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Evaluation of Feasibility of Solar Photovoltaic for Electrical Vehicle

Ms. Deepali More
Research Student, Department of Technology, deepalimore63@gmail.com
Mr. N. N. Shinde*
Professor, Department of Technology, energyunishivaji@gmail.com
Dr. P. S. Patil*
Professor, Department of Physics, energyunishivaji@gmail.com

Abstract **- The use of electrical vehicle is eminent in view of climate change word while. The electrical vehicle can be charged either by plug in technology or on board charging by suitable renewable energy technologies.**
This paper evaluates different types of solar pv technologies in accordance with its cost and efficiency and optimizes further the type of solar pv technologies for utilization in electrical vehicles. It is further stated that there is need to modify the forms of existing electrical vehicles for uses of such new technologies.
The paper further reviews that the modified polycrystalline solar cells are best suited for electrical vehicle applications, with the objective of low cost considerations.

Key Words **- Photovoltaic, Electric vehicle (EV), Fuzzy logic, Energy storage system, Maximum power point.**

1. Introduction

The current state of technological development states that the future of Electric Vehicles (EVs) seems to go through the hybridization of various Energy Storage Systems (ESSs). This strategy seeks to benefit from the best qualities of each available energy source, and is especially useful in urban driving [1].The use of renewable energy resources is increasing rapidly. Following this trend, several design approaches of the solar pv systems have been presented in order to achieve the maximum overall efficiency. But optimization with proper strategy helps to built efficient products in the everyday competing market [7].
Based on the reviews it is felt that there is need to evaluate for selection of solar pv system for electrical vehicles based on requirement of demand side energy systems for EV as against the properties and characteristics of supply side energy management that is solar pv system. This work develops a systematic strategy for selection of solar pv system.

2. Photovoltaic System Challenges

- Improving PV efficiency
- Optimizing for design performance and target reliability
- Reducing the effects of variation on system performance
- Predicting manufacturing yields
- Lowering production costs
- System Cell Design criteria –Cell Level
  - Maximize efficiency
  - Optimize cell: contact pitches, junctions, Anti-reflective coatings, etc.
- Design criteria –Module Level
  - Minimize effect of inter connects on performance
  - Minimize impact of cell variation or degradation on module performance
- Design Criteria–System Level
  - Maximize system performance accounting for diurnal solar inclination
  - Maximize system level efficiency delivered to the grid, including inverter system

3. Electric Vehicle Problems

- Batteries are too costly.
- Batteries should be replaced when its life is over
- Frequent recharging is a very important drawback.
- Recharging time is high and waiting for recharging is a big pain.
- Access for recharge is not easily available outside the home, but in the case of petrol and diesel availability, it is not a problem.
- Efficiency of solar panels

In addition to above the EV energy system incorporates the components like solar panels, charge controllers, batteries, dc to dc and dc to ac converter, electrical drives and possible hybridization with existing system drives along with master control system. The schematic diagram of the EV hybrid system is shown in fig 1.

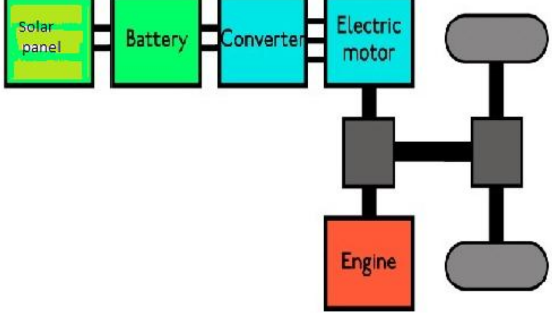

Fig.1. Schematic diagram of electric vehicle on solar panel

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4. METHODOLOGY

Fuzzy Logic (FL) can model nonlinear functions of arbitrary complexity to a desired degree of accuracy. FL is a convenient way to map an input space to an output space. FL is one of the tools used to model a multi-input, multi-output system.

The logic algorithm is developed based on the type of solar pv as against its efficiency, use and its application flexibility, maximum output and cost. The table.1 shows the types of solar cell and its efficiency.

Table1

Sr.NO	CLASSIFICATION	EFFIC. (%)
A)	**SILICON**	
a)	Si (crystaline)	25±0.5
b)	Si (multycrystaline)	20.4±0.5
c)	Si (thin film transfer)	16.7±0.4
d)	Si (thin film submodule)	10.5±0.3
B)	**III-V CELL**	
a)	GaAs(thin film)	27.6±0.8
b)	GaAs(multycrystaline)	18.4±0.5
c)	Inp (crystalline)	22.1±0.7
C)	**THIN FILM CHALCOGENIDE**	
a)	CIGS(cell)	19.6±0.6
b)	CIGS(submodule)	16.7±0.4
c)	CdTe (cell)	16.7±0.4
d)	CdTe(submodule)	12.5±0.4
D)	**AMORPHUS/NANOCRYSTALINE**	
a)	Si (amorphous)	10.1±0.3
b)	Si (nanocrystaline)	10.1±0.2
E)	**PHOTOCHEMICAL**	
a)	Dye sensitiesed	10.4±0.4
b)	Dye sensitiesed (submodul)	9.9±0.4
F)	**ORGANIC**	
a)	organic polymer	8.3±0.3
b)	organic (submodule)	3.5±0.3
G)	**MULTIJUNCTION DEVICES**	
a)	GalnP/GaAs/Ge	32.0±1.5
b)	GaAs/CIS (thin film)	25.8±1.3
c)	a-Si/µc-Si (thin film)	11.9±0.8
d)	a-Si/µc-Si (thin film submodule)	11.7±0.4
e)	organic (2-cell tandem	8.3±0.3

5 .FUZZY FICTION OUTPUT TABLE

Sr.NO	CLASSIFICATION	EFFIC. (%)	flexibility	output power	cost
A)	**SILICON**				
a)	Si (crystaline)	High	Yes	High	High
b)	Si (multycrystaline)	Mediam	Yes	High	Low
c)	Si (thin film transfer)	Mediam	Yes	High	High
d)	Si (thin film submodule)	Low	Yes	Mediam	Low
B)	**III-V CELL**				
a)	GaAs(thin film)	High	Yes	High	High
b)	GaAs(multycrystaline)	Mediam	No	Low	Low
c)	Inp (crystalline)	Mediam	No	High	Low
C)	**THIN FILM CHALCOGENIDE**				
a)	CIGS(cell)	Mediam	Yes	High	Low
b)	CIGS(submodule)	Mediam	Yes	High	Low
c)	CdTe (cell)	Mediam	Yes	High	High
d)	CdTe(submodule)	Low	Yes	High	High
D)	**AMORPHUS/NANOCRYSTALINE**				
a)	Si (amorphous)	Low	Yes	Mediam	Low
b)	Si (nanocrystaline)	Low	Yes	High	Low
E)	**PHOTOCHEMICAL**				
a)	Dye sensitiesed	Low	No	Mediam	Low
b)	Dye sensitiesed (submodul)	Low	No	High	High
F)	**ORGANIC**				
a)	organic polymer	Low	Yes	High	Low
b)	organic (submodule)	Low	No	Low	Low
G)	**MULTIJUNCTION DEVICES**				
a)	GalnP/GaAs/Ge	High	Yes	High	High
b)	GaAs/CIS (thin film)	High	Yes	Undifined	Undifined
c)	a-Si/µc-Si (thin film)	Low	Yes	High	High
d)	a-Si/µc-Si (thin film submodule)	Low	Yes	High	High
e)	organic (2-cell tandem)	Low	Yes	High	Low
H)	**Consantrated solar photovoltaic**	High	Low	High	High

Legend
High
Mediam
Low
No
Undifined
Yes

6. CONCLUSION

The table shows that the best solar cell for the application of electric vehicle is 1) monocrystalline 2) polycrystalline and 3) CSPV.

The monocrystalline solar cell has 20-25% efficiency also flexibility they are available in the market with low cost. The polycrystalline solar cell which has 18-20% efficiency also has flexibility, and low cost.

Further concentrated solar pv is having the maximum efficiency of 44.37% as it is multi junction, high cost solar cells. However its reliability in long term and flexibility for EV application is yet to be proved.

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AUTHOR'S PROFILE

Name: Ms. More Deepali Ramchandra. Department of Energy Technology; Department of Technology; Shivaji University, Kolhapur. (Research Student).