

The Pathway Of Future Production Hybrid Solar Vehicles In Iran

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Abstract: one of industries that have been focused by experts and industrialists is transportation and logistics industry. The present research analyzes, describes, and investigates evaluation factors according to experts' (professors at universities, university students, and employees in automotive industry) point of view in Shiraz city. To assume studied variables normality, single sample t-test was used and Friedman testing factors for ranking was used. According to experts point of view, effectiveness of technology factors was 3.06, technical factors was 2.84, financial-economic factors was 2.78, organizational factors was 2.52, and environmental factors was 3.79 on production of hybrid solar vehicles.

Index Terms: hybrid solar vehicles, renewable energies, solar energy.

1 INTRODUCTION

TODAY, technology is a golden key in business world and requisite of organizations and nations economic growth. Many years ago, people such as Joseph Schumpeter and Robert Solow proposed necessity of investment in usage and development of technology. In recent years, permeating greenhouse gases and dependency on natural fossil fuels has been changed into a serious global matter from another view. (Masayushi, 2009) It is noticeable that human will face with a great crisis in further future that one is environmental pollution made by consuming fossil fuels and another is incremental acceleration in ending up these resources. (Mobini Dehkordi, 2008) Discussion about energy consumption and development of resources alternation is considered as one of main principals of permanent development which has been focused a lot by developed countries in recent years. Therefore, hybrid vehicles technology development has been focused as a solution to remove challenges and problems such as climate changes, air pollutions, and non-dependency to fossil fuels in recent years.

2 NECESSITY OF PRODUCING HYBRID SOLAR VEHICLES

One of important industries that should go toward alternation with fossil fuels is automotive industry. Moving with vehicles both for human and goods is fully dependent on derivative fuels from oil; on the other hand, environmental problems and limitation in fossil fuels has been proposed as necessary problem simultaneously with incremental demand for transportation.

(Letendre, 2006) In near future, moving toward solar hybrid vehicles can be seen more than ever for the following reasons:

1. In spite of pollution reduction in classic vehicles, their pollutions are increasing for increase in number of vehicles.
2. Solar cells panels are incrementally evolving and their efficiency has been increased permanently. On the other hand, preparation and their production process are decreasing.
3. Cost of fuel production from fossil fuels is increasing. (Arsiyeh, 2008)

In addition, for users of personal vehicles, cases such as reduction in energy consumption, pure and cheap energy are so important. It seems that hybrid electric vehicles are one of the most promising technologies to reduce fuel consumptions and pollutants. (Jermain, 2003) Therefore, evolution of hybrid vehicles in past decade shows these vehicles usage is a realistic solution to reduce air pollution and also save energy consumption. (Arsiyeh, 2008)

3 HYBRID SOLAR VEHICLES

As generally, all vehicles made by combination of two or more driving force which are directly or indirectly dependent on power transfer system are called hybrid vehicles. Hybrid electric vehicles obtain their needed electric energy by photovoltaic cells. (Saeito, 1992) Advantages of hybrid electric cells can be referred as following:

- a) Possibility of break energy recovering to minimize energy loss and evaluates energy for slowing or stopping vehicle.
- b) These vehicles can be designed for average utilization state not maximum state which reduces engine volume greatly.
- c) It increases fuel yield (hybrid vehicles use less energy than ordinary vehicles.)
- d) It decreases pollutions greatly.
- e) Hybrid vehicles reduce dependency on fossil fuel significantly, because alternative fuels can be used in them.
- f) Very light materials are used to manufacture hybrid vehicles.

However, there are some confronting obstacles. One of the main obstacles in presence of plugin hybrid vehicles (connectable to network) in market is their using battery. Actually, one reason for hybrid vehicles being more expensive

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then vehicles with ordinary fuel is the used batteries in them. Studies in this field and removing the related problems can reduce costs of these vehicles significantly and improve their performance. Besides high costs of these batteries, non-full advancement of this technology, they are involved with technical problems. For example, limited capacity of energy storage in them and their relative low life can be mentioned. To cope with these problems and maturing this technology, it is necessary to investigate more proposals in this field that of course make a great fortune and universities and institutes alone can't support researchers.

5 METHODOLOGY

According to purposes of research, this is applied for purpose and it is descriptive-analytical according to its nature. Methodology of this research is descriptive and causal-comparative analysis. Since the purpose of this research is evaluating effectiveness factors on production of hybrid solar vehicles, this is surveying which describes and evaluate five technological, technical, economic and financial, organizational, and environmental factors on hybrid solar vehicles according to experts (professors of universities, students, employees in industries) point of view.

6 DESCRIPTIVE ANALYSIS OF DATA

Analysis descriptive variables of study including average, middle, standard deviation, skewness and kurtosis values shows that average of environmental factors is 4.00 with the highest value among variables. In the rest, medium value for this variable is 4.25 with the highest middle among variables. In the rest, standard deviation was calculated for the existed variables that shows technological factors with standard deviation of 0.83 has the least standard deviation. In other words, data dispersion of average is lower than other variables and organizational factors variables with standard deviation of 1.05 have the highest standard deviation. In other words, data dispersion than average is higher than other variables. In the rest, skewness of variables is shown and seems that variables with positive skewness are tended to right side and variables with negative skewness are tended to left side. As more variables' skewness is positive and negative, their skewness is more tended to right and left sides. Amongst, environmental factors with -1.16 has the most intended skewness to left and organizational factors has the least intended skewness to left side. In the rest, kurtosis made for variables shows that variables with positive kurtosis are more intended to upside and variables with negative kurtosis have more intended skewness to downside; in other words, their curve is flat. As curves kurtosis is more positive and negative, their kurtosis is more intended to upside, and downside and flat, respectively. Among variables, environmental factors with 0.99 value has the most kurtosis upside and organizational factors variable with kurtosis value of -0.69 has the most kurtosis downside.

Variable	average	middle	Standard deviation	skewness	Kurtosis
Technological factors	3.60	3.66	0.83	-0.41	0.02
Technical factors	3.46	3.57	0.93	-0.36	-0.31
Economic-financial factors	3.58	3.57	0.94	-0.80	0.60
Organizational factors	3.29	3.20	1.05	-0.17	-0.69
Environmental factors	4.00	4.25	1.00	-1.16	0.99

Table 1. Descriptive information results according to experts' point of view

7 INVESTIGATING DATA DEDUCTIVE STATISTICS

In order to analyze data and select the related tests, first normality of variables should be investigated, because if variables are normal, we will be permitted to use both parametric and non-parametric test. If variables aren't normal, we will just be permitted to use non-parametric tests. Kolmogorov-Smirnov (KS) test was used to investigate normality of variables. This test is used, when we want to check whether the mentioned data is normal or not. If significance level of this test is more than 0.05, H₀ based on data normality is accepted.

Variables	Kolmogorov-Smirnov	Sig	situation
Technological factors	1.360	0.055	normal
Technical factors	0.985	0.286	normal
Economic-financial factors	1.329	0.164	normal
Organizational factors	1.118	0.164	normal
Environmental factors	1.012	0.095	normal

Table 2. Testing normality of factors data according to experts' point of view

8 FACTORS RANKING

Now, we investigate which effectiveness factors on hybrid solar vehicles are highly important than other factors. To test this question, Friedman test is used. Results from Friedman test is summarized in this question.

Row	Effectiveness factors on hybrid solar vehicles	Average rank
1	Technological factors	3.06
2	Technical factors	2.84
3	Economic-financial factors	2.78
4	Organizational factors	2.52
5	Environmental factors	3.79
6	Chi-Square=55/494 Df=4 Sig=0/00017	

Table 3: results obtained from Friedman ranking for effective factors

According to the mentioned data from Friedman test, since significance value is less than 0.05, studied factors ranking for effectiveness factors on hybrid solar vehicles is significant and Friedman test is acceptable. It can be claimed that environmental factors is the most significant then organizational factor is significant in comparison to other studied factors hence, it can be claimed that effectiveness factors are significant and acceptable on hybrid solar vehicles.

9 CONCLUSION

By investigating which effectiveness factor (technological, technical, economic-financial, organizational, and environmental factors) is greatly important on production of hybrid solar vehicles, Friedman test is used. According to obtained data from Friedman test, it can be claimed that since significance value is less than 0.05, ranking the studied factors on hybrid solar vehicles is significant and Friedman test is acceptable. It can be stated that environmental factors has the most significance then organizational factors is significant in comparison to other factors. According to experts' point of view, average effectiveness technological factor is 3.06, technical factor is 2.78, organizational factor is 2.52, and environmental factor is 3.79 on production of hybrid solar vehicles.

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