Product Carbon Footprint of a 100 kW AWE Generator

Giorgio Sella
Kitenergy S.r.l.

Giorgio Sella

Board Member & Deputy General Manager
Kitenergy S.r.l.

Via Massimo D'Antona 55/57
10040 Rivalta di Torino
Italy

g.sella@kitenrg.com
www.kitenrg.com

Today, among the many options available within renewable sources, solar and traditional wind technologies are well-established solutions capable of generating the 12% of global electricity.

Despite this, small islands and remote/isolated areas often rely solely on diesel generators for energy supply. Depending on the operational scenarios and external constraints, a mix of different renewable energy technologies would help to mitigate the impacts of fossil fuel generated energy and provide 24-hours grid quality electricity.

Regulatory emission controls on diesel generators and intense debate over the actual impacts of solar PV and wind energy open the way to innovative technologies. Airborne Wind Energy (AWE) generators, thanks to their peculiar characteristics, are almost ready to offer a highly competitive solution from an environmental and economic perspective, while overcoming many of the concerns associated with other technologies. A Product Carbon Footprint (PCF) method has been adopted to preliminary assess the Kitenergy AWE generator system and estimate the greenhouse gases (GHGs) emitted throughout its life cycle.

Then, the PCF of Kitenergy's 100 kW AWE generator is firstly compared with those of potential alternative solutions such as Solar Photovoltaic (PV) and traditional wind power and, finally, used to estimate the potential reduction of GHG emissions resulting from the substitution of a diesel generator with a Kitenergy AWE generator of the same rated power. The system architecture, combined with the ability of harvesting winds at altitude, results in extremely high performance in terms of use of materials and quantity of electricity produced with low impacts:

- in order to manufacture and install a 100 kW Horizontal Axis Wind Turbine (HAWT), 27.6 t of materials such as steel, copper, glass and polyester with the addition of 190 t of concrete for foundation are needed. Our AWE generator design allows a material weight reduction of 90% for the same rated power and a Carbon Intensity (g CO2eq/kWh) 5.6x lower than a wind turbine;
- solar PV plant at global scale has on average a Capacity Factor (CF) of 16.1%. On the contrary, thanks to altitude winds, it is easy for Kitenergy AWE generators reach a CF of more than 50% with lower day to night production variability. This results in a Carbon Intensity up to 16x lower than solar PV.
- adopting an average carbon emission factor of 695 g CO2/kWh for diesel gensets and, taking into account only the fuel necessary to operate a 100 kW diesel generator unit, the emissions reduction achieved by installing a Kitenergy AWE generator can reach 292 tonnes CO2/year.

kitenrg