Methane losses in the gas infrastructure - challenge for network operators
Material, leaks, technology, operation

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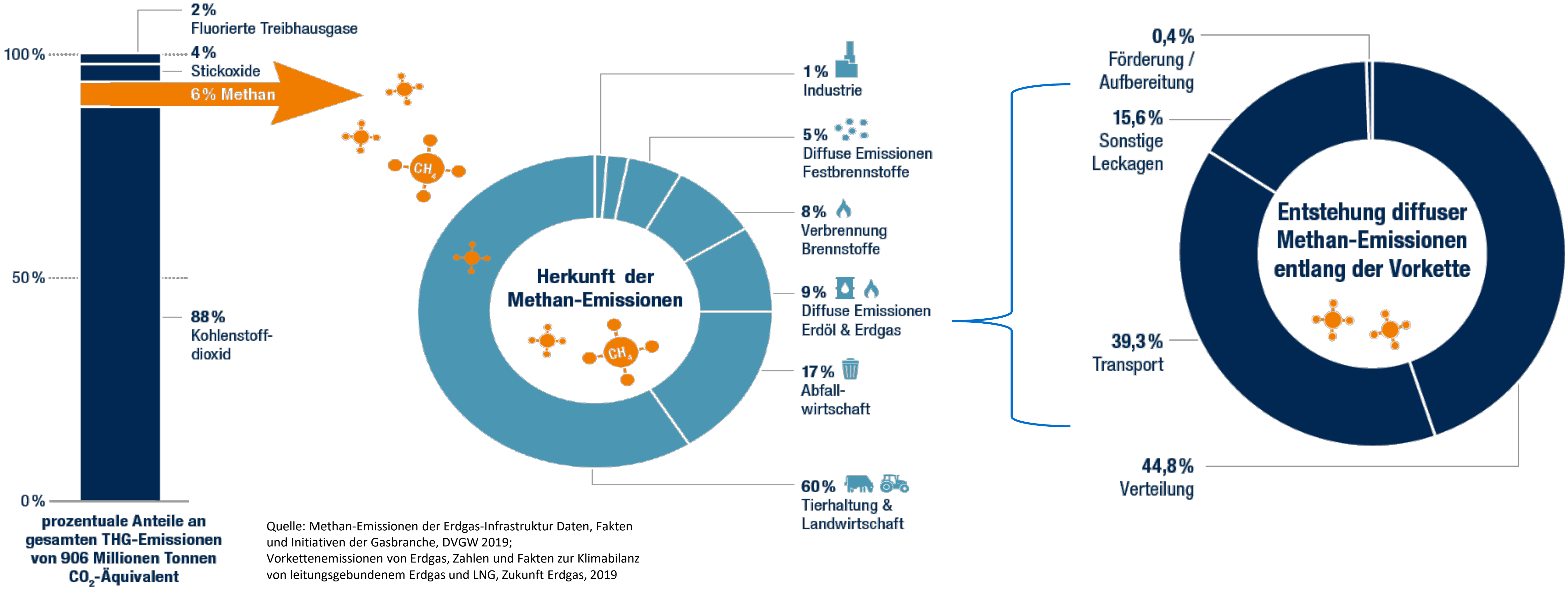
Methane emissions distribution of emissions in Germany
Starting situation

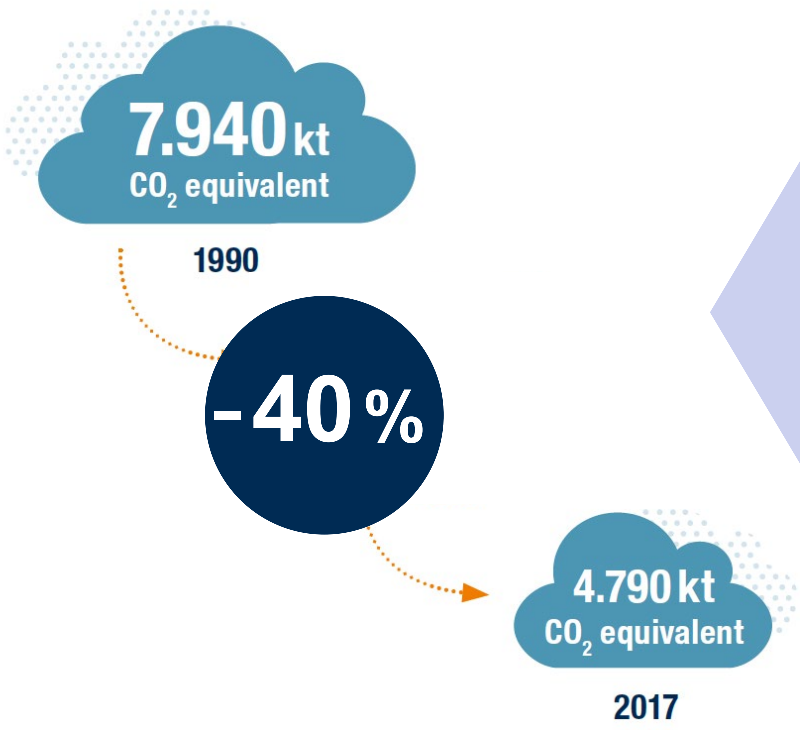


Quelle: Methan-Emissionen der Erdgas-Infrastruktur Daten, Fakten und Initiativen der Gasbranche, DVGW 2019;
Vorkettenemissionen von Erdgas, Zahlen und Fakten zur Klimabilanz von leitungsgebundenem Erdgas und LNG, Zukunft Erdgas, 2019

GHG emissions: The oil and gas industry accounted for 5 million tonnes at 0.6%.

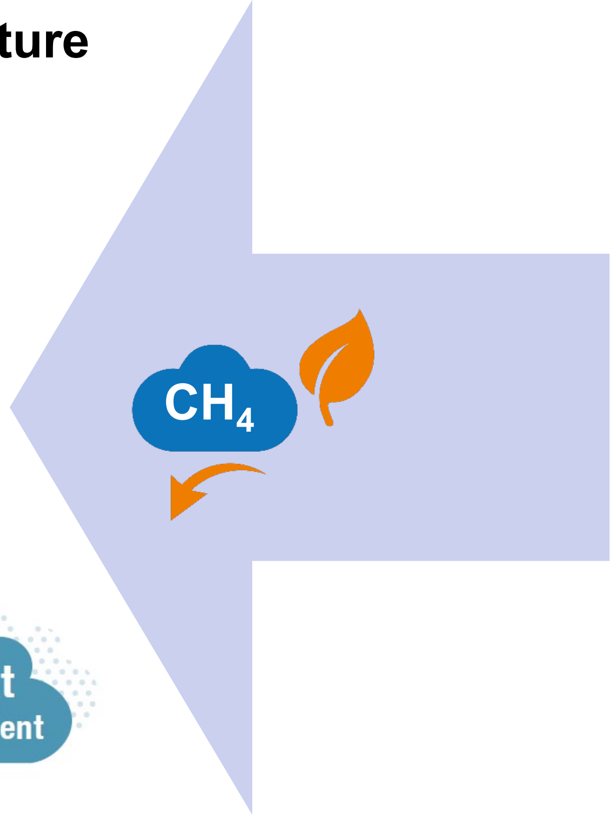
Methane emissions have already been significantly reduced in Germany in the past

Diffuse methane emissions* of the German natural gas infrastructure

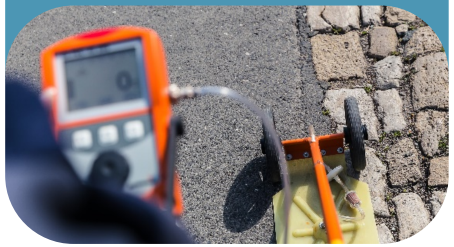


Quelle: UNFCCC, Greenhouse Gas Inventory Data,
Fugitive methane emissions from natural gas.

* Methane emissions emitted into the atmosphere through production, treatment, transport, storage and distribution



Leak Detection And Repair (LDAR)



Investment into the gas infrastructure

Training of technical staff

Replacement of grey cast iron pipes

Quelle:DVGW-Stakeholder Workshop Methanverluste, Feb. 2021.

Development of pipeline lengths in the German Gas Distribution Network
Where do we stand today? Trend goes to PE

	2014
VL (VL+HAL)	**371.500** (498.500)
PE	189.680 (272.680)
Stahl	162.800 (206.800)
Duktil + Grauguss	8.770
Others (z.B. PVC)	10.250

	2014
(HAL)	**127.000**
PE	**83.000**
Stahl	**44.000**

Quelle: DVGW (Jan. 2017)

Distribution pipe length		
Gesamt	**258.000 km**	**100 %**
Polyethylen *(PE)*	**52.000 km**	**20 %**
Stahl/Duktil guss	**196.000 km**	**76 %**
Grauguss	**10.000 km**	**4 %**

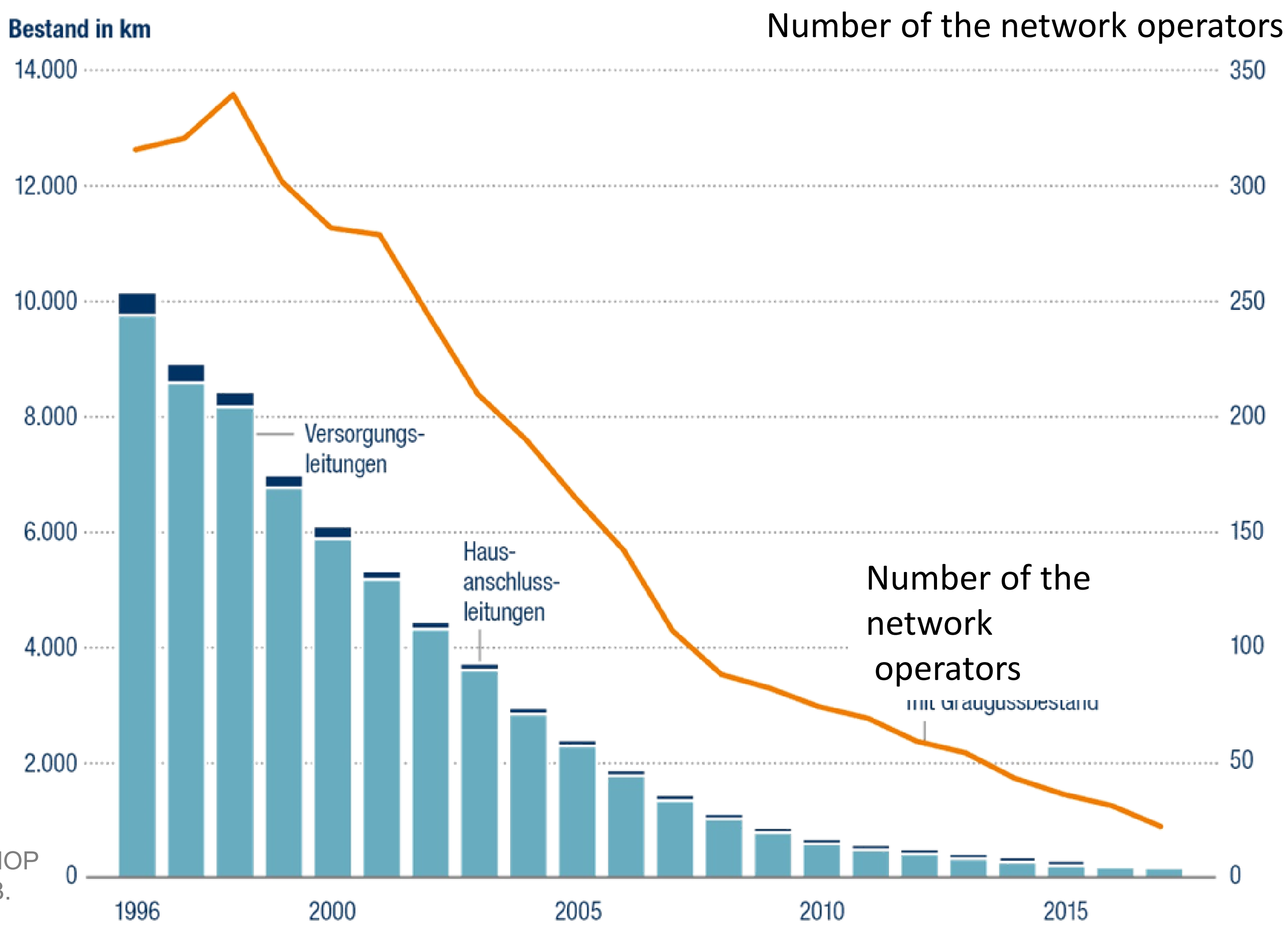
Status 1990_DVGW-Statistik

Success story in Germany:

Already 55% of the gas distribution network is made of PE.
Trend towards PE is still uninterrupted today.
The proportion of steel has fallen from 76% to 40%.

Length of transport pipes: 52.500 km (2014)

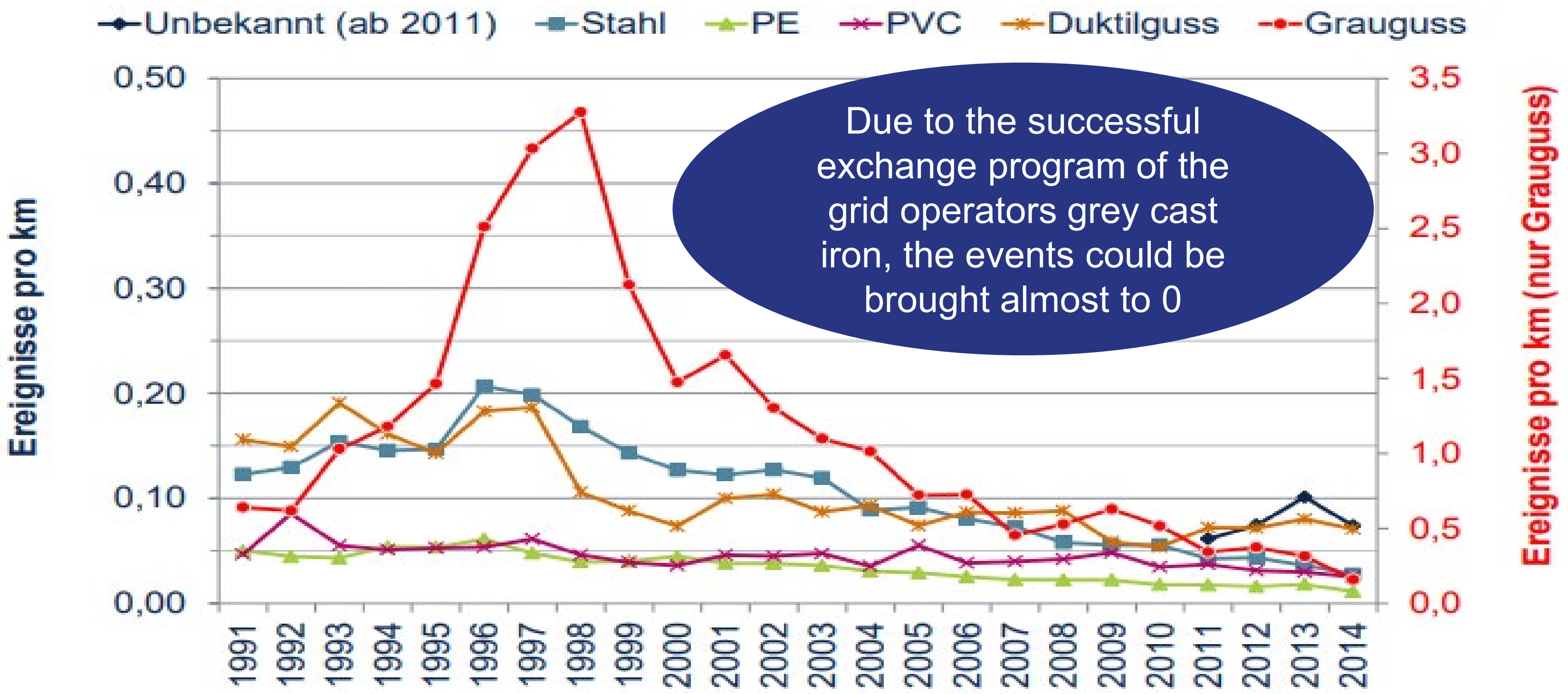
Reduction of the grey cast iron stock between 1996 and 2017 (replacement of pipes < DN 150)



QUELLE:DVGW-STAKEHOLDERWORKSHOP METHANVERLUSTE, FEB. 2021.

A success concerning increasing security and reduction of methane losses.

Event development 1991-2014 on all gas pipelines _ the general trend continues to this day



Quelle: Pipelife

Gasstop for Service Lines

Quelle: DVGW_ EWP 01/2016_ Bestandserhebung, Frank Dietzsch

The events per km in German gas distribution networks are already very low; by further expansion of PE networks, the annual events will be reduced even further. In the event of damage by third parties, the amounts of gas released in the HAL area are already limited by a GS. After the grey cast iron exchange program, the network operators are not seeking any further large-scale material exchange.

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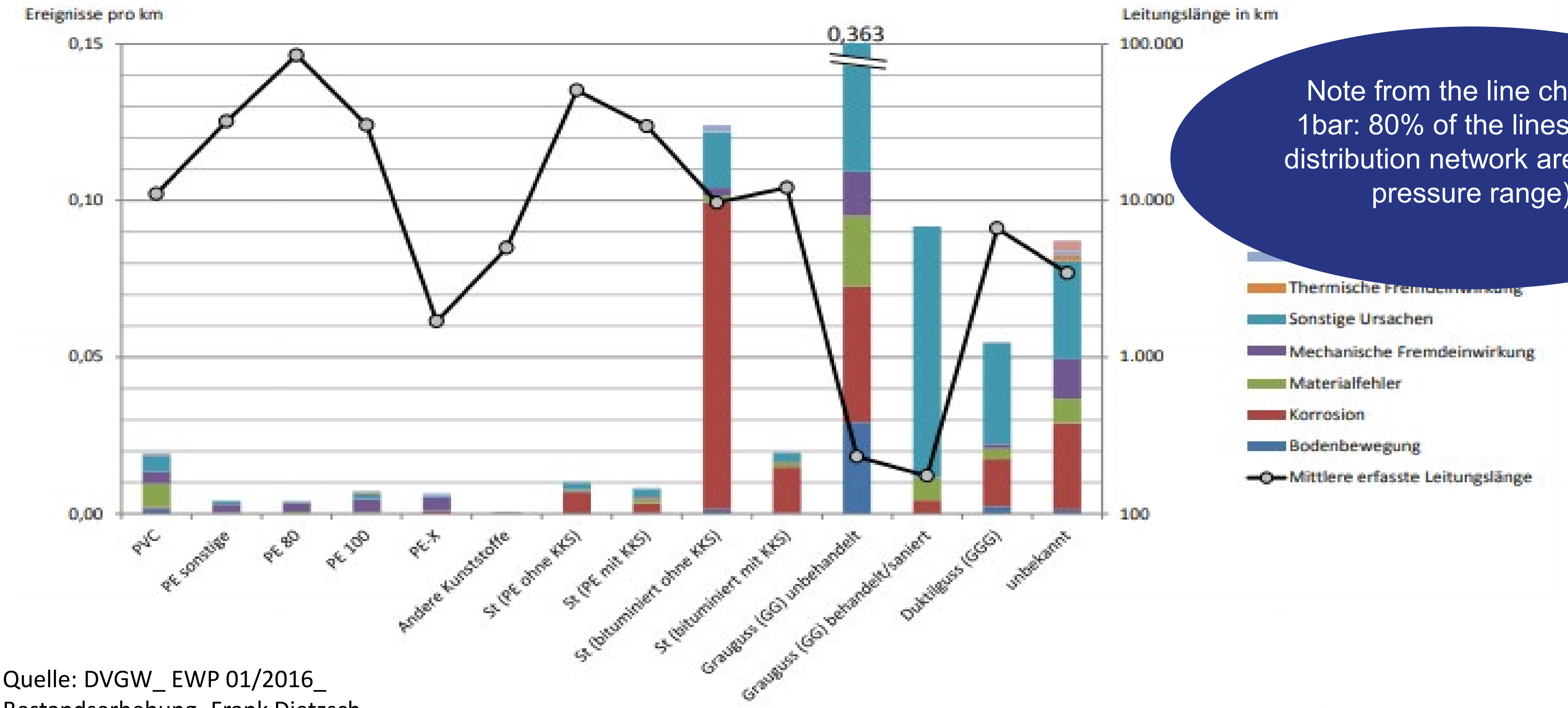
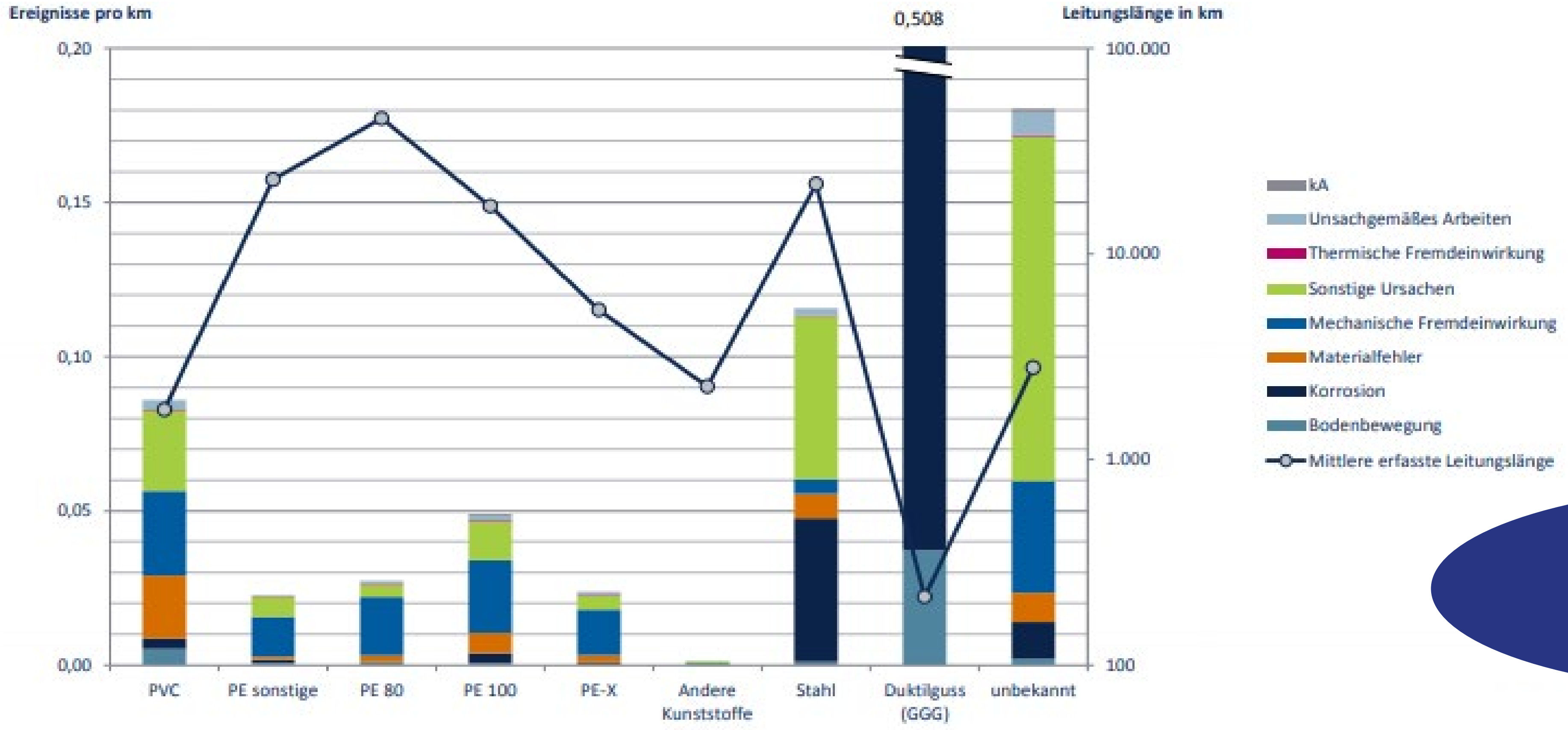
main lines (DSO) MOP ≤ 16 bar _events by material group and cause (2011 to 2014))



Note from the line check < 1bar: 80% of the lines in the distribution network are in this pressure range)

Quelle: DVGW_ EWP 01/2016_ Bestandserhebung, Frank Dietzsch

Events per km for service lines by material and cause (2011 to 2014)



Note on line verification < 1bar
PE every 6 years
Steel every 4 years

Quelle: DVGW_ EWP 01/2016_ Bestandserhebung, Frank Dietzsch

Results from the Cast Iron- Program in Germany

Substitution from 10.000 km Cast iron pipes in Germany.

New material: PE

Leak reduction

3.430 Leaks /year

(150l/h, Lifetime 0,5 years)

Leakage rate

Cast iron:

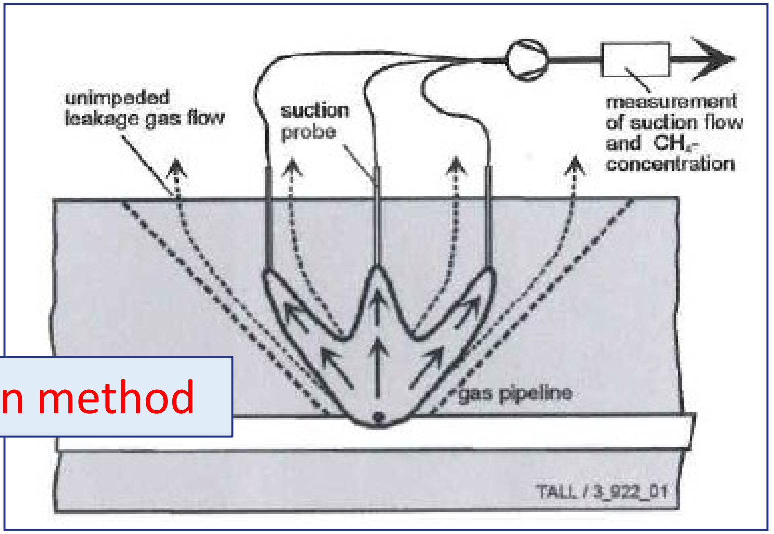
0,363 Leaks/ km a

PE:

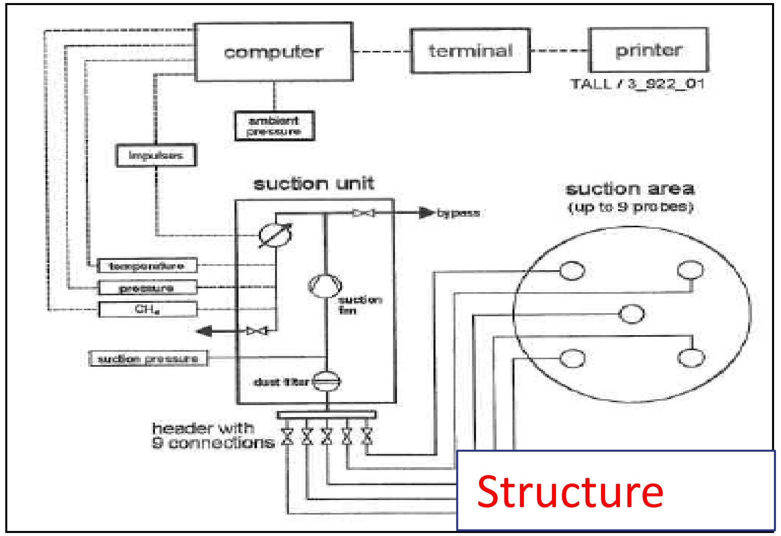
0,02 Leaks/ km a

Methan Reduction

2.253.510 m³/a Methane



Suction method



Structure

GERG Project: 'Methane test methods for buried pipes'

Project members:

Ruhrgas (PL)

GdF

Italgas

Natural Gas

and other

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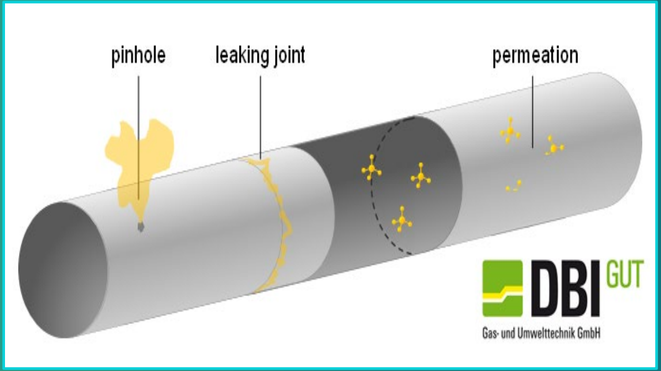
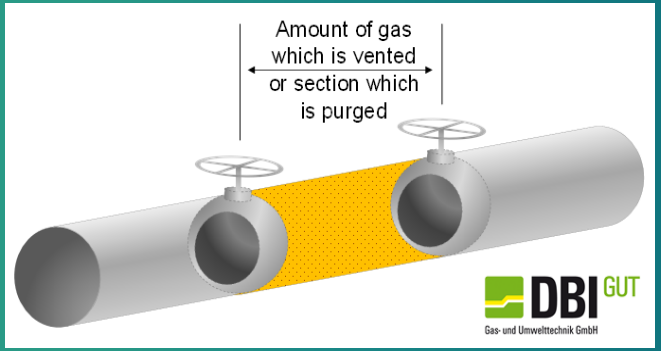
Methane emissions from gas grids (categorization)



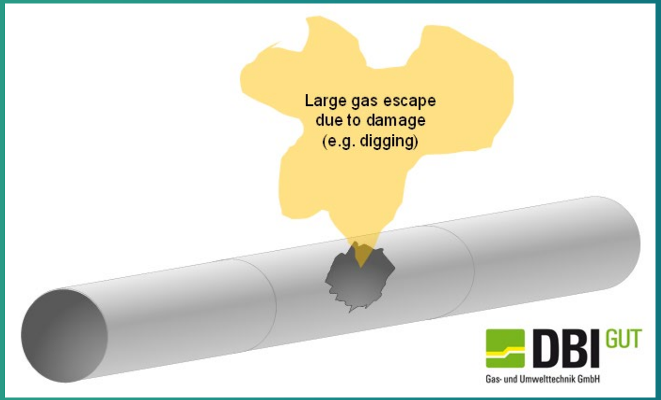
Fugitive methane losses in the gas infrastructure

These are emissions that occur during regular operation and typically have low leakage rates. However, due to its permanent presence, this category often represents the majority of emissions in a gas network, especially in the area of gas distribution. This category includes permeation in plastic pipes, leaks at weld seams and pinholes (e.g. as a result of corrosion, point load on the PE pipe).



Operational losses

This category includes all emissions that occur due to the planned intervention of the grid operator in the pipeline system. This includes the commissioning and decommissioning of pipeline sections as well as regular maintenance and repair work. Emissions are mainly caused by the necessary application of safety measures, such as the flushing of new pipelines or the emptying of sections to be repaired. These emissions are mainly due to pipe dimensions and pressure in the transport area.



Losses due to incidents

Incidents are to be understood as unplanned interventions in the gas network, typically due to the actions of third parties (e.g. excavator damage to pipelines) or accidents (e.g. pipeline rupture due to landslide, for example as a result of flooding). Due to the tendency of significant size of the leakages occurring here, considerable emissions can occur despite short periods of time until the affected pipeline sections are shut off and repaired. Fortunately, these events are statistically rather rare, so that the overall contribution to emissions remains manageable.

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Pipe inspection times in Germany < 16 bar

Number of localised leaks per km and inspection time	≤ 0,1	≤ 0,5	≤ 1
Operation pressure	inspection time in year		
≤ 1 bar	6 *	4	2
> 1 bar bis ≤ 5 bar	2	2	1
> 5 bis ≤ 16 bar	1 materialungebunden		

*) for plastic pipelines and actively protected steel pipelines.

Inspection periods of pipelines in years
within the built-up area according to G 465-1

Number of localised leaks per km and year	≤ 0,1	≤ 0,5	≤ 1
Operation pressure	Average leakage rate each year		
≤ 1 bar	< 0,016	< 0,125	< 0,50
> 1 bar bis ≤ 5 bar	< 0,05	< 0,250	< 1,0
> 5 bis ≤ 16 bar	mate en		

Average damage rate to pipelines in relation to the inspection periods according to G 465-1

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European calculation formula for the gas distribution sector in coordination

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$$E = 8{,}76 \times R \times N \times F \times (J + j) / 2$$

- **Repair period** (j)
- **control period (G 465-1)_ life time** (J)
- Methane share (F)
- **Leakage frequency** **(depending on material))** (N)
- **Leakage rate** **(DVGW project)** (R)
- Conversion factor (8,76)

Effects of a change in leakage life times on gas losses in the network

Art	Druck	Über-prüfungs-zeit-räume	Leck-stellen pro Jahr	Variante A	Gasverlust Mio. m³/a	Variante B	Gasverlust Mio. m³/a	Variante C	Gasverlust Mio. m³/a	Variante D	Gasverlust Mio. m³/a
Kunststoff **Gruppe** **< 0,1**		6	4.352	6 Jahre (Ü) 3 Jahre (MU) 0,5 Jahre (MR) 3,5 Jahre (VZ)	4,7	6 Jahre (Ü) 3 Jahre (MU) 0,5 Jahre (MR) 3,5 Jahre (VZ)	4,7	4 Jahre (Ü) 2 Jahre (MU) 0,5 Jahre (MR) 2,5 Jahre (VZ)	3,4	4 Jahre (Ü) 2 Jahre (MU) 0,5 Jahre (MR) 2,5 Jahre (VZ)	3,4
Stahl **Gruppe** **< 0,5**	< 1bar	4	25.750	4 Jahre (Ü) 2 Jahre (MU) 0,5 Jahre (MR) 2,5 Jahre (VZ)	19,7	2 Jahre (Ü) 1Jahr (MU) 0,5 Jahre (MR) 1,5 Jahre (VZ)	11,8	2 Jahre (Ü) 1 Jahr (MU) 0,5 Jahre (MR) 1,5 (VZ)	11,8	1 Jahre (Ü) 0,5 Jahr (MU) 0,5 Jahre (MR) 1,0 Jahre (VZ)	7,9
Reduktion um					24,4 0 %		16,5 33 %		15,2 38 %		11,3 54 %

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On the way: New Techologies and Control times

Introduction of increased state-oriented instan-agement

+

New Technologies for the inspection of pipelines

+

Opening of the path: Adjustment of the inspection and and repair times

Result:

Reduction of methane losses

New: Introduction of monitoring tools for early detection of large emitters (large leakage points)

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Summary

Our transformation path of the grid

Check

towards greater climate neutrality.

Activities to be continued in all sectors.