Title :

Exchangeable Battery Powered System of Japan: Possible to meet future power needs for light EVs in Bangladesh?

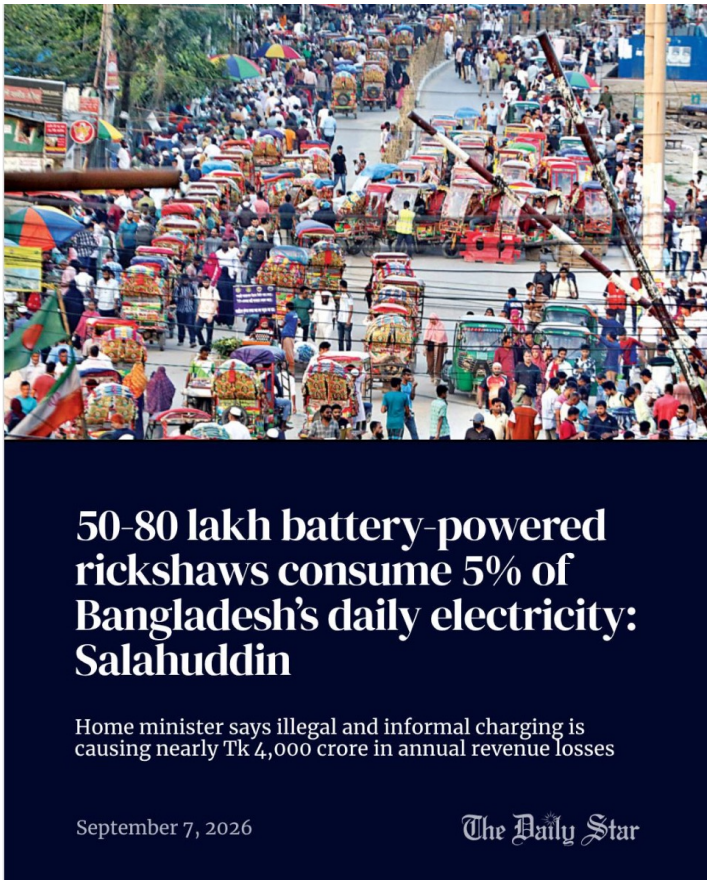
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Institution : Universiti Tun Hussein Onn Malaysia

Project Title: (Max: 2 slides)

Background :

- Light Electric Vehicles (LEVs), such as three-wheelers, electric rickshaw vans, and easy bikes, has been on the rise in rural areas of Bangladesh since 2009.
- Rapid increase in LEV adoption demands approx. 500 MW of power daily from the national grid, posing a significant strain on grid itself
- The charging facilities are improper and insufficient.
- Japan has significantly reduced CO_2 emissions in transport sector and Industries like J-power, Toyota, Idemitsu Kosan, and Honda to install hundreds of solar powered charging station with fast charging technology and smart energy management



Targets:

- Exchangeable Battery System (EBS) in Okinawa, takes only a few minutes to replace, demonstrating that 23% of the micro EV's energy can be derived from a 6 kW solar PV.
- To support Bangladesh Govt plan building EBS that can be charged in just a few minutes, rather than requiring a long waiting period.
- research methods and procedures conducted in Japan to determine a solar-powered EBS for light EVs and its management system in Bangladesh.

Project Title: (Max: 2 slides)

Aim:

Investigate EBS, encompassing a study of a market overview, battery swapping technology, solar integration, regulatory and safety standards, cost-benefit analysis, and implementation methods in Japan, and how it can be implemented in Bangladesh for light EVs in rural infrastructure.

Objectives:

(1) Site survey in Japan to analyze the socio-economic benefits from the adoption of EV technology as a model for Bangladesh.
(2) To perform an on-site assessment aimed to examine the infrastructure planning and the national power grid in Bangladesh.
(3) Feasibility study on upgrading to solar-powered EBS under Bangladesh environment from the proven Japanese technological expertise.

電池容量を増大した新型の交換式バッテリー「Honda Mobile Power Pack e:」を搭載した電動三輪スクーターを日本で発売

従来のモバイルパワーパックに対し電池容量を増大した「Honda Mobile Power Pack e:」を2個搭載した、屋根付きのビジネス用電動ビジネススクーター「GYRO CANOPY e:」を法人向けに日本で発売しました。





Proposed Method: (Max. 3 slides)

1. Literature study on EBS for light EV charging and implementation methods in Japan and Bangladesh. This will provide an understanding on the mechanism that govern battery swapping technique, requirement standards, installation challenges, return of investment, and any innovative technologies used in Japan.

1. Site visit to Japan for -

(a) Data collection at University of Fukui (Yoshimi Kawamoto and Syuhei Asano) and EV charging equipment company in Tokyo (e.g., Gachaco) to understand infrastructure planning for EBS, modification in design and technology, procurement process, revenue, and vandalism issue. The discussion topic will be how Japan is managing EBS/LEV charging stations to ensure meeting industry standards and users expectations.

(b) Data collection on the investment costs between an EBS and non-EBS stations, market research, installation, and maintenance requirements.

(c) Survey on Japan's EV ecosystem, carbon neutrality, and explore 'how Japan has achieved the early success in EV industry and maintain growth to solar integration and EBS?'.

Proposed Method: (Max. 3 slides)

3. Site visit to Bangladesh for -
a) Data collection from current solar-powered EV stations and meet respective authorities of BREB, PDB, and Rahimafrooz Renewable Energy Ltd. Discuss on procurement, involvement of women engineers, government incentives, and regulation standards.
Location: (i) Dhaka; (ii) Solar-powered battery charging station, Chuadanga, Keraniganj, and Gazipur.

(b) SWOT analysis to identify challenges of project location, PV plant and vehicle charging capacity, investment, tariff charges, revenue, CO_2 emission reduction, safety, and vandalism prevention methods.

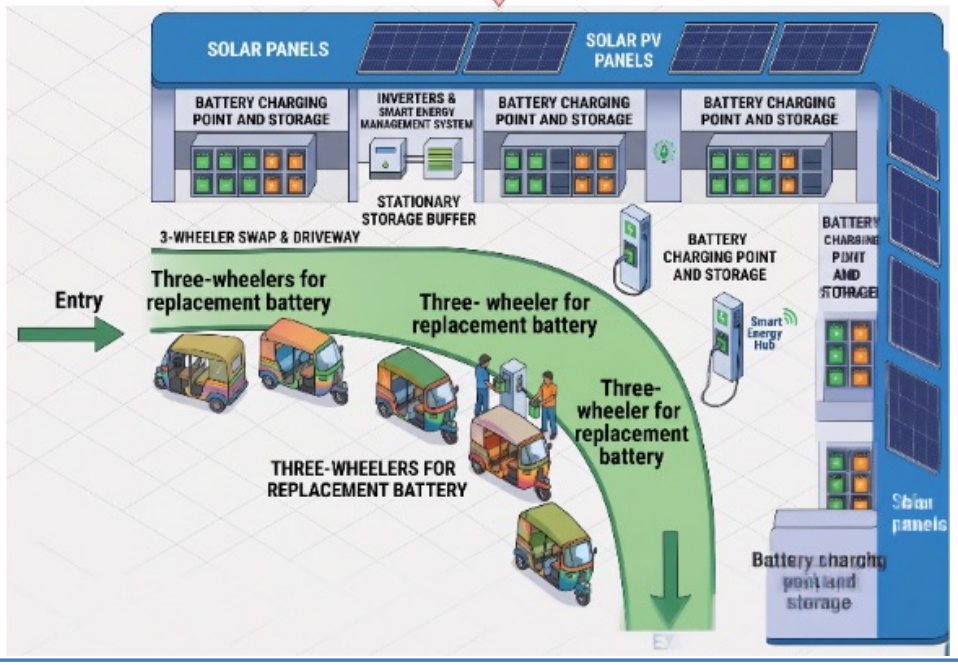
4. Assess economic benefit of EBS for LEVs in Bangladesh. Compare it with the current daily charging cost of JPY160-200 per light vehicle for 8 hours.

5. Review all the data, analyse, and discuss. Prepare articles for journal and international conference.

6. Conclude, final report, and provide recommendation. Publish report in local newspaper.

Proposed Method: (Max. 3 slides)





1. Review **Japan's EV ecosystem** to understand swap station standards, installation, commercial models, and technological innovations.

2. Site visit to Bangladesh- meet respective authorities to **analyze electrical specifications and battery management** under local scenario.

3. Model the electrical load requirements, calculate solar PV and storage capacity, and design a f**unctional station layout** for light EVs.

4. Run a **SWOT analysis** to pinpoint practical risks, infrastructure gaps, and local operational constraints.

5. Analyze the cost savings, driver earnings, and business feasibility of r**eplacing traditional lead-acid batteries** with swappable lithium packs.

Impact: (Max. 3 slides)

Scientific and technological

Standardizing Batteries Across Brands: Adapts Japan's modular battery swapping systems (like the Gachaco and Honda models) so different three-wheeler models in Bangladesh can share the exact same battery pack.

Safer and Longer-Lasting Chemistry: Replaces old, toxic lead-acid batteries with high-grade Lithium-ion packs, testing how well they handle Bangladesh's extreme summer heat, monsoon humidity, and rough road conditions.

Protecting the Power Grid: Instead of hundreds of thousands of LEVs plugging in at home every night and overloading local neighborhood transformers, smart swap stations charge batteries during off-peak hours or using daytime solar power.

Impact: (Max. 3 slides)

Societal Impact

More Take-Home Income for Drivers: Drivers spend less than two minutes swapping an empty battery for a full one. This replaces 8 to 10 hours of waiting for slow chargers, giving drivers more working hours and higher daily earnings.

Healthier Living Conditions: Eliminates the risk of acid burns, toxic lead fumes, and home garage electrical fires common with makeshift charging setups.

Lower Upfront Costs: Drivers do not need to buy expensive battery packs outright. Through a battery subscription ("Battery-as-a-Service"), they only pay for the energy they swap, avoiding high-interest informal loans.

Ending Toxic Waste and Dumping: Replaces short-lived lead-acid batteries (which wear out in 1–2 years) with long-lasting packs, setting up a formal collection network to keep toxic materials out of landfills and waterways.

Clear National Roadmap: Provides government policymakers with a proven, practical framework to officially recognize, standardize, and regulate light electric vehicles across Bangladesh.

Impact: (Max. 3 slides)

Collaborative Impact

Knowledge Exchange Between Japan and Bangladesh: Connects Japanese technology providers and engineering institutes directly with Bangladeshi researchers, universities, and transport agencies.

Public-Private Cooperation: Brings municipal transport authorities (like the BRTA), national energy agencies (like SREDA), and local vehicle builders together to agree on unified safety and charging rules.

Hands-On Local Training: Upgrades local mechanic workshops with practical training on handling smart battery systems safely.

Output/Outcome: (Max. 2 slides)

This research project aims to conduct a comprehensive analysis of solar-powered EBS, focusing on implementation methods, regulatory standards, potential return on investment (ROI), and relevant technologies in Japan. We will then compare this information with current practices in Bangladesh to identify any obstacles that may hinder the goal of reaching 10,000 EBS units by 2028.

By the end of the research period, we intend to propose standardized guidelines to government agencies, outlining the current status, necessary steps, and future enhancements for the socio-economic development and growth of solar-powered EBS charging stations. We will support EBS management and sustainability in implementing these measures based on our research findings.

Throughout the study, we plan to publish at least one article in a prominent journal like 'Materialstoday Energy' and present one paper in international conference. Upon project completion, we will also submit several technology articles to local media outlets to raise public awareness about smart EV technologies, the potential market, and safety considerations in Bangladesh.

Conclusion:

- The excess energy consumption required for LEVs charging has led to significant load shedding in Bangladesh.
- The Japanese government is dedicated to enhancing the economic gains from the EV industry, aiming for a 26% reduction in CO2 emissions by 2030 using solar-powered charging stations equipped with fast charging technology and smart energy management.
- Gachaco, the battery exchanging company is established to introduce EBS, which can charge the light EVs in few minutes with smart power management.
- This offers an effective solution to the long waiting periods, land scarcity, and environmental issues outlined in the context of Bangladesh.
- The project's motivation is to establish guidelines for government agencies and other companies to develop and support solar-powered EBS for powering 3 million light EVs in Bangladesh.
- The objective is to study the methods and procedures used in Japan and determine how the solar-powered EBS, coupled with a smart management system, can be implemented in Bangladesh.
- Additionally, the socio-economic benefits of the users will be reviewed to ensure that the EBS charging cost does not surpass the current cost.