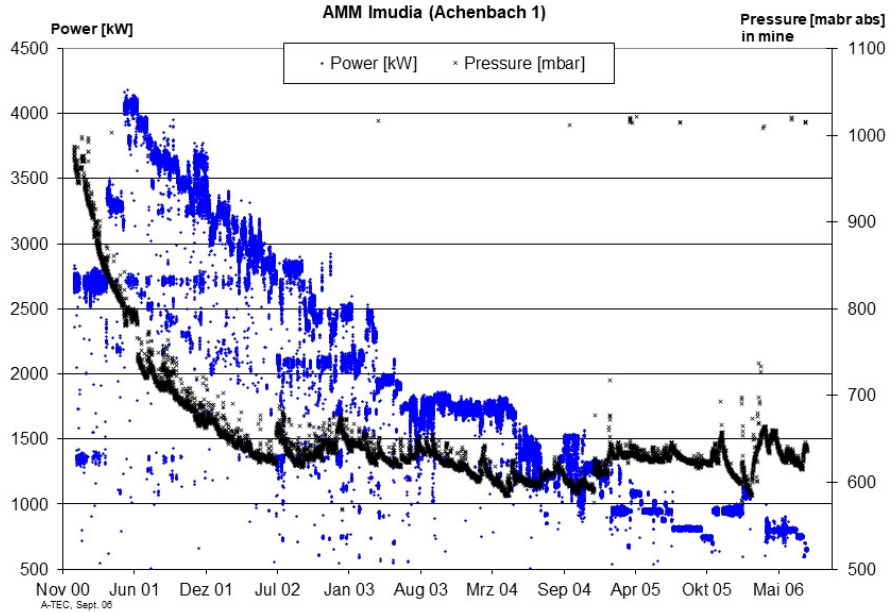
The mine operated from 1911 to 2001. The mine had no degassing station during its operation, because only a little gas was released during mining.
The shafts are well filled and degassing pipes are installed in 2 shafts. Mine gas has been extracted through these pipes since 2004.
The diagram shows: the methane concentration in the mine gas has increased in the past 14 years.

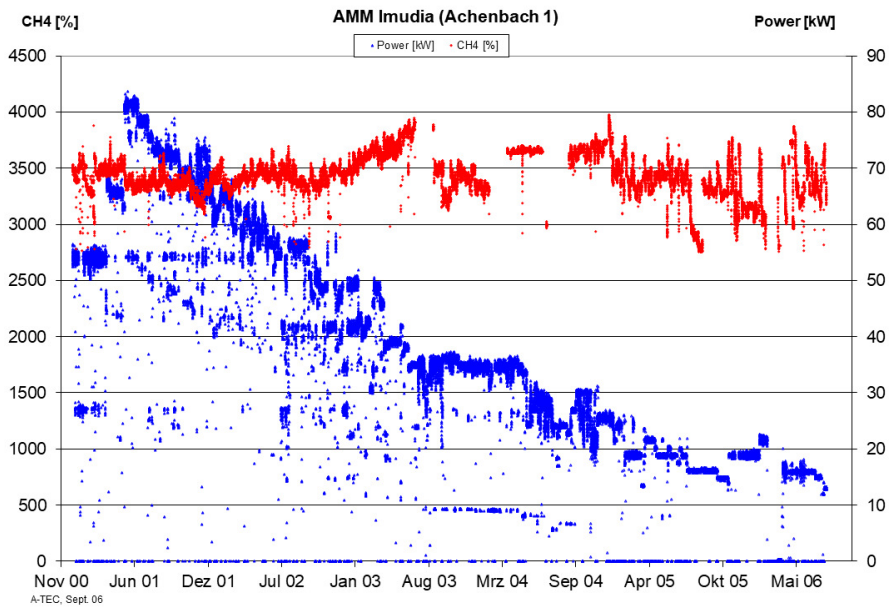
AMM Powerproduction Case 4



The mine produced coal from 1914 to 2005. The mine was very gas-rich. The CMM was partly used in the boiler plant of the mine. Only the values for the gas used in the CHP plant are shown in the diagram. The decrease in the CH4 concentration is clear. In the area surrounding the mine there are still open shafts of the last active mine. It will be interesting to see how the AMM quantity and quality develop when all the shafts are sealed.

AMM Powerproduction Case 5





Mine Minister Achenbach plant,
Lünen, Germany
1900 – Mine started
1992 – Mine closed
2000 – AMM extraction start
2007 – AMM extraction stopped, Mine floaded

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