



# THAKEHAM

LAND EAST OF COLLEGE LANE - HURSTPIERPOINT



## ENERGY & SUSTAINABILITY STATEMENT

September 2026

SEC/dc/ss/ES- 3833/-



**Southern Energy**  
**Consultants**  
Energy & Sustainability Solutions



### **About Southern Energy Consultants Ltd**

*Southern Energy Consultants Ltd are a construction consultancy formed in 2009 specialising in sustainability, energy conservation, suitability of renewable technologies, building regulation compliance services, thermal modelling and overheating modelling. As a consultancy we do not sell or have financial interest in any products so are able to take an objective view of developments to assist Clients with incorporating cost effective, compliant and practical solutions.*

*Our services include Planning Energy Statements, Planning Sustainability Statements, Energy Calculations for Residential and Commercial Building Regulation compliance, Air Permeability Testing, Sound Testing, psi value Construction Junction Modelling, CIBSE TM52 and TM59 Overheating Modelling, AD Part O Overheating Modelling and Compliance Reports.*

*Within SEC Ltd we have over fifty years of combined experience working with and for National Developers, Construction and Design and Build Contractors we apply our expertise not only to assist with Client understanding of new energy and sustainability obligations but also in a way that ensures that the needs and responsibilities of all stakeholders are wholly respected and considered.*

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## **1.00 Illustrative SAP Calculations:**

- 1a. Type 2B1B with energy efficiency measures and ASHP
- 1b. Type 2H2 with energy efficiency measures and ASHP
- 1c. Type 3H3B with energy efficiency measures and ASHP
- 1d. Type 4H2B with energy efficiency measures and ASHP

## **2.00 Part G Water Efficiency Calculation**



## 1.0 Introduction and Planning Policy Requirements

### Introduction

- 1.1 This Energy and Sustainability Statement has been prepared by Southern Energy Consultants on behalf of Thakeham Homes Limited (hereafter referred to as the Applicant). The Statement reviews and reports on the sustainable design and construction measures on land east of College Lane, Hurstpierpoint (the Proposed Development), Figure 1, which is located within the jurisdiction of Mid Sussex District Council. A planning application is proposed, including erection of 100 dwellings, with associated access, car parking, refuse/recycling storage, landscaping, infrastructure and works.



Figure 1: Proposed Development



- 1.2 The Proposed Development is located on a 5.4 hectare greenfield site behind existing residential properties on Wickham Hill and bordering the hamlet of Hurst Wickham to the north. It is situated within walking distance of Hurstpierpoint village centre and Hassocks railway station is nearby, providing regular direct train services to major settlements such as London and Brighton. The village centre of Hurstpierpoint includes amenities such as local convenience stores, a bakery, post office, pharmacies, cafes, pubs, and schools. The Proposed Development is also planned to integrate directly with existing rural footpaths, providing immediate access to countryside walking trails and the nearby South Downs National Park setting.
- 1.3 This Statement first summarises the national and local energy and sustainability policies applicable to the Proposed Development, before outlining the Applicant's various sustainability measures in response to these.

#### **National policies**

- 1.4 In preparing this Statement in support of the planning application, the policies set out in the National Planning Policy Framework (2026 version), the adopted Mid Sussex District Plan (2018), and the emerging Mid Sussex District Plan 2021-2040 were taken into consideration. A summary of the main applicable content in each of these policy documents is set out in the following paragraphs.
- 1.5 National and derived local policies for sustainable development are led by the **National Planning Policy Framework (2026 version)**. The NPPF 2026 includes a 'presumption in favour of sustainable development' and sets out three core objectives that all new developments must meet in order to be considered sustainable. These objectives are interdependent and need to be pursued in mutually supporting ways. They are as follows:
- a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.



- b) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed beautiful and safe places, with accessible community facilities, public service infrastructure and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- c) **An environmental objective** – to support efforts to mitigate and adapt to climate change, including moving to a low carbon economy; and to protect and enhance our natural, built and historic environment: including making effective use of land, improving biodiversity, using natural resources prudently, and minimising waste and pollution.

#### **Local policies**

- 1.6 More locally, the **Mid Sussex District Plan 2014-2031** was adopted in March 2018. Key policies in relation to sustainable development are: DP38 (Biodiversity), DP39 (Sustainable Design and Construction), DP40 (Renewable Energy Schemes), DP41 (Flood Risk and Drainage), and DP42 (Water Infrastructure and the Water Environment).
- 1.7 **Policy DP38** requires the protection and enhancement of biodiversity. New developments must contribute and take opportunities to improve, enhance, manage and restore biodiversity and green infrastructure, so that there is a net gain in biodiversity, including through creating new designated sites and locally relevant habitats, and incorporating biodiversity features within developments. In addition, developments are required to protect existing biodiversity, so that there is no net loss of biodiversity. Appropriate measures should be taken to avoid and reduce disturbance to sensitive habitats and species. Unavoidable damage to biodiversity must be offset through ecological enhancements and mitigation measures.
- 1.8 **Policy DP39** sets a requirement for new developments to minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation. Furthermore, development proposals should explore opportunities to generate an efficient energy supply through the use of communal



heating networks, wherever viable and feasible. Opportunities to include renewable energy sources in new development proposals should be taken advantage of. Developments must also be water efficient and water use should be limited to 110 litres/person/day.

- 1.9 **Policy DP40** provides more specific guidance with regards to renewable energy installations, voicing that proposals for new renewable and low carbon energy projects, including community-led schemes, will be permitted provided that any adverse local impacts can be made acceptable.
- 1.10 **Policy DP41** stipulates that proposals for development will need to follow a sequential risk-based approach, ensuring development is safe across its lifetime and not increase the risk of flooding elsewhere. The District Council's Strategic Flood Risk Assessment (SFRA) should be used to identify areas at present and future flood risk from a range of sources including fluvial (rivers and streams), surface water (pluvial), groundwater, infrastructure and reservoirs.
- 1.11 **Policy DP42** reiterates that residential development proposals should meet a target of no more than 110 litres per person per day for water consumption, including external use. Non-residential developments should meet the equivalent of the 'Good' standard set by BREEAM.
- 1.12 Finally, **Mid Sussex District Council** opened a six-week public consultation on 27 July 2026 concerning the main modifications to the emerging Mid Sussex District Plan 2021-2040. These include references to proposed policies DPS1 (Climate Change) and DPS2 (Sustainable Design and Construction). Policy DPS1 reiterates the objectives of the NPPF concerning the tackling of climate change, requiring new developments to contribute to radical reductions in greenhouse gas emissions. Policy DPS2 states that new developments should, where possible, contribute to climate change mitigation and adaptation and the transition to net zero emissions, through its design, construction and operation and use. Applicants will need to consider building layouts, building orientation, massing, landscaping, materials, overheating, water resources and efficiency and waste to ensure development



proposals conserve energy and other resources, and minimise risks from the impacts of climate change.

### **Aims and structure**

- 1.13 Section 2 of this Statement sets out the Applicant's best practice energy efficiency measures, which will lead to contribute to compliance with a carbon dioxide emissions baseline calculated according to the parameters Approved Document Part L Volume 1: Dwellings 2021 edition incorporating 2023 amendments (AD L 2021). Sections 3 to 7 of this Statement then describe the other sustainability aspects of the Applicant's proposals, which include details of how Policy DP 42's required internal potable water consumption of not more than 110 litres per person per day will be met.

## **2.0 Building Design and Emissions Reduction Measures**

### **Building Regulations (2021) Baseline**

- 2.1 All 100 proposed dwellings will be designed and built to meet or better the current carbon dioxide emissions standard set by AD L 2021. The estimated carbon dioxide emissions for all proposed dwellings have been calculated using SAP 10.2 methodology and the most up-to-date Elmhurst software. SAP calculates the regulated carbon dioxide emissions and energy demand associated with space heating, hot water and fixed electrical items. The methodology in SAP10.2/AD L 2021 requires fabric performance compliance to be delivered prior to consideration of heating, lighting, ventilation systems and incorporating renewable technologies, and is therefore consistent with 'Fabric First' design principles. The estimated regulated carbon dioxide emissions for the 100 proposed dwellings are displayed per dwelling type and aggregated in Table 1 overleaf.



Table 1: Baseline Carbon Dioxide Emissions

| Dwelling type | No. dwellings | Carbon dioxide emissions (kgCO <sub>2</sub> /year) | Total carbon dioxide emissions (kgCO <sub>2</sub> /year) |
|---------------|---------------|----------------------------------------------------|----------------------------------------------------------|
| 2B1B          | 7             | 896                                                | 6,272                                                    |
| 2H1           | 7             | 813                                                | 5,691                                                    |
| 2H2           | 8             | 842                                                | 6,736                                                    |
| 3H1           | 6             | 898                                                | 5,388                                                    |
| 3H2           | 5             | 921                                                | 4,605                                                    |
| 3H3B          | 4             | 1,009                                              | 4,036                                                    |
| 3H5           | 4             | 1,111                                              | 4,444                                                    |
| 4H1B          | 6             | 1,007                                              | 6,042                                                    |
| 4H2B          | 6             | 1,009                                              | 6,054                                                    |
| 4H3           | 4             | 1,189                                              | 4,756                                                    |
| 4H4B          | 5             | 1,342                                              | 6,710                                                    |
| 4H5B          | 2             | 1,401                                              | 2,802                                                    |
| 1B flat       | 12            | 796                                                | 9,552                                                    |
| 2B flat       | 6             | 868                                                | 5,208                                                    |
| S2            | 11            | 872                                                | 9,592                                                    |
| S3            | 7             | 985                                                | 6,895                                                    |
| <b>TOTAL</b>  | <b>100</b>    |                                                    | <b>94,783</b>                                            |

- 2.2 Baseline carbon dioxide emissions for the Proposed Development are **94,783 kgCO<sub>2</sub>/year**, averaging **948 kgCO<sub>2</sub>/year** per dwelling. This Statement now sets out the Applicant's energy efficiency measures, which will contribute to the delivery of compliance with the baseline emissions standard.

#### Proposed enhanced energy efficiency measures

- 2.3 Insulation thicknesses and associated thermal conductivity will result in the attainment of average U-values considerably better than the limiting standards demanded by AD L 2021. Table 2 overleaf identifies the proposed U-values and compares these with the limiting area-weighted values set by AD L 2021.



Table 2: Insulation Enhancement Proposals for Main Thermal Elements

| Thermal Element      | Maximum Area-Weighted U-value (W/m <sup>2</sup> K) Allowable Under AD L 2021 | Proposed U-values (W/m <sup>2</sup> K) | % Improvement Over AD L 2021 Allowable U-Value Standard |
|----------------------|------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------|
| Main external walls  | 0.26                                                                         | 0.17                                   | 34.62                                                   |
| Party walls          | 0.20                                                                         | 0.00                                   | 100.00                                                  |
| Roof (plane ceiling) | 0.16                                                                         | 0.08                                   | 50.00                                                   |
| Roof (sloping)       | 0.16                                                                         | 0.14                                   | 12.50                                                   |
| Ground floor         | 0.18                                                                         | 0.11                                   | 38.89                                                   |
| Windows              | 1.60                                                                         | 1.30                                   | 18.75                                                   |

- 2.4 The Applicant intends to meet the U-value performance standards detailed in Table 2 through the insulation measures set out below in Table 3:

Table 3: Fabric Enhancement Construction Specification

| Construction Element   | U-Value (W/m <sup>2</sup> K) | Insulation Specification                                                                                                        |
|------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Main external walls    | 0.17                         | Timber frame, insulated panels, and brick outer leaf.                                                                           |
| Party walls            | 0.00                         | Fully filled and sealed.                                                                                                        |
| Ground floor           | 0.11                         | Approximately 150 mm PIR insulation (thermal conductivity of 0.022 W/m <sup>2</sup> K) under screed.                            |
| Roof (plane ceiling)   | 0.08                         | 500 mm mineral wool insulation.                                                                                                 |
| Roof (sloping ceiling) | 0.14                         | At least a total of 155mm Celotex (or similar) insulation between and underneath rafters                                        |
| Windows                | 1.30                         | Enhanced PVCu double-glazed windows to specialist BFRC approved manufacturers design and specification, with 'g' value of 0.45. |

- 2.5 The fabric measures detailed in Tables 2 and 3 will result in a reduced space heating requirement for the Proposed Development. All proposed dwellings will benefit from advanced heating controls in the form of programmers, delayed start



thermostats and thermostatic radiator valves, which collectively increase the efficiency of the heating system.

- 2.6 Air tightness standards will be improved by the Applicant adopting predominantly bespoke calculated Pinewood Timber Frame psi values for non-repeating thermal bridges. These details incorporate an improvement over Building Regulations requirements by reducing air leakage loss and convective bypass of insulation. The Applicant will reduce each dwelling's design air permeability from 8 m<sup>3</sup>/hm<sup>2</sup> to not more than 5.0 m<sup>3</sup>/hm<sup>2</sup> to further reduce space heating requirements.
- 2.7 It is not proposed to provide any mechanical cooling to the proposed dwellings. Instead, it is the intention of the Applicant to reduce the need for active cooling as far as possible. This will be achieved through the specification of mainly non-mechanical measures such as good thermal insulation and air-tight build.
- 2.8 Ventilation to the proposed dwellings will be facilitated via the installation of highly efficient extract fans. Ventilation to all proposed dwellings will be facilitated via the installation of System 3 ventilation, which will incorporate SMART Technology to reduce heat loss and automatically sense humidity levels in kitchens, bathrooms, and WCs. Openable windows will be installed as a necessary fixture to facilitate natural ventilation. These will help facilitate passive solar gains, cross-ventilation, convective-ventilation, and night purging.
- 2.9 All internal lighting throughout the Proposed Development will be low energy LED. Although not assessed under AD L 2021, any external lighting will also be low energy, and some will be controlled through PIR sensors or daylight cut-off devices.
- 2.10 An Approved Document Part O 2021 overheating assessment will be provided to Building Control detailing the specifications required to deliver regulatory compliance at the detailed technical designed stage, thus ensuring that any potential overheating issues are considered and fully mitigated.



## Outcomes of Enhanced Energy Efficiency Measures

2.11 The Applicant's array of energy efficiency measures detailed above will help to facilitate compliance with the regulatory standards for emissions set by AD L 2021. This section outlines the feasible renewable and low carbon technologies that can be considered further for implementation at the detailed design stage. The technologies to be evaluated in this Statement are as follows:

- District Heating / CHP
- Biomass
- Heat pumps (ground source and air source)
- Hydroelectric power
- Wind energy
- Solar thermal panels
- Solar photovoltaic panels

### District Heating/CHP

2.12 The Applicant has conducted a detailed review of the feasibility of installing Combined Heat and Power infrastructure (CHP) to serve the Proposed Development. CHP is a form of district heating that generally uses gas to generate electricity for local consumption, reducing the need for grid electricity and its associated high carbon dioxide emissions. As the CHP system is close to the point of energy demand, it is possible to use the heat that is generated during the electricity generation process. While CHP would enable reductions in carbon dioxide emissions beyond the baseline case, the following reasons make it unsuited to this development:

- **Diversity and extent of heat demand** – CHP is best suited to developments where there is a diversity of energy demand. A mixed-use scheme built out in a single phase, or a very large residential scheme (> 1,000 homes) will have extended periods of the day in which there is a continuous demand for heat. In these circumstances, the district heating network and CHP engine can operate consistently to generate electricity, with heat as a by-product. On a moderately-sized, residential led scheme such as this, heat demand would



be very low and not continuous, especially during the working day, leading to over-generation and subsequent dumping of heat.

- **Distributional heat losses** – thermal stores are a source of standing heat losses, as are even the best insulated distribution networks. When communal systems satisfy only a small and intermittent demand, these standing losses will represent a large part (>30%) of total demand. Carbon dioxide emissions savings gained within the proposed dwellings through association with CHP may be considerably reduced by the additional heat losses associated with the network.
- **Plant room size and location** – to incorporate a central plant room would require a considerable amount of space. The most suitable location in terms of space would be one of the proposed areas of communal open space in eastern flank of the site, but the installation of such infrastructure would conflict with the Applicant's objective to deliver a vibrant and ecologically prosperous development with land uses suitable for people of all ages, including children and young families. Noise emissions generated from plant infrastructure would also be high.
- **Minimised heat demands** – the Applicant's proposed energy strategy is based on the adoption of best practice standards for energy efficiency, an approach resulting in reduced space heating demands, which reduces the suitability of any district heating scheme.
- **Installed costs** – the installed cost of any CHP / district heating network benefits from economies of scale. However, pipe run costs remain approximately £1,000 per metre, and total costs for CHP infrastructure across the Proposed Development – predominantly from the plant room, CHP engine and pipe runs – would likely extend beyond £6 million for a scheme of this scale.
- **Running costs** – the fixed costs associated with the management and operation of a communal plant room would need to be shared by future occupants as part of an energy standing charge. The smaller the scheme, the greater the cost for the individual occupant, a particularly unfair situation in



the light of the Applicant's commitment to provide a significant proportion of affordable housing. In addition, CHP engines impose additional running costs as contracts for maintenance and replacement costs are typically handled by specialist companies.

- **Absence of other local infrastructure** – there are no other CHP / district heating networks in the vicinity of the Proposed Development with which to forge a connection.
- **Fossil Fuel Lock-in** – As the National Electricity Grid continues its journey towards 100% renewable energy, a gas fired development, no matter how energy efficient, would still contribute to substantial greenhouse gas emissions over its lifetime and not accord with the UK Government's priority of decarbonising heat in homes.

### **Biomass**

- 2.13 Biomass community heating is an alternative to conventional fossil fuel heating but, as per the reasons used against the installation of gas-fuelled CHP or district heating, with the exception of fossil fuel lock-in, should be discounted as an option for the Proposed Development. Biomass boilers within individual dwellings are usually installed with a standard gas boiler as back-up in case the occupier runs out of fuel. Although they are reducing in size, they are still large enough to require a dedicated room with additional space for the fuel – there will likely be insufficient space available for such infrastructure in several of the proposed dwelling types, especially the two-bedroom houses and one/two-bedroom apartments. The management of fuel deliveries and ash dispersal would also be complex, necessitating a dedicated operative as opposed to residents of the future dwellings at the Proposed Development. Furthermore, the emissions of Nitrous Oxide and particulate matter that are associated with biomass installations would have the capacity to worsen local air pollution.

### **Ground and Air Source Heat Pumps (GSHPs and ASHPs)**

- 2.14 Although GSHPs require considerable land area for deployment, ASHPs can be affixed to a property, providing space heating and hot water heating. In addition,



ASHPs provide an efficient form of heating throughout the year to a very high seasonal coefficient of performance, which is typically around 2.8. This means that a heat pump provides heating which is 280% efficient, as compared to a gas boiler which typically has a SEDBUK (2009) efficiency of around 90%. Maintenance requirements are low and there is no requirement on the part of the future homeowner to store fuel, as would be the case with a biomass boiler. Although ASHPs have traditionally been considered a 'noisy technology', technological advancements mean that modern systems rarely emit any more noise than a domestic fridge-freezer. Decarbonising heat in homes underpins the strategies set out in the UK's Heat & Buildings (2021) and Carbon Budget and Growth Delivery Plan (2025), and with the potential for the technology to be positioned appropriately, thus presenting a low visual impact to surroundings, it has been deemed suitable for all dwellings at the Proposed Development.

### **Hydroelectric power**

- 2.15 Hydroelectric power plants generate electricity using the gravitational force of flowing or falling water. However, there are no rivers of sufficient scale in the vicinity of the Proposed Development to facilitate a hydroelectric power installation.

### **Wind Turbines**

- 2.16 Wind turbines are a modern, high-technology descendant of the windmills that have been around for centuries. In modern windmills the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a gristmill wheel. A site with an average wind speed of 5 m/s or more is generally considered to be suitable for installing a wind turbine. The average wind speed at the Proposed Development is moderate, around 4.1 m/s at 10m AOD and is below the level required to generate significant carbon dioxide reductions or commercial take-up. The installation of a single, large wind turbine to serve the Proposed Development would also be controversial due to the nature of the locality. Even if space could be found within the Proposed Development to accommodate a very high (15-20m) turbine, their installation would then present a significant visual blight to neighbours.



### **Solar thermal and photovoltaic panels**

- 2.17 Solar thermal heating panels contribute to the hot water demand of a dwelling. Water or glycol (heat transfer liquid) is circulated to roof level where it is heated using solar energy before being returned to a thermal store where heat is exchanged with water from the conventional system. The proposed dwellings generally contain suitable attributes (orientation, available roof-space, and limited shadowing) for solar photovoltaic installations to be designed-in, although solar thermal installations are unsuitable in some cases. This is because smaller proposed dwelling types, such as one-bedroom apartments and two-bedroom houses, would have limited space to accommodate an oversized hot water cylinder incorporating additional dedicated solar storage. Most importantly, due to the seasonal availability of solar radiation, at best solar thermal panels can satisfy around 60% of a dwelling's annual hot water demand, thus failing to reduce carbon dioxide emissions to levels according with zero-carbon readiness. In contrast, there appear to be few constraints on the capacity of solar photovoltaic panels to deliver reductions in emissions. For all of the dwellings on the Proposed Development, roof-space will be available at no worse than a west-east orientation and based on the Applicant's proposed set of house types, there would be sufficient roof-space available to potentially accommodate up to 4-10 panels.

### **Impacts of feasible options**

- 2.18 The feasibility study confirms that two technologies are technically suitable for deployment at the Proposed Development. These are ASHPs and solar photovoltaic panels. The Applicant's preference, however, is to deliver zero carbon readiness through the provision of ASHPs alone to serve every proposed dwelling, which overcomes the potential risk of any form of visual impact being presented to local residents and the rural hinterland via the introduction of rooftop technologies. The Applicant will, potentially, also install a small array (two panels per dwelling) of solar photovoltaic panels to serve apartments, sufficient for all of apartments to obtain at least a 'B' rated Energy Performance Certificate. However, this will be determined at the detailed design stage and be based on SAP calculations from working drawings following consultation with a dedicated solar engineer. Illustrative SAP calculations have been undertaken on all dwelling types, which demonstrate the impact of



introducing air source heat pumps. These are predicted to reduce carbon dioxide emissions from the baseline case of **94,783 kgCO<sub>2</sub>/year** to **38,284 kgCO<sub>2</sub>/year**. This is a reduction of **56,499 kgCO<sub>2</sub>/year**, equal to **59.61%**. The breakdown of the predicted carbon dioxide emissions after the introduction of energy efficiency measures and ASHPs is provided in Table 4 overleaf, with examples of detailed SAP calculations provided for four dwelling types in the Appendix.

**Table 4: Baseline Carbon Dioxide Emissions After Energy Efficiency Measures and ASHPs**

| Dwelling type | No. dwellings | Carbon dioxide emissions (kgCO <sub>2</sub> /year) | Total carbon dioxide emissions (kgCO <sub>2</sub> /year) |
|---------------|---------------|----------------------------------------------------|----------------------------------------------------------|
| 2B1B          | 7             | 301                                                | 2,107                                                    |
| 2H1           | 7             | 264                                                | 1,848                                                    |
| 2H2           | 8             | 276                                                | 2,208                                                    |
| 3H1           | 6             | 359                                                | 2,154                                                    |
| 3H2           | 5             | 350                                                | 1,750                                                    |
| 3H3B          | 4             | 393                                                | 1,572                                                    |
| 3H5           | 4             | 433                                                | 1,732                                                    |
| 4H1B          | 6             | 442                                                | 2,652                                                    |
| 4H2B          | 6             | 443                                                | 2,658                                                    |
| 4H3           | 4             | 476                                                | 1,904                                                    |
| 4H4B          | 5             | 537                                                | 2,685                                                    |
| 4H5B          | 2             | 574                                                | 1,148                                                    |
| 1B flat       | 12            | 374                                                | 4,488                                                    |
| 2B flat       | 6             | 408                                                | 2,448                                                    |
| S2            | 11            | 392                                                | 4,312                                                    |
| S3            | 7             | 374                                                | 2,618                                                    |
| <b>TOTAL</b>  | <b>100</b>    |                                                    | <b>38,284</b>                                            |

### 3.0 Layout, Permeability and Landscaping

- 3.1 The proposed dwellings are massed to enable them to be articulated in a sensitive manner with respect to the street scene, whilst enabling the economic potential of the land to be maximised with respect to its capacity to provide a variety of much needed housing in the local area, especially affordable accommodation. Careful consideration has been given to the design and location of the proposed dwellings to prevent over-shading and the subsequent desire for lopping and felling of trees, which will be retained across the Proposed Development, as confirmed by the Arboricultural Impact Assessment (September 2026) by TGA Arboricultural



Consultants. By following the recommended management measures outlined in TGA's Arboricultural Method Statement and Tree Protection Plan, the Applicant will minimise any possible negative impacts.

- 3.2 The Applicant's commitment to inclusivity will be demonstrated through their attitude towards movement and equality. They will incorporate the requirements of the Equality Act (2010) into their design, making reasonable adjustments to enable disabled access, and providing necessary design adjustments where it is practicable to do so.
- 3.3 It is important that future residents feel secure and free from the fear of crime. The Applicant and their design team will integrate Approved Document Part Q of the Building Regulations into the design of the proposed dwellings. The design proposals also integrate sound urban design principles in locating circulation routes so that they are overlooked by ground floor active windows from habitable rooms, maximising the surveillance of the public realm.
- 3.4 The proposed dwellings have been afforded generous set-backs from the road and are open and largely laid to lawn with shrub planting. Extensive soft landscaping will be used throughout the Proposed Development to provide 'defensible' areas to the front and flanks of the proposed dwellings, and this approach will contribute to the sustainable management of surface water runoff on site.
- 3.5 As stated in the Transport Assessment by Campbell Reith Consulting Engineers (September 2026), all proposed dwellings will be provided with secure cycle storage facilities in either garden sheds, garages or communal stores. Provision will be in accordance with the requirements set by West Sussex County Council 'Guidance for Parking at New Developments'. In addition, the Proposed Development will be provided with 189.5 allocated parking spaces, and there will be 50 additional car parking spaces provided for visitors. All dwellings will be provided with one electric vehicle charging point.
- 3.6 All proposed dwellings will be provided with home office infrastructure, enabling working from home, an issue that has become more prevalent in recent years



following the COVID-19 pandemic. Future residents will benefit from high-speed broadband. All proposed dwellings will have the ability to 'house' home office facilities, with sufficient space for a desk, office chair and filing cabinet, as well as the necessary electrical infrastructure located in a suitable position within the property (e.g., 2 double power sockets, telephone / CAT5 cabling point).

3.7 All proposed dwellings will be provided with fully accessible private spaces in the form of rear or communal gardens. Access to all private and communal open spaces will be facilitated in accordance with the principles of inclusive design. The following measures will be introduced to ensure that those with mobility difficulties can access all areas of the development:

- A pedestrian friendly environment
- Step free entrance access from all dwellings to bin store areas and private gardens
- Pavements with tactile surfacing
- Carefully designed landscaping

3.8 The Proposed Development has been the subject of multiple ecological and biodiversity net gain assessments by BMD (September 2026). These confirm that the site supports commuting and foraging habitat of local value only for bats and potential roosting features in trees, all of which are to be retained under the Applicant's proposals. Although the Proposed Development is situated within a red Nature Space Partnership great crested newt risk zone, no presence was found during two earlier assessments in 2023 and 2025.

3.9 The Applicant will protect existing features of ecological value, wherever practicable, as well as integrating the array of ecological mitigation and enhancement measures advised by BMD, which have been incorporated into the landscaping proposals. BMD assess that these will ensure that there are no significant adverse residual ecological consequences from the Proposed Development. The ecological enhancement measures include but are not limited to the use of native and wildlife friendly species within any soft landscaping and the installation of bird, bat and invertebrate boxes. The submitted BNG Plan confirms a



predicted positive increase in biodiversity as a result of the Proposed Development, with a net increase in excess of the 10% according with the requirements of national legislation and planning policy.

## 4.0 Materials

- 4.1 Given the rural character of the Proposed Development, a major consideration in materials selection is maintaining a locally influenced architectural style that is common to the local area. However, from a sustainability perspective, the Applicant is equally committed to minimising the environmental impact of the materials used over the lifetime of the building – from manufacture to eventual demolition, to disposal. For building materials, the Applicant will, in the main, seek to specify 'A+' or 'A' rated materials using the online BRE Green Guide to Housing Specification, with all materials rated at least 'E'.
- 4.2 The Applicant will avoid the specification of peat and natural weathered limestone in buildings or landscaping.
- 4.3 Timber used in the Proposed Development for both basic and finishing elements will be sourced from sustainable European sources (e.g. PEFC or FSC accredited).
- 4.4 Wherever feasible, the Applicants will commit to using materials that are locally sourced, from renewable sources and recycled e.g. secondary aggregates.

## 5.0 Noise and Dust Pollution

- 5.1 Mitigation measures will be investigated during the M&E design and construction phase to ensure that the baseline ambient noise levels are not overtly increased by the Proposed Development.



5.2 In order to best mitigate the Proposed Development's contribution to local air pollution, the Applicant will adopt best practice mitigation procedures on-site during the construction phase, which will include the following measures:

- Dampening and sweeping roadways
- Covering vehicles and skips when loaded with material
- Locating stock piles to take into account the prevailing wind
- Sealing and replanting completed earthworks as early as practicable
- Using low emission vehicles and plant equipment

5.3 Air intakes and outlets within the proposed dwellings will all avoid any sources of external pollution in order to avoid internal air pollution. In addition, any construction phase risks to site workers and the environment from potential contamination will be managed through an effective Risk Assessment and Method Statement and a Construction Phase Plan, both of which will adhere to Construction, Design and Management Regulations.

## 6.0 Recycling and Waste Management

6.1 The Applicant's proposals have allocated sufficient space within external storage areas to satisfy the Mid Sussex District Council's waste bin specification for the deposition of general refuse, recyclable waste and garden waste, respectively.

6.2 All proposed dwellings will be provided with segregated internal recycling bins in the kitchen to facilitate the recycling of various waste streams. In addition, all proposed dwellings will be provided with small internal caddy bins for the transfer of compostable waste, and private gardens will be provided with composting bins.

6.3 The Applicant will adhere to the waste hierarchy in order to ensure that the generation of waste is reduced, while re-use is increased across the site during the construction phase. They will:



- Ensure the accurate specification of materials and volumes.
- Recycle and re-use waste generated on site.
- Arrange take-back schemes with suppliers.
- Instruct a licensed waste contractor to segregate site waste for recycling.

## 7.0 Avoiding Flooding and Minimising Water Use

- 7.1 The Proposed Development has a low risk of flooding from fluvial, tidal, groundwater, surface runoff and artificial sources, as per the conclusions of the Flood Risk Assessment by Robert West Consulting Ltd (September 2026). This is because the entirety of the Proposed Development lies within Flood Zone 1. Regardless of this fact, a sustainable drainage system will be introduced to further lower the risk of flooding. This will enable attenuation of all storms up to and including the 1 in 100 year event, and factor in a 45% allowance for the anticipated impacts of climate change.
- 7.2 During the construction phase, the Applicant will adopt best practice procedures on site in relation to the potential for water pollution. Detailed procedural guidance will be disseminated to site operatives having been prepared in accordance with Environment Agency advice.
- 7.3 In terms of internal potable water consumption, the Applicant is committed to delivering performance of not more than 110 litres per person per day in all dwellings (see AD Part G calculation in the Appendix), which is considerably lower than the 125 litres per person per day requirement under Approved Document G of the Building Regulations in accordance with the requirements of adopted Policy DP42. In order to meet these targets, a combination of reduced-flow taps and showers, dual-flush toilets and moderately sized baths will be installed. Flow rates and volumes will not exceed the following:
- Toilets = 4/2.6 litre dual flush
  - Kitchen taps = 6 litres per minute



- Wash hand basin taps = 5 litres per minute
- Showers = 8 litres per minutes
- Baths = 193 litres

7.4 In addition, all proposed dwellings will be provided with water butts in private gardens to help conserve supplies, especially for the purposes of irrigating gardens during the increasingly dry summers in the south-east of England.

## 8.0 Conclusion

- 8.1 This Statement sets out the Applicant's comprehensive response to the various sustainability policies set by the NPPF (2026), the Mid Sussex District Plan (2018), the adopted Mid Sussex District Plan (2018) and the emerging Mid Sussex District Plan 2021-2040, which, together, require the efficient and sustainable use of energy, water, materials and waste across the Proposed Development. The Applicant intends to deliver a sustainable development by providing a range of accommodation for individuals of all ages – from first-time buyers to families. The design of the proposed dwellings will reflect the character of other rural communities in the local area, while the provision of communal areas of green space for leisure and relaxation will encourage the community to integrate and flourish, and help to advance the ecological prosperity and vibrancy of the area.
- 8.2 The Applicant will specify a range of best practice energy efficiency measures to enable all proposed dwellings to meet or better the standard for carbon dioxide emissions set by AD L 2021. A combination of energy efficient fabric, ventilation and heating systems will lead to this level of performance, together with the specification of low energy lighting throughout and the delivery of an air-tight build. In addition, air source heat pumps will be installed to all dwellings, ensuring that each proposed dwelling reduces its carbon dioxide emissions to levels significantly below the regulatory baseline standard. Site-wide, this strategy is predicted to reduce annual carbon dioxide emissions by **59.61%**. The specifications of the proposed dwellings ensure that the Proposed Development has 'zero carbon readiness', meaning that the only barrier to its full decarbonisation concerns the



level of renewable energy used to supply the UK's electricity grid, targeted to be at 100% by 2030 by the current UK Government.

8.3 The Applicant is also committed to an array of additional measures which will help to promote the sustainability of the Proposed Development. These include:

- Provision of internal recycling bins for recyclable waste in every kitchen and composting bins to serve each house;
- Ensuring internal potable water consumption of not more than 110 litres per person per day in every dwelling (see strategy in Appendix);
- Supply of water butts to ensure recycling of rainwater;
- Adoption of all ecological enhancement measures outlined in the studies by BMD and ensuing ecological designations, landscaping and management plans, leading to a net increase in biodiversity of at least 10% across the site;
- Integration of sustainable drainage techniques across the Proposed Development to further reduce the already low risk of flooding;
- Specification of materials for main construction and finishing elements that have the lowest environmental impact;
- Provision of cycle storage facilities to serve every proposed dwelling.
- All dwellings will be provided with electric vehicle charging points.



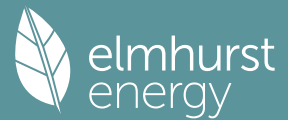
## APPENDIX

### 1.00 Illustrative SAP Calculations:

- 1a. Type 2B1B with energy efficiency measures and ASHP
- 1b. Type 2H2 with energy efficiency measures and ASHP
- 1c. Type 3H3B with energy efficiency measures and ASHP
- 1d. Type 4H2B with energy efficiency measures and ASHP

### 2.00 Part G Water Efficiency Calculation

## Full SAP Calculation Printout



|                                    |                                                      |               |       |               |                |            |  |
|------------------------------------|------------------------------------------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | 2B1B                                                 |               |       |               | Issued on Date | 31/07/2026 |  |
| Assessment Reference               | 001                                                  |               |       | Plot Type Ref | Detached       |            |  |
| Plot Address                       | 2B1B, College Lane, Hurstpierpoint, West Sussex, BN6 |               |       |               | SAP Version    | 10.2       |  |
|                                    |                                                      |               |       |               |                |            |  |
| SAP Rating                         | 83 B                                                 | DER           | 4.15  | TER           | 12.38          |            |  |
| Environmental                      | 97 A                                                 | % DER < TER   |       |               |                | 66.48      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.28                                                 | DFEE          | 36.20 | TFEE          | 38.10          |            |  |
| Compliance Check                   | See BREL                                             | % DFEE < TFEE |       |               |                | 5.01       |  |
| % DPER < TPER                      | 32.27                                                | DPER          | 43.86 | TPER          | 64.76          |            |  |
|                                    |                                                      |               |       |               |                |            |  |
| Assessor Details                   | Mr. Stephen Smith                                    |               |       |               | Assessor ID    | D168-0001  |  |
| Client                             | TH002, Thakeham Southern                             |               |       |               |                |            |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 36.2200 (1b)              | x 2.4600 (2b)                   | = 89.1012 (1b) - (3b)       |
| First floor                                            | 36.2200 (1c)              | x 2.6800 (2c)                   | = 97.0696 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.4400                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 186.1708 (5)              |

## 2. Ventilation rate

|                                                      | m <sup>3</sup> per hour                                                         |
|------------------------------------------------------|---------------------------------------------------------------------------------|
| Number of open chimneys                              | 0 * 80 = 0.0000 (6a)                                                            |
| Number of open flues                                 | 0 * 20 = 0.0000 (6b)                                                            |
| Number of chimneys / flues attached to closed fire   | 0 * 10 = 0.0000 (6c)                                                            |
| Number of flues attached to solid fuel boiler        | 0 * 20 = 0.0000 (6d)                                                            |
| Number of flues attached to other heater             | 0 * 35 = 0.0000 (6e)                                                            |
| Number of blocked chimneys                           | 0 * 20 = 0.0000 (6f)                                                            |
| Number of intermittent extract fans                  | 0 * 10 = 0.0000 (7a)                                                            |
| Number of passive vents                              | 0 * 10 = 0.0000 (7b)                                                            |
| Number of flueless gas fires                         | 0 * 40 = 0.0000 (7c)                                                            |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8) |
| Pressure test                                        | Yes                                                                             |
| Pressure Test Method                                 | Blower Door                                                                     |
| Measured/design AP50                                 | 4.0000 (17)                                                                     |
| Infiltration rate                                    | 0.2000 (18)                                                                     |
| Number of sides sheltered                            | 2 (19)                                                                          |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = 0.8500 (20)                                         |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) = 0.1700 (21)                                                |

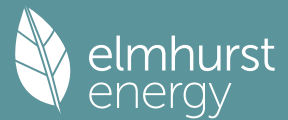
|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2167 | 0.2125 | 0.2083 | 0.1870 | 0.1827 | 0.1615 | 0.1615 | 0.1573 | 0.1700 | 0.1827 | 0.1913 | 0.1998 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                         | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Opening Type 2                                                  |                         |                            | 12.4600                   | 1.2357                        | 15.3973      |                                | (27)          |
| Opening Type 3                                                  |                         |                            | 2.1500                    | 1.0000                        | 2.1500       |                                | (26)          |
| Heat Loss Floor 1                                               |                         |                            | 40.5600                   | 0.1100                        | 4.4616       |                                | (28a)         |
| Brick Faced                                                     | 90.4640                 | 14.6100                    | 75.8540                   | 0.1700                        | 12.8952      |                                | (29a)         |
| Main Roof                                                       | 36.2200                 |                            | 36.2200                   | 0.0800                        | 2.8976       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )     |                         |                            | 167.2440                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                             |                         |                            |                           | (26)...(30) + (32) =          | 37.8017      |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K  |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| Thermal bridges (User defined value 0.040 * total exposed area) |                         |                            |                           |                               |              |                                | 6.6898 (36)   |
| Point Thermal bridges                                           |                         |                            |                           |                               |              | (36a) =                        | 0.0000        |
| Total fabric heat loss                                          |                         |                            |                           |                               |              | (33) + (36) + (36a) =          | 44.4915 (37)  |

|                                                                     |     |     |     |     |     |     |     |     |     |     |     |     |
|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

# Full SAP Calculation Printout



|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 | 30.7182 (38) |
| Heat transfer coeff       | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 | 75.2097 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 75.2097      |
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP                       | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382  | 1.0382 (40)  |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0382       |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                                                                                               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------------------------------------------------------------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2.3039 (42)                                                                                   |
| Hot water usage for mixer showers                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (42a)                                                                                  |
| Hot water usage for baths                                       | 27.1500  | 26.7467  | 26.1789  | 25.1320  | 24.3480  | 23.4788  | 23.0093  | 23.5731  | 24.1870  | 25.1172  | 26.1857  | 27.0582  | (42b)                                                                                         |
| Hot water usage for other uses                                  | 38.2240  | 36.8340  | 35.4441  | 34.0541  | 32.6641  | 31.2742  | 31.2742  | 32.6641  | 34.0541  | 35.4441  | 36.8340  | 38.2240  | (42c)                                                                                         |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          |          | 59.9214 (43)                                                                                  |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                                                                                               |
| Daily hot water use                                             | 65.3739  | 63.5808  | 61.6230  | 59.1861  | 57.0122  | 54.7530  | 54.2834  | 56.2372  | 58.2411  | 60.5612  | 63.0197  | 65.2822  | (44)                                                                                          |
| Energy content (annual)                                         | 103.5363 | 90.5382  | 94.7122  | 81.0228  | 76.7494  | 67.3251  | 65.6511  | 69.6334  | 71.8171  | 82.1810  | 89.7831  | 102.2161 | (45)                                                                                          |
| Distribution loss (46)m = 0.15 x (45)m                          | 15.5305  | 13.5807  | 14.2068  | 12.1534  | 11.5124  | 10.0988  | 9.8477   | 10.4450  | 10.7726  | 12.3271  | 13.4675  | 15.3324  | (46)                                                                                          |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |          |          |                                                                                               |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 200.0000 (47)                                                                                 |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          |          | 1.2200 (48)                                                                                   |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                                                                                   |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.6588 (55)                                                                                   |
| Total storage loss                                              | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | (56)                                                                                          |
| If cylinder contains dedicated solar storage                    | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | (57)                                                                                          |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (59)                                                                                          |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)                                                                                          |
| Total heat required for water heating calculated for each month | 147.2215 | 129.9958 | 138.3974 | 123.2988 | 120.4346 | 109.6011 | 109.3363 | 113.3186 | 114.0931 | 125.8662 | 132.0591 | 145.9013 | (62)                                                                                          |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a)                                                                                         |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63b)                                                                                         |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)                                                                                         |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)                                                                                         |
| Output from w/h                                                 | 147.2215 | 129.9958 | 138.3974 | 123.2988 | 120.4346 | 109.6011 | 109.3363 | 113.3186 | 114.0931 | 125.8662 | 132.0591 | 145.9013 | (64)                                                                                          |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = 1509.5238 (64)                                         |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |          | 1510 (64)                                                                                     |
| Electric shower(s)                                              | 48.7073  | 43.3986  | 47.3896  | 45.2233  | 46.0719  | 43.9481  | 45.4130  | 46.0719  | 45.2233  | 47.3896  | 46.4985  | 48.7073  | (64a)                                                                                         |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 554.0422 (64a) |
| Heat gains from water heating, kWh/month                        | 81.5508  | 72.5197  | 78.2874  | 72.0667  | 71.9853  | 67.1934  | 68.1304  | 69.6192  | 69.0058  | 74.1207  | 75.2983  | 81.1118  | (65)                                                                                          |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (66)m                                                                               | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 105.3410 | 116.6276 | 105.3410 | 108.8524 | 105.3410 | 108.8524 | 105.3410 | 105.3410 | 108.8524 | 105.3410 | 108.8524 | 105.3410 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.9235 | 205.0293 | 199.7229 | 188.4264 | 174.1665 | 160.7643 | 151.8108 | 149.7051 | 155.0114 | 166.3079 | 180.5678 | 193.9700 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194 (69)  |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 (71) |
| Water heating gains (Table 5)                                                       | 109.6113 | 107.9162 | 105.2250 | 100.0926 | 96.7544  | 93.3242  | 91.5731  | 93.5743  | 95.8414  | 99.6246  | 104.5810 | 109.0213 (72) |
| Total internal gains                                                                | 475.4340 | 487.1311 | 467.8471 | 454.9296 | 433.8201 | 420.4991 | 406.2831 | 406.1785 | 417.2633 | 428.8317 | 451.5593 | 465.8905 (73) |

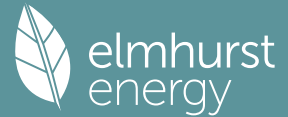
## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 5.2600     | 10.6334                        | 0.4500                            | 0.7000                             | 0.7700                       | 12.2096 (74) |          |          |               |
| South       |          |          |          | 7.2000     | 46.7521                        | 0.4500                            | 0.7000                             | 0.7700                       | 73.4813 (78) |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 85.6909  | 143.6767 | 192.9450 | 236.9441   | 266.3366                       | 265.5924                          | 255.5109                           | 232.8938                     | 207.8067     | 157.5768 | 102.1626 | 73.6732 (83)  |
| Total gains | 561.1250 | 630.8078 | 660.7921 | 691.8737   | 700.1567                       | 686.0914                          | 661.7940                           | 639.0723                     | 625.0700     | 586.4086 | 553.7218 | 539.5636 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548 | 26.7548      |
| alpha                                                                       | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837  | 2.7837       |
| util living area                                                            |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | 0.9384  | 0.9148  | 0.8850  | 0.8268  | 0.7353  | 0.5959  | 0.4609  | 0.4915  | 0.6641  | 0.8309  | 0.9118  | 0.9441 (86)  |
| Living                                                                      | 18.8638 | 19.1439 | 19.5190 | 20.0102 | 20.4594 | 20.7876 | 20.9241 | 20.9067 | 20.6959 | 20.1363 | 19.4172 | 18.7916      |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Non living             | 17.5611 | 17.9115 | 18.3805 | 18.9848 | 19.5188 | 19.8791 | 20.0065 | 19.9931 | 19.7888                   | 19.1474 | 18.2607 | 17.4706      |
| 24 / 16                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                 | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                 | 28      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 10           |
| MIT                    | 19.9072 | 19.1439 | 19.5190 | 20.0102 | 20.4594 | 20.7876 | 20.9241 | 20.9067 | 20.6959                   | 20.1363 | 19.4172 | 19.1005 (87) |
| Th 2                   | 20.0516 | 20.0516 | 20.0516 | 20.0516 | 20.0516 | 20.0516 | 20.0516 | 20.0516 | 20.0516                   | 20.0516 | 20.0516 | 20.0516 (88) |
| util rest of house     |         |         |         |         |         |         |         |         |                           |         |         |              |
|                        | 0.9301  | 0.9037  | 0.8694  | 0.8019  | 0.6946  | 0.5307  | 0.3741  | 0.4054  | 0.6042                    | 0.8019  | 0.8984  | 0.9366 (89)  |
| MIT 2                  | 19.0587 | 17.9115 | 18.3805 | 18.9848 | 19.5188 | 19.8791 | 20.0065 | 19.9931 | 19.7888                   | 19.1474 | 18.2607 | 17.9357 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.2841 (91)  |
| MIT                    | 19.2998 | 18.2616 | 18.7039 | 19.2761 | 19.7860 | 20.1372 | 20.2672 | 20.2527 | 20.0465                   | 19.4284 | 18.5892 | 18.2666 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 19.2998 | 18.2616 | 18.7039 | 19.2761 | 19.7860 | 20.1372 | 20.2672 | 20.2527 | 20.0465                   | 19.4284 | 18.5892 | 18.2666 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9226    | 0.8770    | 0.8423   | 0.7783   | 0.6820   | 0.5370   | 0.3947   | 0.4245   | 0.6039   | 0.7796        | 0.8722   | 0.9184 (94)    |
| Useful gains                                                                   | 517.6659  | 553.2482  | 556.5940 | 538.4609 | 477.4793 | 368.4079 | 261.2030 | 271.3149 | 377.4707 | 457.1431      | 482.9582 | 495.5463 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 1128.1278 | 1004.9226 | 917.8525 | 780.3853 | 608.1447 | 416.4508 | 275.8068 | 289.7573 | 447.2348 | 663.9788      | 864.1002 | 1057.9476 (97) |
| Space heating kWh                                                              | 454.1837  | 303.5252  | 268.7763 | 174.1856 | 97.2150  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.8857      | 274.4223 | 418.4266 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |          |          |          |          |          |          |          |               |          | 2144.6205      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 454.1837  | 303.5252  | 268.7763 | 174.1856 | 97.2150  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.8857      | 274.4223 | 418.4266 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |          |          |          |          |          |          |          |               |          | 2144.6205      |
| Space heating per m2                                                           |           |           |          |          |          |          |          |          |          | (98c) / (4) = |          | 29.6055 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 287.5969 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                                                                    | 454.1837 | 303.5252 | 268.7763 | 174.1856 | 97.2150  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 153.8857 | 274.4223 | 418.4266 (98)  |
| Space heating efficiency (main heating system 1)                                                             | 287.5969 | 287.5969 | 287.5969 | 287.5969 | 287.5969 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 287.5969 | 287.5969 | 287.5969 (210) |
| Space heating fuel (main heating system)                                                                     | 157.9237 | 105.5384 | 93.4559  | 60.5659  | 33.8025  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 53.5074  | 95.4191  | 145.4906 (211) |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                                                                    | 147.2215 | 129.9958 | 138.3974 | 123.2988 | 120.4346 | 109.6011 | 109.3363 | 113.3186 | 114.0931 | 125.8662 | 132.0591 | 145.9013 (64)  |
| Efficiency of water heater (217)m                                                                            | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 | 271.1790 (216) |
| Fuel for water heating, kWh/month                                                                            | 54.2894  | 47.9373  | 51.0355  | 45.4677  | 44.4115  | 40.4165  | 40.3189  | 41.7874  | 42.0730  | 46.4144  | 48.6981  | 53.8026 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |
| Pumps and Fa                                                                                                 | 3.7616   | 3.3976   | 3.7616   | 3.6403   | 3.6403   | 3.6403   | 3.7616   | 3.7616   | 3.6403   | 3.7616   | 3.6403   | 3.7616 (231)   |
| Lighting                                                                                                     | 20.3667  | 16.3389  | 14.7114  | 10.7782  | 8.3254   | 6.8019   | 7.5947   | 9.8719   | 12.8226  | 16.8239  | 19.0026  | 20.9328 (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)  |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 745.7036 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)   |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)   |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 271.1790       |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 556.6522 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)   |
| Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)             |          |          |          |          |          |          |          |          |          |          |          |                |
| mechanical ventilation fans (SFP = 0.1950)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 44.2900 (230a) |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 44.2900 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 164.3710 (232) |

## Energy saving/generation technologies (Appendices M ,N and Q)

|                                                |  |  |  |  |  |  |  |  |  |  |  |                 |
|------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|-----------------|
| PV generation                                  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (233)    |
| Wind generation                                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)         |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N) |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (235)    |
| Appendix Q - special features                  |  |  |  |  |  |  |  |  |  |  |  |                 |
| Energy saved or generated                      |  |  |  |  |  |  |  |  |  |  |  | -0.0000 (236)   |
| Energy used                                    |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (237)    |
| Total delivered energy for all uses            |  |  |  |  |  |  |  |  |  |  |  | 2065.0591 (238) |

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## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |        |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|--------|
| Space heating - main system 1                   | 745.7036           | 0.1548                        | 115.4496                 | (261)  |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373)  |
| Water heating (other fuel)                      | 556.6522           | 0.1406                        | 78.2658                  | (264)  |
| Energy for instantaneous electric shower(s)     | 554.0422           | 0.1391                        | 77.0795                  | (264a) |
| Space and water heating                         |                    |                               | 193.7154                 | (265)  |
| Pumps, fans and electric keep-hot               | 44.2900            | 0.1387                        | 6.1436                   | (267)  |
| Energy for lighting                             | 164.3710           | 0.1443                        | 23.7238                  | (268)  |
| Total CO2, kg/year                              |                    |                               | 300.6623                 | (272)  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.1500                   | (273)  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |        |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|--------|
| Space heating - main system 1               | 745.7036           | 1.5731                              | 1173.0906                  | (275)  |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473)  |
| Water heating (other fuel)                  | 556.6522           | 1.5199                              | 846.0422                   | (278)  |
| Energy for instantaneous electric shower(s) | 554.0422           | 1.5143                              | 839.0050                   | (278a) |
| Space and water heating                     |                    |                                     | 2019.1328                  | (279)  |
| Pumps, fans and electric keep-hot           | 44.2900            | 1.5128                              | 67.0020                    | (281)  |
| Energy for lighting                         | 164.3710           | 1.5338                              | 252.1178                   | (282)  |
| Total Primary energy kWh/year               |                    |                                     | 3177.2576                  | (286)  |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 43.8600                    | (287)  |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)                        | Volume<br>(m3) |             |
|--------------------------------------------------------|--------------|---------------------------------------------|----------------|-------------|
| Main dwelling                                          |              |                                             |                |             |
| Ground floor                                           | 36.2200 (1b) | x 2.4600 (2b)                               | = 89.1012      | (1b) - (3b) |
| First floor                                            | 36.2200 (1c) | x 2.6800 (2c)                               | = 97.0696      | (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 72.4400      |                                             |                | (4)         |
| Dwelling volume                                        |              | (3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = | 186.1708       | (5)         |

### 2. Ventilation rate

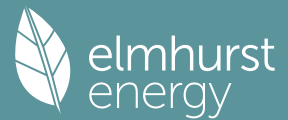
|                                                      |                                                       | m3 per hour     |             |
|------------------------------------------------------|-------------------------------------------------------|-----------------|-------------|
| Number of open chimneys                              | 0 * 80 =                                              | 0.0000          | (6a)        |
| Number of open flues                                 | 0 * 20 =                                              | 0.0000          | (6b)        |
| Number of chimneys / flues attached to closed fire   | 0 * 10 =                                              | 0.0000          | (6c)        |
| Number of flues attached to solid fuel boiler        | 0 * 20 =                                              | 0.0000          | (6d)        |
| Number of flues attached to other heater             | 0 * 35 =                                              | 0.0000          | (6e)        |
| Number of blocked chimneys                           | 0 * 20 =                                              | 0.0000          | (6f)        |
| Number of intermittent extract fans                  | 3 * 10 =                                              | 30.0000         | (7a)        |
| Number of passive vents                              | 0 * 10 =                                              | 0.0000          | (7b)        |
| Number of flueless gas fires                         | 0 * 40 =                                              | 0.0000          | (7c)        |
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1611 (8)  |
| Pressure test                                        | Yes                                                   |                 |             |
| Pressure Test Method                                 | Blower Door                                           |                 |             |
| Measured/design AP50                                 | 5.0000                                                |                 | (17)        |
| Infiltration rate                                    | 0.4111                                                |                 | (18)        |
| Number of sides sheltered                            | 2                                                     |                 | (19)        |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                 | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                 | 0.3495 (21) |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4456 | 0.4368 | 0.4281 | 0.3844 | 0.3757 | 0.3320 | 0.3320 | 0.3233 | 0.3495 | 0.3757 | 0.3932 | 0.4106 | (22b) |
| Effective ac    | 0.5993 | 0.5954 | 0.5916 | 0.5739 | 0.5706 | 0.5551 | 0.5551 | 0.5522 | 0.5611 | 0.5706 | 0.5773 | 0.5843 | (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| TER Opaque door                                |             |                | 2.1500        | 1.0000               | 2.1500       |                   |               | (26)  |
| TER Opening Type                               |             |                | 12.4600       | 1.1450               | 14.2672      |                   |               | (27)  |
| Heat Loss Floor 1                              |             |                | 40.5600       | 0.1300               | 5.2728       |                   |               | (28a) |
| Brick Faced                                    | 90.4640     | 14.6100        | 75.8540       | 0.1800               | 13.6537      |                   |               | (29a) |
| Main Roof                                      | 36.2200     |                | 36.2200       | 0.1100               | 3.9842       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 167.2440      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 39.3279      |                   |               | (33)  |

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

100.0000 (35)

List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           | 8.9700  | 0.0500    | 0.4485 |
| E2 Other lintels (including other steel lintels)     | 7.9600  | 0.0500    | 0.3980 |
| E3 Sill                                              | 25.7700 | 0.0500    | 1.2885 |
| E4 Jamb                                              | 18.0100 | 0.1600    | 2.8816 |
| E5 Ground floor (normal)                             | 18.0100 | 0.0000    | 0.0000 |
| E6 Intermediate floor within a dwelling              | 8.8600  | 0.0600    | 0.5316 |
| E10 Eaves (insulation at ceiling level)              | 9.1400  | 0.0600    | 0.5484 |
| E12 Gable (insulation at ceiling level)              | 10.2800 | 0.0900    | 0.9252 |
| E16 Corner (normal)                                  | 10.2800 | 0.0600    | 0.6168 |
| E18 Party wall between dwellings                     | 9.1400  | 0.0800    | 0.7312 |
| P1 Party wall - Ground floor                         | 9.1400  | 0.0000    | 0.0000 |
| P2 Party wall - Intermediate floor within a dwelling | 9.1400  | 0.1200    | 1.0968 |
| P4 Party wall - Roof (insulation at ceiling level)   |         |           |        |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

|                        |                       |              |
|------------------------|-----------------------|--------------|
| Point Thermal bridges  | (36a) =               | 0.0000       |
| Total fabric heat loss | (33) + (36) + (36a) = | 48.7945 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 36.8169 | 36.5801 | 36.3479 | 35.2576 | 35.0536 | 34.1040 | 34.1040 | 33.9282 | 34.4698 | 35.0536 | 35.4663 | 35.8977 (38) |
| Heat transfer coeff       | 85.6114 | 85.3746 | 85.1424 | 84.0521 | 83.8481 | 82.8985 | 82.8985 | 82.7226 | 83.2643 | 83.8481 | 84.2608 | 84.6922 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 84.0511      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.1818 | 1.1786 | 1.1754 | 1.1603 | 1.1575 | 1.1444 | 1.1444 | 1.1419 | 1.1494 | 1.1575 | 1.1632 | 1.1691 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1603      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          | 2.3039 (42)    |
| Hot water usage for mixer showers                               | 62.8481  | 61.9036  | 60.5273  | 57.8940  | 55.9507  | 53.7835  | 52.5517  | 53.9176  | 55.4149  | 57.7417                                | 60.4316  | 62.6073 (42a)  |
| Hot water usage for baths                                       | 27.1500  | 26.7467  | 26.1789  | 25.1320  | 24.3480  | 23.4788  | 23.0093  | 23.5731  | 24.1870  | 25.1172                                | 26.1857  | 27.0582 (42b)  |
| Hot water usage for other uses                                  | 38.2240  | 36.8340  | 35.4441  | 34.0541  | 32.6641  | 31.2742  | 31.2742  | 32.6641  | 34.0541  | 35.4441                                | 36.8340  | 38.2240 (42c)  |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 117.8652 (43)  |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec            |
| Daily hot water use                                             | 128.2220 | 125.4843 | 122.1503 | 117.0801 | 112.9629 | 108.5365 | 106.8351 | 110.1548 | 113.6560 | 118.3029                               | 123.4513 | 127.8894 (44)  |
| Energy conte                                                    | 203.0723 | 178.6880 | 187.7404 | 160.2768 | 152.0697 | 133.4583 | 129.2078 | 136.3947 | 140.1492 | 160.5360                               | 175.8790 | 200.2439 (45)  |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1957.7160      |
| Distribution loss (46)m = 0.15 x (45)m                          | 30.4608  | 26.8032  | 28.1611  | 24.0415  | 22.8105  | 20.0187  | 19.3812  | 20.4592  | 21.0224  | 24.0804                                | 26.3818  | 30.0366 (46)   |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 200.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          | 1.6525 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          | 0.8924 (55)    |
| Total storage loss                                              | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637                                | 26.7713  | 27.6637 (56)   |
| If cylinder contains dedicated solar storage                    | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637                                | 26.7713  | 27.6637 (57)   |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624 (59)   |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month | 253.9984 | 224.6858 | 238.6665 | 209.5601 | 202.9958 | 182.7416 | 180.1339 | 187.3207 | 189.4325 | 211.4620                               | 225.1622 | 251.1700 (62)  |
| WWHRS                                                           | -28.7315 | -25.4104 | -26.6083 | -22.0327 | -20.5337 | -17.5708 | -16.4699 | -17.5140 | -18.1795 | -21.4316                               | -24.2794 | -28.1994 (63a) |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                | -0.0000  | -0.0000 (63b)  |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 225.2669 | 199.2754 | 212.0582 | 187.5273 | 182.4621 | 165.1707 | 163.6640 | 169.8067 | 171.2530 | 190.0305                               | 200.8829 | 222.9706 (64)  |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2290.3683 (64) |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (64a)   |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 108.2624 | 96.2120  | 103.1645 | 92.7187  | 91.3040  | 83.8015  | 83.7025  | 86.0921  | 86.0262  | 94.1191                                | 97.9064  | 107.3220 (65)  |

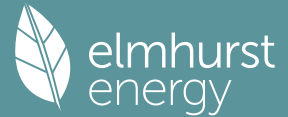
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 | 115.1938 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 105.3410 | 116.6276 | 105.3410 | 108.8524 | 105.3410 | 108.8524 | 105.3410 | 105.3410 | 108.8524 | 105.3410 | 108.8524 | 105.3410 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 202.9235 | 205.0293 | 199.7229 | 188.4264 | 174.1665 | 160.7643 | 151.8108 | 149.7051 | 155.0114 | 166.3079 | 180.5678 | 193.9700 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194  | 34.5194 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 | -92.1550 (71) |
| Water heating gains (Table 5)                                                       | 145.5140 | 143.1726 | 138.6620 | 128.7759 | 122.7205 | 116.3910 | 112.5033 | 115.7152 | 119.4809 | 126.5041 | 135.9811 | 144.2500 (72) |
| Total internal gains                                                                | 514.3367 | 525.3875 | 504.2841 | 486.6129 | 462.7862 | 443.5658 | 427.2133 | 428.3194 | 440.9028 | 458.7112 | 485.9594 | 504.1192 (73) |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |  |        |         |  |        |        |        |               |
|-------|--|--|--|--------|---------|--|--------|--------|--------|---------------|
| North |  |  |  | 5.2600 | 10.6334 |  | 0.6300 | 0.7000 | 0.7700 | 17.0934 (74)  |
| South |  |  |  | 7.2000 | 46.7521 |  | 0.6300 | 0.7000 | 0.7700 | 102.8739 (78) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 119.9673 | 201.1473 | 270.1230 | 331.7218 | 372.8712 | 371.8293 | 357.7153 | 326.0513 | 290.9294 | 220.6076 | 143.0276 | 103.1424 (83) |
| Total gains | 634.3040 | 726.5349 | 774.4072 | 818.3346 | 835.6574 | 815.3951 | 784.9286 | 754.3707 | 731.8322 | 679.3188 | 628.9870 | 607.2616 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 23.5041 | 23.5693 | 23.6336 | 23.9402 | 23.9984 | 24.2733 | 24.2733 | 24.3249 | 24.1667                   | 23.9984 | 23.8809 | 23.7592      |
| alpha                                                                       | 2.5669  | 2.5713  | 2.5756  | 2.5960  | 2.5999  | 2.6182  | 2.6182  | 2.6217  | 2.6111                    | 2.5999  | 2.5921  | 2.5839       |
| util living area                                                            | 0.9269  | 0.8980  | 0.8618  | 0.7951  | 0.6968  | 0.5571  | 0.4290  | 0.4591  | 0.6311                    | 0.8053  | 0.8965  | 0.9333 (86)  |
| MIT                                                                         | 18.6562 | 18.9872 | 19.4172 | 19.9724 | 20.4454 | 20.7849 | 20.9210 | 20.9034 | 20.6828                   | 20.0876 | 19.2981 | 18.6061 (87) |
| Th 2                                                                        | 19.9346 | 19.9372 | 19.9398 | 19.9519 | 19.9542 | 19.9648 | 19.9648 | 19.9667 | 19.9607                   | 19.9542 | 19.9496 | 19.9448 (88) |
| util rest of house                                                          | 0.9168  | 0.8844  | 0.8428  | 0.7660  | 0.6513  | 0.4883  | 0.3397  | 0.3701  | 0.5665                    | 0.7719  | 0.8805  | 0.9241 (89)  |
| MIT 2                                                                       | 17.2301 | 17.6437 | 18.1795 | 18.8645 | 19.4215 | 19.7963 | 19.9204 | 19.9093 | 19.6954                   | 19.0176 | 18.0477 | 17.1735 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2841 (91)  |
| MIT                                                                         | 17.6353 | 18.0254 | 18.5311 | 19.1792 | 19.7124 | 20.0772 | 20.2046 | 20.1917 | 19.9759                   | 19.3216 | 18.4029 | 17.5805 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 17.6353 | 18.0254 | 18.5311 | 19.1792 | 19.7124 | 20.0772 | 20.2046 | 20.1917 | 19.9759                   | 19.3216 | 18.4029 | 17.5805 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.8879    | 0.8534    | 0.8122    | 0.7412   | 0.6397   | 0.4963   | 0.3613   | 0.3904   | 0.5675   | 0.7483        | 0.8505   | 0.8963 (94)    |
| Useful gains                                                                   | 563.2074  | 620.0259  | 628.9817  | 606.5625 | 534.5728 | 404.6682 | 283.5940 | 294.5022 | 415.3092 | 508.3206      | 534.9221 | 544.3083 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 1141.6515 | 1120.5736 | 1024.3602 | 863.9913 | 671.8247 | 454.0503 | 298.8194 | 313.6588 | 489.2528 | 731.2873      | 952.3948 | 1133.2241 (97) |
| Space heating kWh                                                              | 430.3624  | 336.3681  | 294.1616  | 185.3487 | 102.1154 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 165.8873      | 300.5803 | 438.1533 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 2252.9770      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 430.3624  | 336.3681  | 294.1616  | 185.3487 | 102.1154 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 165.8873      | 300.5803 | 438.1533 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 2252.9770      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 31.1013 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |           |           |           |           |           |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |           |           |           |           |           |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr       | May       | Jun       | Jul       | Aug       | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 430.3624 | 336.3681 | 294.1616 | 185.3487  | 102.1154  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 165.8873 | 300.5803 | 438.1533 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 92.3000  | 92.3000  | 92.3000  | 92.3000   | 92.3000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 92.3000  | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                                             | 466.2648 | 364.4291 | 318.7016 | 200.8112  | 110.6342  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 179.7262 | 325.6558 | 474.7056 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating requirement                                                                            | 225.2669 | 199.2754 | 212.0582 | 187.5273  | 182.4621  | 165.1707  | 163.6640  | 169.8067  | 171.2530 | 190.0305 | 200.8829 | 222.9706 (64)   |
| Efficiency of water heater (217)m                                                                    | 85.4873  | 85.2241  | 84.7939  | 84.0336   | 82.8117   | 79.8000   | 79.8000   | 79.8000   | 79.8000  | 83.7565  | 84.9615  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 263.5091 | 233.8251 | 250.0866 | 223.1576  | 220.3337  | 206.9809  | 205.0928  | 212.7904  | 214.6027 | 226.8844 | 236.4400 | 260.6438 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                                             | 21.8878  | 17.5592  | 15.8101  | 11.5832   | 8.9472    | 7.3099    | 8.1619    | 10.6092   | 13.7802  | 18.0804  | 20.4218  | 22.4961 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |          |          |          |                 |
| (233a)m                                                                                              | -33.9609 | -47.9161 | -68.9356 | -77.5898  | -83.7474  | -78.2106  | -77.2524  | -72.8935  | -65.2069 | -54.8342 | -37.3526 | -29.3575 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |          |          |          |                 |
| (233b)m                                                                                              | -19.0723 | -40.1363 | -79.7978 | -119.8827 | -158.5406 | -159.2960 | -157.4129 | -133.2628 | -97.6594 | -57.3999 | -25.4658 | -15.0801 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |          |          |          | 2440.9285 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |          |          |          | 79.8000         |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |          |          |          | 2754.3470 (219) |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |          |          |          | 0.0000 (221)    |

# Full SAP Calculation Printout



|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Electricity for pumps and fans:                               |                  |
| Total electricity for the above, kWh/year                     | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)           | 176.6470 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -1790.2642 (233) |
| Wind generation                                               | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)     |
| Appendix Q - special features                                 |                  |
| Energy saved or generated                                     | -0.0000 (236)    |
| Energy used                                                   | 0.0000 (237)     |
| Total delivered energy for all uses                           | 3667.6583 (238)  |

## ----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2440.9285          | 0.2100                        | 512.5950 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2754.3470          | 0.2100                        | 578.4129 (264)           |
| Space and water heating                       |                    |                               | 1091.0079 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 176.6470           | 0.1443                        | 25.4956 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -727.2575          | 0.1346                        | -97.8619                 |
| PV Unit electricity exported                  | -1063.0067         | 0.1259                        | -133.8215                |
| Total                                         |                    |                               | -231.6834 (269)          |
| Total CO2, kg/year                            |                    |                               | 896.7493 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 12.3800 (273)            |

## ----- 13a. Primary energy - Individual heating systems including micro-CHP -----

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2440.9285          | 1.1300                              | 2758.2492 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2754.3470          | 1.1300                              | 3112.4121 (278)            |
| Space and water heating                     |                    |                                     | 5870.6614 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 176.6470           | 1.5338                              | 270.9471 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -727.2575          | 1.4973                              | -1088.9376                 |
| PV Unit electricity exported                | -1063.0067         | 0.4621                              | -491.2168                  |
| Total                                       |                    |                                     | -1580.1545 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4691.5548 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 64.7600 (287)              |

## Full SAP Calculation Printout



|                                    |                                                     |               |               |                |            |  |
|------------------------------------|-----------------------------------------------------|---------------|---------------|----------------|------------|--|
| Plot Reference                     | 2H2                                                 |               |               | Issued on Date | 31/07/2026 |  |
| Assessment Reference               | 001                                                 |               | Plot Type Ref | End Br Ea Ga   |            |  |
| Plot Address                       | 2H2, College Lane, Hurstpierpoint, West Sussex, BN6 |               |               | SAP Version    | 10.2       |  |
|                                    |                                                     |               |               |                |            |  |
| SAP Rating                         | 83 B                                                | DER           | 4.41          | TER            | 13.43      |  |
| Environmental                      | 97 A                                                | % DER < TER   |               |                | 67.16      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.26                                                | DFEE          | 37.31         | TFEE           | 40.01      |  |
| Compliance Check                   | See BREL                                            | % DFEE < TFEE |               |                | 6.75       |  |
| % DPER < TPER                      | 33.79                                               | DPER          | 46.64         | TPER           | 70.44      |  |
|                                    |                                                     |               |               |                |            |  |
| Assessor Details                   | Mr. Stephen Smith                                   |               |               | Assessor ID    | D168-0001  |  |
| Client                             | TH002, Thakeham Southern                            |               |               |                |            |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 31.3400 (1b)              | x 2.4600 (2b)                     | = 77.0964 (1b) - (3b)       |
| First floor                                            | 31.3400 (1c)              | x 2.6800 (2c)                     | = 83.9912 (1c) - (3c)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 62.6800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 161.0876 (5)                |

## 2. Ventilation rate

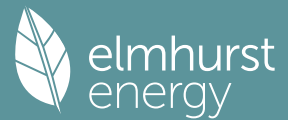
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.0000 (17)                             |
| Infiltration rate                                                                                  | 0.2000 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1700 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2167 | 0.2125 | 0.2083 | 0.1870 | 0.1827 | 0.1615 | 0.1615 | 0.1573 | 0.1700 | 0.1827 | 0.1913 | 0.1998 (22b) |
| Mechanical extract ventilation - centralised                                                            |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                         | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Opening Type 2                                                  |                         |                            | 12.4600                   | 1.2357                        | 15.3973      |                                | (27)          |
| Opening Type 3                                                  |                         |                            | 2.1500                    | 1.0000                        | 2.1500       |                                | (26)          |
| Heat Loss Floor 1                                               |                         |                            | 31.3400                   | 0.1100                        | 3.4474       |                                | (28a)         |
| Brick Faced                                                     | 83.2680                 | 14.6100                    | 68.6580                   | 0.1700                        | 11.6719      |                                | (29a)         |
| Main Roof                                                       | 31.3400                 |                            | 31.3400                   | 0.0800                        | 2.5072       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )     |                         |                            | 145.9480                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                             |                         |                            |                           | (26)...(30) + (32) =          | 35.1738      |                                | (33)          |
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Party Wall 1                                                    |                         |                            | 46.9700                   | 0.0000                        | 0.0000       |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K  |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| Thermal bridges (User defined value 0.040 * total exposed area) |                         |                            |                           |                               |              |                                | 5.8379 (36)   |
| Point Thermal bridges                                           |                         |                            |                           |                               |              | (36a) =                        | 0.0000        |
| Total fabric heat loss                                          |                         |                            |                           |                               |              | (33) + (36) + (36a) =          | 41.0117 (37)  |

# Full SAP Calculation Printout



|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 | 26.5795 (38) |
| Average = Sum(39)m / 12 =                                           | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 | 67.5912 (39) |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784  | 1.0784 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

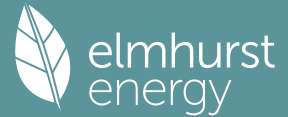
|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |          |          |          |          |          |          |          |          |          |          |          |                |
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.0563 (42)    |
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (42a)          |
| Hot water usage for baths                                                      | 25.3649  | 24.9882  | 24.4577  | 23.4796  | 22.7472  | 21.9351  | 21.4964  | 22.0232  | 22.5968  | 23.4657  | 24.4640  | 25.2791 (42b)  |
| Hot water usage for other uses                                                 | 35.6886  | 34.3909  | 33.0931  | 31.7953  | 30.4976  | 29.1998  | 29.1998  | 30.4976  | 31.7953  | 33.0931  | 34.3909  | 35.6886 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 55.9615 (43)   |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Energy conte                                                                   | 61.0535  | 59.3790  | 57.5508  | 55.2749  | 53.2448  | 51.1349  | 50.6962  | 52.5208  | 54.3921  | 56.5588  | 58.8549  | 60.9678 (44)   |
| Energy content (annual)                                                        | 96.6939  | 84.5550  | 88.4534  | 75.6686  | 71.6777  | 62.8763  | 61.3127  | 65.0317  | 67.0709  | 76.7498  | 83.8495  | 95.4608 (45)   |
| Distribution loss (46)m = 0.15 x (45)m                                         | 14.5041  | 12.6832  | 13.2680  | 11.3503  | 10.7517  | 9.4314   | 9.1969   | 9.7548   | 10.0606  | 11.5125  | 12.5774  | 14.3191 (46)   |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 200.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.2200 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.6588 (55)    |
| Total storage loss                                                             | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228 (56)   |
| If cylinder contains dedicated solar storage                                   | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228 (57)   |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624 (59)   |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 140.3791 | 124.0126 | 132.1386 | 117.9446 | 115.3629 | 105.1523 | 104.9979 | 108.7169 | 109.3469 | 120.4350 | 126.1255 | 139.1460 (62)  |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                | 140.3791 | 124.0126 | 132.1386 | 117.9446 | 115.3629 | 105.1523 | 104.9979 | 108.7169 | 109.3469 | 120.4350 | 126.1255 | 139.1460 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 1443.7583 (64) |
| Electric shower(s)                                                             | 45.4902  | 40.5322  | 44.2596  | 42.2364  | 43.0289  | 41.0454  | 42.4136  | 43.0289  | 42.2364  | 44.2596  | 43.4273  | 45.4902 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 517.4488 (64a) |
| Heat gains from water heating, kWh/month                                       | 78.4714  | 69.8137  | 75.4238  | 69.5397  | 69.5382  | 64.9885  | 65.9380  | 67.3284  | 66.6810  | 71.5324  | 72.5576  | 78.0614 (65)   |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 91.3110  | 101.0943 | 91.3110  | 94.3547  | 91.3110  | 94.3547  | 91.3110  | 91.3110  | 94.3547  | 91.3110  | 94.3547  | 91.3110 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 179.6518 | 181.5160 | 176.8183 | 166.8172 | 154.1927 | 142.3275 | 134.4008 | 132.5366 | 137.2343 | 147.2354 | 159.8599 | 171.7251 (68) |
| Pumps, fans                                                                         | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815 (69)  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Water heating gains (Table 5)                                                       | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 (71) |
| Total internal gains                                                                | 105.4723 | 103.8894 | 101.3761 | 96.5829  | 93.4654  | 90.2618  | 88.6264  | 90.4952  | 92.6124  | 96.1457  | 100.7744 | 104.9213 (72) |
|                                                                                     | 430.2798 | 440.3443 | 423.3500 | 411.5994 | 392.8137 | 380.7886 | 368.1827 | 368.1873 | 378.0461 | 388.5366 | 408.8336 | 421.8020 (73) |

|                |          |            |               |               |          |              |          |          |          |          |          |               |
|----------------|----------|------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|---------------|
| 6. Solar gains |          |            |               |               |          |              |          |          |          |          |          |               |
| [Jan]          |          |            |               |               |          |              |          |          |          |          |          |               |
|                | Area     | Solar flux | g             | FF            | Access   | Gains        |          |          |          |          |          |               |
|                | m2       | Table 6a   | Specific data | Specific data | factor   | W            |          |          |          |          |          |               |
|                |          | W/m2       | or Table 6b   | or Table 6c   | Table 6d |              |          |          |          |          |          |               |
| Southeast      | 7.2000   | 36.7938    | 0.4500        | 0.7000        | 0.7700   | 57.8297 (77) |          |          |          |          |          |               |
| Northwest      | 5.2600   | 11.2829    | 0.4500        | 0.7000        | 0.7700   | 12.9554 (81) |          |          |          |          |          |               |
| Solar gains    | 70.7852  | 124.8766   | 182.2919      | 245.0274      | 291.9384 | 297.5193     | 283.6393 | 247.4656 | 203.8323 | 141.0972 | 85.5680  | 60.0703 (83)  |
| Total gains    | 501.0649 | 565.2209   | 605.6419      | 656.6268      | 684.7520 | 678.3079     | 651.8220 | 615.6529 | 581.8784 | 529.6338 | 494.4016 | 481.8722 (84) |

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| 7. Mean internal temperature (heating season)                               |         |         |         |         |         |         |         |         |         |         |         |              |
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594 | 25.7594      |
| alpha                                                                       | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173  | 2.7173       |
| util living area                                                            | 0.9357  | 0.9112  | 0.8760  | 0.8054  | 0.6990  | 0.5540  | 0.4252  | 0.4626  | 0.6460  | 0.8245  | 0.9088  | 0.9415 (86)  |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Living                 | 18.7983 | 19.0877 | 19.5002 | 20.0359 | 20.4997 | 20.8104 | 20.9324 | 20.9129 | 20.6981                   | 20.1117 | 19.3646 | 18.7253      |
| Non living             | 17.4587 | 17.8204 | 18.3345 | 18.9889 | 19.5333 | 19.8682 | 19.9796 | 19.9655 | 19.7613                   | 19.0940 | 18.1744 | 17.3672      |
| 24 / 16                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                 | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                 | 28      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 10           |
| MIT                    | 19.8737 | 19.0877 | 19.5002 | 20.0359 | 20.4997 | 20.8104 | 20.9324 | 20.9129 | 20.6981                   | 20.1117 | 19.3646 | 19.0435 (87) |
| Th 2                   | 20.0186 | 20.0186 | 20.0186 | 20.0186 | 20.0186 | 20.0186 | 20.0186 | 20.0186 | 20.0186                   | 20.0186 | 20.0186 | 20.0186 (88) |
| util rest of house     | 0.9270  | 0.8995  | 0.8592  | 0.7782  | 0.6556  | 0.4882  | 0.3405  | 0.3771  | 0.5842                    | 0.7942  | 0.8948  | 0.9336 (89)  |
| MIT 2                  | 18.9980 | 17.8204 | 18.3345 | 18.9889 | 19.5333 | 19.8682 | 19.9796 | 19.9655 | 19.7613                   | 19.0940 | 18.1744 | 17.8450 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.3283 (91)  |
| MIT                    | 19.2855 | 18.2365 | 18.7173 | 19.3327 | 19.8506 | 20.1775 | 20.2924 | 20.2765 | 20.0689                   | 19.4281 | 18.5652 | 18.2385 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 19.2855 | 18.2365 | 18.7173 | 19.3327 | 19.8506 | 20.1775 | 20.2924 | 20.2765 | 20.0689                   | 19.4281 | 18.5652 | 18.2385 (93) |

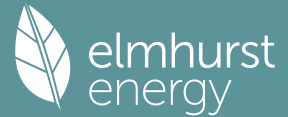
## 8. Space heating requirement

|                                                                                | Jan       | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.9195    | 0.8726   | 0.8322   | 0.7565   | 0.6475   | 0.4994   | 0.3650   | 0.4006   | 0.5877   | 0.7729        | 0.8685   | 0.9151 (94)    |
| Useful gains                                                                   | 460.7176  | 493.2199 | 504.0140 | 496.7300 | 443.3572 | 338.7394 | 237.9052 | 246.6044 | 341.9469 | 409.3794      | 429.4006 | 440.9579 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                                                               | 1012.8904 | 901.4273 | 825.7785 | 705.1563 | 550.9080 | 376.9926 | 249.5752 | 262.0201 | 403.4441 | 596.7043      | 774.9465 | 948.8776 (97)  |
| Space heating kWh                                                              | 410.8165  | 274.3154 | 239.3928 | 150.0670 | 80.0177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 139.3697      | 248.7930 | 377.8922 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |          |          |          |          |          |          |          |          |               |          | 1920.6643      |
| Solar heating kWh                                                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |          |          |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 410.8165  | 274.3154 | 239.3928 | 150.0670 | 80.0177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 139.3697      | 248.7930 | 377.8922 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |          |          |          |          |          |          |          |          |               |          | 1920.6643      |
| Space heating per m2                                                           |           |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 30.6424 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 286.3354 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                                                                    | 410.8165 | 274.3154 | 239.3928 | 150.0670 | 80.0177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 139.3697 | 248.7930 | 377.8922 (98)  |
| Space heating efficiency (main heating system 1)                                                             | 286.3354 | 286.3354 | 286.3354 | 286.3354 | 286.3354 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 286.3354 | 286.3354 | 286.3354 (210) |
| Space heating fuel (main heating system)                                                                     | 143.4739 | 95.8021  | 83.6057  | 52.4095  | 27.9455  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 48.6736  | 86.8887  | 131.9754 (211) |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                                                                    | 140.3791 | 124.0126 | 132.1386 | 117.9446 | 115.3629 | 105.1523 | 104.9979 | 108.7169 | 109.3469 | 120.4350 | 126.1255 | 139.1460 (64)  |
| Efficiency of water heater (217)m                                                                            | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 | 271.6032 (216) |
| Fuel for water heating, kWh/month                                                                            | 51.6853  | 45.6595  | 48.6514  | 43.4253  | 42.4748  | 38.7154  | 38.6586  | 40.0278  | 40.2598  | 44.3423  | 46.4374  | 51.2314 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |
| Pumps and Fa                                                                                                 | 3.2548   | 2.9398   | 3.2548   | 3.1498   | 3.2548   | 3.1498   | 3.2548   | 3.1498   | 3.1498   | 3.2548   | 3.1498   | 3.2548 (231)   |
| Lighting                                                                                                     | 17.6541  | 14.1628  | 12.7520  | 9.3427   | 7.2166   | 5.8960   | 6.5832   | 8.5571   | 11.1148  | 14.5832  | 16.4717  | 18.1448 (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)  |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)  |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)  |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 670.7744 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)   |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)   |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 271.6032       |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 531.5690 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)   |
| Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)             |          |          |          |          |          |          |          |          |          |          |          |                |
| mechanical ventilation fans (SFP = 0.1950)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 38.3227 (230a) |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 38.3227 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 142.4790 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |          |          |          |          |          |          |          |          |                |
| PV generation                                                                                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (233)   |
| Wind generation                                                                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)   |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)  |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)   |
| Appendix Q - special features                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
| Energy saved or generated                                                                                    |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)  |

# Full SAP Calculation Printout



Energy used  
Total delivered energy for all uses

0.0000 (237)  
1900.5939 (238)

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                         | Energy<br>kWh/year | Emission factor<br>kg CO <sub>2</sub> /kWh | Emissions<br>kg CO <sub>2</sub> /year |        |
|---------------------------------------------------------|--------------------|--------------------------------------------|---------------------------------------|--------|
| Space heating - main system 1                           | 670.7744           | 0.1550                                     | 103.9414                              | (261)  |
| Total CO <sub>2</sub> associated with community systems |                    |                                            | 0.0000                                | (373)  |
| Water heating (other fuel)                              | 531.5690           | 0.1406                                     | 74.7155                               | (264)  |
| Energy for instantaneous electric shower(s)             | 517.4488           | 0.1391                                     | 71.9886                               | (264a) |
| Space and water heating                                 |                    |                                            | 178.6569                              | (265)  |
| Pumps, fans and electric keep-hot                       | 38.3227            | 0.1387                                     | 5.3158                                | (267)  |
| Energy for lighting                                     | 142.4790           | 0.1443                                     | 20.5641                               | (268)  |
| Total CO <sub>2</sub> , kg/year                         |                    |                                            | 276.5254                              | (272)  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                                            | 4.4100                                | (273)  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                                         | Energy<br>kWh/year | Primary energy factor<br>kg CO <sub>2</sub> /kWh | Primary energy<br>kWh/year |        |
|---------------------------------------------------------|--------------------|--------------------------------------------------|----------------------------|--------|
| Space heating - main system 1                           | 670.7744           | 1.5736                                           | 1055.5594                  | (275)  |
| Total CO <sub>2</sub> associated with community systems |                    |                                                  | 0.0000                     | (473)  |
| Water heating (other fuel)                              | 531.5690           | 1.5197                                           | 807.8302                   | (278)  |
| Energy for instantaneous electric shower(s)             | 517.4488           | 1.5143                                           | 783.5904                   | (278a) |
| Space and water heating                                 |                    |                                                  | 1863.3897                  | (279)  |
| Pumps, fans and electric keep-hot                       | 38.3227            | 1.5128                                           | 57.9746                    | (281)  |
| Energy for lighting                                     | 142.4790           | 1.5338                                           | 218.5390                   | (282)  |
| Total Primary energy kWh/year                           |                    |                                                  | 2923.4937                  | (286)  |
| Dwelling Primary energy Rate (DPER)                     |                    |                                                  | 46.6400                    | (287)  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |  |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|--|
| Main dwelling                                          |                           |                                   |                             |  |
| Ground floor                                           | 31.3400 (1b)              | x 2.4600 (2b)                     | = 77.0964 (1b) - (3b)       |  |
| First floor                                            | 31.3400 (1c)              | x 2.6800 (2c)                     | = 83.9912 (1c) - (3c)       |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 62.6800                   |                                   | (4)                         |  |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 161.0876 (5)                |  |

## 2. Ventilation rate

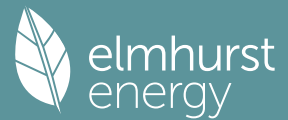
|                                                                                                    | m <sup>3</sup> per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 2 * 10 =                    | 20.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) =             | 0.1242 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.3742                      | (18)         |
| Number of sides sheltered                                                                          | 2                           | (19)         |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.8500 (20)  |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3180 (21)  |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4055 | 0.3975 | 0.3896 | 0.3498 | 0.3419 | 0.3021 | 0.3021 | 0.2942 | 0.3180 | 0.3419 | 0.3578 | 0.3737 | (22b) |
| Effective ac    | 0.5822 | 0.5790 | 0.5759 | 0.5612 | 0.5584 | 0.5456 | 0.5456 | 0.5433 | 0.5506 | 0.5584 | 0.5640 | 0.5698 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |       |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|-------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |               |       |
| TER Opaque door                                             |                         |                            | 2.1500                    | 1.0000                        | 2.1500       |                                |               | (26)  |
| TER Opening Type                                            |                         |                            | 12.4600                   | 1.1450                        | 14.2672      |                                |               | (27)  |
| Heat Loss Floor 1                                           |                         |                            | 31.3400                   | 0.1300                        | 4.0742       |                                |               | (28a) |
| Brick Faced                                                 | 83.2680                 | 14.6100                    | 68.6580                   | 0.1800                        | 12.3584      |                                |               | (29a) |
| Main Roof                                                   | 31.3400                 |                            | 31.3400                   | 0.1100                        | 3.4474       |                                |               | (30)  |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 145.9480                  |                               |              |                                |               | (31)  |

# Full SAP Calculation Printout



|                                                                     |                      |                       |                |         |         |         |         |         |         |         |         |         |      |
|---------------------------------------------------------------------|----------------------|-----------------------|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Fabric heat loss, W/K = Sum (A x U)                                 | (26)...(30) + (32) = | 36.2972               | (33)           |         |         |         |         |         |         |         |         |         |      |
| Main dwelling                                                       |                      |                       |                |         |         |         |         |         |         |         |         |         |      |
| Party Wall 1                                                        | 46.9700              | 0.0000                | 0.0000 (32)    |         |         |         |         |         |         |         |         |         |      |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                   |                      |                       | 100.0000 (35)  |         |         |         |         |         |         |         |         |         |      |
| List of Thermal Bridges                                             |                      |                       |                |         |         |         |         |         |         |         |         |         |      |
| K1 Element                                                          | Length               | Psi-value             | Total          |         |         |         |         |         |         |         |         |         |      |
| E2 Other lintels (including other steel lintels)                    | 8.9700               | 0.0500                | 0.4485         |         |         |         |         |         |         |         |         |         |      |
| E3 Sill                                                             | 7.9600               | 0.0500                | 0.3980         |         |         |         |         |         |         |         |         |         |      |
| E4 Jamb                                                             | 25.7700              | 0.0500                | 1.2885         |         |         |         |         |         |         |         |         |         |      |
| E5 Ground floor (normal)                                            | 18.0100              | 0.1600                | 2.8816         |         |         |         |         |         |         |         |         |         |      |
| E6 Intermediate floor within a dwelling                             | 18.0100              | 0.0000                | 0.0000         |         |         |         |         |         |         |         |         |         |      |
| E10 Eaves (insulation at ceiling level)                             | 8.8600               | 0.0600                | 0.5316         |         |         |         |         |         |         |         |         |         |      |
| E12 Gable (insulation at ceiling level)                             | 9.1400               | 0.0600                | 0.5484         |         |         |         |         |         |         |         |         |         |      |
| E16 Corner (normal)                                                 | 10.2800              | 0.0900                | 0.9252         |         |         |         |         |         |         |         |         |         |      |
| E18 Party wall between dwellings                                    | 10.2800              | 0.0600                | 0.6168         |         |         |         |         |         |         |         |         |         |      |
| P1 Party wall - Ground floor                                        | 9.1400               | 0.0800                | 0.7312         |         |         |         |         |         |         |         |         |         |      |
| P2 Party wall - Intermediate floor within a dwelling                | 9.1400               | 0.0000                | 0.0000         |         |         |         |         |         |         |         |         |         |      |
| P4 Party wall - Roof (insulation at ceiling level)                  | 9.1400               | 0.1200                | 1.0968         |         |         |         |         |         |         |         |         |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                      |                       | 9.4666 (36)    |         |         |         |         |         |         |         |         |         |      |
| Point Thermal bridges                                               |                      |                       | 0.0000 (36a) = |         |         |         |         |         |         |         |         |         |      |
| Total fabric heat loss                                              |                      | (33) + (36) + (36a) = | 45.7638 (37)   |         |         |         |         |         |         |         |         |         |      |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                      |                       |                |         |         |         |         |         |         |         |         |         |      |
| (38)m                                                               | Jan                  | Feb                   | Mar            | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     | (38) |
| Heat transfer coeff                                                 | 30.9497              | 30.7800               | 30.6137        | 29.8324 | 29.6862 | 29.0057 | 29.0057 | 28.8797 | 29.2678 | 29.6862 | 29.9819 | 30.2911 | (39) |
| Average = Sum(39)m / 12 =                                           | 76.7136              | 76.5439               | 76.3775        | 75.5962 | 75.4500 | 74.7695 | 74.7695 | 74.6435 | 75.0316 | 75.4500 | 75.7457 | 76.0549 | (39) |
|                                                                     |                      |                       |                |         |         |         |         |         |         |         |         | 75.5955 |      |
| HLP                                                                 | Jan                  | Feb                   | Mar            | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     | (40) |
| HLP (average)                                                       | 1.2239               | 1.2212                | 1.2185         | 1.2061  | 1.2037  | 1.1929  | 1.1929  | 1.1909  | 1.1971  | 1.2037  | 1.2085  | 1.2134  | (40) |
| Days in mont                                                        | 31                   | 28                    | 31             | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

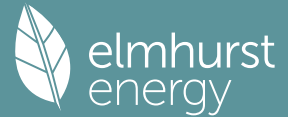
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2.0563 (42)    |
| Hot water usage for mixer showers                               | 58.6971  | 57.8150  | 56.5296  | 54.0702  | 52.2552  | 50.2312  | 49.0808  | 50.3564  | 51.7548  | 53.9280  | 56.4402  | 58.4722  | (42a)          |
| Hot water usage for baths                                       | 25.3649  | 24.9882  | 24.4577  | 23.4796  | 22.7472  | 21.9351  | 21.4964  | 22.0232  | 22.5968  | 23.4657  | 24.4640  | 25.2791  | (42b)          |
| Hot water usage for other uses                                  | 35.6886  | 34.3909  | 33.0931  | 31.7953  | 30.4976  | 29.1998  | 29.1998  | 30.4976  | 31.7953  | 33.0931  | 34.3909  | 35.6886  | (42c)          |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          |          | 110.0782 (43)  |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Daily hot water use                                             | 119.7506 | 117.1940 | 114.0804 | 109.3451 | 105.5000 | 101.3661 | 99.7770  | 102.8772 | 106.1469 | 110.4868 | 115.2951 | 119.4400 | (44)           |
| Energy content (annual)                                         | 189.6557 | 166.8827 | 175.3373 | 149.6880 | 142.0233 | 124.6415 | 120.6716 | 127.3835 | 130.8897 | 149.9296 | 164.2589 | 187.0141 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                          | 28.4484  | 25.0324  | 26.3006  | 22.4532  | 21.3035  | 18.6962  | 18.1007  | 19.1075  | 19.6335  | 22.4894  | 24.6388  | 28.0521  | (46)           |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 200.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          |          | 1.6525 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.8924 (55)    |
| Total storage loss                                              | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | (56)           |
| If cylinder contains dedicated solar storage                    | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | (57)           |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (59)           |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)           |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 240.5818 | 212.8805 | 226.2634 | 198.9713 | 192.9494 | 173.9248 | 171.5977 | 178.3095 | 180.1730 | 200.8557 | 213.5422 | 237.9402 | (62)           |
| WWHRS                                                           | -26.8339 | -23.7321 | -24.8509 | -20.5775 | -19.1775 | -16.4103 | -15.3821 | -16.3573 | -16.9787 | -20.0161 | -22.6758 | -26.3369 | (63a)          |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)          |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)          |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)          |
| Output from w/h                                                 | 213.7479 | 189.1484 | 201.4125 | 178.3938 | 173.7719 | 157.5144 | 156.2156 | 161.9523 | 163.1943 | 180.8396 | 190.8665 | 211.6033 | (64)           |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |          | 2178.6605 (64) |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)          |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 103.8014 | 92.2867  | 99.0405  | 89.1979  | 87.9636  | 80.8699  | 80.8642  | 83.0959  | 82.9475  | 90.5924  | 94.0427  | 102.9231 | (65)           |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
|                                                                                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (66)m                                                                               | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | 102.8153 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 91.3110  | 101.0943 | 91.3110  | 94.3547  | 91.3110  | 94.3547  | 91.3110  | 91.3110  | 94.3547  | 91.3110  | 94.3547  | 91.3110  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 179.6518 | 181.5160 | 176.8183 | 166.8172 | 154.1927 | 142.3275 | 134.4008 | 132.5366 | 137.2343 | 147.2354 | 159.8599 | 171.7251 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | 33.2815  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | -82.2522 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 139.5180 | 137.3314 | 133.1190 | 123.8860 | 118.2307 | 112.3193 | 108.6884 | 111.6880 | 115.2048 | 121.7640 | 130.6149 | 138.3374 | (72) |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 467.3254 | 476.7864 | 458.0928 | 441.9025 | 420.5790 | 402.8461 | 388.2448 | 389.3801 | 400.6384 | 417.1550 | 441.6740 | 458.2181 | (73) |

## 6. Solar gains

# Full SAP Calculation Printout



| [Jan]                                                                                                |                           |           |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b |           | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W      |
|------------------------------------------------------------------------------------------------------|---------------------------|-----------|----------|------------|--------------------------------|-----------------------------------|-----------|------------------------------------|----------|------------------------------|----------|-----------------|
| Southeast                                                                                            |                           |           |          | 7.2000     | 36.7938                        | 0.6300                            |           | 0.7000                             |          | 0.7700                       |          | 80.9616 (77)    |
| Northwest                                                                                            |                           |           |          | 5.2600     | 11.2829                        | 0.6300                            |           | 0.7000                             |          | 0.7700                       |          | 18.1376 (81)    |
| Solar gains                                                                                          | 99.0993                   | 174.8273  | 255.2087 | 343.0383   | 408.7137                       | 416.5270                          | 397.0950  | 346.4518                           | 285.3652 | 197.5360                     | 119.7952 | 84.0984 (83)    |
| Total gains                                                                                          | 566.4246                  | 651.6136  | 713.3015 | 784.9408   | 829.2927                       | 819.3731                          | 785.3397  | 735.8319                           | 686.0037 | 614.6910                     | 561.4692 | 542.3165 (84)   |
| 7. Mean internal temperature (heating season)                                                        |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| Temperature during heating periods in the living area from Table 9, Th1 (C)                          |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 21.0000 (85)    |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                                   |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
|                                                                                                      | Jan                       | Feb       | Mar      | Apr        | May                            | Jun                               | Jul       | Aug                                | Sep      | Oct                          | Nov      | Dec             |
| tau                                                                                                  | 22.6963                   | 22.7466   | 22.7961  | 23.0317    | 23.0764                        | 23.2864                           | 23.2864   | 23.3257                            | 23.2050  | 23.0764                      | 22.9863  | 22.8928         |
| alpha                                                                                                | 2.5131                    | 2.5164    | 2.5197   | 2.5354     | 2.5384                         | 2.5524                            | 2.5524    | 2.5550                             | 2.5470   | 2.5384                       | 2.5324   | 2.5262          |
| util living area                                                                                     | 0.9239                    | 0.8939    | 0.8508   | 0.7696     | 0.6553                         | 0.5118                            | 0.3912    | 0.4286                             | 0.6115   | 0.7985                       | 0.8935   | 0.9306 (86)     |
| MIT                                                                                                  | 18.5962                   | 18.9366   | 19.4092  | 20.0087    | 20.4945                        | 20.8102                           | 20.9303   | 20.9102                            | 20.6856  | 20.0615                      | 19.2423  | 18.5390 (87)    |
| Th 2                                                                                                 | 19.9009                   | 19.9031   | 19.9052  | 19.9152    | 19.9170                        | 19.9257                           | 19.9257   | 19.9273                            | 19.9224  | 19.9170                      | 19.9132  | 19.9093 (88)    |
| util rest of house                                                                                   | 0.9134                    | 0.8797    | 0.8305   | 0.7380     | 0.6073                         | 0.4431                            | 0.3049    | 0.3407                             | 0.5450   | 0.7637                       | 0.8768   | 0.9209 (89)     |
| MIT 2                                                                                                | 17.1352                   | 17.5596   | 18.1457  | 18.8774    | 19.4402                        | 19.7811                           | 19.8879   | 19.8756                            | 19.6637  | 18.9599                      | 17.9562  | 17.0687 (90)    |
| Living area fraction                                                                                 | fLA = Living area / (4) = |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.3283 (91)     |
| MIT                                                                                                  | 17.6149                   | 18.0117   | 18.5606  | 19.2488    | 19.7863                        | 20.1190                           | 20.2302   | 20.2153                            | 19.9992  | 19.3216                      | 18.3785  | 17.5515 (92)    |
| Temperature adjustment                                                                               |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000          |
| adjusted MIT                                                                                         | 17.6149                   | 18.0117   | 18.5606  | 19.2488    | 19.7863                        | 20.1190                           | 20.2302   | 20.2153                            | 19.9992  | 19.3216                      | 18.3785  | 17.5515 (93)    |
| 8. Space heating requirement                                                                         |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
|                                                                                                      | Jan                       | Feb       | Mar      | Apr        | May                            | Jun                               | Jul       | Aug                                | Sep      | Oct                          | Nov      | Dec             |
| Utilisation                                                                                          | 0.8842                    | 0.8485    | 0.8004   | 0.7160     | 0.6010                         | 0.4561                            | 0.3302    | 0.3653                             | 0.5501   | 0.7414                       | 0.8468   | 0.8927 (94)     |
| Useful gains                                                                                         | 500.8215                  | 552.9238  | 570.9176 | 561.9827   | 498.4320                       | 373.6771                          | 259.3532  | 268.8014                           | 377.3969 | 455.7218                     | 475.4582 | 484.1324 (95)   |
| Ext temp.                                                                                            | 4.3000                    | 4.9000    | 6.5000   | 8.9000     | 11.7000                        | 14.6000                           | 16.6000   | 16.4000                            | 14.1000  | 10.6000                      | 7.1000   | 4.2000 (96)     |
| Heat loss rate W                                                                                     | 1021.4356                 | 1003.6219 | 921.1564 | 782.3315   | 610.1149                       | 412.6513                          | 271.4279  | 284.7879                           | 442.6282 | 658.0441                     | 854.2985 | 1015.4447 (97)  |
| Space heating kWh                                                                                    | 387.3369                  | 302.8691  | 260.5777 | 158.6511   | 83.0921                        | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 150.5278                     | 272.7650 | 395.2963 (98a)  |
| Space heating requirement - total per year (kWh/year)                                                |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 2011.1160       |
| Solar heating kWh                                                                                    | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (98b)    |
| Solar heating contribution - total per year (kWh/year)                                               |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000          |
| Space heating kWh                                                                                    | 387.3369                  | 302.8691  | 260.5777 | 158.6511   | 83.0921                        | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 150.5278                     | 272.7650 | 395.2963 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)                       |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 2011.1160       |
| Space heating per m2                                                                                 | (98c) / (4) =             |           |          |            |                                |                                   |           |                                    |          |                              |          | 32.0855 (99)    |
| 9a. Energy requirements - Individual heating systems, including micro-CHP                            |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| Fraction of space heat from secondary/supplementary system (Table 11)                                |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000 (208)    |
|                                                                                                      | Jan                       | Feb       | Mar      | Apr        | May                            | Jun                               | Jul       | Aug                                | Sep      | Oct                          | Nov      | Dec             |
| Space heating requirement                                                                            | 387.3369                  | 302.8691  | 260.5777 | 158.6511   | 83.0921                        | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 150.5278                     | 272.7650 | 395.2963 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 92.3000                   | 92.3000   | 92.3000  | 92.3000    | 92.3000                        | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 92.3000                      | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                                             | 419.6499                  | 328.1356  | 282.3161 | 171.8864   | 90.0239                        | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 163.0853                     | 295.5201 | 428.2733 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| Water heating requirement                                                                            | 213.7479                  | 189.1484  | 201.4125 | 178.3938   | 173.7719                       | 157.5144                          | 156.2156  | 161.9523                           | 163.1943 | 180.8396                     | 190.8665 | 211.6033 (64)   |
| Efficiency of water heater                                                                           | 85.3759                   | 85.1099   | 84.6384  | 83.7978    | 82.5050                        | 79.8000                           | 79.8000   | 79.8000                            | 79.8000  | 83.6513                      | 84.8600  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 250.3608                  | 222.2403  | 237.9682 | 212.8861   | 210.6198                       | 197.3865                          | 195.7590  | 202.9477                           | 204.5041 | 216.1826                     | 224.9193 | 247.6623 (219)  |
| Space cooling fuel requirement                                                                       |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (221)m                                                                                               | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 7.3041                    | 6.5973    | 7.3041   | 7.0685     | 7.3041                         | 7.0685                            | 7.3041    | 7.3041                             | 7.0685   | 7.3041                       | 7.0685   | 7.3041 (231)    |
| Lighting                                                                                             | 18.9726                   | 15.2205   | 13.7044  | 10.0404    | 7.7555                         | 6.3363                            | 7.0748    | 9.1962                             | 11.9449  | 15.6723                      | 17.7019  | 19.4999 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (233a)m                                                                                              | -29.5881                  | -41.8538  | -60.3774 | -68.1628   | -73.7663                       | -68.9807                          | -68.1531  | -64.2188                           | -57.3006 | -48.0048                     | -32.5875 | -25.5663 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (234a)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (235a)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (235c)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (233b)m                                                                                              | -16.2999                  | -34.3351  | -68.3169 | -102.7038  | -135.8778                      | -136.5261                         | -134.8953 | -114.1616                          | -83.6223 | -49.1077                     | -21.7672 | -12.8842 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (234b)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (235b)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| (235d)m                                                                                              | 0.0000                    | 0.0000    | 0.0000   | 0.0000     | 0.0000                         | 0.0000                            | 0.0000    | 0.0000                             | 0.0000   | 0.0000                       | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |                           |           |          |            |                                |                                   |           |                                    |          |                              |          |                 |
| Space heating fuel - main system 1                                                                   |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 2178.8906 (211) |
| Space heating fuel - main system 2                                                                   |                           |           |          |            |                                |                                   |           |                                    |          |                              |          | 0.0000 (213)    |

# Full SAP Calculation Printout



|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Space heating fuel - secondary                                | 0.0000 (215)     |
| Efficiency of water heater                                    | 79.8000          |
| Water heating fuel used                                       | 2623.4368 (219)  |
| Space cooling fuel                                            | 0.0000 (221)     |
| Electricity for pumps and fans:                               |                  |
| Total electricity for the above, kWh/year                     | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)           | 153.1199 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -1549.0580 (233) |
| Wind generation                                               | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)     |
| Appendix Q - special features                                 |                  |
| Energy saved or generated                                     | -0.0000 (236)    |
| Energy used                                                   | 0.0000 (237)     |
| Total delivered energy for all uses                           | 3492.3893 (238)  |

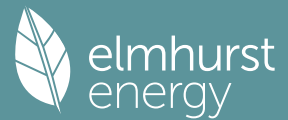
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2178.8906          | 0.2100                        | 457.5670 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2623.4368          | 0.2100                        | 550.9217 (264)           |
| Space and water heating                       |                    |                               | 1008.4887 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 153.1199           | 0.1443                        | 22.0999 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -638.5601          | 0.1345                        | -85.8842                 |
| PV Unit electricity exported                  | -910.4979          | 0.1259                        | -114.6072                |
| Total                                         |                    |                               | -200.4913 (269)          |
| Total CO2, kg/year                            |                    |                               | 842.0266 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 13.4300 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2178.8906          | 1.1300                              | 2462.1464 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2623.4368          | 1.1300                              | 2964.4835 (278)            |
| Space and water heating                     |                    |                                     | 5426.6299 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 153.1199           | 1.5338                              | 234.8604 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -638.5601          | 1.4971                              | -955.9701                  |
| PV Unit electricity exported                | -910.4979          | 0.4620                              | -420.6866                  |
| Total                                       |                    |                                     | -1376.6566 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4414.9345 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 70.4400 (287)              |

## Full SAP Calculation Printout



|                                    |                                                      |  |               |               |                |            |       |
|------------------------------------|------------------------------------------------------|--|---------------|---------------|----------------|------------|-------|
| Plot Reference                     | 3H3B                                                 |  |               |               | Issued on Date | 31/07/2026 |       |
| Assessment Reference               | 001                                                  |  |               | Plot Type Ref | Sem Br Ea Ga   |            |       |
| Plot Address                       | 3H3B, College Lane, Hurstpierpoint, West Sussex, BN6 |  |               |               | SAP Version    | 10.2       |       |
|                                    |                                                      |  |               |               |                |            |       |
| SAP Rating                         | 80 C                                                 |  | DER           | 4.59          |                | TER        | 11.78 |
| Environmental                      | 96 A                                                 |  | % DER < TER   |               |                |            | 61.04 |
| CO <sub>2</sub> Emissions (t/year) | 0.37                                                 |  | DFEE          | 38.34         |                | TFEE       | 40.07 |
| Compliance Check                   | See BREL                                             |  | % DFEE < TFEE |               |                |            | 4.32  |
| % DPER < TPER                      | 21.16                                                |  | DPER          | 48.51         |                | TPER       | 61.53 |
|                                    |                                                      |  |               |               |                |            |       |
| Assessor Details                   | Mr. Stephen Smith                                    |  |               |               | Assessor ID    | D168-0001  |       |
| Client                             | TH002, Thakeham Southern                             |  |               |               |                |            |       |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.8400 (1b)              | x 2.4400 (2b)                   | = 104.5296 (1b) - (3b)      |
| First floor                                            | 42.8400 (1c)              | x 2.6800 (2c)                   | = 114.8112 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.6800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 219.3408 (5)              |

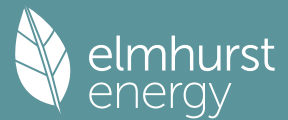
## 2. Ventilation rate

|                                                                                                         | m <sup>3</sup> per hour                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                     |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                     |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                     |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                     |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                     |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                     |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                     |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                     |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                     |
| Infiltration due to chimneys, flues and fans                                                            | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)                                                          |
| Pressure test                                                                                           | Yes                                                                                                                                      |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                              |
| Measured/design AP50                                                                                    | 4.0000 (17)                                                                                                                              |
| Infiltration rate                                                                                       | 0.2000 (18)                                                                                                                              |
| Number of sides sheltered                                                                               | 2 (19)                                                                                                                                   |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.8500 (20)                                                                                                  |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.1700 (21)                                                                                                         |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)                                                |
| Adj infilt rate                                                                                         | 0.2167 0.2125 0.2083 0.1870 0.1827 0.1615 0.1615 0.1573 0.1700 0.1827 0.1913 0.1998 (22b)                                                |
| Mechanical extract ventilation - centralised                                                            |                                                                                                                                          |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                             |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                             |
| Effective ac                                                                                            | 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                 |

## 3. Heat losses and heat loss parameter

| Element                                                         | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Opening Type 1                                                  |                         |                            | 2.1400                    | 1.3000                        | 2.7820       |                                | (26a)         |
| Opening Type 2                                                  |                         |                            | 18.1700                   | 1.2357                        | 22.4534      |                                | (27)          |
| Opening Type 3                                                  |                         |                            | 2.1500                    | 1.0000                        | 2.1500       |                                | (26)          |
| Heat Loss Floor 1                                               |                         |                            | 42.8400                   | 0.1100                        | 4.7124       |                                | (28a)         |
| Brick Faced                                                     | 96.7680                 | 22.4600                    | 74.3080                   | 0.1700                        | 12.6324      |                                | (29a)         |
| Main Roof                                                       | 42.8400                 |                            | 42.8400                   | 0.0800                        | 3.4272       |                                | (30)          |
| Total net area of external elements Aum (A, m <sup>2</sup> )    |                         |                            | 182.4480                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                             |                         |                            |                           | (26)...(30) + (32) =          | 48.1574      |                                | (33)          |
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Party Wall 1                                                    |                         |                            | 46.5400                   | 0.0000                        | 0.0000       |                                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K  |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| Thermal bridges (User defined value 0.040 * total exposed area) |                         |                            |                           |                               |              |                                | 7.2979 (36)   |
| Point Thermal bridges                                           |                         |                            |                           |                               |              | (36a) =                        | 0.0000        |
| Total fabric heat loss                                          |                         |                            |                           |                               |              | (33) + (36) + (36a) =          | 55.4553 (37)  |

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     | (38)    |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 | 36.1912 |         |
| Heat transfer coeff       | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | 91.6465 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 91.6465 |
| HLP                       | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     | (40)    |
| HLP (average)             | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  | 1.0696  |         |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |         |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.5619 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (42a)   |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |          | 29.0101 (42b)  |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |          | 40.8660 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |          | 64.0478 (43)   |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Energy conte                                                                   | 69.8761  | 67.9592  | 65.8664  | 63.2617  | 60.9381  | 58.5232  | 58.0215  | 60.1100  | 62.2520  | 64.7319  | 67.3597  | 69.7780  | (44)           |
| Energy content (annual)                                                        | 110.6666 | 96.7730  | 101.2343 | 86.6022  | 82.0343  | 71.9611  | 70.1720  | 74.4287  | 76.7630  | 87.8406  | 95.9662  | 109.2555 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |          | 1063.6974      |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 200.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          |          | 1.2200 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.6588 (55)    |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |          |                |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Primary loss                                                                   | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | (56)           |
| Combi loss                                                                     | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | (57)           |
| Total heat required for water heating calculated for each month                | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (59)           |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)           |
| PV diverter                                                                    | 154.3518 | 136.2306 | 144.9195 | 128.8782 | 125.7195 | 114.2371 | 113.8572 | 118.1139 | 119.0390 | 131.5258 | 138.2422 | 152.9407 | (62)           |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a)          |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63b)          |
| Output from w/h                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)          |
| Total per year (kWh/year)                                                      | 154.3518 | 136.2306 | 144.9195 | 128.8782 | 125.7195 | 114.2371 | 113.8572 | 118.1139 | 119.0390 | 131.5258 | 138.2422 | 152.9407 | (64)           |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          | 1578.0554 (64) |
| Heat gains from water heating, kWh/month                                       | 52.0596  | 46.3855  | 50.6512  | 48.3358  | 49.2428  | 46.9729  | 48.5386  | 49.2428  | 48.3358  | 50.6512  | 49.6988  | 52.0596  | (64a)          |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 592.1747 (64a) |
|                                                                                | 84.7597  | 75.3395  | 81.2714  | 74.7000  | 74.5353  | 69.4911  | 70.4150  | 72.0064  | 71.4284  | 76.8180  | 78.1543  | 84.2905  | (65)           |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  |      |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 116.7070  | 129.2113  | 116.7070  | 120.5972  | 116.7070  | 120.5972  | 116.7070  | 116.7070  | 120.5972  | 116.7070  | 120.5972  | 116.7070  | (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 230.9020  | 233.2980  | 227.2601  | 214.4060  | 198.1800  | 182.9299  | 172.7419  | 170.3459  | 176.3838  | 189.2379  | 205.4638  | 220.7140  | (68) |
| Pumps, fans                                                                         | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | (69) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Water heating gains (Table 5)                                                       | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | (71) |
| Total internal gains                                                                | 113.9243  | 112.1123  | 109.2357  | 103.7500  | 100.1818  | 96.5154   | 94.6438   | 96.7828   | 99.2062   | 103.2500  | 108.5476  | 113.2937  | (72) |
|                                                                                     | 522.9612  | 536.0495  | 514.6306  | 500.1811  | 476.4967  | 461.4704  | 445.5206  | 445.2636  | 457.6151  | 470.6227  | 496.0365  | 512.1425  | (73) |

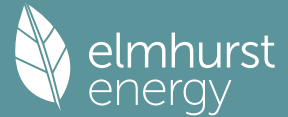
## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 4.6800     | 10.6334                        | 0.4500                            | 0.7000                             | 0.7700                       | 10.8633 (74) |          |          |               |
| East        |          |          |          | 11.5700    | 19.6403                        | 0.4500                            | 0.7000                             | 0.7700                       | 49.6049 (76) |          |          |               |
| South       |          |          |          | 1.9200     | 46.7521                        | 0.4500                            | 0.7000                             | 0.7700                       | 19.5950 (78) |          |          |               |
| Solar gains | 80.0632  | 149.8896 | 235.9631 | 335.9351   | 410.1118                       | 420.4467                          | 399.9370                           | 343.6116                     | 270.9796     | 174.4696 | 98.4795  | 66.7807 (83)  |
| Total gains | 603.0244 | 685.9391 | 750.5937 | 836.1162   | 886.6086                       | 881.9171                          | 845.4577                           | 788.8752                     | 728.5947     | 645.0923 | 594.5160 | 578.9232 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| alpha                                                                       | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 | 25.9693 |              |
|                                                                             | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  | 2.7313  |              |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| util living area       | 0.9509  | 0.9299  | 0.8963  | 0.8253  | 0.7174  | 0.5715  | 0.4417  | 0.4847  | 0.6783                    | 0.8549  | 0.9294  | 0.9557 (86)  |
| Living                 | 18.6568 | 18.9493 | 19.3936 | 19.9746 | 20.4705 | 20.7980 | 20.9270 | 20.9039 | 20.6617                   | 20.0167 | 19.2339 | 18.5851      |
| Non living             | 17.2864 | 17.6540 | 18.2103 | 18.9235 | 19.5087 | 19.8642 | 19.9832 | 19.9664 | 19.7334                   | 18.9902 | 18.0187 | 17.1961      |
| 24 / 16                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                 | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                 | 28      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 10           |
| MIT                    | 19.8013 | 18.9493 | 19.3936 | 19.9746 | 20.4705 | 20.7980 | 20.9270 | 20.9039 | 20.6617                   | 20.0167 | 19.2339 | 18.9229 (87) |
| Th 2                   | 20.0257 | 20.0257 | 20.0257 | 20.0257 | 20.0257 | 20.0257 | 20.0257 | 20.0257 | 20.0257                   | 20.0257 | 20.0257 | 20.0257 (88) |
| util rest of house     |         |         |         |         |         |         |         |         |                           |         |         |              |
| MIT                    | 0.9440  | 0.9203  | 0.8816  | 0.7999  | 0.6750  | 0.5055  | 0.3553  | 0.3973  | 0.6177                    | 0.8281  | 0.9180  | 0.9495 (89)  |
| MIT 2                  | 18.9337 | 17.6540 | 18.2103 | 18.9235 | 19.5087 | 19.8642 | 19.9832 | 19.9664 | 19.7334                   | 18.9902 | 18.0187 | 17.7060 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2190 (91)  |
| MIT                    | 19.1236 | 17.9376 | 18.4694 | 19.1537 | 19.7193 | 20.0687 | 20.1899 | 20.1717 | 19.9367                   | 19.2150 | 18.2848 | 17.9725 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 19.1236 | 17.9376 | 18.4694 | 19.1537 | 19.7193 | 20.0687 | 20.1899 | 20.1717 | 19.9367                   | 19.2150 | 18.2848 | 17.9725 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.9364    | 0.8930    | 0.8521    | 0.7732   | 0.6602   | 0.5086   | 0.3705   | 0.4111   | 0.6115   | 0.8010   | 0.8908        | 0.9319    | (94)  |
| Useful gains                                                                   | 564.6911  | 612.5171  | 639.5658  | 646.4695 | 585.3415 | 448.5763 | 313.2733 | 324.2844 | 445.5636 | 516.7312 | 529.6180      | 539.4866  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000        | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1358.5348 | 1194.8509 | 1096.9500 | 939.7131 | 734.9383 | 501.1856 | 328.9993 | 345.6606 | 534.9090 | 789.5309 | 1025.0482     | 1262.1976 | (97)  |
| Space heating kWh                                                              | 590.6197  | 391.3283  | 340.2938  | 211.1354 | 111.3000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 202.9630 | 356.7097      | 537.6970  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |               | 2742.0468 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 590.6197  | 391.3283  | 340.2938  | 211.1354 | 111.3000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 202.9630 | 356.7097      | 537.6970  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |               | 2742.0468 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          | (98c) / (4) = | 32.0033   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |          | 289.2299 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Space heating requirement                                                                                    | 590.6197 | 391.3283 | 340.2938 | 211.1354 | 111.3000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 202.9630 | 356.7097 | 537.6970 | (98)           |
| Space heating efficiency (main heating system 1)                                                             | 289.2299 | 289.2299 | 289.2299 | 289.2299 | 289.2299 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 289.2299 | 289.2299 | 289.2299 | (210)          |
| Space heating fuel (main heating system)                                                                     | 204.2042 | 135.3001 | 117.6551 | 72.9992  | 38.4815  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 70.1736  | 123.3309 | 185.9064 | (211)          |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)          |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)          |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)          |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                                                                    | 154.3518 | 136.2306 | 144.9195 | 128.8782 | 125.7195 | 114.2371 | 113.8572 | 118.1139 | 119.0390 | 131.5258 | 138.2422 | 152.9407 | (64)           |
| Efficiency of water heater (217)m                                                                            | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | 170.8307 | (216)          |
| Fuel for water heating, kWh/month                                                                            | 90.3537  | 79.7459  | 84.8322  | 75.4420  | 73.5930  | 66.8715  | 66.6491  | 69.1409  | 69.6824  | 76.9919  | 80.9235  | 89.5276  | (219)          |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)          |
| Pumps and Fa                                                                                                 | 4.7273   | 4.2698   | 4.7273   | 4.5748   | 4.7273   | 4.5748   | 4.7273   | 4.5748   | 4.7273   | 4.5748   | 4.7273   | 4.7273   | (231)          |
| Lighting                                                                                                     | 22.5642  | 18.1019  | 16.2987  | 11.9411  | 9.2237   | 7.5358   | 8.4141   | 10.9370  | 14.2061  | 18.6392  | 21.0529  | 23.1913  | (232)          |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233a)         |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a)         |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a)         |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c)         |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (233b)         |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b)         |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b)         |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d)         |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 948.0510 | (211)          |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (213)          |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (215)          |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 170.8307 |                |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 923.7538 | (219)          |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (221)          |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
| (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2080)                                             |          |          |          |          |          |          |          |          |          |          |          |          |                |
| mechanical ventilation fans (SFP = 0.2080)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 55.6599  | (230a)         |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 55.6599  | (231)          |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 182.1061 | (232)          |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| PV generation                                                                                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (233)          |
| Wind generation                                                                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (234)          |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (235a)         |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (235)          |

# Full SAP Calculation Printout



## Appendix Q - special features

|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 2701.7456 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 948.0510           | 0.1550                        | 146.9223 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 923.7538           | 0.1406                        | 129.9198 (264)           |
| Energy for instantaneous electric shower(s)     | 592.1747           | 0.1391                        | 82.3846 (264a)           |
| Space and water heating                         |                    |                               | 276.8421 (265)           |
| Pumps, fans and electric keep-hot               | 55.6599            | 0.1387                        | 7.7207 (267)             |
| Energy for lighting                             | 182.1061           | 0.1443                        | 26.2835 (268)            |
| Total CO2, kg/year                              |                    |                               | 393.2310 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.5900 (273)             |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 948.0510           | 1.5737                              | 1491.9466 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 923.7538           | 1.5200                              | 1404.1379 (278)            |
| Energy for instantaneous electric shower(s) | 592.1747           | 1.5143                              | 896.7504 (278a)            |
| Space and water heating                     |                    |                                     | 2896.0845 (279)            |
| Pumps, fans and electric keep-hot           | 55.6599            | 1.5128                              | 84.2023 (281)              |
| Energy for lighting                         | 182.1061           | 1.5338                              | 279.3205 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4156.3577 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 48.5100 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 42.8400 (1b) | x 2.4400 (2b)                     | = 104.5296 (1b) - (3b) |
| First floor                                            | 42.8400 (1c) | x 2.6800 (2c)                     | = 114.8112 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.6800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 219.3408 (5)           |

### 2. Ventilation rate

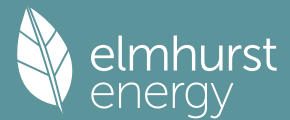
|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1368 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3868 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3288 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.4192 | 0.4109 | 0.4027 | 0.3616 | 0.3534 | 0.3123 | 0.3123 | 0.3041 | 0.3288 | 0.3534 | 0.3699 | 0.3863 (22b) |
| Effective ac    | 0.5878 | 0.5844 | 0.5811 | 0.5654 | 0.5625 | 0.5488 | 0.5488 | 0.5462 | 0.5540 | 0.5625 | 0.5684 | 0.5746 (25)  |

### 3. Heat losses and heat loss parameter

| Element              | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|----------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling        |             |                |               |                  |              |                   |               |
| TER Opaque door      |             |                | 2.1500        | 1.0000           | 2.1500       |                   | (26)          |
| TER Semi-glazed door |             |                | 2.1400        | 1.0000           | 2.1400       |                   | (26a)         |
| TER Opening Type     |             |                | 17.1300       | 1.1450           | 19.6145      |                   | (27)          |
| Heat Loss Floor 1    |             |                | 42.8400       | 0.1300           | 5.5692       |                   | (28a)         |

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|                                                |         |         |                      |        |         |       |
|------------------------------------------------|---------|---------|----------------------|--------|---------|-------|
| Brick Faced                                    | 96.7680 | 21.4200 | 75.3480              | 0.1800 | 13.5626 | (29a) |
| Main Roof                                      | 42.8400 |         | 42.8400              | 0.1100 | 4.7124  | (30)  |
| Total net area of external elements Aum(A, m2) |         |         | 182.4480             |        |         | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |         |         | (26)...(30) + (32) = |        | 47.7487 | (33)  |
| Main dwelling                                  |         |         |                      |        |         | (32)  |
| Party Wall 1                                   |         | 46.5400 | 0.0000               | 0.0000 |         |       |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

| List of Thermal Bridges                              | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           | 13.3900 | 0.0500    | 0.6695 |
| E2 Other lintels (including other steel lintels)     | 11.3600 | 0.0500    | 0.5680 |
| E3 Sill                                              | 38.6200 | 0.0500    | 1.9310 |
| E4 Jamb                                              | 19.7500 | 0.1600    | 3.1600 |
| E5 Ground floor (normal)                             | 19.7500 | 0.0000    | 0.0000 |
| E6 Intermediate floor within a dwelling              | 10.0100 | 0.0600    | 0.6006 |
| E10 Eaves (insulation at ceiling level)              | 9.9000  | 0.0600    | 0.5940 |
| E12 Gable (insulation at ceiling level)              | 20.4800 | 0.0900    | 1.8432 |
| E16 Corner (normal)                                  | 10.2400 | 0.0600    | 0.6144 |
| E25 Staggered party wall between dwellings           | 9.0000  | 0.0800    | 0.7200 |
| P1 Party wall - Ground floor                         | 9.0000  | 0.0000    | 0.0000 |
| P2 Party wall - Intermediate floor within a dwelling | 9.0000  | 0.1200    | 1.0800 |
| P4 Party wall - Roof (insulation at ceiling level)   |         |           |        |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.7807 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 59.5294 (37)

| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug     | Sep     | Oct      | Nov      | Dec      |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|
| (38)m                                                               | 42.5500  | 42.3031  | 42.0611  | 40.9243  | 40.7116  | 39.7215 | 39.7215 | 39.5381 | 40.1028 | 40.7116  | 41.1419  | 41.5917  | (38) |
| Heat transfer coeff                                                 | 102.0795 | 101.8326 | 101.5905 | 100.4537 | 100.2410 | 99.2509 | 99.2509 | 99.0675 | 99.6323 | 100.2410 | 100.6713 | 101.1211 | (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |         |         |         |         |          |          | 100.4527 |      |

| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP (average) | 1.1914 | 1.1885 | 1.1857 | 1.1724 | 1.1699 | 1.1584 | 1.1584 | 1.1563 | 1.1628 | 1.1699 | 1.1750 | 1.1802 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

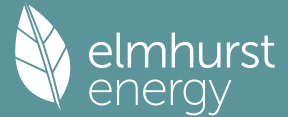
## 4. Water heating energy requirements (kWh/year)

| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5619 (42) |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Hot water usage for mixer showers                                              | 67.1737  | 66.1642  | 64.6931  | 61.8786  | 59.8015  | 57.4852  | 56.1686  | 57.6285  | 59.2288  | 61.7159  | 64.5908  | 66.9163   | (42a)       |
| Hot water usage for baths                                                      | 29.0101  | 28.5793  | 27.9725  | 26.8539  | 26.0162  | 25.0874  | 24.5857  | 25.1882  | 25.8441  | 26.8380  | 27.9797  | 28.9120   | (42b)       |
| Hot water usage for other uses                                                 | 40.8660  | 39.3799  | 37.8939  | 36.4079  | 34.9218  | 33.4358  | 33.4358  | 34.9218  | 36.4079  | 37.8939  | 39.3799  | 40.8660   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 125.9797  | (43)        |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |             |
| Energy conte                                                                   | 137.0497 | 134.1234 | 130.5596 | 125.1403 | 120.7396 | 116.0084 | 114.1901 | 117.7385 | 121.4809 | 126.4478 | 131.9505 | 136.6943  | (44)        |
| Energy content (annual)                                                        | 217.0533 | 190.9899 | 200.6652 | 171.3109 | 162.5387 | 142.6459 | 138.1031 | 145.7849 | 149.7980 | 171.5884 | 187.9877 | 214.0302  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          | 2092.4962 |             |
| Water storage loss (or HIU loss):                                              | 32.5580  | 28.6485  | 30.0998  | 25.6966  | 24.3808  | 21.3969  | 20.7155  | 21.8677  | 22.4697  | 25.7383  | 28.1982  | 32.1045   | (46)        |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 200.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.6525    | (48)        |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.8924    | (55)        |
| Total storage loss                                                             | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637   | (56)        |
| If cylinder contains dedicated solar storage                                   | 27.6637  | 24.9865  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637  | 27.6637  | 26.7713  | 27.6637  | 26.7713  | 27.6637   | (57)        |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624   | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                | 267.9793 | 236.9876 | 251.5913 | 220.5942 | 213.4648 | 191.9292 | 189.0291 | 196.7110 | 199.0813 | 222.5145 | 237.2710 | 264.9563  | (62)        |
| WWHRS                                                                          | -30.7090 | -27.1593 | -28.4396 | -23.5491 | -21.9470 | -18.7802 | -17.6034 | -18.7195 | -19.4307 | -22.9066 | -25.9504 | -30.1403  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.2703 | 209.8283 | 223.1517 | 197.0450 | 191.5178 | 173.1490 | 171.4257 | 177.9915 | 179.6507 | 199.6079 | 211.3206 | 234.8160  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2406.7745 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 112.9111 | 100.3023 | 107.4620 | 96.3875  | 94.7850  | 86.8564  | 86.6601  | 89.2143  | 89.2345  | 97.7940  | 101.9325 | 111.9059  | (65)        |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m                                                                               | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | 128.0928  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 117.2882  | 129.8548  | 117.2882  | 121.1978  | 117.2882  | 121.1978  | 117.2882  | 117.2882  | 121.1978  | 117.2882  | 121.1978  | 117.2882  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 230.9020  | 233.2980  | 227.2601  | 214.4060  | 198.1800  | 182.9299  | 172.7419  | 170.3459  | 176.3838  | 189.2379  | 205.4638  | 220.7140  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | 35.8093   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | -102.4743 | (71) |
| Water heating gains (Table 5)                                                       | 151.7622  | 149.2594  | 144.4382  | 133.8715  | 127.3992  | 120.6339  | 116.4787  | 119.9117  | 123.9368  | 131.4436  | 141.5730  | 150.4112  | (72) |
| Total internal gains                                                                | 564.3802  | 576.8401  | 553.4143  | 533.9032  | 507.2953  | 486.1895  | 467.9366  | 468.9737  | 482.9463  | 502.3975  | 532.6625  | 552.8412  | (73) |

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## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 4.4100     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 14.3312 (74) |          |          |               |
| East        |          |          |          | 10.9100    | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 65.4853 (76) |          |          |               |
| South       |          |          |          | 1.8100     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 25.8614 (78) |          |          |               |
| Solar gains | 105.6778 | 197.8450 | 311.4577 | 443.4134   | 541.3184                       | 554.9576                          | 527.8873                           | 453.5446                     | 357.6772     | 230.2896 | 129.9864 | 88.1457 (83)  |
| Total gains | 670.0580 | 774.6851 | 864.8721 | 977.3166   | 1048.6136                      | 1041.1470                         | 995.8239                           | 922.5183                     | 840.6235     | 732.6871 | 662.6489 | 640.9869 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 23.3152 | 23.3717 | 23.4274 | 23.6925 | 23.7428 | 23.9796 | 23.9796 | 24.0240 | 23.8878                   | 23.7428 | 23.6413 | 23.5361      |
| alpha                                                                       | 2.5543  | 2.5581  | 2.5618  | 2.5795  | 2.5829  | 2.5986  | 2.5986  | 2.6016  | 2.5925                    | 2.5829  | 2.5761  | 2.5691       |
| util living area                                                            | 0.9420  | 0.9167  | 0.8758  | 0.7940  | 0.6773  | 0.5308  | 0.4081  | 0.4507  | 0.6459                    | 0.8334  | 0.9176  | 0.9475 (86)  |
| MIT                                                                         | 18.4811 | 18.8173 | 19.3177 | 19.9620 | 20.4752 | 20.8042 | 20.9280 | 20.9051 | 20.6575                   | 19.9791 | 19.1328 | 18.4291 (87) |
| Th 2                                                                        | 19.9269 | 19.9292 | 19.9315 | 19.9421 | 19.9441 | 19.9534 | 19.9534 | 19.9552 | 19.9498                   | 19.9441 | 19.9401 | 19.9359 (88) |
| util rest of house                                                          | 0.9337  | 0.9051  | 0.8582  | 0.7646  | 0.6308  | 0.4626  | 0.3211  | 0.3619  | 0.5809                    | 0.8027  | 0.9040  | 0.9399 (89)  |
| MIT 2                                                                       | 17.0077 | 17.4298 | 18.0542 | 18.8451 | 19.4438 | 19.8020 | 19.9135 | 19.8992 | 19.6625                   | 18.8869 | 17.8401 | 16.9474 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2190 (91)  |
| MIT                                                                         | 17.3303 | 17.7336 | 18.3309 | 19.0897 | 19.6697 | 20.0215 | 20.1357 | 20.1195 | 19.8803                   | 19.1261 | 18.1231 | 17.2718 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 17.3303 | 17.7336 | 18.3309 | 19.0897 | 19.6697 | 20.0215 | 20.1357 | 20.1195 | 19.8803                   | 19.1261 | 18.1231 | 17.2718 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9056    | 0.8734    | 0.8252    | 0.7371    | 0.6175   | 0.4673   | 0.3368   | 0.3766   | 0.5762   | 0.7739        | 0.8732    | 0.9132 (94)    |
| Useful gains                                                                   | 606.8314  | 676.6404  | 713.6588  | 720.3698  | 647.5364 | 486.5124 | 335.4402 | 347.3767 | 484.3445 | 567.0110      | 578.6294  | 585.3586 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1330.1279 | 1306.8735 | 1201.9025 | 1023.5904 | 798.8882 | 538.0844 | 350.9174 | 368.4780 | 575.9088 | 854.6613      | 1109.7127 | 1321.8388 (97) |
| Space heating kWh                                                              | 538.1326  | 423.5166  | 363.2533  | 218.3188  | 112.6057 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 214.0118      | 382.3800  | 547.9413 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2800.1602      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 538.1326  | 423.5166  | 363.2533  | 218.3188  | 112.6057 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 214.0118      | 382.3800  | 547.9413 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2800.1602      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.6816 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |           |           |           |           |           |           |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |           |           |           |           |           |           |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |           |           |           |           |           |           |          |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 538.1326 | 423.5166 | 363.2533 | 218.3188  | 112.6057  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 214.0118 | 382.3800 | 547.9413 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 92.3000  | 92.3000  | 92.3000  | 92.3000   | 92.3000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 92.3000  | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                                                     | 583.0256 | 458.8479 | 393.5572 | 236.5318  | 121.9997  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 231.8654 | 414.2795 | 593.6525 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |           |           |           |           |           |           |          |          |                 |
| Water heating requirement                                                                                    | 237.2703 | 209.8283 | 223.1517 | 197.0450  | 191.5178  | 173.1490  | 171.4257  | 177.9915  | 179.6507  | 199.6079 | 211.3206 | 234.8160 (64)   |
| Efficiency of water heater (217)m                                                                            | 85.8377  | 85.6015  | 85.1457  | 84.2902   | 82.9114   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.2163  | 85.3728  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 276.4175 | 245.1222 | 262.0821 | 233.7697  | 230.9910  | 216.9787  | 214.8192  | 223.0470  | 225.1261  | 237.0180 | 247.5267 | 273.3789 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                                                     | 24.3702  | 19.5507  | 17.6032  | 12.8969   | 9.9619    | 8.1390    | 9.0876    | 11.8124   | 15.3431   | 20.1310  | 22.7379  | 25.0475 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -39.7127 | -55.8020 | -79.9505 | -89.5925  | -96.3506  | -89.8272  | -88.6927  | -83.8368  | -75.2558  | -63.6370 | -43.5835 | -34.3537 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -23.0135 | -48.3440 | -95.9673 | -143.9725 | -190.2209 | -191.0889 | -188.8628 | -159.9991 | -117.3778 | -69.1103 | -30.7163 | -18.2058 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)         |          |          |          |           |           |           |           |           |           |          |          |                 |

# Full SAP Calculation Printout



|                                                               |        |        |        |        |        |        |        |        |        |        |        |            |        |
|---------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
| (235d)m                                                       | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000     | (235d) |
| Annual totals kWh/year                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Space heating fuel - main system 1                            |        |        |        |        |        |        |        |        |        |        |        | 3033.7597  | (211)  |
| Space heating fuel - main system 2                            |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (215)  |
| Efficiency of water heater                                    |        |        |        |        |        |        |        |        |        |        |        | 79.8000    |        |
| Water heating fuel used                                       |        |        |        |        |        |        |        |        |        |        |        | 2886.2772  | (219)  |
| Space cooling fuel                                            |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (221)  |
| Electricity for pumps and fans:                               |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Total electricity for the above, kWh/year                     |        |        |        |        |        |        |        |        |        |        |        | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)           |        |        |        |        |        |        |        |        |        |        |        | 196.6812   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |        |        |        |        |        |        |        |        |        |        |        |            |        |
| PV generation                                                 |        |        |        |        |        |        |        |        |        |        |        | -2117.4743 | (233)  |
| Wind generation                                               |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                        |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235)  |
| Appendix Q - special features                                 |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Energy saved or generated                                     |        |        |        |        |        |        |        |        |        |        |        | -0.0000    | (236)  |
| Energy used                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (237)  |
| Total delivered energy for all uses                           |        |        |        |        |        |        |        |        |        |        |        | 4085.2439  | (238)  |

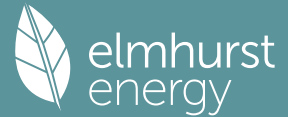
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3033.7597          | 0.2100                        | 637.0895 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2886.2772          | 0.2100                        | 606.1182 (264)           |
| Space and water heating                       |                    |                               | 1243.2078 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 196.6812           | 0.1443                        | 28.3872 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -840.5951          | 0.1347                        | -113.1944                |
| PV Unit electricity exported                  | -1276.8792         | 0.1259                        | -160.7937                |
| Total                                         |                    |                               | -273.9881 (269)          |
| Total CO2, kg/year                            |                    |                               | 1009.5361 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.7800 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3033.7597          | 1.1300                              | 3428.1485 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2886.2772          | 1.1300                              | 3261.4933 (278)            |
| Space and water heating                     |                    |                                     | 6689.6418 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 196.6812           | 1.5338                              | 301.6762 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -840.5951          | 1.4977                              | -1258.9459                 |
| PV Unit electricity exported                | -1276.8792         | 0.4622                              | -590.2250                  |
| Total                                       |                    |                                     | -1849.1709 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5272.2479 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 61.5300 (287)              |

## Full SAP Calculation Printout



|                                    |                                                      |               |                 |                |            |
|------------------------------------|------------------------------------------------------|---------------|-----------------|----------------|------------|
| Plot Reference                     | 4H2B                                                 |               |                 | Issued on Date | 31/07/2026 |
| Assessment Reference               | 001                                                  | Plot Type Ref | Sem Br Th Ea Ga |                |            |
| Plot Address                       | 4H2B, College Lane, Hurstpierpoint, West Sussex, BN6 |               |                 | SAP Version    | 10.2       |
|                                    |                                                      |               |                 |                |            |
| SAP Rating                         | 80 C                                                 | DER           | 4.60            | TER            | 11.52      |
| Environmental                      | 96 A                                                 | % DER < TER   |                 |                | 60.07      |
| CO <sub>2</sub> Emissions (t/year) | 0.42                                                 | DFEE          | 41.43           | TFEE           | 41.57      |
| Compliance Check                   | See BREL                                             | % DFEE < TFEE |                 |                | 0.34       |
| % DPER < TPER                      | 19.41                                                | DPER          | 48.49           | TPER           | 60.17      |
|                                    |                                                      |               |                 |                |            |
| Assessor Details                   | Mr. Stephen Smith                                    |               |                 | Assessor ID    | D168-0001  |
| Client                             | TH002, Thakeham Southern                             |               |                 |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 48.1100 (1b)              | x 2.4400 (2b)                   | = 117.3884 (1b) - (3b)      |
| First floor                                            | 48.1100 (1c)              | x 2.6800 (2c)                   | = 128.9348 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 96.2200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 246.3232 (5)              |

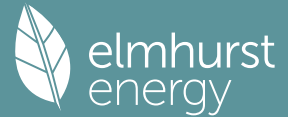
## 2. Ventilation rate

|                                                                                                         | m <sup>3</sup> per hour                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                     |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                     |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                     |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                     |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                     |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                     |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                     |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                     |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                     |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 0.0000 / (5) = 0.0000 (8)                                                                                                                |
| Pressure test                                                                                           | Yes                                                                                                                                      |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                              |
| Measured/design AP50                                                                                    | 4.0000 (17)                                                                                                                              |
| Infiltration rate                                                                                       | 0.2000 (18)                                                                                                                              |
| Number of sides sheltered                                                                               | 2 (19)                                                                                                                                   |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.8500 (20)                                                                                                  |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.1700 (21)                                                                                                         |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)                                                |
| Adj infilt rate                                                                                         | 0.2167 0.2125 0.2083 0.1870 0.1827 0.1615 0.1615 0.1573 0.1700 0.1827 0.1913 0.1998 (22b)                                                |
| Mechanical extract ventilation - centralised                                                            |                                                                                                                                          |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                             |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                             |
| Effective ac                                                                                            | 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                 |

## 3. Heat losses and heat loss parameter

| Element                                                         | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Main dwelling                                                   |                         |                            |                           |                               |              |                                |               |
| Opening Type 2                                                  |                         |                            | 22.1600                   | 1.2357                        | 27.3840      |                                | (27)          |
| Opening Type 3                                                  |                         |                            | 2.1600                    | 1.0000                        | 2.1600       |                                | (26)          |
| Heat Loss Floor 1                                               |                         |                            | 48.1100                   | 0.1100                        | 5.2921       |                                | (28a)         |
| Brick Faced                                                     | 96.1972                 | 14.8700                    | 81.3272                   | 0.1700                        | 13.8256      |                                | (29a)         |
| Tile Hung                                                       | 55.1500                 | 9.4500                     | 45.7000                   | 0.1700                        | 7.7690       |                                | (29a)         |
| Main Roof                                                       | 52.3600                 |                            | 52.3600                   | 0.0800                        | 4.1888       |                                | (30)          |
| Bay Roof                                                        | 2.3000                  |                            | 2.3000                    | 0.1900                        | 0.4370       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )     |                         |                            | 254.1172                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                             |                         |                            | (26)...(30) + (32) =      |                               | 61.0566      |                                | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K  |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| Thermal bridges (User defined value 0.040 * total exposed area) |                         |                            |                           |                               |              |                                | 10.1647 (36)  |
| Point Thermal bridges                                           |                         |                            |                           |                               |              | (36a) =                        | 0.0000        |
| Total fabric heat loss                                          |                         |                            |                           |                               |              | (33) + (36) + (36a) =          | 71.2212 (37)  |

# Full SAP Calculation Printout



Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | 40.6433  | (38) |
| Heat transfer coeff       | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | 111.8646 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 111.8646 |      |
| HLP                       | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | 1.1626   | (40) |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1626   |      |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.7017 (42) |
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (42a)       |
| Hot water usage for baths                                                      | 30.0182  | 29.5724  | 28.9446  | 27.7870  | 26.9203  | 25.9592  | 25.4401  | 26.0635  | 26.7422  | 27.7706                                | 28.9520  | 29.9167   | (42b)       |
| Hot water usage for other uses                                                 | 42.2978  | 40.7597  | 39.2216  | 37.6835  | 36.1454  | 34.6073  | 34.6073  | 36.1454  | 37.6835  | 39.2216                                | 40.7597  | 42.2978   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 66.2841   | (43)        |
| Daily hot water use                                                            | 72.3160  | 70.3321  | 68.1662  | 65.4705  | 63.0657  | 60.5665  | 60.0473  | 62.2088  | 64.4257  | 66.9922                                | 69.7117  | 72.2145   | (44)        |
| Energy conte                                                                   | 114.5309 | 100.1519 | 104.7689 | 89.6259  | 84.8985  | 74.4735  | 72.6221  | 77.0276  | 79.4434  | 90.9078                                | 99.3171  | 113.0705  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1100.8380 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 17.1796  | 15.0228  | 15.7153  | 13.4439  | 12.7348  | 11.1710  | 10.8933  | 11.5541  | 11.9165  | 13.6362                                | 14.8976  | 16.9606   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |          | 200.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                                        |          | 1.2200    | (48)        |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |          | 0.6588    | (55)        |
| Total storage loss                                                             | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228                                | 19.7640  | 20.4228   | (56)        |
| If cylinder contains dedicated solar storage                                   | 20.4228  | 18.4464  | 20.4228  | 19.7640  | 20.4228  | 19.7640  | 20.4228  | 20.4228  | 19.7640  | 20.4228                                | 19.7640  | 20.4228   | (57)        |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624   | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                | 158.2161 | 139.6095 | 148.4541 | 131.9019 | 128.5837 | 116.7495 | 116.3073 | 120.7128 | 121.7194 | 134.5930                               | 141.5931 | 156.7557  | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 158.2161 | 139.6095 | 148.4541 | 131.9019 | 128.5837 | 116.7495 | 116.3073 | 120.7128 | 121.7194 | 134.5930                               | 141.5931 | 156.7557  | (64)        |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 1615.1960 | (64)        |
| Electric shower(s)                                                             | 53.8764  | 48.0043  | 52.4188  | 50.0227  | 50.9613  | 48.6122  | 50.2326  | 50.9613  | 50.0227  | 52.4188                                | 51.4332  | 53.8764   | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                                        |          | 612.8406  | (64a)       |
| Heat gains from water heating, kWh/month                                       | 86.4988  | 76.8677  | 82.8885  | 76.1271  | 75.9172  | 70.7363  | 71.6531  | 73.3002  | 72.7414  | 78.2797                                | 79.7020  | 86.0132   | (65)        |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | 135.0835  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 126.1306  | 139.6446  | 126.1306  | 130.3350  | 126.1306  | 130.3350  | 126.1306  | 126.1306  | 130.3350  | 126.1306  | 130.3350  | 126.1306  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 250.0680  | 252.6630  | 246.1238  | 232.2028  | 214.6300  | 198.1141  | 187.0804  | 184.4855  | 191.0246  | 204.9456  | 222.5184  | 239.0344  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | 36.5083   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | -108.0668 | (71) |
| Water heating gains (Table 5)                                                       | 116.2618  | 114.3864  | 111.4093  | 105.7320  | 102.0393  | 98.2449   | 96.3080   | 98.5217   | 101.0297  | 105.2147  | 110.6973  | 115.6091  | (72) |
| Total internal gains                                                                | 555.9855  | 570.2190  | 547.1888  | 531.7949  | 506.3250  | 490.2190  | 473.0441  | 472.6629  | 485.9143  | 499.8160  | 527.0757  | 544.2992  | (73) |

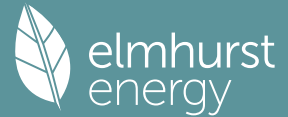
## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |          |          |          |      |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|----------|----------|----------|------|
| North       |          |          |          | 8.8400     | 10.6334                        | 0.4500                            | 0.7000                             | 0.7700                       | 20.5196 (74)  |          |          |          |      |
| East        |          |          |          | 0.9000     | 19.6403                        | 0.4500                            | 0.7000                             | 0.7700                       | 3.8586 (76)   |          |          |          |      |
| South       |          |          |          | 10.9100    | 46.7521                        | 0.4500                            | 0.7000                             | 0.7700                       | 111.3446 (78) |          |          |          |      |
| West        |          |          |          | 1.5100     | 19.6403                        | 0.4500                            | 0.7000                             | 0.7700                       | 6.4739 (80)   |          |          |          |      |
| Solar gains | 142.1968 | 241.7804 | 332.2079 | 418.1132   | 477.2548                       | 478.5363                          | 459.3313                           | 413.9541                     | 361.4810      | 267.3488 | 170.1784 | 121.8151 | (83) |
| Total gains | 698.1822 | 811.9995 | 879.3967 | 949.9080   | 983.5798                       | 968.7552                          | 932.3754                           | 886.6169                     | 847.3953      | 767.1648 | 697.2541 | 666.1143 | (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 | 23.8930 |              |
| alpha                                                                       | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  | 2.5929  |              |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| util living area       | 0.9497  | 0.9262  | 0.8947  | 0.8346  | 0.7416  | 0.6062  | 0.4750  | 0.5112  | 0.6872                    | 0.8509  | 0.9270  | 0.9551 (86)  |
| Living                 | 18.4572 | 18.7865 | 19.2376 | 19.8167 | 20.3439 | 20.7284 | 20.8960 | 20.8705 | 20.6001                   | 19.9225 | 19.0828 | 18.3768      |
| Non living             | 16.9914 | 17.4048 | 17.9696 | 18.6834 | 19.3109 | 19.7341 | 19.8907 | 19.8717 | 19.6087                   | 18.8262 | 17.7849 | 16.8902      |
| 24 / 16                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 24 / 9                 | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0            |
| 16 / 9                 | 28      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 10           |
| MIT                    | 19.6992 | 18.7865 | 19.2376 | 19.8167 | 20.3439 | 20.7284 | 20.8960 | 20.8705 | 20.6001                   | 19.9225 | 19.0828 | 18.7437 (87) |
| Th 2                   | 19.9500 | 19.9500 | 19.9500 | 19.9500 | 19.9500 | 19.9500 | 19.9500 | 19.9500 | 19.9500                   | 19.9500 | 19.9500 | 19.9500 (88) |
| util rest of house     | 0.9424  | 0.9157  | 0.8792  | 0.8088  | 0.6983  | 0.5355  | 0.3784  | 0.4153  | 0.6235                    | 0.8224  | 0.9148  | 0.9485 (89)  |
| MIT 2                  | 18.7705 | 17.4048 | 17.9696 | 18.6834 | 19.3109 | 19.7341 | 19.8907 | 19.8717 | 19.6087                   | 18.8262 | 17.7849 | 17.4416 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2297 (91)  |
| MIT                    | 18.9838 | 17.7221 | 18.2609 | 18.9437 | 19.5482 | 19.9625 | 20.1216 | 20.1011 | 19.8364                   | 19.0780 | 18.0830 | 17.7407 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 18.9838 | 17.7221 | 18.2609 | 18.9437 | 19.5482 | 19.9625 | 20.1216 | 20.1011 | 19.8364                   | 19.0780 | 18.0830 | 17.7407 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9344    | 0.8860    | 0.8474    | 0.7792    | 0.6796   | 0.5364   | 0.3951   | 0.4300   | 0.6158   | 0.7932        | 0.8855    | 0.9298    | (94)  |
| Useful gains                                                                   | 652.3945  | 719.4306  | 745.2423  | 740.1720  | 668.3946 | 519.6084 | 368.4167 | 381.2581 | 521.7964 | 608.5264      | 617.4068  | 619.3258  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1642.6000 | 1434.3439 | 1315.6235 | 1123.5317 | 877.9353 | 599.8703 | 393.9401 | 414.0218 | 641.6982 | 948.3888      | 1228.6061 | 1514.7201 | (97)  |
| Space heating kWh                                                              | 736.7129  | 480.4218  | 424.3636  | 276.0189  | 155.8982 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 252.8576      | 440.0635  | 666.1733  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3432.5100 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 736.7129  | 480.4218  | 424.3636  | 276.0189  | 155.8982 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 252.8576      | 440.0635  | 666.1733  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3432.5100 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 35.6736   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 285.8771  | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                                                            | 736.7129 | 480.4218 | 424.3636 | 276.0189 | 155.8982 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 252.8576 | 440.0635 | 666.1733  | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 285.8771 | 285.8771 | 285.8771 | 285.8771 | 285.8771 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 285.8771 | 285.8771 | 285.8771  | (210)  |
| Space heating fuel (main heating system)                                                             | 257.7027 | 168.0518 | 148.4427 | 96.5516  | 54.5333  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.4498  | 153.9345 | 233.0279  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 158.2161 | 139.6095 | 148.4541 | 131.9019 | 128.5837 | 116.7495 | 116.3073 | 120.7128 | 121.7194 | 134.5930 | 141.5931 | 156.7557  | (64)   |
| Efficiency of water heater (217)m                                                                    | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876 | 169.8876  | (216)  |
| Fuel for water heating, kWh/month                                                                    | 93.1298  | 82.1776  | 87.3837  | 77.6407  | 75.6875  | 68.7216  | 68.4613  | 71.0545  | 71.6470  | 79.2248  | 83.3452  | 92.2702   | (219)  |
| Space cooling fuel requirement (221)m                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 4.9770   | 4.4954   | 4.9770   | 4.8165   | 4.9770   | 4.8165   | 4.9770   | 4.9770   | 4.8165   | 4.9770   | 4.8165   | 4.9770    | (231)  |
| Lighting                                                                                             | 25.4463  | 20.4140  | 18.3805  | 13.4664  | 10.4018  | 8.4984   | 9.4889   | 12.3340  | 16.0206  | 21.0199  | 23.7420  | 26.1535   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1200.6942 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 169.8876  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 950.7440  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)     |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.1950)                                                           |          |          |          |          |          |          |          |          |          |          |          | 58.6003   | (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 58.6003   | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 205.3663  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |

# Full SAP Calculation Printout



## Appendix Q - special features

|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3028.2453 (238) |

### 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 1200.6942          | 0.1548                        | 185.8677 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 950.7440           | 0.1407                        | 133.7362 (264)           |
| Energy for instantaneous electric shower(s)     | 612.8406           | 0.1391                        | 85.2597 (264a)           |
| Space and water heating                         |                    |                               | 319.6039 (265)           |
| Pumps, fans and electric keep-hot               | 58.6003            | 0.1387                        | 8.1286 (267)             |
| Energy for lighting                             | 205.3663           | 0.1443                        | 29.6407 (268)            |
| Total CO2, kg/year                              |                    |                               | 442.6328 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.6000 (273)             |

### 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1200.6942          | 1.5731                              | 1888.7544 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 950.7440           | 1.5201                              | 1445.2403 (278)            |
| Energy for instantaneous electric shower(s) | 612.8406           | 1.5143                              | 928.0454 (278a)            |
| Space and water heating                     |                    |                                     | 3333.9947 (279)            |
| Pumps, fans and electric keep-hot           | 58.6003            | 1.5128                              | 88.6505 (281)              |
| Energy for lighting                         | 205.3663           | 1.5338                              | 314.9977 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4665.6883 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 48.4900 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 48.1100 (1b) | x 2.4400 (2b)                   | = 117.3884 (1b) - (3b) |
| First floor                                            | 48.1100 (1c) | x 2.6800 (2c)                   | = 128.9348 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 96.2200      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 246.3232 (5)         |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1218 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3718 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3160 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.4029 | 0.3950 | 0.3871 | 0.3476 | 0.3397 | 0.3002 | 0.3002 | 0.2923 | 0.3160 | 0.3397 | 0.3555 | 0.3713 (22b) |
| Effective ac    | 0.5812 | 0.5780 | 0.5749 | 0.5604 | 0.5577 | 0.5451 | 0.5451 | 0.5427 | 0.5499 | 0.5577 | 0.5632 | 0.5689 (25)  |

### 3. Heat losses and heat loss parameter

| Element           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|-------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling     |             |                |               |                  |              |                   |               |
| TER Opaque door   |             |                | 2.1600        | 1.0000           | 2.1600       |                   | (26)          |
| TER Opening Type  |             |                | 21.8700       | 1.1450           | 25.0420      |                   | (27)          |
| Heat Loss Floor 1 |             |                | 48.1100       | 0.1300           | 6.2543       |                   | (28a)         |
| Brick Faced       | 96.1972     | 14.7100        | 81.4872       | 0.1800           | 14.6677      |                   | (29a)         |

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|                                                |         |        |                      |        |         |       |
|------------------------------------------------|---------|--------|----------------------|--------|---------|-------|
| Tile Hung                                      | 55.1500 | 9.3200 | 45.8300              | 0.1800 | 8.2494  | (29a) |
| Main Roof                                      | 52.3600 |        | 52.3600              | 0.1100 | 5.7596  | (30)  |
| Bay Roof                                       | 2.3000  |        | 2.3000               | 0.1100 | 0.2530  | (30)  |
| Total net area of external elements Aum(A, m2) |         |        | 254.1172             |        |         | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |         |        | (26)...(30) + (32) = |        | 62.3860 | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

|                                                                  |         |           |         |  |  |  |
|------------------------------------------------------------------|---------|-----------|---------|--|--|--|
| List of Thermal Bridges                                          |         |           |         |  |  |  |
| K1 Element                                                       | Length  | Psi-value | Total   |  |  |  |
| E1 Steel lintel with perforated steel base plate                 | 15.6500 | 0.0500    | 0.7825  |  |  |  |
| E3 Sill                                                          | 14.6400 | 0.0500    | 0.7320  |  |  |  |
| E4 Jamb                                                          | 35.3300 | 0.0500    | 1.7665  |  |  |  |
| E5 Ground floor (normal)                                         | 22.2700 | 0.1600    | 3.5632  |  |  |  |
| E6 Intermediate floor within a dwelling                          | 20.5800 | 0.0000    | 0.0000  |  |  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.0700  | 0.0600    | 0.5442  |  |  |  |
| E12 Gable (insulation at ceiling level)                          | 11.6000 | 0.0600    | 0.6960  |  |  |  |
| E14 Flat roof                                                    | 4.3600  | 0.0800    | 0.3488  |  |  |  |
| E16 Corner (normal)                                              | 11.4400 | 0.0900    | 1.0296  |  |  |  |
| E17 Corner (inverted - internal area greater than external area) | 1.2000  | -0.0900   | -0.1080 |  |  |  |
| E18 Party wall between dwellings                                 | 10.2400 | 0.0600    | 0.6144  |  |  |  |
| P1 Party wall - Ground floor                                     | 9.0500  | 0.0800    | 0.7240  |  |  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 9.0500  | 0.0000    | 0.0000  |  |  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 9.0500  | 0.1200    | 1.0860  |  |  |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.7792 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 74.1652 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|                           | 47.2418  | 46.9856  | 46.7345  | 45.5548  | 45.3341  | 44.3066  | 44.3066  | 44.1164  | 44.7024  | 45.3341  | 45.7806  | 46.2474  | (38) |
| Heat transfer coeff       | 121.4070 | 121.1508 | 120.8996 | 119.7200 | 119.4993 | 118.4718 | 118.4718 | 118.2815 | 118.8676 | 119.4993 | 119.9458 | 120.4125 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 119.7189 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|               | 1.2618 | 1.2591 | 1.2565 | 1.2442 | 1.2419 | 1.2313 | 1.2313 | 1.2293 | 1.2354 | 1.2419 | 1.2466 | 1.2514 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.2442 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7017 (42)

Hot water usage for mixer showers 69.5179 68.4732 66.9508 64.0381 61.8885 59.4914 58.1288 59.6397 61.2958 63.8696 66.8450 69.2515 (42a)

Hot water usage for baths 30.0182 29.5724 28.9446 27.7870 26.9203 25.9592 25.4401 26.0635 26.7422 27.7706 28.9520 29.9167 (42b)

Hot water usage for other uses 42.2978 40.7597 39.2216 37.6835 36.1454 34.6073 34.6073 36.1454 37.6835 39.2216 40.7597 42.2978 (42c)

Average daily hot water use (litres/day) 130.3773 (43)

|                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
|                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Daily hot water use | 141.8339 | 138.8053 | 135.1170 | 129.5086 | 124.9542 | 120.0578 | 118.1762 | 121.8485 | 125.7215 | 130.8619 | 136.5567 | 141.4661 | (44) |

Energy conte 224.6302 197.6568 207.6698 177.2908 168.2124 147.6251 142.9238 150.8739 155.0272 177.5783 194.5500 221.5017 (45)

Energy content (annual) Total = Sum(45)m = 2165.5400

Distribution loss (46)m = 0.15 x (45)m 33.6945 29.6485 31.1505 26.5936 25.2319 22.1438 21.4386 22.6311 23.2541 26.6367 29.1825 33.2252 (46)

Water storage loss (or HIU loss): 200.0000 (47)

Store volume 1.6525 (48)

a) If manufacturer declared loss factor is known (kWh/day): 0.5400 (49)

Temperature factor from Table 2b 0.8924 (55)

Enter (49) or (54) in (55)

Total storage loss 27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 (56)

If cylinder contains dedicated solar storage 27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 275.5563 243.6546 258.5959 226.5741 219.1384 196.9084 193.8499 201.8000 204.3105 228.5044 243.8333 272.4277 (62)

WWHRS -31.7807 -28.1071 -29.4321 -24.3710 -22.7129 -19.4356 -18.2177 -19.3727 -20.1088 -23.7060 -26.8561 -31.1921 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 243.7756 215.5475 229.1637 202.2031 196.4256 177.4729 175.6322 182.4272 184.2017 204.7984 216.9773 241.2356 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2469.8607 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 115.4304 102.5191 109.7911 98.3758 96.6715 88.5120 88.2630 90.9064 90.9732 99.7856 104.1145 114.3902 (65)

## 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

(66)m 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 135.0835 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 126.1048 139.6160 126.1048 130.3083 126.1048 130.3083 126.1048 126.1048 130.3083 126.1048 130.3083 126.1048 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 250.0680 252.6630 246.1238 232.2028 214.6300 198.1141 187.0804 184.4855 191.0246 204.9456 222.5184 239.0344 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 36.5083 (69)

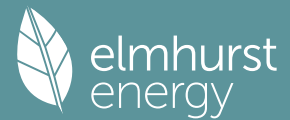
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5) -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 -108.0668 (71)

Water heating gains (Table 5) 155.1484 152.5582 147.5686 136.6331 129.9348 122.9333 118.6331 122.1861 126.3517 134.1205 144.6035 153.7502 (72)

Total internal gains 597.8463 611.3622 586.3223 565.6693 537.1947 514.8808 495.3434 496.3014 511.2096 531.6960 563.9553 585.4144 (73)

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## 6. Solar gains

| [Jan]       |          |          |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |          |               |
|-------------|----------|----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|----------|---------------|
| North       |          |          |           |           | 8.7300     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 28.3699 (74)  |          |               |
| East        |          |          |           |           | 0.8900     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 5.3421 (76)   |          |               |
| South       |          |          |           |           | 10.7600    | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 153.7393 (78) |          |               |
| West        |          |          |           |           | 1.4900     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 8.9435 (80)   |          |               |
| Solar gains | 196.3947 | 333.9472 | 458.8790  | 577.5944  | 659.3422   | 661.1327                       | 634.5914                          | 571.8674                           | 499.3323                     | 369.2713      | 235.0438 | 168.2432 (83) |
| Total gains | 794.2410 | 945.3094 | 1045.2013 | 1143.2637 | 1196.5369  | 1176.0135                      | 1129.9348                         | 1068.1688                          | 1010.5419                    | 900.9673      | 798.9991 | 753.6576 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 22.0150                   | 22.0616 | 22.1074 | 22.3252 | 22.3665 | 22.5605 | 22.5605 | 22.5967 | 22.4853 | 22.3665 | 22.2832 | 22.1968      |
| alpha                                                                       | 2.4677                    | 2.4708  | 2.4738  | 2.4883  | 2.4911  | 2.5040  | 2.5040  | 2.5064  | 2.4990  | 2.4911  | 2.4855  | 2.4798       |
| util living area                                                            | 0.9374                    | 0.9063  | 0.8653  | 0.7919  | 0.6868  | 0.5475  | 0.4230  | 0.4585  | 0.6365  | 0.8170  | 0.9093  | 0.9440 (86)  |
| MIT                                                                         | 18.3822                   | 18.7664 | 19.2655 | 19.8851 | 20.4051 | 20.7644 | 20.9107 | 20.8880 | 20.6357 | 19.9594 | 19.0709 | 18.3149 (87) |
| Th 2                                                                        | 19.8709                   | 19.8730 | 19.8751 | 19.8848 | 19.8866 | 19.8951 | 19.8951 | 19.8966 | 19.8918 | 19.8866 | 19.8829 | 19.8791 (88) |
| util rest of house                                                          | 0.9282                    | 0.8932  | 0.8460  | 0.7613  | 0.6388  | 0.4754  | 0.3293  | 0.3644  | 0.5687  | 0.7835  | 0.8943  | 0.9357 (89)  |
| MIT 2                                                                       | 16.8517                   | 17.3321 | 17.9533 | 18.7137 | 19.3226 | 19.7146 | 19.8467 | 19.8321 | 19.5912 | 18.8222 | 17.7286 | 16.7719 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.2033                   | 17.6615 | 18.2547 | 18.9828 | 19.5712 | 19.9557 | 20.0911 | 20.0746 | 19.8311 | 19.0834 | 18.0369 | 17.1263 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.2033                   | 17.6615 | 18.2547 | 18.9828 | 19.5712 | 19.9557 | 20.0911 | 20.0746 | 19.8311 | 19.0834 | 18.0369 | 17.1263 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |           |          |          |          |          |          |           |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec            |
| Utilisation                                                                    | 0.8981                     | 0.8592    | 0.8114    | 0.7324    | 0.6237   | 0.4797   | 0.3467   | 0.3804   | 0.5646   | 0.7543    | 0.8614    | 0.9072 (94)    |
| Useful gains                                                                   | 713.3052                   | 812.2518  | 848.1274  | 837.3722  | 746.2453 | 564.0844 | 391.7804 | 406.3648 | 570.5128 | 679.5904  | 688.2495  | 683.6929 (95)  |
| Ext temp.                                                                      | 4.3000                     | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000   | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1566.5470                  | 1546.0711 | 1421.1341 | 1207.1085 | 940.6084 | 634.5052 | 413.5931 | 434.6416 | 681.2428 | 1013.7559 | 1311.8364 | 1556.4836 (97) |
| Space heating kWh                                                              | 634.8119                   | 493.1266  | 426.3170  | 266.2102  | 144.6062 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 248.6191  | 448.9825  | 649.3563 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 3312.0297                  |           |           |           |          |          |          |          |          |           |           |                |
| Solar heating kWh                                                              | 0.0000                     | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |           |          |          |          |          |          |           |           |                |
| Space heating kWh                                                              | 634.8119                   | 493.1266  | 426.3170  | 266.2102  | 144.6062 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 248.6191  | 448.9825  | 649.3563 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 3312.0297                  |           |           |           |          |          |          |          |          |           |           |                |
| Space heating per m2                                                           | (98c) / (4) = 34.4214 (99) |           |           |           |          |          |          |          |          |           |           |                |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |           |           |           |           |           |           |           |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |           |           |           |           |           |           |           |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |           |           |           |           |           |           |           |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |           |           |           |           |           |           |           |          |          | 92.3000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |           |           |           |           |           |           |           |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |           |           |           |           |           |           |           |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 634.8119 | 493.1266 | 426.3170  | 266.2102  | 144.6062  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 248.6191 | 448.9825 | 649.3563 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 92.3000  | 92.3000  | 92.3000   | 92.3000   | 92.3000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 92.3000  | 92.3000  | 92.3000 (210)   |
| Space heating fuel (main heating system)                                                                     | 687.7702 | 534.2650 | 461.8819  | 288.4184  | 156.6697  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 269.3598 | 486.4383 | 703.5280 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |           |           |           |           |           |           |           |          |          |                 |
| Water heating requirement                                                                                    | 243.7756 | 215.5475 | 229.1637  | 202.2031  | 196.4256  | 177.4729  | 175.6322  | 182.4272  | 184.2017  | 204.7984 | 216.9773 | 241.2356 (64)   |
| Efficiency of water heater (217)m                                                                            | 86.1055  | 85.8549  | 85.4314   | 84.6774   | 83.3835   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.4957  | 85.6526  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 283.1126 | 251.0602 | 268.2428  | 238.7922  | 235.5690  | 222.3971  | 220.0904  | 228.6056  | 230.8293  | 242.3772 | 253.3223 | 279.9608 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                                                     | 26.2021  | 21.0203  | 18.9264   | 13.8663   | 10.7107   | 8.7508    | 9.7707    | 12.7003   | 16.4965   | 21.6443  | 24.4471  | 26.9303 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -44.1562 | -61.8220 | -88.2550  | -98.5194  | -105.6191 | -98.3310  | -97.0669  | -91.9001  | -82.7418  | -70.3019 | -48.3716 | -38.2222 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -26.2863 | -55.1356 | -109.3035 | -163.7777 | -216.2053 | -217.1423 | -214.6324 | -181.9314 | -133.5888 | -78.7754 | -35.0683 | -20.8030 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                          |          |          |           |           |           |           |           |           |           |          |          |                 |

# Full SAP Calculation Printout



|                                                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
|------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
| (235b)m                                                                                              | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |        |        |        |        |        |        |        |        |        |        |        |            |        |
| (235d)m                                                                                              | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Space heating fuel - main system 1                                                                   |        |        |        |        |        |        |        |        |        |        |        | 3588.3313  | (211)  |
| Space heating fuel - main system 2                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |        |        |        |        |        |        |        |        |        |        |        | 79.8000    |        |
| Water heating fuel used                                                                              |        |        |        |        |        |        |        |        |        |        |        | 2954.3595  | (219)  |
| Space cooling fuel                                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Total electricity for the above, kWh/year                                                            |        |        |        |        |        |        |        |        |        |        |        | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |        |        |        |        |        |        |        |        |        |        |        | 211.4659   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| PV generation                                                                                        |        |        |        |        |        |        |        |        |        |        |        | -2377.9573 | (233)  |
| Wind generation                                                                                      |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Energy saved or generated                                                                            |        |        |        |        |        |        |        |        |        |        |        | -0.0000    | (236)  |
| Energy used                                                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |        |        |        |        |        |        |        |        |        |        |        | 4462.1993  | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 3588.3313          | 0.2100                        | 753.5496                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2954.3595          | 0.2100                        | 620.4155                 | (264) |
| Space and water heating                       |                    |                               | 1373.9651                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 211.4659           | 0.1443                        | 30.5211                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -925.3072          | 0.1347                        | -124.6788                |       |
| PV Unit electricity exported                  | -1452.6501         | 0.1260                        | -182.9779                |       |
| Total                                         |                    |                               | -307.6567                | (269) |
| Total CO2, kg/year                            |                    |                               | 1108.7587                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.5200                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 3588.3313          | 1.1300                              | 4054.8143                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2954.3595          | 1.1300                              | 3338.4262                  | (278) |
| Space and water heating                     |                    |                                     | 7393.2406                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 211.4659           | 1.5338                              | 324.3534                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -925.3072          | 1.4980                              | -1386.1073                 |       |
| PV Unit electricity exported                | -1452.6501         | 0.4624                              | -671.6584                  |       |
| Total                                       |                    |                                     | -2057.7657                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5789.9291                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.1700                    | (287) |

Job no: 3833  
 Date: 24/09/2026  
 Calculated by: S.R.Smith  
 Client: Thakeham Homes  
 Development name: College Lane



# THAKEHAM

## WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

|                                            |                             | House Type:         |                     | Type 1              |                     | Type 2              |                     | Type 3              |                     | Type 4              |                     | Type 5              |                     | Type 6              |                     | Type 7              |                     | Type 8              |                     | Type 9              |                     | Type 10             |                     |
|--------------------------------------------|-----------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                                            |                             | Description:        |                     | All Plots           |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |                     |
| Installation Type                          | Unit of measure             | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day | Capacity/ flow rate | Litres/ person/ day |
| Is a dual or single flush WC specified?    |                             | Dual                |                     | Dual                |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Click to Select     |                     | Click to Select     |                     | Click to Select     |                     |
| WC                                         | Full flush volume           | 4                   | 5.84                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
|                                            | Part flush volume           | 2.6                 | 7.70                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Taps (excluding kitchen and external taps) | Flow rate (litres / minute) | 5                   | 9.48                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Are both a Bath & Shower Present?          |                             | Bath & Shower       |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     |
| Bath                                       | Capacity to overflow        | 193                 | 21.23               |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Shower                                     | Flow rate (litres / minute) | 8                   | 34.96               |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Kitchen sink taps                          | Flow rate (litres / minute) | 6                   | 13.00               |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Has a washing machine been specified?      |                             | No                  |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     |
| Washing Machine                            | Litres / kg                 |                     | 17.16               |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Has a dishwasher been specified?           |                             | No                  |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     |
| Dishwasher                                 | Litres / place setting      |                     | 4.50                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Has a waste disposal unit been specified?  |                             | No                  |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     | Select option:      |                     |
| Water Softener                             | Litres / person / day       |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |                     | 0.00                |
| Calculated Use                             |                             | 113.9               |                     |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |
| Normalisation factor                       |                             | 0.91                |                     |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |                     | 0.91                |
| Code for Sustainable Homes                 | Total Consumption           | 103.6               |                     |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |
|                                            | Mandatory level             | Level 3/4           |                     |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |
| Building Regulations 17.K                  | External use                | 5.0                 |                     |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |                     | 5.0                 |
|                                            | Total Consumption           | 108.6               |                     |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |                     | 0.0                 |
|                                            | 17.K Compliance?            | Yes                 |                     |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |                     | -                   |

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