

ECO-FRIENDLY AND SUSTAINABLE TRANSPORT IN AUROVILLE, INDIA

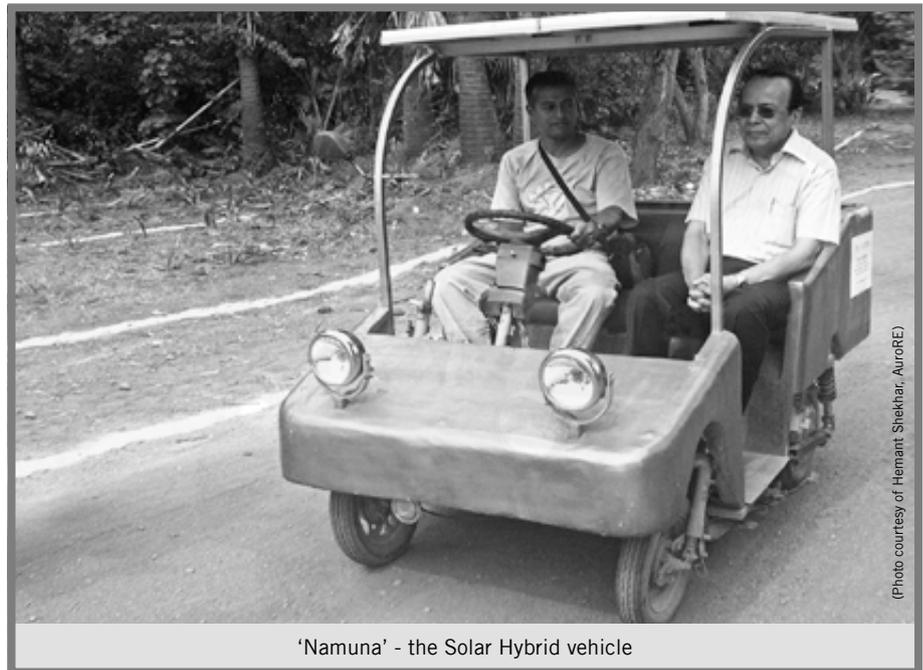
By Nina Sengupta and Alok Mallick

The research team at Auroville Renewable Energy and Auroville Center for Scientific Research (AuroRE/CSR), India, has embarked on several initiatives to provide their township with greener and more sustainable transport options. This article deals with some of the successful designs which have materialised from these efforts, such as a pedal-powered four-wheeler/quadricycle as well as a solar hybrid vehicle which are currently undergoing further improvements.

As the sun's rays reach the dewy undercover and dirt roads on a typical misty morning, one can see bullock carts taking produce from the farms to the grocery centers, and people going about their daily chores using the network of shaded cycle paths which stretch across Auroville. Auroville, is a UNESCO - ratified international township in India dedicated to manifesting human unity in diversity. Reforestation and land reclamation work over the last 40 years has transformed a desert-like landscape into a green space which supports people, flora and fauna. The township constantly endeavours to find means of living lightly and sustainably on earth.¹ Part of this quest involves finding reliable and eco-friendly solutions for transportation.

There is a wonderful network of cycle paths that many people use in Auroville. However, for various reasons - such as the ruggedness of the terrain, dust turbulence on earth roads, intense heat, age factor and ability of the riders - the bicycle is not the ideal choice for everyone. Many are therefore compelled to use motorbikes and few use cars. However, most of those in Auroville who currently use fossil fuel powered

¹Several of Auroville's earth day initiatives focused on sustainable transportation along with carbon-neutral living options through seminars, exhibition, café-conversation, and films.



'Namuna' - the Solar Hybrid vehicle

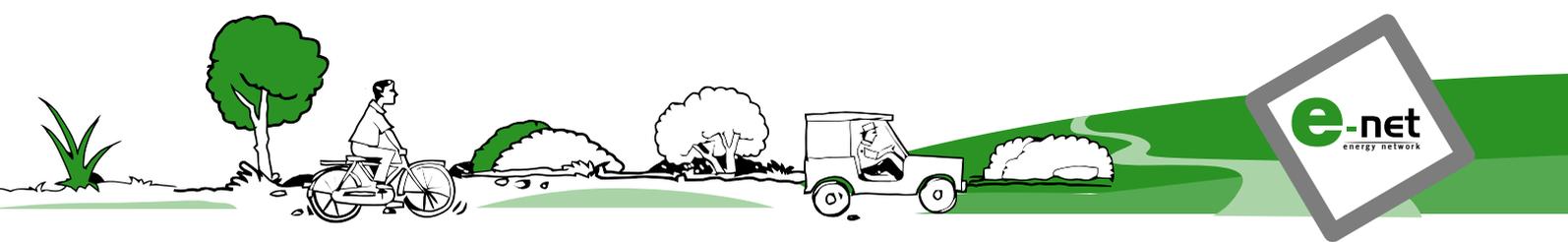
vehicles would rather switch to more eco-friendly alternatives if they were available and affordable. Several groups in Auroville are trying to address this need for eco-friendly and sustainable means of transportation at various levels. It is also one of the main focus areas of research at the AuroRE/CSR. As part of this focus area, AuroRE is involved in experimenting and designing reliable eco-friendly vehicles for Auroville and other rural areas in the developing world.

The following are a few examples of AuroRE's ongoing efforts:

Solar/Hybrid Vehicle: The prototype called "Namuna", which means "an example" or "a character", is a hybrid four wheeler with an automatic transmission. It is capable of running entirely on either solar electricity or liquid fuel (petro or bio-based), or on a desired combination of either solar electricity or fuel. This hybrid feature that is both unique and useful was developed in Auroville. As much as 40% of the energy captured can be lost in transferring it from the solar-panel or grid to a battery system. To avoid this, Namuna attempts to use the energy directly from the solar-panel and meets any extra demand using the battery bank first, and then

fuel if necessary. Battery storage is necessary when driving in shaded areas, less sunlight, cloudy days or during the night as well as when the power requirement is greater than the direct solar energy supplied from the vehicle's solar photovoltaic canopy (for example under fast acceleration, on sandy roads, or while carrying an extra load). This transition between direct power usage from the panel to substitution of power from the battery or fuel when necessary, occurs smoothly, without any involvement of the driver. The exemplary feature of Namuna is that it needs to be parked in a sunny spot - which also means less competition from any other vehicle for parking. While parked under direct sunlight it generates energy. When the vehicle is driven at a slow speed or when it is parked in the sun the net excess power gets stored in the battery. Namuna was launched officially on Earth Day in 2007. To date, Namuna has run 2000+ kms within Auroville. It can travel at a maximum speed of 60 kmph on a good (tarmac) road. Though the speed is lower while running on earth roads, Namuna has proven to be resilient enough to deal with very rugged road conditions.

Solar/Electric vehicle: At AuroRE/CSR, we are now ready for the



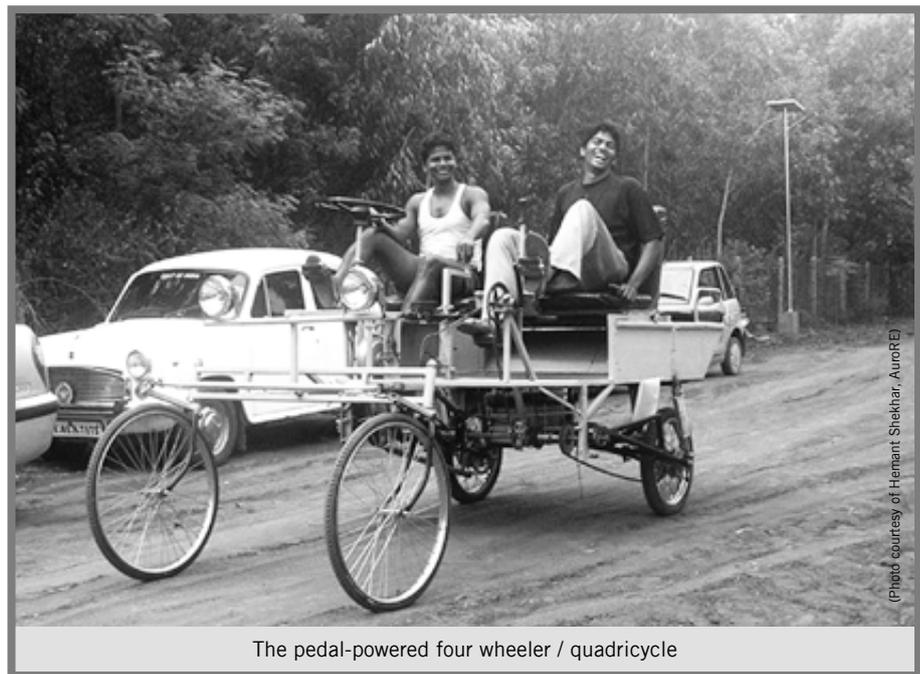
second generation Namuna based on the experience and learning gained from the first prototype. Our tests revealed that Namuna can run entirely on solar - approximately 50 km on a fully-charged battery. To fully charge an empty battery it takes about 5 hours if it is really sunny. However for normal daily driving in Auroville one hardly has to drive long distances. One either drives to work or to the solar kitchen² for lunch or to pour-tous³ for groceries. The vehicle is parked at places where sunlight is ample and the battery gets an opportunity to recharge.

The second generation Namuna currently under construction is entirely solar/electric (by eliminating bio or fossil fuel engine, transmission system, and tank) making it somewhat lighter and therefore more efficient. It will be a truly zero emission vehicle with solar as its primary energy source. A backup recharging option from the grid or any other alternative energy source will however be provided for use during the monsoon season or for occasional driving needs that exceeds what the battery can sustain. Like its predecessor the new model will not have any frills but will have a rather simple look to highlight its robustness and reliability.

Pedal-Powered Four-wheeler/quadricycle: A pedal powered vehicle is clearly one of the most eco-friendly alternatives. However, in Auroville and on use in other rural roads even the most ardent cyclist will find it difficult to carry another person or transport goods on a bicycle. Cycle rickshaws that exist in India and several other developing nations are probably an answer but they are not very easy on the rider. We have therefore designed and built our first pedal-powered four wheeler or quadricycle. It has a strong

²Solar Kitchen: Is a community kitchen equipped to cook for 2000 people everyday using a hybrid fuel source that is primarily supplied through a large solar collector.

³Pour-Tous literally means "for all". It is the grocery store and distribution center for all living in Auroville.



The pedal-powered four wheeler / quadricycle

suspension, a tough chassis to take the structural stresses of travelling on a rugged terrain, a wide width that allows it to be more stable even on undulating roads, and a substantial height to minimise the ground turbulence which in turn reduces the kicking up of dust from the road. The vehicle can be pedaled by one or two riders. Each of the two riders has independent gears. Thus, while two people are riding, each rider is able to pedal according to his/her ability or strength by choosing the desired gear. The vehicle is large enough to carry two extra passengers or an equivalent load. A battery bank and motor is provided to assist in riding when desired. There are plans to add a canopy in the near future which will be equipped with a solar panel to recharge the battery while also providing shade.

The above vehicles have been taken for test runs outside Auroville. The quadricycle has an average energy use of 200 Watts(W) and can be used outside Auroville in regular traffic. Namuna uses over 200W and therefore requires registration to be allowed on the road. Thus, so far, Namuna has been used only within the Auroville campus and can be used in other campus situations. In the future AuroRE/CSR hopes to forge

partnerships with manufacturers, within India or elsewhere, who will produce and sell the vehicles. Apart from the above mentioned innovations, there are several on-going efforts in designing reliable eco-friendly vehicles for various users at AuroRE/CSR. Through these and other alternate energy work AuroRE/CSR also provides essential training opportunities for students and interns who come from various universities across the globe. Together we continue our quest to find better and greener options for all of us to live in harmony with the myriad of plants and animals with whom we share the earth.

Nina Sengupta is a researcher at Auroville Center for Scientific Research (CSR). She is an ecologist who works on integrating biodiversity conservation/restoration with sustainable energy and development issues. Alok Mallick is a researcher at Auroville Renewable Energy (AuroRE) and CSR. He continues to work on his long term passion and interest of designing and fabricating innovative renewable energy systems. He leads the R&D at AuroRE.
E-mails: alokm@auroville.org.in, nina@auroville.org.in