

**Appendix 3: Executive Summary and extracts from Energy Savings Trust 'A feasibility study into a rapid charge point network for plug-in taxis.' November 2016**

# Executive Summary

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## Background

Energy Saving Trust was commissioned by Transport for London (TfL) in 2013 to review the feasibility of a rapid chargepoint network for plug-in taxis in London, determine suitable locations for infrastructure and provide advice on operational viability. This report is part of a suite of studies being undertaken by TfL to understand where rapid charge infrastructure might be needed to serve a variety of potential users in London.

From January 2018, all newly licensed London taxis will be zero emissions capable ( $\leq 50\text{g/km CO}_2$  with a minimum zero emission range of 30 miles). This will complement the introduction of the world's first big city Ultra Low Emission Zone (ULEZ) in central London currently planned in 2020 but under review following a series of consultations through 2016 and 2017.

- **Phase 1 – July 2016:** Air quality consultation on high level proposals including the principle of introducing a new Emissions Surcharge to discourage the oldest vehicles from driving in Central London and changes to the plans for the Ultra Low Emission Zone (ULEZ), high pollution alerts and incentivising the use of cleaner vehicles.
- **Phase 2 – Autumn 2016:** Policy consultation on transport related proposals including a detailed statutory public consultation on the introduction of a new Emissions Surcharge
- **Phase 3 – 2017:** A detailed statutory public consultation on the transport related proposals including the widening of the ULEZ boundary to include more of inner London and proposal to tighten the emission standards for the London-wide Low Emission Zone

## Plug-in vehicles and rapid charging

Plug-in vehicles emit zero tailpipe emissions while driving using electric power and can therefore make a significant contribution towards air quality objectives. According to TfL's research, taxis are responsible for 19% of  $\text{PM}_{10}$  emissions and 18% of  $\text{NO}_x$  emissions arising from road transport sources in central London<sup>1</sup>.

Taxis' duty cycles make them ideal for utilising plug-in technology, as they are driven predominantly in an urban, stop-start environment, where battery electric vehicles operate most effectively.

'Rapid charging' involves charging a plug-in vehicle at a rate of 43kW or more, which would typically provide a vehicle with the capability of charging at this rate with an 80% charge in less than half an hour. Access to rapid charging offers three potential benefits for taxis:

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<sup>1</sup> Source: TfL modelling based on the LAEI 2010

1. The limited range on a single charge is effectively no longer an issue given the speed at which vehicles can be recharged, eliminating excess driver downtime.
2. The low cost per mile when driving on electric power reduces total cost of ownership
3. Vehicles will produce zero tailpipe emissions and therefore reduce the negative impact on London's air quality.

## Rapid chargepoint network

This report proposes a rapid chargepoint network for taxis based on current vehicle movements. In designing this network, the intention is to minimise disruption to drivers' working patterns.

- Chargepoints should be sited at or close to where taxis are stationary in large numbers, such as key ranks and drivers' break locations. Strategically locating chargepoints is also necessary to maximise chargepoint utilisation rates.
- The rate of charging should allow drivers to recharge their vehicles without being off the road for longer than they are currently.

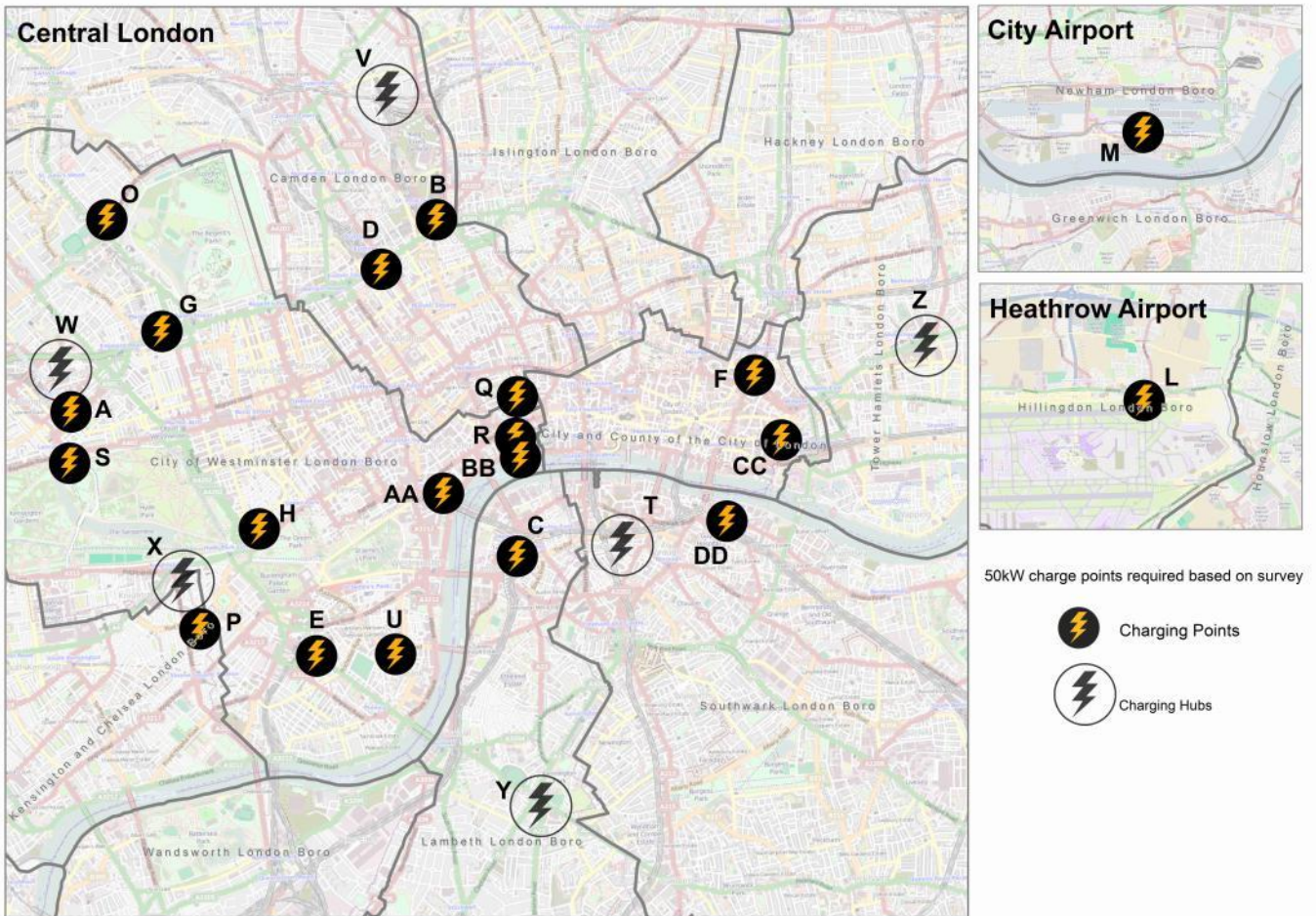
We estimate that by the end of 2018 approximately 90 rapid chargepoints will be required to support the introduction of 1,400 taxis, based on the current replacement cycle of the vehicles. Additional financial support being made available to drivers by TfL, in particular a voluntary decommissioning scheme, and the increase in replacements typically seen when a new vehicle is launched is anticipated to lead to the following scenarios:

Scenario	Number of chargepoints (2018)
1 Baseline, 50% E-REV <sup>2</sup>	88
2 Baseline, 100% E-REV	73
3 Accelerated uptake, 50% E-REV	150
4 Accelerated uptake, 100% E-REV	126

Based on taxi drivers' current working patterns, the following illustrative locations are suggested:

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<sup>2</sup> Also applies 100% E-REV and 50% of drivers both commute and work in electric drive mode

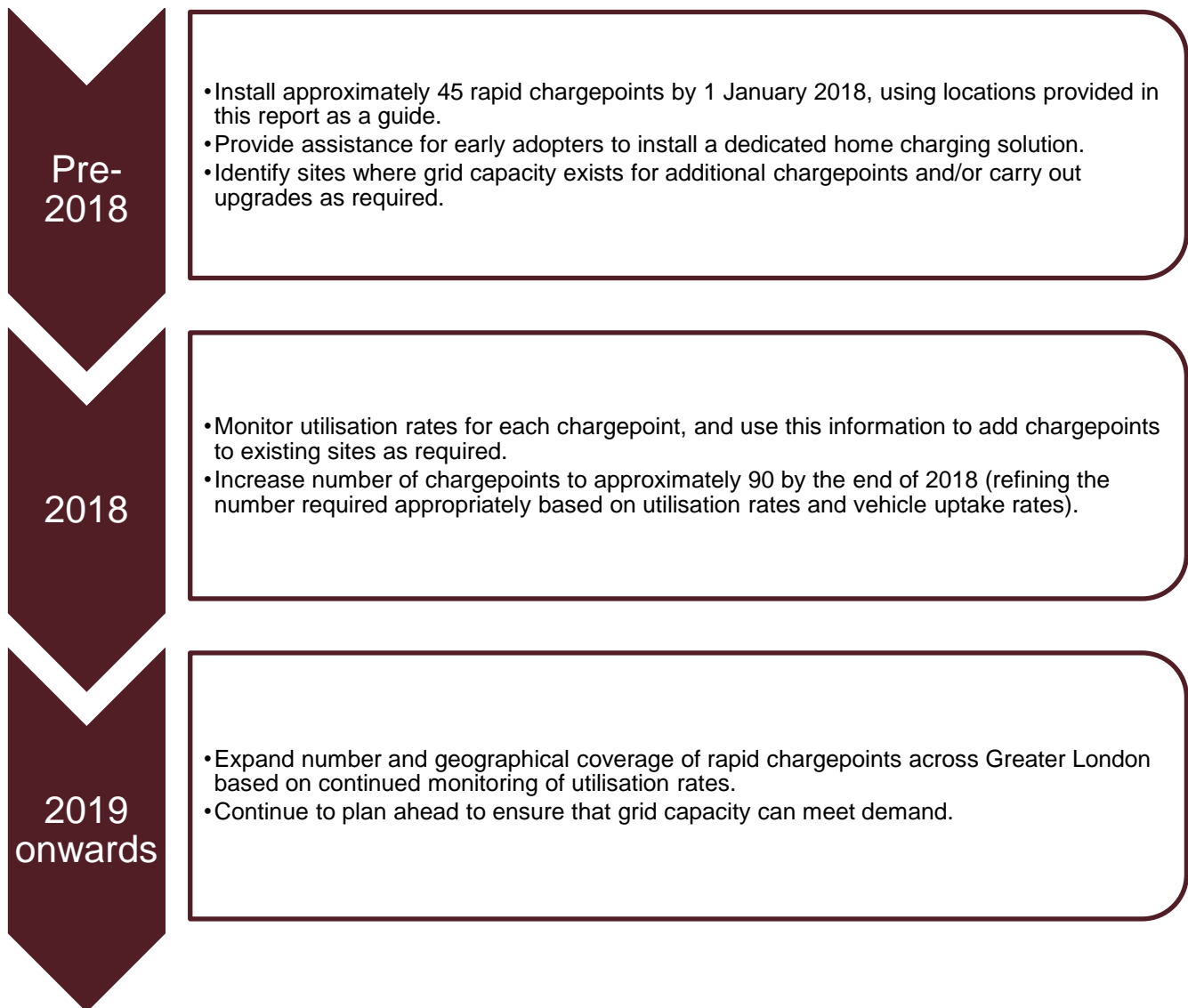


*Illustrative rapid chargepoint locations*

- **Stations:**
  - Paddington (A), King’s Cross / St. Pancras (B), Waterloo (C), Euston (D), Victoria (E), Liverpool Street (F), Marylebone(G), Charing Cross (AA), Fenchurch Street (CC) and London Bridge (DD).
- **Hotels:**
  - In W1 postcode area.
- **Airports:**
  - Heathrow (L), London City (M).
- **Cabmen’s shelters:**
  - Wellington Place NW8 (O), Pont Street SW1 (P), Temple Place WC2 (BB).
- **Rest ranks:**
  - Lincoln Inn Fields WC2 (Q), Strand WC2 (R), Lancaster Gate W2 (S).
- **Additional locations:**
  - Great Suffolk Street SE1 (T), Horseferry Road SW1 (U), Camley Street King’s Cross (V), North Wharf Road near Paddington (W), Hyde Park Corner (X), Oval / Kennington (Y), Whitechapel (Z).

In order to provide the forecast number of chargepoints (c.90) in and around central London between one and three rapid chargepoints should be installed at each location. The exact number to be installed at a given site will depend on the results of Distribution Network Operator surveys to establish local grid capacity.

## Timescale for network introduction



## Comments on the feasibility of a rapid chargepoint network for taxis

The purpose of this study is primarily to determine the feasibility of a rapid chargepoint network for taxis. Therefore this report does not consider the viability of other options such as slow, fast or inductive charging in detail. It is presumed however that fast charging at 20/22 kW may be required in some central areas, such as Westminster, where space to install rapid chargepoints is at a premium. Our research suggests that it is feasible – and necessary – to implement a network of rapid chargepoints, supported in central areas by fast chargepoints to support the introduction of zero emission capable taxis and ensure that the potential financial and environmental benefits are maximised. However, in order to ensure the network is successful, it is critical that the following four areas are addressed.

**1. Zero emission capable vehicles licensed to operate as taxis should be available by 2018. All taxis should be rapid charge capable in order to make a rapid charge network feasible.**

- Several manufacturers are developing zero emission capable vehicles designed to meet the Conditions of Fitness for use as a London taxi. All vehicles described in this report can be driven without producing any tailpipe emissions, although the choice of technology includes both pure electric vehicles and extended range electric vehicles. Final decisions have not been reached or published by all manufacturers about incorporating rapid charge capability into the potential taxis. We recommend TfL determine the charging capability for all London taxis and incorporate a minimum charging specification into the conditions of fitness.
- When these vehicles are presented for licensing, TfL should work with the manufacturers to establish electrically driven range in 'real-world' conditions and petrol consumption (of plug-in hybrid or extended range electric vehicles) once the battery has been depleted.

**2. Sufficient rapid chargepoints should be installed at strategic locations across London, supported by appropriate KPIs and data management**

- Taxi drivers in London typically stop for 15 minutes or fewer when they take breaks. Therefore rapid (rather than slow or fast) chargepoints are desirable so that drivers can recharge vehicles without additional downtime. 50kW chargepoints (compatible with both major DC protocols) should be installed; they will supply approximately up to 40 miles of additional range in 15 minutes.
- Chargepoints should be reliable and supported by an appropriate back office system. We recommend that TfL sets KPIs for licensed network operator(s) to ensure they provide sufficient, reliable and well maintained chargepoints. TfL should also collate and monitor chargepoint utilisation data to plan the expansion of the network beyond 2018.

**3. Taxi drivers in extended range and plug-in hybrid vehicles should use rapid charging rather than rely on the petrol engine once the battery is depleted**

- Even if rapid charge compatible vehicles and rapid chargepoints are provided, there is a significant risk that drivers of extended range and plug-in hybrid vehicles will rely on the petrol engine once the battery is depleted. This will reduce the environmental and financial effectiveness of the new vehicles and will lead to significant under-utilisation of chargepoints. Drivers should, whenever practicable, use rapid chargepoints once the vehicle battery is depleted.
- Part of the solution will be to ensure that the cost of rapid charging is less than the cost of petrol, on a pence per mile basis. However, a price incentive to use rapid charging will not be sufficient by itself. TfL should consider the risks associated with drivers not

utilising their vehicles effectively and ensure the use of rapid charging becomes normal practice.

**4. Electricity supply constraints at the substation level are potentially the biggest barrier to rapid chargepoint provision. Plans for mitigating this should be drawn up.**

- Installing rapid chargepoints will add significant demand to the already constrained electricity supply system in London. Given the estimated number of rapid chargepoints required to support zero emission capable taxis, the cost of upgrading the electricity network is likely to be the greatest potential barrier to developing rapid charge infrastructure.
- Some installations may require a new substation which could cost up to £200,000, in addition to the cost of land to site chargepoints and a substation. Distribution Network Operators are not responsible for paying for upgrades, except in instances where they have demonstrated that it will benefit network users. If prospective chargepoint operators are expected to be responsible for the full upfront cost of any network reinforcement, it is unlikely that they will be able to produce a business case for installing chargepoints.
- TfL and the appropriate Distribution Network Operators should collaborate from the outset to manage rapid chargepoint installations and any necessary supply upgrades, including integrating chargepoints into new built environment developments where practicable.
- Subsequent to the initial (unpublished) draft of this report TfL has confirmed that it will identify and enable sites for the installation of charging infrastructure across the TfL, borough and private sector estates. Enabling works will include upgrades of power capacity and groundworks to make the site suitable for charge point installations.