

THE COST OF BEING GREEN: INTEGRATING ENGINEERING AND FINANCE IN STRATEGIC FLEET MANAGEMENT

Giomaria Columbu^a, Carlo Alberto Magni^b, Davide Baschieri^c, Manuel Iori^d

^aIren Ambiente, Reggio Emilia, Italy, giomaria.columbu@gruppoiren.it

^bSchool of Doctorate E4E (Engineering for Economics - Economics for Engineering), University of Modena and Reggio Emilia, Italy, magni@unimore.it

^cGRAF Industries Spa, Modena, Italy, d.baschieri@grafspa.it

^dDepartment of Sciences and Methods for Engineering, University of Modena and Reggio Emilia, Italy, manuel.iori@unimore.it

Abstract

Our study delves into the intricate balance between sustainability and profitability in vehicle replacement. Focusing on Iren Ambiente's challenge of transitioning to eco-friendly fuel policies for waste vehicles, we present an integrated engineering-and-finance system consisting of a comprehensive engineering model encompassing 2,303 inputs classified into five areas: operating inputs, non-operating inputs, equity inputs, debt inputs, and market data. The engineering model processes the operating inputs across five distinct "green scenarios" and its outputs feed into a robust financial model, which employs the other inputs to assess economic profitability across the five green scenarios.

Our findings unveil a trade-off between environmental sustainability and economic value creation, encapsulated in the Net Value curve – a Pareto frontier combining Net Present Value (NPV), measuring economic value creation, and Net Green Value (NGV), quantifying CO2 emission reduction. This curve serves as an essential managerial tool for decision makers, illustrating the financial sacrifice required to enhance sustainability. Our NPV-to-NGV ratio unearths the "shadow" prices for one unit of CO2 reduction, offering a nuanced understanding of the financial sacrifice associated with each green scenario. Expanding our analysis to 21 scenarios confirms a strictly decreasing relation between NGV and NPV and reveals an increasing marginal rate of substitution between NPV and NGV.

In essence, our study provides valuable insights into navigating the delicate equilibrium between profitability and sustainability, indeed a crucial one for informed decision-making in strategic green fleet planning.

Keywords. Green mobility, financial modeling, integrated engineering and finance, vehicle replacement policies, environmental sustainability.