

## *The Prototype of Road Power Generator*

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The Asian Conference on Sustainability, Energy and the Environment 2014  
Official Conference Proceedings  
0158

### **Abstract**

This paper presents the prototype of Road Power Generator (RPG) to convert the compression force from the traffic into the electricity. The RPG consists of two main parts: the mechanical part and the generator part. The mechanical part comprises of three compartments: ramp-up plate, flat plate and ramp-down plate. A folded plate is embedded into the center of the flat plate with slope of slightly less than 26 degrees. It transfers the compression force to drive the generator. The generator part uses the evaporator motor as a generator. The RPG is tested by riding a motorcycle passing RPG. The RPG test is divided into two tests including no-load test and resistance load test. For no-load test, it was found that the induced voltage from a generator will increase when the weight increases. For load test, the motorcycle with a weight of 170 kilograms is riding pass along the RPG which connects the resistance load varying from 43 to 787ohms. The results showed that the RPG produces the maximum power of 10.98W at load 43ohms while the speed, the induced voltage, and the current are 489.33 RPM, 27.67V, and 0.397mA, respectively. In addition, the RPG produces a maximum voltage of 82V at load more than 579ohms and speed 522-535RPM.

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## **1. Introduction**

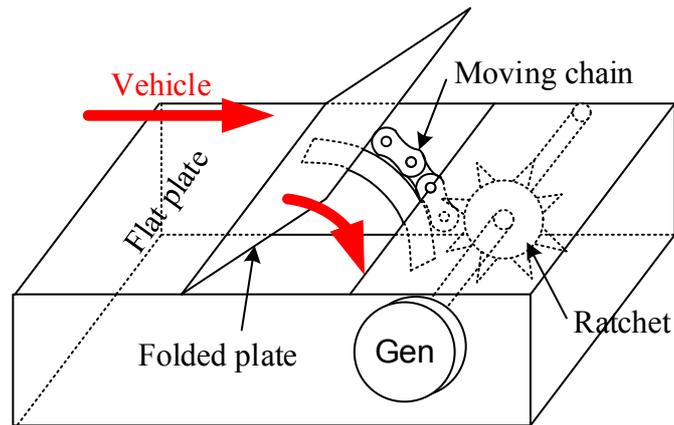
Nowadays, alternative energy has become an interesting topic for the researchers. The several alternative energies such as solar energy, wind energy, wave energy etc. have been developed for supporting the comfortable of the human life. The road power generator is the one of the alternative energy sources. The compression force could be taken from the vehicle traffic every places on the road. Therefore, the utilization of converting the compression force to the electrical energy plays an important role in determining an actual and acceptable performance.

Road Power Generator (RPG) is the device for converting the compression force from the traffic into the electricity. The apparatus for converting inertia of moving vehicles into power was discovered by Wiggins Earl B [1] since 1933. He provide the apparatus including a plurality of depressible plates interconnected with a series of links and levers arranged in such a manner as to impart rotation to a power take of shaft through passage of a motor vehicle or the like-over said plates. After that, various techniques of road power generator have been invented from many inventor [2-12]. The conversion techniques of compression force to electrical can be separated into two types including mechanical mechanism source and piezoelectric source. The mechanical mechanism source [1-9, 11-12] will use the mechanical mechanism received the compression force and then drive the shaft of generator while the piezoelectric source [10, 13] use the piezoelectric device for converting the compression force to electricity.

From the above mention, RPG is used and developed continuity. However, it is rarely to found in Thailand. So, this paper presents a road power generator prototype. The electrical power, voltage and current generations of a RPG were investigated. The paper will proceed as follows. In Section 1, the introduction of road power generator are proposed. The basic concept of RPG is explained in section 2. In Section 3, the road power generator system is mentioned. In Section 4, the system overview of road power generator experiment is provided. Section 5 describes the results of the research and includes a discussion of the experimental data. Finally, the summary of the paper are presented in Section 6.

## **2. Concept of Road Power Generator**

The RPG is a device capable of converting the compression force from the vehicle traffic into the electricity. The concept of road power generator can be shown in figure 1.



**Figure 1.** Basic concept of RPG

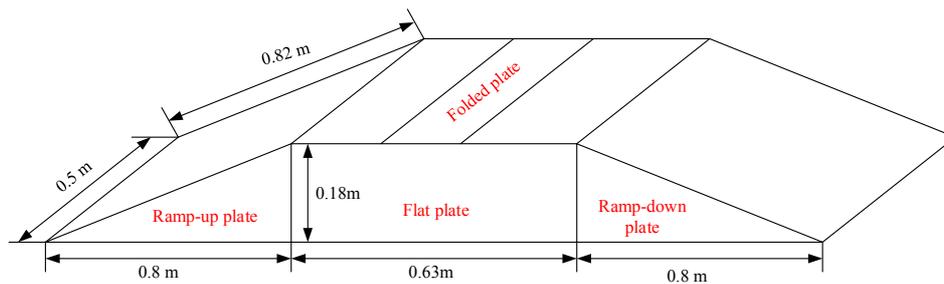
From the figure 1, if the motorcycle moves through along the RPG the folded plate will be pressed on the flat plate. Then, the moving chain drives the ratchet which attached on the spindle with generator too. Therefore, the generator can generate the electricity output to the connected load.

### 3. Road Power Generator

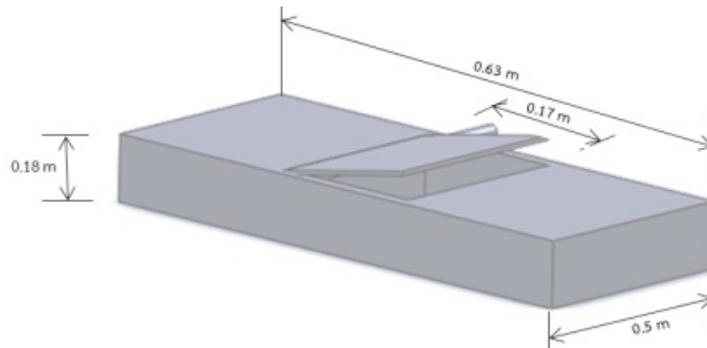
The RPG is a new device capable of converting the compression force from the vehicle traffic into the electricity. The device can be split into two parts including the mechanical part and the generator part.

#### 3.1 The Mechanical Part of RPG

The mechanical part consists of three compartments: ramp-up plate, flat plate and ramp-down plate as shown in figure 2. A folded plate is embedded into the centre of the flat plate with slope of slightly less than 26 degrees. It transfers the compression force to drive the generator. The size of the flat and folded plates are shown in figure 3.



**Figure 2.** Ramp-up plate, flat plate and ramp-down plate



**Figure 3.** Flat plate and folded plate

### 3.2 The Generator Part of RPG

The dc evaporator motor is used as a generator in RPG. The details of dc evaporator motor can be shown in figure 4.



**Figure 4.** DC evaporator generator



(a) Construction of RPG prototype



(b) Completely RPG



(c) Mechanism of RPG

**Figure 5.** Road Power Generator

## 4. Methodology

### 4.1 Equipment

The voltage, current and power generating from the RPG was measured by TRMS&POWER CLAMP METER (CHAUVIN ARNOUX F09). The speed of the generator was measured by CT1000S Hand-Held Tachometer.

### 4.2 Test Method

In this experiment, the YAMAHA fino is used as the motorcycle. The weight of the motorcycle is about 96 kilograms. The speed of the motorcycle is 10km/hr. The weight of the driver is varied from 45 – 75 kilograms. The RPG test can be divided into 2 parts, such as no load test and load test. The output voltage and speed of generator are measured for showing the relationship in no load test. While the output voltage, current and power of the generator are measured by varying the resistance load ( $R_{load}$ ) from 43 to 787 ohms. The experiment can be shown in figure 6.

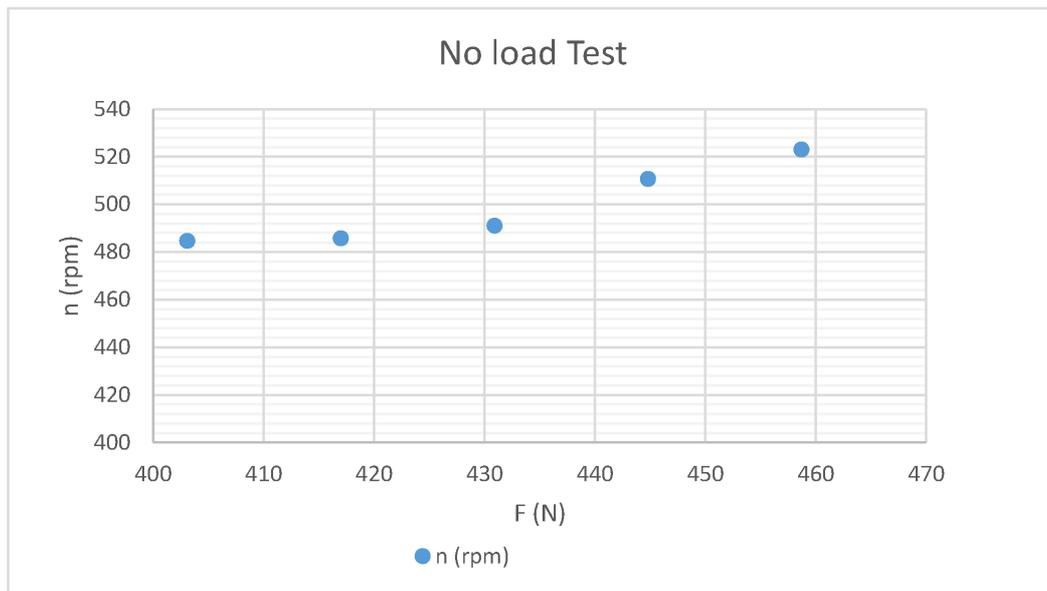


**Figure 6.** Test RPG by the motorcycle

## 5. Results and Discussions

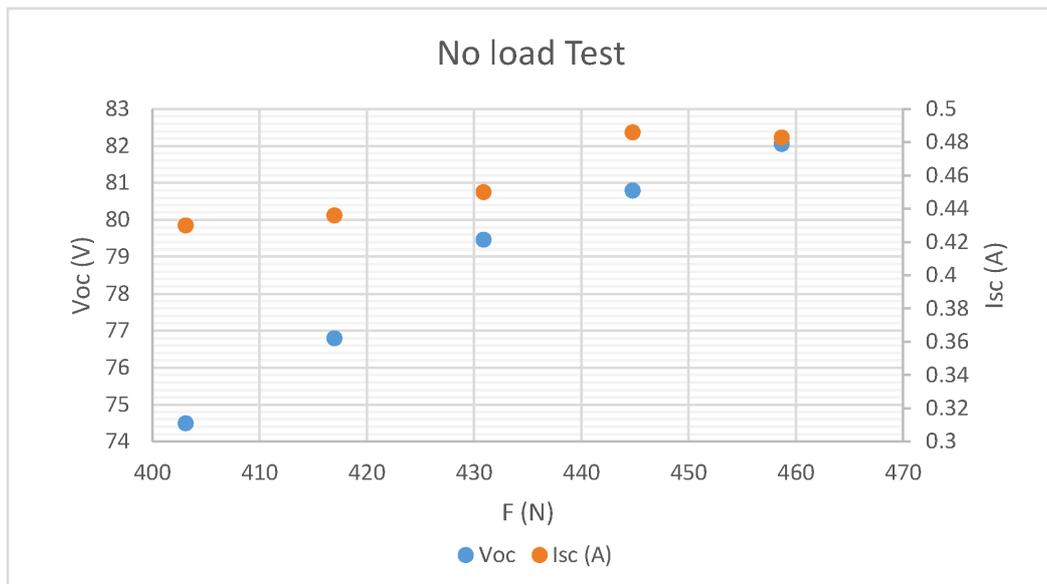
The RPG test is divided into two tests including no-load test and resistance load test. The result of RPG with no-load is shown in figure 7 - 8. Figure 9 - 10 show the result of the RPG with resistance load.

## 5.1 No-Load Test



**Figure 7.** The speed of a RPG versus different force with no load

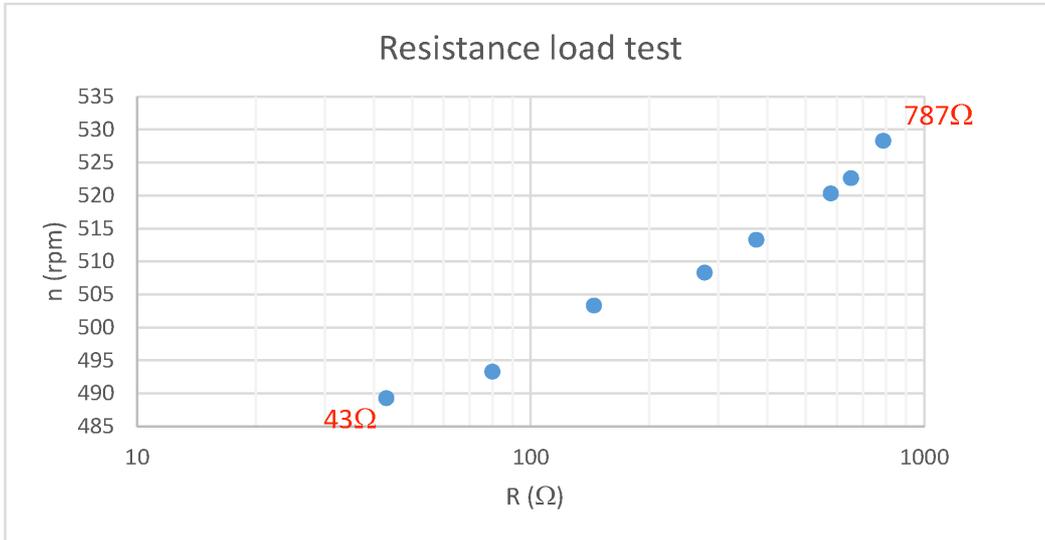
Figure 7 shows that if the compression force increases in the range of 400-430 rpm the speed increase slightly while the speed will increase about 10rpm as the compression force. Meanwhile, the open circuit voltage and the short circuit current will be increased as speed increases as shown in figure 8. The maximum open circuit voltage of 82V and the maximum short circuit current of 0.49A were obtained from the compression force of 460N and 445N, respectively. The result implies that a RPG can produce the electricity when the compression force press on the folded plate.



**Figure 8.** The open circuit voltage and short circuit current of a RPG versus different force with no load

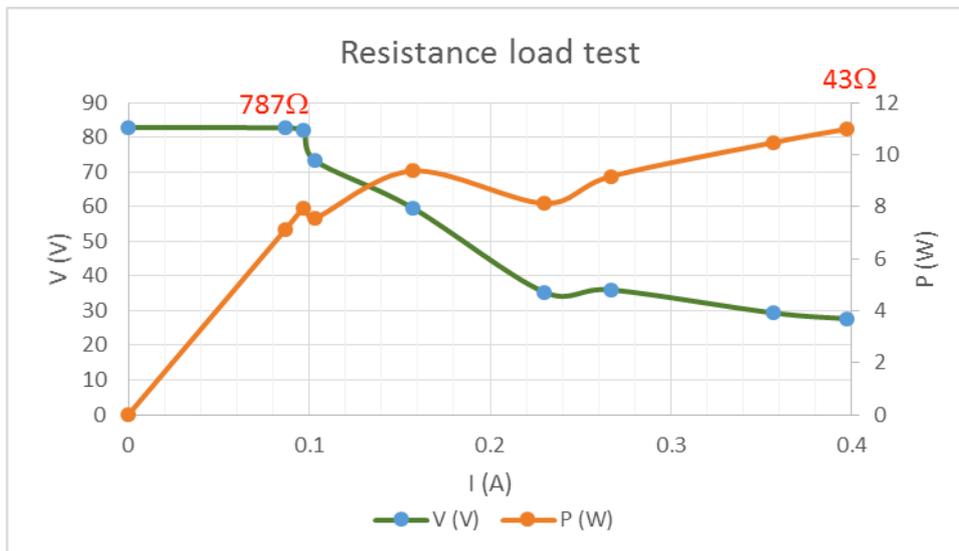
## 5.2 Load Test

In this experiment, the motorcycle is fixed at 170 kilograms. The speed of the motorcycle is 10km/hr. It was found that if the resistance load is lower, the speed of the generator will be also lower obtained as shown in figure 9.



**Figure 9.** The speed of a RPG versus resistance load (from 43 to 787 ohms)

Figure 10 shows the measured voltage and power of a RPG versus current with resistance load. The results show that the maximum voltage of the RPG is about 83V at no load. The maximum current (short circuit current) of the RPG is about 0.49A. The maximum power of the RPG is about 10.98W at 43 ohms.



**Figure 10.** The voltage and power of a RPG versus current with resistance load (from 43 to 787 ohms)

## **6. Conclusion**

This paper presents the prototype of Road Power Generator to convert the compression force from the traffic into the electricity. YAMAHA Fino is used as a test motorcycle which have weight about 96 kilograms. The speed of the motorcycle is 10 km/hr. The weight of the driver is varied from 45 – 75 kilograms. The RPG test is divided into two tests including no-load test and resistance load test. For no-load test, it was found that the speed of generator and the induced voltage from the generator will increase when the weight increases. For load test, the motorcycle with a weight of 170kilograms is riding pass along the RPG which connects the resistance load varying from 43 to 787ohms. The results showed that the RPG produces the maximum power of 10.98W at load 43ohms while the speed, the induced voltage, and the current are 489.33 RPM, 27.67V, and 0.397mA, respectively. In addition, the RPG produces a maximum voltage of 82V at load more than 579ohms and speed 522-535RPM.

## **7. Acknowledgment**

The author would like to thank Mr. Kritsana Kunsrithaiwong and Mr. Poravit Vaingveera for their help on the experiments.

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