

**INVESTIGATION OF POWER PRODUCED FROM TURBOCHARGER  
IN VEHICLE**

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**I admit that have read this report and to my opinion this report fulfill in terms of scope and quality from the bachelor of mechanical engineering (design and innovation)**

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This report is submitted in partial fulfillment of the requirements for the Bachelor of  
Mechanical Engineering (Design & Innovation)

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April 2009

**hereby declared that this project report has written by me and is my own effort  
and that no part has been plagiarized without citation**

**Signature** :  
**Name of writer** :  
**Date** :

## **DEDICATION**

**I would like to thanks to all who helped me a lot during the making of this report, especially my parents En. Ab. Razak Bin Saad and Pn. Saeniah Bt Ahmad who give full support and not to forget,En. Safarudin who not stopping giving me guidance and taught me to be independent**

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## **ABSTRACT**

Nowadays, most of the vehicle around the world use Internal Combustion System engines. Internal Combustion System is an inefficient system for transportation because most of the energy that been burn from fuel are wasted to heat losses, mechanical losses and others. To recover the energy losses, a modified turbocharger system can be used to recycle the power by using alternator. The alternator will be moved by a modified turbine. The alternator will generate current to support car usage. The result after the system installed will be compared with the result after installing the turbine to see the suitability with the daily driven car. By understanding the systems, a recovery system can be designed to recover the energy losses from the engine and by generating current to recover the energy losses.

## ABSTRAK

Sekarang, kebanyakan kenderaan sekitar dunia menggunakan enjin-enjin Sistem Pembakaran Dalaman. Sistem Pembakaran Dalaman adalah sebuah sistem yang tidak cekap untuk pengangkutan kerana kebanyakan tenaga yang digunakan daripada bahan api hilang dalam bentuk haba hasil dari pembakaran, geseran yang terhasil daripada pergerakan mekanikal, dan untuk menampung kegunaan aksesori. Untuk mengitar semula kehilangan tenaga tersebut, satu sistem pengecas turbo yang telah diubahsuai boleh digunakan. Alternator akan digerakkan dengan sistem turbin yang telah diubahsuai. Alternator tersebut akan digunakan untuk menghasilkan tenaga elektrik untuk menampung kegunaan kereta. Keputusan sebelum akan dibandingkan dengan keputusan selepas turbin dipasangkan untuk melihat kesesuaian dengan kereta yang dipandu oleh pengguna. Dengan memahami sistem pembakaran dalaman ini, satu sistem untuk menampung kembali tenaga yang telah hilang. Dengan menampung semula dengan menggunakan kembali tenaga yang terhasil, dan dengan menghasilkan tenaga elektrik melalui alternator, kita dapat meningkatkan keberkesanan enjin, seterusnya kita sekaligus dapat menjimat minyak dan wang ringgit.



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**LIST OF SYMBOLS**

$W_b$  = *brake work of one revolution (J)*

$V_d$  = *displacement volume (m<sup>3</sup>)*

$N$  = *number of revolution per cycle*

$\dot{W}$  = *Power (W)*

$N$  = *Engine Speed (rev/s)*

$\tau$  = *Torque (N.m)*

$m_a$  = *mass of air (kg)*

$\dot{m}_a$  = *mass flow rate of air (kg/s)*

$m_{af}$  = *mass of fuel (kg)*

$\dot{m}_f$  = *mass flow rate of fuel (kg/s)*

## **CHAPTER I**

### **INTRODUCTION**

#### **1.0 Introduction**

Turbocharger is an air compressor mechanism which is used to force and increase the combustion rate in an engine. Turbocharger is used to increase air capacity which enters the engine chamber to produce more power. Turbochargers are widely applied by the car manufacturer nowadays as the turbo technology is the cheapest way to produce more power for the vehicle such as trucks, lorries, and cars.

#### **1.1 Project Background**

Nowadays, most of daily use cars use the Internal Combustion Systems engine. As we know, internal combustion engine system is not so efficient systems because the just around 20-25 percent of the power produced are used to move the car. The other 75 percent of the energy produced are wasted by heat produced, mechanical system friction such as gear, power train, and car accessories. For countering this problems a lot of new systems are developed such as turbocharger systems to increase the efficiency of an engine. For this project, an additional system will be experimented in order to recover the loss of energy from the engine. This system will be using alternator to produce

current to support the current alternator. This alternator will be powered by a turbine which is moved by the engine exhaust gas itself. This mean, that the wasted exhaust gas will be re-used to power the turbine.

## 1.2 Objectives

Objectives for this project is:

- a) To determine the power and torque produce by the turbine for turbochargers.
- b) To design a new system that recover energy losses from the engine.
- c) To design a new system to recycle the power produce to generate electricity for the car usage.
- d) To determine the car engine performance after applying the designed system were installed.

## 1.3 Scope

Scope for this project are:

- a) Determine the power produce and torque by specimen engines.
- b) Conduct experiment to determine the power and torque.
- c) Analyze and research the mechanism of turbochargers.
- d) Re-construct the turbine so it can be used to generate current.
- e) Designed a system to produce current from the turbine.
- f) Testing whether the system can be used or not.

## 1.4 Problem Statement

Nowadays, there are a lot of vehicles that used turbo to increase the power produce by the engine. If we look again into the turbo mechanism, it used wasted exhaust gas to move the turbine to compress the air into the engine. The daily used car will generate up to 50 kPa of pressure in the combustion chamber. This high pressure will produce extremely high velocity exhaust gases which are used to move the turbine in order for the turbo to operate. Based on this situation, we want to investigate how much power and torque will the turbine generate with such high velocity for turbo turbine. From that, we can reuse the excessive power generated by the turbine to produce current.

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## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.0 Literature Review**

This part explain about the literature review that have been done to guide the research in the future

#### **2.1 Introduction To Turbo**

A turbocharger, or turbo, is an air compressor used for forced-induction of an internal combustion engine. Like a supercharger, the purpose of a turbocharger is to increase the mass of air entering the engine to create more power. However, a turbocharger differs in that the compressor is powered by a turbine driven and turbo by the engine's own exhaust gases [1].

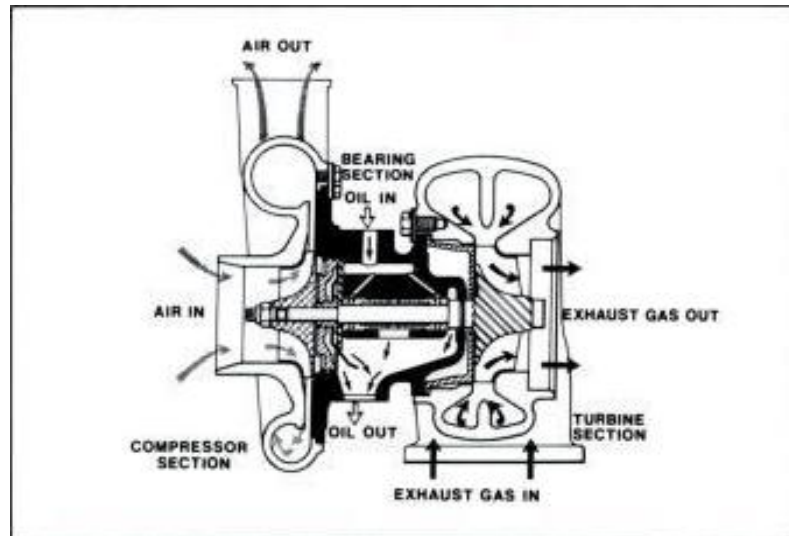


Figure 2.1: Cross-section of a turbo  
(Source: [www.google.com](http://www.google.com))

## 2.2 History of Turbo

The turbocharger was invented by Swiss engineer Alfred Büchi. His patent for a turbo charger was applied for use in 1905. Diesel ships and locomotives with turbochargers began appearing in the 1920s.

## 2.3 Turbochargers For Automotive

The first Turbo-Diesel truck was produced by the "Schweizer Maschinenfabrik Saurer" (Swiss Machine Works Saurer) 1938.