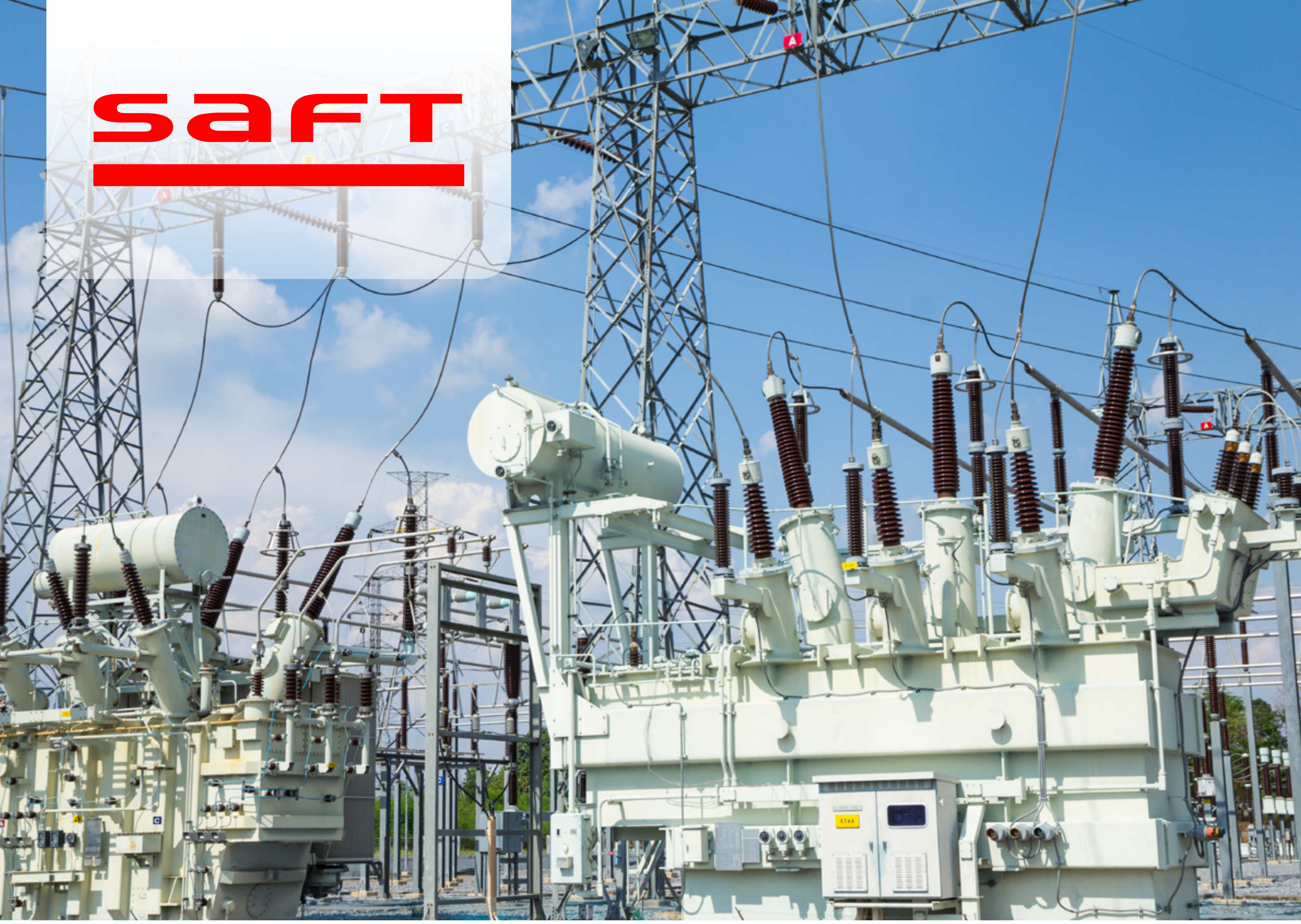

# Reducing Green House Gas (GHG) emissions using Saft Ni-Cd batteries

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# Context

**Today, industrial sectors are engaged in a relentless effort to reduce the GHG emissions related to their operations.**

This reduction effort covers scope 1 emissions (GHG emitted on the site of the concerned industry), scope 2 emissions (GHG emitted by the electricity supplier) and scope 3 emissions (derived from upstream sourcing and the use of the selected solution.

This paper examines two back-up battery solutions from the purpose of their manufacture and their use.

# The use case

A regional energy supplier active in the Qatari Oil & Gas market is supervising multiple electrical substations using American made Valve Regulated Lead Acid (VRLA) batteries (108V – 100Ah) and is looking for a battery replacement.

To ensure safe operation and increase the reliability of the back-up service, a Saft battery - sized to match the existing 54 VRLA cells and consisting of 87 Uptimax UP1M 100 Ah cells - is selected.

This white paper evaluates and compares over 20 years of service the GHG emissions related to the manufacture and the operations of the VRLA solution and of the alternative Ni-Cd based Uptimax solution.

*Transformers are critical parts relying on battery backup.*

# GHG emissions from manufacturing

First, the GHG emissions related to the manufacture of one VLRA battery and one Ni-Cd battery must be calculated. Second, the use life of each technology must be estimated, so as to identify the number of batteries that will be used for a 20-year operation. These use-life estimates will be developed considering the battery ambient temperature, which in Qatar varies between +21°C to +42°C. An average temperature of 32°C over the 20 years of operations is selected.

Under such conditions, a VLRA battery has a service life of 6 years, and four units are therefore considered. A Ni-Cd battery has a use life of 18 years, and therefore two batteries are considered.

| 108V/100 Ah System | Battery life expectation | Estimated service life at +32°C | Nbr of systems for 20 years of operation | $CO_2$eq for manufacturing system | Total for 20 years of operation $CO_2$eq |
|---|---|---|---|---|---|
| VRLA (AGM) | 12 years | 6 years | 4 | 619 kg | 2,476 kg |
| Saft Uptimax | 20 years | 18 years | 2 | 194 kg | 387 kg |

# GHG emissions from maintenance

Maintenance visits to the site where the batteries are used are GHG emitting activities due to the truck journey between the maintenance center and the site. An estimate of GHG emissions is generated based on the number of visits (as per IEEE recommendations) over 20 years of operations, the round-trip distance to the substation (2 x 50 km = 100 km) using average light maintenance truck GHG emission factor (0.27 kg $CO_2$eq/km).

| 108V/100 Ah System | Nbr of visits per year | Distance per visit | $CO_2$eq per km (1) | Total for 20 years of operation $CO_2$eq |
|---|---|---|---|---|
| VRLA (AGM) | 4 | 100 km | 0.27 | 2,160 kg |
| Saft Uptimax | 2 | 100 km | 0.27 | 1,080 kg |

*(1) An average light truck emits 0.27 kg of $CO_2$eq per km (https://www.eea.europa.eu/)*

# GHG emissions to ensure full charge

For the battery to remain fully charged at all times, it needs to be constantly fed with a float current (supplying energy to the battery system to compensate for self-discharge and keeping the battery fully charged). The difference between Ni-Cd and VRLA in energy need is small (a few mA/Ah), however it is important to consider it for a 100 Ah battery over a 20-year period.

| 108V/100 Ah System | Float current | Charge efficiency (2) | Energy per year | $CO_2$eq per kWh (3) | Total for 20 years of operation $CO_2$eq |
|---|---|---|---|---|---|
| VRLA (AGM) | 10 mA /Ah | 1.28 | 1,230 kWh | 0.484 | 11,906 kg |
| Saft Uptimax | 5 mA/ Ah | 1.28 | 615 kWh | 0.484 | 5,953 kg |

*(2) charge efficiency is 1.2 for the battery and 1.06 for the charger. Charge efficiency for the system is therefore 1.2 * 1.06 = 1.28*

*(3) 1 kWh of electricity produced in Qatar generate 0.484 kg of $CO_2$eq emission into the atmosphere (2021 data from IEA).*

# Total GHG emissions and conclusion

| 108V/100 Ah System | Manufacturing $CO_2$eq | Maintenance (site visits) $CO_2$eq | Energy for charging $CO_2$eq | Total GHG for 20 years $CO_2$eq |
|---|---|---|---|---|
| VRLA (AGM) | 2,476 kg | 2,160 kg | 11,906 kg | 16,542 kg |
| Saft Uptimax | 387 kg | 1,080 kg | 5.953 kg | 7,419 kg |

When comparing GHG emissions of a VLRA battery with a Ni-Cd battery solution over 20 years of operations, the Ni-Cd solution is clearly the lowest GHG emission solution by a factor of 2.2.

# We energize the world.

# On land, at sea, in the air and in space.

## Saft has launched a sustainability initiative, Program Net Zero, consisting of 5 pillars:

1. Reducing the environmental footprint of our activities and that of our battery solutions.

2. Assisting Saft's customers in lowering their environmental footprint.

3. Using natural resources sustainably and implementing circular economy principles throughout our operations.

4. Prioritizing suppliers with strong environmental, social, and human rights records.

5. Working to always ensure compliance with environmental regulations and best practices in all locations.

Batteries facilitate the shift towards clean energy, but there is much work to do to achieve Net Zero. Therefore, Saft is committed to reducing its impact while respecting social and human rights all along the value chain.

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