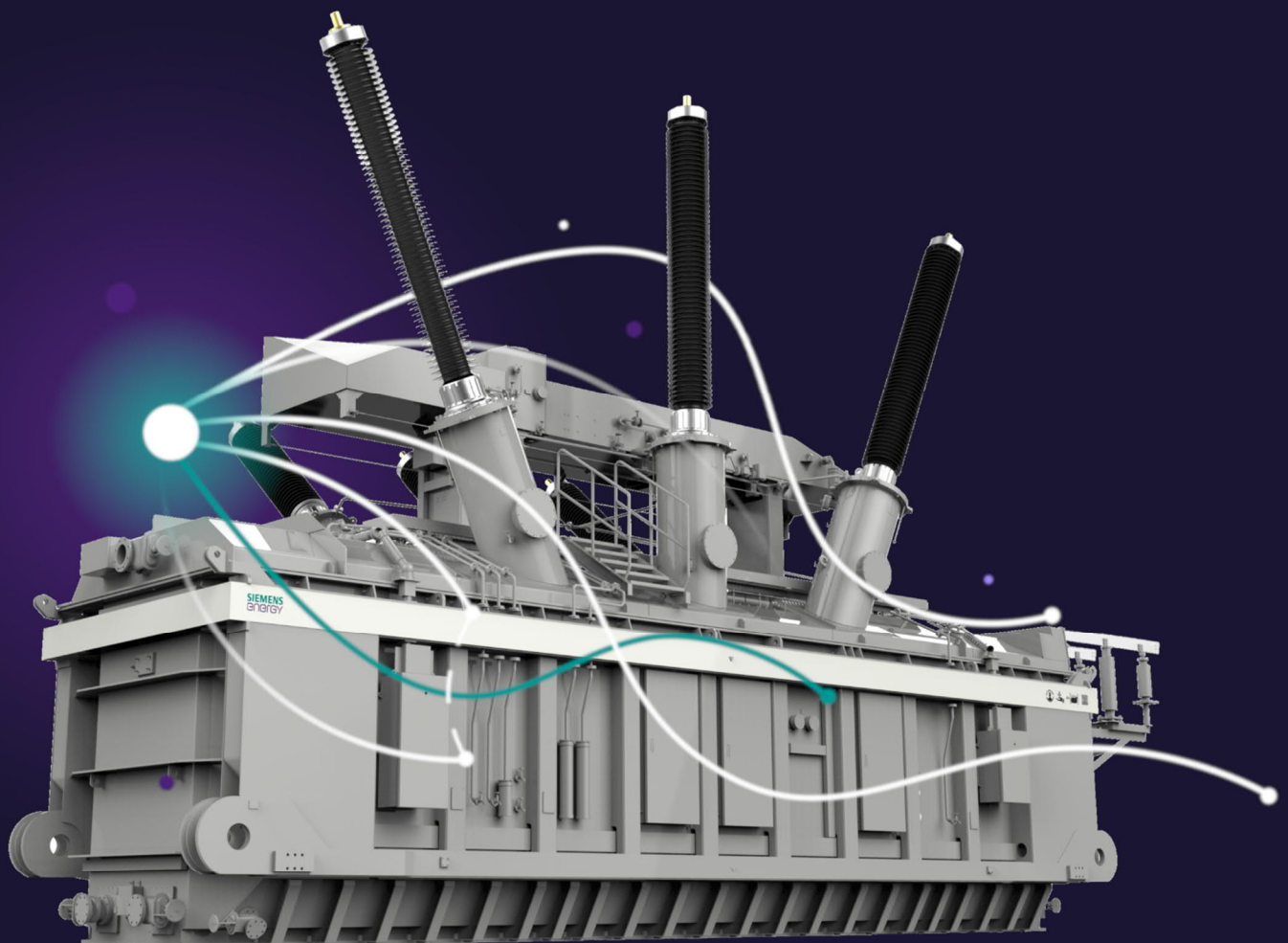
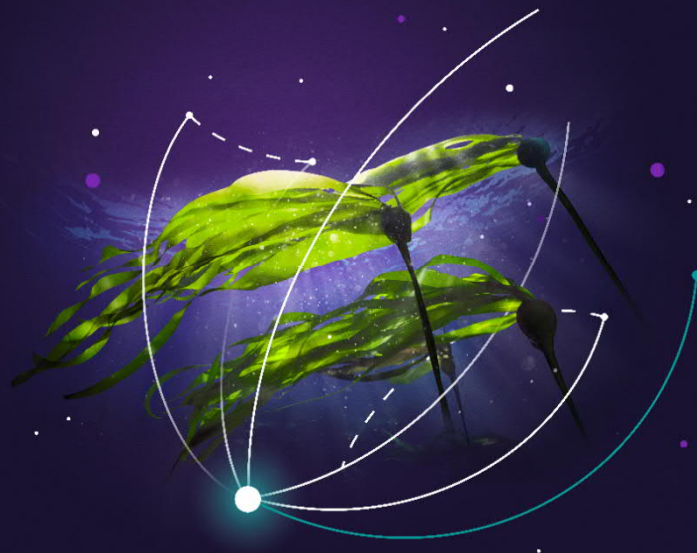


Large power transformers

Environmental product declaration according to
ISO 14021





Large power transformers

The entire energy system is in a state of profound change. This poses new challenges to the entire power supply system and to the equipment used in electric grids. The cross-linking of grids, for instance, an ideal solution to ensure supply security, and grid expansions help meet these challenges, but they also demand equipment that offers high levels of environmental safety and reliability.

Transformers are one of the most important grid components. They enable the efficient transmission of power even over long distances. And while the basic requirement of safely connecting power generation and power consumption applies to all power transformers, every single transformer is unique – designed according to individual factors such as voltage, power, climate, system topography, sound level, and many others.

Siemens Energy's large power transformers like the 3-phase GSU transformer on the title page (820 MVA, 362±2x2.5%/25 kV) are manufactured in accordance with a quality management system that is certified to EN ISO 9001. Compliance with relevant standards like IEEE and IEC is a matter of course, just as much as the exclusive use of high-quality materials. Qualified employees implement the demanding standards in daily practice, so quality is the logical result of a universal philosophy. All Siemens Energy factories work in accordance with an environmental management system certified to EN ISO 14001. With Siemens Energy transformers you are also on the safe side in terms of environmental protection and sustainability. For especially high demands we offer special designs as well as alternative cooling and insulating fluids, such as ester, which offer extra fire safety and environmental compatibility. Environmental protection is further increased by additional measures like rupture-proof tank design. Siemens Energy's large power transformers also boast the lowest noise emissions worldwide thanks to continuous research and development.

Sustainability as opportunity

Sustainability is the basis for how we do business
Our goal at Siemens Energy is to create long-term value by treating people and the environment in a responsible manner.

Innovative products and solutions are the foundation of our success

They help our customers achieve their business goals while meeting global challenges such as urbanization, demographic change, climate change, and resource scarcity.

We walk the talk

We pursue ambitious goals with regard to resource efficiency and environmental protection; we see our employees as our most valuable asset and develop them for the long term; we value a corporate culture with a strong emphasis on integrity; and we promote education, social issues, the arts, and culture wherever we operate.

Higher standards

Siemens Energy aims to set the highest standards for environmental protection in the industry. We urge our business partners to share this ambition and cooperate with both customers and suppliers to strive for continual improvement.

The main objective of our environmental work is to prevent pollution and continually reduce the environmental impact of our activities in order to protect the environment for future generations.

To meet these objectives, we will maintain and further develop a culture in which reducing the environmental impact over each product's life cycle is an integral part of our daily work practices. Our integrated management system for quality, environmental, health, and safety according to ISO 9001, ISO 14001 and ISO 45001 is implemented worldwide within Siemens Energy.

Description of the Life Cycle Stages

Materials

The data for this life cycle stage is based on a full-scale life cycle assessment involving the extraction of natural resources, transport to the processing sites, and the production of raw materials.

Manufacturing and transport

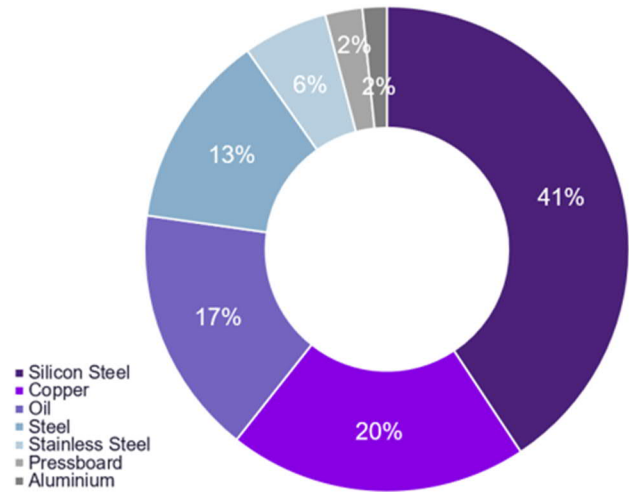
This stage covers all production processes up to the assembly of the finished product at the manufacturing site. The essential data like energy and water consumption are based on the annual manufacturing data of the site. Large power transformers are optimized for transport and on-site installation. Due to their huge dimensions, large power transformers have to be shipped with specific transport equipment by truck, via rail, or by sea. Electricity mix during manufacturing: UCTE. Our products are delivered to customers all over the world. Transport figures for this publication are based on an average travel distance of 12,700 km by train/ river barge/ocean vessel/train from Europe to the U.S.

Operation and maintenance

The lifetime of a power transformer is usually assumed to be 30 years. Our large power transformer is designed and manufactured to achieve an optimal balance of design, used materials, and maintenance required. The hermetically sealed transformers are maintenance-free under normal operating conditions. An exact assessment in critical or ambiguous cases should be carried out by specialists, or in coordination with our specific departments (oil testing laboratory). Transformers filled with alternative insulating fluid are especially suitable for the use in areas with high environmental standards.

End-of-life scenario

The end-of-life scenario includes the disassembly, material recycling, and thermal treatment of all recyclable materials and also the disposal of all other materials. For all metals like copper, steel, and aluminum, recycling significantly reduces the consumption of primary materials.



Material composition

Impact Categories

The global warming potential (GWP) refers to the gradual warming of global average temperatures due to increasing concentrations of atmospheric greenhouse gases such as CO₂ and methane, among others.

Ozone Depletion Potential (ODP): is the number that refers to the amount of ozone depletion caused by a substance. The ODP is the ration of the impact on ozone of a chemical compared to the impact of a similar quantity of CFC-11. Possible consequences are damages to plants and animals, human health impacts through skin cancer, cataracts and reduced immune defense.

Photochemical oxidation is caused by atmospheric emissions of nitrogen oxides (NOX) and volatile organic compounds (VOCs). The possible consequences of photochemical ozone are damages to human respiratory systems, degradation of many materials, and reduced yield of crops in agriculture.

Acidification of the environment is due to emissions of gases that are converted to acids in the atmosphere. The possible consequences of acidification are damage to vegetation and life in lakes and rivers and degradation of materials such as metals, limestone, and concrete.

Eutrophication is the process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen.

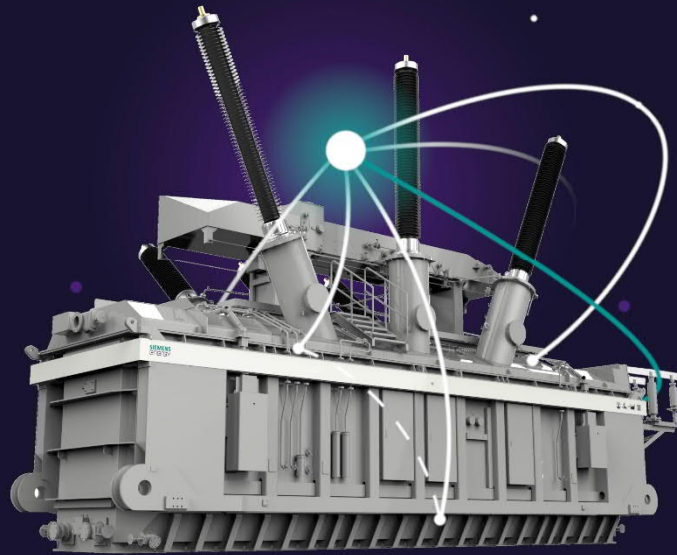
Resource depletion defines the use of materials taken from nature and includes renewable and non-renewable raw materials. Non-renewable resources include minerals and fossil fuels, and renewable resources include water, wind and wood.

Large power transformer (3-Phase GSU transformer: 820 MVA, 362 ± 2x2.5%/25 kV)

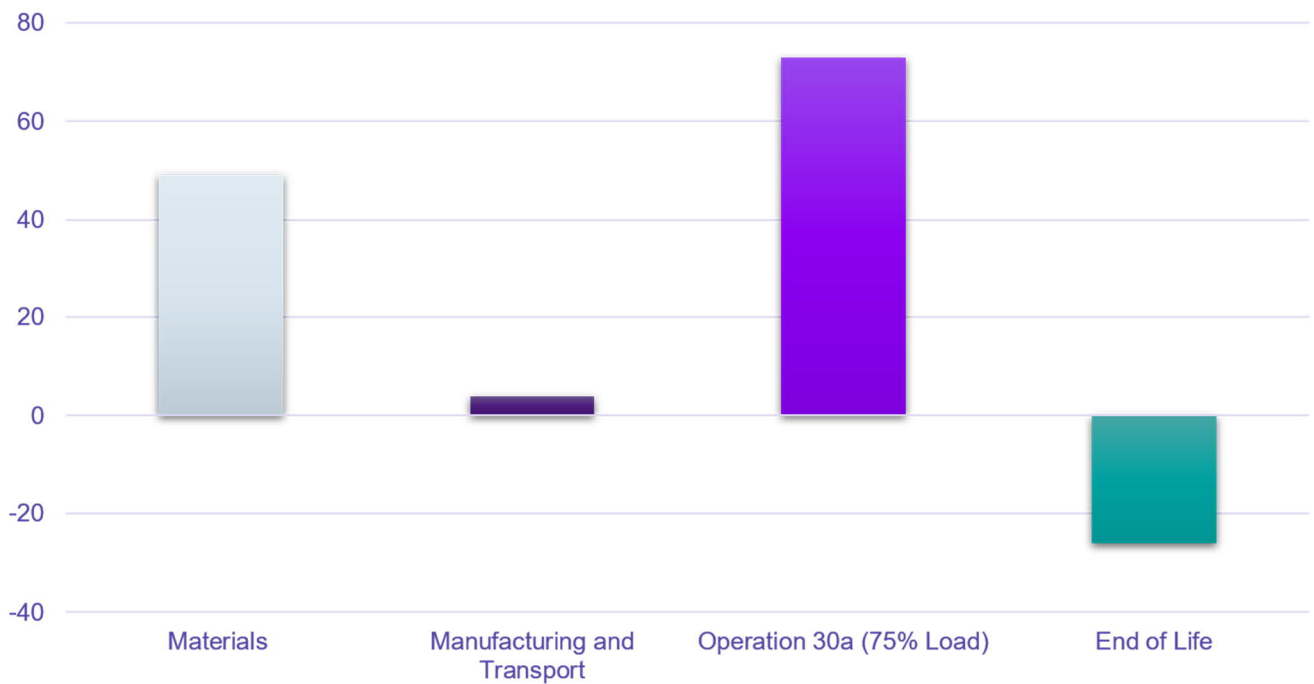
Impact Category	Unit	Total	Materials	Manufacturing and Transport*	Operation 30a (75% Load)	End of Life
Climate change	kg CO ₂ eq	2.984.607,82	1.466.465,15	118.160,55	2.179.667,60	-779.685,48
Ozone depletion	kg CFC-11 eq	11,75	0,31	0,02	11,71	-0,29
Photochemical ozone formation	kg NMVOC eq	12.904,11	9.473,88	1.499,03	9.640,62	-7.709,42
Acidification	molc H ⁺ eq	23.662,23	39.656,55	1.819,10	18.390,52	-36.203,94
Terrestrial eutrophication	molc N eq	46.420,51	32.969,64	5.690,69	34.042,11	-26.281,94
Freshwater eutrophication	kg P eq	1.443,83	6.822,37	19,04	985,96	-6.383,54
Marine eutrophication	kg N eq	3.387,96	2.261,60	516,30	3.683,64	-3.073,60
Mineral, fossil & ren resource depletion	kg Sb eq	1.227,84	851,35	1,62	1.075,66	-700,78

Reference electricity mix for operation: U.S. nuclear mix (Ecoinvent database)
All figures in this EPD refer to 1 unit trafo.

* from manufacturer to customer



Results of the Impact Assessment



Global warming CO₂ equivalents in %

Siemens Energy uses standard life cycle software for the evaluation of the environmental impact of all product life cycle stages. All results are verified by internal reviews. The international standard ISO 14021 («Environmental labels and declarations – Self-declared environmental claims – Type II») is the basis for these environmental product declarations (EPDs). The data in this EPD has been evaluated on a full-scale life cycle assessment (LCA) study according to ISO 14040.

Published by

Siemens Energy Global GmbH & Co. KG
Transmission
Freyeslebenstr. 1
91058 Erlangen
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Article No. PTNP-T10010-00-7600

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For the U.S. published by

Siemens Energy, Inc
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Raleigh, NC 27616USA