

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

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

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Division III1.4 / Substance-related Product Issues

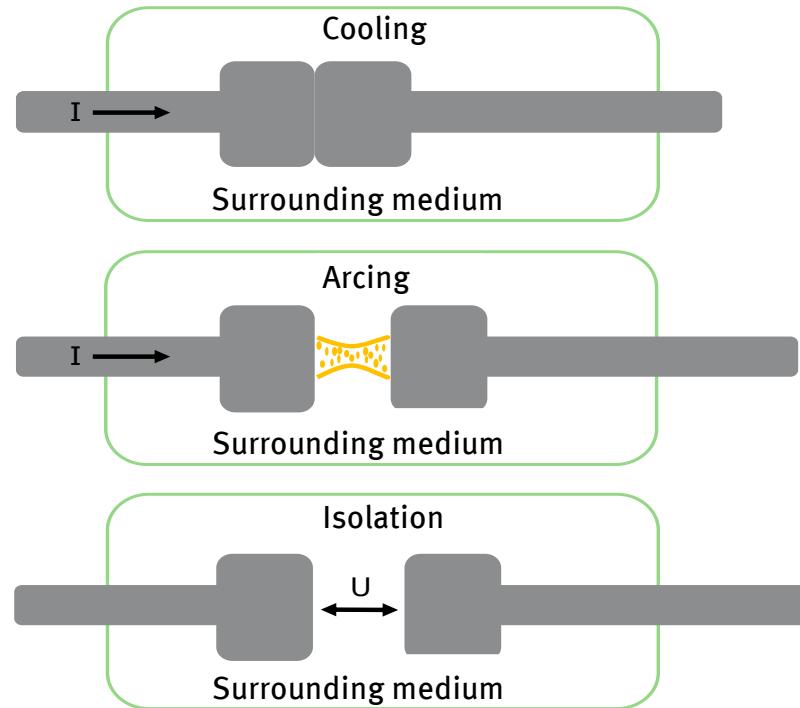
Outline

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

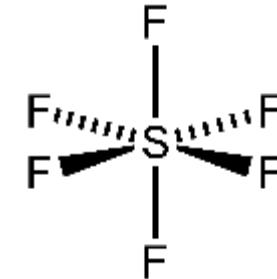
Central importance of SF₆ as electric insulator

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).

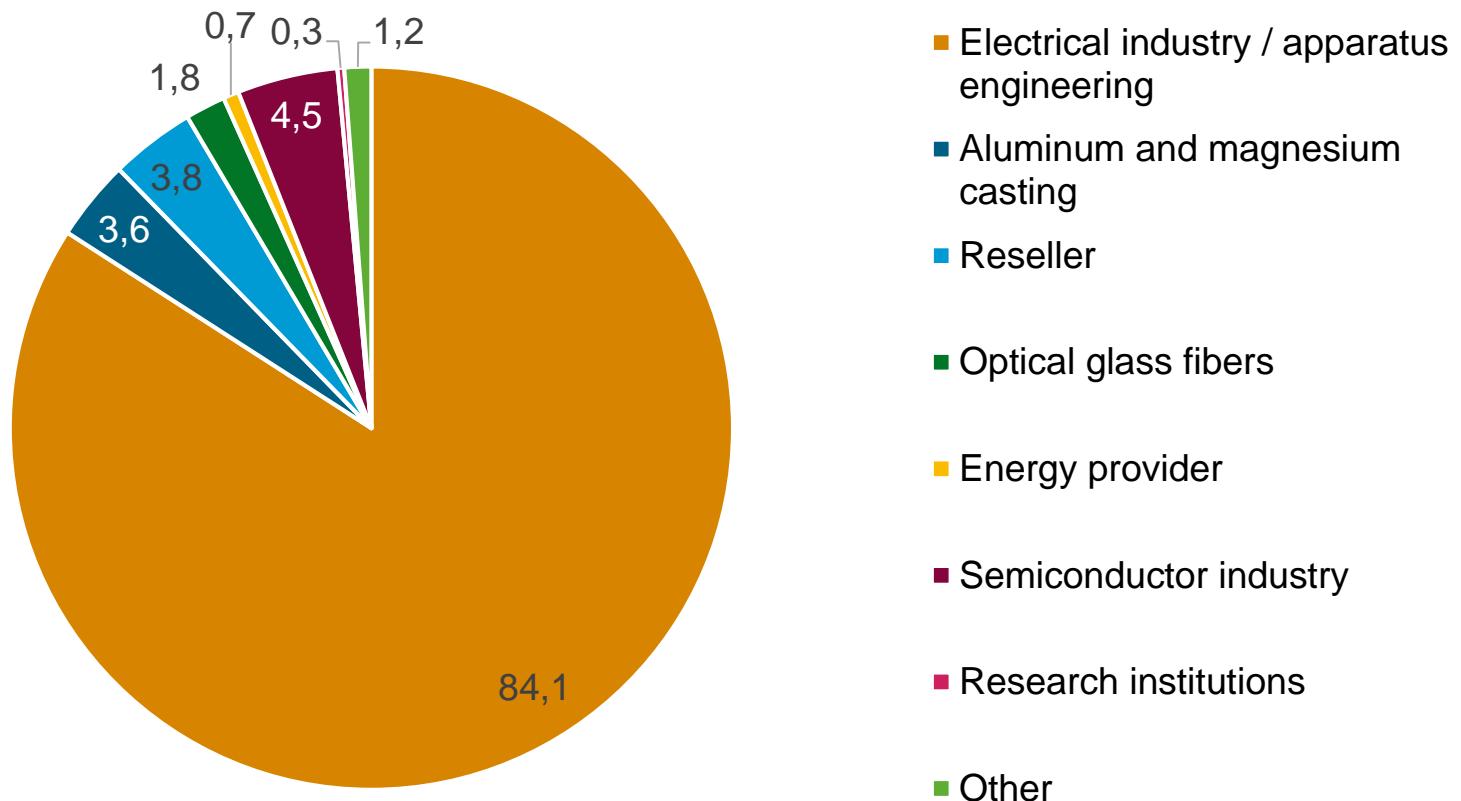


- Chemically inert
- Non-flammable
- Non-toxic
- Gaseous at temp. $> -64^\circ \text{ C}$
- Low thermal conductivity
- Good sound absorption
- High ability of electrical isolation



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

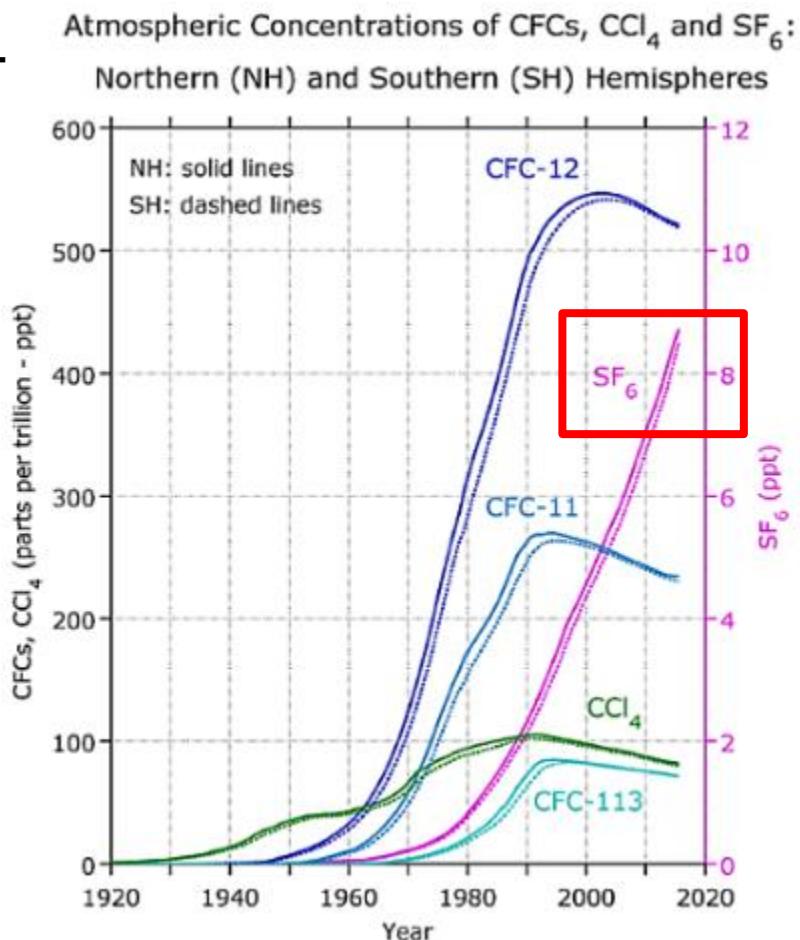
Substance	Global warming potential (GWP; 100 years)	Atmospheric lifetime (years)
SF ₆	22.800	3.200
CFC-11	4.750	45
CFC-12	10.900	100
HFC-134a	1.430	14

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 GREEN-HOUSE 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”

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: UBA

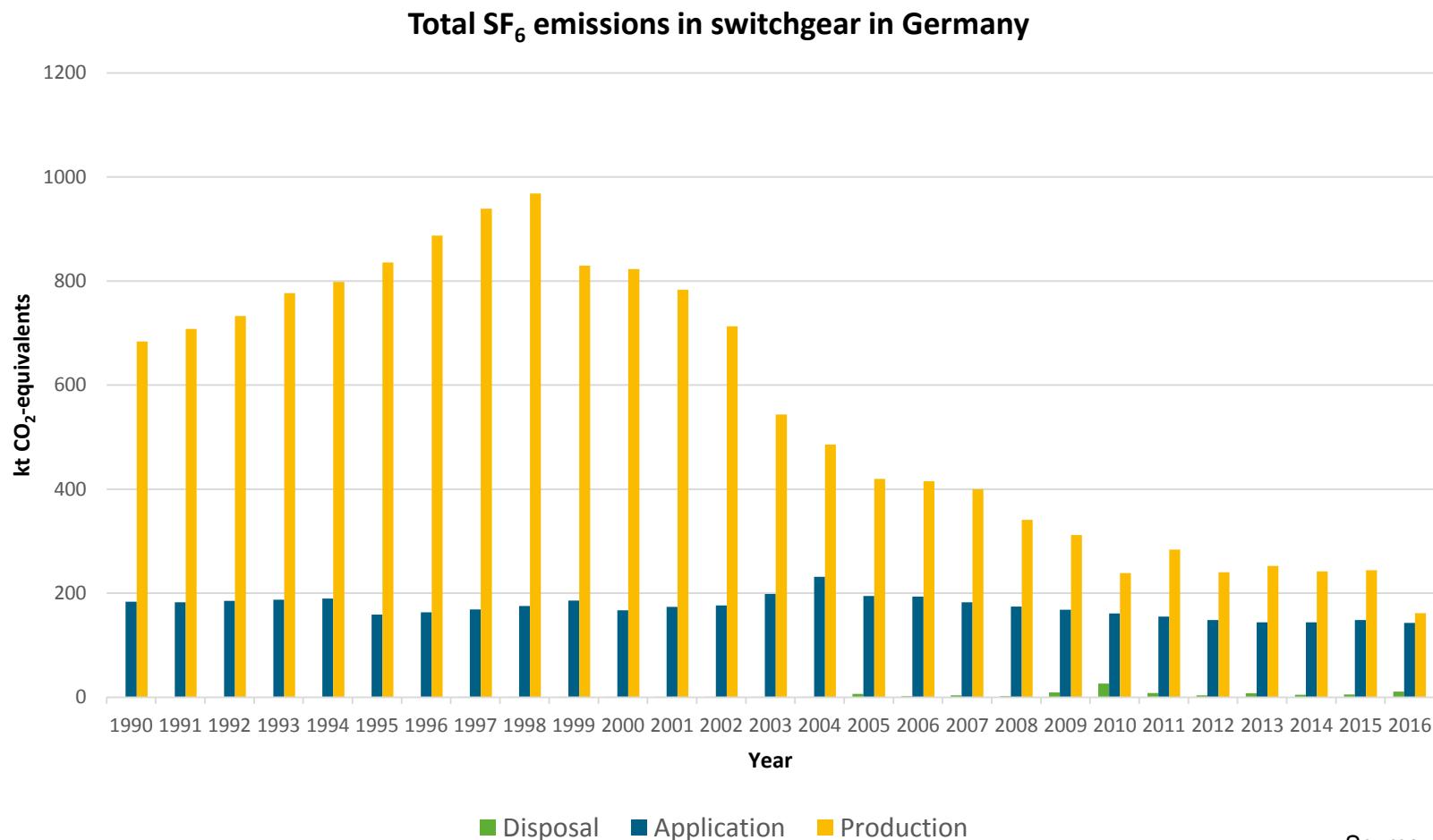


Source: www.unep.org

The necessity for a phase-down of SF₆

SF₆ emissions from electrical equipment in Germany

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

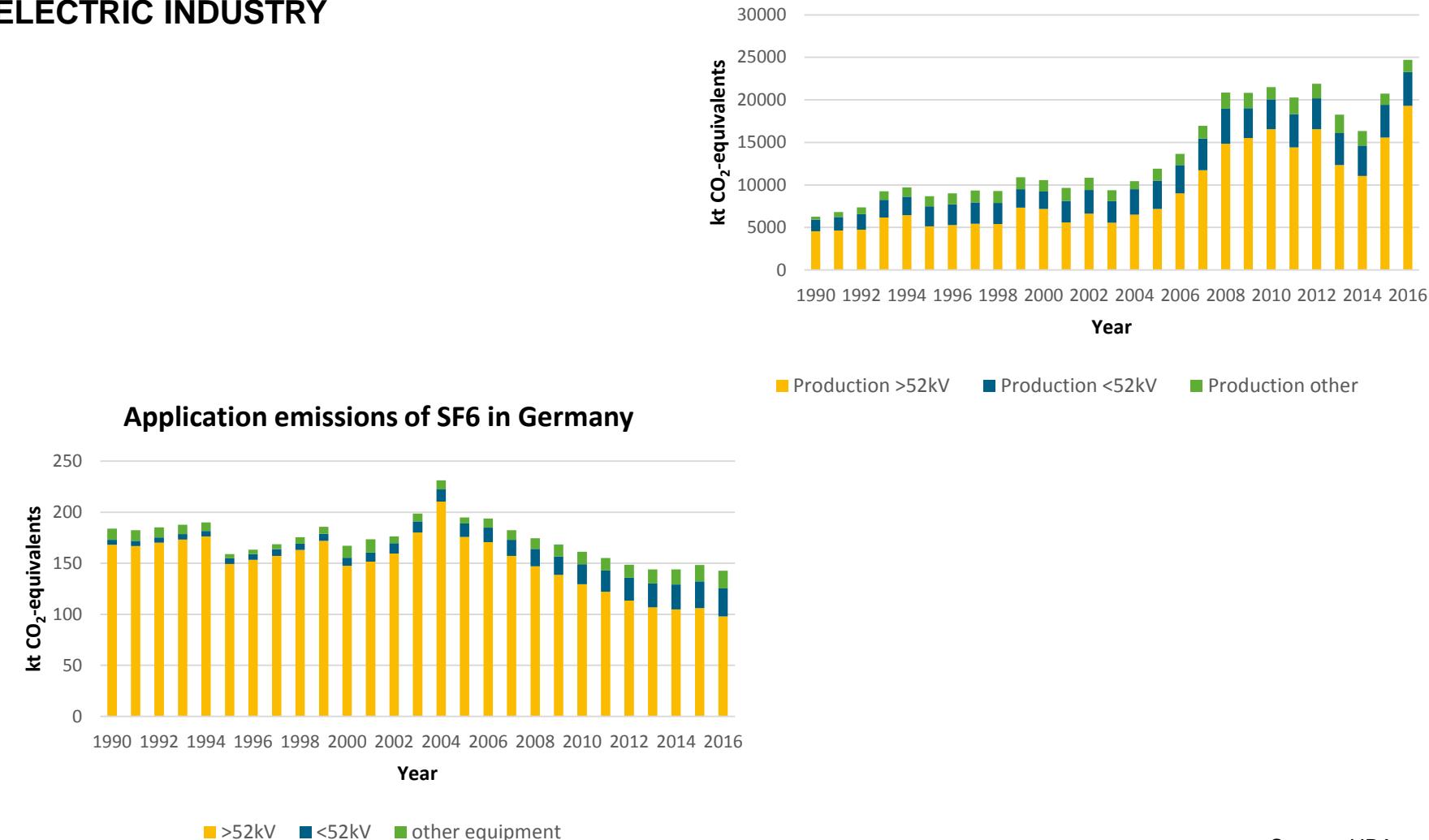


Source: UBA

The necessity for a phase-down of SF₆

SF₆ emissions from electrical equipment in Germany

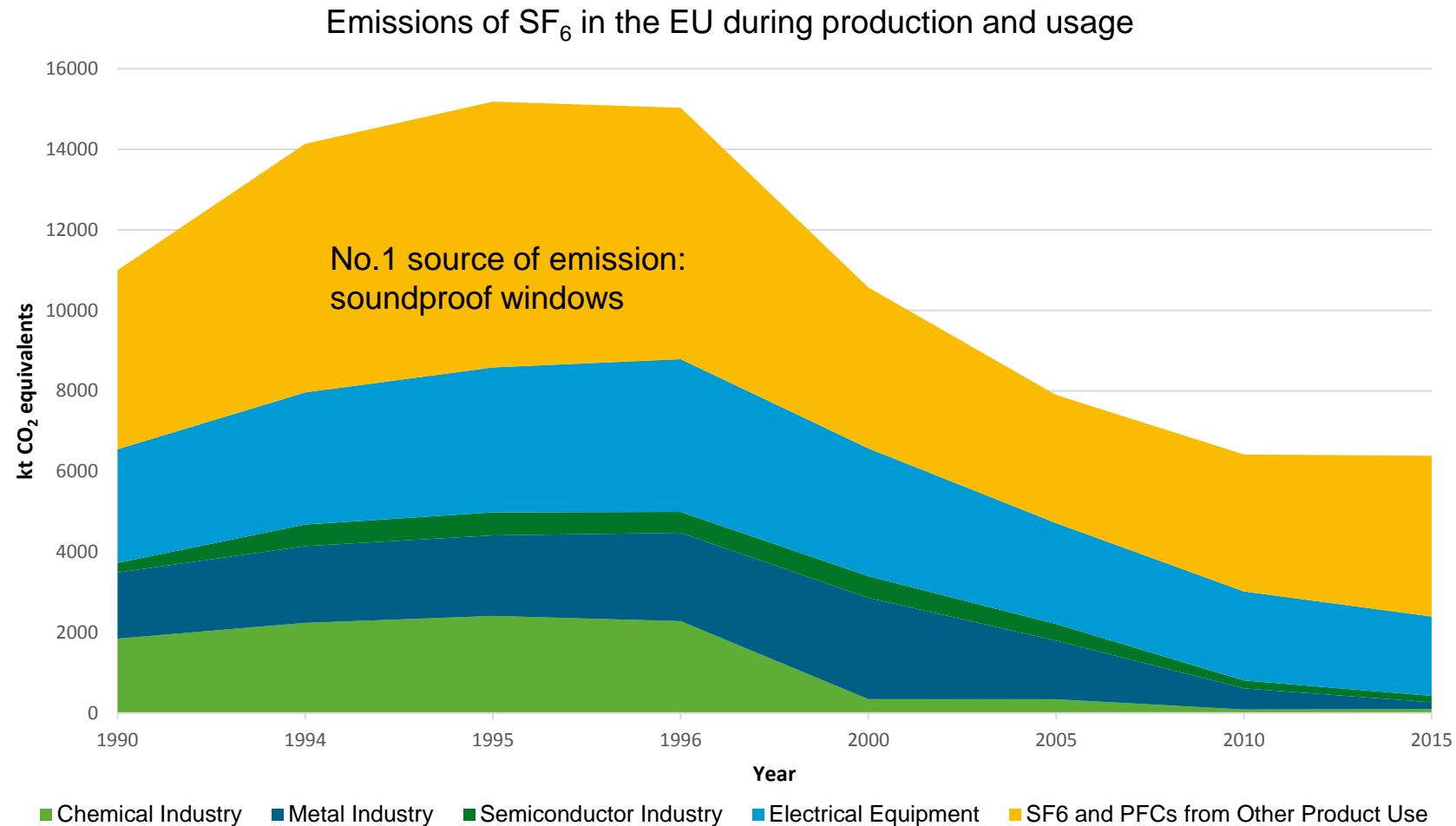
INCREASING DEMAND FOR SF₆ IN
ELECTRIC INDUSTRY



Source: UBA

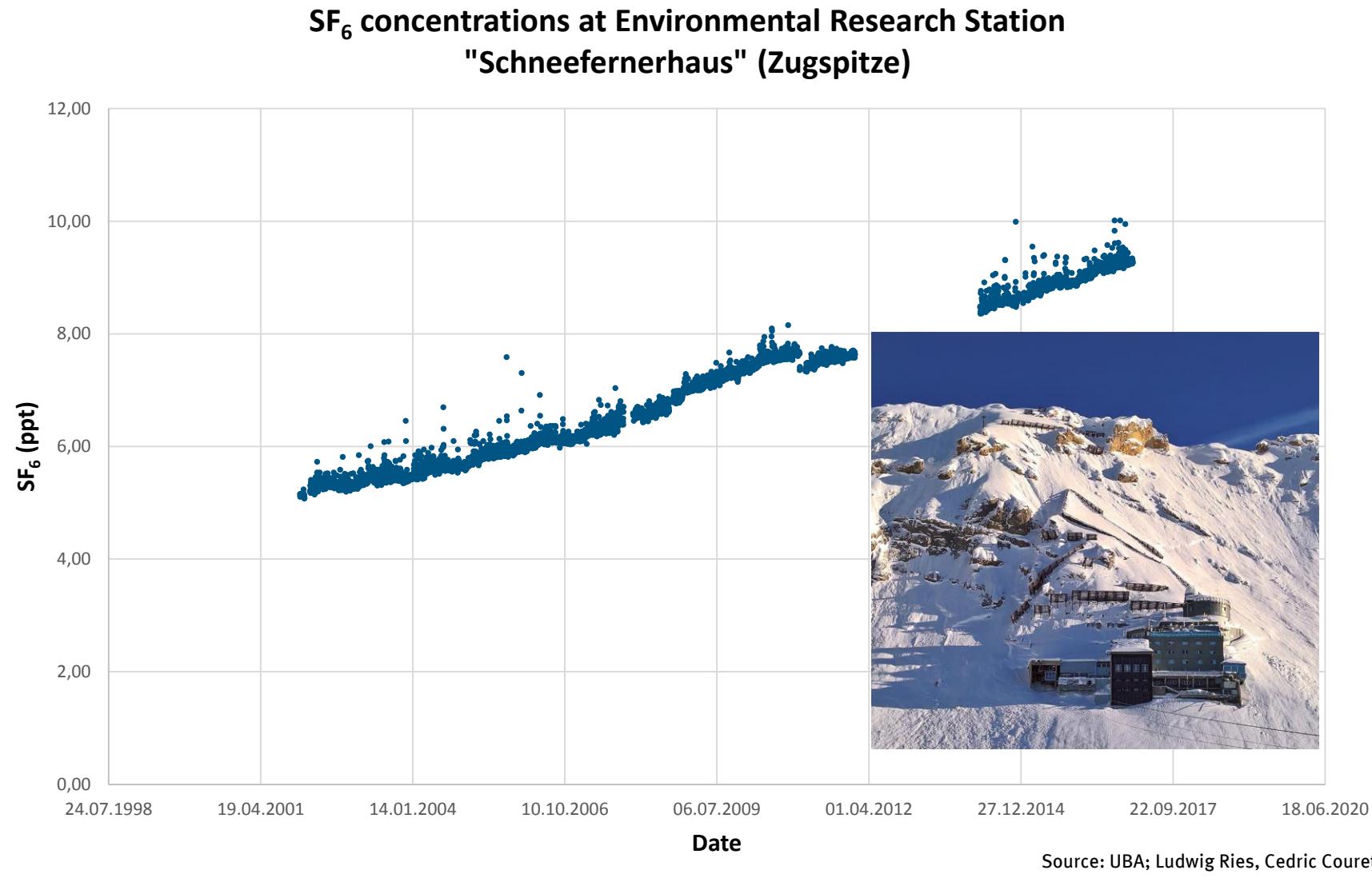
Intersectional SF₆ emissions in the EU

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 Topics Press Publications Green Economy in the Alpine region - Start Service Sitemap Disclaimer and privacy policy Deutsch

Umwelt Bundesamt

Topics

Topics > Economics | Consumption > Products > Fluorinated Greenhouse Gases and Fully Halogenated CFCs > Application domains and emission reduction > Switchgear

Switchgear

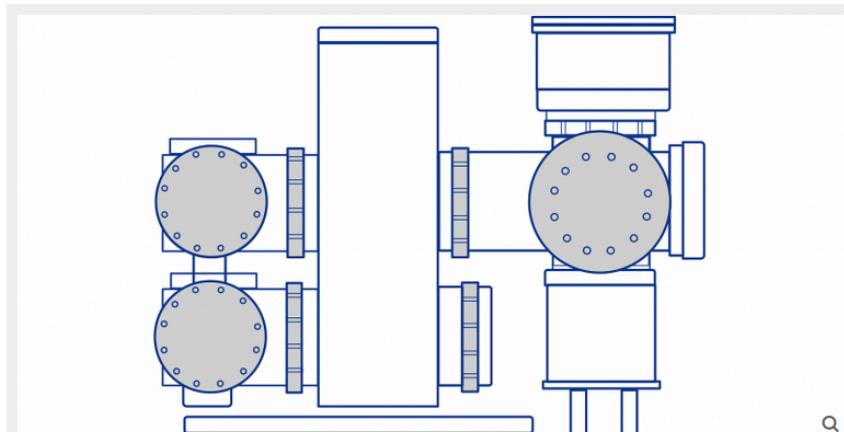


Illustration of a typical gas-insulated switchgear

Source: Ecofys

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

Table of Contents

Study on possible alternatives to SF₆

Publication of progress report

Links

voluntary agreement for switchboards (PDF, in German)

UBA web page: EU Regulation on fluorinated greenhouse gases

Topics

Economics | Consumption

Products

Fluorinated Greenhouse Gases and Fully Halogenated CFCs

Application domains and emission reduction

Supermarkets

Heat pumps

Building air conditioning

Moble air conditioning in cars, buses and railway vehicles

Eco-friendly transport refrigeration

Switchgear

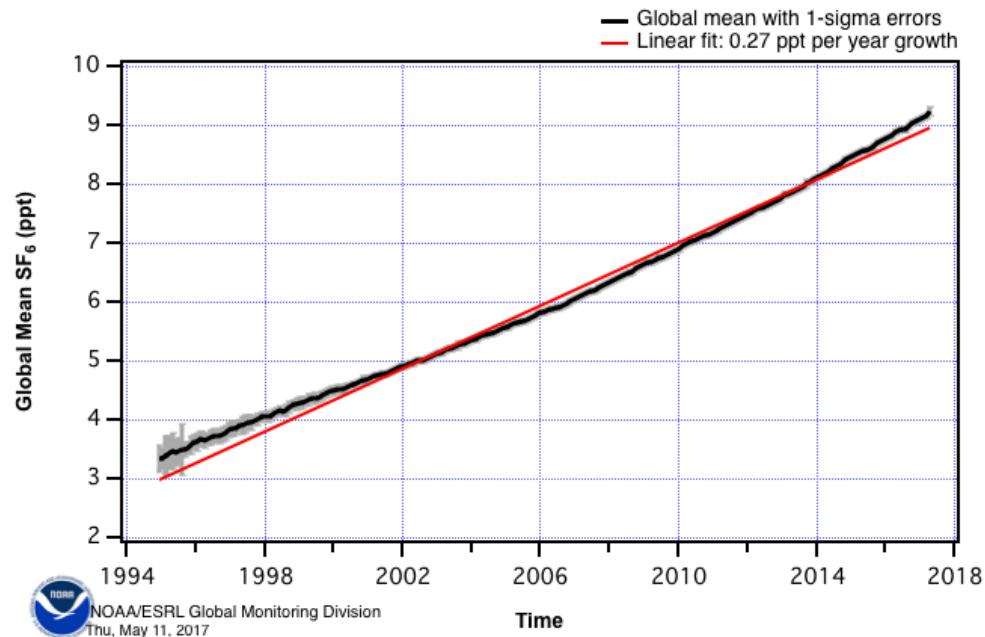


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Summary

- 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

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Division III1.4 / Substance-related Product Issues

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



A screenshot of a search results page from the Umweltbundesamt website. The search bar at the top contains the text "switchgear uba". Below the search bar, there are several navigation links: "Alle" (selected), "Bilder", "News", "Maps", "Videos", "Mehr", "Einstellungen", and "Tools". A search icon is located to the right of the search bar. Below these links, a message states "Ungefähr 33.000 Ergebnisse (0,48 Sekunden)". A tip below the message says "Tipp: Begrenze die Suche auf deutschsprachige Ergebnisse. Du kannst deine Suchsprache in den Einstellungen ändern." At the bottom of the search results, there is a snippet of a page from the "Switchgear | Umweltbundesamt" section, which discusses the use of Sulphur hexafluoride (SF6) in switchgear.