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Soleckshaw, An alternate solution to green transport

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ABSTRACT

SOLECKSHAW, a motor assisted pedal driven three wheeled vehicle, was developed by CSIR-CMERI in 2008-09, under the recent CSIR vision, CSIR-800, aimed at empowering 800 million Indians, who belong to the underprivileged class of society in our country, by way of S&T intervention. Rear wheels of SOLECKSHAW are driven by manual power and front wheel is driven by brushless DC (BLDC) electric hub motor, leading to driving comfort of the driver. Once the product was developed and on road trial was successful, the technology was transferred to a few Indian Industries. It is found that the users of SOLECKSHAW are financially handicapped and not exposed to modern science and technology, which is a major hindrance in deploying this technology. Thus this market seeding project was taken up to make these users (rickshaw pullers) empowered through extra effort and financial facilitation. The main objective of this project was deployment of SOLECKSHAW technology on a large scale in a faster mode, to ensure its acceptability in the society. Based on the user's feedback and ready availability of interested "Operator" in the form of either NGO or a start-up tourism company, Soleckshaws have been successfully implemented on road in different cities of the country.

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1.0. Introduction

In the busy streets of cities, mainly in Asian subcontinent, we find many tricycles and auto rickshaws. Most of the auto rickshaws are driven by fossil fuel, which produces lot of toxic gases which are harmful for human being and polluting to the environment. In most of busy and narrow streets hand tricycle or cycle rickshaw is used to carry two nos of passengers at a speed below 20 Km/hr. Since it is not using any kind of fossil fuel, it is free from environment pollution. But it is driven fully by manual power, which is a very strenuous job for driver. Nowadays considering the climatic changes caused by environmental pollution, introduction of green vehicles has become very important. Especially in busy streets of cities, pollution is at alarmingly high levels due to very slow movement of automobile vehicles and dense population.

2.0 SOLECKSHAW, green solution to urban transport:

Based on above feedback, introduction of solar powered motor assisted pedicab has been thought to be a wise prerogative, mainly in the busy and narrow streets of cities. In this project three-wheeled cycle rickshaw (or pedicab) has been developed of which rear wheels are driven by manual power and front wheel is driven by Brush Less DC (BLDC) electric hub motor. Electric motor is powered by 36V, 18AH lead acid battery source. The battery is charged at a solar power charging station during off line. This vehicle provides driving comfort to the driver due to addition of electric motor. These pedicabs can run for longer distances compared to present manual driven cycle rickshaws, results in more earning of rickshaw puller. The motor power has been imparted at front wheel and manual power on the rear wheel to achieve simple transmission system. The BLDC hub motor is a traction type motor, which can supply high torque at low speed and low torque at high speed. This interesting characteristic of motor eliminates the use of any gear train, results in simple and light transmission system. An

override mechanism has been used at the center of rear axle; result in proper turning and better dynamic stability of the vehicle. The braking system is introduced in all three wheels for proper stability and safety. Its power source is solar energy, which eliminate the problem of environment pollution, lies with normal auto rickshaw. The battery is charged from solar charging station by battery swapping mechanism and no need of any overhead solar panel, which reduces the weight and cost of vehicle. Its body is aesthetically designed for attraction of customers. The seating system is very comfortable for two passengers and supported by proper suspension. All necessary lighting systems (like head light, tail lamp, indicator etc) have been provided for driving during night.

3.0 Significance of the name:

This pedicab has been named SOLECKSHAW; SOL stands for solar, E for Electric and CKSHAW for Rickshaw. It is a rickshaw i.e. three wheeled vehicle driven by electric power, which is driven by electric power, supplied by battery, which is charged from solar energy. This three-wheeler requires lesser driving effort than normal rickshaw, due to assistance of electric motor. Due to use of electric motor, this vehicle can be driven for longer distances continuously compared to present manual driven cycle rickshaws, results in more earning of rickshaw puller. On the other hand manual power minimizes the requirement of electric power, i.e. it optimizes the use of manual power and electric power. The motor is driven by lead acid batteries, which are charged from solar energy, leading to minimizing the environment pollution. As a whole this pedicab is coming out one as an alternate means of transport in place of auto rickshaws for tomorrow.

4.0 Salient Features:-

- Zero Carbon Urban Transport
- Low Noise
- Dual Drive: Manual & Solar Power Assisted

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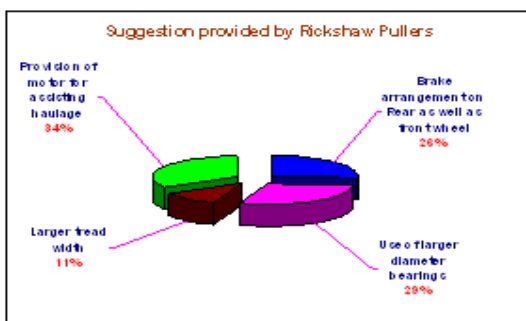
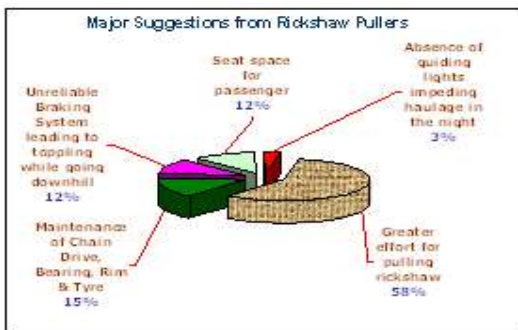
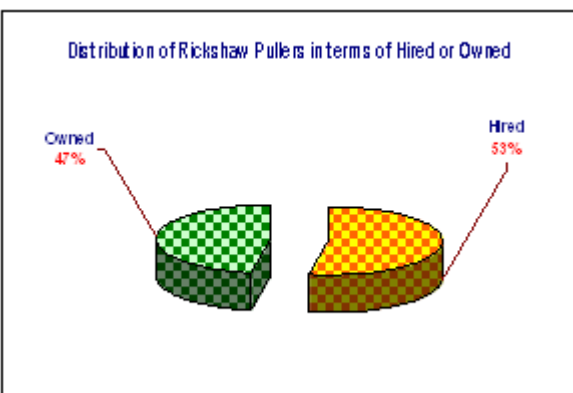
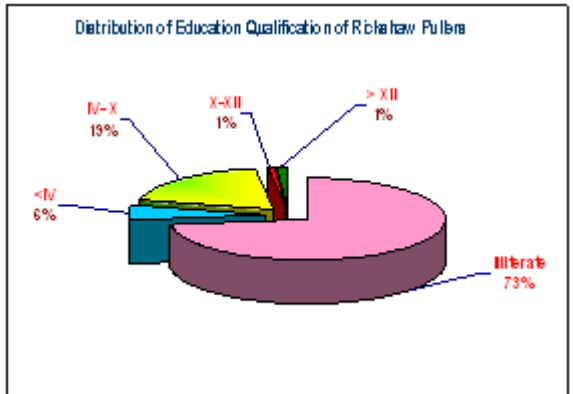
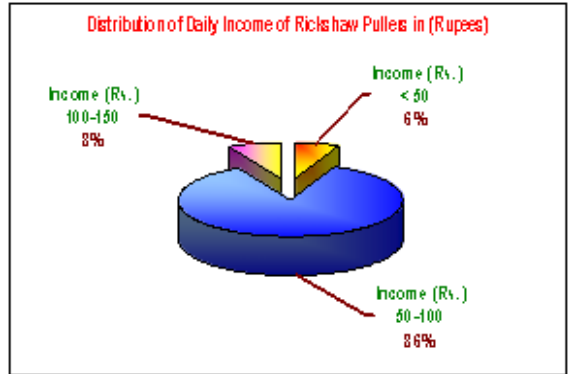
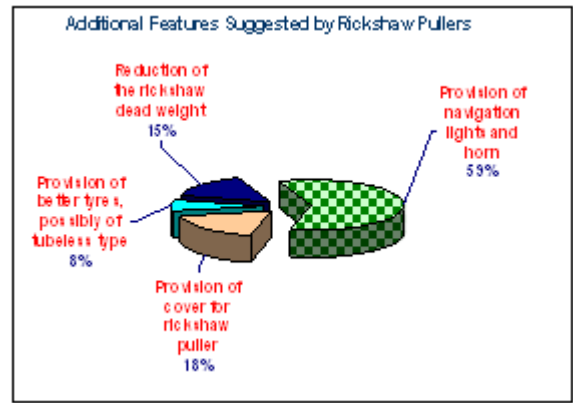
- Batteries charged from solar charging station by battery swapping mechanism.
- Aesthetic look
- Lower foot board
- Ease of boarding for driver
- Comfortable seating system for passenger.

5.0 Technical Specification:-

- 1) Power source : Electric and manual
- 2) Type of drive : Motor assisted pedal driven (hybrid)
- 3) Electric motor : BLDC type Hub Motor (240W, 36V) mounted on front/rear wheel
- 4) Charging : Batteries may be charged from solar charging station or from mains power supply source by battery swapping mechanism
- 5) Battery : Deep discharge type lead acid batteries
- 6) Transmission : Chain & sprocket drive
- 7) Brakes : Drum and shoe brake on both rear wheels, Brake on motor drum on front wheel
- 8) Axle : The entire rear axle system is mounted on separate structure to ensure better alignment of both the axles
- 9) Pay load : 210 Kg (driver and two passengers)
- 10) Average speed : 15 Km/hr
- 11) Weight of motor : 5 Kg (approx)
- 12) Electronic throttle : Mounted on Right side Handle
- 13) Lighting & horn : Head light, tail lamp indicator and electric horn provided

6.0 Interactions with Rickshaw pullers:-

At the very beginning of the development of SOLECKSHAW, studied the existing rickshaws in eastern India and discussed with Rickshaw Puller regarding their difficulties with present Rickshaws. A workshop was conducted at CMERI with hundreds of Rickshaw pullers Of Durgapur. Following are the outcome:



As per the sample survey the rickshaw pullers wanted following improvements:

- ❖ Motor assistance, while going up at slopes.
- ❖ Better breaking system on all 3 wheels, to avoid toppling
- ❖ More seating space for passenger
- ❖ Better horn system
- ❖ Headlight , tail light etc for night drive
- ❖ Better driving system to avoid tearing of chain
- ❖ Larger tread width of tires for better grip with road and stability

7.0 Technology transfer:-

SOLECKSHAW technology has been transferred to the following industries: -

1. M/s Stilam Automobiles pvt. Ltd. Plot No -16, sector- 27 C, Industrial Area Faridabad-121005, Haryana, INDIA Ph: +91-0129-4135200, 4136200 M: +91-9910339976 Mail : rajiv.vashishta@stilam.net website: www.stilam.net	3. M/s HBL Power Systems Limited 8-2-601, Road No 10, Banjara Hills, Hyderabad-500 034 Mobile No: 09958798546 E.mail: anilsahoo@hbl.in
2. M/s Modular Machines 16/2, Karkhana Bagh, Mathura Road, Faridabad (Haryana) 121 002 Fax No: 0129-2227079 Mobile No: 09810829404 E.mail: modularmachines@gmail.com / avbhatnagar@yahoo.com	4. M/s DEAN Systems New Green Park, Narendrapur, Kolkata 700103 Telephone: 033-24773375 Fax No: 033-24770627 Mobile No: 09331841091/ 9432745125 E.mail: dean01@vsnl.net / deansystems01@gmail.com
5. M/s Kinetic Motors Kinetic Motor Company Limited, Pune, sfm@kineticindia.com	NRDC has been provided authority to transfer the technology to Indian entrepreneurs on non-exclusive basis

8.0 Deployment of SOLECKSHAW in India:-

The Chief Minister of Delhi, Smt. Sheila Dikshit, ceremonially launched the first TDP (Technology Demonstration Project) of Soleckshaw on 2nd October, 2008, (commemorating Gandhi Jayanti) at Chandni Chowk Metro Station in the august presence of Shri Kapil Sibal, Union Minister of Science, Technology and Earth Sciences and Vice-President, CSIR and Prof. Samir K. Brahmachari, Director General, CSIR was among the other dignitaries who were present on the occasion.

Here the regular operation was attempted with 7 vehicles, 5 of them were manufactured by CMERI and rest two were supplied by M/s Modular Machines, Faridabad, one of the licensees of the technology. A solar charging station, manufactured by M/s CEL, was also installed there for charging of the batteries. The responsibility of operation was entrusted to M/s CRD, an NGO represented by Dr. Pradip Sharmah. The TDP continued successfully for 2 years and users' (Rickshaw Puller) feedback were collected.



Fig.1: Demonstration of BLDC based SOLECKSHAW at Chandni Chowk, New Delhi

Then Department of Science and Technology (DST), Govt. of Chandigarh launched a TDP of SOLECKSHAW with 10 vehicles and one solar charging station. They made an outright purchase of 10 vehicles as well as a solar charging station from CMERI and CEL respectively. This time, CMERI did not

manufacture the vehicles themselves but outsourced them from M/s Modular Machines, Faridabad.

Based on the user's feedback and ready availability of interested "Operator" in the form of either NGO or a start-up tourism company, following locations have been chosen for the operation of Soleckshaws:

1) Gurgaon 2) Jaipur 3) Faridabad, 4) Kolkata 5) Durgapur, and 6) Ajmer

The NGOs / start-up companies/ Organisation, who have agreed to take part in these programme, are: 1) "Uthhan" at Gurgaon 2) M/s Solarick Tourism at Jaipur, 3) "Umeed" at Faridabad, 4) Bengal Engineering and Science University at Kolkata and 5) Swami Vivekananda Vani Prachar Samity (SVVPS) of Durgapur

So far, 50 (fifty) numbers of Soleckshaws have been procured from different licensees ("Manufacturer") and distributed to "Operators" at five different locations.



Fig. 2: Soleckshaws manufactured by M/s stilam, Faridabad deployed at Gurgaon by M/s Uthaan, NGO



Fig. 3: Soleckshaws manufactured by M/s Stilam, Faridabad deployed at Jaipur with the help of M/s Solarick tourism

9.0 Postal soleckshaw:-

CSIR and M/s Kinetic Motors, Pune have jointly developed Postal SOLECKSHAW, for a new application, which is delivery of POSTAL items. INDIA POST purchased 5 such Postal Soleckshaws from M/s Kinetic and those have been formally launched at Ajmer on 17th January, 2011 by the Hon'ble MoS, C&IT, Shri Sachin Pilot. Currently the vehicles are being used by identified Postmen on a regular basis at Ajmer under the administrative supervision of the Sr. Post Master, Head Post Office, Ajmer.





Fig. 4: Postal Soleckshaw and its Launching at Ajmer on 17th January, 2011

10.0 Conclusion:-

The dual-powered Soleckshaw is the CSIR's solution for the dual problem of better life to Rickshaw puller and mitigation of global warming. More than 60% of the increase in the green house gas (GHG) emission is from the transport sector. Presently, no powered vehicle or transport system is free from carbon dioxide emission. Soleckshaw, with its zero carbon foot print and the trend of widespread use, is expected to reverse global warming and protect the planet from the perils of the climate change. Its worldwide use would also enhance energy security by reducing the world's dependence on limited fossil fuel. Equipped with novel features, this pedicab is easy to drive both on plain as well as uphill road, without any strain of imbalance, which all of the current cycle rickshaws suffer from. As per CSIR vision, appropriately titled, CSIR-800 aimed at empowering 800 million Indians by way of S&T intervention, Soleckshaw has been designed, and developed by CSIR-CMERI at Durgapur a constituent establishment of CSIR, under Ministry of Science and Technology, Govt of India.

With better aesthetics and ergonomics, the cost-effectiveness of Soleckshaw has been engineered by optimizing the system around the most appropriate commercially available components. This would also minimize the capital requirement for a mass manufacturing unit. Only the novel sub-assemblies like the differential drive, the special hub motor and the light weight solar panel at low cost need to be manufactured apart from the chassis designed for comfortable ride even for the senior citizens and physically challenged. Innovative business model is being evolved with NGOs, banks, environment-loving corporate and manufacturing organizations to make the rickshaw available to the drivers at the cost of an ordinary rickshaw. Now

it is the responsibility of the technology takers to build the business model in a self sustainable basis which will suit the customers with respect to better aesthetics, ergonomics, and cost-effective. So that people from the middle class can easily afford its minimum amount and the rest amount should be paid through any financial agencies like bank, govt which reequipped from the rickshaw pullers by means of means on monthly basis.

11.0 Acknowledgements:-

I am thankful to our present DG CSIR, who inspired us to develop a product for our 20 million underprivileged people who are at the bottom of the pyramid because so far as countries' whole development is concerned nothing has been done for people who were below poverty line. I am also thankful to our Director Dr Gautam Biswas, who have taken enough initiative for giving actual shape to the prototype considering all the hindrance for purchase of its parts and other difficulties. I am also thankful to the team of Soleckshaw's for their kind cooperation for the fabrication of the different prototypes, its trial & testing, collection of the feedback datas from the rickshaws puller's, assist in the process of technology transfer and help the technology takers during fabrication of the prototypes arrangement of Soleckshaw launching programme to various parts of the countries.

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