

EFFICIENCY ASSESSMENT REPORT

CARWATT

CARWATT converts industrial and special vehicles into electric vehicles, using new or 2nd life batteries.

Solution ID: 10589
Company: CARWATT

Country: France
Export Date: 16.03.2020

ASSESSMENT RESULTS



APPROVED

FEASIBILITY

- Credibility of concept	YES
- Scalability	YES

ENVIRONMENT

- Environmental benefits	YES
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PROFITABILITY

- Client's economic incentive	YES
- Seller's profitability	YES

GENERAL COMMENTS FROM THE SOLAR IMPULSE FOUNDATION

The solution ID10589 is declared by the Solar Impulse Foundation as labelled Solar Impulse Efficient Solution after going through the following selection steps :

- It is falling into the eligibility scope in terms of (1) Minimum Maturity and (2) Type of solution. Moreover, the solution is owned and developed by an entity Member of the World Alliance that is operating in accordance with the Solar Impulse Foundation's ethical position.
- The Solution Submission Form was assessed by six independent Experts with at least five years of Experience in one of the sectors of application of the Solution and valid and coherent answers with justifications were collected enabling the deliberation of a majority opinion on each of the five criteria.
- Based on Experts' deliverables, the Solar Impulse Team concluded that the Solution's assessments had been satisfactory and that the five criteria obtained a majority of "YES".
- After a final verification performed by Solar Impulse Team representatives, the validity of the assessment performed and the requirements for the five criteria were confirmed, resulting in the solution being awarded the Solar Impulse Efficient Solution Label.

FEASIBILITY

The Feasibility section is aimed at determining the technical viability of the idea behind the Solution, such as ensuring a Solution is feasible in the real world. This section is composed of two criteria and it considers: the technical requirements of the proposed Solution and captures its ability to be credible based on a resilient technology or concept (**Criterion 1**) and its potential to be technically scaled up and deployed in the real world (vs. in a laboratory environment) without additional constraints (**Criterion 2**).

EXPERTS REVIEWS

CRITERION 1 - CREDIBILITY OF CONCEPT

Can the technology behind the Solution be constructed and operated as designed?

YES

First Expert justification - The Solution is based on new or reconditioned Li-ion batteries, off-the-shelf electric motors, and customized systems (power train and battery packaging and battery management system - BMS). All of these building blocks are available since more than a decade and make the concept of retrofitting ICE engines with an electric engine+battery a credible concept

YES

Second Expert justification - Electric power trains are proven technology. Application of this via retrofitting on vehicles with the team's expertise is very much implementable. The target segment where this solution is applied is also very focussed and hence it is credible and operable.

YES

Third Expert justification - The solutions is relatively straight forward because it uses mainly of the shelves products that can be acquired from multiple vendors, such as battery pack and electric engines. The integration with the vehicle electronics cam be a bit more complicated. The solution could be not possible if the vehicle specs (size, needed range, power) and or the operating environment (temp, humidity, dust etc) causes problems for such a solution. The concept is credible.

CRITERION 2 – SCALABILITY

Is the manufacturing (if a product) or distribution (if a service) of the Solution at scale technically feasible?

YES

First Expert justification - The manufacturing at a scale of the solution (starting from Belt Loader retrofit) around the world is technically feasible. Batteries, motors, and other components can be easily sourced locally or transported, the same for the power train redesign. The system design scalability is feasible as well, it is driven by the availability of skills to grow the team and design processes.

YES

Second Expert justification - The solution offered is repetitive in nature. For example, one target segment is Airport ground support equipment such as loaders, pushers etc., Once done on one vehicle, the process can be copied and replicable in that segment. Hence, Scaling up is not an issue.

No

Third Expert justification - The product is actually also very much a service. A large amount of dedicated engineering man hour has to be done to retrofit the battery pack per vehicle. Many different vehicles types with different specifications and operating circumstances will hamper a fast roll out. A large and scalable roll out will require a large number of staff to be

involved. This a real challenge. Similar electrification retrofit businesses have faced similar challenges and have not succeeded.

ENVIRONMENTAL IMPACT

The **Environmental Impact section** is aimed at determining the impact of the Solution at the different phases of its lifetime: production, transportation and distribution, as well as use and disposal phase.

This section is composed of one criterion and it considers: the potential to enable a direct positive impact (**Criterion 3**) on the environment compared to the mainstream alternative identified – referring to the scope of the following elements: Energy use, CO2 emissions, Water use/materials use, Air quality, Ecosystem preservation.

EXPERTS REVIEWS

CRITERION 3 - ENVIRONMENTAL BENEFITS

Can the Solution deliver an incremental environmental benefit versus a mainstream alternative, considering the lifecycle (production, use and disposal stages) of its value chain?

YES

First Expert justification - The solution delivers environmental benefit versus the mainstream alternative (Diesel-powered belt loader to start) in terms of (i) extending the life cycle of Li-ion batteries to its total usable life of 20 years, (ii) removing from the diesel engine from the road straight away (that would potentially otherwise still create 3T/ Year per vehicle in another airport), and most importantly (iii) enabling zero CO2 emission by retrofitting with electric engine and batteries (this only would approximately save 3T/Year per vehicle)

YES

Second Expert justification - The fundamental of this solution is giving 2nd life to batteries which otherwise need to be disposed of. Secondly, converting a fossil fuel-driven vehicle with an electric power train reduces the carbon footprint (about 3T of Co2 /vehicle/year). Third but not least is the massive reduction in sound pollution which improves the overall workplace productivity and reduces employee fatigue.

YES

Third Expert justification - Replacing combustion engines with electric engines is a clear method to reduce decentralized pollution. Furthermore, it can improve the local air quality, reduces noise pollution. Reduce maintenance cost and materials also have a positive effect on the environment.

PROFITABILITY

The **Profitability section** is aimed at determining the capacity of a Solution to deliver an economic incentive for the client, as well as to generate profits for the seller in a short term. This section is composed of two criteria and it considers: The capacity of a Solution to deliver an economic incentive (direct, indirect, or hidden economic savings) for the client (**Criterion 4**) compared to the mainstream alternative and the capacity of the Solution to generate profits for the seller (**Criterion 5**) in the short term, regardless of the marketing strategy and the novelty of the product.

EXPERTS REVIEWS

CRITERION 4 - CLIENT'S ECONOMIC INCENTIVE

Is the total cost of ownership of the Solution lower (or same) compared to the mainstream alternative? Please evaluate this considering potential hidden benefits for society, and foreseeable regulatory changes within 5 years.

YES

First Expert justification - Updating a fleet with Electrical vehicles can be expensive to set up when compared to existing ICE vehicles. However, the innovation can provide economic incentives to the client by (i) reducing the initial investment to 5k-20kEUR per vehicle, (ii) extending between the 60 and 100% the usable life of the vehicle, (iii) reduce fuel and maintenance costs. In summary, the solution can provide clients' economic incentives both in terms of initial spending and return on investment.

YES

Second Expert justification - The upfront cost is 1/3rd to 1/4th of the market alternatives. This is a direct economic benefit. Secondly, it enhances the life of the equipment by extending its usage as an electric power drive. Third, it reduces workplace noise and enhances employee workplace environment which is good for client.

YES

Third Expert justification - The clients incentive is mainly driven by the reduction of fuel cost, reduction of noise and clean air/ less CO2. This will help will the sustainability targets or airport. As long as the pricing provide by the founder is correct (euro 240k for 12 belt loaders) and it didn't hav a significant "first client" discount, reasonable pay backs can be achieved. In Europe, pay back under 5/6 years seem acceptable, Middle East and Asia require faster payback periods. can image there would also be reduction in operational cost.

CRITERION 5 - SELLER'S PROFITABILITY

Could the Solution itself be profitable for the seller within 5 years, with a sale's price at which clients would buy it? Please evaluate this regardless of the marketing strategy and the novelty of the product.

YES

First Expert justification - The target of retrofitting at least 1100 vehicles in the next 3 years to generate a profit seems reasonable, also considering that the company is working on a pilot project in Paris CDG airport in 2019 and has secured a project in Nice in 2020. The Innovator has already identified clients in the airport industry willing to buy at that price range; this increases the solution potential to be profitable in the next 5 years.

YES

Second Expert justification - Seller at current sales of 500K and projected sales of 12 mil by 2022 is profitable. The volume drives the profitability of this solution. As the electric power train is picking up momentum, the availability of 2nd life batteries also increases and CARWATT has a bargaining power to lower their costs and improves profitability.

YES

Third Expert justification - Reduction in battery systems, more engineering experience will increase the profitability. As long as the market segment sought after will have a decent pay back period, acceptable pricing can be asked for. Outsourcing the engineering to - for instance- Eastern European countries could help

The information set out above, is solely for the purposes of information and the Solar Impulse Foundation does not provide any guarantee as to its authenticity, completeness or accuracy. This information is the direct outcome of the assessment performed by external non-remunerated experts that volunteered to review your solution submission form following the application of the Efficiency Assessment Process of the Solar Impulse Efficient Solution Label Standards. This information is shared to you as it might be of value for you to get the feedback provided on your application – regardless of the outcome of the general selection process.

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