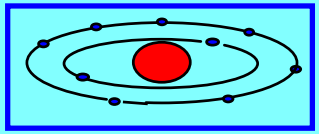


Product stewardship

- Product stewardship is defined as

  The responsible and ethical management of the health, safety, and environmental aspects of a product throughout its life-cycle

- Product stewardship is:

  “Responsible care” applied to products!

Product stewardship for SF_6: communication

- Leaflet from VDEW and ZVEI (German electrical associations)

Voluntary self commitment of GIS manufacturers, GIS users, and SF_6 producers to undertake efforts with respect to the state of the art to minimise SF_6 emissions.

This voluntary self commitment of all participants may assure a maximum protection of the product by guaranteeing a minimisation of emissions.

Further co-operation developing new facts and describing the real environmental impact of SF_6 technology will support the environmental discussion and the assessment of SF_6.

Established product stewardship for SF_6:

- **Anchoring in the company**

  Target: To continue to improve the quality of products and services

- **Safety and environmental protection as goals**

  Risk management: SF_6 ReUse concept

- **Communication**

  Voluntary commitment:
  "Use of SF_6 in Switchgears and GIS (Gas Insulated Substations)"

- **Co-operation**

  Life Cycle Assessment Study: "Electricity Supply Using SF_6 Technology"

SOLVAY

SF_6 and the environment

Environmental impacts:

- SF_6 has no ODP
- SF_6 has no ecotoxic potential
- But SF_6 is a greenhouse gas:
  GWP = 23,900 (ITH = 100 a)
  atmospheric
  lifetime = > 3,000 a

Conclusion:

→ Minimising emissions!

Improvement already achieved:

- 27% reduction of global annual SF_6 emissions between 1995 and 1998[1]

What do we expect?

- Further growth in demand for energy efficient electricity distribution systems with minimised environmental impact
- Further decline of annual emissions into the atmosphere due to
  - Closed systems
  - Responsible handling
  - ReUse concepts
- Less than 1% SF_6 contribution to the greenhouse effect by 2010

[1] Maiss, M., C.A.M. Brenninkmeijer, "A reversed trend in emissions of SF_6 into the atmosphere?" in "Non-CO_2 greenhouse gases: scientific understanding, cont and implementation," edited by van Ham, Baede, Meyer, Ibe Kluwer Academic Publishers, Dordrecht, 2000, pp 199–204

Support for environmental assessment

- **In general about SF_6:**
- **The SF_6 ReUse folder and (especially environment-related) the SF_6 Newsletter**
- **With application-related problems on SF_6:**
- **Special advice including all available measures, e.g., IEC 376, IEC 480, IEC 1634, CIGRE documents, etc.**

Specification

	IEC Norm 376	Solvay Specification	Maximum Impurity Limits*
Air in ppm by weight	500	150	300000
CF_4 in ppm by weight	500	50	50000
H_2O in ppm by weight	15	0.65	1000
Hydrolysable fluorides, in terms of HF in ppm by weight	1	1	1000
Mineral oil in ppm by weight	10	10	100

For impurities not mentioned (e.g., SOF_2, SO_2F_2 etc.), Solvay will assist upon request.

Certified ISO 9001

*Reclaimable by Solvay

Recycling and re-use
SF_6 ReUse concept

- **Precleaning of used SF_6 to remove particles**
- **Feeding into the cleaning process for new SF_6**
- **Reclaiming without residues**
  (as decomposition products in used SF_6 are fed back into the SF_6 production reactors together with byproducts in the raw material)
- **Possibility to incinerate used SF_6**
  (in case reclaiming is impossible)

Life cycle assessment

Electricity supply using SF_6 technology:

This project compared different types of switchgear, with (GIS) and without (AIS) SF_6 technology, at the levels of switchgear bays and of a practical power supply grid (for a city with 130,000 inhabitants).

ABB

PreussenElektra Netz

RWE Energie

SIEMENS

Solvay
Fluor und Derivate

SOLVAY

GÜLTIGKEITSERKLÄRUNG

VALIDITY STATEMENT

This is to confirm to:

SOLVAY FLUOR UND DERIVATE GMBH
Hans-Böckler-Allee 20
D-30173 Hannover

that the product life-cycle assessment submitted,

Electricity Supply Using SF_6 Technology

was drafted according to the principles and state of the art of life-cycle assessment, in particular with regard to

- proper methodologies
- representative inventory and impact categories
- transparency and consistency throughout.

By means of a critical review, Report No. 306 935 01, it has been established that the requirements of the standards series

DIN EN ISO 14040: 1997-06

have been met in the product life-cycle assessment submitted.

Hannover, April 22nd, 1999

Dr. Johann Josef Hanel
Environmental verifier

Dr. Winfried Hirtz
Environmental verifier

TÜV NORD

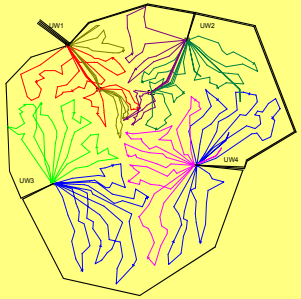
ZERTIFIZIERUNGS- UND
UMWELTGUTACHTER GESELLSCHAFT

FD/E 910/10.00

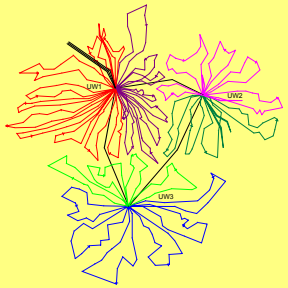
SF_6 and climate protection - implemented life cycle management -

- Voluntary commitments
- SF_6 ReUse concept
- Systems optimisation by LCA approach

Power supply of a 130,000-inhabitant city



Without SF_6 technology

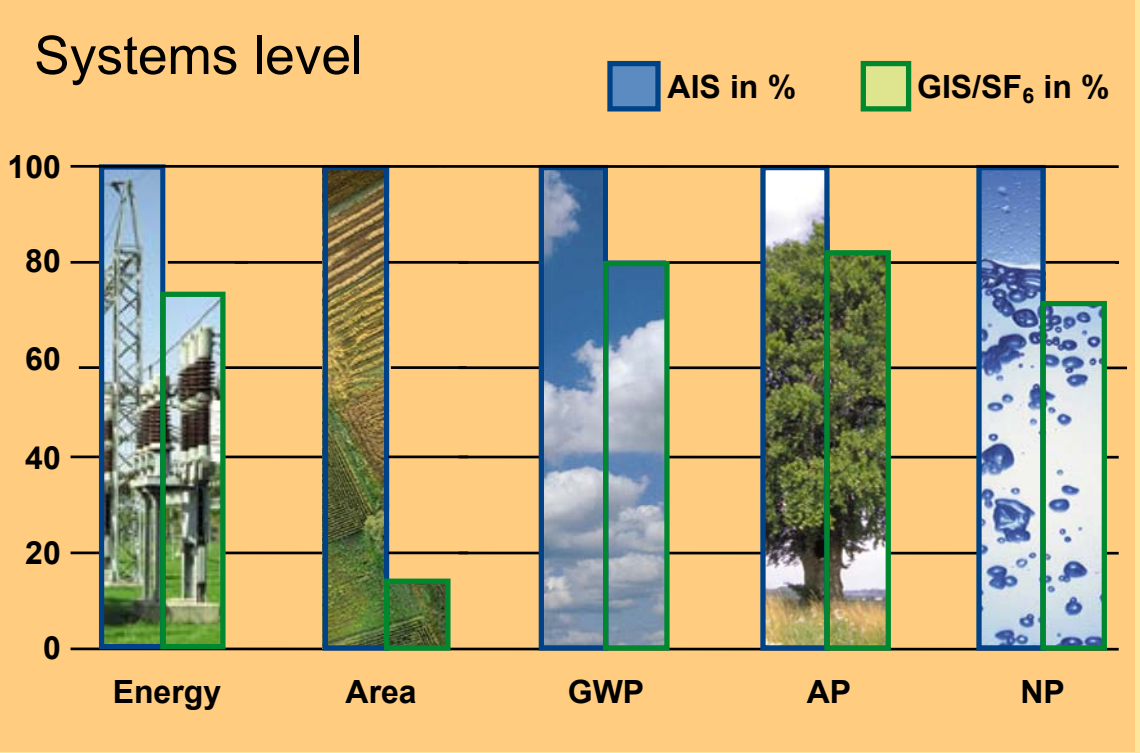


With SF_6 technology

	Electricity supply grids - SF_6 vs. SF_6-free -
Energy	☺
Area	☺
GWP (global warming)	☺
AP (acid rain)	☺
NP (nutrification)	☺

Result of the LCA on SF_6

Reduction of potential environmental impacts studied by use of GIS (SF_6) switchgear in the power supply system considered compared to AIS switchgear technology



SF_6 and climate protection

- Responsible use of SF_6
- SF_6 emissions trend broken: 1995-1998 27% less

  (Maiss, Brenninkmeijer "A reversed trend in emissions of SF_6 into the atmosphere?" 2nd Symposium on Non-CO_2 Greenhouse Gases (NCGG 2), 8-10 September 1999 in Noordwijkerhout)
- Ecological system benefits of SF_6 use exceed potential impacts