

# Renewables and coal mine methane in German Legislation

## Recommendations for Ukraine

Clemens Backhaus



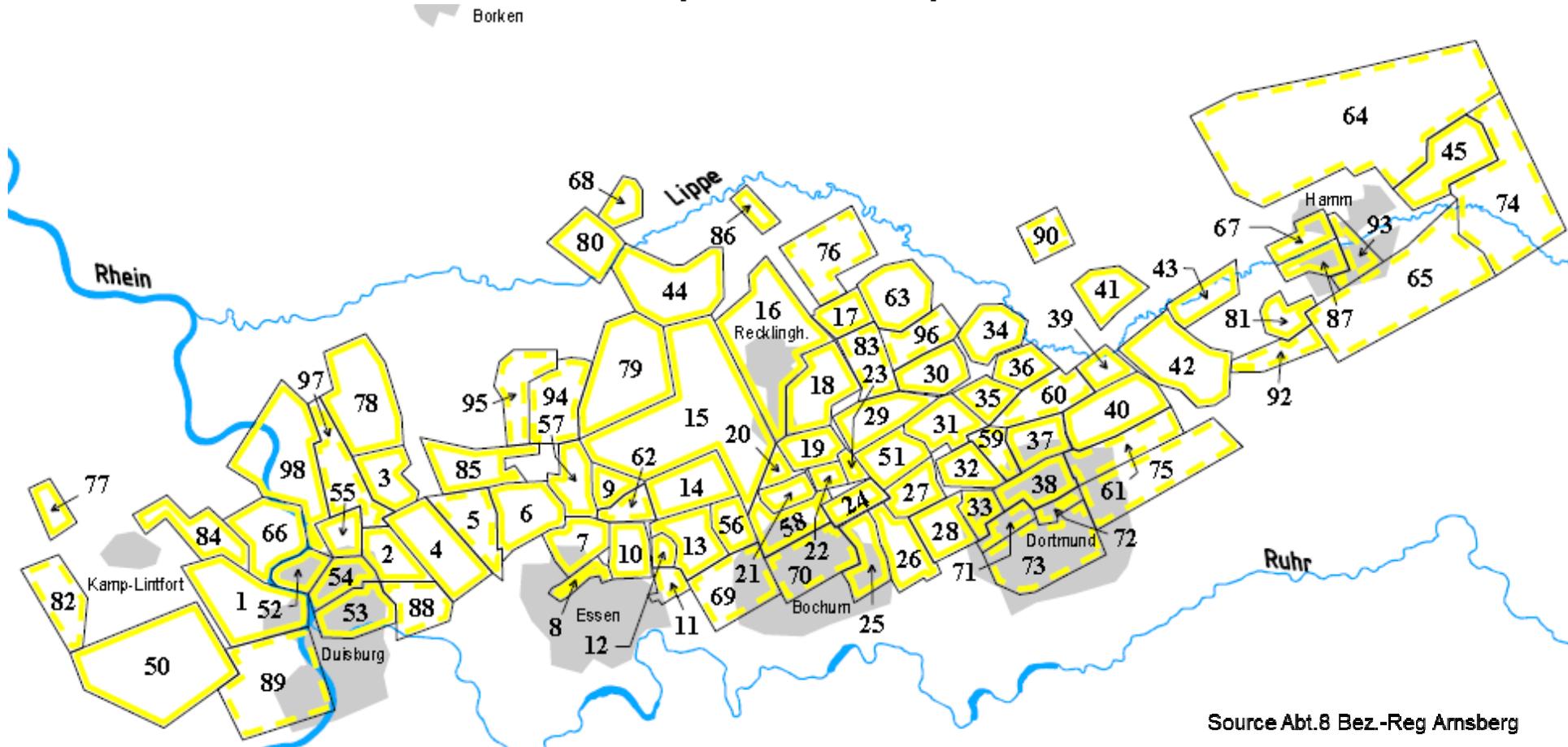
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# CMM in Germany 1

68 Licenses, 24 Exploration permits 31.12.2010



# CMM in Germany 2

## Revenues by EGG

\* EEG = renewable Law Germany

Power Year	kW < 500	kW >1000kW	Max >5000 KW
	Cent/kWh	Cent/kWh	Cent/kWh
2000	7,67	6,65 (>500kW)	6,65
2009	7,67	5,16	4,16
2012	6,84	4,93	3,98

In 2000 CMM included in Group landfill gas and sewage gas.

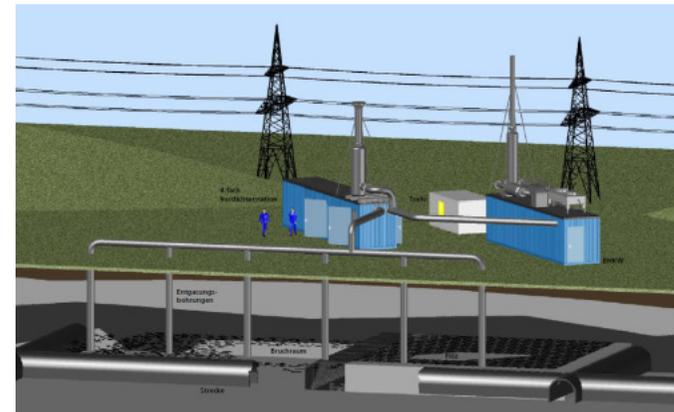
The production of these gases is not part of the utilization and not part of the power production costs.

The power production from CMM was scheduled to be part of the emission trading under Kyoto protokoll. So the invertors could receive additional income for emissions reduction. This was withdrawn by government in 2005. After this point no new investments for CMM was made.

# CMM in Germany 2

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- The price for the power feeded to the grid is paid from the grid owner to the plant operator
- More costs are spread across all electricity consumers  
(spezial regulations in the law)



Download EEG in english

<http://www.erneuerbare-energien.de/en/unser-service/mediathek/downloads/detailview/artikel/renewable-energy-sources-act-eeq-2012/>

# CMM in Germany 2

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## Taxes on Gas extraction in Germany [The legal text: http://esb.bezreg-arnsberg.nrw.de/a\\_1/a\\_1\\_021/](http://esb.bezreg-arnsberg.nrw.de/a_1/a_1_021/)

### Active mines

**0,00 Euro/ m<sup>3</sup> methane  
on active mines**

Methan has to extracted for safety reasons. Extraction and uilization of this gas should not be effected negative by taxes

### Abandoned mines

**0,00 Euro/m<sup>3</sup> methane on  
abandoned mines**

If the extraction of gas occurs for safety reasons

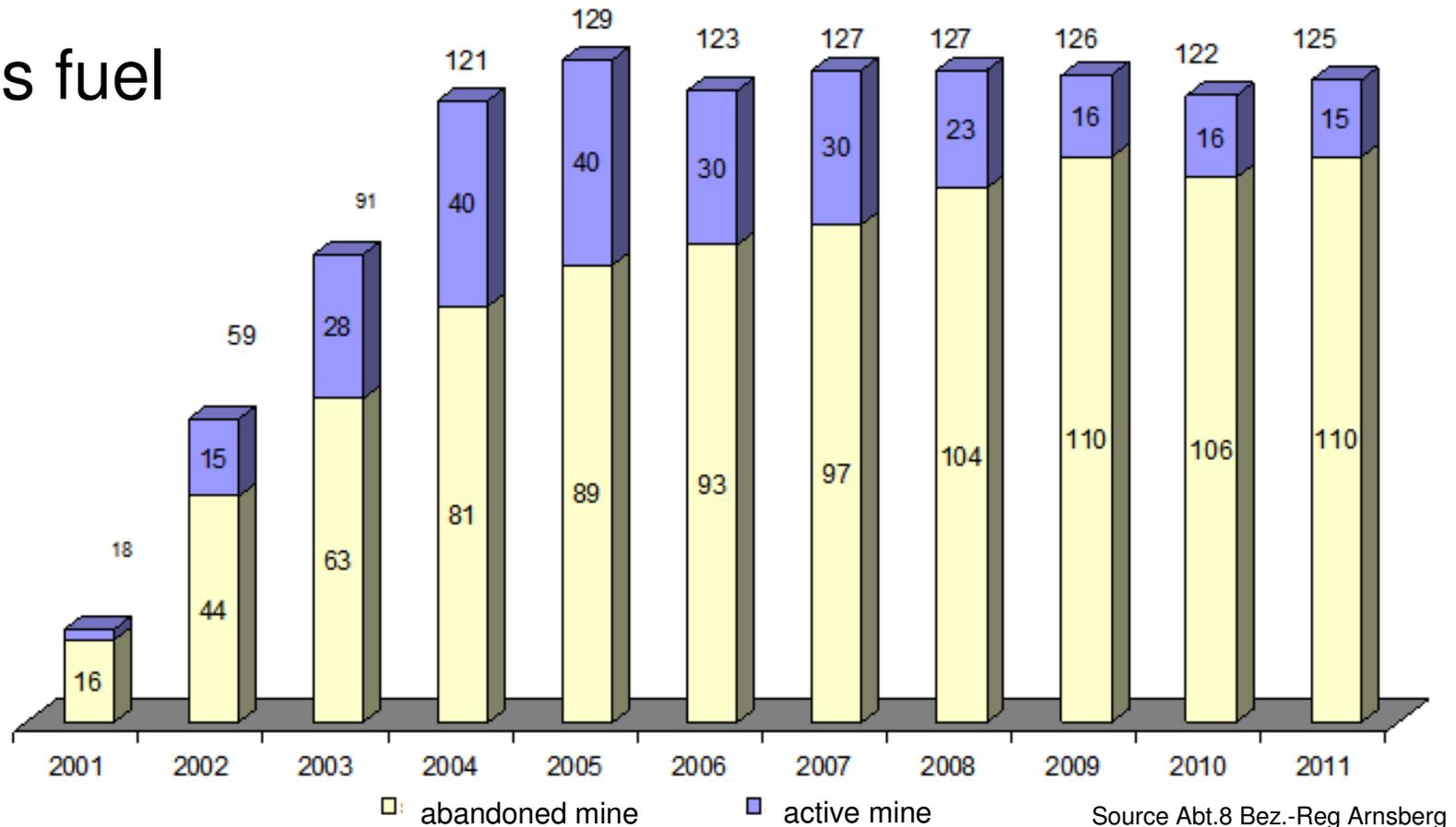
**0,03 Euro/m<sup>3</sup> methane on  
abandoned mines**

If the extraction of gas is **not** occurs for safety reasons

# CMM in Germany - 3

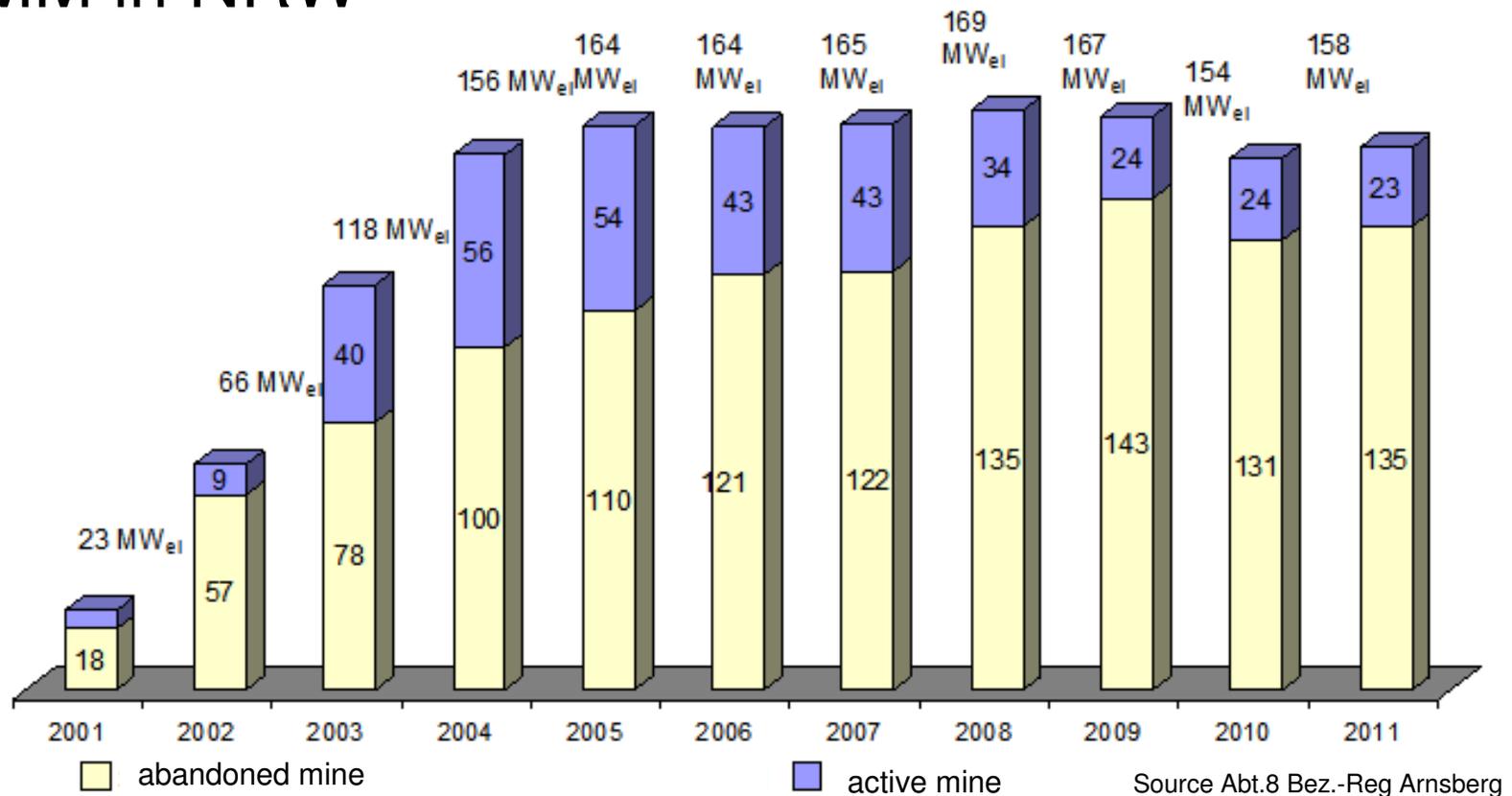
## Number of CHP in NRW

### CMM as fuel



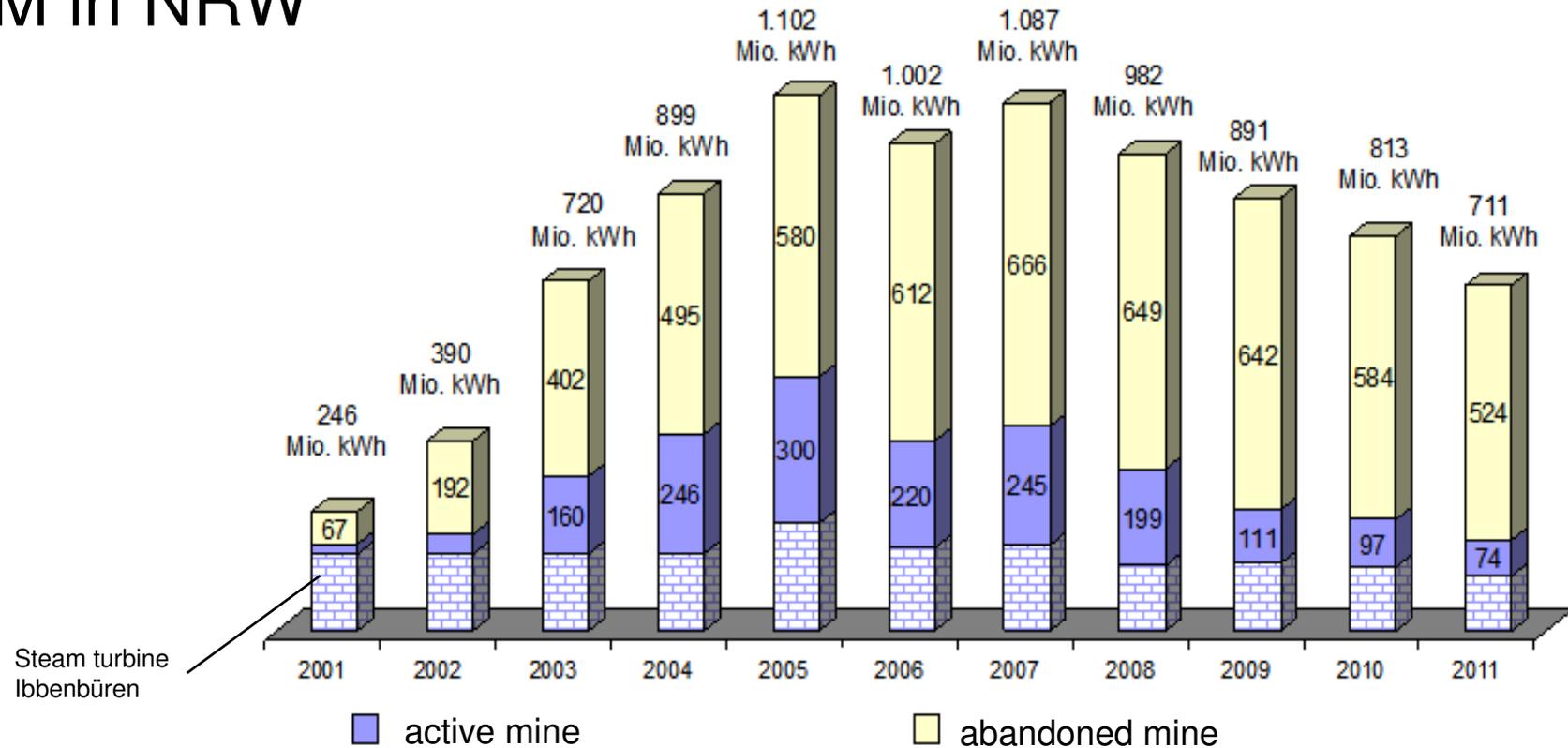
# CMM in Germany - 4

## Installed Power from CMM in NRW



# CMM Germany - 5

## Power production from CMM in NRW

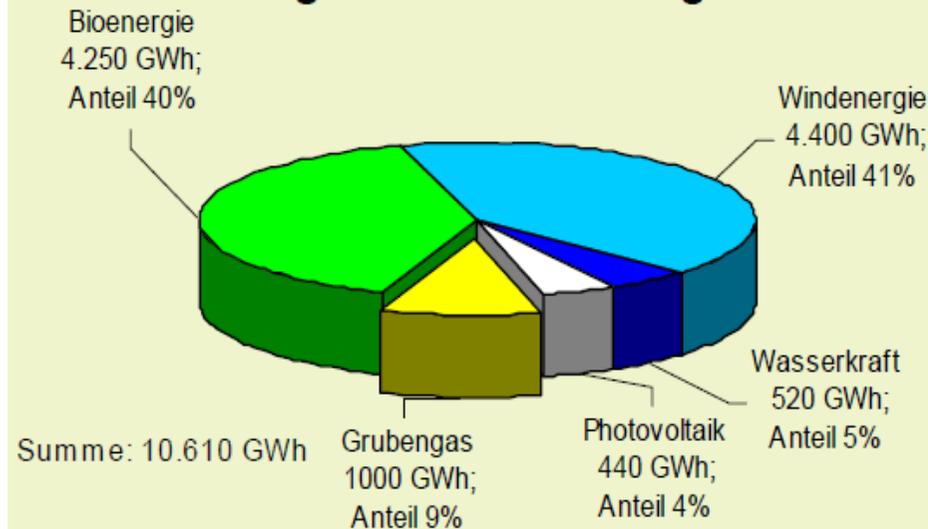


Source Abt.8 Bez.-Reg Arnsberg

# CMM Germany – 6 in NRW

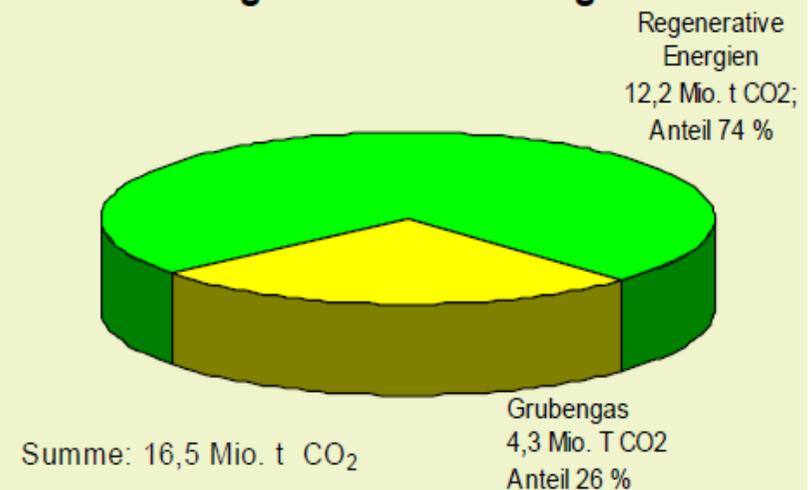
## Power production by renewables in 2008

### Stromerzeugung durch regenerative Energien und Grubengas



## CO<sub>2</sub> reduction by Renewables in 2008

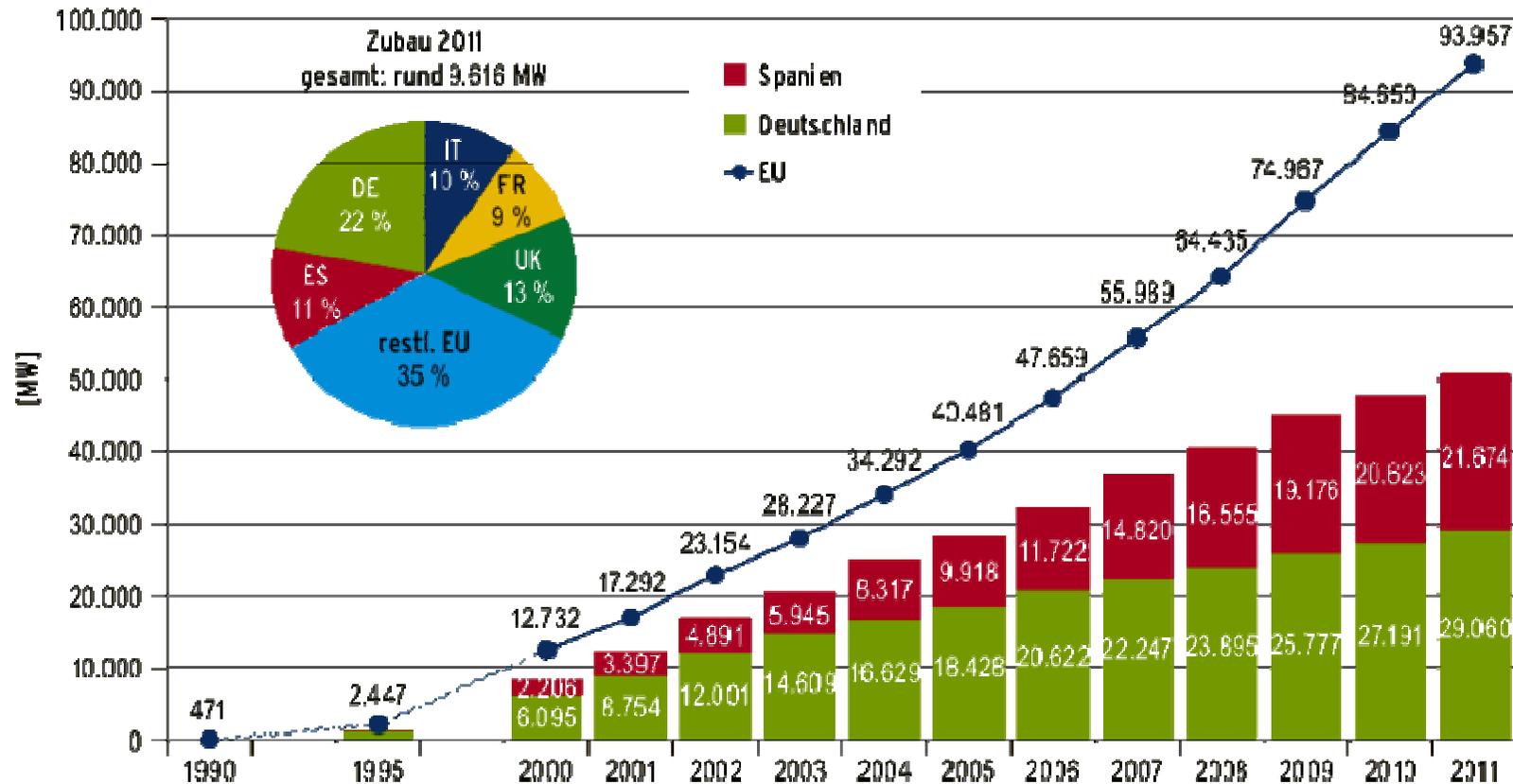
### CO<sub>2</sub>-Minderung durch regenerative Energien und Grubengas



Source Abt.8 Bez.-Reg Arnsberg

# CMM Germany - 7

## Wind energy installed power as comparison



Source: BMU

# CMM installations

- 2000 - 2002



Donetsk, 17. October 2013 — C. Backhaus

No. 12

# CMM installations



Donetsk, 17. October 2013 — C. Backhaus

# Technologies for CMM utilisation

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## CMM Utilisation Opportunities

### High-Quality Gas

> 50% CH<sub>4</sub>

- Natural gas pipelines
- Vehicle fuel (CNG, LNG)
- Local distribution
- Power generation
- Heat generation
- (Fuel cells)

### Medium-Quality Gas

25 – 50% CH<sub>4</sub>

- Power generation
- Heat generation
- Boiler fuel
- Ventilation air heating
- Coal drying
- Industrial applications
- (Fuel cells)

### Low-Quality Gas

< 25 % CH<sub>4</sub>

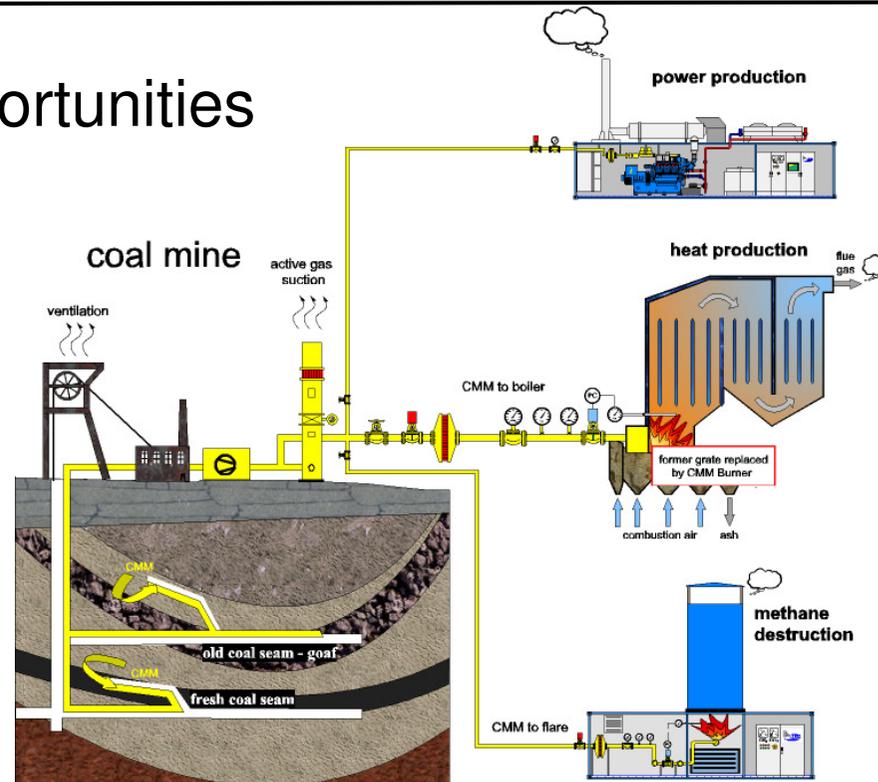
- Thermal Oxidation
- Catalytic Oxidation
- Combustion  
low Quality CMM
- Use as additional Fuel  
for Gas engines

# Technologies for CMM utilisation

## CMM Utilisation Opportunities

### Medium-Quality Gas $25\% < \text{CH}_4 < 50\%$

- Power generation
- Heat generation
- Combined heat & power generation
- Boiler fuel
- Coal mine heating
- Ventilation air heating
- Coal drying
- District heating
- Industrial applications



Technology can also utilise high quality gas

Utilisation close to production

- Power production on site from own resources
- Saving of coal for own heat requirements
- Additional revenues from emissions trading
- Additional stimulation of mine degassing
- Increase of mine safety

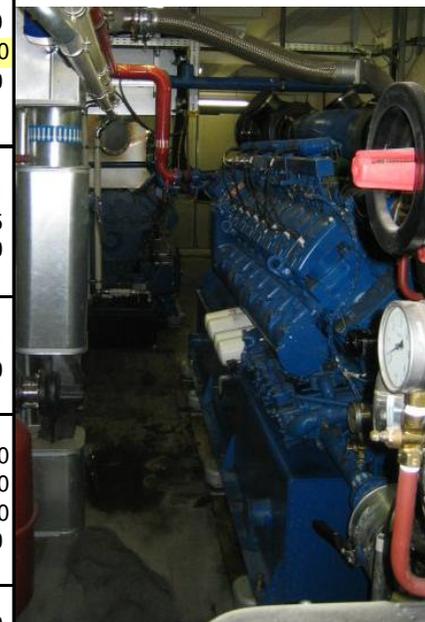
# CMM economics

## Projekte CMM Ukraine

Investment		Projekt 1,0 MWeI	Projekt 2,0 MWeI
yearly operation hour (full load)	h	5.800	5.800
max electric power	kW	1.000	2.000
plant consumption :	kW	60	110
net power :	kW	940	1.890
<b>Costs</b>			
CHP	€	650.000	1.300.000
Transformer	€	40.000	80.000
compressorstation	€	200.000	240.000
bohrhole	€	0	0
buildings	€	120.000	150.000
permissions	€	40.000	50.000
planning	€	60.000	70.000
other	€	40.000	60.000
<b>Sum Investment</b>	<b>€</b>	<b>1.150.000</b>	<b>1.950.000</b>
Investment	€	1.150.000	1.950.000
interest rate	%	5	5
run time	years	8	8
residual value	€	0	0
<b>Annuity per annum</b>	<b>€</b>	<b>177.930</b>	<b>301.708</b>

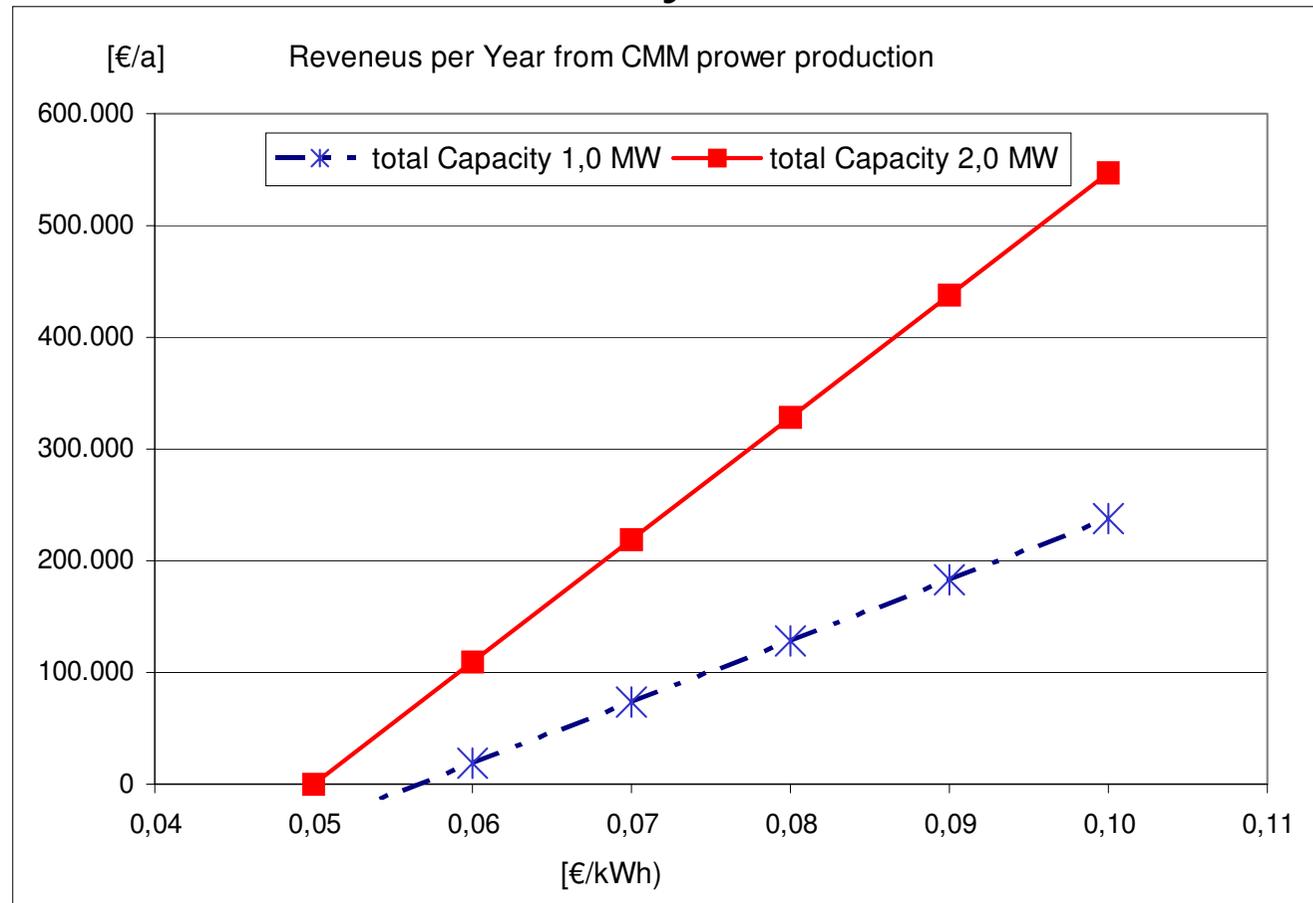
<b>NET INCOME</b> (incl. Capital costs)	€	<b>18.940</b>	<b>109.362</b>
<b>payback time simpel</b>	years	<b>5,8</b>	<b>4,7</b>

Operation		Projekt 1,0 MWeI	Projekt 2,0 MWeI
amount of electricity sold	kWh	5.452.000	10.962.000
average electricity price	EUR/kWh	0,060	0,060
<b>Revenues power p.a.</b>	<b>€/a</b>	<b>327.120</b>	<b>657.720</b>
sold heat amount	MWh	0	0
average heat price	EUR/MWh	15	15
<b>Revenues per annum heat</b>	<b>€/a</b>	<b>0</b>	<b>0</b>
Spec. maintenance costs	EUR/kWh	0,018	0,018
<b>maintenance costs</b>	<b>€/a</b>	<b>104.400</b>	<b>208.800</b>
Land costs		5.000	5.000
Insurance costs 1.5%	€/a	17.250	29.250
administrative costs	€/a	3.600	3.600
<b>costs p.a.</b>	<b>€/a</b>	<b>25.850</b>	<b>37.850</b>
<b>Operating revenue p. a.</b>	<b>€/a</b>	<b>196.870</b>	<b>411.070</b>



# CMM economics

power price determines the economy



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# Thank you for your attention

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