Exicom Tele-Systems
EV Charging Solutions

e-Bus Charging Infrastructure
Setup and Management

17th November, 2019
Electric Bus Eco-System

- Grid
- Electrical Infra at Depot
- E-Bus Depot
- EV Charging System
- Public Services
## Barriers to Adoption of Electric Buses

### GENERAL BARRIERS

<table>
<thead>
<tr>
<th>Technological</th>
<th>Financial</th>
<th>Institutional</th>
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</thead>
<tbody>
<tr>
<td>• Lack of information on the advantages and disadvantages of e-buses</td>
<td>• High Upfront capital cost compared to ICE engine buses</td>
<td>• Lack of plans to replace existing buses</td>
</tr>
<tr>
<td>• Range and power limitations of e-buses</td>
<td>• Lack of risk underwriting</td>
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<tr>
<td>• Lack of information on how to start</td>
<td>• Rigid Financial Management &amp; Business Models</td>
<td>• Dependency on subsidy</td>
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<td>• Long range or short range</td>
<td>• Scaling investments past initial pilots</td>
<td>• Negative public perception</td>
</tr>
<tr>
<td>• What to do with batteries post its usage in vehicles</td>
<td>• Large capital expenses for grid infrastructure</td>
<td>• Limited planning for long-term implications</td>
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<tr>
<td>• Lack of understanding of the requirements to upgrade infrastructure</td>
<td></td>
<td></td>
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<tr>
<td>• Lack of skill set in operation</td>
<td></td>
<td></td>
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<tr>
<td>• Grid instability</td>
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## Impact Analysis

<table>
<thead>
<tr>
<th>Issues</th>
<th>Impact</th>
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<tbody>
<tr>
<td>• Power Demand/Supply Management</td>
<td>• Substation will drop the load</td>
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<tr>
<td>• Uneven Consumption</td>
<td>• Low Voltage during peak hours</td>
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<td>• Unawareness of peak time and peak load demand</td>
<td>• Penalty for crossing sanctioned load.</td>
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<tr>
<td>• There is no system to avoid the sanction load by substation</td>
<td>• More the consumption, more will be the tariff</td>
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<tr>
<td>• Load intensity is only at night time, hence, load balancing becomes a</td>
<td>• Load may cross the sanctioned load</td>
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<tr>
<td>• Unavailability of charger scheduling system</td>
<td>• Increase in idle time charging – low ROI</td>
</tr>
<tr>
<td>• Unavailability of dynamic communication system between charger, bus</td>
<td>• Charging of batteries is more than route sufficiency</td>
</tr>
<tr>
<td>• Day ahead planning for power demand is not possible</td>
<td>• Employee conflict</td>
</tr>
<tr>
<td>• Charging station utilization is low during day time</td>
<td></td>
</tr>
<tr>
<td>• Routes have been planned based on linear usage of battery at linear</td>
<td>• Unexpected consumption of energy</td>
</tr>
<tr>
<td>• Power generation data from re-generative braking during the route</td>
<td>• Range variation as battery consumption variation</td>
</tr>
<tr>
<td>• Data Logging about energy and sufficiency not in practice</td>
<td>• Increase in waiting time of buses</td>
</tr>
<tr>
<td>• Time scheduling are not digitalized</td>
<td>• Increase in OPEX</td>
</tr>
<tr>
<td>• Peak time energy requirement and peak time deployment of buses are</td>
<td></td>
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E-Bus Infrastructure: Success Drivers

Land & Permissions
- Space identification and allotment
- Space under Municipal Corp, Transport Authority and Smart City should be utilized
- STU’s to lead the project and provide right of way

Technology & Implementation
- Selection of Efficient Bus/Vehicle
- Selection of Best Electrical and Charging Solutions provider
- Appointment of accurate operation management team
- Create ease of project implementation

Effective Business Model
- Adopt Effective and Efficient Business Model
- IOT - Energy Management and Scheduling Platform
- Attract System Integrators and Investors by providing mutual benefit schemes
- Provide additional revenue generation possibilities to system integrators
Land & Permissions

- Identification of right spots to create common EV Infrastructure
- STU’s Should provide locations to private players to offer Bus Charging

- STU’s Should join hands with multiple govt. departments to co-work on City EV Infra Plan
- Work on inter departmental support to get permissions to expedite projects
Technology & Implementation: How to be Best

“A chosen technology performs well only if put in its ‘best operational’ conditions”

Grid → Electrical Infra at Depot → E- Bus Depot → EV Charging System → Public Services

Bridging the Gap:
- All these above entities are working **heterogeneously**, there is a need to interconnect them
- All the stack holders should be connected and collaborate with each other, Compatibility should be ensured

17th November, 2019
Depot Charging or Opportunity Charging?
Both the charging options are acceptable and viable but in different scenarios

**Depot Charging**
- Flexible of Operation
- Easy to manage charging infra
- Large Battery Size
- Range Anxiety

**Opportunity Charging**
- Small Battery Size
- Range assured within city
- Big Infra cost in Multi location
- Complex Operation

Good for Tier 2 Cities
Good for Tier 1 cities or intercity bus operation
**Effective Operation**

**Effective Grid Management:**
- There could be multiple Depot/Charging Location under a common grid. Effective use management of charging sessions will ensure efficient operation without burdening the Grid.
Efficient Operation

Discrete Electrical Infrastructure:
- Building discrete Charging infrastructure will help more to grid than creating a Big Infrastructure at a Depot location.

It will be beneficial with:
- Charging Infrastructure redundancy
- Optimized Power requirement in a particular Area
Effective Business Model
- We recommend to create separate operation of Bus and Charging Infrastructure, This will add more encouragement among stakeholders and create efficient model
How to Bridge the Gap?

- Impart training on multiple levels
- Encourage Stakeholders to share knowledge
# Training & Knowledge Sharing Matrix

<table>
<thead>
<tr>
<th>Trainees</th>
<th>Trainers</th>
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</thead>
<tbody>
<tr>
<td>Govt. Authority</td>
<td>Trainees</td>
</tr>
<tr>
<td>Trainees</td>
<td>Trainers</td>
</tr>
</tbody>
</table>
| Bus OEM | - Policy  
- Certification  
- Subsidy  
- City Infrastructure |
| Govt. Authority | Trainees |
| Trainees | Trainers |
| Charging Infra OEM | - Policy  
- Grid Availability  
- Govt. Servers  
- Parking Space |
| Bus Operation Team | Trainees |
| Trainees | Trainers |
| Charging Infra OEM | - Allowance  
- Statutory Requirements  
- Code of Conduct  
- Route Plan |
| Bus Operation Team | Trainees |
| Trainees | Trainers |
| Bus Operation Team | - Bus Features  
- Comfort Drive  
- Troubleshooting  
- Failure/ Rectification |
| Charging Infra OEM | - Product Specification  
- Capacity Planning  
- Software Infrastructure  
- Communication  
- Infra Optimization |
| Bus Operation Team | - Charging Operation  
- Troubleshooting  
- Safety Precautions  
- Software Applications |
| Bus Operation Team | - Product Specification  
- Vehicle Communication  
- Testing Procedure  
- Charging Operation |
| Bus Operation Team | - User Feedback  
- Routine Issues  
- Charging Session behavior  
- Charging Pattern |
| Bus Operation Team | - Passenger Feedback  
- Routine Issues  
- Battery behavior  
- Deterioration |
| Bus Operation Team | - Manpower Planning  
- Effective Operation  
- Daily route planning  
- Field Challenges  
- Business Model |
| Bus Operation Team | - Business Model  
- Daily route planning  
- Field Challenges  
- Business Model |
Exicom Support

Market Leader with State of Art Technology

All 3 Market Standards in DC

CCS  CHAdeMO  GB/T

Members of

Certification

IOT Based Operation Management

Energy Management and Scheduling Platform
Exicom is playing a key role in India’s transition to clean energy & riding the wave of disruption in mobility and electricity markets

Thank You