

# Grant Proposal Sample

**Executive Summary**

**Title of Project**

The technical feasibility of a multipurpose electrical vehicle propulsion system

**Objectives**

Identification of the propulsion system configuration that will have the best technical feasibility and determining the technical feasibility of producing the selected propulsion system.

**Which aspects of the project are new/unique?**

Formulating the design requirements for a multi-purpose propulsion system. Determining the best configuration for a multi-purpose propulsion system.

**What are the expected findings?**

Whether producing an electrical propulsion system that is suitable for multiple applications, will be feasible or not.

**What value do the results have?**

To determine whether the expenses involved in a study of the economical viability should be incurred.

**What contributions have/will other students made/make?**

A previous student investigated the state of currently available battery technology.

**Which aspects of the project will carry on after completion?**

The economical viability of the chosen configuration will be explored.

**What are the expected advantages of continuation?**

To be ready to enter the electrical vehicle market at the right moment.

**What arrangements have been made to expedite continuation?**

The chosen configuration has to be defined in sufficient detail that the production demands and marketing potential can be determined.

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1. **Introduction**

There is growing interest in electrical vehicles due to increased concern about climate change. Many companies already market electrical vehicles. Future increases in the price of crude oil will lead to marked increases in the price of petrol and diesel. Although electricity cost has increased significantly in recent years, electricity still remains an economically attractive energy source for vehicles. Further, there have been significant advances in battery technology over the last decade, while internal combustion engines still have shorter life spans and higher maintenance costs than electrical motors. These factors can result in electrical vehicles being able to compete on a lifetime cost basis with petrol and diesel vehicles.

The project proposed here is a technical feasibility study of a propulsion system that will be suitable for a range of electrical motor vehicle applications. Economic considerations will play an obvious part in the study, but the primary focus of this study is the technical aspects. This project, which Mr HAR de Worker is doing as part of Mechanical Project 448, stems from a proposal by Dr MY Lecturer and builds upon a project by Formerstudent [1993]. The work forms part of a bigger project aimed at the application of renewable energy and is funded by GreenEnergy Ltd.

This document explains the project's objectives, motivation and planning. The steps that are planned in this study, as well as the expected costs and time scales for the study, are also outlined.

1. **Objectives**

As mentioned above, this project is aimed at determining the technical feasibility of a multi-purpose electrical vehicle propulsion system. The objectives of the project are therefore:

1. Identifying the propulSsion system configuration that will have the best technical feasibility.
2. Proof of the technical feasibility of producing the chosen propulsion system.
3. **Motivation**

Since production volumes in South Africa’s vehicle market are fairly small, the economic viability of an electrical vehicle will be increased significantly by using the same electrical propulsion system (battery, electrical distribution, propulsion and control) for a number of different vehicles. One would expect that the body and interior of an electrical vehicle would not differ much from that of a conventional vehicle. It is therefore not deemed necessary to include that in this study.

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The Department of Mechanical and Mechatronic Engineering, in conjunction with the Department of Electrical and Electronic Engineering, has a wide ranging expertise that will be used in this study. These fields of expertise include: the mechanical requirements that a propulsion system should comply with, the development and application of the electrical subsystems, and the development and utilisation of sophisticated electronic control systems.

1. **Planned Activities**

The following activities are anticipated for the execution of the project. The costs and time scales associated with each activity are given in Table 1 and Figure 1 respectively.

1. **Literature Study**

Study the literature on electrical vehicle propulsion to determine the current level of technology and to identify existing propulsion systems.

1. **Identify Compatible Applications**

Investigate possible/probable applications of electrical propulsion systems. Determine the categories of applications (from the perspective of the demands placed on the propulsion system). Determine which applications will be suitable for a multi-purpose propulsion system.

1. **Compile Design Requirements**

Determine the requirements for the propulsion system to be suitable for the chosen combination of applications. Compile a list of the evaluation criteria to be used to compare the different concepts. The whole life cycle of the propulsion system will be considered, including development and testing, manufacturing, operation, support and disposal.

1. **Investigate Concepts for the Propulsion System**

Formulate a set of concepts for the propulsion system based on these ideas, as well as the information gained from the literature study. Investigate each concept using simple analyses to determine the extent to which it meets the criteria set in Activity 4.3. Compile a shortlist of the most promising concepts on these grounds.

1. **Simulate the Most Promising Concepts**

Investigate the shortlisted concepts in detail. Develop a vehicle dynamic simulation of each concept to determine quantitatively the extent to which it meets the design requirements.

1. **Preferred Concept Selection**

Use the information gained from the previous activity to make a fully motivated choice of the most suitable concept(s). Throughout, the whole life

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cycle of the propulsion system will be considered, including development and testing, manufacturing, operation, support and disposal.

1. **Design Review**

Present the findings of the preceding activities to the client and technical advisors to obtain their approval for the selected concept.

1. **Demonstration Model Detail Design**

Design a model propulsion system where the core elements of the simulation are represented. The model will be suitable to verify the main results of the simulation. Plan the test procedure that will be used.

1. **Demonstration Model Manufacturing**

Have the model manufactured by MMW, and supervise the manufacturing.

1. **Demonstration Model Testing**

Instrument and test the demonstration model. Process the test results and compare it with the results from the simulation.

1. **Final Report**

Document the whole investigation, including the preparatory study, the investigative procedures and the results obtained in each activity. Make a recommendation regarding the technical feasibility of a multi-purpose electrical vehicle propulsion system.

1. **Conclusions**

Electrical vehicles are increasingly gaining attention and the propulsion system is a determining factor in the performance and production cost of such a vehicle. The proposed project will identify the best propulsion system for these vehicles, and will investigate the technical feasibility of producing such a propulsion system. The results from the investigation will be verified by tests on a demonstration model. This will provide the basis for decision regarding further development and funding in electric propulsion systems.

The project team has at its disposal all the expertise required to successfully complete the project. The expected total costs are R232 700, of which R5 000 is for capital expenditure. The expected duration is 8 months.

1. **References**

Formerstudent, A, 1993, "Investigation into Electrical Vehicle Substructure", Mechanical Project 478 Final Report, Department Mechanical and Mechatronic Engineering, Stellenbosch University.

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**Table 1: Estimated Cost per Activity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **Engineering Time** | **Running** | **Facility** | **Capital** | **MMW** |  | **MMW** | **TOTAL** |
|  |  |  | **Costs** | **Use** | **Costs** |  |  |  |  |  |
|  |  |  | **Labour** | **Material** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **hr** | **R** | **R** | **R** | **R** | **hr** |  | **R** | **R** | **R** |
|  |  |  |  |  |  |  |  |  |  |  |
| Literature study | 25 | 8750 | 500 |  |  |  |  |  |  | 9250 |
|  |  |  |  |  |  |  |  |  |  |  |
| Identify | 25 | 8750 |  |  |  |  |  |  |  | 8750 |
| Compatible |  |  |  |  |  |  |  |  |  |  |
| Applications |  |  |  |  |  |  |  |  |  |  |
| Compile Design | 25 | 8750 |  |  |  |  |  |  |  | 8750 |
| Requirements |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Investigate | 70 | 24500 | 100 | 100 |  |  |  |  |  | 24700 |
| Concepts for the |  |  |  |  |  |  |  |  |  |  |
| Propulsion System |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Simulate the Most | 100 | 35000 | 150 | 1000 |  |  |  |  |  | 36150 |
| Promising Concepts |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Preferred Concept | 10 | 3500 |  |  |  |  |  |  |  | 3500 |
| Selection |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Design Review | 5 | 1750 | 500 | 500 |  |  |  |  |  | 2750 |
|  |  |  |  |  |  |  |  |  |  |  |
| Demonstration | 100 | 35000 | 50 | 200 |  | 5 |  | 1250 |  | 36500 |
| Model Detail Design |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Demonstration | 20 | 7000 | 10000 |  |  | 120 |  | 30000 | 10000 | 57000 |
| Model |  |  |  |  |  |  |  |  |  |  |
| Manufacturing |  |  |  |  |  |  |  |  |  |  |
| Demonstration | 50 | 17500 | 500 | 1000 | 5000 | 15 |  | 3750 |  | 27750 |
| Model Testing |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Final Report | 50 | 17500 | 100 |  |  |  |  |  |  | 17600 |
|  |  |  |  |  |  |  |  |  |  |  |
| **TOTAL** | 480 | 168000 | 11900 | 2800 | 5000 | 140 |  | 35000 | 10000 | 232700 |
|  |  |  |  |  |  |  |  |  |  |  |

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**Figure 1: Gantt Chart for Electrical Vehicle Propulsion Investigation**

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