CIGRE-515

2022 CIGRE Canada Conference & Expo
Calgary, Alberta, Oct.31 – Nov. 3, 2022

Contribution of Electrical Industry to Clean Environment

& Elimination of Green House Gases

M. SHARIF AHMED
SIEMENS CANADA LIMITED

SUMMARY

There has been a concern of climate change globally for the safety of our planet and the human life on this planet " Earth ".The global Industry is knowingly or unknowingly contributing to greenhouse gasses which in turn is bringing a Climate change. As the awareness is increasing there are efforts to pay attention to this concern and try to eliminate these Greenhouse Gases. The first step is to reduce Carbon Di-oxide level in the atmosphere. The use of SF6(Sulphur Hexafluoride) is common in Gas Insulated Switchgear due to its property of High Di-electric strength, good arc extinguishing properties and insulation. But SF6 is a Greenhouse Gas. One Molecule of SF6 Gas has the same effect as 23,500 molecules of CO2 Gas.15% of SF6 Gas is leaked by the electrical Industry in the atmosphere. Steps are now taken after a lot of R&D work and to come with a Blue Gas / Clean Air which can be used in place of SF6 Gas thus avoiding addition of CO2 level in the atmosphere.

Manufacturers of Gas Insulated Switchgear are coming up with a Clean air / Blue Gas Insulated Switchgear. Our Leakage rate of SF6 Gas from our Switchgear is <0.1% per annum. To avoid this leakage of SF6 Gas in the atmosphere the Blue Gas is introduced by Siemens which is as good as SF6 gas for insulation.
This is one step forward by Siemens to cut the Greenhouse gas in the atmosphere. The Blue Gas is Environmentally friendly with no use of F-gases or chemical additives with Global Warming Potential GWP<1: minimum global warming potential and with no depletion Potential (ODP=0) and no accidental potential. It is very safe and is Non-toxic, non-carcinogenic, Non-flammable, extremely stable with low boiling point and the insulating medium does not liquify. No Gas recycling required. This can be very successfully used in place of SF6 Gas in Gas Insulated Switchgear.

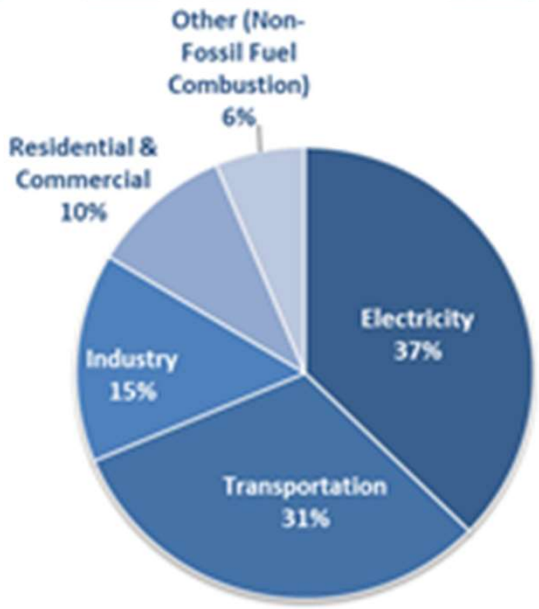
The electrical Industry strongly believes that Clean Air Insulation in combination with Vacuum Switching Technology and intelligent & digital solutions is the right way into a Sustainable Future. In 2020, the European Union presented a report outlining alternatives to SF6 used in in Switchgear and related equipment. The report concluded that SF6-free alternative policy is required to move from the use of SF6 Gas to an alternative so that a leakage of such a Gas should not be a threat to the atmosphere increasing the CO2 level. Power System Industry must phase out the SF6 Gas as its important to address the Global warming. When SF6 gas is released in the atmosphere it remains in the atmosphere for 3,200 Years. It depletes the ozone layer thus disturbing the nature of protecting the Earth from ultraviolet rays. Thus, avoiding the use of SF6 Gas in Gas Insulated Switchgear will be the first step to step down the Global warming.

At present SF6 Insulated GIS is very successful with its small footprint, minimum maintenance, safety and with a life span of 35 to 50 years. With the growing concern of climate change many of the Utilities are trying to bring a change and avoid using SF6 Gas Insulated Switchgear.

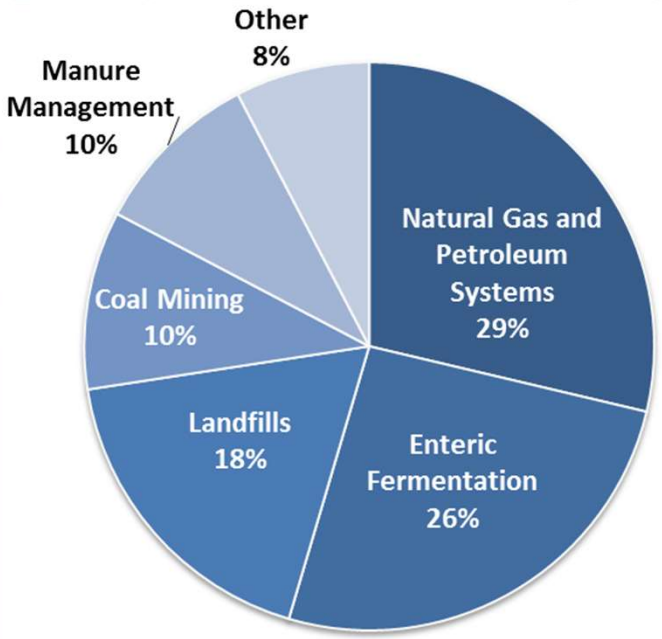
What are Green house Gases?

Gases that trap heat in the atmosphère are called green house Gases.
The four main green house Gases are:-

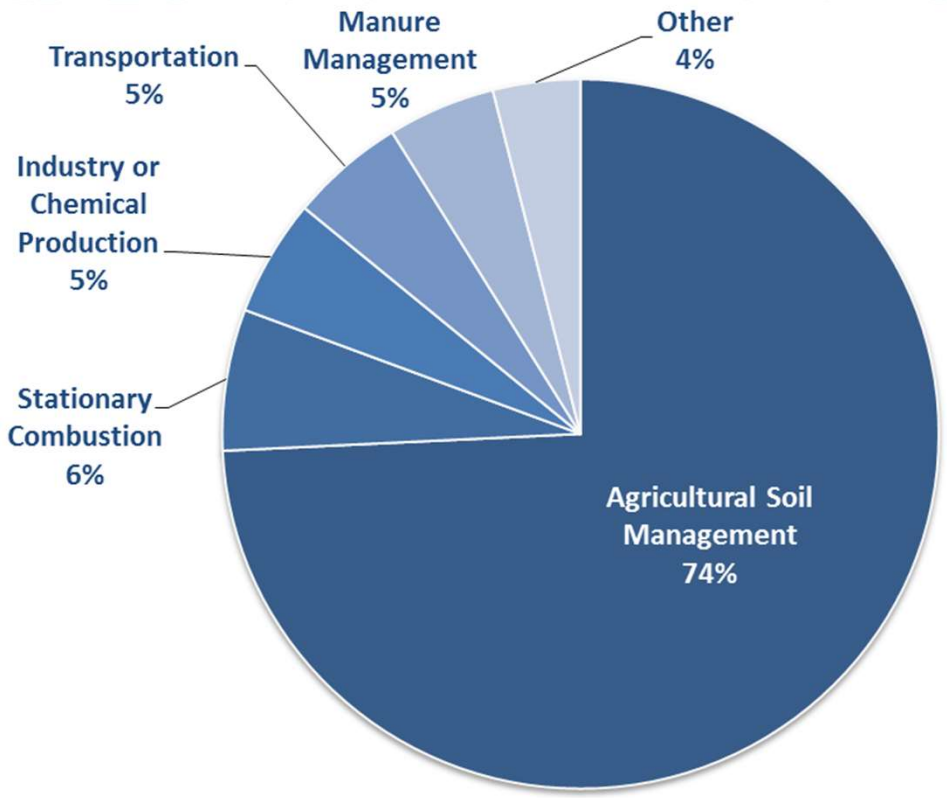
- **Carbon dioxide (CO_2)**: Carbon dioxide is in Maximum quantity which enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.



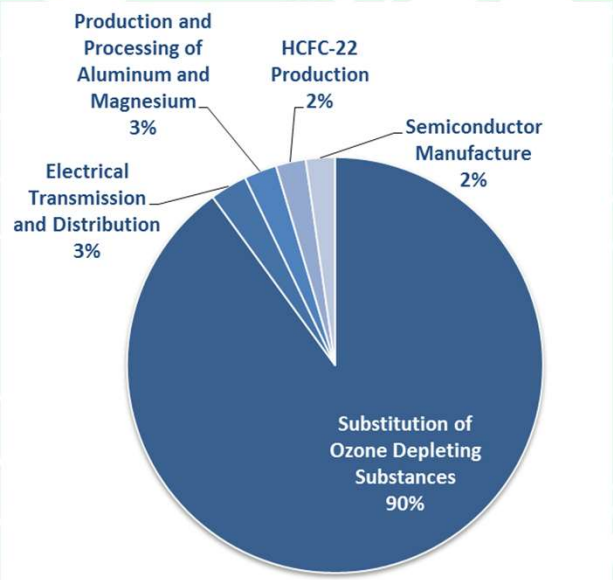
- **Methane (CH_4)**: Methane is another Gas which is released during the production and transport of coal, natural gas, and oil. Methane emissions is also a result from live stock and other agricultural practices, land use and by the decay of organic waste in municipal solid waste landfills which are found all around the word.

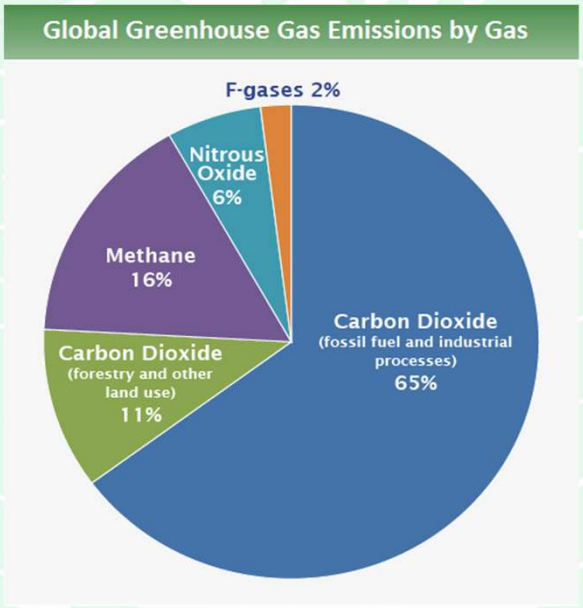


- **Nitrous oxide (N_2O)**: Nitrous oxide is emitted during agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of waste water.

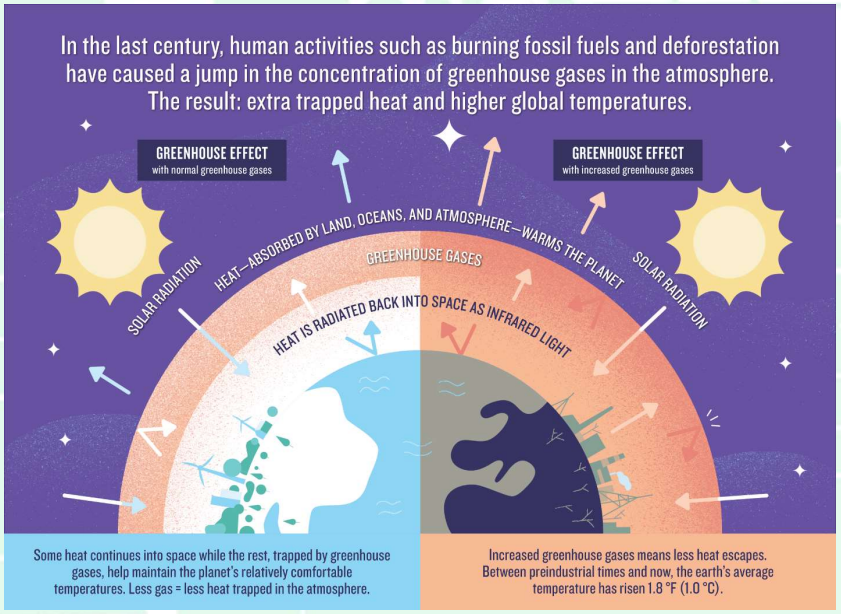


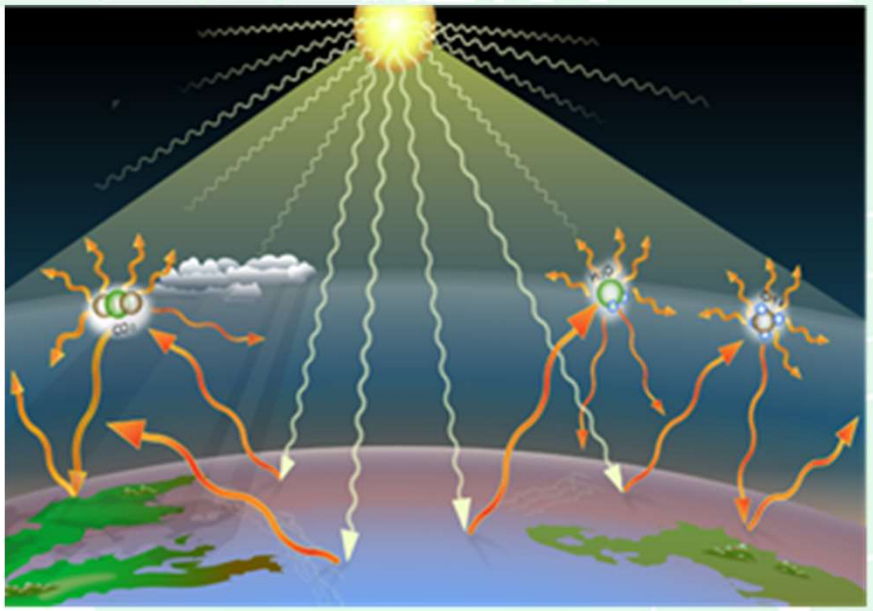
- **Fluorinated gases**: Hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful greenhouse gases that are emitted from a variety of household, commercial, and industrial applications and processes. Fluorinated gases (especially hydrofluorocarbons) are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). Fluorinated gases are typically emitted in smaller quantities than other greenhouse gases, but they are potent greenhouse gases. With global warming potentials (GWPs) that typically range from thousands to tens of thousands, they are sometimes referred to as high-GWP gases because, for a given amount of mass, they trap than substantially more heat than CO2.





Heat is absorbed by these green house gases and reflected back to earth that causes the earth temperature to rise.





Each Gas's effect on climate change depends on three main factors:

How much is it in the atmosphere?

Abundance amount of a particular green house Gas in the air. Larger emissions of green house Gases lead to higher concentrations in the atmosphere. Green house Gas concentrations are measured in parts per million, parts per billion, and even parts per trillion. One part per million is equivalent to one drop of water diluted into about 13 gallons of liquid (roughly the fuel tank of a compact car).

How long do they stay in the atmosphere?

Each of these gases can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years.

-**Carobon dioxide** CO2 remains in atmosphere for 100 years
-**Methane** remains in atmostphere for 12 years
-**Nitrous oxide (N_2O)**: remains in atmostphere for 120 years
- SF6 (Sulpher Hexa Floride) remains in atmosphère for 3,200 years.

All of these Gases remain in the atmosphere long enough to become well mixed, meaning that the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

Just a few examples of Green house Gases effect in pictures

Because of extensive heat the snow in the North Pole areas is melting out effecting the natural sea life.

Because of excessive heat there are more forest fires taking away the green trees which is a natural source for absorbing Carbondioxide

Draught due to excessive heat and no rains.

How strongly do they impact the atmosphere?

Some gases are more effective than others at making the planet warmer and "thickening the Earth's blanket." For each greenhouse gas, a Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2). Gases with a higher GWP absorb more energy, per pound emitted, than gases with a lower GWP, and thus contribute more to warming Earth.

Note: All emission estimates are from the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020.

When energy from the sun reaches the Earth, the planet absorbs some of this energy and radiates the rest back to space as heat. The Earth's surface temperature depends on this balance between incoming and outgoing energy. Average conditions tend to remain stable unless the Earth experiences a force that shifts the energy balance. A shift in the energy balance causes the Earth's average temperature to become warmer or cooler, leading to a variety of other changes in the lower atmosphere, on land, and in the oceans.

A variety of physical and chemical changes can affect the global energy balance and force changes in the Earth's climate. Some of these changes are natural, while others are influenced by humans. These changes are measured by the amount of warming or cooling they can produce, which is called "radiative forcing." Changes that have a warming effect are called "positive" forcing, while changes that have a cooling effect are called "negative" forcing.

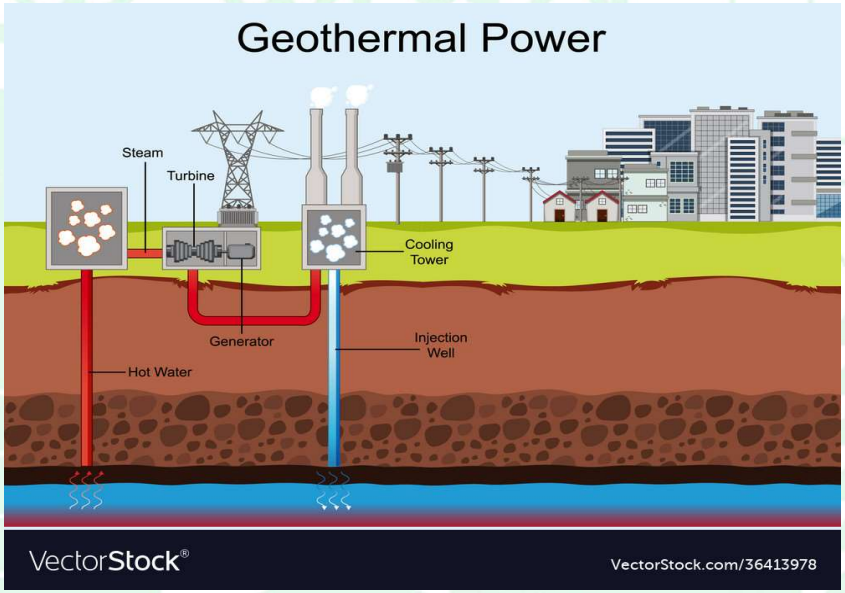
When positive and negative forces are out of balance, the result is a change in the Earth's average surface temperature. Changes in greenhouse gas concentrations in the atmosphere affect radiative forcing (see the Atmostpheric Concentrations of Greenhouse Gases indicator). Greenhouse gases absorb energy that radiates upward from the Earth's surface, re-emitting heat to the lower atmosphere and warming the Earth's surface.
The major steps taken by the electrical Industry to reduce greehouse gases are :-

Renewable Energy production

- Electrical Energy production by Wind Farms
- Electrical Energy production by Solar Farms
- Electrical Energy production by Hydro Turbines
- Electrical Energy production by Geothermal
- Avoid using SF6 Gas in Gas Insulated Switchgear.
- Use of Lithium Batteries for Electric cars

Electrical Energy production by Wind Farms

Electrical Energy production by Solar Farms



Electrical Energy production by Géothermal

Electrical Energy production by Hydro

By the above mentioned four methods of Genreration Utilites are already contributing to avoid greenhouse gases. Manufacturing lab evaluations have détermine that éliminating SF6 Gas offer comparably high reliability and increased performance making it the most sustainable alternative for Heath, Safety and Enviornment. Intensive research was conducted on more than 200 Gases for insulating and switching performance. One of the most promising gases compared to SF6 is clean air.

Electric Vehicles is a great way of reducing the greenhouse gases. No burning of fuel and there is no exhaust in these cars thus no release of Carbon dioxide.

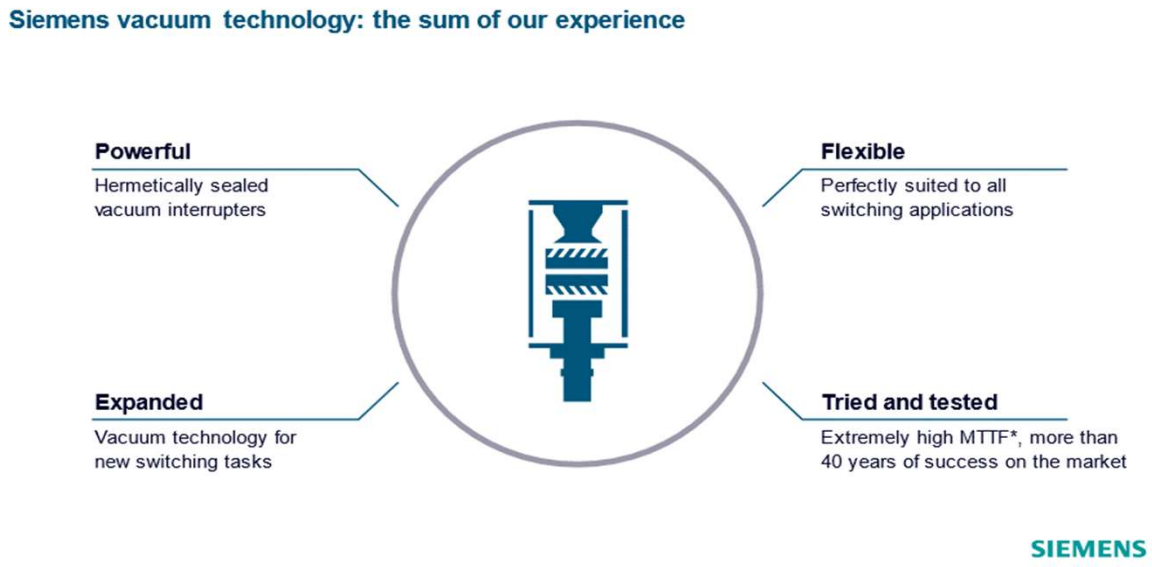
Use of Lithium Batteries for Electric cars

As mentioned earlier SF6 is a green house Gas which remains in the atmostphere for 3,200 years. One molecule of SF6 Gas is equivalent to 23,500 molecules of Carbon dioxide CO2.

Siemens is coming up with its clean air / Blue Gas Gas Insulated Switchgear. Siemens strongly believes that **Clean Air Insulation** in combination with **Vacuum Switching Technology** and **intelligent & digital** solutions is the right way into a **Sustainable Future.**

- **Blue Gas with clean air insulating medium based on the components of the ambient air**
- **Vacuum Interrupter Switching principle based on proven vacuum technology**

Gas Insulated Switchgear – Customers will continue to enjoy all the benefits of Siemens Gas Insulated Switchgear in the future.



Our contribution

blue GIS

with Clean Air

Blue GIS

Triple benefits with intelligent and digital features

Clean Air

Insulating medium based on the components of the ambient air

Vacuum interrupters

Switching principle based on proven vacuum technology

Gas-insulated switchgear

Customers will continue to enjoy all the benefits of Siemens gas-insulated switchgear in the future

Siemens strongly believes that **Clean Air Insulation** in combination with **Vacuum Switching Technology** and **intelligent & digital** solutions is the right way into a **Sustainable Future**

M. Sharif Ahmed
MS (EE) Power Systems USA
Sr. Member IEEE
Director Business Development
Siemens Canada Limited
Smart Infrastructure
Electrification & Automation
1577 North Service Road East
Oakville, Ontario L6H 0H6
Mobile: (403) 561-6521
E-mail: sharif.ahmed@siemens.com