

Green energy transition in isolated grids: Assessing hybrid and energy storage solutions for Anafi island (Greece)

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Introduction

The dependence of the Non-Interconnected Islands (NII) on conventional oil power stations makes the cost of producing electricity much higher than the rest of the mainland. The present work aims to highlight this high cost in these islands as well as to study the green energy transition of one of them.

Methods

The program RETScreen was used for the analysis. This program is a free software that was created to evaluate the production of energy from potential projects with Renewable Energy Sources (RES), their cost and emissions. Two different scenarios are proposed for Anafi. The first combines wind, solar and conventional energy source and the second solar, storage system and conventional energy source.

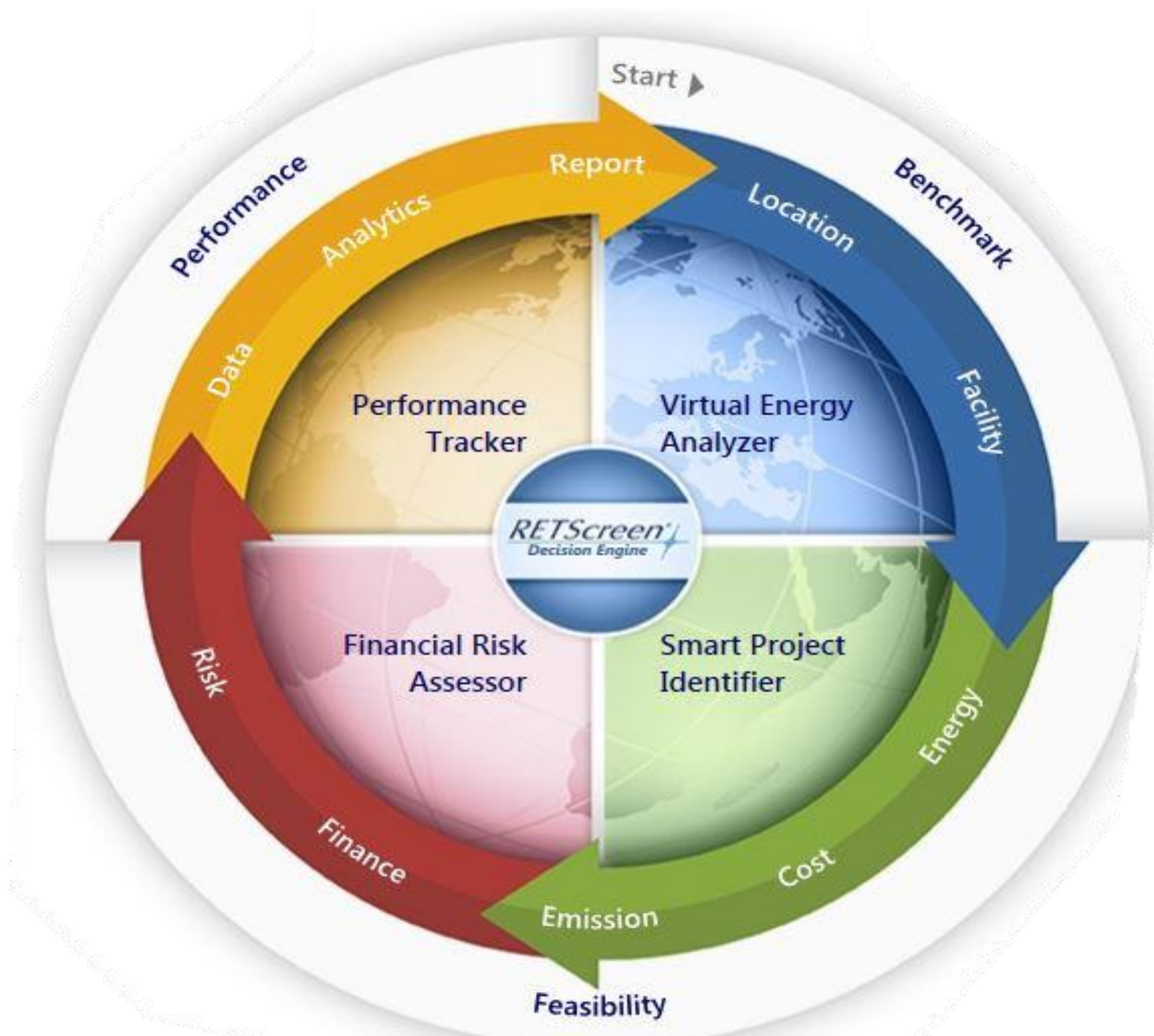


Fig.1. RETScreen

Results

RES Penetration

In the first proposed scenario the penetration from RES is approximately 90%, while in the second one is 68%.

CO₂ Emissions

Regarding the greenhouse gas emissions in the first scenario, there is a reduction of CO₂ of about 95%. By removing the wind energy and adding a battery storage system (Scenario 2), there is a drop of about 80% in CO₂.

Financial Analysis

In the first case (Fig. 2), it was estimated by the program that the initial cost is over 5.200.000€, and the savings start after the 6th year.

In the second case (Fig. 3), it was estimated by the program that the initial cost is over 5.600.000€ and the savings start after the 11th year, with larger revenue than the first one.

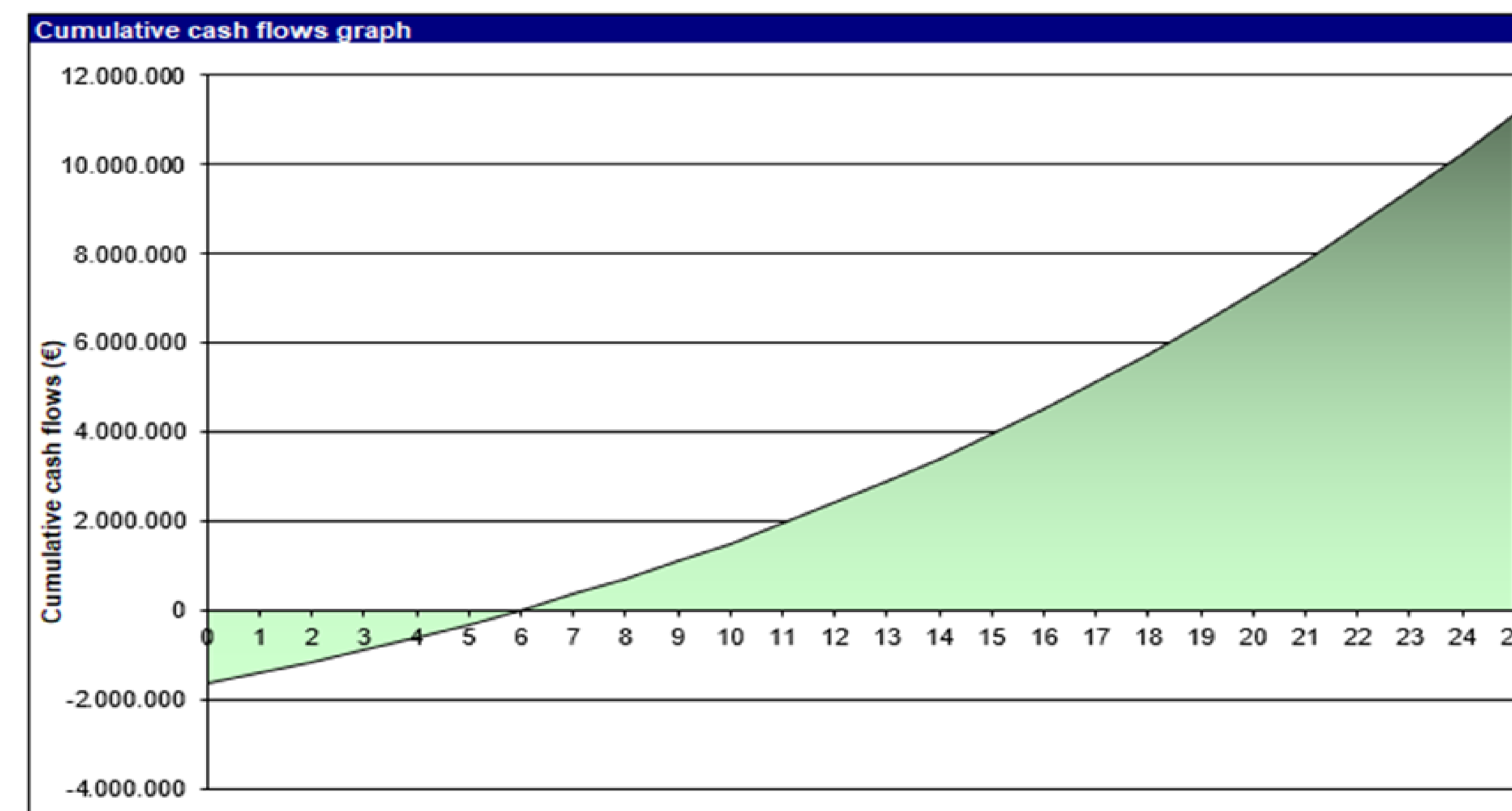


Fig.2. Financial Analysis for scenario 1

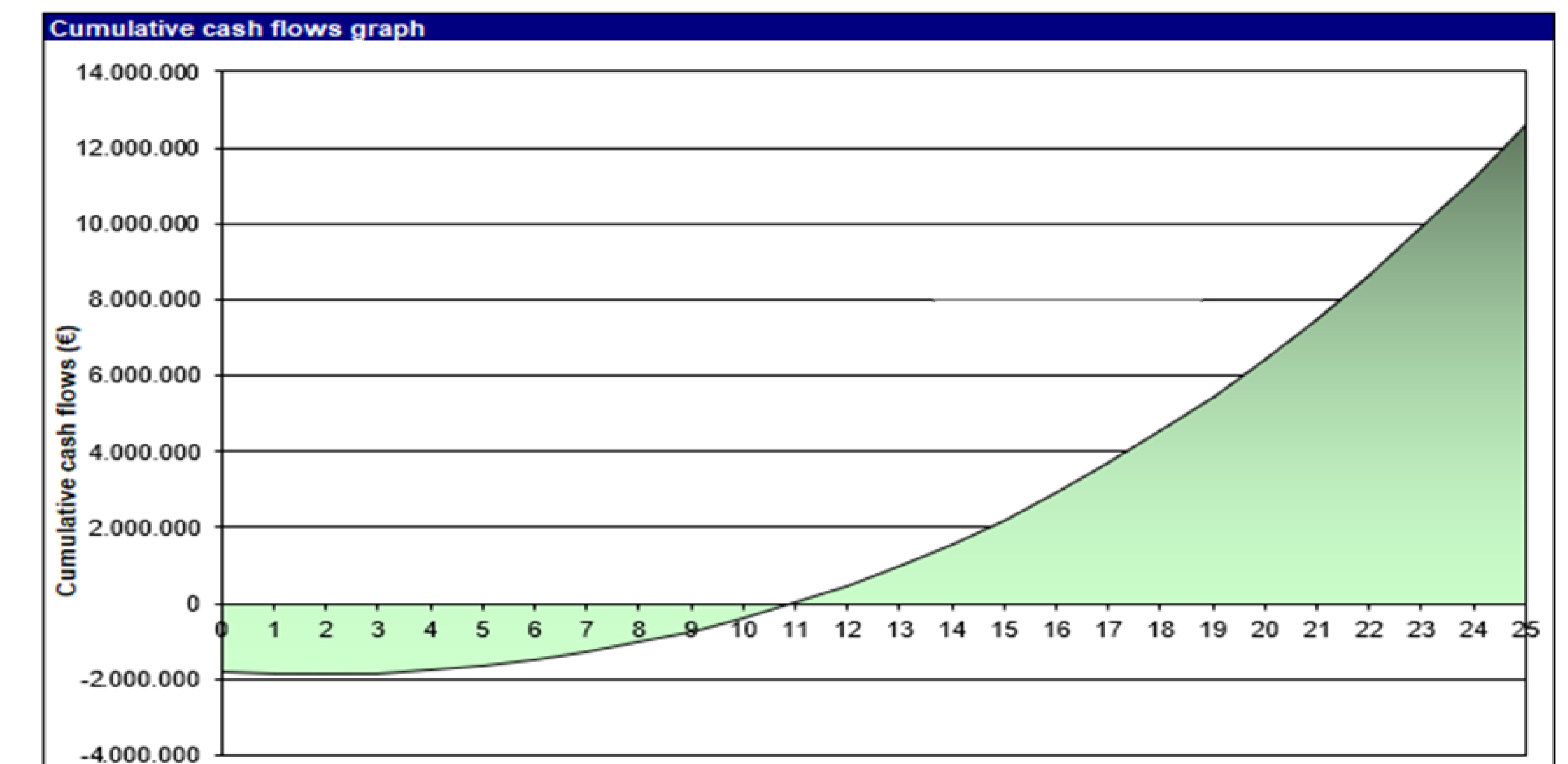


Fig.3. Financial Analysis for scenario 2

Conclusions

- This study demonstrates that in a small NII it is possible to create hybrid stations with penetration of RES that could exceed 90%, with the help of government programs and grants, through a relatively low self-financing,
- This will also lead to a reduction of the greenhouse gas emissions of such islands, as shown in both scenarios, and consequently to achieve the goals set at national and European level.
- From the sixth year onwards, there is the possibility of revenue that can be used for the maintenance of the island's project itself, as well as for the financing of new similar projects on other islands, in order to contribute to their own green energy transition.