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Fairview Estates (Housing) Ltd

Centric Close, Camden

Energy Statement

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Energy Statement

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Disclaimer

Contents

Executive Summary

This energy statement describes the details of the energy strategy proposed by Fairview Estates (Housing) Ltd for the proposed redevelopment of 32 Lawn Road, Camden, NW3 in response to the London Plan and Camden Borough Council energy policies.

The energy statement describes the design and technology options appraised and proposes the preferred energy strategy option in line with the London Plan, Camden Council policies and the requirements of Code for Sustainable Homes.

The proposed energy solution for the development follows and responds to the Be Lean, Be Clean, Be Green principles and includes various energy efficiency measures as well as low-carbon and renewable energy technologies.

The development will significantly reduce CO_2 emissions by incorporating a range of passive design and energy efficiency measures throughout the site, including improved building fabric standards beyond the requirements of building regulations, energy efficient ventilation and low energy lighting. The energy assessment demonstrates that by implementing these passive design and energy efficient measures, the development comes very close to meeting Part L compliance without contribution from low carbon and renewable energy technologies.

Once energy demand has been reduced, the strategy proposes implementation of gas-fired CHP and efficient gas-fired boilers connected to a communal heating system, which will supply heating and hot water for the entire development. It is anticipated that the use of the CHP engine and communal heating network will reduce CO_2 emissions by approximately 29.5%.

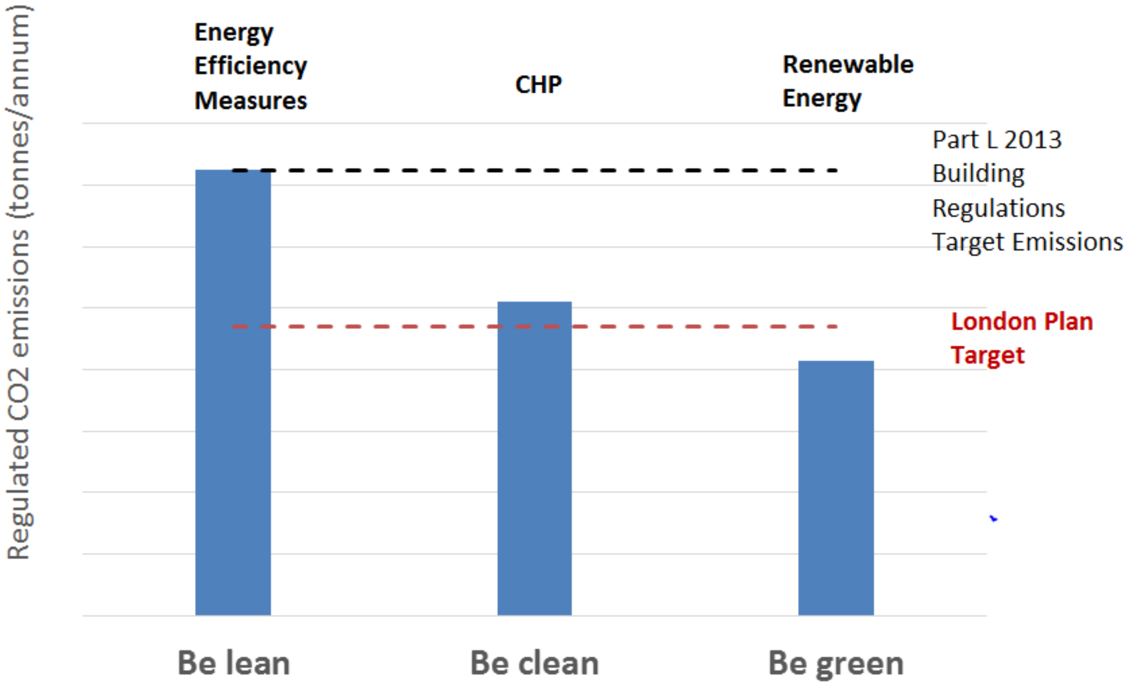
Photovoltaic (PV) systems will be provided to supply renewable energy for the development. The assessment shows that the proposed PV systems will result in approximately 18.9% CO_2 reduction for the entire site. This means that the renewable target is achieved.

The regulated energy CO_2 savings expressed in terms of actual and percentage reduction after each stage of the energy hierarchy are presented in the table below.

	Regulated Energy CO_2 savings	
	Tonnes per annum	**%**
Savings from energy demand reduction	-0.023	-0.03%
Savings from CHP	21.4	29.5%
Savings from renewable - PV	9.6	18.9%
Total cumulative savings	31.0	42.8%

The table shows that the proposed strategy can achieve regulated CO_2 savings of circa 31 tCO_2 which is equivalent to 42.8% reduction when compared to original baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in the figure below.



A summary of the overall reduction in CO_2 emissions after each stage of the energy hierarchy is presented in the following table.

	CO_2 emissions (tonnes per year)		
	Regulated	**Unregulated**	**Total**
Residential CO_2 Emissions Baseline	72.5	87.3	159.7
After energy demand reduction	72.5	84.2	156.7
After use of CHP technology	51.1	84.2	135.3
After use of PV technology	41.4	84.2	125.6

This table shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by 34 tCO_2 per annum which is equivalent to circa 21.3%.

In summary, the proposed energy solution for the development:

1. Informs the built form and orientation of the buildings to respond to daylight and overheating issues.
2. Includes optimal fabric standards, energy efficient design of building services and energy efficient appliances
3. Complies with Part L 2013 Building Regulations and meets TFEE requirements.
4. Includes an efficient on-site heating network with a CHP system designed to meet the hot water demand of the development.

5. Includes PV renewable technology and achieves 18.9% renewable contribution which is the maximum that can be achieved with the available roof area.
6. Exceeds the 35% regulated energy CO_2 emissions reduction requirement by 7.8%.
7. Achieves Code Level 4 energy requirements.

1. Introduction

1.1 Background

This energy statement has been prepared by Silver on behalf of Fairview Estates (Housing) Ltd ('Fairview'). It accompanies an application for full planning permission for a residential development at 32 Lawn Road, Camden, NW3.

To support the draft planning application this document identifies and describes the energy efficiency design and low carbon/renewable technology options that have been explored for this proposal and describes the preferred option for achieving the carbon emissions and renewable energy targets. The document is produced to demonstrate how the development can fulfil the relevant London Plan and London Borough of Camden planning policies.

In order to achieve the energy and sustainability objectives defined by national, regional and local policies, research has been undertaken to identify and present the most appropriate commercially viable technology to achieve the carbon and renewable reductions targets.

1.2 Description of the Development

The proposed development comprises a building of 5-7 storey containing 73 apartments of mixed size set within landscaped grounds. This includes a central landscaped courtyard fronting Upper Park Road and gardens along the Lawn Road frontage. New trees will line the perimeter of the site.

The site is located within the Belsize Park/Gospel Oak area of NW3, between Lawn Road to the west and Upper Park Road to the east, south of the junction with Fleet Road.

The site covers approximately 0.25ha and currently contains two existing buildings. These comprise a former car park building, now utilised as seven (part vacant) commercial units with under croft car parking, and a former launderette, most recently used as a community centre.

Until earlier this year, the London Borough of Camden was the freehold owner of the site. In 2012, the Council decided to sell the site as part of its Community Investment Programme, intended to raise investment in Camden's schools, homes and community facilities through the sale of underutilised Council assets. In March 2014, the Council agreed the sale of the site to Fairview for redevelopment for housing.

The development that is subject to the planning application has been subject to considerable pre-application discussion with Council officers, local representatives and the community.

The total GIA of the building will be 6095m^2.

All dwellings will be designed to Lifetime Homes standards. Seven of the units will be designed as Wheelchair Homes.

Figure 1.1 presents the ground floor layout of the site.

Figure 1.1 Ground floor layout of Lawn Road development

2. Planning Requirements

This section summarises the relevant energy policy context for the proposed development. The national, regional and local policies and regulations related to energy and sustainability are summarised below.

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) document sets out the Government's planning policies for England and was published on 27th March 2012.

The NPPF is designed to consolidate all policy statements, circulars and guidance documents into a single, simpler National Planning Policy Framework, making the planning system more user-friendly and transparent. The primary objective of the framework is sustainable development, therefore focussing on the 3 pillars of sustainability. The framework is split into three sections; planning for prosperity (Economic), planning for people (Social) and planning for places (Environmental), each of which outline guidance to tackle issues such as housing, transport infrastructure, business and economic development, climate change, etc.

In regard to climate change, the NPPF supports reduction in greenhouse gas emissions and the delivery of renewable and low carbon energy. Climate change is covered in section 10 'Meeting the challenge of climate change, flooding and coastal change'. In summary the framework advises the following:

To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirements for a building's sustainability do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply, unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.2 The London Plan

As a major development in London, the Carlton House development will be governed by the London Plan.

The London Plan requires all developments to actively tackle climate change through their design as an integral part of sustainable development. Chapter 5 (London's Response to Climate Change) of the London Plan contains the following crosscutting policies supporting London as an exemplar city in adapting to climate change.

1. Policy 5.1 - Climate change mitigation
2. Policy 5.2 - Minimising carbon dioxide emissions
3. Policy 5.3 - Sustainable design and construction
4. Policy 5.5 - Decentralised energy networks
5. Policy 5.6 - Decentralised energy in development proposals
6. Policy 5.7 - Renewable energy
7. Policy 5.8 - Innovative energy technologies
8. Policy 5.9 - Overheating and cooling

The London Plan requires that developments include energy assessments with the planning applications explaining the strategy for carbon emissions reduction based on the energy hierarchy.

The London Plan requires that major development proposals include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined below are to be met within the framework of the energy hierarchy.

Policy 5.2 of the London Plan requires carbon dioxide emissions to be minimised in accordance with the following energy hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

Policy 5.2 also requires that major developments meet the following targets for carbon dioxide emissions reduction in buildings. The targets are expressed in the tables below as minimum improvements over a Target Emission Rate (TER) outlined in the National Building Regulations. The London Plan requires an improvement of 40% reduction in carbon emissions between 2013-2016 against 2010 Building Regulations.

<u>Residential Buildings</u>

Year	Improvement on 2010 Building Regulations
2010 - 2013	25% CO_2 emissions reduction
2013 - 2016	40% CO_2 emissions reduction
2016 - 2031	Zero Carbon

Policy 5.6 requires development proposals to select energy systems in accordance with the following hierarchy:

1. Connection to existing heating or cooling networks
2. Connection to site wide CHP network
3. Development of communal heating and cooling networks.

Policy 5.7 requires major developments to provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation where feasible.

In April 2014 the Greater London Authority (GLA) published a revised Sustainable Design and Construction SPG and Energy Planning Guidance, which provide guidance on how the energy targets need to be assessed and met over Part L 2013 that came into force on the 6th of April 2014.

As outlined in the Sustainable Design and Construction SPG, from 6th April 2014 a 35% carbon reduction target beyond Part L 2013 of the Building Regulations needs to be met which deemed to be broadly equivalent to the 40% target beyond Part L 2010, as set out in London Plan Policy 5.2 for 2013-2016.

If the carbon reduction targets cannot be achieved on-site, any shortfall will be provided off-site or through a cash in lieu contribution to the relevant borough. Boroughs can use the guidance in the SPG, including the suggested nationally recognised price (£60 per tonne), to form the basis of their carbon off-setting fund or develop a locally specific fund. Contributions will be secured by a S106 agreement.

2.3 Local Policy - Camden Local Plan

The site falls within the London Borough of Camden therefore the development should also comply with the local planning policies. These are set out in the Camden Core Strategy 2010 and Development plan Policies 2010.

The Local Development Framework document is the Core Strategy and the key policies relating to energy and sustainability are identified below.

- Policy DP22 Promoting sustainable design and construction.
  - Expecting new build housing to meet Code for Sustainable Homes Level 4 by 2013
- Policy CS13 Reducing the effects of and adapting to climate change.
  - Minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all the elements of the following energy hierarchy:
    - Ensuring developments use less energy;
    - making use of energy from efficient sources;
    - generating renewable energy on-site; and
    - ensuring buildings and spaces are designed to cope with, and minimise the effect of climate change.
- Planning Guidance – 3 Sustainability
  - The guidance provides information on ways to achieve CO_2 reductions and more sustainable developments. It also highlights the Council’s requirements and guidelines which support the relevant LDF policies:
    - CS13 - Tackling climate change through promoting higher environmental standards
    - DP22 - Promoting sustainable design and construction
    - DP23 - Water

- Among other sustainable development issues the guidance covers the following aspects:
    - Energy efficiency – in new and existing buildings
    - Decentralised energy and combined heat and power (CHP)
    - Renewable energy

2.4 Code for Sustainable Homes

To strengthen the sustainability requirements of new dwellings, the Government launched the Code for Sustainable Homes (CfSH or ‘the Code’) in 2006 to operate in parallel to the Building Regulations for energy use for new residential development (Approved Document Part L1A). CfSH sets out the national standard for sustainable design and construction of new homes.

In March 2014, in response to the Housing Standard Review (HSR) the Government confirmed that is intended to ‘wind down’ the Code for Sustainable Homes with many of its requirements being consolidated into a national framework centred on Building Regulations, in particular energy and water standards, with the remaining requirements abandoned to simplify the current system.

Policy DP22 encourages all new development to achieve the following standards:

Time Period	**Minimum rating**	**Minimum standard for categories (% of un-weighted credits)**
2010 - 2012	Level 3	Energy 50%
2013 - 2015	Level 4	Water 50%
2016+	Level 6 ‘zero carbon’	Materials 50%

2.5 Building Regulations

The Lawn Road development will need to comply with the current version of Part L1A 2013 which came into force on the 6th of April 2014. Approved Document Part L1A 2013 incorporates a number of changes and additions compared to Part L1A 2010. Part L1A 2013 requires new homes to reduce their carbon emissions by a further 6% across the build mix, compared to Part L1A 2010. In addition to achieving an overall carbon emission target, (i.e. TER or Target Emission Rate), there is a further requirement to achieve or better fabric energy efficiency targets (TFEE: “Target Fabric Energy Efficiency”). This means the thermal performance of the building fabric now has its own standards which cannot be compensated by services strategy or renewable features.

2.6 Summary of Policy Requirements

The following provides a summary of local and national planning policy requirements which should be met to achieve compliance.

- Comply with Part L1A 2013 Building Regulations
- Achieve a minimum of 35% reduction in carbon emissions (against current 2013 Building Regulations) by following Lean, Clean and Green principles. Meeting this carbon requirement will ensure compliance with Part L 2013 and the minimum Code Level 4 CO_2 emissions reduction requirements.

- Expect to select energy systems in accordance with the following hierarchy:
    1. Connection to existing heating or cooling networks,
    2. Connection to site wide CHP network,
    3. Development of communal heating and cooling networks.
- Provide a 20% reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
- Achieve Code for Sustainable Homes Level 4

3. Approach to the Energy Strategy Development

3.1 Energy Strategy Development Principles

In accordance with the London Plan and the Camden planning requirements, the proposed energy strategy for the development should focus on three key principles:

1. **Be Lean:** Use less energy. Minimise energy demand through efficient design and the incorporation of passive measures;
2. **Be Clean:** Supply energy efficiently. Reduce energy consumption through use of low-carbon technology; and
3. **Be Green:** Use renewable energy systems.

The first principle stresses the primacy of seeking to reduce energy consumption. Within the built environment this comprises of energy efficiency measures in both design and construction of new buildings.

The second principle addresses the efficiency of energy supply. This will require 'decarbonising' and improving efficiency in the generation and distribution of energy.

The third principle comprises the use of 'green' energy systems. These are renewable sources of energy with low or zero carbon emissions and include, amongst others, solar generated heat and power, wind energy and biomass.

The suggested approach to energy and carbon has been proposed in line with the overall approach to climate change, reflecting requirements of the London Plan, Local Policies, Building Regulations Part L and Code for Sustainable Homes Level 4.

The proposed low carbon and renewable energy supply solutions match energy profiles of the development, ensuring effective use of these technologies. The solutions also take into consideration viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures, decentralised energy and renewable energy.

Applying these principles, Fairview is aiming to achieve the following objectives:

- Comply with the relevant regulatory requirements;
- Improve viability of the scheme by developing a technically robust and cost effective energy strategy; and
- Improve feasibility, operation and management of the energy systems by promoting holistic design methods and solutions.

3.2 CO_2 Emissions Reduction Assessment Methodology

FSAP software, which uses the Standard Assessment Procedure (SAP) 2012 methodology to assess compliance with Part L1A, is used to evaluate an initial CO_2 performance of air typical residential dwellings. To assess energy performance of the entire residential development, an energy and carbon assessment model has been produced, which extrapolated the results of the SAP analysis of the representative dwellings using the weighted average method provided in Part L1A to predict the energy consumption and CO_2 performance of the development.

Since the FSAP software does not include unregulated energy use (for appliances and cooking), the unregulated CO_2 emissions have been calculated separately using BREDEM methodology.

Although the produced data by the FSAP software provides estimations of possible energy and carbon performance of the development for assessment purposes, it is not intended to be used as a detailed design tool and the results need to be used with caution.

4. Energy Assessment

4.1 Baseline CO_2 Emissions

In order to assess CO_2 performance of the proposed energy strategy, a CO_2 emissions baseline was established. This section sets out the approach taken to calculate the baseline CO_2 emissions for the development based on the accommodation schedule presented in Section 1.2.

Baseline emissions have been calculated for both regulated (space heating, hot water, fans and pumps, and fixed lighting) CO_2 emissions covered by Part L Building Regulations as well as the unregulated (cooking and appliances) CO_2 emissions not covered by Part L. The regulated CO_2 emissions baseline is based on the Part L 2013 Target Emission Rate (TER) performance of representative dwellings. However, it should be noted that unregulated CO_2 emissions should be excluded when calculating compliance with the planning policy and CSH Level 4 requirements.

The baseline CO_2 performance was determined by carrying out SAP 2012 assessments and establishing the TERs for representative dwellings. The representative dwellings have been selected from ground, mid and top floors and have different sizes and orientations. The TER results of the SAP analysis from the representative dwellings have been extrapolated to predict the residential CO_2 emissions baseline.

Since SAP, and subsequently TERs, do not include the energy use for appliances and cooking, the unregulated CO_2 emissions have been calculated separately using BREDEM methodology. The regulated, unregulated and total baseline CO_2 emissions for the whole development are summarised in Table 4.1.

Table 4.1 Baseline CO_2 emissions for the development

	CO_2 emissions (tonnes/year)		
	Regulated	**Unregulated**	**Total**
Residential CO_2 Emissions Baseline	72.4	87.3	159.7

4.2 Energy Demand Reduction

The key focus for the proposed energy strategy is to reduce the energy demands of the development as much as practically and cost effectively possible by implementing various energy demand reduction measures.

Reducing the energy demand is the most effective way to reduce the CO_2 emissions associated with energy use. Energy efficiency measures can be adopted to reduce energy demand without making a significant impact on the design, appearance or character of the building. Reducing energy demand also helps to reduce fuel demand and hence reduces the future energy costs for the residents.

A range of measures to reduce CO_2 emissions and increase resilience to climate change will be incorporated into the design of the building. This will include good building fabric standards as well as an energy efficient M&E systems and lighting.

4.2.1 Passive Design

Policy 5.3 of the London Plan requires the development to demonstrate that passive design and energy efficiency have been considered at the beginning of the design process. In addition, Policy 5.9 requires the development to reduce potential overheating and reliance on air conditioning systems.

Through adopting best practice in design, and in response to these policies, the development has considered sustainable design and construction standards to reduce potential overheating and reliance on air conditioning systems through the following approaches and measures.

Care has been taken in the proposed scheme to respect the amenity of neighbouring properties whilst optimising the potential of the site through the established scale and massing of the existing buildings.

The development will incorporate passive solar design measures. The building incorporates balconies which help to provide shading, therefore minimising overheating of the units. The proposed windows aim to maximise daylight and again minimise overheating. The glazing specification will be selected to provide a balance of solar control and access to passive solar gain.

The majority of the units are dual aspect to maximise daylight and to support natural ventilation. A noise assessment has been carried out for the development which shows that there are some noise constraints around the site and this aspect should be taken into account during development of the ventilation strategy.

The preference is to naturally ventilate the development by providing carefully designed and adequately sized acoustic trickle vents. However, if the air permeability is below 5 $m^3/s/m^2$ @50pa, it may not be possible to naturally ventilate the building. In this case, taking into consideration building fabric, low carbon and renewable energy proposals, an appropriate mechanical ventilation system will be selected which will comply with the Building Regulations Part F.

It is proposed to have openable windows albeit they may not be essential to provide fresh air supply but will offer further choice to residents and occupiers. If opening windows cannot be accepted due to noise constraints, mechanical purge ventilation should be considered and implemented were necessary.

The ventilation strategy needs to be constantly under review as the design develops to ensure compliance with all the relevant regulations and standards.

4.2.2 Building Fabric

The first stage in the energy hierarchy is the consideration of energy efficiency measures to ensure the baseline energy demand is minimised. Part L of the 2013 Building Regulations highlights this emphasis on passive design further by improving building fabric and the efficiency of building services. A fabric energy efficiency standard (TFEE) has been introduced and is the maximum space heating and cooling energy demand for a new home. It is measured as the amount of energy which would need to maintain comfortable internal temperatures in a home. The introduction of this target means that the fabric of all new dwellings cannot exceed the TFEE rate.

In order to achieve the Part L 2013 TFEE standards, a good building fabric standard will be adopted. The use of good fabric standards for residential developments is a most cost-effective measure to reduce CO_2 emissions, it will also help to improve the cost effectiveness of other energy mitigation measures and reduce running costs and in some instances reduce the costs of low carbon and renewable systems. The use of good building fabric standards will help to deliver substantial reductions in CO_2 emissions, meet the TFEE standards and achieve the requirements for energy mitigation and CO_2 abatement at Level 4 of the Code for Sustainable Homes.

Proposed key passive design measures to achieve the TFEE standards and ensure the baseline energy demand is minimised, are detailed below in Table 4.2 against the minimum building fabric requirement for Part L1A 2013, in line with the suggested standards in CPG3.

Table 4.2 Proposed fabric energy efficiency targets for individual building elements

Element	U-values W/m^{2}K	
	Part L1A 2013 minimum fabric requirements	**Proposed specification for the development**
External walls	0.30	0.20
Roof	0.20	0.13
Ground floor	0.25	0.20
Windows [1]	2.00	1.50
Airtightness	10 (m^3/s/m^2 @50pa)	3 (m^3/s/m^2 @50pa)
y - value	0.15	0.08

[1] Glazing performance will need to be reviewed alongside acoustic performance as the design is developed.

The proposed specification should be viewed as guidance and may be subject to change as the design progresses to ensure compliance with all the relevant standards and regulations.

Implementing these (or similar) building fabric standards will help to deliver substantial reductions in CO_2 emissions.

4.2.3 Energy Efficient Systems

Energy demand can be significantly reduced by using energy efficient mechanical and electrical (M&E) systems. Some of the proposed key measures for the development are listed below:

- 100% energy efficient lighting
- Energy efficient mechanical ventilation
- Variable flow rate heating system with high delta T and low return temperatures
- High efficiency motors and variable speed pumps for heating
- High efficiency heating system (high efficiency boilers with NOx emissions less than 40 mg/kWh)
- Appropriate controls for heating
- Temperature and time zoning
- Appropriate insulation of heating pipes

Implementing these energy efficiency measures will further reduce CO_2 emissions.

4.2.4 Energy Efficient Appliances

The unregulated energy demand and the associated CO_2 emissions can be reduced by providing energy efficient white goods. Fairview will provide ovens, hobs and washer dryers in all the dwellings which are expected to be energy efficient and can reduce the total unregulated CO_2 emissions by circa 3.5%.

4.2.5 Anticipated CO_2 Savings from Energy Demand Reduction Measures

Based on the proposed energy efficiency measures, the Dwelling Emission Rate (DER) for each representative dwelling provides an indication of the anticipated regulated CO_2 emissions. DERs do not include the unregulated energy use for appliances and cooking, and these CO_2 emissions have been calculated separately using the BREDEM methodology.

The regulated energy and carbon baselines have been calculated by extrapolating the DER results of typical dwellings across the entire residential development. The energy demand and the CO_2 emissions of the representative dwellings were input in the energy and carbon assessment model, which calculated the total CO_2 emissions for the development.

The energy assessment demonstrates that by implementing the energy efficient design, by enhancing the building fabric and by using energy efficient systems, the development comes very close to meeting Part L compliance without contribution from low carbon and renewable energy technologies.

The regulated, unregulated and total emissions after energy demand reduction are summarised in Table 4.3.

Table 4.3 CO_2 emissions after energy demand reduction

	CO_2 emissions (tonnes per year)		
	Regulated	**Unregulated**	**Total**
Residential CO_2 Emissions Baseline	72.5	87.3	159.7
After energy demand reduction	72.5	84.2	156.7

4.3 Energy Efficient Supply

London Plan Policy 5.6 and Camden Planning Guidance 3 require all major development proposals to evaluate and where appropriate select decentralised energy options systems in accordance with the following hierarchy:

1. Connection to existing heating or cooling networks;
2. Site wide CHP network;
3. Communal heating and cooling.

4.3.1 Connection to Existing Heating or Cooling Networks

In response to the hierarchy an investigation was carried out to identify existing and planned district heating networks in the vicinity of the site. The London Heat Map indicated that there were no existing or planned district heating networks around the site. It also indicates that the development was not within a district heating opportunity area. A snapshot of the London Heat Map is provided in Figure 4.1 which indicates location of the site.

Figure 4.1 District heating opportunity areas in the vicinity of the site (London Heat Map)

However, through further investigation, it has been identified that there is one existing district heating network in close proximity to the site. The district heating network is linked to and fed from the Royal Free Trust Hospital CHP plant. The plant currently provides heat to several local developments in the Gospel Oak Ward. The location of the Royal Free Hospital Trust and the associated CHP plan is highlighted in blue on the London Heat Map (Figure 4.1) which is in close proximity to the site.

Feasibility of a connection to the district heating network has been explored. Silver has contacted Utilyx, the company managing the on-site decentralised system and the district heat network, and discussed the possibilities to connect the proposed development to the system.

Utilyx informed Silver that at present connection of the development to the district heating network is not possible due to unresolved contractual issues between Royal Free Hospital Trust, Camden Borough Council and Utilyx, which prevent third parties connecting to the network. Utilyx were not in a position to provide any further information about the network due to the unresolved contractual issues between all the key stakeholders. Following consultation with the Sustainability Officer at the London Borough of Camden, it was agreed that connection was not possible, as such this option has been discounted and an on-site heat supply solution will be looked into.

4.3.1.1 Future-proofing

An on-site district heating system will provide an opportunity for the proposed development to be ‘future proofed’ to make the best use of efficient energy generation, with current and future technologies.

In particular, such a system will enable the necessary infrastructure to be brought forward to link with other potential decentralised energy generation schemes coming forward in the vicinity, following completion of the proposed development. This ability to link with wider decentralised infrastructure is consistent with the requirement of the London Plan.

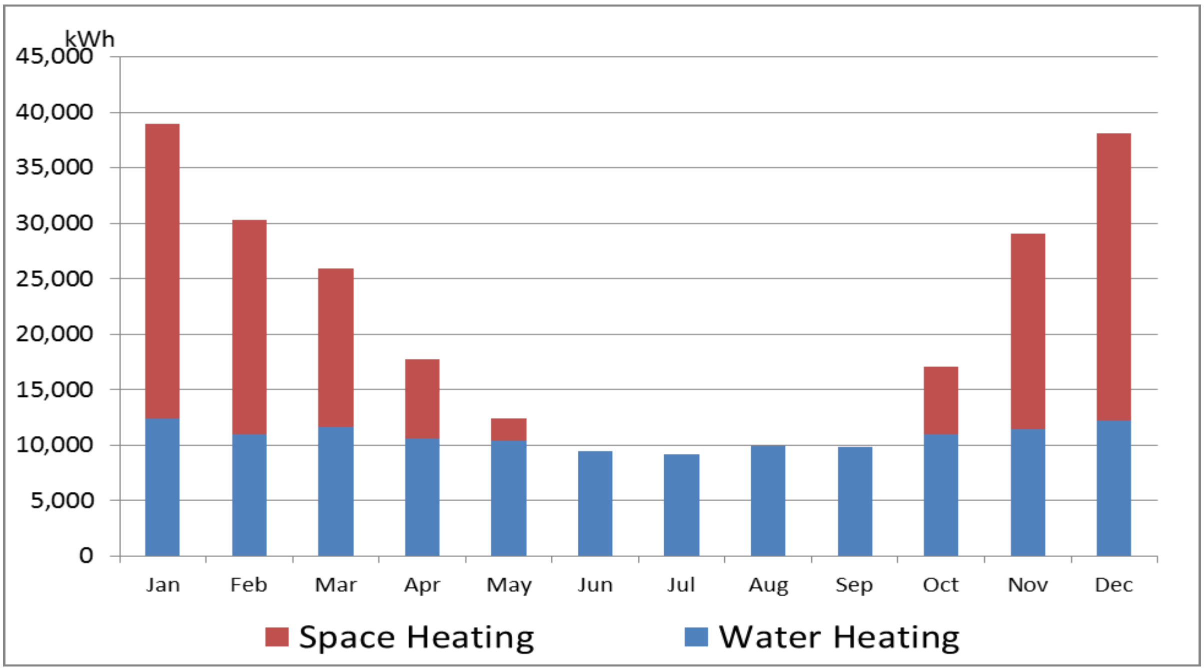
It should be noted that permission to connect to decentralised schemes is subject to agreement with third parties and not guaranteed; depending on its technical and financial viability. The provision of capped pipework connections will enable physical connection of the development to near-site energy generation facilities if this becomes available in the future.

4.3.2 On-site District Heat Network

As there could be a possibility in the future to connect the development to a wider heat network, investigation into on-site decentralised energy is required for the site.

On-site Combine Cooling Heat and Power and Combined Heat and Power (CCHP/CHP) systems are favoured by Policy 5.5 and Policy 5.6 in the London Plan. Combined Heat and Power technology requires a relatively consistent heat demand throughout the year. In order to investigate suitability of the CHP technology, an assessment was carried out to establish the preliminary space heating and hot water demand profiles based on the SAP assessment of the selected representative dwellings. Figure 4.2 shows the anticipated demand profiles for the space heating and hot water.

Figure 4.2 Demand profiles for the space heating and hot water



Hot Water

The estimated domestic hot water load is expected to present a consistent load throughout the year although there will be peaks and troughs in daily use. These peaks and troughs can be managed through use of a thermal store to transform the hot water load into a consistent base load that is suitable for CHP technology.

Space Heating

The space heating load does not present a consistent demand and is seasonal in nature. It is also minimised through the application of the proposed energy efficiency measures. The space heating demand is particularly low during summer months which means that only a small portion of this energy demand can effectively be met by CHP (even though the CHP system will act as a primary heat source).

Cooling

As no energy demand for cooling is expected for the development, a CCHP system will not be used.

4.3.2.1 On-site Heat Network Design

CHP is a low carbon technology which can use fossil or renewable fuels to generate heat and power. CHP is effectively a mini power station with heat reclaim and minimum distribution losses due to its close proximity to the load.

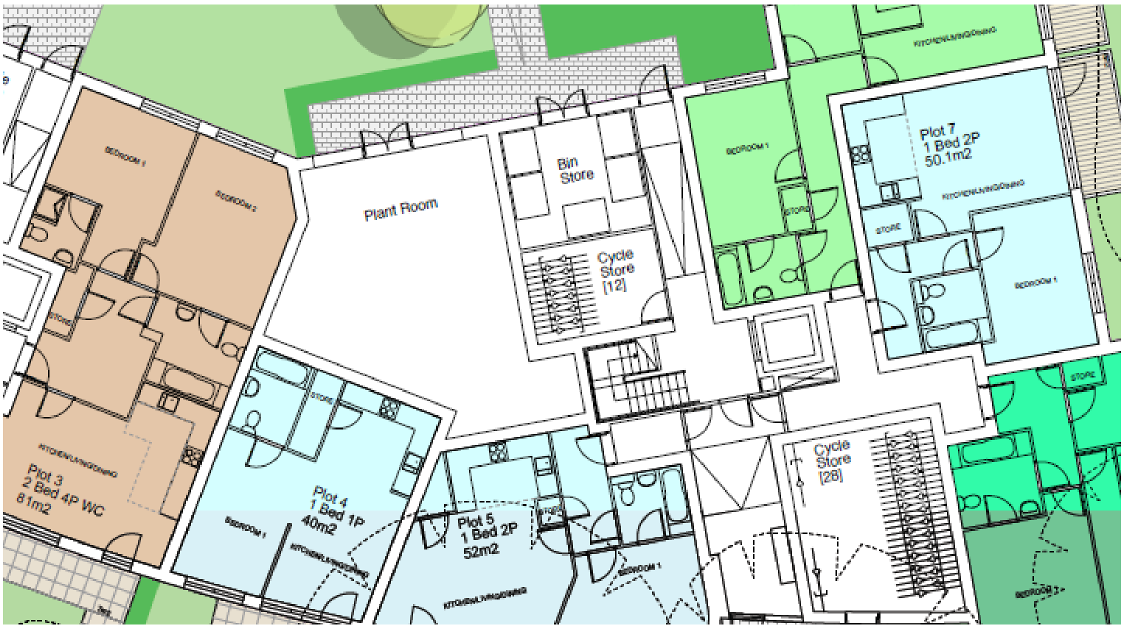
When the technology is applied correctly, it can be much more energy efficient than obtaining energy from conventional gas boilers. It can also help to significantly reduce CO_2 emissions associated with heat supply which can help the development to achieve the CO_2 reduction targets. Taking into account advantages of the CHP technology and availability of thermal load, it is proposed to incorporate this technology into the on-site heat network design.

The proposed design of the development's on-site decentralised heating system will incorporate:

1. gas-fired CHP engine;
2. thermal store(s) for hot water storage;
3. gas-fired boilers as back-up/top-up; and

These systems together with all the associated ancillary equipment and controls will be located on the ground floor in a single energy centre with a total floor area of 50 m^2. This size of energy centre will be sufficient for the size development and the proposed design. Capped pipework connections will be provided to enable physical connection of the on-site heat network to the near-site energy generation facilities and networks should they become available and feasible in the future. Figure 4.3 identifies the location of the energy centre.

Figure 4.3 Location of Energy Centre



4.3.2.2 Choice of Fuel for CHP

Most CHP systems in the UK run on natural gas or diesel but there are other fuels which are technically feasible, such as biomass and biogas.

Specially designed CHP engines can run on biogas, however, it would not be possible to produce biogas on site (e.g. via anaerobic digestion) due to space and technical (food stock etc.) constraints. In addition, there are a limited number of biogas suppliers, therefore there are concerns regarding the fuel supply security and fuel cost. Taking into consideration the above, this option has been ruled out.

Small biomass CHP systems are in development. However, this technology is still unproven, representing high technical risks at this time.

Liquid biofuels can be used to run biodiesel CHP engines, however, there are similar concerns as with biogas regarding security of supply and over the sustainability of liquid biofuel production. In addition, delivery of liquid biofuels will be an issue for the site. Taking into account the aforementioned issues, biofuel CHP is neither reliable nor cost effective and has been disregarded for the application. It is therefore proposed to use proven and reliable gas-fired CHP units.

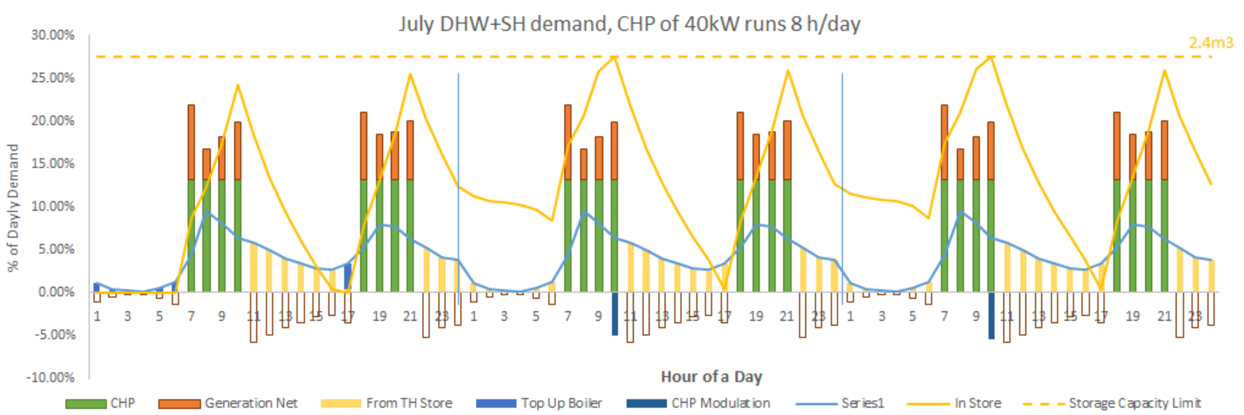
4.3.2.3 CHP System Sizing and Operation

The underlying principle for sizing and selecting the CHP engine and the thermal store will be to reduce CO_2 emissions and life cycle costs as well as optimise the CHP heat contribution to the heating system.

Based on the assessment of the space heating and hot water demand profiles (Figure 4.2), it is proposed to size the CHP system to supply at least 70% of the total heat demand of the development. It is assumed that the CHP system will supply all annual domestic water demand of the development. The remaining space heating load will be covered by energy efficient gas boilers, installed in parallel to the CHP unit in the energy centre.

Based on the available information, a preliminary CHP sizing has been carried out which indicates that the CHP engine would be approximately 20 kWe (40 kWth). To facilitate achievement of the 70% heat supply target from the CHP system, the estimated total thermal store size should be circa 2.4 m^3 assuming 30^{o}C temperature difference between flow and return. The sizing of the thermal store is based on the July heating demand which represents the worst case scenario from a hot water storage perspective. Figure 4.4 presents the CHP operation and thermal store performance during 3 days in July.

Figure 4.4 CHP operation and thermal store performance during 3 days in July



Sizing of the CHP engine and the thermal store should be reassessed and confirmed during detailed design stage when a more detailed thermal demand assessment is carried out.

Detailed design of the heating system is to be completed during the detailed design stage but the intention is that the CHP engine will act as a primary heat source followed by the thermal store and top-up gas boilers. Heat will be provided from the CHP engine to meet demand from the building and / or to charge the thermal storage vessel. If the heat demand of the building cannot be met by the CHP, the thermal store will discharge heat into the heating system. If the thermal store contains insufficient heat to meet the required heat demand which exceeds that provided by the CHP, the gas-fired boilers will operate.

The inclusion of a thermal store allows the CHP to run when there is low demand to build up a reserve of heat energy in the stored hot water. This energy can be released to provide heat at periods of peak demand. Releasing stored heat energy in this way means that the use of the top-up gas boilers is reduced and the proportion of heat supplied from the CHP increased. There are other benefits from the thermal store in that the CHP system will run at optimum output for the majority of the time. An optimum run time also reduces the size and life cycle cost of CHP required to meet a given energy load and increases CO_2 savings.

The gas boiler system will be sized to provide full hot water demand backup in the event of failure or maintenance of the CHP units.

When there is an electricity demand in the landlord areas, the electrical output of the system will be fully utilised on site with no export to the grid. If the electricity demand is lower than the electricity supplied by the CHP unit, the surplus will be exported to the grid. As required, the electricity export contractual arrangements should be discussed and agreed with an DNO during later stages of the project. The electricity demand of the landlord areas will also be determined during later stages of the project when more details about the M&E design of the development is available.

The proposed CHP system will facilitate minimum operating hours of 4,260 per year and should improve the financial viability of the heating system operation whilst maintaining the technical ability of the system to meet variations in hot water and space heating demand.

Selection of CHP engine

The choice of a mini CHP engine in the required range is limited. There are a number of key technical parameters such as engine efficiencies, NOx emissions, noise levels and maintenance costs which influence the selection of the engine.

Based on assessment of the currently available CHP engines, it is proposed to use the LoadTracker XRG20 CHP engine. The engine is relatively efficient and has very low noise and NOx levels. In addition, the engine can modulate between 10 and 20 kW power output (25 and 40 thermal output) which can help to meet the thermal load more effectively.

As the energy centre is adjacent to the residential units, it is important for the engine to have low noise levels. The noise level of the LoadTracker XRG20 CHP engine is 49 dB(A).

In April 2014, the GLA published specific NOx requirements related to the CHP engines which are provided in the Sustainable Design and Construction SPG. The NOx emissions levels related to the LoadTracker XRG20 CHP engine are less than 90 mg/Nm^3 which meet the most stringent NOx standards required by the SPG. The technical specification of LoadTracker XRG20 is provided in Appendix B.

The impact of the proposed heating system on local air quality has been assessed and the results are provided in the Air Quality Impact Assessment (AQIA) produced by The Airshed.

Air quality impacts have been predicted using the dispersion model ADMS 5 and 5 years of hourly sequential meteorological data and the emission rates are based on emission data provided by the equipment suppliers.

The AQIA states that the emissions of combustion pollutants are predicted to comply with all relevant air quality standards. The greatest impact on residents of the proposed development is predicted to be on residents living on the top floor but these impacts are likely to be of negligible significance.

The AQIA also states that the worst case impact offsite is predicted to be at the nearest 15 storey tower block to the north-east where the increase in the annual mean NO_2 is of negligible significance.

It is envisaged that the CHP engine will need to be serviced annually. The service cost (per visit) is £1,675 as provided in Appendix B. The CHP maintenance cost will not have a significant effect on the total maintenance cost of the proposed decentralised system and will not significantly impact on the heating costs of the residents.

Including the CHP engine in the heating network will not have a significant impact on the maintenance costs of the heating system but will likely improve viability of the system which will help significantly reduce the CO_2 emissions.

Management of Heating Network

Fairview will employ an energy services company (ESCo) to operate and maintain the proposed heating system. The ESCo will be contractually required to ensure that the heat supply costs are minimised by energy efficiency operation of the system. The ESCo will also monitor the operation of the CHP system and provide evidence of continued compliance with emissions limits annually in the form of a maintenance report. These requirements and obligations are likely to be incorporated in the heat supply contract contracts.

4.3.3 Anticipated CO_2 savings from CHP system

The energy model assessment identifies that by use of the proposed CHP system it is possible to achieve an overall reduction of CO_2 emissions of approximately 21.4 tCO_2 per annum. This is equivalent to a reduction in the regulated CO_2 emissions from the energy efficient building of circa 29.5%. The regulated, unregulated and total regulated emissions savings through use of CHP technology is summarised in Table 4.4.

Table 4.4 CO_2 emissions after use of CHP technology

	CO_2 emissions (tonnes per year)		
	Regulated	**Unregulated**	**Total**
Residential CO_2 Emissions Baseline	72.5	87.3	159.7
After energy demand reduction	72.5	84.2	156.7
After use of CHP technology	51.1	84.2	135.3

4.4 Renewable Energy

Policy 5.7 of the London Plan and CPG3 require a 20% reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

The likely energy use of the proposed development allows for a feasibility assessment of the renewable energy technology options to determine which are most favourable for this particular development. The following technologies have been assessed for their potential to meet the renewable energy target:

- Biomass boilers
- Ground source heat pumps
- Air source heat pumps
- Wind turbines
- Solar thermal systems
- Photovoltaic (PV) systems

The assessment of these technologies shows that the installation of PV systems is considered to be the most suitable renewable energy technology option for the development. All other renewable energy technology options are considered to be less suitable (or unsuitable) for this development. A summary of the assessment of the renewable technology options is provided in Appendix A.

The preferred PV option is discussed further below.

4.4.1.1 Photovoltaic (PV) systems

The renewable energy assessment shows that PV system can be provided to generate renewable power. The technology can work well with all the other proposed technologies (e.g. CHP and gas boilers) and can supply the remaining required CO_2 reduction for the development.

PV systems are suitable for any type of building but they require significant un-shaded south facing space. PV systems can be incorporated into the units in various ways: on sloped roofs and flat roofs, or on facades, atria and shading devices.

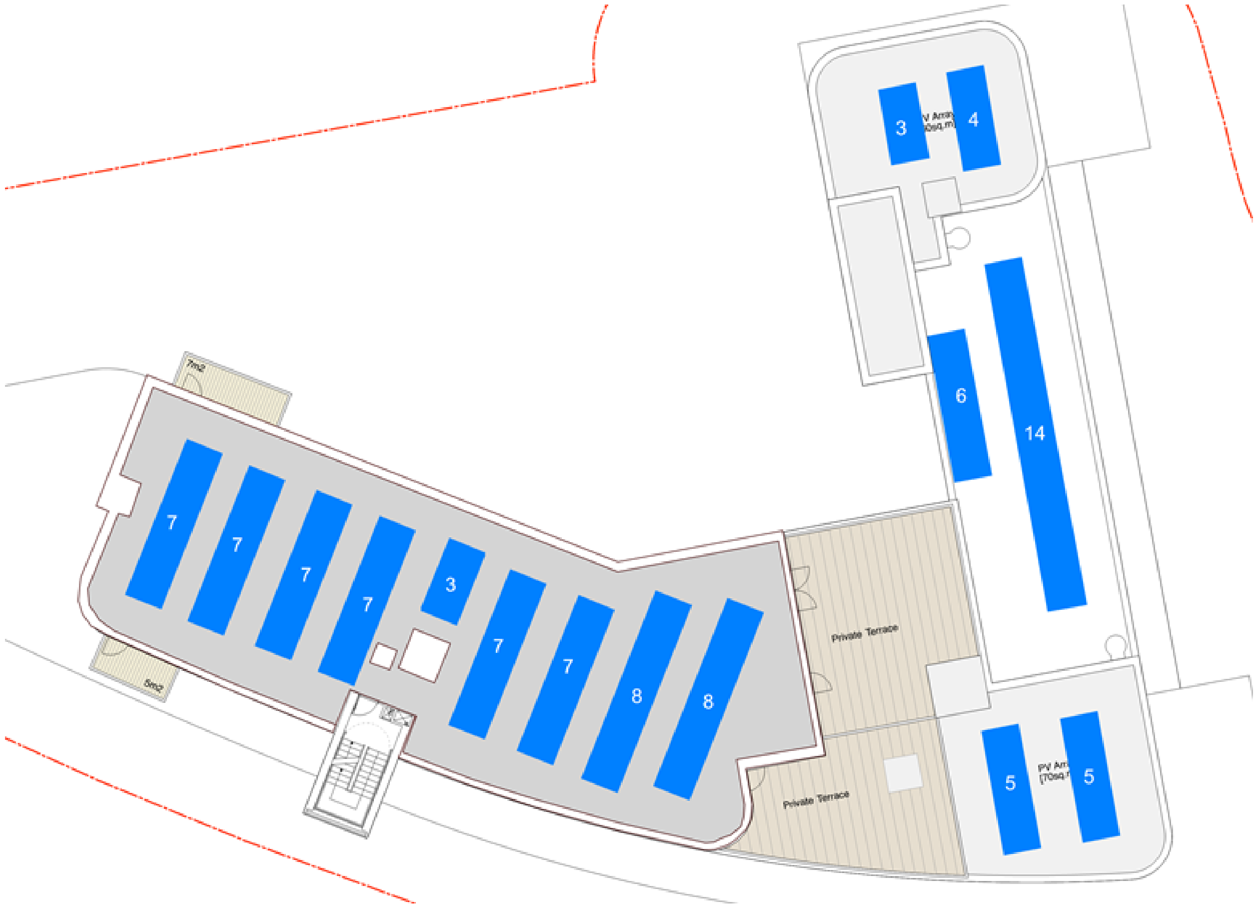
The proposed PV system will face south with an incline of 10º, although orientations within 45º of south and other angles can still generate high outputs. The panels should be ideally mounted on the roof of the building to facilitate correct orientation and minimise shading.

The technology is easily scalable, which means that the required amount can be installed to meet the renewable energy requirements and the required CO_2 reduction targets. The only technically limiting factor on the maximum size of the PV system is the available south facing un-shaded roof area as surplus electricity which cannot be utilised onsite can be exported back into the grid.

An initial overshadowing study carried out shows that the available roof area of the building is largely unshaded, hence suitable for PV installation. The study shows that approximately 550 m^2 of the total roof area is available for the installation of PV panels.

The available roof area suitable for the installation of PV panels is illustrated in Figure 4.5.

Figure 4.5 Roof plan for the development indicating proposed areas for PV panels



A preliminary assessment of the capacity of the PV systems assumes that, due to physical constraints of the roof layout, (self-overshadowing and access requirements) not all the roof areas can be covered with PV panels.

If all the available roof areas are covered with the PV panels as proposed on Figure 4.5, it is possible to achieve a total system capacity of 24.5 kWp.

It is assumed that 1 kWp of PV panels can generate circa 800 kWh per annum which will equate to circa 19,600 kWh/year renewable electricity production. The required PV capacity and the required roof area will be re-assessed and confirmed during detailed design stage. The total system capacity, indicative available roof areas and the estimated total electricity production is provided in Table 4.5

Table 4.5 Proposed PV system capacity and anticipated CO_2 emissions reduction

Building Type	Total PV system capacity (kW)	Total indicative roof area covered with PV panels (m^2)	Estimated total electricity production kWh/year)
Residential	24.5	550	19,600

Optimum design of the PV installation is required to ensure maximum electrical output per kWp installed. There are a number of design considerations to be made to ensure the best use of the system. The key design considerations are:

- Design of PV installation to optimise inclination and orientation
- Ensure that all parts of the PV panels are un-shaded
- Ensure correct installation of PV arrays for good ventilation
- Ensure that the electrical wiring from PV arrays to inverters is kept to minimum to reduce electrical losses.
- Provide sufficient space around PV installations for safe access and maintenance of the modules and other equipment installed on the roof.
- Ensure that inverter performance is monitored to ensure consistent electrical generation in line with the strategy.

It is assumed that most of the electricity generated by the PV system will be exported to the grid. All the necessary design arrangements will be made to enable the export of the PV system.

4.4.2 Anticipated CO_2 savings from PV system

The energy model assessment shows that the PV system may result in approximately 9.6 tCO_2 reduction of regulated CO_2 emissions per annum which equates to approximately 18.9% reduction for the development which is the maximum that can be achieved with the available roof area. The regulated, unregulated and total emissions after use of the PV system is summarised in Table 4.6.

Table 4.6 CO_2 emissions after use of PV technology

	CO_2 emissions (tonnes per year)		
	Regulated	**Unregulated**	**Total**
Residential CO_2 Emissions Baseline	72.5	87.3	159.7
After energy demand reduction	72.5	84.2	156.7
After use of CHP technology	51.1	84.2	135.3
After use of PV	41.4	84.2	125.6

5. Summary and Conclusions

The proposed strategy is to reduce the overall energy demand as far as practically and economically possible, relative to the policy requirements, by implementing energy efficiency measures before applying low carbon and renewable energy technologies.

The strategy follows and responds to the Be Lean, Be Clean and Be Green energy hierarchy principles as summarised and presented in Table 5.1.

Table 5.1 The Energy Strategy: Be Lean, Be Clean and Be Green principles

Energy Principles	Energy Strategy Response
Be Lean: Use less energy. Minimise energy demand through efficient design and the incorporation of passive measures	**Passive design** • Optimised orientation to enable controlled solar gain and improved direct and indirect natural lighting. • Incorporation of balconies into the design to reduce risks of overheating in summer. **Building Fabric** • Use of optimal building fabric standards. **Energy Efficiency** • 100% energy efficient lighting and appropriate controls • Variable speed heating system with high delta T and low return temperatures • High efficiency motors and variable speed pumps for heating and extraction systems • High efficiency heating system (e.g. seasonal efficiency > 92% and NOx emissions less than 40 mg/kWh) • Appropriate controls for heating system • Temperature and time zoning • Appropriate insulation of heating distribution system • Provision of energy efficient oven, hob and washer dryer (applicable to unregulated emissions)
Be Clean: Supply energy efficiently. Reduce energy consumption through use of low-carbon technology	**Energy efficient energy supply** • On-site CHP system connected to on-site heating network to supply domestic hot water and space heating to the development
Be Green: Use renewable energy systems	**Renewable energy** • PV system to supply renewable electricity for the development.

The regulated CO_2 savings expressed in terms of actual and percentage reduction after each stage of the energy hierarchy are presented in Table 5.2.

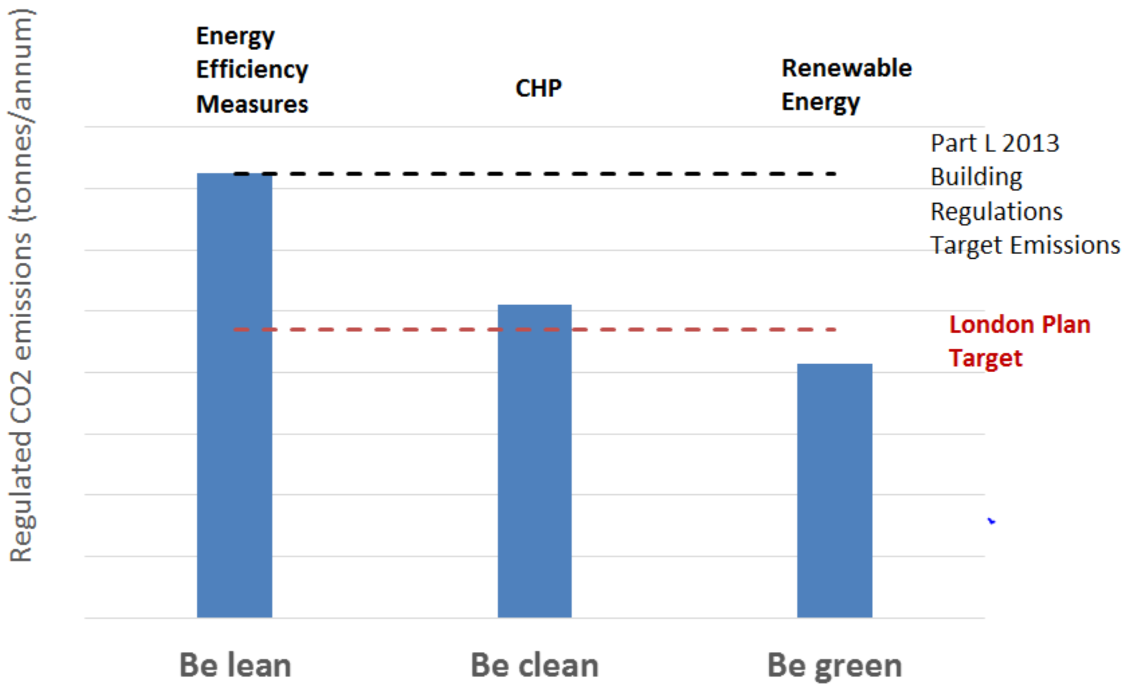
Table 5.2 Summary of CO_2 savings from each stage of the Energy Hierarchy

	Regulated Energy CO_2 savings	
	Tonnes per annum	**%**
Savings from energy demand reduction	-0.023	-0.03%
Savings from CHP	21.4	29.5%
Savings from renewable - PV	9.6	18.9%
Total cumulative savings	31.0	42.8%

Table 5.2 shows that the proposed strategy can achieve regulated CO_2 savings of circa 31 tCO_2 which is equivalent to 42.8% reduction when compared to original baseline.

The overall reduction in regulated carbon emissions associated with the proposed design is graphically illustrated in Figure 5.1.

Figure 5.1 Overall reduction in regulated CO_2 emissions compared to Part L baseline emissions



The summary of the overall reduction in CO_2 emissions after each stage of the energy hierarchy is presented in Table 5.3.

Table 5.3 Summary of CO_2 emissions after each stage of the Energy Hierarchy

	CO_2 emissions (tonnes per year)		
	Regulated	Unregulated	Total
Residential CO_2 Emissions Baseline	72.5	87.3	159.7
After energy demand reduction	72.5	84.2	156.7
After use of CHP technology	51.1	84.2	135.3
After use of PV technology	41.4	84.2	125.6

Table 5.3 shows that the overall CO_2 emissions from both regulated and unregulated energy can be reduced by 34 tCO_2 per annum which is equivalent to circa 21.3%.

In summary, the proposed energy solution for the development:

1. Informs the built form and orientation of the buildings to respond to daylight and overheating issues.
2. Includes optimal fabric standards, energy efficient design of building services and energy efficient appliances
3. Complies with Part L 2013 Building Regulations and meets TFEE requirements.
4. Includes an efficient on-site heating network with a CHP system designed to meet the hot water demand of the development.
5. Includes PV renewable technology and achieves 18.9% renewable contribution which is the maximum that can be achieved with the available roof area.
6. Exceeds the 35% regulated energy CO_2 emissions reduction requirement by 7.8%.
7. Achieves Code Level 4 energy requirements.

Appendix A – Assessment of Renewable Energy Options

This appendix presents an assessment of the renewable technology options relative to site. This assessment demonstrates that the installation of PV systems is considered to be the most suitable renewable energy technology option for the development. All other renewable energy technology options are considered to be less suitable (or unsuitable).

Biomass Boilers

Biomass boilers are now regarded as a conventional form of technology with a wide range of sizes and types to meet renewable targets. Biomass boilers use biomass as a fuel source, which is an alternative solid fuel to the conventional fossil fuels and has carbon emissions close to zero. Various types of biomass fuel are in use, the most common being wood chips and pellets.

Although pellets are more expensive than chips, they have greater energy content per unit of weight and require a lower storage volume. Pellet boilers also require less maintenance and produce considerably less ash residue.

There are some local/regional as well as national biomass suppliers who can supply biomass for the site. Biomass would need to be delivered to site in large trucks and the arrangements for supply and storage of the biomass fuel would need careful consideration. It would also require a suitable biomass storage space, which given the space constraints on this site is likely to be restrictive.

Biomass boilers could provide heat for a community heating scheme supplying the remaining 30% thermal demand (space heating) after CHP.

The potential reduction in carbon emissions from the installation of biomass boilers can be considerable and this would likely meet the GLA's target for carbon emissions reduction from renewable energy sources. Also, biomass boilers are compatible with CHP units due to similarity in operating temperatures. However, although biomass systems have a number of advantages, in the context of this development, the following issues prevent the installation of biomass boilers:

- Potential negative effect on air quality;
- No space availability for fuel delivery and storage;
- Significantly higher capital costs in comparison with gas boiler system;
- Requirements of additional resources for management of the operation;
- The location of the development may not be suitable for large-scale fuel delivery; and,
- Security of biomass supply.

The conclusion is that biomass boilers can deliver additional CO_2 reductions but the solution is considered to be unsuitable and not cost effective for this development.

Ground Source Heat Pumps

The ground can be used as both a source of heating and a source for cooling. Ground source heating involves heat pumps, drawing heat from underground, whereas ground source cooling can either use heat pumps or make use of low temperature groundwater directly. Ground Source Heat Pumps (GSHP) are a relatively mature technology and utilise the energy in the ground through a refrigeration cycle. Where GSHP are used for both heating and cooling, depending on the season, this can be a very efficient solution. GSHP can be open loop or closed loop.

Closed loop GSHP system comprises a sealed system of buried pipes normally containing brine or water/antifreeze solution. The solution is circulated continuously around a closed system.

Open Loop GSHP system uses groundwater which is taken from an aquifer to supply heating or cooling. The water is then returned to the ground (sometimes via a borehole or sometimes via storm water drainage). Open loop systems require abstraction and discharge licences from the Environment Agency (EA).

There should be sufficient area within the development to accommodate a sufficient number of boreholes to meet the heating demand with a closed-loop system. However, the ground conditions are currently unknown and may not be suitable to use an open-loop system.

GSHP systems which provide heating are most efficient when warming water to 35-40ºC. Theoretically, GSHPs could provide heat for a community heating scheme supplying the remaining 50% thermal demand by preheating the district heating water.

However, as the GSHPs operate at low temperatures, they are not very compatible with higher temperature technologies and systems such as CHP system. Integration of GSHPs in one system with CHP units has significant technical challenges and risks. The overall heating supply system may become unnecessarily complicated, which will likely to significantly increase the costs of the system and maintenance risks. In addition, due to space constraints it is unlikely be possible to accommodate the system within the proposed plantroom area. Because of the aforementioned issues, this arrangement is unlikely be practical and cost effective and therefore, it is not recommended for this development.

Air Source Heat Pumps

The Air Source Heat pumps (ASHP) can be used as both a source of heating and a source for cooling. ASHP use the same principle of operation as GSHPs but the use air as a heat source. The downside is that the air temperature and therefore efficiency of the heat pump is reduced in cold weather when the heat is most needed. This means that one either needs to oversize ASHPs to take into account degradation in performance or, alternatively, provide an auxiliary electric heater. Provision of an auxiliary heater reduces capital cost but adds to running costs and reduces carbon savings.

Outdoor air systems are widely implemented in the form of split systems, with indoor and outdoor units linked by refrigerant pipes running through the wall. Packaged air systems where outdoor air is ducted to an indoor package are also available.

Theoretically, ASHPs could provide heat for a community heating scheme supplying the remaining 30% thermal demand by preheating the district heating water.

However, because the ASHPs should be placed on the roofs of the building, it will significantly reduce area available roof area for PV as well as will have significant negative aesthetic impact on the development.

Installation of the ASHPs on the roofs would require higher installation costs associated with support and access to the plant and greater need to consider noise impacts.

In addition, they are not very compatible with higher temperature technologies and systems such as CHP systems. Integration of ASHPs in one system with CHP units has significant technical challenges and risks. Therefore, the ASHP system installing should ideally be installed separately from the CHP system. In either option, the overall heating supply system could become unnecessarily complicated, which would likely to significantly increase the costs of the system. Because of the aforementioned issues, this arrangement is unlikely be practical and cost effective and therefore, it is not recommended for this development.

Wind turbines

The capacity of wind turbines can range from 500W to more than 2.5MW. Generally speaking, the larger the turbine, the more cost-effective, but also the more complex it is to find suitable space and obtain planning permission.

Installation of large/medium scale wind turbine(s) could meet the renewable energy and carbon reduction targets, however there is no appropriate space for installation of large/medium scale wind turbines within the site. The installation is unlikely to be permitted due to close proximity of the Heathrow airport.

Effective energy generation through small scale roof mounted wind turbines is not feasible due to the following:

- Location of the development in a densely populated area.
- The average wind speed at the site is estimated to be circa 5.6 m/s at 25 m above ground which is based on NOABLE Wind Map (the wind speed was taken from the Rensmart Wind Map). The wind speed is marginal for effective operation of a wind turbine.
- Issues such as noise, telecoms interference proximity to Heathrow airport and visual impact are likely to restrict installation of wind turbines.

Therefore, wind energy is not recommended for this development.

Solar Thermal systems

Solar water heating systems use the energy from the sun to heat water, most commonly for domestic hot water needs. Solar heating systems use a heat collector that is usually mounted on a roof in which a fluid is heated by the sun.

The use of solar thermal panels is inappropriate for this development on the basis that the technology is not compatible with the use of CHP as both technologies compete for the same summertime hot water load.

In addition, the system will produce relatively small CO_2 savings but will have significant negative impact of the cost of the heating system and its practicability. Therefore, solar thermal systems are not recommended for this development.

Appendix B – Loadtracker CHP Technical Data and Costs

SAV Systems Ltd.
Surrey, GU21 5BX

Tel: 01483 771 910
E-mail: info@sav-systems.com

Project Name	**BUDGET QUOTE 1 x 20G**		
Date	**MAY 2014**		

LoadTracker CHP

Item	Description		Total
1.1	1 x LoadTracker XRGI 20G system with Q60; 1 x CHP heat storage vessel 500 litres including storage control, 50 mm connections, 6 bar; 1 x Installation kit for 1 x CHP 1 x Q-network Flow Control	£	**40,055.00**
1.2	10m Flue	£	**1,210.00**
	Additions and Commissioning		
2.1	Standard commissioning of 1 x CHP unit. Also includes for standard commissioning of the mains monitoring relay to G59/2. Please see notes 1 - 4. Note : This does not include application to the DNO for approval of the relay(s).	£	**2,165.00**
2.2	Commissioning day rate for any requirements which are additional to standard commissioning involvement (eg. System wide testing for LTHW system, BMS and electrical distribution system). Charged at £515/day.		**TBC £515**
2.3	Day rate for equipment handover and demonstration. Allowance for attendance to site by commissioning engineer subsequently to commissioning. Charged at £515/day.		**TBC £515**
2.4	To cover application to the District Network Operator (DNO) for approval of the G59/2 monitoring relays. Please note that because application process can take 3 - 6 months to complete, SAV will accept orders for G59/2 application only at the time of receiving order for CHP equipment supply. Please see notes 5 , 6 & 7	£	**565.00**
		£	**43,995.00**
	Installation		
3.1	1 x CHP installation estimate. Scope includes for all mechanical, electrical, gas, flue and controls work associated with CHP. **Price quoted is an estimate on behalf of Aston Cord Ltd, exact price can be given based on site survey.**	£	**10,950.00**

CHP COMMISSIONING NOTES:

1. Standard commissioning must be included in each CHP order.
2. Standard commissioning to include checking that all connections have been made correctly, all associated electrical systems are satisfactory, priming of all hydraulic circuits, start up of all equipment, optimisation of gas/air mix using flue gas analysis, verification that all instrumentation readings are acceptable, checking that all hydraulic circuits remain leak free and proving that fume extraction is safe. Also includes for standard commissioning of the mains monitoring relay to G59/2. Test equipment will be brought to site and injection testing carried out by an engineer accredited under G59/2, to select & verify relay settings for under / over voltage, under / over frequency and phase shift. Also includes for the preparation and issue of the G59/2 test results.
3. Prior to commissioning being authorised by SAV Systems, settlement of accounts is required in full for all equipment supplied under page 3 of this quote package.
4. Commissioning is payable in advance, before SAV Systems arrange for their commissioning engineer to attend site.
5. Before any CHP is allowed to operate (supplied by SAV Systems or any other party), written agreement to this must first be secured from the local District Network Operator (or DNO, ie, the electricity supply company). This condition is laid down by Engineering Recommendation G59/2 (2010). Without such agreement, the DNO may impose a generation cessation order.
6. The relevant Application Forms to the DNO can be filled out and submitted either by the site operator or by a separate party on behalf of the site operator (the consultant, the contractor or by SAV Systems). If the purchasing contractor agrees with the eventual client that SAV Systems should carry out the Application process, this should be confirmed at the time of the order for equipment supply. This means that an early start can be made with the Application process, which can take 3 - 6 months to complete.
7. Should SAV Systems be required to process all G59/2 Application paperwork, it is recommended that provision be made by the purchasing contractor for the one-off charge which may be imposed by the DNO for the processing of the G59 Application Forms and to witness testing. This charge is not applied consistently by DNOs across the UK; in some cases the charge is waived, in the worst case the charge can reach £900 for a single unit.

CHP INSTALLATION NOTES:

8. Installation cost provided on previous page is provided for budget purposes only. It is not to be construed as an offer by SAV.
9. Price quoted is an estimate, exact pricing can be provided subject to a site survey.
10. The order for installation work should be placed by Main Contractor directly on SAV's recommended installer: Aston Cord Energy Services Ltd, Unit 12c, Shepperton Business Park, Govett Avenue, Shepperton, Surrey TW17 8BA Tel No: 01932 770051. Contact : Mr Ian Stewart
11. Mechanical & Electrical Installation - Scope of works:

Mechanical installation: All LoadTracker CHP components (according to scope of supply) such as power unit(s), Q60 heat distributor(s), thermal storage vessel(s), all interconnecting hydraulic pipework, gas piping to CHP engine, all piping supports as required

Electrical installation: control panel(s), reference meter, all interconnecting cabling in the ancillary kit and load sharer device for multiple CHPs installations

Health & Safety: To cover all site liaison & reporting duties

Access: To provide all necessary scaffolding and access equipment

12. Gas supply line terminal point diam. in plant room is assumed to be 50mm or less. If supply line is greater than this, an additional charge may be required for attendance by coded welder.
13. Electrical distribution board is assumed to be in the plant room. If location of this is further afield, an additional charge may be required, pro-rata to distance between distribution board and plant room.
14. Isolation valves on hydraulic pipework terminals are assumed to be within the plant room, not more than 8 metres from the CHP units. If terminations are further away than this, an additional charge may be required according to length of run.
15. A suitable removal point is assumed to be available within 6 metres of the CHP units for the disposal of flue condensate.

SAV UNITED KINGDOM LIMITED CONDITIONS OF SALE

1 DEFINITIONS

In these Conditions:

"Buyer" is the buyer for the Goods referred to in the Seller's Order Confirmation (or if there is none the Seller's Delivery Note).

"Conditions" means these terms and conditions of sale for the Goods.

"Contract" means the contract for the supply of the Goods consisting of the Buyer's purchase order, the Seller's Order Confirmation (or if there is none the Seller's Delivery Note), the Specification if applicable and the Conditions.

"Goods" means the products [and services] described by the seller.

"Price" means the price for the Goods set out on the Seller's Order Confirmation.

"Seller" is the seller of the Goods referred to in the Seller's Order Confirmation or if there is none the Seller's Delivery Note.

"Specification" if relevant means the detailed requirements for the Goods in an assembled form which is attached to the Seller's Order Confirmation.

2 CONTRACT TERMS

2.1 The Contract is made by the Seller subject to these Conditions, which supersede all earlier sets of conditions issued by the Seller. Any terms and conditions proffered by the Buyer as part of the Buyer's purchase order or otherwise are excluded and do not form a part of the Contract.

2.2 Any order by the Buyer whether made orally or in writing or electronically shall be treated as an offer to the Seller only, and any acceptance thereof by the Seller, whether made orally or in writing or electronically or by conduct, shall be subject to the Conditions to the exclusion of all others.

2.3 No communication from the Seller, its servants or agents, whether oral or in writing or electronically shall be of any contractual effect or be relied on as a representation, condition or warranty, and no variation of the Conditions or any part of the Contract shall be effective save as hereinafter expressly provided for unless given in writing and signed by a Director of the Seller.

3 INTELLECTUAL PROPERTY RIGHTS

3.1 Any and all intellectual property rights including but not limited to copyright, patents, registered or unregistered design rights, or trademarks anywhere in the world in or related to the Goods (and any improvements to the Goods) or the Specification belong to or shall vest in the Seller or its suppliers.

3.2 The Buyer is licensed to use such intellectual property rights only in connection with its acquisition and use or onward distribution of the Goods and for no other purpose. The Buyer and any subsequent purchaser of the Goods is prohibited as a condition of the Contract from copying, manufacturing, reverse engineering or otherwise replicating all or any part of the Goods or the Specification.

4 PAYMENT AND INTEREST

4.1 The Buyer shall pay to the Seller the Price on delivery of an invoice for the Goods or end of month plus 30 days thereafter for approved credit account customers. A discount of 2.50% will be allowed where payment is made before delivery of the Goods.

4.2 The time for payment of the Price is of the essence of the Contract.

4.3 The Seller shall be entitled to charge interest from day to day on any overdue payments at the rate of 2% per month calculated on a daily basis from the first day of the calendar month following the expiry of one month from the date of the delivery of the invoice until payment.

4.4 Delivery shall be of part or of the whole of the Goods at the discretion of the Seller, and the Buyer shall be obliged to take instalment deliveries of the Goods unless otherwise expressly agreed in writing in accordance with clause 2.3 hereof. The Seller shall be entitled to invoice each instalment of the goods separately and the Buyer shall make payment of each instalment invoice in accordance with the terms as to payment herein.

5 VAT

All prices quoted or accepted are exclusive of Value Added Tax and the Price shall be such price plus VAT at the prevailing rate.

6 TERMINATION

6.1 The Seller shall be entitled forthwith (without prejudice to any of its other rights and remedies against the Buyer and without liability for breach of contract) by notice in writing to the Buyer to cancel the Contract and/or any other contract between the Seller and the Buyer or to suspend delivery in the following events:

6.1.1 should any sums owing by the Buyer to the Seller be overdue, whether under the Contract and/or any other contract;

6.1.2 should the Buyer be in breach of any provisions of the Contract and/or any other contract with the Seller or if any distress or execution shall be levied upon the Buyer, its property or assets or if it shall become insolvent or have a receiver or administrator or an equivalent officer appointed in respect of its assets or business.

6.2 Any such contract then subsisting shall be deemed to have been cancelled.

7 DELIVERY

7.1 Delivery dates for the Goods provided by the Seller whether on the Seller's Order Confirmation or the Seller's Delivery Note or otherwise are estimates only. Although every reasonable endeavour will be made by the Seller to meet the Buyer's requirements for delivery of the Goods the Seller shall not be liable for any loss or damage whether direct or indirect or consequential caused by any delay in delivery.

7.2 All deliveries arranged by the Seller shall be arranged as agent for the Buyer and on condition that the Seller is under no obligation to contract under anything but the carrier's normal conditions.

7.3 The Buyer must ensure that proper arrangements are made for the receipt of the Goods on delivery and will indemnify the Seller against all losses arising from failure to comply with this obligation.

7.4 The Buyer or purchasers from the Buyer shall be responsible for installing the Goods on site and for following any instructions provided by the Seller with reference to such installation.

8 PROPERTY AND RISK

8.1 The risk in the Goods shall pass to the Buyer on delivery notwithstanding that the property in the Goods may not have passed to it.

8.2 The property in the Goods shall not pass to the Buyer until the Price has been paid in full.

8.3 The Buyer shall at its own expense take all necessary steps to protect the Seller's title to the Goods against third parties.

8.4 Until the Price has been paid in full the Buyer shall hold the Goods as the Seller's fiduciary agent and bailee and shall to the extent possible keep the Goods separate from or at least separately identifiably from the any other Goods. If the Buyer resells such unpaid Goods in the ordinary course of its business it shall hold the proceeds of sale as trustee on account for the Seller.

8.5 In case of default in payment by the Buyer or upon termination of the Contract by the Seller under clause 7 of the Conditions, the Seller shall be entitled to retake possession of and permanently retain any unpaid Goods and to revoke all liability of the Seller to the Buyer under this Contract. The Buyer shall give the Seller such facilities as are reasonably required by the Seller to enable the Seller to retake possession of the said Goods including, without limitation, an irrevocable license to enter any premises where the Goods are located.

9 WARRANTY AND LIABILITY FOR DEFECTS

9.1 Subject to the conditions set out below the Seller warrants that the Goods shall at the time of delivery to the Buyer comply with the Specification.

9.2 The Seller's liability for any breach of the above warranty shall be limited, at the Seller's option, to:

9.2.1 replacement of the Goods by the Seller provided that the Buyer notifies the Seller in writing of any complaint concerning the Goods delivered within 3 days of receipt of them by the Buyer and prior to the Goods being used failing which the Seller shall be under no further or other liability to the Buyer for any such breach.

9.3 EXCEPT AS EXPRESSLY PROVIDED IN THE CONTRACT THE SELLER MAKES NO WARRANTY OR REPRESENTATION EXPRESS OR IMPLIED RELATING TO THE GOODS OR THE SPECIFICATION AND ALL OTHER REPRESENTATIONS, WARRANTIES, TERMS OR CONDITIONS WHETHER EXPRESS, IMPLIED STATUTORY OR OTHERWISE RELATED TO THE FITNESS FOR PURPOSE, QUALITY, OR COMPLIANCE WITH DESCRIPTION OF THE GOODS OR THE SPECIFICATION ARE HEREBY EXCLUDED TO THE EXTENT PERMITTED BY LAW.

9.4 The Buyer relies on its own skill and judgment as to the sufficiency, capacity and performance of the Goods and as to the suitability of the goods for any purposes for which they are required by the Buyer. The Seller shall not be responsible for any failure of the Goods attributable to the failure of the Buyer or any purchaser from the Buyer to comply with any installation instructions provided by the Seller.

9.5 If the Seller has assembled or otherwise dealt with or processed all or any part of the Goods in accordance with the requirements of the Buyer, these requirements shall be as expressed and given effect to in the Specification. This relies upon the adequacy, accuracy and completeness of the information provided by the Buyer as to its requirements whether on the Buyer's purchase order or otherwise.

9.6 The Seller shall be under no liability under or with reference to the Contract or the Goods or the Specification for any defect in the Goods (or the way in which they are assembled, dealt with or processed) or in the Specification which is attributable to any defect, inaccuracy, inadequacy or incompleteness of any drawing, design, specification or other material or information supplied by the Buyer.

9.7 The Buyer shall before using the Goods, and before parting with possession of them, test and examine them to satisfy itself that the Goods are of the contractual quality and description and are suitable for the purpose for which they are intended to be used.

10 LIMIT OF LIABILITY

10.1 THE LIABILITY OF THE SELLER UNDER OR WITH REFERENCE TO THE CONTRACT, THE GOODS AND/OR THE SPECIFICATION WHETHER IN CONTRACT, TORT, FOR BREACH OF STATUTORY DUTY OR OTHERWISE, WHETHER ARISING DIRECTLY OR INDIRECTLY, SHALL BE LIMITED TO THE AMOUNT OF THE PRICE PAYABLE UNDER THE CONTRACT.

10.2 THE SELLER SHALL IN ANY EVENT NOT BE LIABLE UNDER OR WITH REFERENCE TO THE CONTRACT, THE GOODS OR THE SPECIFICATION WHETHER IN CONTRACT, TORT, FOR BREACH OF STATUTORY DUTY OR OTHERWISE FOR ANY CONSEQUENTIAL, INDIRECT OR PUNITIVE LOSS OR DAMAGE, LOSS OF PROFIT, REVENUE OR ANTICIPATED LOSS OF PROFIT, OR LOSS OF BUSINESS, DATA OR GOODWILL OF OR RELATED TO THE BUYER OR ANY THIRD PARTY EVEN IF THE SELLER HAS BEEN MADE AWARE OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE. THE BUYER IS ADVISED TO INSURE AGAINST ALL POTENTIAL RISKS.

10.3 THE BUYER ACKNOWLEDGES THAT SUCH LIMITS OF LIABILITY ARE REASONABLE IN THE CONTEXT OF THE CONTRACT.

11 FORCE MAJEURE

11.1 The Seller shall not be liable for any failure to carry out its obligations under the Contract if and to the extent that such failure is due to force majeure which shall mean an event beyond the control of the Seller including but not limited to an act of war, an outbreak of hostilities (whether or not involving the United Kingdom and whether war is declared or not), terrorism, national emergency, strikes, lock-outs, trade disputes or other labour difficulties, breakdown, delays in transport, accidents, explosions, fire, flood, drought, tempest, abnormal weather conditions, delay in delivery of raw materials or components, or failure to obtain any necessary licenses, consents or authorities for the exportation or importation of the Goods.

11.2 The Seller shall be entitled to terminate the Contract without liability for breach of contract in the event that such a force majeure event continues for 30 days or longer.

12 CONFIDENTIALITY

12.1 The parties to the Contract will keep confidential the Contract and any confidential information relating to the other party, their business, the Goods, other products, the Specification, clients, projects or otherwise which is marked as confidential or is clearly intended to be confidential and will provide the same degree of protection for this as it would for its own confidential information and will not use copy or disclose the same to any third party except to the extent that this is expressly permitted under this agreement or is necessary for its proper operation.

12.2 This obligation of confidentiality will not apply to any such confidential information which:

(a) is already in the public domain;

(b) becomes known from a third party without breach of this or any other obligation of confidentiality;

(c) is required to be disclosed by a court of law or any other competent tribunal, government or other authority or regulatory body.

13 STATUS OF THE PARTIES

The parties to the Contract are to be considered as independent contractors and nothing shall be deemed to create a relationship of partnership or agency between them.

14 ENTIRE AGREEMENT

The Contract represents the entire agreement between the parties relating to its subject matter and supersedes any and all prior promises, representations, agreements, statements and understandings whatsoever which existed or may have existed between the parties other than those expressly incorporated in the Contract. This clause shall not exclude liability for fraudulent misrepresentation.

15 WAIVER

Any delay or failure by any party in exercising any right or remedy arising under the Contract shall not constitute a waiver of such right or remedy.

16 SEVERABILITY

If any provisions of the Contract should be declared invalid by a court of law or other competent tribunal or governmental body then the remainder of the Contract shall continue in full force and effect provided that it is capable of so doing.

17 UN CONVENTION

The parties hereto specifically exclude the United Nations Convention on Contracts for the International Sale of Goods from the Contract, and any transaction that may be implemented in connection with this Agreement.

18 THIRD PARTY RIGHTS

Save where expressly stated, the Contract is not intended to nor shall it create any rights, entitlements, claims or benefits enforceable by any person that is not a party to it. Accordingly, save as aforesaid, no person shall derive any benefit or have any right, entitlement or claim in relation to this Agreement by virtue of the Contracts (Rights of Third Parties) Act 1999.

19 HEADINGS

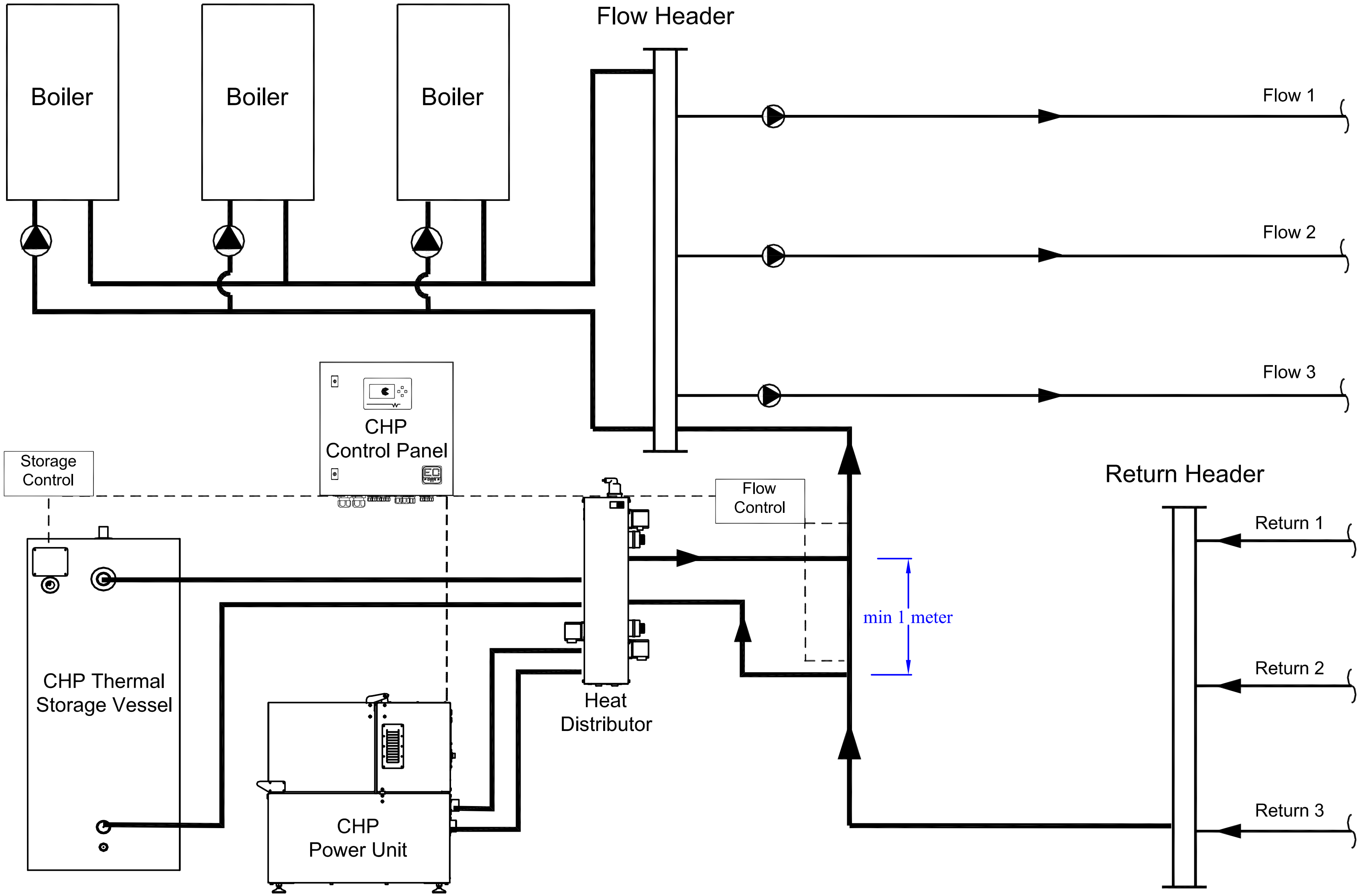
The headings in the Conditions are included for reference purposes only and shall not be taken into account in their interpretation.

20 NOTICES

All communications and notices by and to the Seller or the Buyer shall be made or given by sending the same by hand, ordinary first class post, facsimile transmission or electronic transmission in the case of the Buyer to the address on the Seller's Order Confirmation (or if none the Seller's Delivery Note) or the Buyer's last known address and in the case of the Seller to Scandia House, Boundary Road, Woking, Surrey, GU21 5BX and if so sent by post shall be deemed to have been made or given on the day after the date when the same was posted and in the case of other notices will be deemed to have been given on delivery.

21 GOVERNING LAW AND DISPUTES

The Contract shall governed by and construed in accordance with the law of England and the parties hereby submit to the exclusive jurisdiction of the English courts.

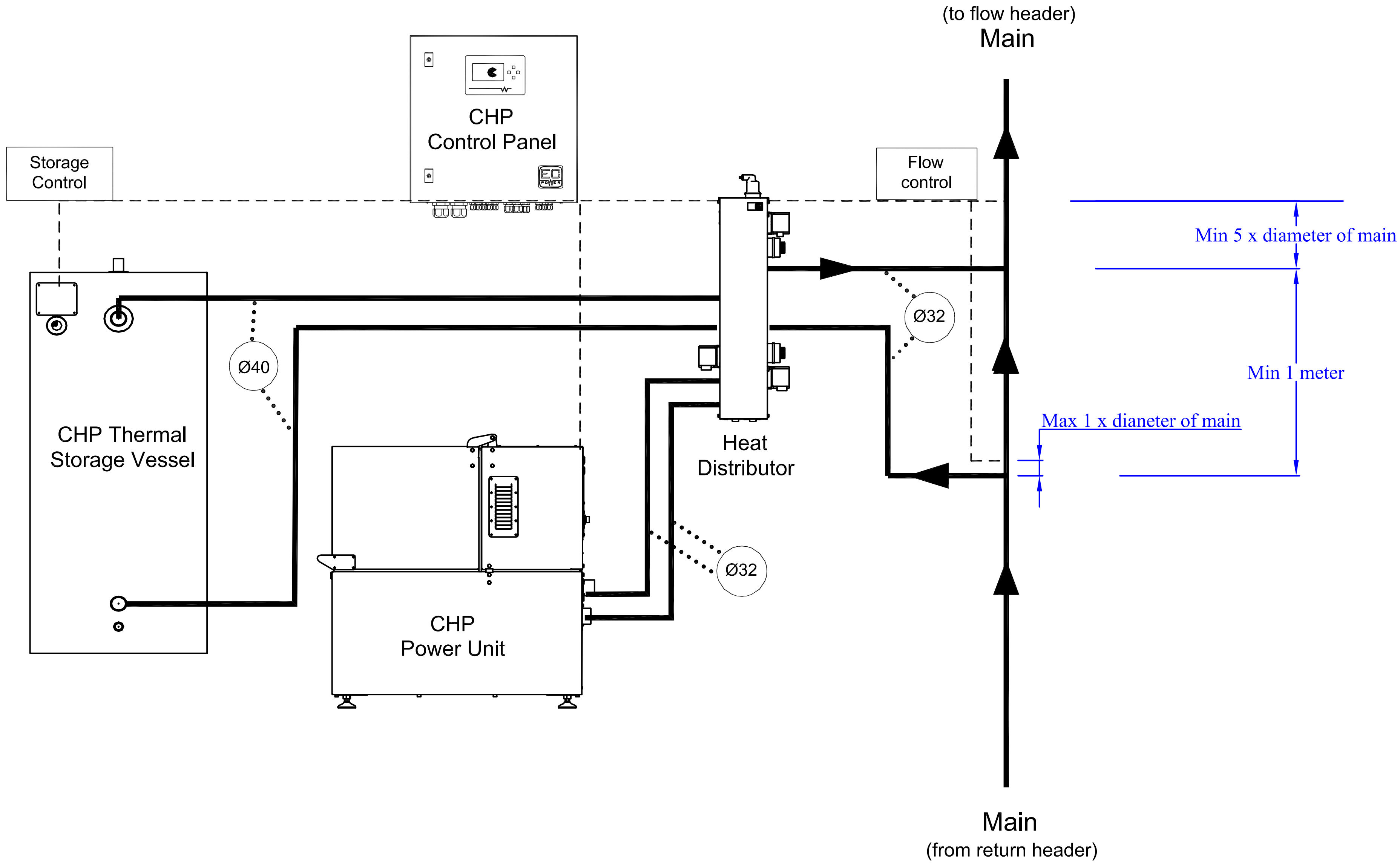


SAV SYSTEMS
Tel: +44(0) 208 941 4153
info@sav-systems.com
www.sav-systems.com

LoadTracker CHP Energy Centre

Drawn EC-Power	Date 13/05/10	Scale n/a	
Checked	Date		
Drawing No SAV-02-010-764		Rev A	

1xCHP with internal Flow Control & Split Low Loss Header



SAV SYSTEMS

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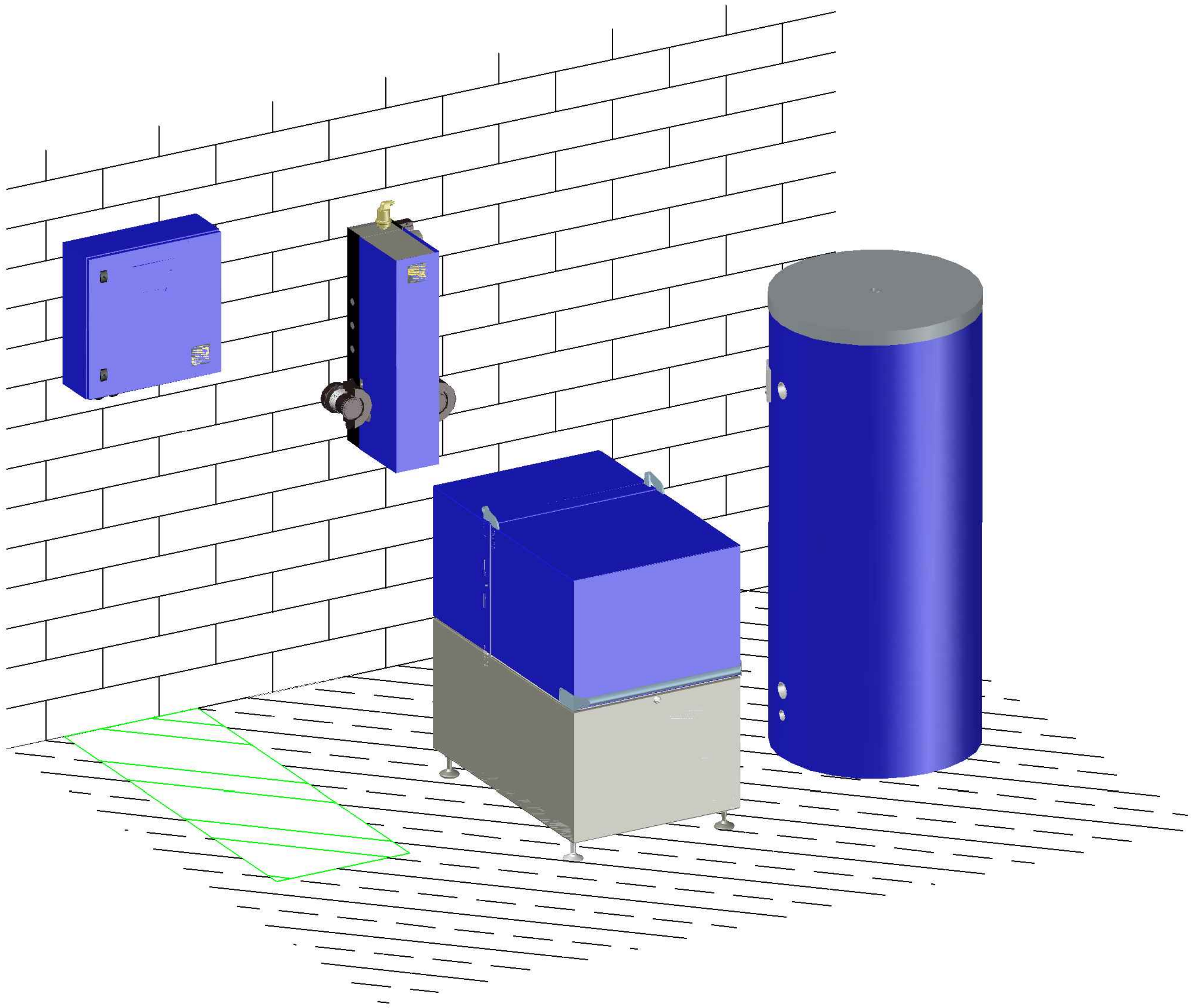
www.sav-systems.com

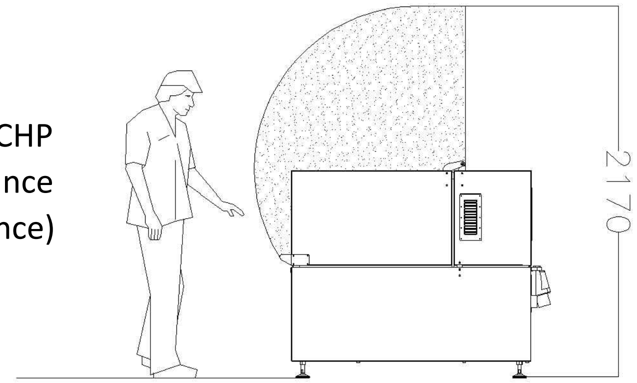
LoadTracker CHP Energy Centre

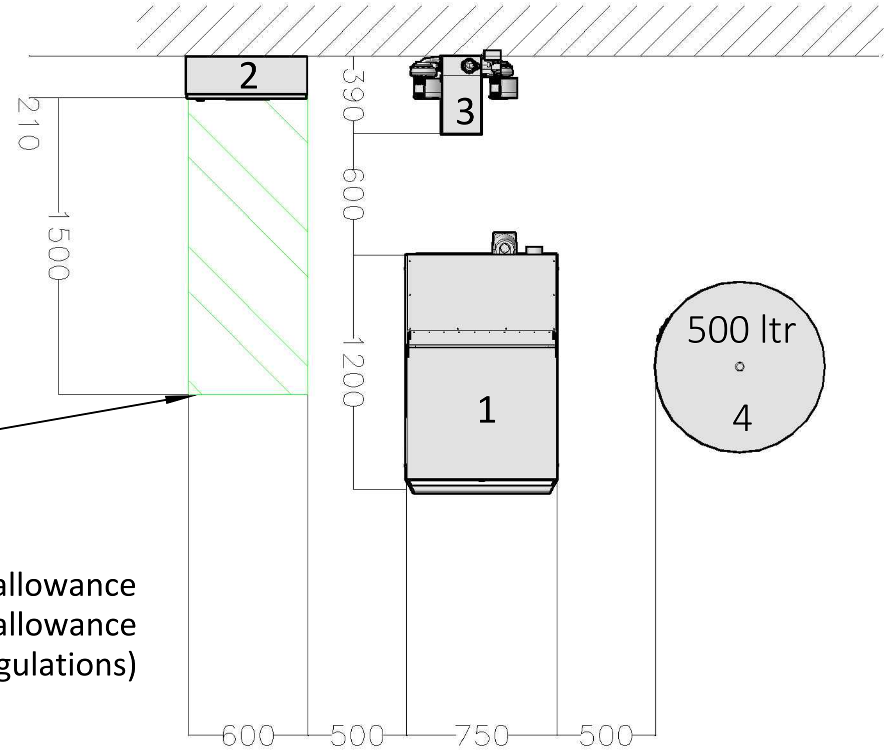
Drawn EC-Power	Date 13/05/10	Scale n/a	
Checked	Date		
Drawing No SAV-02-010-766		Rev A	

1xCHP with internal Flow Control & Heat Storage Outboard



Ensure minimum 500-mm clearance in front of CHP Power Unit and 920-mm above for maintenance (i.e. 2170 floor to open lid clearance)





Space reserved for throw back allowance (installer to ensure space allowance conforms to latest electrical regulations)

Equipment

1.	CHP Power Unit	(750 kg)	H 1250 D 1200 W 750
2.	CHP Control Panel	(40 kg)	H 600 D 210 W 600
3.	Q60 Heat Distributor	(68 kg)	H 1100 D 390 W 510
4.	Thermal Storage Vessel	(593 kg)	H 1870 Ø 850

CHP system components should be located in close proximity to each other. Recommended lengths for mechanical connections are as follows:
- max. 1.5 m from power unit to heat distributor
- max. 10 m from heat distributor to storage vessel
- max. 10 m from heat distributor to the main

EC POWER
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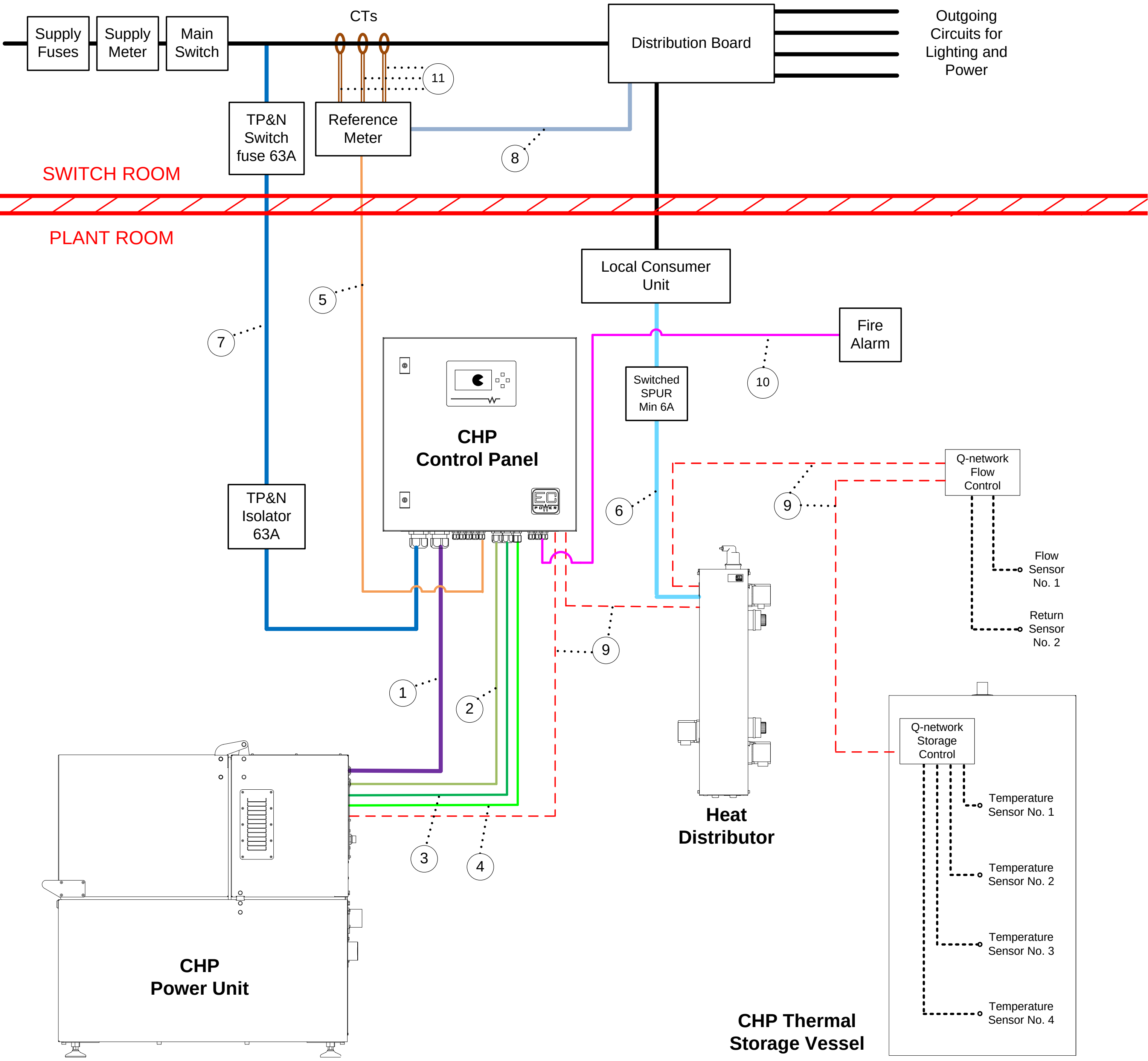
LoadTracker CHP Energy Centre

Drawn JWHH	Date 01/08/2013	Scale n/a	
Checked	Date		
1 x CHP with 1 x 500 ltr thermal storage vessels	Drawing No SAV-01-010-1385	Rev C	



Cables provided by SAV		Cables to be provided by installer	
1	10 mm^2, 4 core SY, LSF	7	to mains, 400V, 5 core, 3 phase
2	0.75 mm^2, 12 core screened, LSF	8	6 amps, 4 core, 3 phase, SY
3	0.75 mm^2, 5 core screened, LSF	9	CAT 5/6 network cable, RJ45 connectors
4	0.75 mm^2, 3 core screened, LSF	10	to site fire alarm, min. 0.75 mm^2, 3 core
5	0.75 mm^2, 2 core, signal cable screened, LSF	11	brown, 2.5 mm 6491b
6	1 phase, power connector lead		

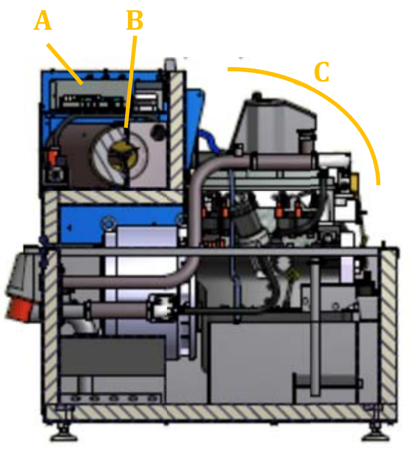
Notes:

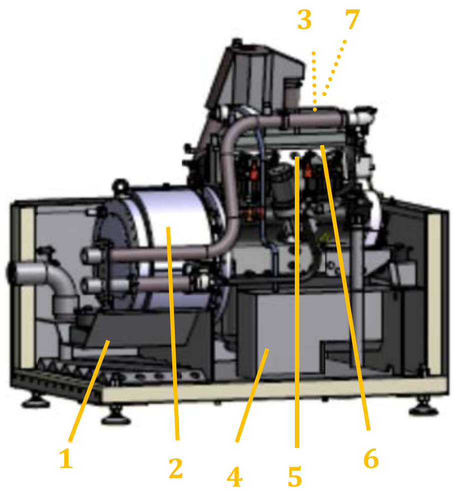
1. The supply to the CHP must be taken from a point after the main switch fuse but before the CTs and distribution boards.
2. If using a panel board, the panel manufacturer must be informed at the planning stage to allow sufficient room for the CTs.
3. Standard CTs supplied by SAV are rated at 300 amps. Larger CTs (up to 2000 amps) are available on request.
4. If the incoming supply is higher than 2000 amps, the reference meter and CTs can be dispensed with.

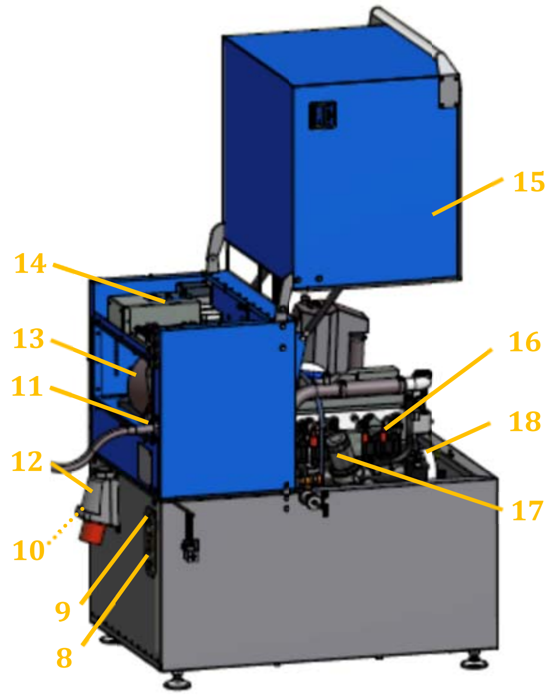
EC POWER / SAV SYSTEMS Tel: +44(0) 208 941 4153 info@sav-systems.com www.sav-systems.com	**Single XRGI 15 / XRGI 20 LoadTracker CHP electrical connections** **Drawing No SAV-02-010-1282**	30/09/2013 Rev D	

LoadTracker CHP
XRGI 15 and XRGI 20

Power unit	XRGI 15G-TO	XRGI 20G-TO
Noise level	49 dB(A)	49 dB(A)
Dimensions (L x W x H)	130 x 75 x 115-125 cm	130 x 75 x 115-125 cm
Weight	700 kg	750 kg
Service interval	8,500 hours	6,000 hours
Power output (modulating)	6 - 15 kW	10 - 20 kW
Electrical efficiency	30%	32%
Thermal output	17 - 30 kW	25 - 40 kW
Thermal efficiency	60%	64%
Overall efficiency	90%	96%
Fuel	natural gas, propane, butane	natural gas, propane, butane
Natural gas consumption	2.6 – 5.0 m^3/h	3.7 - 6.2 m^3/h
Fuel supply pressure	5 – 65 mbar	10 – 50 mbar
Emission levels	CO < 89 mg/Nm^3 NO_x < 314 mg/Nm^3	CO < 50 mg/Nm^3 NO_x < 100 mg/Nm^3
Oil capacity	28 l	50 l
Generator	4 pole asynchronous	4 pole asynchronous
Voltage	400 V, 3 phase	400 V, 3 phase
Current	26 A	36 A







A Electrical components and safety circuit
B Air filter & mixer (ventilated area under partial vacuum)
C Soundproofed, thermally insulated engine compartment

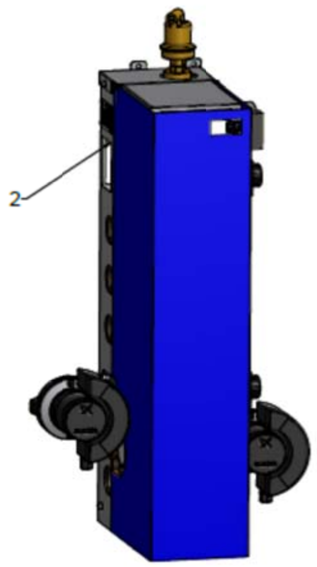
1. Silencer (integrated)
2. Water-cooled generator
3. Exhaust gas heat exchanger (not visible)
4. Oil sump
5. Toyota gas engine (4-cylinders)
6. Oil separator (patented)
7. Three-way catalyser (not visible)
8. Primary circuit return (1 ¼“)
9. Primary circuit flow (1 ¼“)
10. Flue connection (twin wall, d_i 60 mm, d_a 100 mm)
11. Gas connection (¾“)
12. Main 3 phase electrical connection
13. Air filter
14. Gas safety tray
15. Lid with gas compression springs
16. Spark plugs
17. Oil filter
18. Oil filter cap

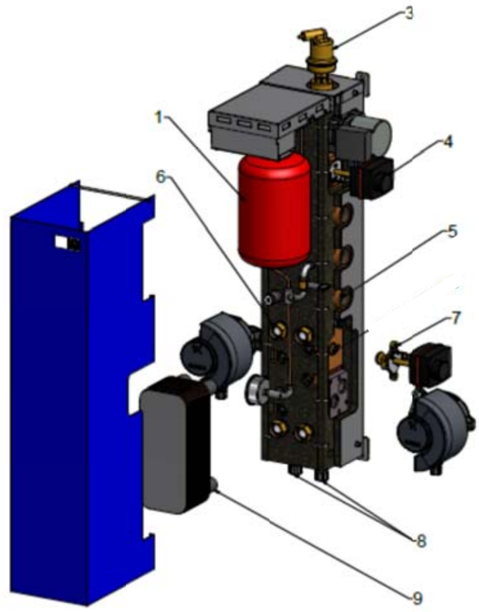
Heat distributor Q60

The heat distributor creates a hydraulic break between the power unit and the building's heating and DHW system. A closed circuit water cooling system extracts heat from the generator, engine and exhaust gases. This useful heat is then transferred via a plate heat exchanger in the heat distributor and can then be distributed to the site heating and DHW system.

Main components

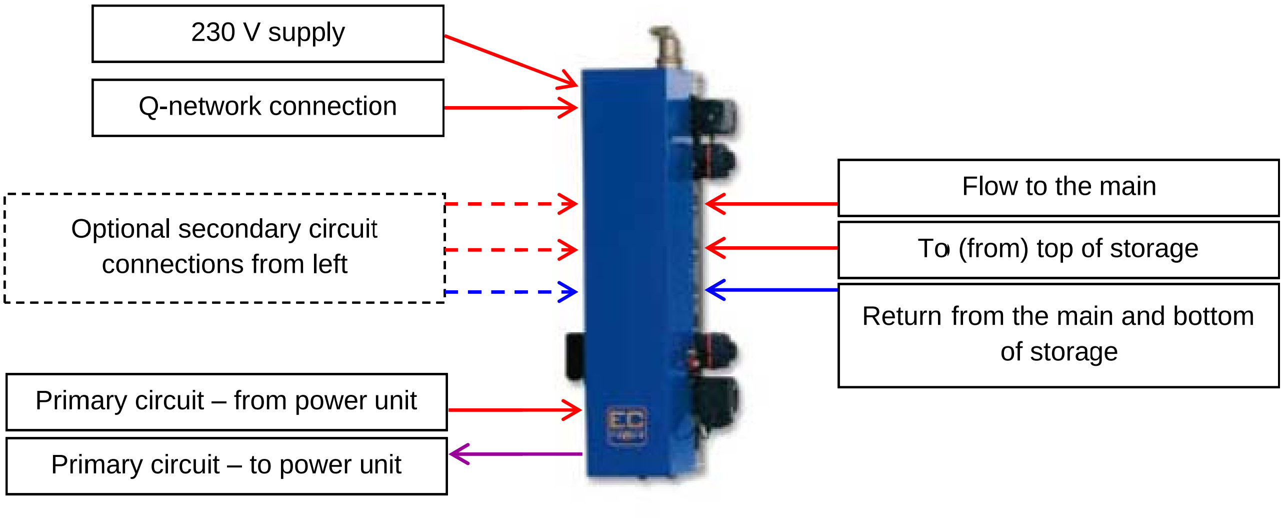
1. Expansion tank
2. Q-network connections (two for control circuit and two for heat circuit)
3. Automatic air vent
4. Flow control valve
5. Secondary circuit connections (1 ¼")
6. Primary circuit connections (1 ¼")
7. Engine circuit temperature control valve
8. Dirt and air separators for primary and secondary circuits
9. Plate heat exchanger





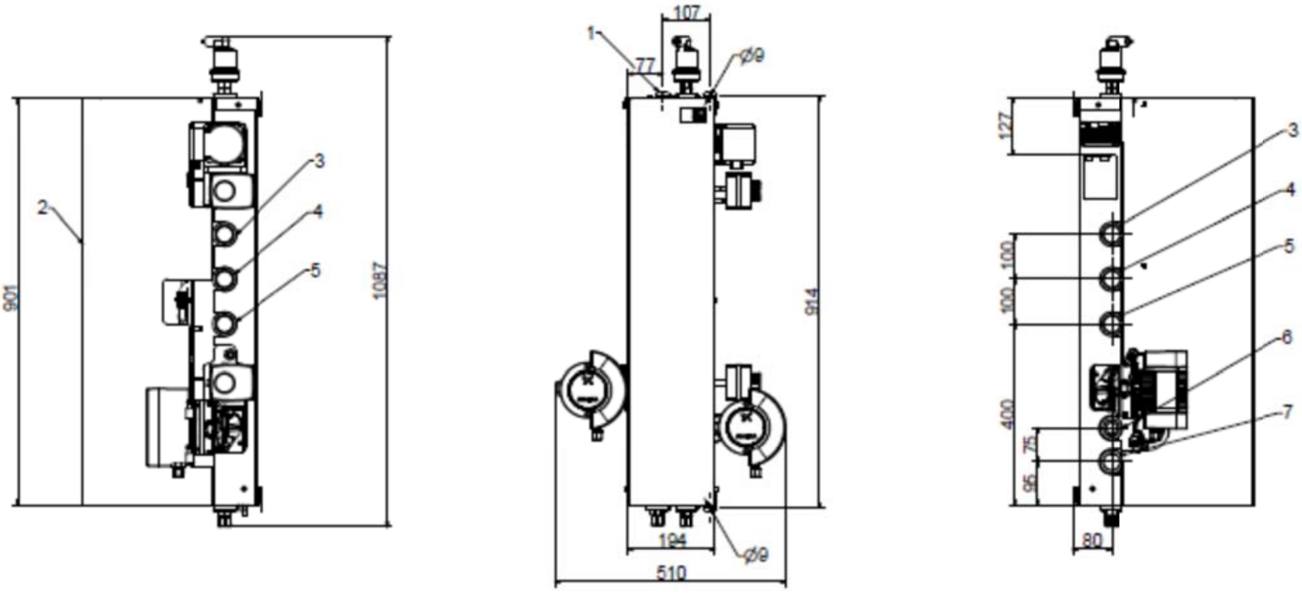
Dimensions (H x W x D)	1100 x 510 x 390 mm
Weight	68 kg
Connections size	1¼"
Flow pump	Grundfos : UPS 15-60 (105W)
Return pump	Grundfos : Magna 25-100 (185W)
Primary circuit pump	Grundfos : Magna 25-100 (185W)
Plate heat exchanger	Danfoss: XB 10-1 50
Q-network connections	Storage Control
	Boiler Control
	Flow Control
Electricity consumption at full load	250 - 500W
Electricity consumption during stand by	25W

Connections with use of internal flow control



Please note that for installations with external flow control or with multiple CHPs, only two lower secondary circuit connections are to be used. The lowest one for connecting return from the main and bottom of storage and upper one (middle) for connecting flow to the main and top of storage.

Dimensions



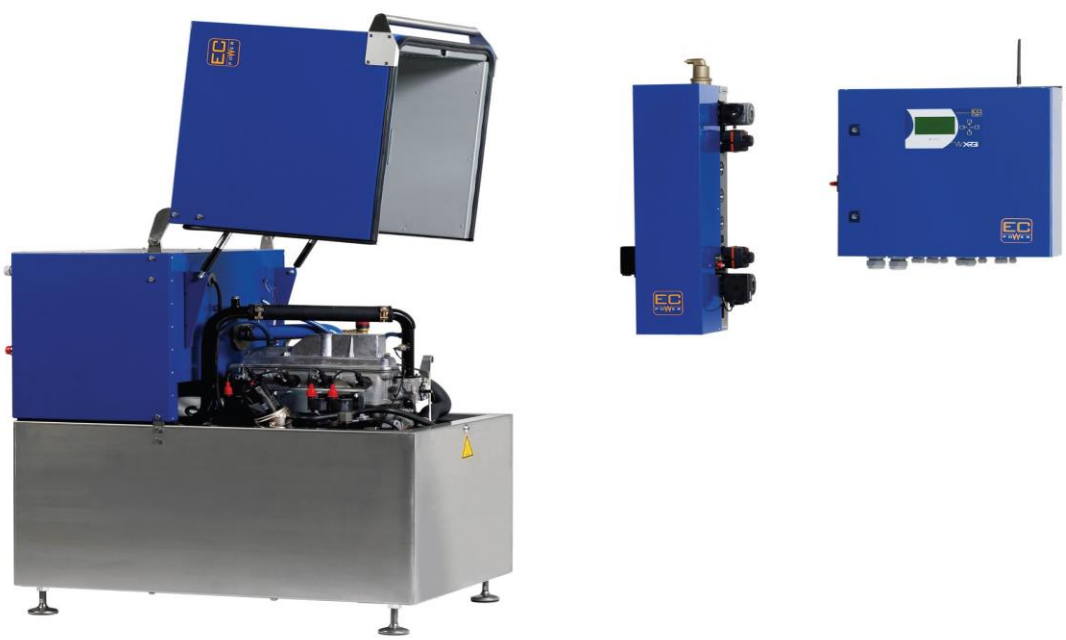
Right ***Front*** ***Left***

1. Installation plate
2. Cover (insulated)
3. Flow to the main (1 ¼“)
4. To (from) top of storage (1 ¼“)
5. Return from the main and bottom of storage (1 ¼“)
6. From power unit (1 ¼“)
7. To power unit (1 ¼“)

Sole UK Distributors of EC Power Denmark Products

XRGI 20G Load Tracker CHP Energy Centre Warranty & Service Document

Dated 04 July 2013



04 July 2013

XRGI 20G Load Tracker CHP Energy Centre

WARRANTY

- SAV Systems warranty for LoadTracker CHP is for a period of 24 months commencing from the date of commissioning, or 90 days from the date of delivery, whichever is the earlier.
- The warranty covers the cost of parts and labour to make good any CHP related breakdown or failure of the CHP equipment which result from defects in manufacture.
- Should servicing or repairs to the equipment be carried out during the warranty period through an agreement *other than that* between the customer and SAV Systems, the warranty would no longer apply.

WATCHMAN Automatic Monitoring
&
Service Cover
UK Price List

CONTINUING CHP MAINTENANCE

Once outside the 24 month warranty period, ***Watchman Automatic Monitoring and Service Cover*** ensures continuing rapid access to spares and specialist labour. Parts and labour for such incidents to be invoiced as and when incurred.

Servicing of a XRGI 20G power unit should be carried out either:

a) Each time the power unit clocks up 6,000 running hours
(equivalent to approximately 12 months operational running 24/7)

Or

b) A calendar back stop of 2 years has elapsed since the previous service. Annual Gas Safe certification of the CHP will be required if the CHP service falls into this category.

- Professional Manufacturers scheduled service of the CHP comprising of an oil change (the sump contains 40 litres, thus allowing long intervals between services), cleaning of strainers, replacement of Oil & Air filters / Spark plugs and the safe disposal of all used items. A CHP system Health Check will also be carried out as part of the service. Also included is the cost of service parts, labour and travelling within the UK.

- Gas Safe certification checks on the CHP will be carried out, including checking of emission levels, setting up the CHP engine, and the issue of a CHP Gas Safe certificate, upon completion.

- For multi-unit installations, it should be noted that site electrical demand is distributed approximately equally between all units by the CHP load-sharer device. This means that all units at any multi-unit installation should reach the 6,000 hour threshold at around the same time. Arrangements for servicing should therefore be simplified.

- SAV Systems maintain a database of all EC Power CHP installations in the UK and ROI. This database includes the automatic counter for operating hours by each unit. When the counter for a XRGI 20G CHP unit gets to 5,500 hours from first start or previous service, e-mail notification of this event will be sent by SAV Systems to the client's nominated contact. This is to enable timely arrangements to be made for the next service visit.

- XRGI 20 CHP units should not normally continue operation beyond a service interval of 6,000 hours, or 2 years' calendar service, from commission.

- Should operation of a XRGI 20G CHP unit from initial commissioning continue beyond the first 6,000 hours, SAV Systems would not consider itself bound by any subsequent warranty claim.

- Gas certification. Although Gas Safe certification is an integral part of initial CHP commissioning, please note that it is a legal requirement check due at the 12 month anniversary date from the initial commission.

Please see over for CHP service costing's.

CHP XRGI 20G Service Tariffs

XRGI 20G CHP Power Unit Maintenance Service Tariff

XRGI 20G for first CHP unit: **£1675.00 per visit**

XRGI 20G
For subsequent units in the same plant room: **£1575.00 per visit**

- **CHP professionally serviced iaw the manufacturers schedule using manufacturer's genuine service replacement components.**
- **Gas Safe checks carried out on CHP equipment.**
- **Gas Safe certification issued upon completion.**

(Service excludes the replacement of any component found defective)

Registration 543636

04 July 2013

Fairview®
NEW HOMES Ltd.