CLIENT: LONDON UNDERGROUND LIMITED

CONTRACT REF: TLL 7917

NORTHERN LINE EXTENSION

MAIN WORKS CONTRACT

ENERGY MANAGEMENT PLAN

Issue and Revision Control

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Revision History			
Rev No	**Date**	**Summary of Changes**	**Section Number**
1.	04.12.2014	Review and approval.	All
2.	11.12.2014	Updated, review and approval.	All
3.	23.01.2015	Updated from review comments	All

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1.0 Introduction

The purpose of this Energy Management Plan is to set out the measures that will be undertaken throughout the construction of the Northern Line Extension (NLE) works to reduce energy consumption and continually improve energy efficiency on site.

Lighting Management is also covered in this plan (Section 5) and details how site lighting arrangements will managed to minimise any impact on adjacent footpaths, amenities and properties, whilst still providing sufficient levels of light for works to be completed safely.

This plan should read in conjunction with the NLE Code of Construction Practice Parts A and B. Part A details the generic controls that apply to manage possible impacts arising from the construction of the NLE, and the Part B are site specific and detail the additional specific controls for each of the four work sites (Kennington Park, Kennington Green, Nine Elms and Battersea).

To ensure that this document remains relevant, adequate and effective as the works progress the Energy Management Plan will be reviewed and updated as necessary:

- Following any change that has a significant impact on sustainable travel;
- As instructed by the London Underground (LU) Project Manager;
- At least every 6 months.

2.0 Aims and Objectives

The aim of this document is to improve the energy efficiency of the NLE scheme by identifying project specific initiatives to reduce electricity consumption and fuel use. Monitoring of electricity and fuel usage is used to inform the success of the initiatives and identify how further energy efficiencies can be achieved. This plan also aims to mitigate the impacts associated with site lighting. FLO will track and reduce the energy consumption across the four worksites in line with the project energy target as defined in Section 10.

3.0 Description of the sites

The Northern Line Extension (NLE) will create a new underground line as an extension to the existing Charing Cross branch of the Northern line between Kennington and a terminus station to the south of Battersea Power Station. The extension will consist of new twin bore running tunnels of 5.2m internal diameter and covering a distance of approximately 3.3km with new stations at Battersea and Nine Elms.

The worksites associated with the construction of the NLE are located at Battersea, Nine Elms, Kennington Park, and Kennington Green, as described below:

Battersea Station worksite is located within the south western section of Battersea Power Station (BPS) development, within the London Borough of Wandsworth. Where the worksite abuts Battersea Park Road, Battersea Park Road is at a higher level than the site. The site is bounded to the west by Network Rail, to the north by Battersea Power Station and to the east by the Battersea Power Station Development Company:

Nine Elms Station worksite, including part of the Covent Garden Market Authority (CGMA), is located on the land to the west of A3036 Wandsworth Road and north of its junction with Pascal Street, within the London Borough of Lambeth. The worksite includes the north footway of Pascal Street. The worksite is bounded to the north by a Sainsbury's worksite and to the west by land owned by Covent Garden Market within the London Borough of Wandsworth. The demolition of the Banham securities building on the west end of the worksite, the CGMA office, boiler house, including the chimney and underground fuel tanks and the relocation of two substations are necessary to release the full area of the worksite.

Kennington Green worksite is located at Kennington Green within the London Borough of Lambeth. The triangular site is bounded on all three sides by Kennington Road, the eastern boundary being the main route of the road. The worksite includes footways and parking bays. It is necessary to carry out some demolition to release the full worksite. There is a local satellite worksite (hereafter referred to as Montford Place) to the west of Kennington Green adjacent to the Beefeater Gin Distillery and this is accessed via a narrow road from an access way to the west of Kennington Green. The area, although not containing any permanent works for NLE, is very close to the Kennington Green shaft. FLO has taken early occupation of the area and developed it for 'satellite' temporary offices and storage.

Kennington Park worksite is located in the north east corner of Kennington Park, south of Kennington Park Place west of its junction with St Agnes Place, within the London Borough of Lambeth. It is necessary to demolish Kennington Park Lodge to release the full worksite.

Two shafts of approx. 25m deep will be sunk at Kennington Green and Kennington Park respectively. These shafts will be used to remove the Tunnel Boring Machine's (TBM), service the Sprayed Concrete Lining (SCL) running tunnels up to the step plate junction, build the step plate junction and build the four cross passages at Kennington Station. The current proposal to build the step plate junction includes two SCL gallery tunnels but this method is currently being reviewed.

4.0 Energy Reduction Measures

Energy use during the construction process can be measured by metering the electricity consumption, measuring site based fuel consumption and fuel usage associated with the transportation of materials. There are a number of both office and site based measures that can be implemented to reduce energy consumption, some of which (if not all) will be

used to achieve the objective of this plan. Specific consideration will be given for installing Power Correction in order to improve performance of energy supply to the works.

Where practicable, consideration will be given to procuring energy efficient equipment and lighting from the Energy Technology List (or Energy Technology Product List (ETPL) which is a government-managed list of energy-efficient plant and machinery, such as boilers, electric motors, and air conditioning and refrigeration systems that qualify for full tax relief). However this will be considered against the capital expenditure versus the short duration of the construction works to determine the best value.

4.1 Office based Energy Saving Measures

FLO is using temporary site accommodation that meets British Standard Codes of Practice (E.g. BS7671, BS 5266: Part 1, BS 5839: Part 1, BS 4737, BS 7671), Building Regulations and are equipped with high standard insulation (taking into account the required fire standards) to prevent heat loss and minimise sound transmission between offices and meeting rooms. FLO will be implementing the below office based energy saving measures:

- High efficiency T5 fluorescent lamps to all areas excluding welfare facilities;
- Passive Infrared (PIR) motion detection sensors to all lighting areas excluding welfare facilities;
- ZIP boilers in canteen facilities;
- Installing lighting sensor controls;
- Door closers to welfare facilities and stair well units;
- Toilets equipped with ‘Dyson’ eco type hand driers;
- In low occupancy areas PIR’s will be installed to activate ventilation fan operation and to improve the energy efficiency of the area heating equipment.

4.2 Site Based Energy Saving Measures

Fuel usage on site is likely to be one of the main contributors to the NLE energy footprint during construction. The following measures will be implemented on site:

- Correct sizing of site based plant
- Engine shut down during periods of inactivity
- Proactive maintenance to ensure efficient running of plant
- Operator training to ensure efficient use of plant
- Selection of energy efficient plant
- Installation of photo sensitive switches and manual override switches for site lighting

4.3 Electricity Tariffs

Where new electricity contracts are set up, rates will be reviewed. Options for green tariffs, including costs and benefits, will be submitted to the Project Manager at least 4 weeks prior to procurement.

5.0 Lighting Management

The extent of the area to be lit varies during the different stages of construction according to security and health and safety requirements. Where appropriate, lighting to site boundaries are provided and illumination is sufficient to provide a safe route for the passing public. Precautions are taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas. Appropriate industry standard procedures are implemented for site lighting.

Lighting is designed, positioned and directed so as not to unnecessarily intrude on adjacent buildings, wildlife sites and land uses and to prevent interference with local residents, railway operations, road traffic signals and signing, passing motorists or navigation lights for air or water traffic. The lighting is designed to comply with the provisions of BS5489, Code of Practice for the Design of Road Lighting, where applicable. Further guidance is contained within Guidance Notes for the Reduction of Light Pollution, 2000, published by the Institute of Lighting Engineers and from the Bat Conservation Trust – 'Interim Guidance: Artificial lighting and wildlife - Recommendations to help minimise the impact of artificial lighting'.

The site supervisor ensures the lighting type and necessity is considered at each stage of the project, for example the hoarding lighting at Montford Place is fitted with deflectors to further reduce illumination of surrounding properties. If lighting is required only the correct amount of lighting for the task will be installed. To reduce the effects of glare the main beam angle of all lights on site are below 70 degrees where practicable. Where feasible lights are directed downwards, if up-lighting is required reflectors are used to minimise light wastage. Where possible, equipment is not be installed which spreads light above the horizontal.

Security flood lighting uses low energy lamps where practicable. Hoarding lighting is compact fluorescent 13W type. Lighting is motion sensitive, daylight auto dimming, T5 fluorescent low energy type. The use of LED lighting for the site hoarding is being investigated to assess if it is a cost effective solution for this project.

6.0 Electricity Supply

All sites will be grid connected as soon as practicable to reduce fuel usage and noise associated with running site generators. The Environmental Manager has input in decisions involving electricity supply and where practicable take steps to reduce consumption. A green tariff will be used where available and cost effective.

7.0 Roles and Responsibilities

Specific duties for staff are listed below:

Role	Responsibilities
Project Director	• Overall responsibility for implementation of this plan. • Assessing training needs along with Environmental Manager and others. • Reviewing roles and responsibilities
Environmental Manager	• Ensure implementation of this management plan and review the plan. • Ensure resources are available to implement this plan • Set objectives and targets for the project in relation to energy-saving measures. • Report performance against objectives and targets • Ensure KPI data is reported to LU
Site Manager	• Integrate this plan into all site activities and method statements. • Identify and implement energy-saving opportunities on site, including minimisation and reuse. • Ensure all machinery and equipment used on site is in good working order. • Ensure all personnel are fully trained on this plan.
Environmental Advisors	• Carry out weekly inspections to ensure energy saving measures are implemented on site • Read the meters on site, and report back to the environmental data manager • Arrange training for site personnel on the contents of this management plan • Ensure energy-saving measures are implemented into method statements, activity briefings and procurement • Review site performance against targets discuss where improvements can be made • Feedback performance to the site teams • Investigate any unexpected rises in energy consumption • Ensure audits and inspections are undertaken • Collect KPI data on energy usage from site teams, and report back to the Environmental Manager and Advisors • Determine baselines and measure performance against

	targets • Compile data to report back to Site Teams, FLO Environment Manager and parent companies. • Determine the CO2 impact of the NLE works.
Logistics Manager	• Maintain the vehicle management booking system • Feed data on vehicle movements to the Environmental Team
All personnel	• Carry out the works in accordance with agreed methods and briefings. • Report anything that deviates from agreed processes. • Use observation cards to report best practice or any improvements that you believe could be made. • Attend environmental training.

8.0 Training

A programme of training on energy saving measures and efficiencies is rolled out across the project team through briefings, toolbox talks and awareness posters. The aim of which is to change environmental behaviours e.g. it is not acceptable to leave plant running when not in use or site accommodation being heated overnight when empty. Information on the Project's energy use is to be made visible to the workforce through the use of graphs, tables or toolbox talks as appropriate.

9.0 Energy Audits

Audits and inspections will be carried out as detailed in the Environmental Management Plan. Monthly site inspections will include checks to ensure that energy minimisation is being utilised on site and in the office.

Audits on energy minimisation, measurement and reporting and will be carried out as a minimum annually, for every site. Audits of all energy using processes, activities and equipment on site is undertaken to identify the high energy demand areas that can be targeted for reduction measures. These audits are to be used to measure the success of energy saving measures, and to flag up any areas of high usage that may not have been predicted in the energy forecast.

10.0 Measurement and Reporting

All mains connections will be metered and sub metering will be considered for high demand activities such as the Tunnel Boring Machine and treatment plants.

Energy consumption will be monitored on a monthly basis. This data will be assessed against an energy forecast for the project. The energy forecast will be based on data from a similar project and normalised against project spend.

A 10% reduction target over the duration of the contract will be incorporated into the forecast and actual energy usage performance is plotted against this energy reduction forecast on a monthly basis.

11.0 Action Plan

An Energy Action Plan will be developed and implemented to target specific energy consumption reduction measures such as staff engagement, training and a review of equipment selection and usage. The plan will also include specified timescales and staff accountability. The specific reduction measures will be identified during the energy audit process.

12.0 Review

The effectiveness of this plan and the associated energy efficiency measures will be undertaken during the 6 monthly environmental management reviews, which includes;

- Energy audits to identify all energy-using processes, activities and equipment on site (aligned with significant changes in site activities through the project life cycle);
- Implementation of an action plan, including staff engagement and training to reduce the consumption of all energy using processes, activities and equipment on site;
- Reporting of energy usage to determine the effectiveness of site energy conservation measures.

This review will be communicated to the project management and LU, so that appropriate corrective actions and initiatives can be implemented in a timely manner.