

German Environment Agency

Relevance of the F-gas regulation for the European energy system

The necessity for a phase-down of sulfur hexafluoride (SF₆)

Sven Baumann

Division III1.4 / Substance-related Product Issues

The necessity for a phase-down of SF₆

Outline

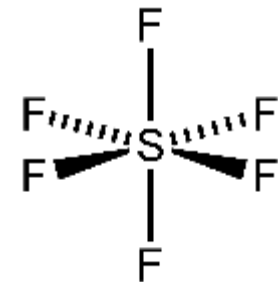
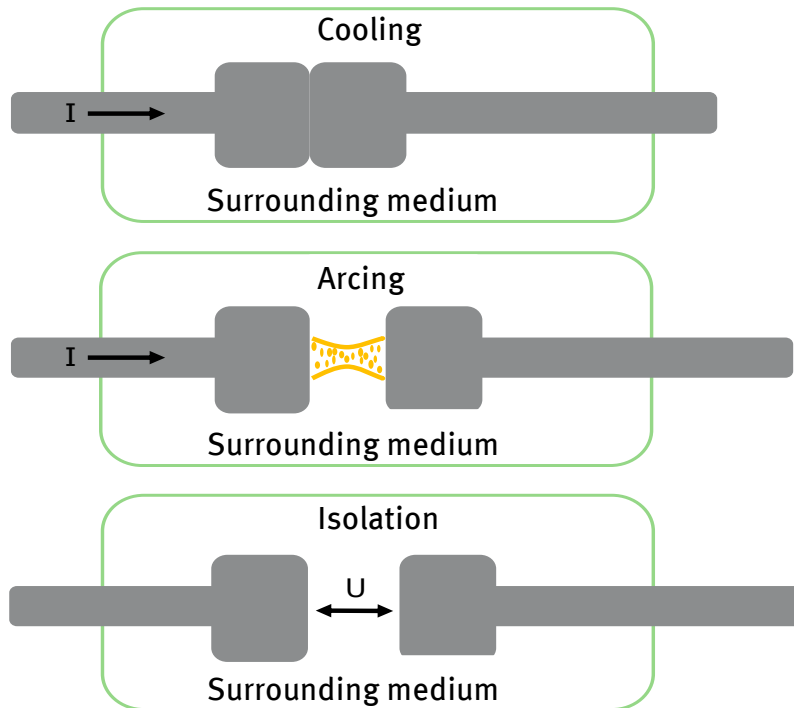
- 1 SF₆ – INDUSTRIAL APPLICATIONS
- 2 SF₆ – ENVIRONMENTAL ASPECTS
- 3 REGULATION (EU) 517/2014
- 4 EMISSIONS OF SF₆
- 5 SUMMARY

Central importance of SF₆ as electric insulator

SF₆ AS GASEOUS ISOLATOR

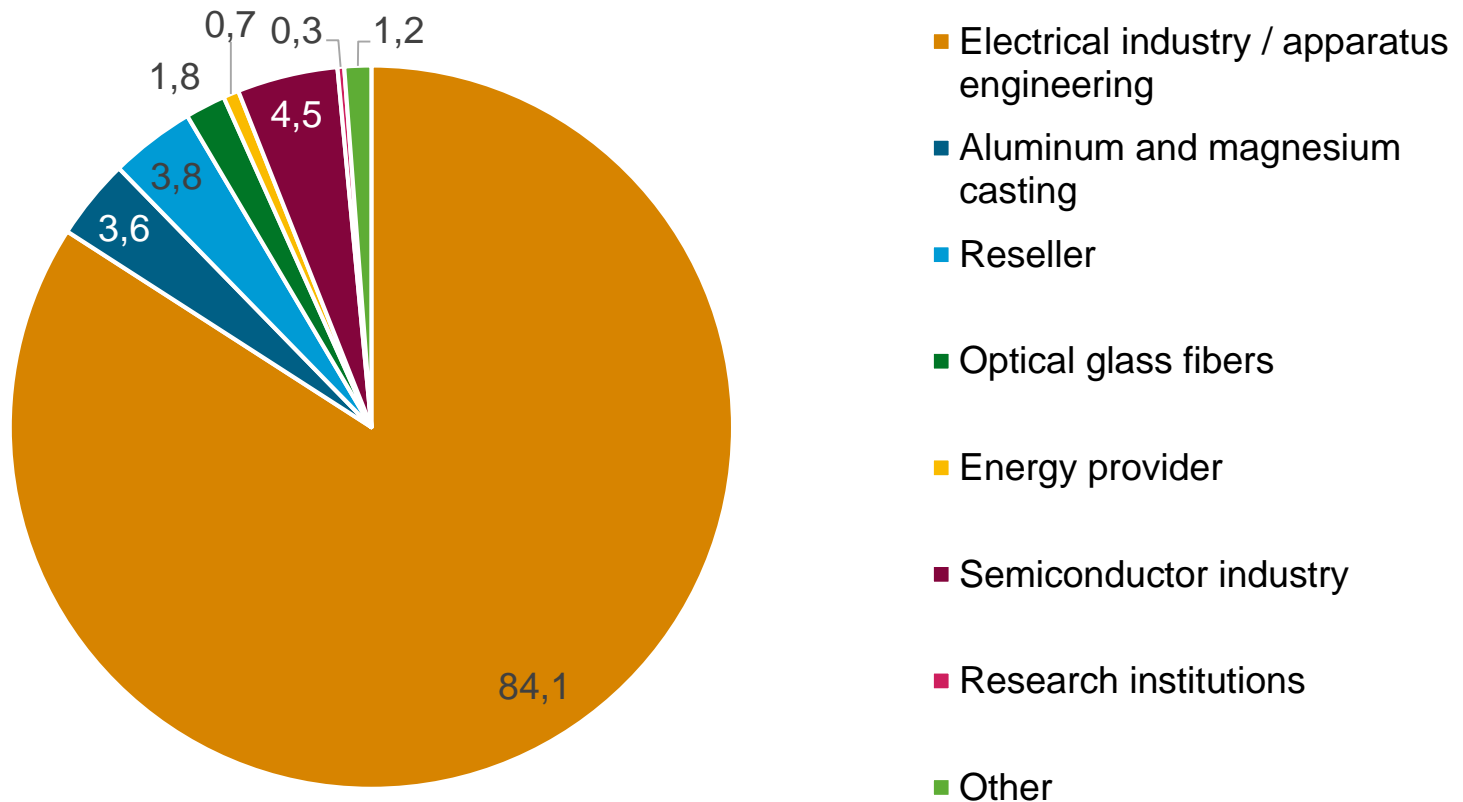
Used in various branches of electrical engineering and therefore well suited e.g. as circuit breakers, in switchgear or gas insulated lines (GIL).

- Chemically inert
- Non-flammable
- Non-toxic
- Gaseous at temp. > -64° C
- Low thermal conductivity
- Good sound absorption
- High ability of electrical isolation



Highest demand of SF₆ in electrical industry

Demand sectors of SF₆ in Germany according to the field of application in 2016 (%)



Source: Destatis 2017

SF₆ is the most potent greenhouse gas on earth

DUE TO ITS CHEMICAL PROPERTIES SF₆ IS A CROSS-GENERATIONAL ENVIRONMENTAL BURDEN

- Largest reported GWP₁₀₀ for a chemical substance
- Highly persistent in the troposphere and stratosphere

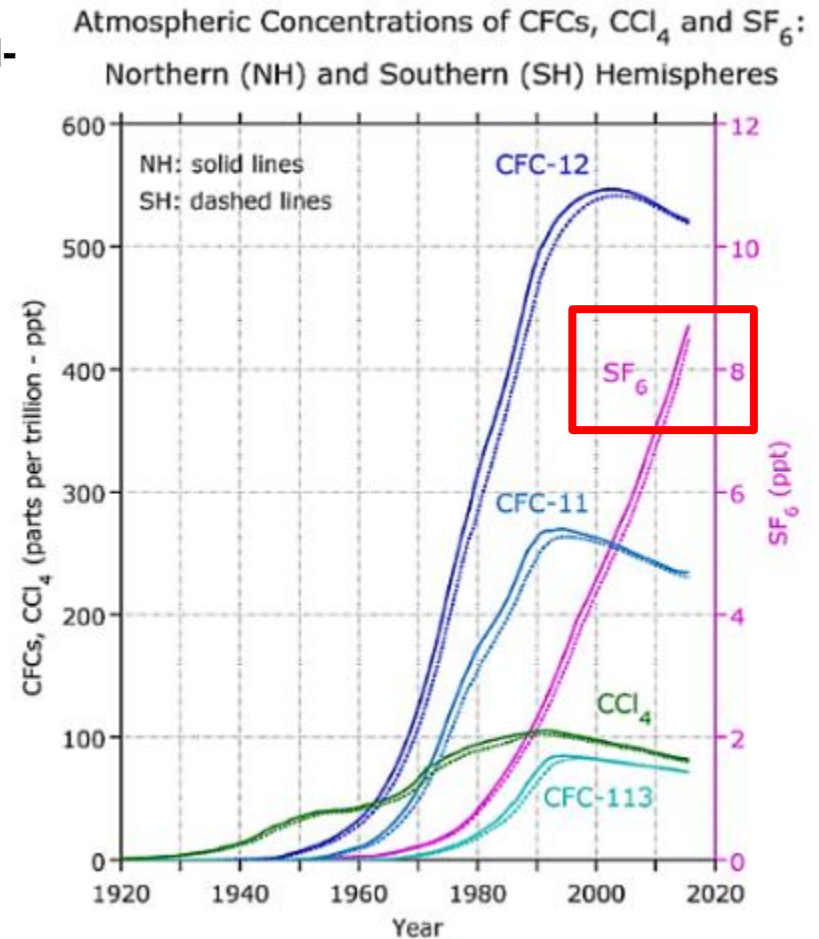
Substance	Global warming potential (GWP; 100 years)	Atmospheric lifetime (years)
SF ₆	22.800	3.200
CFC-11	4.750	45
CFC-12	10.900	100
HFC-134a	1.430	14

Source: IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment. Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

Emission of SF₆ is a global problem

CATEGORIZATION OF SF₆ AS ONE OF SIX GREENHOUSE GASES IN KYOTO PROTOCOL (1997)

Mean mid-year tropospheric CFC-11, CFC-12, CFC-113, carbon tetrachloride (CCl₄), sulfur hexafluoride (SF₆) concentrations in the northern (NH) and southern (SH) hemispheres for the period 1920 to 2015.



Source: Bullister, J.L. 2015. Atmospheric Histories (1765-2015) for CFC-11, CFC-12, CFC-113, CCl₄, SF₆ and N₂O. NDP-095(2015).

http://cdiac.ornl.gov/ftp/oceans/CFC_ATM_Hist/CFC_ATM_Hist_2015. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, Tennessee. doi: 10.3334/CDIAC/otg.CFC_ATM_Hist_2015

Regulation (EU) 517/2014

ARTICLE 21

(4) No later than **1 July 2020**, the Commission shall publish a report assessing whether cost-effective technically feasible energy-efficient and reliable **alternatives exist**, which make the replacement of fluorinated greenhouse gases possible, **in new medium-voltage secondary switchgear...**

Source: Regulation (EU) 517/2014 of the European Parliament and the Council

POSITION OF THE ELECTRICAL INDUSTRY

- „For specific applications SF₆-free technologies already exist.“
- „Ecological balance of SF₆ is critical..., however the percentage of total emissions is small.
- „Industrial sector tends towards a continuous emission reduction of SF₆ and the development of alternative solutions.“

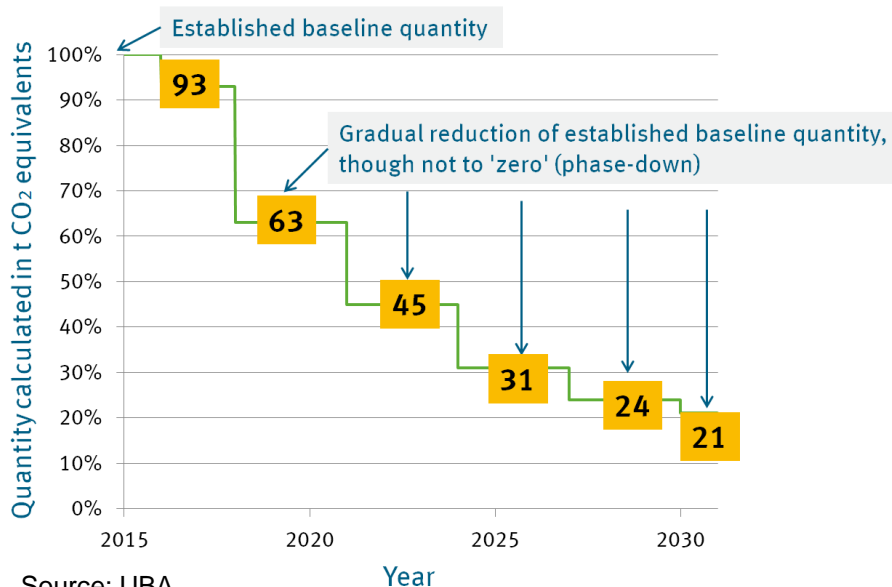
Source: Ecofys Progress Report: “Concept for SF₆-free transmission and distribution of electricity”

The necessity for a phase-down of SF₆

Position and mission of the German Environment Agency

INTENSIVE EFFORTS FOR THE REDUCTION AND REPLACEMENT OF OZONE DEPLETING AND GREENHOUSE GASES

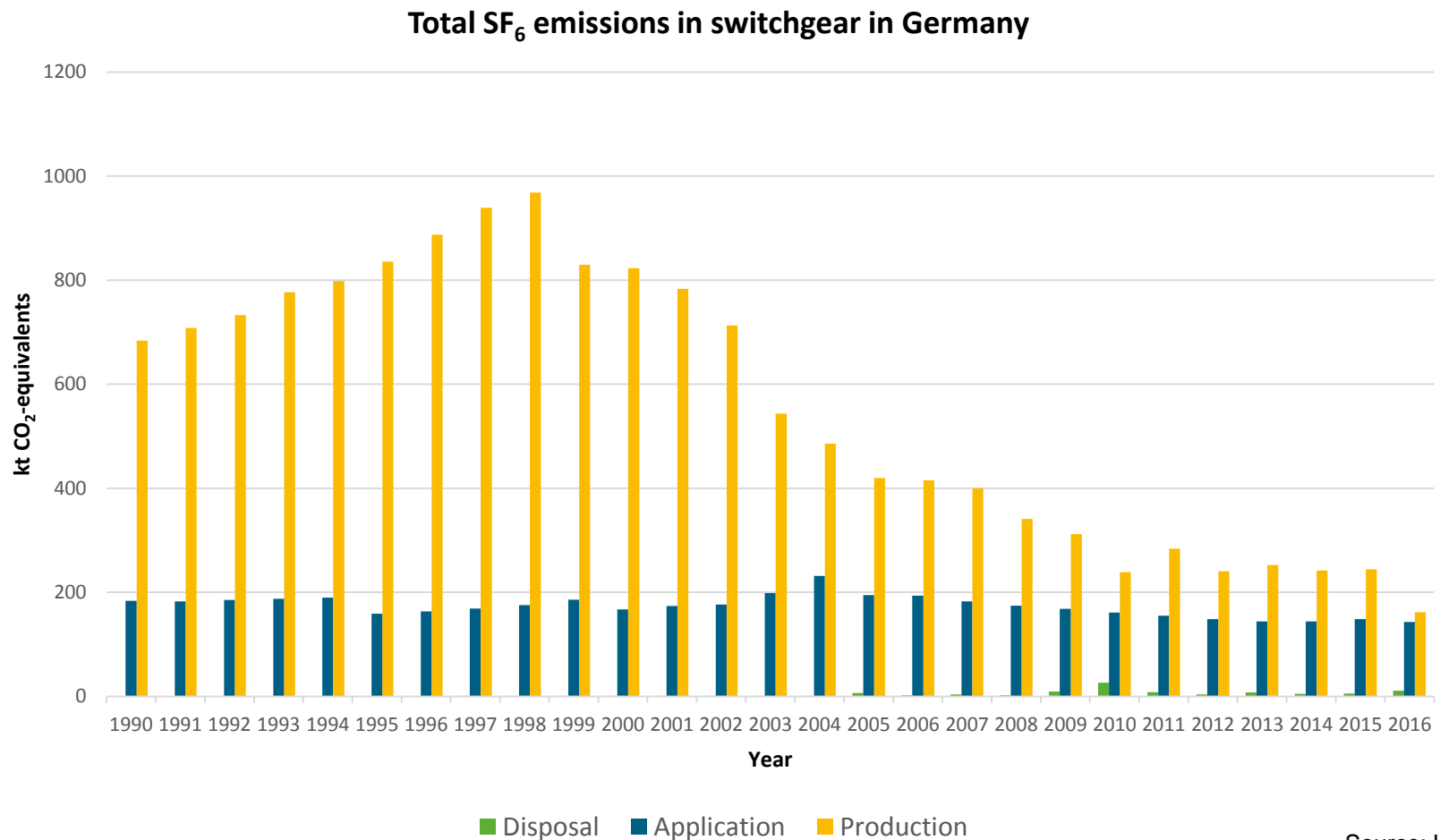
- The Montreal Protocol bans CFCs and halons and is the key factor for a recovery of the ozone layer
- The Regulation (EU) 517/2014 and Kigali amendment regulate future phase-down of HFCs
- First steps for the reduction of SF₆-based technologies are already done
- Still intensive need for SF₆-free alternatives and further investigation



Source: www.unep.org

SF₆ emissions from electrical equipment in Germany

VOLUNTARY COMMITMENT FOR THE REDUCTION OF SF₆ AND OBLIGATION TO REPORT IN GERMANY SINCE 1997



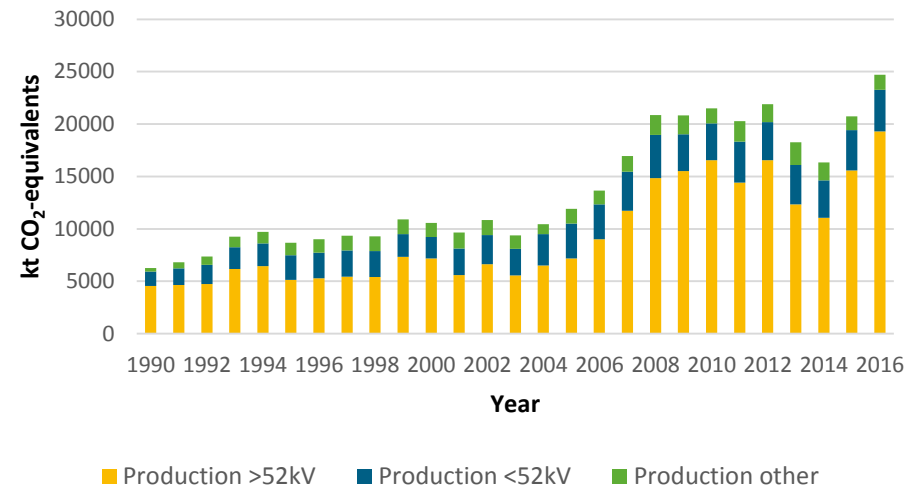
Source: UBA

The necessity for a phase-down of SF₆

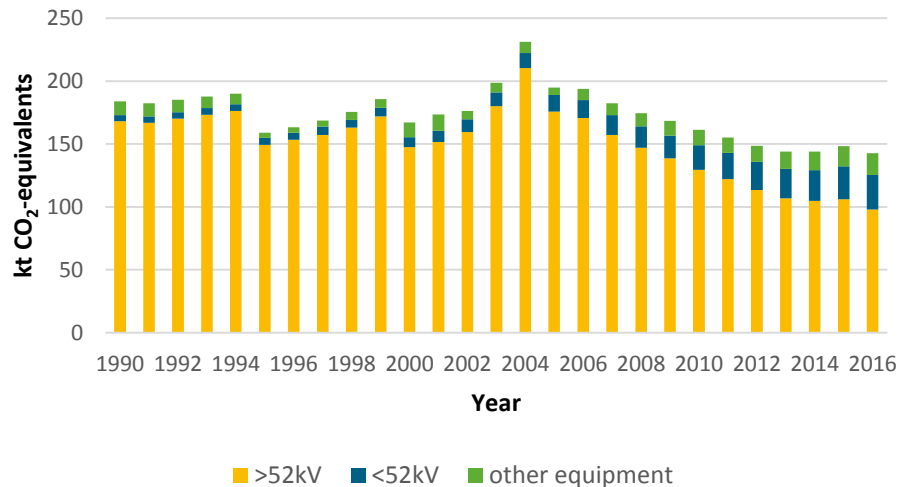
SF₆ emissions from electrical equipment in Germany

INCREASING DEMAND FOR SF₆ IN
ELECTRIC INDUSTRY

Produced amounts of SF₆ in Germany



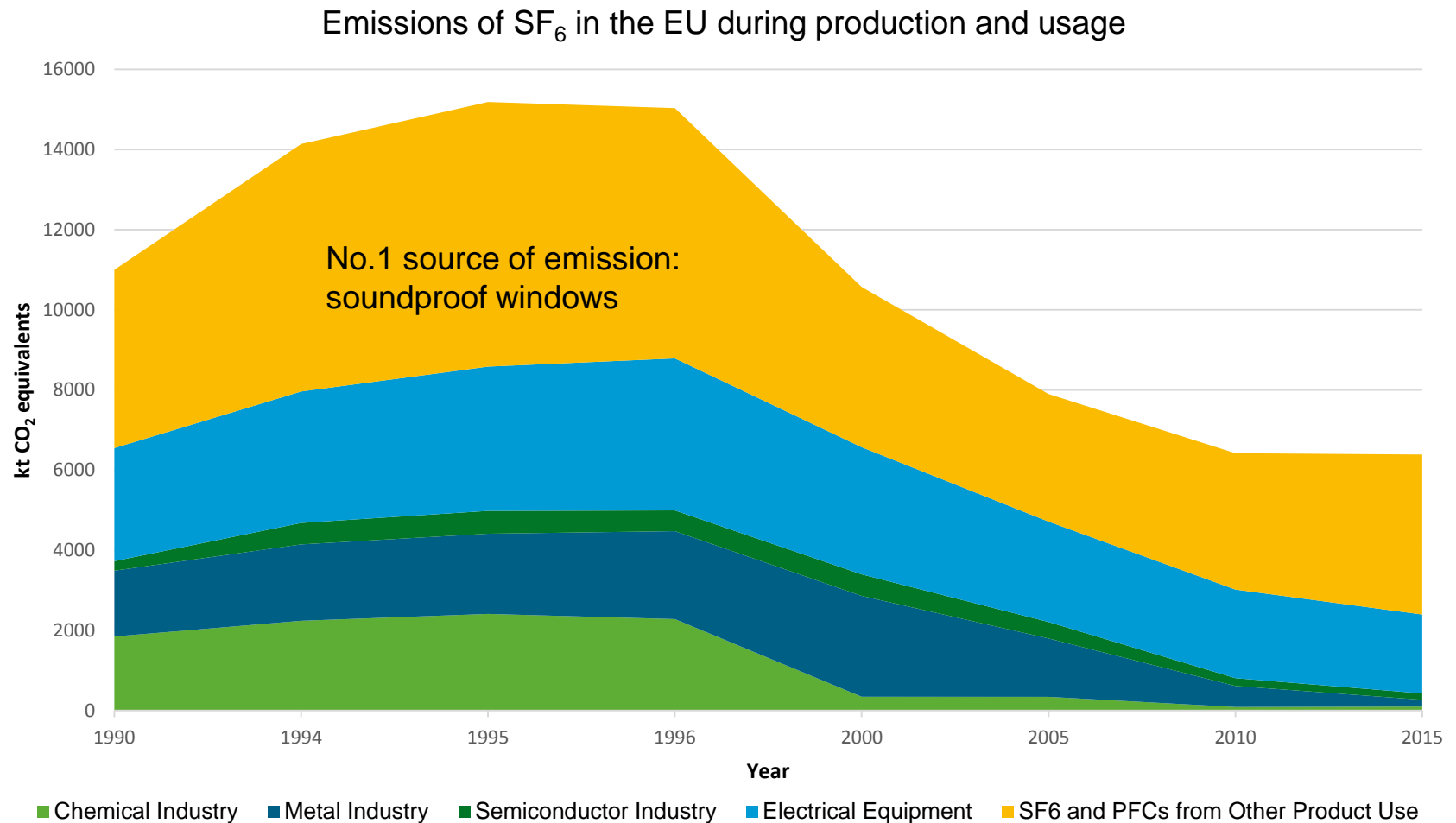
Application emissions of SF₆ in Germany



Source: UBA

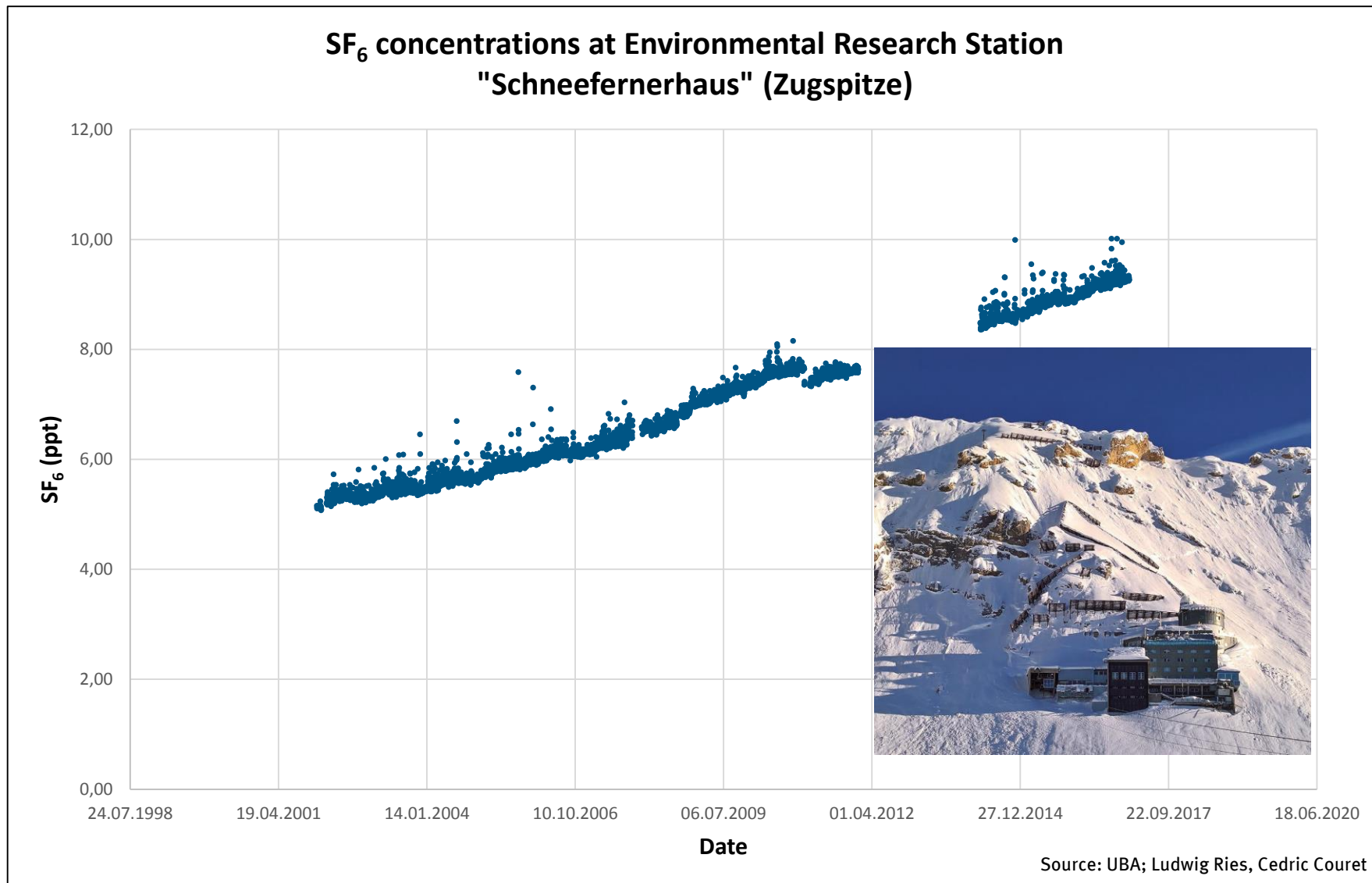
Intersectional SF₆ emissions in the EU

SOURCES FOR SF₆ EMISSIONS IN OTHER SECTORS OF INDUSTRY




Source: http://unfccc.int/ghg_data/new_reporting_requirements/items/9560.php

Strategies and tasks of the German Environmental Agency



Strategies and tasks of the German Environmental Agency



The UBA
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Data

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Switchgear

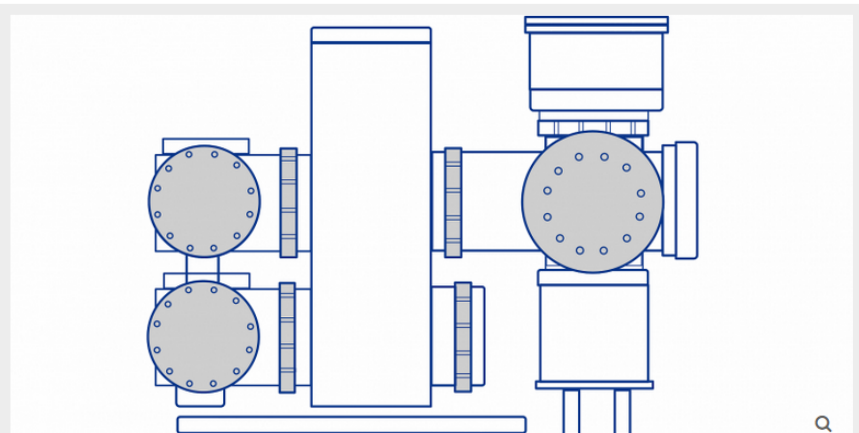


Illustration of a typical gas-insulated switchgear
Source: Ecotys

Sulphur hexafluoride (SF₆), which has a very high global warming potential, is used for insulation and arc interruption in switchgear. SF₆ emissions have been successfully reduced thanks to a voluntary industry commitment. Alternative products to substitute SF₆ in various applications are developed.

17.07.2017 ★ 322 times rated as helpful

Links

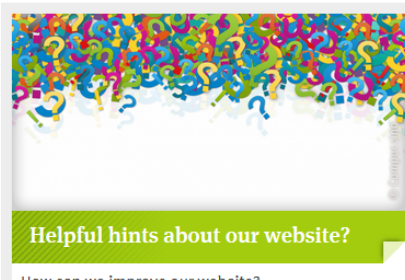
- voluntary agreement for switchboards (PDF, in German)
- UBA web page: EU Regulation on fluorinated greenhouse gases

Table of Contents

- Study on possible alternatives to SF₆
- Publication of progress report

Topics

- Economics | Consumption
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 - Eco-friendly transport refrigeration
- Switchgear

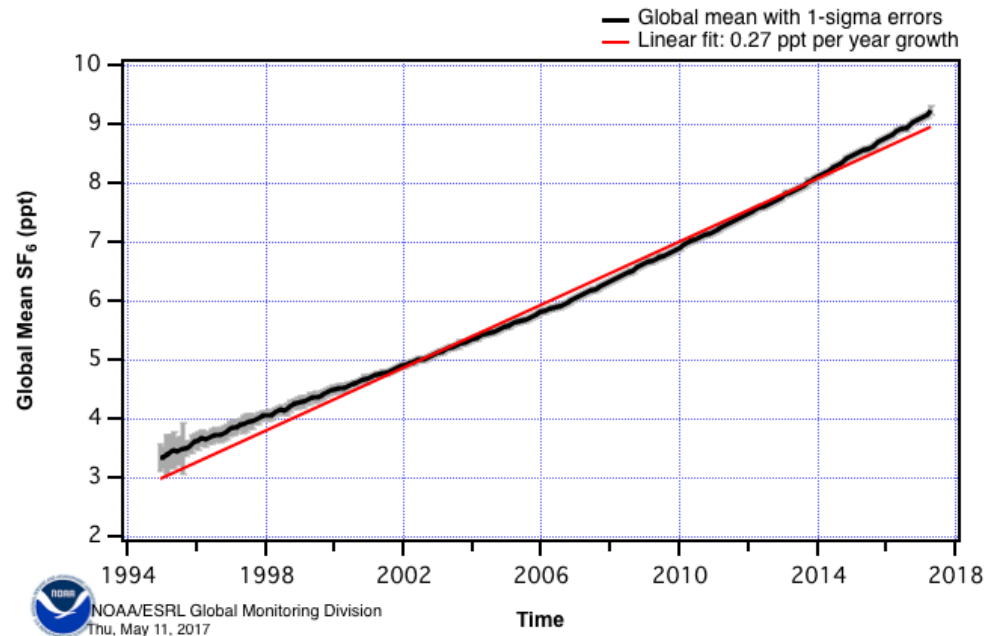


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How can we improve our website?

Summary

- Due to its technical benefits SF₆ is still of importance in electrical engineering.
- SF₆ possesses the largest reported GWP₁₀₀ for a chemical substance on earth.
- It is highly persistent in the troposphere and stratosphere and has a cross-generational environmental impact.
- This implies the necessity for a continuous development of alternatives to SF₆-based technologies.
- A consistent framework of requirements and regulations provides reliability. Together with efforts from manufacturers, researchers and users of switchgear smart and efficient solutions are feasible and the establishment of a sustainable transmission and distribution of electricity is possible.



Source: US Department of Commerce; National Oceanic & Atmospheric Administration; Earth System Research Laboratory; Global Monitoring Division

Thank you for your attention

Sven Baumann

Sven.Baumann@uba.de

Division III1.4 / Substance-related Product Issues

<https://www.umweltbundesamt.de/en/topics/economics-consumption/products/fluorinated-greenhouse-gases-fully-halogenated-cfcs/application-domains-emission-reduction/switchgear>

