Comparative Study of Wind Energy Utilization using Fans on Front and Rear Side of Automobile Vehicle

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Abstract— Now a days in four wheeler automobile, we need to distract the load on the engine by means of utilizing the renewable source of the energy by operating electrical equipment of the vehicle with the same. Most of the battery is utilized for human comfort in automobile. So in some scare area where the charging facility is not available then it creates the user helpless without charging. In today's world, the most reliable and most easily available source of energy, coal is deploying with increment in the human population and number of the users of the source. Thereby creating a huge leap between the source and the usage of the energy. Making a point on this stone issue we have dragged ourselves in the need of finding an option of the same for the future generation and the betterment of the world. This project includes the experimental comparison of wind generator on front and rear side of the vehicle. As we know that drag force plays a vital role in power generation. The experimental comparison is carried out for drag force and power generation on both the side of the vehicle. And how the drag force works when the fans assembly is to be attached at the front portion. The comparison will be made at various speed of vehicle.

Key words: Wind Energy, Renewable Energy Source, Series & Parallel Connection, Effects of Drag Force

I. INTRODUCTION

Electricity in India, is a big problem which is faced by people who reside in the country. Electricity is the form of energy, Electricity is a basic part of nature and it is one of our most widely used forms of energy. We get electricity, which is a secondary energy source, from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources. Before electricity generation began slightly over 100 years ago, we use kerosene lamps, and rooms were warmed by wood-burning or coal burning stoves. Direct current (DC) electricity had been used in arc lights for outdoor lighting. In the late-1800s, Nikola Tesla pioneered the generation, transmission, and use of alternating current (AC) electricity, which can be transmitted over much greater distances than direct current. Generating electricity by speed breakers is innovative and useful concept. Researches show that the world has already had its enough Shares of its energy resources. Fossil fuels pollute the environment. Nuclear energy requires careful handling of both raw as well as waste material. The focus now is shifting more and more towards the renewable sources of energy, which are essentially, non-polluting. Energy conservation is the cheapest new source of energy. The utilization of energy is an indication of the growth of a nation. One might conclude that to be materially rich and prosperous, a human being needs to consume more and more energy. And this paper is best source of energy that we get in day to day life. There are lot of way present to generate the electricity from the Automobile and use that energy into charging of the battery like use of Alternator and wind driven turbines etc.[1] N. S. H mapure, A B. Bachche have performed an experiment on the Wind Energy Utilization for Generation of Electricity on an Automobile. In this project wind energy and drag force is investigated to get fuel efficiency of an automobile by using experimental setup. [2] Dr. S.N. Singh has performed wind driven mobile charging of automobile battery. In this work Permanent Magnet, Synchronous Generator, Wind Energy, Pulse width modulation PWM etc. is used as input parameter and a constant current charging has been adopted during investigation in this method; pulses of constant current were supplied to the battery to get the fuel economy and alter the fossil fuel. [3] Michael Orlando Collier has investigated wind energy fan-turbine generator for electric and hybrid vehicle. In this, fans on the front side are being used and wind as the renewable energy source is used to calculate the power generation and to identify the economy by experimental setup. [4] Kenneth P. Glynn has done Vehicle with electricity generating, braking wind turbine. In this report power generation is being calculated by using fans on roof of the moving vehicle. [5] Cletus L. Taylor; Walter H. Mueller have performed Venturi effect charging system for automobile batteries. In this theoretical based research ventury effect is used to get the power output using turbine on the rear portion of the vehicle. [6] R. Dell Hull has performed Automobile with wind driven generator. In this paper work Author has evaluated economic power generation by performing an experiment on channelizing oncoming air. [7] Mario Pena has investigated Wind-powered battery charging system. In this work, getting better fuel economy and power generation, air duct is used in the vehicle to guide the wind in the proper manner.

II. THE EXPERIMENTAL SETUP

The experiment is being done on the Ahmedabad-Mehsana Highway straight to our college. We have made the circuit connection on the base of series and parallel path. For that we have used the SMPS fans, renewable energy source i.e. wind energy and multi-meter for conducting the output voltage and current. And for getting the following specifications of the fans we have used various electrical instruments. For assuring the fans precisions, we have tested them in the college laboratory with the help of tachometer

for detecting the RPM of the engine shaft, anemometer for measuring the wind speed. After that we have decided to take the readings on several range of speed starting from 20 kmph to 110 kmph. First on the way to college we managed to take the readings of series connection on front and rear side of the vehicle, while on returning to home, we managed to evaluate the output on the parallel circuits on the front and rear side of the vehicle. For making this project work we have used several instruments as well as material such as multi-meter, anemometer, tachometer and front and rear bumper of the Hyundai Santro car with the specifications of length*breadth = 520*150 mm. Acrylic plate for mounting of several plates (7 nos.) and screw and bolts fittings for attaching the plates with the bumpers. Wires for red and black for the connections to fans.

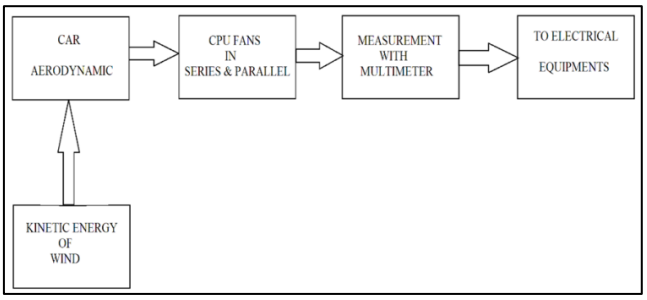

Fig. 1: Energy conversion chart

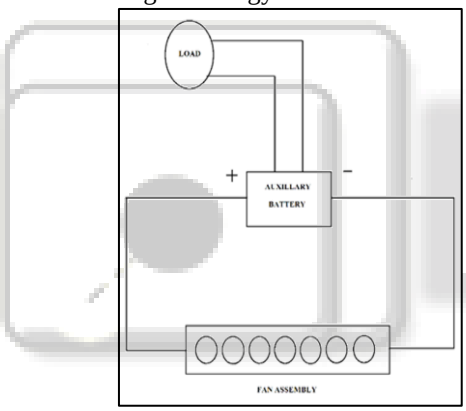

Fig. 2: Circuit diagram

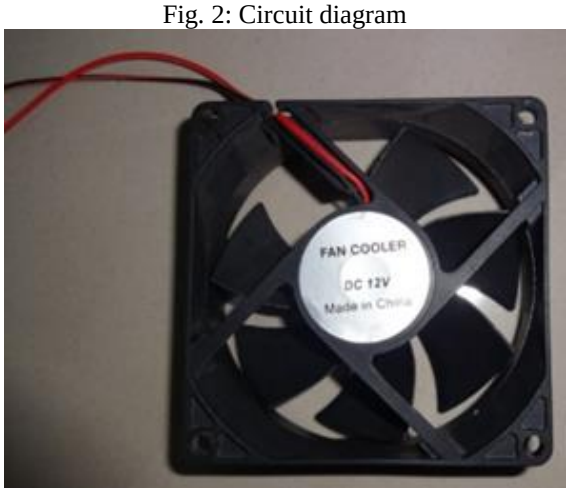

Fig. 3: SMPS fan (C.P.U. fan)

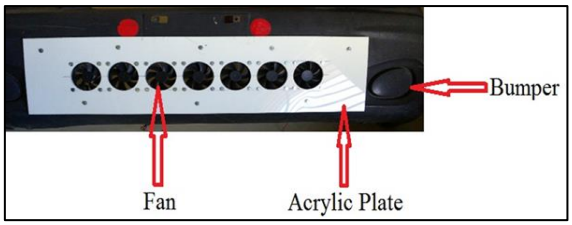

Fig. 4: front bumper assembly with attached fans

Fig. 5: actual view of the front bumper assembly

Fig. 6: actual view of the rear bumper assembly

Fan type	D.C. Brushless
Model	M802512M
Rating	7 Blades 12v DC 0.14A
Length	75 mm
Breadth	75 mm
Thickness	25 mm
Max. air pressure	6.9 mm of H2O
Max. air flow	1.66 m3/min.
Weight	60 Grams
Max. RPM	5000
Max. air velocity on the blades	110 kmph

Table1: specifications of fans

III. RESULT AND DISCUSSION

Our on wheels readings were taken on the Ahmedabad-Mehsana Highway with the speed ranging from 20 kmph to 110 kmph. And from deep assessment of the readings which were taken by the team, we came to know that when the fans are attached at the front portion of the vehicle, voltage is gradually increasing for both the parameters, series and parallel path. But it is also clear that the voltage output in the series connection is far greater than the output from the parallel path way. While comparing it with the current output, we can say that both the connection show gradual increment but parallel connection shows the noticeable increment over the series connection.

While considering the rear portion measurements, for voltage output series connection shows immense increment as compare to parallel connection. And same as for the current output shows greater increment in the parallel circuit as compare to the series connection.

After evaluating both the sides under various circumstances, we have compared the front portion output with the rear portion output. And we came to know that power output in the front portion is comparatively high than the power output in the rear portion of the vehicle. Moreover it is also the universal fact when any obstacles which can affect the frontal area of the vehicle by blocking the air, is known as the drag force. And here when the readings were taken at the front part of the vehicle, drag force has performed its role and has increased. But these readings were far greater than the rear readings.

A. Drag Force Calculation

$$R = 0.5\ C\ \rho\ A\ V^2$$

Where, R = Drag Force, ρ = Density of Air, V = Velocity of Wind, C = co-efficient of Drag (0.25 to 0.35) A = frontal area of the vehicle

Sr. no	Speed (kmph)	Series			Parallel		
		Voltage (V)	Current (A) (Rated 20m)	Power (W)	Voltage (V)	Current (A) (Rated 20 m)	Power (W)
1	20	8	0.08	0.64	1.93	0.1	0.193
2	30	15	0.11	1.65	2.89	0.15	0.4335
3	40	18.7	0.15	2.805	3.45	0.21	0.7245
4	50	29.2	0.17	4.964	5.98	0.26	1.5548
5	60	38.2	0.2	7.64	6.58	0.29	1.9082
6	70	40	0.22	8.8	7.45	0.37	2.7565
7	80	49.3	0.26	12.818	8.13	0.42	3.4146
8	90	64	0.29	18.56	9.49	0.47	4.4603
9	100	72.8	0.31	22.568	11.97	0.53	6.3441
10	110	84	0.34	28.56	13.09	0.58	7.5922

Table 2: Spread sheet for front readings

Spread sheet							
Sr. No	Speed (kmph)	Series			Parallel		
		Voltage (V)	Current(A) (Rated 20m)	Power (W)	Voltage (V)	Current(A) (Rated 20 m)	Power (W)
1	20	4.7	0.03	0.141	0.5	0.05	0.025
2	30	9	0.08	0.72	1.2	0.07	0.084
3	40	11.27	0.1	1.127	2.45	0.13	0.3185
4	50	17.03	0.14	2.3842	3.73	0.18	0.6714
5	60	22.8	0.17	3.876	4.1	0.23	0.943
6	70	29	0.21	6.09	6.45	0.29	1.8705
7	80	34.9	0.225	7.8525	7.6	0.35	2.66
8	90	41	0.28	11.48	8.49	0.43	3.6507
9	100	54	0.292	15.768	9.2	0.49	4.508
10	110	65	0.3	19.5	10.09	0.54	5.4486

Table 3: Spread sheet for rear readings

Sr. No	Speed (kmph)	Series			Parallel		
		Voltage (V)	Current (A) (Rated 20m)	Power (W)	Voltage (V)	Current (A) (Rated 20 m)	Power (W)
1	20	12.7	0.11	1.397	2.43	0.15	0.364
2	30	24	0.19	4.56	4.09	0.22	0.899
3	40	29.97	0.25	7.4925	5.9	0.34	2.006
4	50	46.23	0.31	14.991	9.71	0.44	4.272
5	60	61	0.37	22.57	10.68	0.52	5.553
6	70	69	0.43	29.67	13.9	0.66	9.174
7	80	84.2	0.485	40.837	15.73	0.77	12.112
8	90	105	0.57	59.85	17.98	0.9	16.182
9	100	126.8	0.602	76.333	21.17	1.02	21.593
10	110	149	0.64	95.36	23.18	1.12	25.961

Table 4: Spread sheet for front and rear combined readings

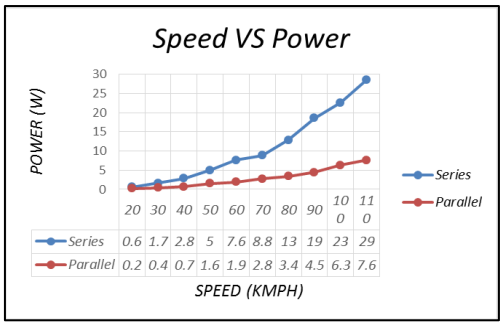

Fig. 7: front bumper readings

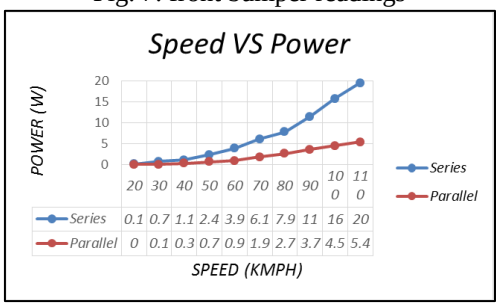

Fig. 8: rear bumper readings

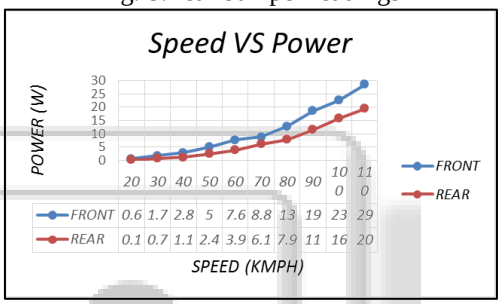

Fig. 9: comparison of front and rear bumper readings in series connection

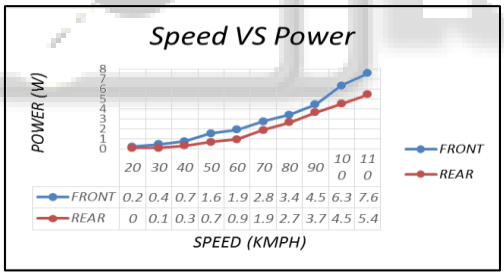

Fig. 10: comparison of front and rear bumper readings in parallel connection

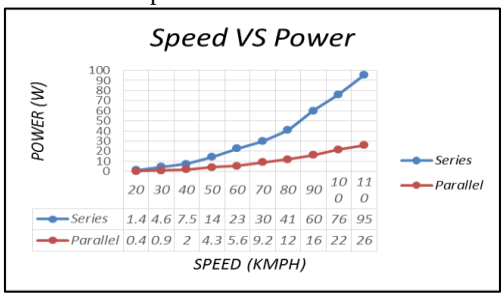

Fig. 11: front and rear bumper readings with combined power output

From the Fig. 7, it is clear that when the fans are attached at the front of the vehicle, with increment in speed power output is also increasing in both the situation weather it is series and parallel. In series connection, maximum power that we can get is 28.56W whereas in parallel we can get maximum output of 7.5922W.

From the Fig. 8, gradual increment we can see in series as well as parallel circuits when the fans assembly is attached at the back of the vehicle. In this Fig. power is generating more in series connection as compare to parallel connection. But it is not as good as the front bumper readings.

In this the maximum output is 19.5W which is generated in the series connection.

In Fig. 9 and 10, comparison of front and rear bumper readings is shown with series and parallel connections respectively. While in Fig. 11, combined readings are shown, by investigating it we can say that power output we can get more in series connections also when we are considering both the portions at a same time as compare to the parallel output. And we can have a good power in series of 95.36W which is again a good result from the renewable energy source when using proper instruments.

IV. Conclusion

The following points conclude the present research work:

1) Electricity generated by the SMPS fans in series/parallel circuits can be utilized in other electrical equipment of the car.
2) Power generation should be more on the front side as compare to the rear side.
3) On the bases of the above readings we can conclude that, for the purpose of the electrical equipment parallel and series connections can be used simultaneously.
4) Result shows that in series connections we can get more amount of the voltage whereas in the parallel circuits current output should be greater than that of the series connection.
5) In spite of the fans assembly at the front of the vehicle, drag force should affects the speed of the vehicle but it is also considerable advantage over some amount of the seed regulations that we can get the higher value of power generated at the front as compare to the rear side of the vehicle.

V. Future Scope

From the readings and the comparison between front and rear side of the vehicle, we can conclude that by applying a good ducting system to the rear portion we can increase the amount of power generation on the vehicle. The important field that we have studied is that by using bigger capacity of fans or by using more no. of fans we can increase the ampere.

Also with the help of the practical there is a vast opportunity in the direction of battery charging with the help of the transducers and the rectifiers/transformers. By means of proper design of front panel/plate on which the fans are fitted induced the drag and by proper aerodynamic panel design we can reduce that drag and induced the overall efficiency.

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