Asia LEDS Partnership Clean Mobility Community of Practice

Summary report of Online Session 1 on 'Enabling a transition to electric mobility in public transport fleets: Policies and Enabling Environment', June 22, 2018

The first virtual session of Clean Mobility Community of Practice (CoP) was held on June 22, 2018 and was attended by 25 participants.

The session focused on bus electrification, types of electric buses, planning considerations and policies to support deployment of buses. It also discussed the electric bus market, strategies for bus charging, its cost along with few case studies. The discussion was supplemented with country presentations focusing on the experiences in rolling out smart incentives and enabling policies.

Introduction to the Clean Mobility CoP – Mr. Anandhan Subramaniyam, ALP

Key points discussed include the following:

- Brief overview of the objectives of Transport CoP, its ongoing activities and support offered under the LEDS GP and ALP. The ALP aims to promote LEDS in the Asia and Pacific region. Clean mobility (transport), NDC/Clean energy Finance, Grid Scale Renewable energy, Multi-level Governance and National Sub-National integration are the priority areas of ALP in the current year. LEDS GP is supported by 6 technical working groups (on Transport, Sub-National Integration, Benefits, AFOLU[1], Finance and Energy) with field expertise to provide technical assistance and training support in the region. Transport working group is hosted by WRI.
- It is an interactive platform which helps practitioners, experts and national representatives in learning and sharing with each other. It is a network envisaged to support CoP members based on the needs of countries that arises from time to time. This network is member driven. Activities are famed to cater to the needs and priorities of the country.
- Under this CoP, there are more than 42 members representing 8 countries including Bhutan, China, India, Malaysia, Philippines, South Korea, Vietnam and Sri Lanka. Activities include interactive virtual sessions, interactive peer learning in-person workshops along with site visits, deep dive support for some countries (country specific) and sharing the tools and resources for learning processes.

Expert Presentation:

Public transport Fleets: Bus Electrification- Mr. Cabell Hodge, NREL[2],

The presentation focused on the type of electric buses, key elements, planning considerations, pilot cases, lessons learnt and policy aspect.

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[1] AFOLU – Agriculture, Forestry and Other Land Use

2 NREL--- National Renewable Energy Laboratory (NREL) supports for bus electrification in the sector of Research and development (battery technologies for longer life and lesser cost, powertrain development and thermal management), 3rd party evaluation, technical consultant providing feedback to the government on technical and policy challenges and fleet assessment (Economic and operational assessments of battery and fuel cell, feasibility).

Types of electric buses: Fuel cell electric bus (requires hydrogen fueling station and is similar to gas/diesel buses in fueling experience), depot charge electric buses (can be charged in off peak hours for cheaper electricity rates but requires longer charging hours, requires different charging stations), on-route charge battery electric buses (can run for more distance with smaller battery packs, fast charging option). Manufacturers offer range of electric bus configurations including swappable battery packs which is quick but labour intensive.

Selection of type of bus depends on following considerations:

1) **Planning considerations**: Focusing mainly on battery electric buses, their planning considerations include developing the bus specifications to meet operational requirements and selecting the bus and charging strategy. Modeling and simulation tools are very helpful for recording the location, speed and direction on second basis to determine the battery needs.
2) **Infrastructure considerations** includes placement of bus chargers, electrical upgrades of transformers, conductors, etc. to support chargers and planning the initial infrastructure for scale up.
3) **Power cost considerations:** Power needs and electricity rate structure should be well understood for better planning. In addition to electricity consumption costs, there are often peak demand charges for commercial customers. Summer and winter season rates may also differ depending on the load of electricity consumption.
4) **Operational considerations:** Labour requirements for maintenance of buses, optimization of operation (including number of buses, schedules, charging needs), and training of drivers, alternative of power source in case the grid is not reliable. Onsite solar generation or any other backup option can be considered.
5) **Maintenance considerations:** training of bus depot staffs, maintenance or repairs during warranty period may be provided by the manufacturers, special tools may be required for troubleshooting and diagnosis issues and a list of parts can be prepared in collaboration with the manufacturers.

Lessons learnt

Working with manufacturers and utility can be more useful for better charging infrastructure solutions, additional training is required for the drivers for docking of buses for charging, maintenance cost when the battery warranty ends.

Deployment examples

Foothill transit deployment: 14 electric buses were deployed in 2014 to make a comparison with CNG buses. These buses utilized fast-charge and on-route charging strategy. CNG buses were running upto 97% while electric buses were running for about 90% with more maintenance. This can be amended with learning experiences by working in this sector. Electric buses are more fuel efficient in comparison to CNG. Comprehensive strategy for bus infrastructure, trainings for docking staff and maintenance cost in warranty period is the major learning points from this deployment.

King County Metro Deployment: 3 buses were deployed in 2016 and had fast charging stations and were compared to diesel, diesel hybrid (uses a small battery) and electric trolley buses. Fuel economy was best for electric buses and better for hybrid buses in comparison to diesel buses. The biggest issue faced was of the high electricity cost which led to higher fuel cost per mile than diesel bus. Electric buses had lowest maintenance cost as compared to hybrid, diesel and trolley bus. It demonstrated the following lessons- more savings in terms of maintenance cost but it can prove to be

more expensive overall if the electricity is expensive. On-route fast charger is necessary, docking training for drivers, limited route selection was done due to bus range.

Data collection of **battery bus in Surat**, India is also underway focusing mainly on routes, timetables, traffic, fuel consumptions, and charging strategy.

Higher initial cost, planning and expenses in charging infrastructure, increase of electricity cost in peak time and lack of awareness of operators are the main barriers to adoption of electric buses.

After the presentation, the following questions were asked:

1) What should be the steps to start with electrification or deployment of electric buses for a country which is new to this sector?

   Response by Mr. Hodge: There are two key pieces to be considered by a country:

   - A person should learn and become aware about everything related to successful bus electrification deployment and understand technical capacities of the buses, interact on forums, talk with other cities/organisations, get an idea of market, request the bus manufacturers for information.
   - Setting up a policy from a high level to incentivize pilot projects may also be helpful. Understand the provision of incentives depending on the country. Policy drivers should be prioritized based on their impact to deployment and the country's capacity.

2) Are there any case studies illustrating that financial incentives work better in case of electrification?

   Response by Mr. Hodge: Different countries have different incentives/policies. Some incentives are more effective than other. For example, rebates at the point of sale were more effective than the tax credits which people had to file later. See https://doi.org/10.1088/1748-9326/aad0f8 for the study mentioned in this response.

3) What is the major difference between the maintenance and asset management of conventional diesel buses and electric bus?
   Response by Mr. Hodge: Long term battery electric buses have fewer moving parts so need lesser maintenance cost. The battery cells will degrade eventually which will cost money and working on new components requires a learning curve. In the long term, electric buses should be cheaper, but we don't have enough data to verify on a large scale yet and in some cases it may cost more money also.

4) What is the environmental benefit of fuel cell buses in comparison to conventional buses?
   Response by Mr. Hodge: There are no tailpiple emissions with hydrogen fuel cell buses besides water. Upstream, emissions depend on the source of power. Hydrogen fuel cells buses normally get power from electricity or natural gas reformation. Use of renewable energy can help in zero emission.

5) Compare the effectiveness and efficiency of electric buses with respect to hilly terrain roads.
   Response by Mr. Hodge: Electric buses don't lose efficiency in case of higher elevation while other buses (diesel and gasoline buses) may lose efficiency when there is deficiency of oxygen.

This is a problem in Colorado. In case of uphill both types of buses loses efficiency but the electric buses have an advantage of recapturing the power when these go downhill.

Country Presentation 1:

Mr. Leki Choda, Planning Officer, Road Safety and Transport Authority, Bhutan: Presentation on "Initiatives being taken by Bhutan to promote electrification of buses"

The presentation focused on initiatives being taken in Bhutan to promote electrification and the challenges in perspective of Bhutan.

In Bhutan there is absence of Ministry of transport, hence Road Safety and Transport Authority is the lead agency for all transport related works and is under Ministry of information and communication.

Electric vehicle initiative was started in 2013-14 and as now it has about 99 electric cars, but the country is facing problem of charging infrastructure. Bhutan is a developing country and due to economic issues faced by the country it is difficult to purchase electric buses. There are 20 districts in the country which are located at large distances from each other with forest areas between them and diesel buses (200 buses) are already plying on these connection routes so it is difficult to replace them with electric buses due to large distances and deficiency of charging infrastructure.

Public transport in Bhutan is a regulated market where the drivers discipline while the seating capacity and fixing the problems, etc. is regularised by the Authority but operation and choosing the routes depends on the private individuals who buy the buses. Currently there are no electric buses.

The proposed plan promotes use of public transport and involvement of private individuals to upgrade buses and operate. Bhutan has another plan to collaborate with Municipal Corporations to purchase more public transport vehicles and encourage the modal shift from private cars to public transport. Electric Vehicle initiative is also being promoted in the country along with replacing the taxis with electric cars. Bhutan is now looking forward to have strategies for tackling financial problems, placement of charging stations at hilly terrains, remote areas etc. It is working towards increasing the incentives to the individual private operators of buses.

Other challenges includes the following

Mr. Cabell Hodge's feedback:

It sounds like topography and distance are major challenges in Bhutan. In this case, following two aspects are important:

Understanding the routes and distance which the buses are travelling, size of battery which is needed, using data logs on second by second basis (regular intervals).

There is a tool to determine the charging infrastructure i.e for fast charging and location of charging infrastructure called EVI Pro. There is a study of Colorado, which has mountainous terrain, which explains where to locate charging infrastructure for consumer demand: https://www.nrel.gov/docs/fy17osti/68447.pdf.

Country Presentation 2:

Ms Joyce, Road Transport and Infrastructure, Department of Transport, Philippines: Presentation on Electric vehicles and public transport in the Philippines

The focus of presentation was on the current situation and success of electric vehicles in Philippines.

Philippines is in the early stages of electrification of vehicles because of the issues related to vehicle standards and registration, servicing infrastructure, battery efficiency, maintenance, cost and funding and initiatives. The country is being prepared for the electric vehicles by developing the infrastructure, preparing the policies, training the people of industry, etc. The government has made efforts by developing 'Philippines Environmentally Sustainable Transport Strategy (GOP)', Electronic & hybrid vehicles including charging stations promotions act, 2016 (DOTr), promotion of Low-Carbon Urban Transport systems in Philippines (DOTr, UNDP), Public Utility Vehicle Modernisation Program (DOTr), Separation of E-vehicles in the Motor Registartion Process (LTFRB), allowing fare increase of 20% to E-vehicles operating as PUVs (LTO) and various house and senate bills are underway for promotion of electrification. According to preference fiscal incentives are not a priority as of now in the country.

Success stories for Electric vehicles in Philippines include Star 8 Electric jeepneys in Tacloban city (part of PUV Modernisation program) and Green frog hybrid bus in Makati City which passes through 2 business districts and institutional area of the city. The city has updated the franchise guidelines to public transport vehicles and the use of hybrid vehicles is encouraged.

The routes and number of electric vehicles are now being improved so one of the issues which are raised is placement of charging stations and its effect on the immediate environment.

Open Question and Answer period:

The following questions were raised after the presentation:

1) How can the government integrate the research & development perspective in the process of implementation?
   Response by Mr. Hodge: Sometimes the authority of the country can't get the budget allocated to research, but some universities may have an expertise of working in this sector which can be integrated. They may be able to secure grants from international partners. Analysis will help in preparing a baseline of the intervention and help in succeeding further by learning from the current interventions.

The audience were encouraged by the ALP representatives to ask questions and discuss the issues they face in their countries on electrification of buses. The participants were requested to use the ALP platform for getting technical inputs from the experts

2) Air conditioning in battery is a challenge in hot and humid country. Any comments? Ms Zaheeda Alam (Bangladesh)
   Response by Mr. Hodge: This is being tested in India. Data logs can be used, more data has to be analysed which will be useful to come up with an approximation of how much efficiency one is losing. The lessons may further be used for better deployment on ground.

Closing remarks and next steps – Ms. Avantika, ALP

Globally the countries have initiated electric vehicle policies with a mix of objectives like enhancing energy security, reducing GHG emissions and local air pollution etc. Few countries like China, Japan, Netherlands, Norway and the United States are driven by clear strategic policy objectives through national mandates. Countries like United States, China and Japan have excelled in manufacturing with clear strategic reasons to invest in research and development and to improve the competitive industry. In the recent years the number and variety of electric vehicles has increased significantly, and it is expected that by 2020, about 20 million EVs would be on the roads worldwide with a major concentration in United States, China and Europe. In general, sales and production of electric vehicles are expected to grow rapidly in the future with significant growth in Asian countries. The charging infrastructure and technology chosen by these countries would also impact policy decisions of the neighbouring country on electric vehicles through cross learning, knowledge exchange, peer learning etc

Further, this session gave an overview of the aspects and factors to be kept in consideration for the process under this forum to move forward. It was mentioned to the participants that in order to gain assistance from the forum in the sector of bus deployment, it would be helpful to know the deep-dive questions in which the audience are interested to learn about in the future sessions.

The audience, whose questions were not answered, were asked to send their questions to ALP through an email and it was conveyed that the all the questions together would be forwarded to Mr. Cabell Hodge and his feedback would be shared with the audiences. ALP staff requested the participants to join the linkedin group- Community of Practice- Clean Mobility for cities in Asia Pacific.

There were questions related to technology, infrastructure, capacity or policy as for each country there is a unique solution. The audience was requested to express these ideas or suggestions. The audience were briefed about the future activities which would be carried out under the project.

The audiences asked the few questions and also gave some suggestions as listed below.

1) Mr. Shah Zulfiqar Haider, Bangladesh -Concept of electric vehicle is new to Bangladesh and land constraint makes solar option of charging a challenge. It was mentioned that renewable source of electricity for charging makes the deployment more economical. Is there any comparison of cost through conventional and solar system?
   Response by Mr. Hodge: It depends on the resources available in a country and the commodity cost for electricity generation. Analysis of data available and lessons learnt can be utilised for recommending the probable resource for electricity generation. In case of solar electricity, larger installation would be more effective in comparison to roof top installations. So we should figure out the cheapest source and zero emission alternatives.
2) In Asian country, is there any practical demonstration to understand more?
   Response by Mr. Hodge: Tutorial type information can be provided to the whole group for better understanding once the study in Surat, India is complete.
3) **Suggestion:** Since India has advanced technology and fast market so their experiences can be shared with Bangladesh for electric vehicles and other related subjects.

   The entire program depends on peer-learning experiences, with COP we have full gradient of countries helping each other.

There was a survey option at the end of the webinar for the audience to give the feedback to help design the next sessions. The audience were requested to post any additional questions which will be forwarded and answered by the experts.

Access further details and materials from the session:

Agenda

Presentation

For any feedback or queries please contact:

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