# Termodinamica

## Innovative solution: Marine Inverter Air Conditioning with Direct Refrigerant Expansion

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## Introduction

The study is part of a larger project by Water Revolution Foundation focused on assessing suppliers' solutions for improved sustainability in the yachting industry. It aims to inform stakeholders, consumers, and public institutions about the industry's commitment to Sustainable Development Goals (SDGs). This study specifically investigates the environmental credentials of Termodinamica's HVAC system with direct refrigerant expansion, comparing with submitted product with traditional HVAC system.

This document offers a brief summary of the LCA study.

## Approach & Data

The LCA, compliant with ISO 14040 and ISO 14044, was conducted by ALEA Design (a spin-off of Università di Modena e Reggio Emilia) and verified by TETIS Institute SRL (a University of Genova spin-off). Data collected cover input and output flows for materials, transport, energy, products, and emissions. Data quality assessed based on parameters like age, reference technology, process, calculation methods, and measurement irregularities. Data categorized as specific (from surveys or literature), selected generic (from databases), and proxy (estimates and averages). Specific data used for most processes, with generic data from Ecoinvent v.3.9 for raw materials, fuels, and electricity production. Transport modeled based on means and distances, using SimaPro 9.5 for the study.

## Functional Unit

The functional unit is defined as 1 year of use for the whole system, with the system function applied in the yachting field.

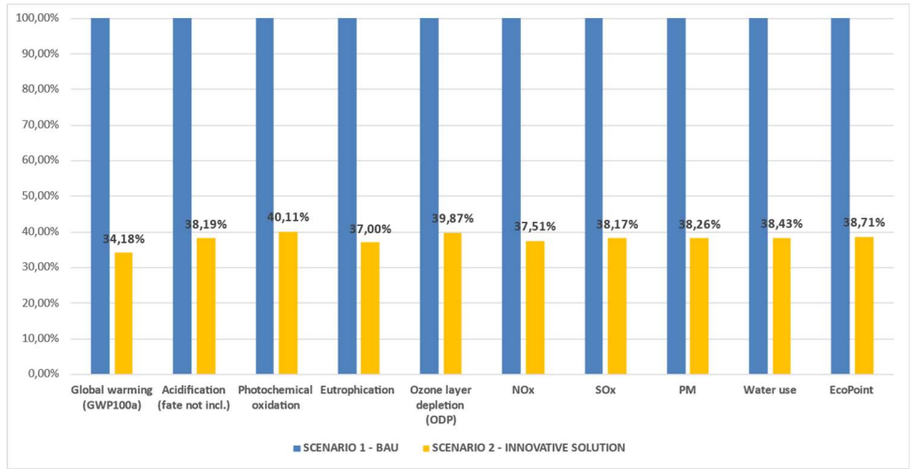
## System Boundary

Divided into three phases: Upstream processes (from cradle to gate), Core processes (manufacturing from gate to gate), and Downstream processes (from gate to grave). No allocation procedure performed, as Termodinamica provided all data regarding system production.

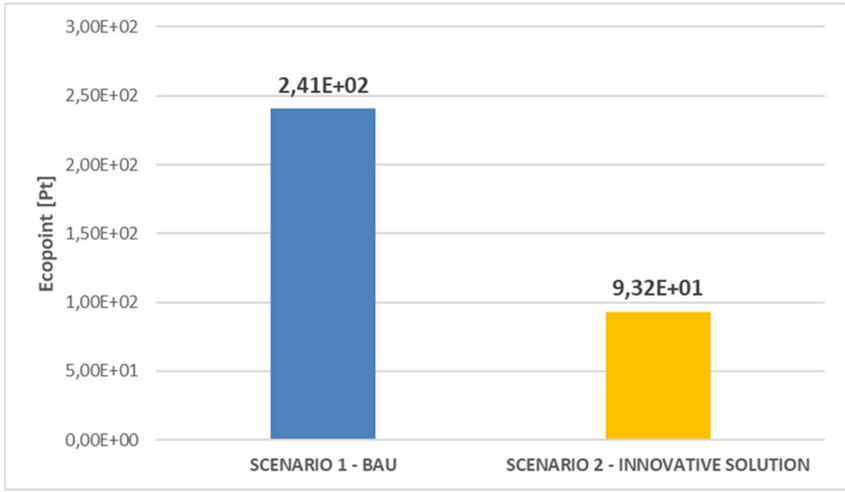
## Conclusions

The comparative LCA study, show how scenario 2 – Yacht using TERMODINAMICA HVAC system, leads to a considerable reduction in all the impact categories analysed. Innovative solution shows a reduction in the indicators ranging from 59,89% to 65,82% for all environmental indicators.

## LCA Impact Category Results (Business-As-Usual vs Termodinamica Innovation)




Comparison between the results of the Scenario 1- Yacht with traditional HVAC system (BAU) and Scenario 2- Yacht with innovative HVAC system (Innovative Solution). The results are expressed in percentage.




Summary of the single score (Ecopoint) assessed scenarios. Scenario 1 is business as usual (yacht with traditional HVAC system), and scenario 2 is the innovative solution (yacht with Termodinamica HVAC system). The higher the Ecopoint value, the higher the potential environmental impact.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