

30 November 2015

## **Energiesprong UK – finance model London**

### **Introduction**

The purpose of the financial model is to establish the financial envelope that is available for an E=0 retrofit based on existing building characteristics and reduced operational cost post refurbishment (enabled by the E=0 performance warranty for 30+ years). This approach implies that properties with the highest planned investment through repair/maintenance and major repairs will have the largest scope for investment; these are likely to be properties with poor energy performance and in relatively dilapidated state. As industry innovates costs for E=0 retrofits come down, thus a smaller financial envelope is sufficient to implement the solution.

Early demonstrators of Energiesprong implementations should therefore be chosen on the basis of already high planned investment (for maintenance and major repair works) and other properties should be added as the cost / unit goes down.

The Energiesprong concept is based on the assumption that the capital investment required to deliver net-zero-energy refurbishments is covered by:

- Aggregating planned routine & maintenance and major repairs cost over a 30 year period (the period of the E=0 retrofit performance warranty)
- Creating an 'energy plan' for tenants (which is equal or less than their current combined utility bills) which is then paid to the housing provider (additional revenue stream)

The principle assumption is that rental income is not required for the financing of the E=0 retrofit; this is to ensure that the current business model of housing providers to use their rental income to finance new development is not impacted. However, the finance model provides an option to add a percentage of the rental income to the financing of Energiesprong where housing providers use (a proportion of) their rental income to maintain their assets.

The financial model enables the testing of different property archetypes in each of the London boroughs; it also distinguishes between stock owned by local authorities and private registered providers. In the context of the Energiesprong finance model the two key differences are the rent levels and the cost of borrowing.

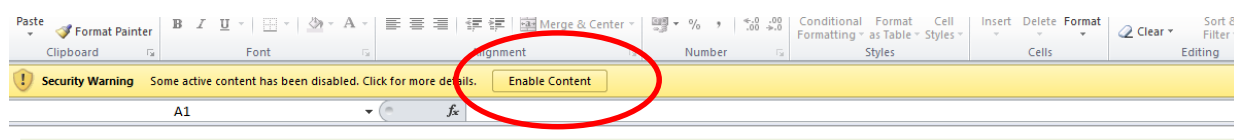
Based on the financial model of Energiesprong UK various financial envelopes are identified that can be tested against what solution providers will be able to deliver. It is anticipated that there will be a gap in the financial envelope that is available for the first prototypes and the investment required by industry to deliver those prototypes. By adding assumptions around the cost for prototypes, number of units and discounts / cost savings through product innovation the finance model is able to calculate the gap in investment from prototypes through initial scaling volumes and leading to a mass market introduction of net zero energy refurbishments.

## User guidance

The Energiesprong finance model is a tool to enable housing providers (both LAs and RPs) to determine the budget that is available for a net zero energy refurbishment following the Energiesprong principles. The resulting budget is broken down into the upfront capital investment (additional borrowing supported), the ongoing maintenance for the Energiesprong solution, the routine & planned maintenance and major works required for the property over a period of up to 50 years. The default calculation is based on a 30 year period which is aligned to long term asset management strategies and also relates to long term borrowing periods in the social housing sector.

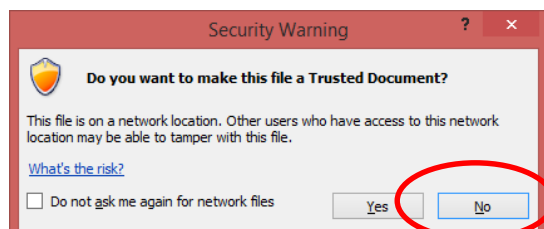
### Using the finance model for the first time

The workbook is macro based and therefore upon opening the file for the first time it is necessary to enable all active content in the workbook by clicking the 'Enable Content' button on the yellow security warning ribbon.

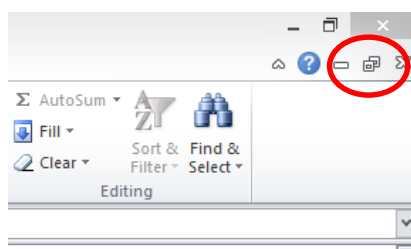


Doing so will trigger a welcome message to appear. This means that all macros are now enabled and that the tool will function correctly.

A final security message will ask if you want to make the file a Trusted Document. Clicking yes to this will prevent any further security messages appearing when the tool is opened in the future.



Lastly, in order to maximise the amount of information visible on the users screen, it is recommended that the toolbar ribbon is minimised when not in use by clicking the following up arrow. The ribbon can be made visible again at any point by clicking this arrow once more.



## Overview

The overview tab provides the version number and date of the model.

## Input

This tab is used to provide user-specific data input. The input is broken down into nine key categories:

1. General: building archetypes, EPC/SAP rating, building lifetime
2. Rent: selection of London boroughs and local authority owned stock or housing association
3. Charges: service charges
4. Provider cost: management cost, routine & planned maintenance, major works
5. Utilities cost: default is based on selected archetype under 1
6. Energy generation: FiTs, solar PV system size, RHI
7. Energy plan: monthly charge to occupant
8. Financing options: debt, grant, own investment, borrowing rate and discount rate
9. Options: input for various scenarios

It should be noted that RHI is currently not used in the main calculation as the payment period and amounts are comparatively low and with growing uncertainty over UK government policy decision the conservative assumption is not include RHI in the finance mix. Nonetheless, the finance model is set up to include RHI as and when a stable policy environment outweighs the risk of inclusion in the finance over 30 years. Other additional support may be available to housing providers or industry (e.g. ECO) which is also not included in the model due to the current policy uncertainty.

## Input 2

This tab allows housing providers to input very specific cost data for properties over a maximum of 50 years; input 2 is an alternative to the sector averages used under 'input' section 4.

## Results

This tab presents the overall results of the Energiesprong calculation. Based on the detailed calculation tables, the lifetime value of a housing unit before and after renovation is compared to establish an additional borrowing capacity. Depending on the chosen finance mix (debt, grant, own investment) an overall investment envelope for an Energiesprong net zero energy refurbishment is calculated. This allows for an optional inclusion of (a percentage of) rental income.

The results table also provides the total Energiesprong maintenance budget that is available over the chosen duration of the warrantee (default 30 years). In addition it sets out the remaining routine & planned maintenance work for that housing unit (e.g. any works not covered by the Energiesprong installation, such as interior decoration etc.) and a major repairs budget (again for works not covered by the Energiesprong installation).

The results page also allows for an easy options analysis; toggling the drop-down selection fields will recalculate the results. Options include:

- Inclusion of energy plan (Y/N)
- Indexation of the energy plan (Y/N)
- Inclusion of FiT (Y/N)
- Option to vary the size of solar PV system (default 5 kW)
- Provider types (LA/HA)

- Selection of archetypes (8 London-specific and 5 national)
- Option to include percentage of rent (default percentage 10%)
- Option to include grant finance (in %)
- Option to extend the building lifetime post Energiesprong (default setting is same lifetime before and after)

### General assumptions

This tab sets out general assumption, such as RPI, CPI, rent formula, rent cuts, reduction in planned & routine maintenance cost (HCA forecast), reduction in major works cost (HCA forecast), increase in management cost (HCA forecast).

### Energy assumptions

This tabs set out the assumptions related to the solar PV system and the energy plan (annual allowance).

### Main calculation

This table compares the income and operation cost per unit pre- and post Energiesprong using lifetime values and net present value calculations. The subsequent tabs and also the results tab draws on the calculations included in this main calculation table.

The main calculation table also includes the various indexation lines and rent cut / rent formulae forecasts provided by the HCA and/or set by UK government. In summary the following indexation has been applied:

- Rental income: adjusted for current rent cuts (4 yrs), then rent formula (CPI+x%) where x has been set to 0
- Service charge: CPI inflation added on
- Management cost: nominal increase of 2% p.a. (as per HCA forecast)
- Planned & routine maintenance: - 2 % p.a. (as per HCA forecast), CPI added on
- Major works: - 3 % p.a. (as per HCA forecast), CPI added on
- Energy plan: CPI inflation added on (default) with option to remove indexation
- Income from solar PV (generation tariff): flat line (as per current FiT)
- Income from solar PV (export tariff): RPI inflation added on (as per current FiT)
- Energiesprong maintenance: no nominal change, no inflation added on
- Planned & routine maintenance (post Energiesprong): -2 % p.a. (HCA), CPI added
- Major repairs (post Energiesprong): - 3 % p.a. (HCA), CPI added on
- Electricity cost: CPI added on (adjusted for auto-consumption)

### Net present value

This tab provides a net present value calculation for an Energiesprong net zero energy refurbishment. The default calculation does not include the use of rental income for the financing of Energiesprong; an option is provided to include (a percentage of) rent.

### Cashflow

The tab provides a cashflow calculation for an Energiesprong net zero energy refurbishment. Without using rental income the calculation is set to achieve a break even at the end of the loan period to identify the maximum Energiesprong investment envelope based on debt finance.

## Financing

This tab provides a breakdown of the debt finance, showing the cost of borrowing and the loan period. The calculation is used in the cashflow table to include the repayment of debt over the loan period.

## Cost of living

This tab provides a comparison of the total cost of living for residents in pre- and post-Energiesprong properties. The total cost of living without an Energiesprong solution is based on paying rent, service charges, electricity, gas, water and sewage bills. Telecommunication bills are excluded from this calculation. The total cost of living in an Energiesprong property is based on paying rent, service charges, electricity standing charge, water and sewage bills, and the energy plan.

The annual and monthly savings to the resident is provided in this calculation. In case the calculation results in a negative figure (e.g. an increase to the total cost of living) the energy plan would need to be adjusted (or an analysis of consumption / generation needs to be undertaken) to ensure that the residents will always benefit from the installation of an Energiesprong solution. This is currently the case for GLA archetypes 6-8.

## Parameters

This sheet contains all the background data lookup tables, assumptions and source information used throughout the finance model. Additional building archetypes could be added to this sheet.

## Building archetypes

The finance model provides 13 different building archetypes:

- 5 generic national archetypes arising from NEF energy modelling.
- 8 GLA London Archetypes derived from DECC National Energy Efficiency Database. London region sample with 5 years actual gas and electric consumption (574,551 properties weighted to represent the 3.2m stock).

Archetype Ref	Archetype Description	TFA (m2)	Number of Storeys
ESUK1_HS_3049_E_GENERIC	House_Semi-detached_1930-1949	86	2
ESUK2_HS_3049_G_GENERIC	House_Semi-detached_1930-1949	86	2
ESUK3_HM_0029_G_GENERIC	House_Mid-terrace_1900-1929	68	2
ESUK4_BS_5066_G_GENERIC	Bungalow_Semi-detached_1950-1966	47	1
ESUK5_FE_5066_E_GENERIC	Flat_Enclosed mid-terrace_1950-1966	49	1
GLA1_SD_3049_Gas	House_Semi-detached_1930-1949_Gas	121	2
GLA2_ET_3049_Gas	House_End-Terrace_1930-1949_Gas	77	2
GLA3_MT_Pre30_Gas	House_Mid-Terrace_Pre 1930_Gas	77	2
GLA4_MT_3049_Gas	House_Mid-Terrace_1930-1949_Gas	77	2
GLA5_Flat_Pre30_Gas	Flat_Enclosed Mid-Terrace_Pre 1930_Gas	42	1
GLA6_Flat_6782_Gas	Flat_Enclosed Mid-Terrace_1967-1982_Gas	42	1
GLA7_Flat_Pre30_Elec	Flat_Enclosed Mid-Terrace_Pre 1930_Electric	42	1
GLA8_Flat_6782_Elec	Flat_Enclosed Mid-Terrace_1967-1982_Electric	42	1

## Sensitivity analysis and scenarios

The Energiesprong model has been used to undertake a sensitivity analysis and to provide some scenarios for consideration.

### 1. Increase / decrease borrowing rate

The finance model allows for two default borrowing rates: 4.2 % for Housing Associations (HAs) and 2.8 % for Local Authorities (LAs). Applying the public borrowing rate (2.8 %) increases the financial envelope by 19% (depending on archetype between £5,500 and £6,000).

		DEFAULT	
Archetype reference	Archetype description	LA (default) CAPEX	HA (default) CAPEX
GLA1_SD_3049_Gas	House_Semi-detached_1930-1949_Gas	£ 34,419	£ 28,880
GLA2_ET_3049_Gas	House_End-Terrace_1930-1949_Gas	£ 35,887	£ 30,104
GLA3_MT_Pre30_Gas	House_Mid-Terrace_Pre 1930_Gas	£ 35,887	£ 30,104
GLA4_MT_3049_Gas	House_Mid-Terrace_1930-1949_Gas	£ 35,887	£ 30,104
GLA5_Flat_Pre30_Gas	Flat_Enclosed Mid-Terrace_Pre 1930_Gas	£ 37,037	£ 31,077
GLA6_Flat_6782_Gas	Flat_Enclosed Mid-Terrace_1967-1982_Gas	£ 37,037	£ 31,077
GLA7_Flat_Pre30_Elec	Flat_Enclosed Mid-Terrace_Pre 1930_Electric	£ 37,037	£ 31,077
GLA8_Flat_6782_Elec	Flat_Enclosed Mid-Terrace_1967-1982_Electric	£ 37,037	£ 31,077

The provision of suitable finance at lower rates would accelerate the implementation of Energiesprong in London. Providing a government loan and / or first loss guarantee would be an excellent mechanism to reduce the cost of private borrowing in capital markets.

### 2. Increase building lifetime after renovation

Increasing the building lifetime post-Energiesprong by just 5 years (compared to BaU) would increase the financial envelope by between 61 and 64 per cent for LAs and even more for HAs (85 and 89 per cent) depending on archetype.

		Five years lifetime extension (post Energiesprong)			
Archetype reference	Archetype description	LA	Increase	HA	Increase
GLA1_SD_3049_Gas	House_Semi-detached_1930-1949_Gas	£ 56,389	64%	£ 54,705	89%
GLA2_ET_3049_Gas	House_End-Terrace_1930-1949_Gas	£ 58,186	62%	£ 56,213	87%
GLA3_MT_Pre30_Gas	House_Mid-Terrace_Pre 1930_Gas	£ 58,186	62%	£ 56,213	87%
GLA4_MT_3049_Gas	House_Mid-Terrace_1930-1949_Gas	£ 58,186	62%	£ 56,213	87%
GLA5_Flat_Pre30_Gas	Flat_Enclosed Mid-Terrace_Pre 1930_Gas	£ 59,616	61%	£ 57,413	85%
GLA6_Flat_6782_Gas	Flat_Enclosed Mid-Terrace_1967-1982_Gas	£ 59,616	61%	£ 57,413	85%
GLA7_Flat_Pre30_Elec	Flat_Enclosed Mid-Terrace_Pre 1930_Electric	£ 59,616	61%	£ 57,413	85%
GLA8_Flat_6782_Elec	Flat_Enclosed Mid-Terrace_1967-1982_Electric	£ 59,616	61%	£ 57,413	85%

For the chosen GLA archetypes it can be assumed that a full exterior enveloping of the building would be installed, including a new roof. Therefore a 5 years building lifetime extension post-Energiesprong is a conservative assumption. However, the default setting of the finance model does compare buildings before and after Energiesprong on the basis of the same lifetime expectation. This is due to the assumption that housing providers would always maintain their assets through ongoing routine and planned maintenance work and also carry out major works when required. This could include roof and window replacements as well as repairs of exterior walls – measures that would equally lead to a lifetime extension of the building.

An alternative assessment option provided in the finance model is to enter a book value at the end of lifetime; it can be expected that the book value of an Energiesprong property is significantly higher compared to a counterfactual property due to the whole house performance warrantee and the enveloping of the existing building structure (e.g. new exterior façade, roof etc.).

### 3. Adding grant finance for demonstrators and initial scaling volumes

Adding 25% grant (e.g. to the first prototypes) would increase the financial envelope by 33%.

### 4. Adding a percentage of rental income to the Energiesprong finance

Adding 10% of rental income to the financing of Energiesprong would add between 29 and 46 per cent to the total financial envelope available for a net zero energy refurbishment. The model allows for an analysis of different rent levels in all London boroughs (and by LA and HA). The example used in the table below is Barking & Dagenham.

		Include 10% of rent (here: Barking & Dagenham)			
Archetype reference	Archetype description	LA	Increase	HA	Increase
GLA1_SD_3049_Gas	House_Semi-detached_1930-1949_Gas	£ 45,731	33%	£ 41,578	44%
GLA2_ET_3049_Gas	House_End-Terrace_1930-1949_Gas	£ 47,190	31%	£ 42,802	42%
GLA3_MT_Pre30_Gas	House_Mid-Terrace_Pre 1930_Gas	£ 47,190	31%	£ 42,802	42%
GLA4_MT_3049_Gas	House_Mid-Terrace_1930-1949_Gas	£ 47,190	31%	£ 42,802	42%
GLA5_Flat_Pre30_Gas	Flat_Enclosed Mid-Terrace_Pre 1930_Gas	£ 48,350	31%	£ 43,775	41%
GLA6_Flat_6782_Gas	Flat_Enclosed Mid-Terrace_1967-1982_Gas	£ 48,350	31%	£ 43,775	41%
GLA7_Flat_Pre30_Elec	Flat_Enclosed Mid-Terrace_Pre 1930_Electric	£ 48,350	31%	£ 43,775	41%
GLA8_Flat_6782_Elec	Flat_Enclosed Mid-Terrace_1967-1982_Electric	£ 48,350	31%	£ 43,775	41%

### 5. Feed-in-Tariffs for solar PV and size of solar PV installation

Taking out the income from Feed-in-Tariffs completely reduces the financial envelope by between 22 and 24 per cent.

Increasing the solar PV system to 7 kW (default 5 kW) increases the financial envelope by about 10%.

## **ANNEX A: Review by Frontier Economics**

Frontier Economics were commissioned by the GLA to conduct a review of the Energiesprong finance model; their review was based on an earlier iteration of the Energiesprong UK model (version D2, dated 09/10/2015). The final version of the Energiesprong finance model for London has integrated comments and suggestions from Frontier Economics.

In response to points raised by Frontier Economics in their review of the earlier iteration of the Energiesprong UK finance model:

- The model assumes that, without Energiesprong, no retrofits will occur.

The purpose of the model is identify an investment envelope that would be available for a net zero energy refurbishment; the approach is therefore that all planned & routine maintenance works and major repairs are analysed to identify which of these costs would be replaced by an Energiesprong installation. Oversimplifying this means that anything to do with the exterior of the property (e.g. façade, roof, windows etc.), space heating and hot water (e.g. boiler replacements) will be included in the Energiesprong solution. A proportion of electric works can also be included in the Energiesprong solution where the opportunity exists to carry out rewiring through the newly installed panels. The majority of works related to the interior (e.g. decoration, floors, carpets etc.) will still need to be undertaken and is thus included in the post Energiesprong budget line of 'planned & routine maintenance' (non-Energiesprong related work). The model also provides a reduced 'major repairs' line which is also not related to the Energiesprong installation. It will be necessary to undertake detailed stock assessments to accurately allocate individual cost elements to either be included or excluded from the Energiesprong financial envelope. This analysis would also consider whether kitchen & bathroom replacements could be included in the Energiesprong solution (depending on whether the property has been upgraded under the Decent Homes programme or not). The purpose of the finance model with its default assumptions is to provide a robust estimate for an initial analysis of the financial envelope that would be available for an Energiesprong installation.

The reason not to include piecemeal measures in the finance model is that these are not cost effective and should be replaced by net zero energy whole house refurbishment. It is, of course, entirely at the discretion of housing providers to continue with less effective approaches to retrofit but the Energiesprong finance model has not been developed to assess these investment scenarios.

- Time of use tariffs (which might become increasingly prevalent) are not modelled.

We acknowledge this point and would like to integrate a time-of-use tariff module in a later iteration of the model. The current model is based on an assumption for auto-consumption (e.g. consumption of energy at the time of on-site generation) which is set to 22%. This means that 78% of energy is exchanged with the grid. In the absence of net metering in the UK (which is available in NL) the installation of energy storage solutions would increase the auto-consumption rate. For example a battery of 10 kWh would increase the autonomy for a net zero fitted house to 60-65%. An inclusion of battery storage in the business model would need to take account of the retail electricity price, export value for solar PV and the cost of the battery; it could also take into account the value of grid services (e.g. peak demand management) and efficiency gains from moving to DC powered houses. The relative lack of sun in winter compared to energy demand in that period is responsible for the remaining 35% that cannot be stored in a 10 kWh battery.



- The effect of Right to Buy is not modelled.

We acknowledge the potential impact of Right to Buy on the business case. Energiesprong UK works with both parts of the social housing sector, e.g. ALMOs and HAs, so we have already undertaken in-depth discussions with housing providers on the potential impact of an Energiesprong solution on RTB.

The RTB policy is outside the control of individual housing providers and thus Energiesprong will need to work on solutions which protect the investment into net zero energy refurbishments. This could either be done by adding the remaining repayment amount to the sale price of the property or by attaching a charge to the freehold of that property. Legal advice is currently being obtained to identify other potential solutions.

- Changes of tenancy are not modelled.

Based on the current void periods in the social housing sector these are not material to the finance model, e.g. a one month period of vacancy would result in the loss of the respective energy plan (e.g. £80) which is expected to be outweighed by the continuous energy generation with no consumption during that period.

Based on the much improved comfort and attractiveness of an Energiesprong property it can be expected that void periods become even shorter (as evidenced in the Dutch implementation of Energiesprong).

- The model is constrained to a single property.

Frontier Economics confirm that this is right assessment approach as the Energiesprong investment is looking at individual properties in order to identify those with the largest (confirmed) financial envelope for the demonstrators and initial scaling volumes.

The finance model allows for housing providers to analyse one particular unit and then aggregate a portfolio of similar properties within their stock. The current finance model could be extended by an aggregation module in case that was useful for housing providers. However, it is more likely that housing providers will use their own investment models to take decisions which will be informed by the Energiesprong UK finance model.

Other points raised in the review by Frontier Economics:

Under 'Assumptions':

- Borrowing rate 4.2%

The latest iteration allows for 2 default borrowing rates: 2.8% for local authority owned stock and 4.2% for housing associations. The user can enter any borrowing rate based on their cost of finance. The impact of various borrowing rates is illustrated in one of the scenarios provided below.

It is not expected that the borrowing rate would be anywhere near as high as 8% (similar to Green Deal finance) as the installed product provides a long term net zero energy warranty.

- Provider cost assumptions (management, planned and routine maintenance, major works)

Some changes have been made to the provider cost assumptions based on the comments received by Frontier Economics (mainly around consistent indexation). The latest iteration of the finance model also

splits the post-Energiesprong planned & routine maintenance cost into an Energiesprong maintenance and non-Energiesprong related maintenance cost.

- Reductions to counterfactual provider costs over time

These reductions are based on HCA Global Account forecast (latest HCA Global Accounts are available for 2014). With the recent UK government decision to cut rents and to extend the Right-to-Buy to housing associations it is expected that there will be even further reductions in anything but statutory maintenance investment. Energiesprong UK therefore does not share the more optimistic view of Frontier Economics that providers cost would not decrease as assumed in the finance model.