

Connecting Electric Vehicle Battery Technologies and Renewable Energy Systems: A New Model for Sustainable Transport? - Mahesh Sugathan

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The proposed paper suggests a holistic approach for making road transport more sustainable and carbon-neutral. The paper describes a conceptual model for electric transportation through forging connections between innovation and research in electric vehicle battery technology and their recharging infrastructure and renewable energy power generation systems. The paper argues that the basic technologies for realising this model already exists but commercialization will require further targeted research and innovation in certain critical areas in battery technology, charging and renewable energy infrastructure that could then bring the model to fruition.

The paper proposes three focus areas for targeted research and innovation:

*Firstly **electric battery technology and design***, namely, the development of small, compact lightweight, rechargeable, portable and possibly lithium-ion batteries that are inter-changeable between different models of cars-or at least to have one or two standardized models for the entire industry. This could make possible 'plug and play' batteries where charge depleted batteries could be exchanged for fully charged ones at pre-determined locations-namely existing gas stations which would then also be used as *battery stations*. The paper will also review current research and commercial developments in this regard.

*Secondly **car-battery charging infrastructure*** where the paper will propose the development of *battery-recharging units* that could potentially charge hundreds if not thousands of lithium-ion car batteries somewhat similar to charging equipment for household batteries but much bigger in size and scale. These re-charging units could also be made mobile in that they could easily be transported from one charging location to another. The paper will explore whether sustainable transport systems could be used to transport depleted batteries from battery stations to the recharging units. Fully-recharged batteries would then be taken from recharging units back to the battery station for use by automobiles. There would thus be a continuous back and forth flow of batteries between the recharging units and the gas stations that would effectively cut down automobile waiting time to the minimum that it takes to detach and load new batteries. This will also ensure that automobiles are able to run on electric batteries for very long ranges-limited only by the location of a gas-cum-battery station to exchange depleted batteries for recharged ones.

Thirdly, in terms of powering the recharging units the paper will argue them for linking them to ***renewable energy generation grids and off-grid sources*** to the extent possible. This will ensure that depleted batteries are charged by renewable sources of energy and thereby ensure life-cycle sustainability and carbon neutrality of electric vehicles running on rechargeable batteries.

The paper will also highlight some of the challenges that could arise in bringing this model from a concept stage to R&D and commercialisation stages while pointing out examples of new developments and actual commercialisation that has already occurred in various aspects of the proposed model for instance-Shai Agassi's 'Better Place' initiative in Israel.