252 Finchley Road
Residential Development

Energy and Sustainability Strategy
(Concept Design Stage)

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1.0 EXECUTIVE SUMMARY

This report summarises a study of the sustainability and renewable energy options for the residential development in 252 Finchley Road, London. Measures that will benefit the development in respect of CO2 emission reductions have been reviewed.

The proposed development comprises a 3 storey development, serving a total of 12No. dwellings.

The CO2 savings have been calculated following the London Plan Energy Hierarchy:
- Use less energy (Be lean)
- Supply energy efficiency (Be clean)
- Use renewable energy (Be green)

The following renewables and LZC technologies have been reviewed in this study:
- Solar Photovoltaic and Thermal
- Ground Source Heating & Cooling
- Biomass Heating
- Biomass Combined Heat and Power (CHP)
- Air source Heat Pumps
- Combined Heat and Power (CHP)

All of the above options were considered and the only feasible solution was to install as much PV as possible to the bike store roof and main building roof and still maintain sufficient maintenance access.

Further enhancements have been incorporated into the project including but not limited to:
- Enhanced U values
- High efficiency boilers
- Low air permeability
- Low energy lighting throughout
- High efficiency fans

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We anticipate with all the energy saving measures and the 'be lean, be clean,' approach the development will improve carbon emissions from Part L 2013 by at least 27%. This is below the 35% The proposal represents an analysis that meets the building design without materially affecting the buildings appearance in its sensitive setting.

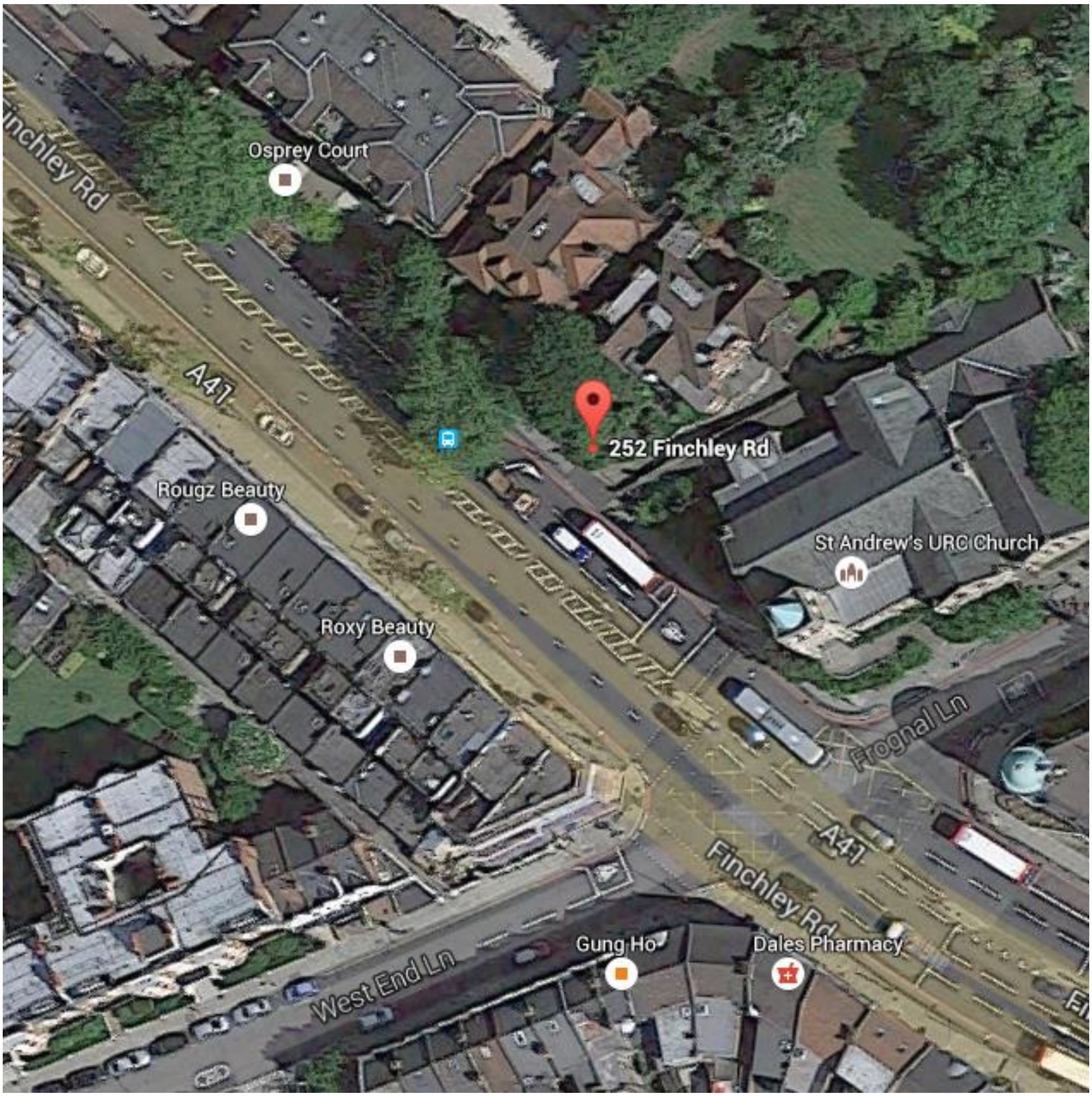
The design team have worked closely together & with the clients input to meet the requirement of the London plan, with respect to energy consumption. Whilst the plan recognises the difficulties experienced in smaller residential developments we have nevertheless endeavoured to meet the standards.

The outcome means there is a shortfall as defined above.

The use of a centralised scheme in such a small development presents the operator & the end user with unnecessary administration resulting in higher usage costs for the end users.

2.0 INTRODUCTION

This report has been re-submitted by Ilec-Imec building services to support the detailed planning application for the proposed development of a new built residential development to 252 Finchley Road. The purpose of the report is to demonstrate how the proposed development complies with London Plan objectives for climate mitigation and adaptation. The project involves 12No. dwellings adjacent to a church.



For the purposes of this report, consideration is taken to comply with Part L1A of the 2013 edition of the Building Regulations and the Greater London plan. The dwellings individually will comply with approved document L1A. The building will also comply with the non-domestic compliance guide. Background heating is proposed to communal areas as to allow for U-Value of 0.0 between walls of apartments and communal areas. We believe as the area is negligible size, this will not require a separate for an SBEM, therefore electric heating is proposed.

This report summarises the approach to energy conservation and adoption of low and zero carbon technologies for the project in response to the objectives of the London Plan and the associated supporting guidance notes, mainly the Mayor's Energy Strategy and London Energy Partnership's (LEP) London Renewable Toolkit.

A low carbon approach will be adopted for the design of the new building and engineering systems.

Under section 4-Be clean a range of energy technologies have been appraised as potential on-site renewable energy sources in relation to a typical development of this nature. In some instances, these are not suitable for the building location and the reason they have been discounted is explained. These comprise:

- Combined heat and power (CHP)
- Wind turbines
- Photovoltaic (PV) electricity generation
- Solar water heating
- Ground source heat pump
- Biomass heating
- Biomass combined heat and power (CHP)

Ilec-Imec building services have been involved with this project from an early stage so have played a major part in influencing the design development as far as is possible on a limited urban site to:

- Ensure the orientation of the building is optimised, from a day lighting, natural ventilation, solar gain and air/acoustic quality perspective.
- Ensure that the overall carbon footprint of the building is optimised to deliver a building that meets the needs of the present without compromising the ability of future generations to meet their own needs and in accordance with planning policy.
- Ensure that the proposals meet the needs and aspirations of the client both commercially and operationally, without which the project will not progress.
- Ensure that the building treads lightly on the existing environment in respect of the local air quality, acoustic environment and water cycle.

It is our intention and the intention of our client to develop a building, in this case a residential development that, meets and respects the requirement to reduce carbon emissions emanating from the built environment.

3.0 THE LONDON PLAN

The development is located within the Greater London Authority, therefore the sustainability targets set by the Mayor of London and the GLA need to be applied. The sustainability strategy for the development has been approached following the London Plan Energy Hierarchy:

1. Use less energy (**Be lean**)
2. Supply energy efficiency (**Be clean**)
3. Use renewable energy (**Be green**)

It is therefore important that energy efficiency as well as renewable energy be considered. In this study the energy consumptions of the development have been assessed based on the “Baseline”, “Be Lean”, “Be Clean” and “Be Green” models.

Policy 5.2 requires new major developments to meet an overall improvement of benchmark figures to Part L 2013 of 35%. They also require on site renewable generation of at least 20% carbon reduction in carbon emissions, which we achieve through the use of PV on both Bike Store and main building roofs.

4.0 ENERGY EFFICIENCY "BE LEAN"

The "Be Lean" measures proposed will reduce the energy consumptions and CO2 emissions for the development. The buildings will be constructed to exceed the energy standards required by Part L 2013 of the Building Regulations. This will be achieved by limiting heat loss through roofs, walls, floors, windows, doors, etc by suitable means of thermal insulation and to specify efficient U-valves.

The "Be Lean" measures include:

- The proposed 'U' values for the various construction elements are provided below and will be

Building fabric & air permeability	Minimum requirements of the building regulations	Proposed for the development
External walls (U values (W/m2.K)	0.30	0.22
Roof (U values (W/m2.K)	0.20	0.18
Ground floor (U values (W/m2.K)	0.25	0.20
Windows (U values (W/m2.K)	2.2	1.5
External doors (U values (W/m2.K)	2.2	1.6
Air permeability (m3/m2.h @50Pa)	10	4

- Insulation of pipework, ductwork and hot water systems will meet and exceed highest building regulations standards.
- Avoidance of excessive 'Thermal Bridging' by using appropriate design details and fixings.
- Utilise solar heat gains and daylighting to benefit the space.
- All boiler plant will be high efficient minimum 90% efficient, Sedbuk A rated.
- MVHR system as manufactured by Nuaire or similar with a specific fan power of 0.5W/l/s
- Apartments will be individually metered and provided with an energy display device so occupants can realise their energy usage.
- Provide the required lighting levels whilst minimising energy consumption by effectively controlling the lighting systems by using energy efficient LED luminaires throughout.
- Limit unnecessary ventilation heat loss by providing building fabric which is reasonably air-tight, but still provide adequate ventilation for health (Building Regulations Part F).
- Use of efficient systems and equipment with suitable time and temperature controls which have been appropriately commissioned such that the systems can be operated efficiently. Utilise A rated appliances where these are provided by the developer.
- Minimise lengths and diameters of 'dead-legs'. In water pipework.

- Components i.e. fans, pumps, refrigeration equipment, will be appropriately sized to have no more capacity for demand and standby than is required for the task so to operate at their optimum levels.

- Sanitaryware is ‘low flow’ to reduce water consumption and will mean a smaller booster set.

- The HWS generation and heating will be generally via combination boilers and therefore high efficiency.

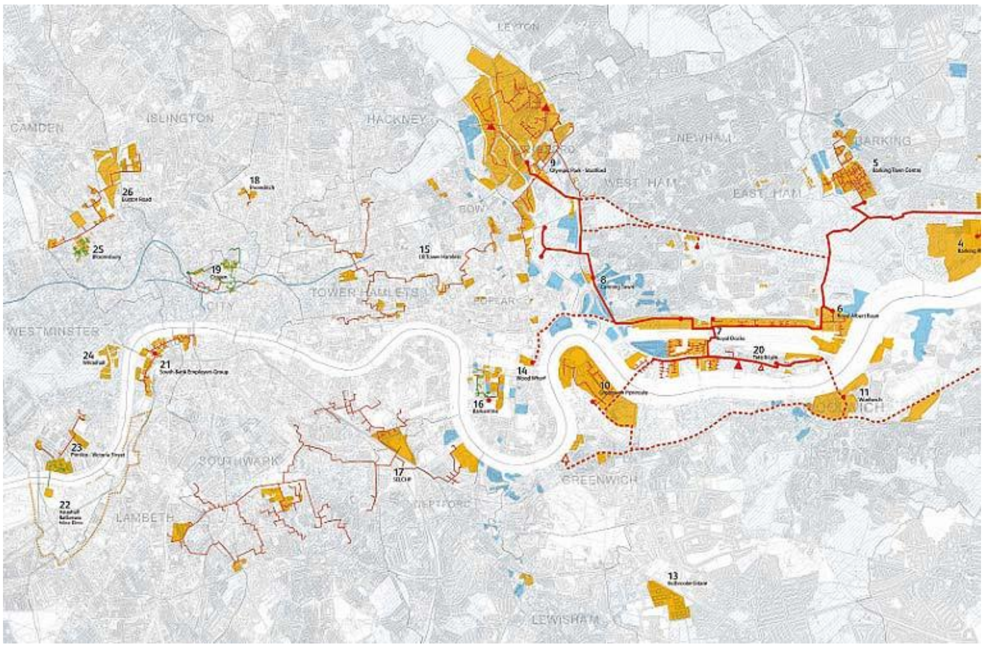
- The glazing has been selected with a solar control layer to minimise the building overheating and achieve L2 criterion 2.

5.0 ENERGY EFFICIENT SUPPLY "BE CLEAN"

The performance of the buildings has been evaluated to ensure the effectiveness of the energy efficiency measures and the compliance with the energy targets. Regulated and unregulated energy consumptions have been considered according to the London Plan Energy Hierarchy methodology to prove that the building is performing according to the highest standards. Typical sap calculations have been produced to understand the developments compliance requirements.

During the initial design brief discussions with the client community heating schemes were researched

District heating has the potential to significantly reduce energy, reduce maintenance and repair costs and also facilitates the use of a wide variety of fuels including low and zero carbon technologies. A search for local community heating schemes showed there was no local district heating schemes that could be economically extended to serve this development.



Map of District heating from Greater London (www.lgtheat.net)

Having discounted district heating, next we considered a central energy centre with a combined heat and power unit (CHP) working as the lead boiler. This was in line with the Chapman BDSP energy strategy issued September 2013.

The central energy centre would distribute district heating to serve heat interface units in individual apartments. Heat interface units consist of a plate heat exchanger and would serve both the heating and hot water demand. The client engaged with a number of energy supply companies (ESCO's) but none were interested in taking on such a small development. Typically the Esco would take ownership and maintenance of the developments plant. They would then bill the occupants. GLA guidance dated April 2014 stipulates that

> '*by general way of guidance, it is not expected that small purely residential developments (for example less than 300 dwellings) include on-site CHP. Due to the small landlord electricity supplies, CHP installed to meet the base heat load would require export of electricity to the grid. It is recognised that the administrative*

burden of managing CHP electricity sales at this small scale, where energy service companies (ESCO's) are generally not active, is too great for operators of residential developments to bear. '

CHP and a central energy centre has therefore been discounted due to the low number of dwellings.

6.0 RENEWABLE ENERGY & LOW CARBON TECHNOLOGIES "BE GREEN"

The following renewable energy sources are considered within the GLA's Renewables Toolkit to have the potential to be employed on urban developments within the London region:-

- Solar Photovoltaic (PV) panels
- Solar Thermal Systems
- Ground Sourced Heating and Cooling
- Biomass Heating
- Biomass Combined Heat and Power(CHP)
- Air source heat pumps

There are various location and physical factors particular to the existing site at Stamford Hill which will influence the choice of renewable technologies which need to be considered, these include, but are not limited to:-

- the compact or "tight" nature of the site
- it is an urban development
- budget cost limitations
- the close proximity of other premises
- the nature of the medium rise buildings, which have limited roof space in relation to the overall floor area of the buildings

6.1 Solar Photovoltaic and Thermal

Solar energy can be harnessed in a number of ways.

The orientation of the building can be optimised to:

- Harness fortuitous gains in winter to reduce heating energy.
- Maximise the use of daylight and reduce energy consumed by artificial lighting.

All of the above factors have been considered, and incorporated into the design as far as is possible, on a restricted site.

The building can also be provided with solar collectors, in the form of photovoltaic panels or solar thermal panels.

As CHP has been discounted for this scheme to meet the GLA London plan the client proposes to install as much photovoltaic as possible on the roof but still maintain adequate maintenance access. Ilec-Imec have engaged with a PV specialist and believe a possible 60m2 can be provided generating 12kw.

Solar thermal panels are an effective renewable energy and typically would be proposed to assist in the production of domestic hot water. The use of a solar panel array depends on the roof scape of the building being sufficiently sized to accommodate the panels together with other plant and equipment.

A solar thermal installation serving the hot water to individual apartments would not be as efficient as PV on the roof, further the roof is fully covered in PV.

6.2 Ground Source Heating & Cooling

Ground source water offers a more practical range of solutions.

Closed loop systems, where pipes are buried in the ground either linked with piles, bore holes or laterally buried loops provide an energy source for a heat pump system. The heat pump system can then provide cooling in summer and heating in winter.

Open loop systems abstract water from bore holes and utilise its energy carrying capability as the closed loop system. The abstracted water can either be returned to the ground or to waste. This system is subject to licensing with the Environment Agency. In certain parts of London abstraction is being encouraged to mitigate a rising water level.

A further potential benefit of the open loop system is the use of bore hole water (private water supply) for domestic usage, producing savings against water charges.

Initial studies have shown that ground source solution on this small site does not offer significant pile or underground opportunities for running the necessary pipework.

The additional capital cost reviewed against the energy saved indicates that the embodied energy and carbon emissions associated with the manufacture, transportation, installation, running and ongoing maintenance of a ground source heat pump installation will not be recovered in the plants life. Further the energy cost benefit does not provide an acceptable revenue return.

6.3 Biomass Heating

Biomass boilers are an established technology, using natural fuel such as wood chips or wood pellets for combustion. Typically, boiler efficiencies in excess of 85% are achievable. Carbon dioxide that is emitted during combustion of wood matter is absorbed during growth, forming a virtually carbon neutral cycle. In general, emissions will be lower using wood chips rather than pellets, as they are less energy-intensive to process. It is acknowledged that biomass heating to achieve a reduction in on-site carbon dioxide emissions is not suitable for every site, particularly in city centre or remote locations.

Utilising a biomass boiler would mean a district energy centre serving the development which has been discounted above. Biomass also creates NOx emissions and has its own inherent air quality issues. We have therefore not considered Biomass for this development.

It is also understood that the integration of biomass heating is not favoured due to implications with deliveries of fuel supplies and associated fume discharge from boilers

6.4 Biomass Combined Heat and Power (CHP)

Biomass CHP works in the same way a gas fired CHP does but has been discounted from this development for the reasons described in section 6.4 above.

6.5 Air source Heat Pumps

Air source heat pumps convert ambient energy sourced directly from solar gain. The average seasonal efficiency is slightly lower than ground source heat pumps (typically 2.5-3.0) however the system is much cheaper than ground or water heat pumps systems.

An air source heat pump works on the same principles as a ground source heat pump.

Air source heat pumps are not proposed for this development due to the tight site constraints and acoustic issues. The condensers would have to go on the roof due to the site constraints which would also lead to refrigerant pipework potentially running through individual demises. This creates issues with BS EN 378 compliance and would necessitate a larger electrical load to the development. The units would have to be served either one per apartment or an individual unit serving multiple apartments. If the latter solution was adopted, the same administrative burden would be passed on to the client, which the client has specifically stated is not possible. If a single condenser per apartment was utilised, a significant amount of roof space would be lost which would prevent installation of the PV.

6.6 Combined Heat and Power (CHP)

Combined heat and power is the site generation of electricity and the site use of the associated waste thermal energy. Electricity generation is selected against the building base load to maximise running hours. Thermal energy could be used for winter heating and hot water generation.

The use of combined heat and power is recognised in the renewable sector. Whilst the energy source is not renewable, gas or oil, the overall performance improves the efficiency of power generation from approximately 30% to 70%, saving energy and reducing carbon emissions.

CHP plant could be utilised as the ‘lead boiler’ and would be supplemented by other thermal generating plant.

CHP needs to have a reliable constant heat requirement in order for the waste heat generated from the CHP plant to be used thus maintaining the plants optimum energy efficiency.

CHP however is not a renewable technology and the proposed unit would be gas fired. Biogas fuelled CHP plant is available on the market but not on small scale plant.

Individual CHP’s serving apartments are available, such as Baxi Ecogen unit. This is a relatively new technology & not particularly popular with developers due to inefficiency in shorter cycles and lack of knowledge within the industry for maintenance. The feed-in tariff is also much lower and at over £6k per installation not deemed commercially viable.

CHP has been discounted on this relatively small scheme due for the reasons as described in section 5.0

7.0 SUMMARY CONCLUSION

In considering the design for the development, we have undertaken preliminary analysis under approved document L1A to define the buildings carbon footprint.

Our target is to develop a building that exceeds part L1A 2013 by at least 35%

It is our aim to illustrate the carbon impact of the design options considered, and to present the members of the client team, design team and planning authority with information that will allow informed decision making.

Embodied energy is significant in all building services systems and it is our view that conventional, simple technology well engineered can often produce a more sustainable solution particularly when considering whole life cycle operations.

Having considered all options and discounted all except PV, we believe it is not feasible to achieve a 35% improvement over Part L 2013. The GLA plan stipulates *'overall carbon dioxide emissions reductions should reflect the context of each proposal, taking account of its size, nature, location, accessibility and expected operation'.*

We anticipate with all the energy saving measures and the 'be lean, be clean' approach the development will improve carbon emissions from Part L 2013 by at least 27.2%.

Our feasibility study has provided us with guidance that shows optimum carbon emission savings will be achieved by incorporating the energy saving measures alluded to earlier and the utilisation of PV

The client is targeting energy conversation including and not limited to the following:

- Installing the largest possible Photovoltaic array on the bike store and main building roof.
- Installing high efficiency boilers to serve dwellings
- Installing LED lighting to all areas
- Installing high efficiency fans to minimise the specific fan powers that would typically be installed.
- Additional insulation to enhance U values