



The European Association of the
Electricity Transmission
and Distribution Equipment and Services
Industry

WG Gases in Switchgear/ Brussels 2018 June 12th

Topics handled by ZVEI

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Chairman WG SF6 in ZVEI

CONTENTS

- Meeting of ZVEI with UBA / BMUA and Ecofys on April 19th in Berlin.
- Meeting of ZVEI WG SF6 on May 23rd in Frankfurt.
- FNN collection of SF6 emission data in Germany recorded in 2016

OPINION OF UBA AND BMUA

- UBA acknowledges the German self-commitment dated 2005 as useful tool to reduce SF6 emissions.
 - However, it has limited value when a low emission level is already achieved. It should be updated with more challenging values.
- And, it should be raised to European level.
 - How to achieve this? T&D Europe could be the leader in such an attempt.
- A reasonable European regulation would give more entrepreneurial certainty (important for review 2020)
- UBA proposes a stronger collaboration with ZVEI

STATEMENTS TO ECOFYS STUDY

- For medium voltage, there are reasonable alternatives available.
 - ZVEI opposed because of missing load switches for secondary distribution (economically and technically)
- The monitoring of emissions in Germany in particular for “other” equipment should be improved.
 - ZVEI has already formed a TF for consideration, but cautions to have high expectations.
 - Reference substations for the definition of emission factors will be reviewed.
 - The identification of “high emission” substations will be considered.
- After the publication and evaluation of the study, another meeting between UBA and ZVEI is planned.
 - ZVEI will analyse the Ecofys study, provide a position on the statements and list obvious mistakes till end of October.

RESULTS FROM ZVEI MEETING

1. Work of WG 12 of CENELEC /CLC TC 216:

prEN 50676: “Electric apparatus used for detection and concentration measurement of refrigerant gases or SF6 - Performance requirements and test methods”

Recommendation of the WG SF6 to T&D Europe:

Promote that SF6 detection devices are removed from the scope and title of the Standard, since the SF6 detectors used in switchgear are specific for the gas compartment and of high safety relevance.

2. The ZVEI Guideline on SF6 is intended to be published end of June, but still needs review and improvement.

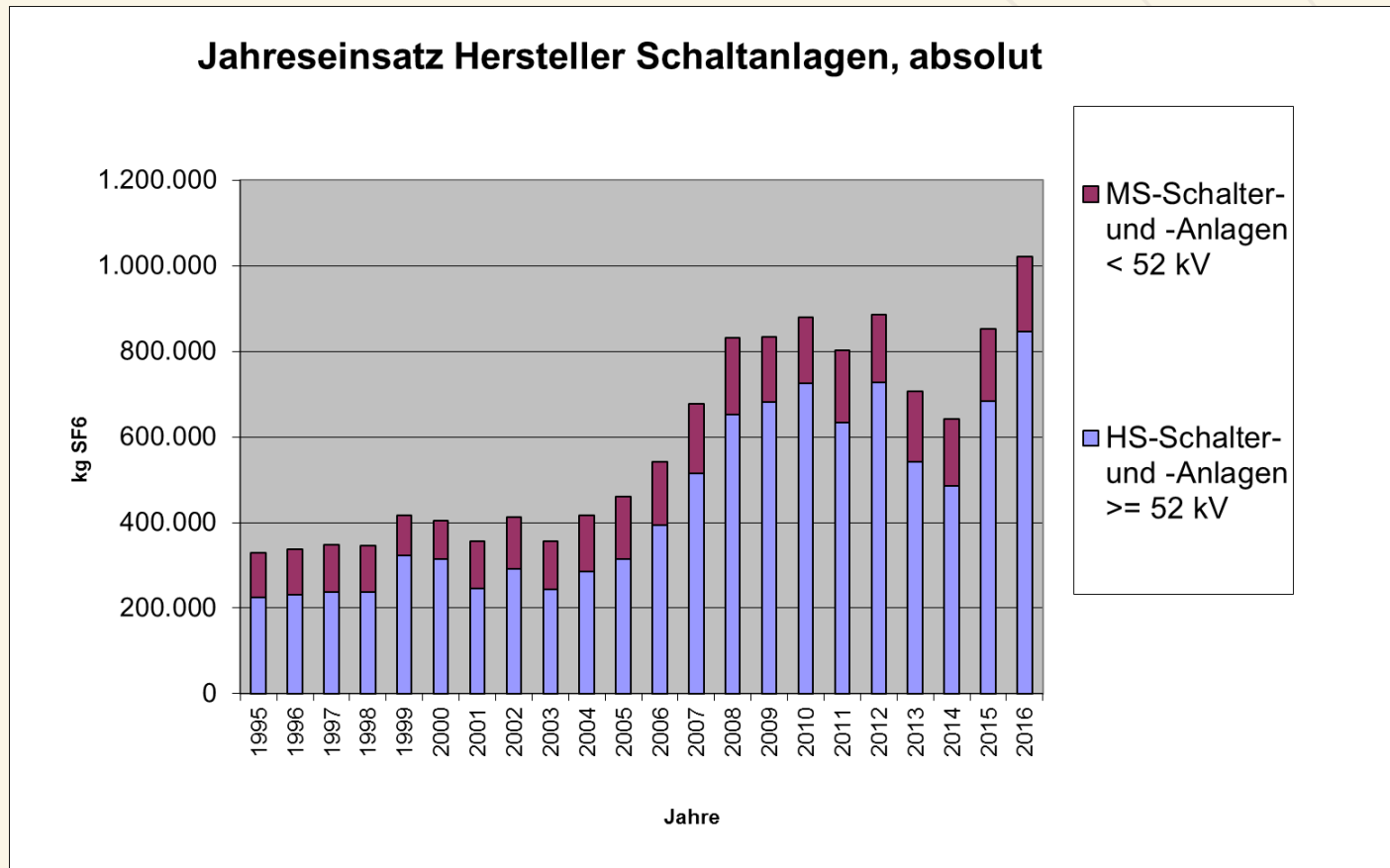
Title: “Advice on the use, transport and waste management of SF6 and SF6-filled equipment in the electric power supply”

3. A Task Force has been formed to evaluate SF6 emission factors for switchgear and other equipment

SELF-COMMITMENT 2005 ON SF6

ITEM 1 - MANUFACTURING OF SWITCHGEAR - REPORTED BY ZVEI

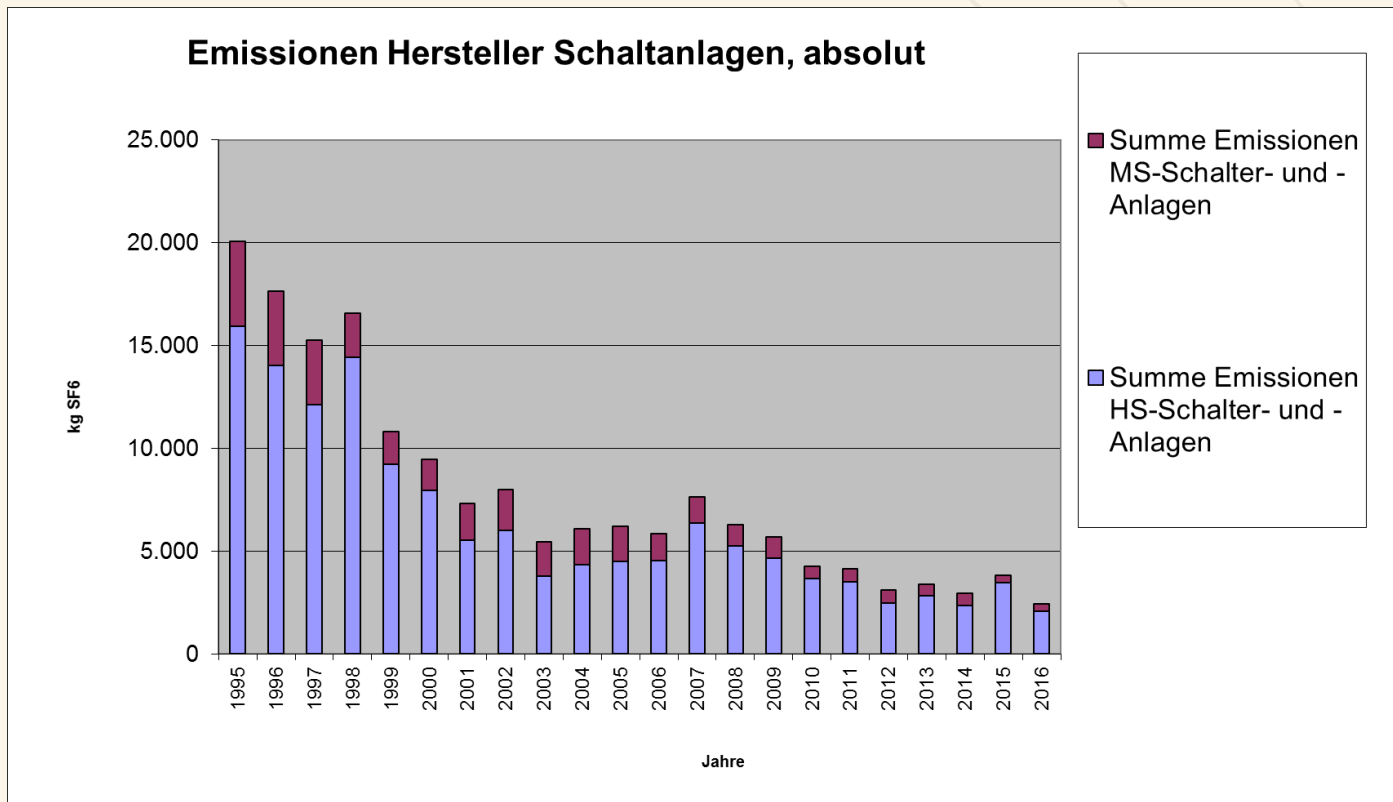
- Annual mass of SF6 used in the development, testing and production as well as during the erection and commissioning of electrical switchgear and amount of SF6 emitted during these stages.



SELF-COMMITMENT 2005 ON SF6

ITEM 1 - MANUFACTURING OF SWITCHGEAR - REPORTED BY ZVEI

- Annual mass of SF6 emitted during development, testing and production as well as during the erection and commissioning of electrical switchgear



Actual emission rates for development, testing and production of switchgear in 2016:

MS: 0,22 %

HS: 0,24 %

Set value acc to SC: < 1.5 % p.a.

Actual emission rates for mounting and commissioning of MV/HV switchgear in 2016: 0,04 %

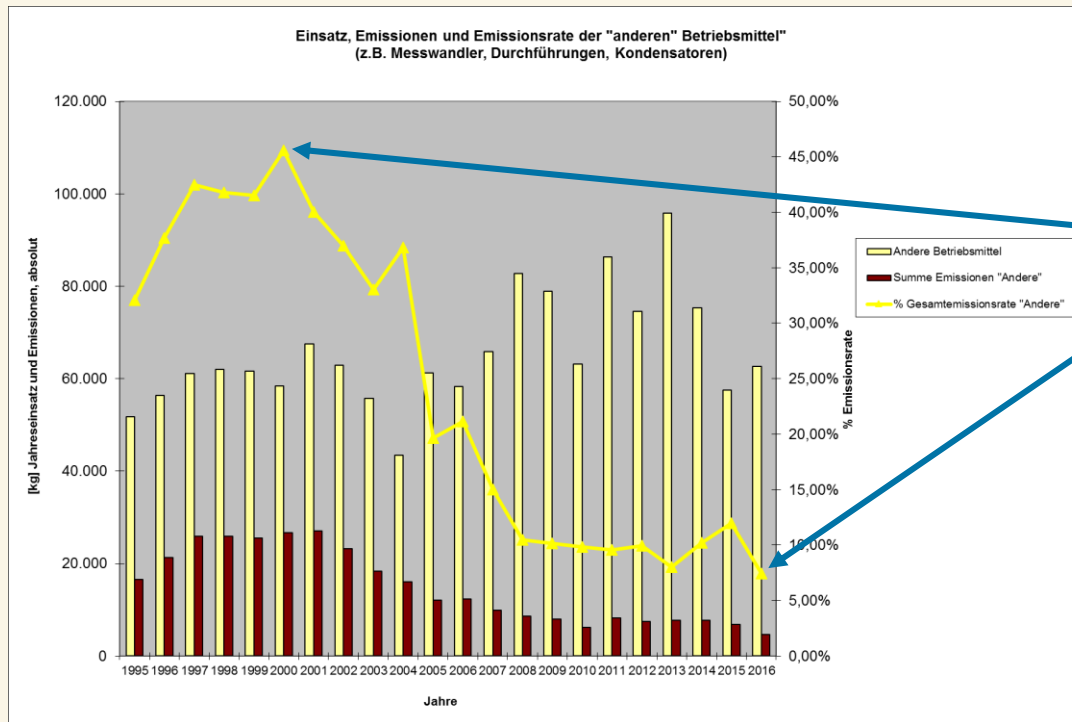
(MV/HV: 0,25 % in 2015

MV/HV: 0,03 % in 2014)

Set value acc to SC: < 0.1 % p.a.

SELF-COMMITMENT 2005 ON SF6

ITEM 1 - MANUFACTURER OF OTHER EQUIPMENT - REPORTED BY ZVEI



Used mass increased in 2016 compared to 2015

Emission rate was reduced from 45 % in 2000 to approx. 10 % in 2012.
In 2016, it is: 7,45 %.

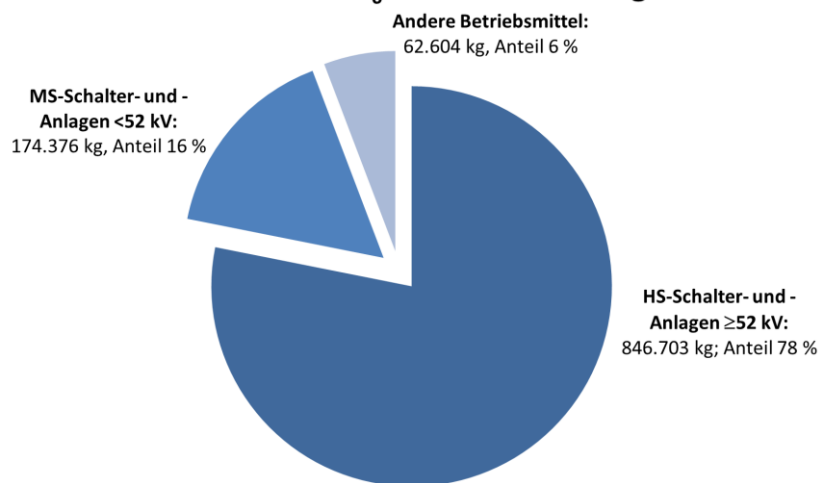
Emissions originate from production process and partly are counted as 100% of used mass, if no recovery is possible.

„other“ equipment devices are instrument transformers, bushings, capacitors etc.

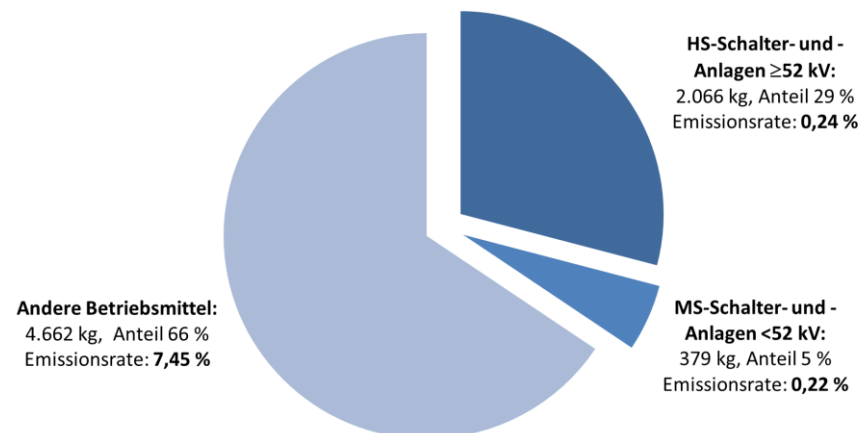
SELF-COMMITMENT 2005 ON SF₆

USED AMOUNT AND EMISSIONS DURING MANUFACTURING - SUMMARY

Jahreseinsatz SF₆ 2016: 1.083.683 kg



Jährliche Emissionen SF₆ 2016: 7.107 kg



SELF-COMMITMENT 2005 ON SF₆

ITEMS 2 AND 3 - OPERATION OF SWITCHGEAR - REPORTED BY FNN AND VIK

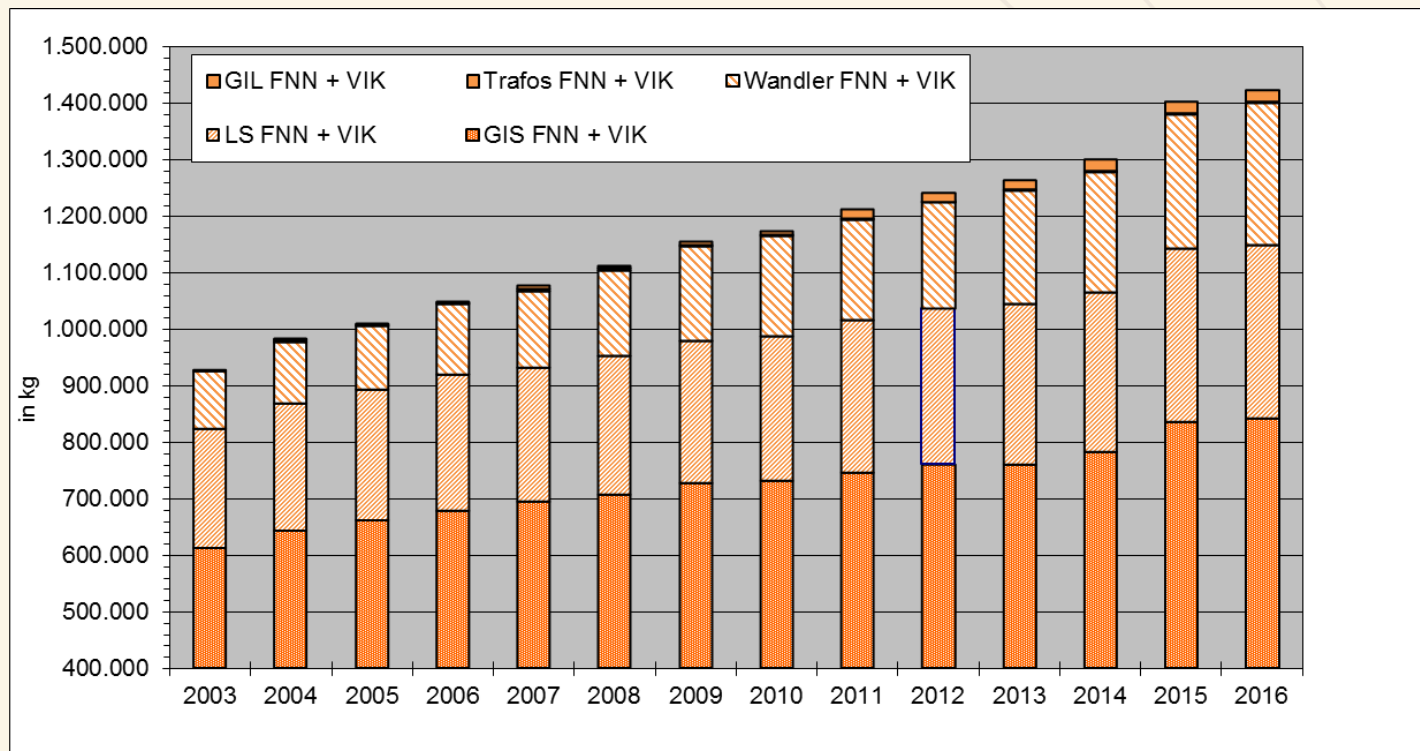
- Annual mass of SF₆ contained in installed electrical switchgear
- Annual mass of SF₆ emitted in operation including maintenance
- Data reporting only for substations and equipment with $U_n \geq 52$ kV
- Collection of data by FNN from 88 network operators.
- Collection of data by VIK from 34 participants (portion of VIK on total SF₆-installations in Germany only 4%)
- Emission factor method in accordance with study of Ökorecherche in 2007:
 - Emission factor HV-GIS: class A 0,15 % (1970 – 2005)
class B 3,5 % (1968 – 1987)
 - Emission factor conventional HV circuit breakers: 0,6 %
 - Emission factor instrument transformes: 0,3 %
 - Emission factor MV-GIS: 0.1 % p.a. acc to IEC applied on installed mass
- Last review of emission factors for HV-GIS was performed in 2013 with no change.

SELF-COMMITMENT 2005 ON SF6

ITEMS 2 AND 3 - OPERATION OF SWITCHGEAR - REPORTED BY FNN AND VIK

Portion of different types of HV equipment on total installed SF6 mass

From bottom to top: HV GIS – CB (outdoor) – Instr. Transf. – power Transf. - GIL



Growth of installed mass for HV in 2016 reported by operators:

HV-breakers and assemblies: + 5.7 t

De-commissioning of HV: - 11.0 t

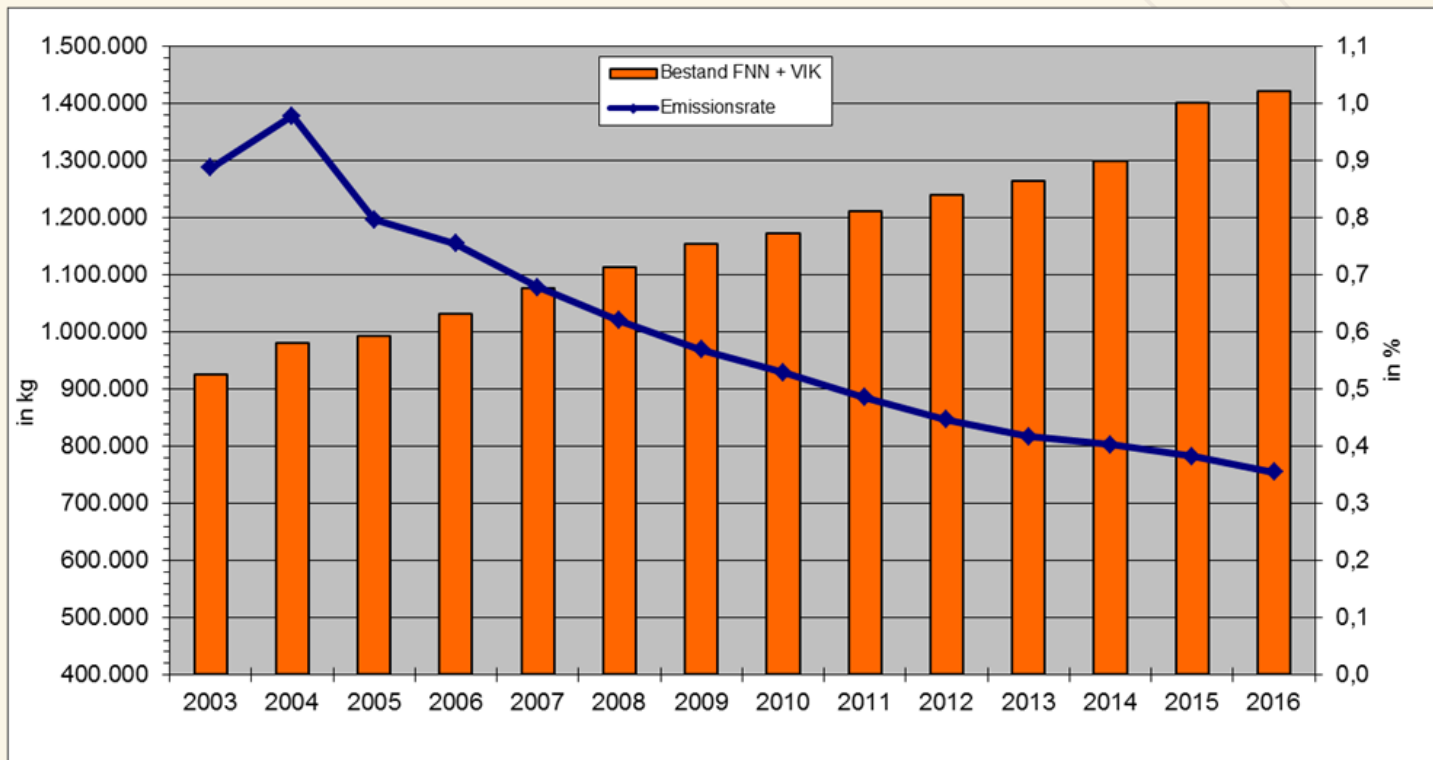
Supply of HV switchgear in 2016 to German operators

HV-breakers and assemblies: + 79.7 t

SELF-COMMITMENT 2005 ON SF6

ITEMS 2 AND 3 - OPERATION OF SWITCHGEAR - REPORTED BY FNN AND VIK

Total installed mass of HV equipment and total emission rate 2002 – 2016



ab 2003 mit VIK-Daten

SELF-COMMITMENT 2005 ON SF6

ITEM 4 - RECOVERED SF6-MASS

ITEMS 5 AND 6 - RE-USE AND DESTRUCTION OF SF6 - REPORTED BY SF6 PRODUCER

- Annual mass of SF6 recovered from equipment (by manufacturers, operators or 3rd parties) and returned to manufacturer of switchgear or SF6 producer.
 - SF6 recovered and filled again on site is not accounted.
- Annual mass of SF6 in the re-use cycle and mass of emitted SF6 (by SF6 producer)
- Annual mass of SF6 destructed by SF6-producer and mass of emitted SF6

Returned by operator in 2016 : 7.813 t

Returned by manufacturers: 15.429 t

De-commissioned in 2016: 12.082 t

Returned by manufacturers or opertors in 2016: 23.242 t

Emissions during the Re-Use cycle in 2016: 0.115 t

Emissions during destruction of SF6 in 2016: 0.021 t

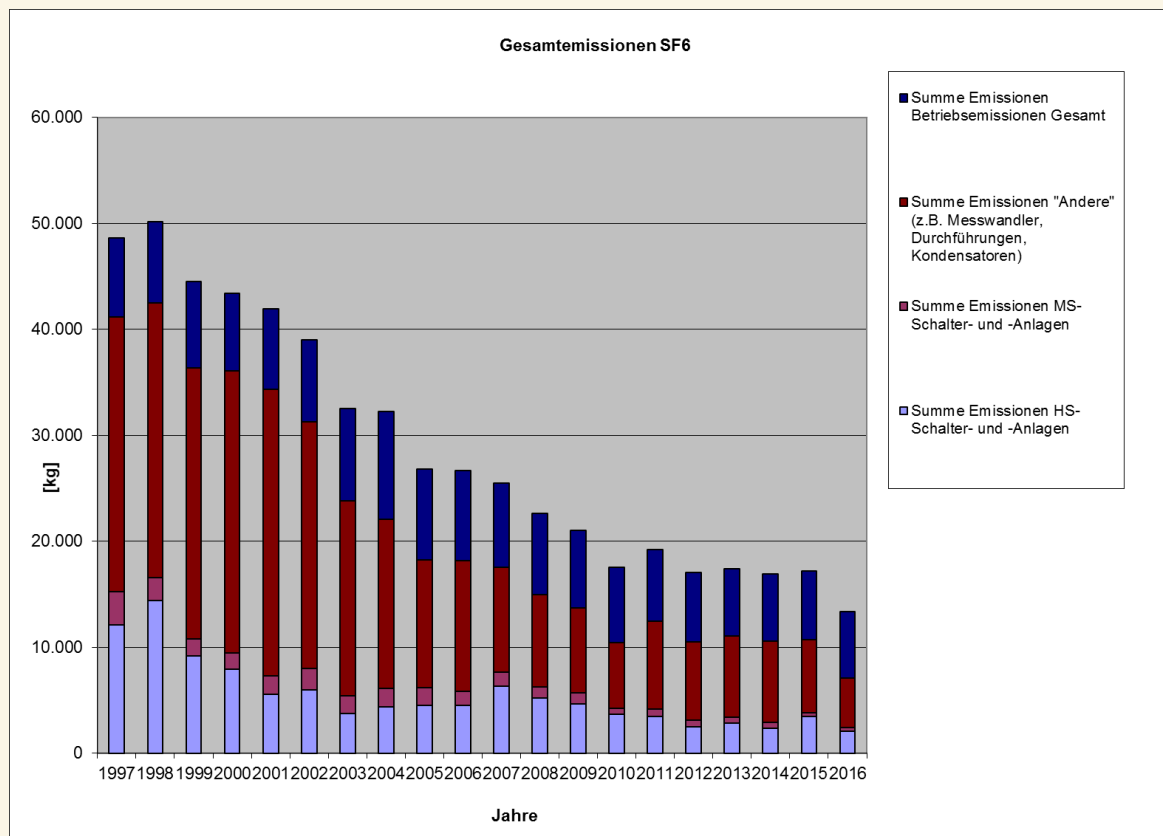
Emission rate during Re-Use 0,5 % (Set value < 0,3 %)

Emission rate during destruction 0,09 % (Set value < 0,5 %)

SELF-COMMITMENT 2005 ON SF₆

SUMMARY OF REPORTING

- Total emissions of SF₆ from electrical equipment (Set value is < 17 t p.a. in 2020)
- From bottom to top:
Manufacturing HV-GIS /CB – MV-GIS – other equipment - Operation in total



Actual emission value in 2016 for switchgear:

9 t SF₆
(10,6 t SF₆ in 2015
9,5 t SF₆ in 2014)

Actual emission value in 2016 in total:

13,7 t SF₆
(17,5 t SF₆ in 2015
17,1 t SF₆ in 2014)