

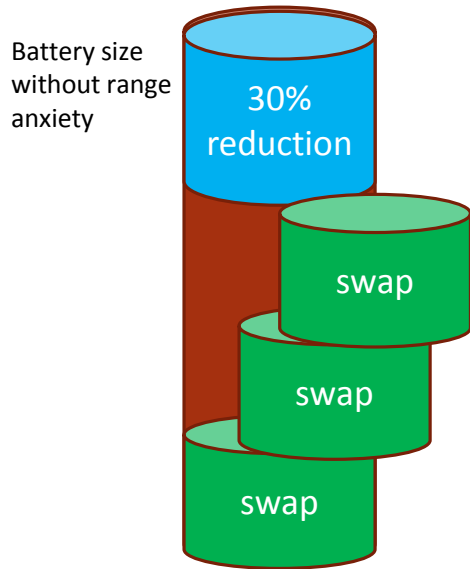
Electric Vehicle programme: 2017 Launch

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Strategy towards EV scaling starting 2017

- Battery price dominates EV costs: use innovative techniques to offset high battery prices
- Intervene in Public transport segment
 - Private vehicles will follow
- Get Volumes: volumes reduce costs

Challenge and Approach



- Battery (without range anxiety) most expensive component of EV
- **Focus to be to enhance efficiency (kms/ kWh)**, especially for 10 to 30 kmph speeds
 - By higher **motor efficiency**, using better tyres, better aero-dynamics and light-weight materials
 - 30% reduction done in many cases
- Still costs too high
- **Introduce Swapping**
 - Divide into smaller parts so that each part not as expensive
- Purchase vehicles without batteries
 - **Capital costs** has to be equal or less than equivalent ICE vehicle costs
 - But with enhanced efficiency
- Treat battery ownership, swapping, charging as separate business ensuring
 - That **operation costs** (cost per km) is no more than that for ICE vehicles

In three wheeler domain

- e-rickshaw
- e-auto
- e-auto (large)

Use **swapping**: 50 km range battery

- **Quality** electric vehicles at price level **same as ICE vehicles** today
- Charged Battery **hire price** per kms no more than that for ICE vehicles



Tasks and progress (green done, brown underway)

- **Meet manufacturers, battery manufacturers, potential battery swappers and vehicle aggregators**
- **Make specs for swappable battery**
- **Make specs for quality e-rickshaw and e-auto**
 - Higher motor efficiency motor and driver
- **Make specs for charger-bank**
- **Find a company to purchase and lease 200K to 1 million vehicles with five years warranty**
 - Lease vehicles to aggregators
- **Find a company to do battery business**
 - Find locations for charging / swapping
- **Select cities for launch**

Everything other than battery cells made in India

For city-buses

Most city buses travel less than 30 kms per trip

- Some 8 to 10 trips per day
- Ten minutes break between trips

Choose **batteries with 50 kms** range (non air-conditioned)

- **Swap batteries** (using robots) at trip-terminal point
- Ensure that cost per km is no more than for diesel vehicle

Buses will be obtained without battery

- Has to have high performance (**minimal Wh/km**)
- Costs **less** than or equal to today's buses

Tasks and progress

- **Meet manufacturers, battery manufacturers, potential battery swappers**
- **Make specs for swappable battery**
- **Make specs for buses**
- **Make specs for charging / swapping infra**
- **Find a company to purchase buses and provide to STC on full-lease basis**
- **Find a company to do battery business**
 - Find locations for charging / swapping
- **Co-opt State Bus corporations and cities**
- **Select cities for launch**



4-wheelers: needs fast chargers

- Focus on **taxis**
 - Typically Runs about 200 kms per day
 - Economics work out
 - Cost per km comparable to that for ICE vehicles
- Have a range of 110 kms
 - Range to be **extended to 160 kms at same costs** by July 2018
 - Charges **overnight** on AC plugs
 - Need **fast charger**
 - will mostly charge in **one hour**
- Also today's vehicles (sedan) available for Government lease at **same rates** as ICE vehicles
- Overnight **slow AC charging** at homes
 - two hour AC charging while parked at office can **extend range** to 150 kms
- DC **fast charger** for one to one and half hour charging

Tasks

- **Bharat Charger Specs released**
- **Get Chargers developed**
- **Make Charger business viable**

Focus on cell manufacturing in India in 2019

Thank You
