FACTSHEET ON ELECTRIC VEHICLES

EVs are increasingly being seen as a sustainable mode of transport by countries worldwide as they are more efficient than internal combustion engine (ICE) vehicles and can help reduce carbon emissions. Likewise, there is potential for Electric Vehicles (EVs) on Singapore roads. While the cost of an EV is still significantly higher than that of an equivalent (ICE) vehicle, there is potential for the costs to come down with technology advancements.

Electric Vehicles – A Cleaner Mode of Transport

• Pure battery electric vehicles offer significant advantages in the areas of energy efficiency and pollution reduction as compared to conventional petrol and diesel internal combustion engine (ICE) vehicles.

• The EV motor system is more than twice as efficient as the ICE. The EV is also able to recover part of the energy expended during braking in a process called regenerative braking. Hence, overall efficiency for EVs is around 65% as compared to 18-23% for ICEs\(^1\).

• EVs charged using electricity from renewable energy sources like solar and wind have virtually zero well-to-wheel carbon emissions\(^2\). EVs charged using electricity generated from natural gas power generation (as is the case in Singapore) would also achieve some reduction in carbon emissions compared to conventional ICE vehicles, up to an estimated 66%.

EVs – Constraints of Charging Time and Travelling Distance

• Most EVs are powered entirely by lithium-ion batteries. A standard full charge at 3-6 kW (230 volt, 15 ampere) will take about 8 hours, although ‘quick charging’ technologies exist which can markedly reduce charging time by providing high levels of power to EVs. Typically, an EV battery can be quick charged within 30 - 45 minutes.

\(^1\) Efficiency (%) is defined as the degree of effective use of energy drawn from the battery or fuel tank to move the vehicle.

\(^2\) Well to wheel carbon emissions refers to the total environmental impact from the extraction of the fuel to the point it is used either directly or indirectly by the car.
The commuting range of EVs depends on:
- the capacity of the batteries;
- the type of routes traveled (such as city or highway driving);
- whether air-conditioning is turned on (air-conditioning is energy-intensive and will drain the battery faster); and
- driver habits/driving style.

With current battery technology, a full charge would allow the EV to travel for a range of between 90 km to 160 km. This is more than the average driving distance of around 55km in Singapore. With further breakthroughs in battery technology in the next few years, it is expected that the range can be increased by 50%.

**EVs – Higher cost due to expensive battery technology**

- The upfront cost of the EV is currently much higher than its ICE equivalent due to the high battery cost.

- However, EV battery prices are likely to decrease with technological advancement and larger scale of production. Already, battery costs have fallen sharply by 30% since 2006. The lifespan of batteries is also expected to increase as technology progresses.

**EVs – Two types of charging infrastructure for Singapore**

- Bosch has been appointed the first Charging Service Provider (CSP) for Singapore’s EV test-bed. It will design, develop, deploy, operate and maintain up to 60 normal charging stations and 3 quick charging stations by the end of 2011. The normal charging stations will comprise both outdoor models manufactured by Bosch and indoor models supplied by Bosch’s sub-contractor Greenlots.

**Types of Charging Infrastructure**

A summary of the different charging technologies is listed below.

<table>
<thead>
<tr>
<th>Types of Charging Infrastructure</th>
<th>Description</th>
<th>Electrical Power</th>
<th>Recharging Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Public Normal Charger</td>
<td>Public normal chargers and residential normal chargers are the two types of normal chargers. Public normal chargers are installed in public locations like</td>
<td>3 kW</td>
<td>7-8 hours</td>
</tr>
</tbody>
</table>
### 2. Residential Normal Charger

<table>
<thead>
<tr>
<th>Description</th>
<th>Power</th>
<th>Charging Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>shopping mall and HDB car parks while residential normal chargers are installed in private premises. Normal chargers have a longer charging time of 7 to 8 hours compared to the quick chargers.</td>
<td>3 kW</td>
<td>7-8 hours</td>
</tr>
</tbody>
</table>

### 3. Quick Charger

<table>
<thead>
<tr>
<th>Description</th>
<th>Power</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared to the normal chargers, the quick chargers have shorter recharging time and hence, require more electrical power.</td>
<td>30-50 kW</td>
<td>30-45 min</td>
</tr>
</tbody>
</table>

- Most EV users will rely on “normal charging”, which will take about 7-8 hours for a full charge. For certain users such as taxi fleets, faster charging options will be required. The quick charging station available in the market today can charge the battery within 30-45 minutes.

**Outdoor normal charger**

**Indoor normal charger**

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**Enhanced Transport Technology Innovation and Development Scheme (TIDES+)**

- TIDES+ is jointly administered by the Economic Development Board (EDB) and the Land Transport Authority (LTA). The purpose of this scheme is to support EDB’s effort in attracting automobile companies to undertake knowledge-based manufacturing, Research and Development (R&D) activities and testing of vehicles in Singapore.

- Under the scheme, programs with new technology vehicles undergoing R&D and test-bedding in Singapore are granted Certificate of Entitlement (COE), Additional Registration Fee (ARF) and Road Tax exemptions upon approval.
Duty exemption permits can also be applied from the Customs & Excise Department.

TIDES+ has been in effect since 1 July 2010 with a cap of 1300 vehicles. The tax exemption period has been extended to 6 years, up from 2 years under the previous scheme.

- Companies can apply for TIDES+ if they intend to purchase EVs under the EV test-bedding programme. Interested parties can email their interest to EMA_EV@ema.gov.sg and representatives from the EV Taskforce would get in touch with them shortly to complete the TIDES+ forms.

**Background information on Singapore’s Electric Vehicle Test-bed**

- Since 2009, a multi-agency taskforce chaired by the Energy Market Authority (EMA) and Land Transport Authority (LTA), and comprising members across different government agencies, including the Agency for Science, Technology and Research (A*STAR), Economic Development Board (EDB), Ministry of Environment and Water Resources (MEWR), Ministry of Trade and Industry (MTI), National Environment Agency (NEA), Housing & Development Board (HDB) and SPRING Singapore has been set up to assess the benefits and feasibility of adopting EVs in Singapore.

- The EV test-bed will involve key industry players to examine infrastructure requirements and new business models arising from EVs, as well as to identify industry and R&D opportunities. The test-bed is open to all automobile manufacturers and technology companies interested in shaping the future of electric transport. The test-bed will run for three years, from 2010 to 2012.

- Besides Mitsubishi, the EV taskforce is in talks with Renault-Nissan to provide EVs to the Singapore market in 2011. Other auto-manufacturers are also welcome to participate in the EV trial as it is intended to be an open test-bed for all interested parties.

- The results of the test-bed will be instrumental in providing relevant policy recommendations pertaining to the commercial roll out of EVs beyond the test-bedding phase.

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