Battery Electric Truck Shared Learning Programme

Transport Operator Prospectus

Accelerating the transition to a commercially viable and environmentally friendly electric vehicle ‘norm’ for heavy road freight operators in the UK.

Version 3, 25th July, 2023
1. Introduction

This Prospectus outlines a collaborative project which is designed to explore how transport operators might move quickly and cost-effectively to an electric vehicle ‘norm’ for heavy road freight in the UK. The programme is based on two guiding principles which, together, ensure that it will deliver good value for money:

- By sharing data with their collaborators, partners will maximise their learning.
- By sharing capital assets with their collaborators, partners will minimize their costs.

The project partners will span several different categories of membership. ‘Freight Operators’ will be the largest partner group, followed by ‘Asset Provider’ partners (supplying vehicles and chargers), and ‘Service Provider’ partners (supplying software and other services). The programme will be managed by Costain plc. The Centre for Sustainable Road Freight (CSRF) will provide instrumentation, data collection, data processing, curation and access management services.

2. Project Description

The project will provide shared access to a fleet of electric vehicles and mobile chargers which can be used by each partner for the purpose of carrying out a pre-agreed sequence of partner trials. High resolution operational data will be collected during each trial period and then analysed, anonymised, and shared with all partners as part of a managed collective learning process. All shared data will be subject to the provisions of a Data Confidentiality Agreement which will be agreed between all partners before the work starts.

2.1 ‘Round-Robin’ Trial

The main project will be a ‘Round-Robin’ trial for which a small fleet of BEV trucks will be acquired along with suitable charging equipment and fleet charge event planning/scheduling software. This equipment will be provided to each operator partner in turn for a limited period of time (for example, three months) during which the partner will commit to carrying out a pre-agreed series of duty-cycles (journey types). Comprehensive high-resolution vehicle and charger performance data will be collected during these duty-cycles and stored in a shared database. Each partner will have unlimited access to their own data plus managed access to the much larger shared data set which will be anonymized, curated, managed and analysed by CSRF. Data will be collected and shared under the conditions described in a Data Confidentiality protocol. This protocol will form part of the binding collaboration agreement which all partners will be required to sign as a condition of participation in the programme.

To operate the trials the vehicles will, at minimum, require regular overnight charging. For the more complex journeys, they may also require ‘opportunity charging’ during the working day. To provide for these requirements, mobile 350kW chargers will be placed temporarily at the partner’s overnight charging sites and at the chosen ‘Opportunity Charging’ locations (e.g. warehouses, retail outlets, roadside facilities, etc). The mobile nature of these units will remove any need to organize fixed charging infrastructure in the partners’ depots or at the chosen Opportunity Charging sites. This will thus allow a high degree of flexibility in selecting the routes and duty-cycles to be explored.
2.2 ‘Bring Your Own BEV’ Trial

A second option in the trial will be for freight operators to supply their own battery electric vehicle. This is expected to happen when a fleet operator and truck OEM have made a separate arrangement to trial a vehicle.

The vehicles and chargers in the ‘BYO BEV’ trial will be fitted with the same instrumentation as for the Round-Robin trial. The data capture, analysis and reporting systems will be the same. So the data collected in the two trials will be directly comparable and will be merged together where appropriate.

This will provide the ‘BYO BEV’ fleet operator with high resolution data and a deep level of knowledge about their own vehicle tests as well as the opportunity to participate in the learning process from all of the testing in the Round-Robin trial.

3. Outline Programme of Work

The programme of work for the Round-Robin trial is outlined in the bar-chart below. (Note: Some of the details may change as the project design evolves.) It is built on the assumption that consortium members are willing to work collaboratively to achieve their objectives, sharing assets to reduce costs and sharing outcomes to increase learning.

The operator members of the consortium will take turns to use the vehicles and their chargers within a series of ‘Operator Segments’ which will have typical durations of 3 months per segment. During each segment, the incumbent operator will explore a number of pre-agreed duty-cycles/journey types. The overall programme will be of approximately 3 years duration.

In addition to collecting and curating the operational data CSRF may, at their discretion, use the data to carry out a range of additional activities designed to better inform the transition to BEV truck operations. These activities will be dependent on additional funds being raised during the life of the programme. The results of any additional activities of this type will be shared with all partners in the project subject to the terms of any additional funding which is raised.

The BYO BEV trial will operate in parallel with the Round-Robin trial, with the exact details depending on the availability of the vehicles. The data collected in the two trials will be merged together.
3.1 The Shared Asset Base

The shared assets in the Round-Robin trial will comprise the vehicles, their associated chargers, and the charge event scheduling software. It is intended that the vehicle fleet will be made up of heavy tractor units from a number of different OEM’s. This will provide the fleet operator partners with an opportunity to compare and contrast the operational performance of a range of different BEV trucks as they become available in the market-place.

The chargers will be portable and will be powered by mobile generators or batteries. This will remove the need for operators to install grid-connected charging infrastructure at their overnight depots and planned Opportunity Charging locations, thus conferring a great deal of flexibility on the choice of routes which can be explored. (NB. Some operators may prefer to have grid-connected charging equipment installed at their chosen locations. An installation survey will be carried out for each operator partner as part of the overall project budget. Any costs directly associated with the installation of grid-connected charging equipment will, however, fall to the operator).

The fleet charge event scheduling software will be provided and supported by FPS Ltd. This service is included within the overall project budget.

The precise numbers of vehicles and chargers in the shared asset base will depend on the final number of consortium partners and their collective appetite for investing in the programme. A representative asset-base, for illustrative purposes only, is defined in the table below.

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric truck fleet</td>
<td>6 x electric trucks with charge event scheduling software</td>
<td>A fleet of 6 electric vehicles (40t tractors) has been chosen for illustrative purposes only. Detailed discussions with the OEM’s are underway. Final numbers of vehicles in fleet to be confirmed. All vehicles will be supplied with supporting software for charge event scheduling (provided by FPS).</td>
</tr>
<tr>
<td>Destination Charger Unit</td>
<td>2x 350kW DC chargers with associated 350kW generators or batteries</td>
<td>During each Operator Segment it is assumed that the electric fleet will be deployed on a number of different pre-defined journey-types. Some will require fast-chargers to be placed at destinations or en-route locations to enable ‘Opportunity Charging’ to take place. The Opportunity Chargers must be easily relocated.</td>
</tr>
<tr>
<td>Overnight Charging Hub</td>
<td>6x 150kW DC chargers plus 2x 500kW generator or batteries (or grid-connected chargers, if preferred, at extra cost to partner)</td>
<td>Within each Operator Segment, it is assumed that all the vehicles will be stabled at the same ‘home’ location each night. The chargers and generator will be re-locatable and will be placed at the operator’s home location for the duration of each Operator Segment. At the operator’s request a grid connection survey will be carried out.</td>
</tr>
</tbody>
</table>

Table 1. Illustrative Shared Asset Base in the Round-Robin trial
3.2 Project Management & Data Management Activities

The Project and Data Management activities are identified in the table below. These illustrate the nature of the proposed activities but do not represent a definitive activity list at this stage.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Management</strong> -</td>
<td>Costain/CSRF</td>
</tr>
<tr>
<td>includes programme</td>
<td></td>
</tr>
<tr>
<td>leadership &amp; co-ordination, shared asset</td>
<td></td>
</tr>
<tr>
<td>procurement and management, insurance, maintenances; technical support to partners; liaison with vehicle and equipment suppliers; stakeholder engagement; public &amp; press relations, and management reporting.</td>
<td></td>
</tr>
<tr>
<td><strong>Data Management</strong> –</td>
<td>CSRF</td>
</tr>
<tr>
<td>includes instrumentation of vehicles, data collection, anonymisation, access management, data processing, operations modelling, and technical reporting.</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Project and Data Management Activities

4. Research Programme

4.1 Project Scope

The precise scope of the project has yet to be defined in detail but, subject to partner agreement, will cover issues including:

(i) Logistics considerations – vehicle usage, payloads, fleet sizes, journey sizes, journey times
(ii) Financial implications (short-term and long-term)
(iii) The need to meet corporate environmental, social, and governance requirements.
(iv) Charging strategies and infrastructure requirements (short-term and long-term).
(v) Best practice strategies for rolling-out battery electric vehicles across corporate fleets.

4.2 Key Issues to be investigated

(i) Factors affecting vehicle range and business case:
   • Component and vehicle performance: chargers, batteries, inverters, drivetrains, tyres, aerodynamics, loading.
   • Effects of operating conditions and environment (eg low temperatures)
   • Driving style
(ii) Battery Health Degradation:
   • Influence of vehicle charging profiles on battery health and life
   • Influence of vehicle use conditions, drive cycle, driving style etc.
(iii) Logistics Performance:
   • Quantify the logistics implications of ZEV performance, relative to diesel
   • Numbers of vehicles required (affected by payload and time constraints)
   • Change in delivery/service time, etc
(iv) Modelling Studies
   • Parameter Estimation
   • Model Validation
   • Viability of electric logistics across all UK operations
   • Modelling national roll-out
4.3 Reporting and Meetings

During the Round-Robin trial, the results of the testing phase will be disseminated through a set quarterly meetings of the project partners with corresponding quarterly project reports. The aim will be to begin generating knowledge and learnings from the trial early and regularly, so that the testing programme can continuously improve and the participants can gain maximum benefit.

5. Project Funding Model

The cost of participation will vary between the different partner types as set out in the table below.

<table>
<thead>
<tr>
<th>Partner Type</th>
<th>Cost of Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Operator</td>
<td>Flat-rate Membership Fee</td>
</tr>
<tr>
<td>Asset Provider</td>
<td>Provision of vehicles and chargers or other assets, plus asset maintenance throughout the life of the programme at no cost to the programme.</td>
</tr>
<tr>
<td>Service Provider</td>
<td>Provision of services throughout the life of the programme at no cost to the programme.</td>
</tr>
</tbody>
</table>

Freight Operators will pay a simple flat-rate membership fee that reflects the cost of managing the programme, collecting/processing/sharing the data, and formulating the learning outcomes. The exact fee will depend on the number of partners who commit to the programme and the size of the shared asset base. However, for illustrative purposes, an indicative fee calculation is set out below. A definitive figure will be set down in the formal collaboration agreement once the exact number of partners, and the exact size of the shared asset base, are known.

The illustrative figure is based on the following assumptions:

There are 8 freight operator partners in the programme. (This is considered to be the minimum number required to create a viable project).

a. The shared asset base is as defined in Table 1
b. The programme secures the supply of vehicles from OEM’s at no cost to the partners.
c. The programme secures the supply of chargers from a charge-point operator at no cost to the partners.
d. The programme secures the supply of charge event scheduling software at no cost to the partners.
e. The cost of managing the programme and collecting/processing the data is the only activity which needs to be paid for by the freight operator partners. These activities are summarised in Table 2.

Based on the above assumptions, the cost of delivering the programme would be £400,000 split between 8 partners. (Cost per partner = £50,000 or £16,700 per annum). This figure is provided for illustrative purposes only.