

28 AVENUE ROAD, ST JOHNS WOOD, LONDON NW8

ENERGY AND SUSTAINABILITY STATEMENT

JB/682: October 2021

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28 AVENUE ROAD, ST JOHNS WOOD, LONDON NW8

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INTRODUCTION

Our client is applying for planning permission to construct a new family home and as part of the process; he is taking the opportunity to significantly enhance its sustainability; including the potential for renewable technologies. 28 Avenue Road is proposed is to be constructed as a sustainable low carbon house, finished to a high quality and standard.

This report has been prepared by ME7 Ltd, to demonstrate how the development will achieve a low carbon status and covers the proposed sustainable design measures related to the building fabric and mechanical and electrical services.

The proposed building has been modelled using an accredited calculation methodology (SAP 2012) and by an accredited energy assessor. Through use of appropriate passive and building fabric design as key points/measures below and energy saving measures, it is shown that the building will release lower net annual CO_2 emissions against baseline levels and satisfies the current Building Regulation Part L, The Adopted London Plan requirements and Camden Energy efficiency and adaption policies requirements.

Key points/measures proposed:

- A CO₂ reduction of 53% (Cumulative), for the site over the baseline; confirming that the proposed refurbished dwelling exceeds the requirements of the Camden Energy efficiency and adaption 2019, The Adopted London Plan 2016 and the National Planning Policy Framework.
- 17.094 tonnes of CO2 saving per annum for the site over the baseline.
- Zero NOx emissions for the GSHP system and low NOx emissions from efficient backup heating plant, complying with the Adopted London Plan.
- Reusing/recycling and salvage existing materials where possible.
- Reducing water consumption through efficiencies and flow restrictors.
- Utilisation of natural shading, orientation and planting.
- Fully insulating/ providing double glazed windows to the new elements low U values.
- Air tightness of 4.0m3/m2/hr@50Pa.
- Heat recovery ventilation to the lower ground floor (lower) area 80% efficiency.
- New materials to be responsibly sourced and life cycle reviewed.
- Inclusion of a renewable energy system (GSHP) and a renewable energy system (PV).
- Data logging/internal digital metering/control for efficient management of the building.

Owing to the above improvements over the minimum Part L requirements, the PEA (Predicted Energy Assessment – Outline EPC) for the proposed refurbished building is an energy efficiency rating of Grade B (87) and a CO2 impact rating of Grade B (87).

Included within the report is an appraisal of various renewable technologies, demonstrating their viability and appropriateness to the environment and nature of the development.

It is proposed that a GSHP system (COP 5.08), will be suitable for providing 90% of the yearly heating demand. With gas boilers for providing heating and domestic hot water production top up and backup only. This combination will significantly reduce CO2 emissions and be well matched to the building. Apart from the GSHP and PV systems proposed, other renewable sources are not effective or suitable for the building.

Heat gains have been reduced with passive measures; building orientation, tree shading, concrete slabs/ brick facades, internal blinds, high performance glazing and passive/ MVHR ventilation. Where cooling is proposed, this is only to some parts of the house and only at peak times. This will be provided by a renewable source, a vertical borehole GSHP system based on high efficiency water cooled condensors with a high efficiency EER of 5.84 for cooling.

A detailed description of the proposed electrical and mechanical systems is also included within the report, detailing the energy efficient and sustainable design measures to be incorporated.

Full assessment modelling/calculations/reports demonstrating compliance, including energy statement, SAP L1A and PEA (Pre-EPC); can be found in the main sections and appendices of this report. The M&E proposals outlined in this report are in line with the Adopted London Plan 2016, the National Planning Policy Framework, Camden Energy efficiency and adaption 2019 and Building Regulations.

Section 1.0

RENEWABLE ENERGY STATEMENT

ME7 LTD Jorand House Bebington Close Billericay Essex, CM12 0DT

ASSESSMENT INFORMATION

Prepared by: Ondrej Gajdos, ME7 Ltd

Date: 06 October 2021

DISCLAIMER

The findings, conclusions and recommendations of this report are based on the information supplied. ME7 Ltd disclaims responsibility in respect of incorrect information imparted to them or for the actual performance of any of the building services installations.

This Report is prepared for the construction of a new house at 28 Avenue Road; a duty of care is not owed to other parties.

EXECUTIVE SUMMARY

ABOUT THE ENERGY STATEMENT

ME7 Ltd have been appointed to provide an Energy Statement for the proposed development.

This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly.

Baseline and all estimated energy consumptions have been calculated using full SAP 2012 assessment of the development in accordance with Part L procedures and SAP 10 emission factors in line with the latest GLA planning guidance.

The tables below show a summary of energy requirements for baseline scheme and reduction proposed to be achieved by passive measures, efficient services and on-site renewable energy sources.

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)				
	Regulated	Unregulated			
Baseline: Part L 2013 of the					
Building Regulations Compliant	32.6	4.6			
Development					
After energy demand reduction	32.5	4.6			
After renewable energy	15.4	4.6			

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic building

	Regulated domestic carbon dioxide savings					
	(Tonnes CO ₂ per annum)	(%)				
Savings from energy demand reduction	0.040	0.1%				
Savings from renewable energy	17.094	52%				
Cumulative on site savings	17.140	53%				

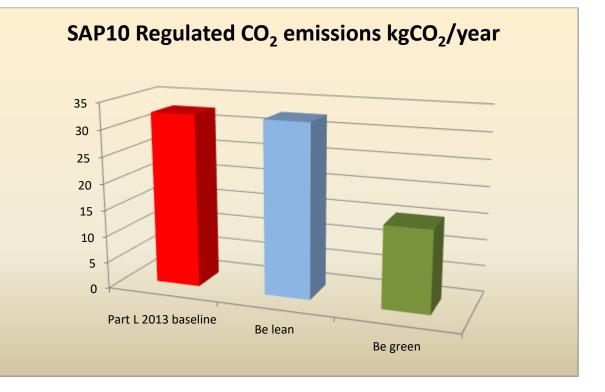


Table 3: SAP calculation specification for each stage of the energy hierarchy

Specification	Notional Baseline	Efficient Baseline (Be Lean)	Proposed Development (Be Green)
External Wall U-value	0.18	0.18	0.18
Ground floor	0.13	0.12	0.12
Roof U-value	0.13	0.12	0.12
Windows U-value	1.50	1.30	1.30
Thermal bridging	Thermal bridging Accredited construction details		Accredited construction details Sthroughout, lintels with psi-value of 0.05 rW/mK (e.g. Keystone Hi Therm lintels or similar)
Air Permeability	5	4	4
Main Heating System	Condensing gas boiler, SEDBUK 2009 efficiency 88%, underfloor heating, programmer and at least 2 room thermostats	6	, GSHP with wet underfloor heating, assumed to provide 90% of heat demand tbacked up by gas boiler (10% of demand
Secondary heating		Gas fires with 80% efficiency	Gas fires with 80% efficiency
DHW System	Condensing gas boiler, SEDBUK 2009 efficiency 88%,	2No 1,000L Heatrae Sadia Megaflo commercial, fed from the main heating system	2No 1,000L Heatrae Sadia Megaflo commercial, fed from the main heating system
Cooling system	-	GSHP system with seasonal cooling SEE of 5.0 or higher	GSHP system with seasonal cooling SEER of 5.0 or higher
Ventilation System	entilation System Natural with intermittent mechanical extracts		Natural with intermittent mechanical extracts
Energy Efficient Lighting	75%	100%	100%
Renewable energy sources			PV system with total peak output of 4.4kWp, e.g. 11 No PV panels Sunpower Maxeon 400, installed horizontally on the flat roof
% Improvement in CO2 over Building regulations compliant baseline	0.0%	0.1%	53%

The proposed house will achieve:

- 52% reduction in regulated CO2 emissions by renewable sources (PV system and GSHP)
- 53% reduction in regulated CO2 emissions compared to 2013 Part L1A notional baseline

All CO2 reductions are calculated using SAP10 emission factors $% \left({{{\rm{S}}}_{{\rm{A}}}} \right)$

Energy consumption of the proposed house

								SAP10 CO2 P	ERFORMANCE	
DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS										
Unit identifier	Model total	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE GREEN' SAP DER WORKSHEET REGULATED CO2 EMISSIONS PER UNIT								
(e.g. plot number, dwelling type etc.)	floor area (m²)	Space Heating (Heat Source 1)	(Heat Source 1) Water (Heat source 2) generated by emissions DER SAP1						Calculated DER SAP10 (kgCO2 / m2)	
28 Avenue Road	2525.6	34679	5142	30312	-3346	2871	105	24	15,445	6.1

INTRODUCTION

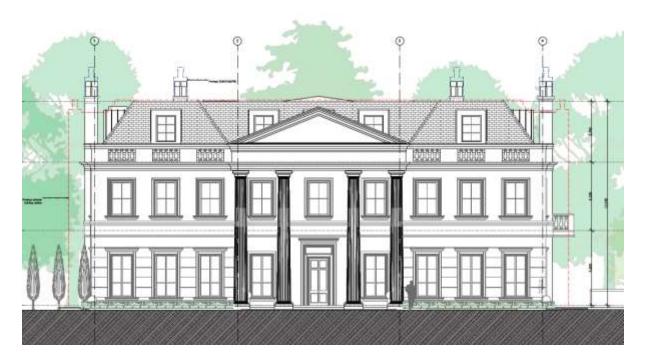
BACKGROUND

ME7 Ltd have been appointed to provide an Energy Statement for the proposed development.

This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly.

DESCRIPTION OF THE DEVELOPMENT

Construction of a new 11-bedroom house arranged over basement, ground, $1^{st}\,and\,2^{nd}$ floor.



PLANNING FRAMEWORK

NATIONAL POLICY

DCLG sets out basis for local policies in section 14 of National Planning Policy Framework. It requires new development to be planned in ways that can help to reduce greenhouse gas emissions, such as through its location, orientation and design. To help increase the use and supply of renewable and low carbon energy and heat, plans are encouraged to:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

BUILDING REGULATIONS 2013 PART L1A

Part L1A sets out 3 main criteria for energy efficiency in newly constructed dwellings:

- CO2 emissions from the proposed dwellings, i.e. Dwelling Emission Rate (DER) has to be lower than the Target Emission Rate (TER)
- Dwelling Fabric Energy Efficiency has to be lower than the Target Fabric Energy Efficiency
- Risk of overheating has to be assessed using SAP appendix P

THE ADOPTED LONDON PLAN

The Adopted London Plan is the name given to the Mayor's spatial development strategy. The current version of the Adopted London Plan was published in 2011 with Further Alterations to the Adopted London Plan published in March 2016. The aim is to develop London as an exemplary sustainable world city, based on three interwoven themes.

- 1. Strong, diverse long term economic growth
- 2. Social inclusivity to give all Londoners the opportunity to share in London's future success
- 3. Fundamental improvements in London's environment and use of resources.

Specific requirements on development sustainability are set out in the following policies:

POLICY 5.2 MINIMISING CO2 EMISSIONS

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

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

Policy 5.6 – Decentralised Energy in Development Proposals

Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites. Major development proposals should select energy systems in accordance with the following hierarchy:

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

Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 – RENEWABLE ENERGY

The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible. There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible.

POLICY 5.9 – OVERHEATING AND COOLING

Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- 1. minimise internal heat generation through energy efficient design
- 2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- 3. manage the heat within the building through exposed internal thermal mass and high ceilings
- 4. passive ventilation
- 5. mechanical ventilation
- 6. active cooling systems (ensuring they are the lowest carbon options)

ZERO CARBON POLICY

As outlined in the Housing SPG, from 1 October 2016 the Mayor applies a zero carbon standard to new residential development. The Housing SPG defines 'Zero carbon' homes as homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site . The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E). This payment is currently fixed (in most boroughs) at £60/tonne of CO₂ per year for 30 years.

As the proposed development comprises less than 10 newly constructed dwellings, it is not considered a major development in accordance with the Adopted London Plan definitions. The zero carbon policy, policies 5.2, 5.6 and 5.7 are therefore not applicable.

BASELINE ENERGY CONSUMPTION & CO2 EMISSIONS

Energy assessment using SAP 2012 has been carried out on the actual proposed dwellings using notional baseline specification achieving compliance with 2013 Part L. The specification is set out in Table 3 above.

The notional baseline is based on 2013 Part L1A notional building for calculating Target Emission Rate (TER)

		SAP10 CO2 PERFO	RMANCE					
DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS								
		REGULATED E	REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - TER WORKSHEET				IONS PER UNIT	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Space Heating	Domestic Hot Water	Lighting	Auxiliary	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated TER SAP10 (kgCO2 / m2)	
28 Avenue Road	2525.6	146768	5129	2871	75	32,585	12.9	

BE LEAN: PASSIVE MEASURES AND EFFICIENT SERVICES

Number of passive design measures and measures improving energy efficiency of building services have been included in the design to help to reduce the CO2 emissions, including:

- Newly constructed elements with U-values going beyond the building regs requirement
- High efficiency condensing boiler
- 100% low energy lights

Full specification of the efficient baseline is described in Table 3.

							SAP10 CO2 P	ERFORMANCE
DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS								
Unit identifier		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE LEAN' SAP DER WORKSHEET					REGULATED CO2 EMISSIONS PER UNIT	
(e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)
28 Avenue Road	2525.6	146623	5055.05	2871.02	75	24.0	32,544	12.9

OVERHEATING AND COOLING

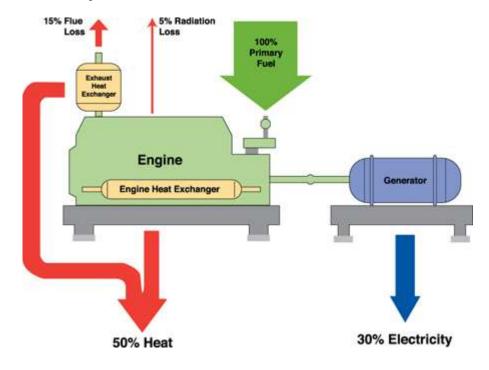
The house has also been assessed against overheating criteria set out in SAP Appendix P.

The house complies with the criteria using passive measures openable windows. Mechanical cooling is also proposed for the development.

BE LEAN: COMBINED HEAT AND POWER

GENERAL INFORMATION

Although not using any renewable energy source, gas CHP helps to reduce CO2 emissions by delivering heat and electricity locally and reducing the losses that normally occur by conventional power plants. Produced electricity can be exported to grid if the on-site demand is lower than production.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

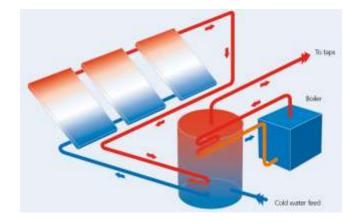
Due to significant de-carbonisation of the grid electricity in the recent years and further decarbonisation expected in near future, gas CHP is no longer beneficial in terms of CO2 reduction. It is therefore not proposed for the development.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE – SOLAR HOT WATER (SHW)

GENERAL INFORMATION

Solar hot water systems for dwellings use collector which provides a separate heating circuit for hot water cylinder. This is usually backed up by electric immersion heater or other source of heat.

- Two types of collectors are available:
- Flat Plate less expensive, less efficient
- Evacuated Tube more expensive and more efficient





RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Solar hot water system has been ruled out due to relatively low hot water demand compared to space heating and lower CO2 reduction potential compared to solar photovoltaic. BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE – AIR SOURCE HEAT PUMP (ASHP)

GENERAL INFORMATION

An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15° C.

On 17 December 2008, the European Parliament adopted the EU Directive on promoting the use of energy from renewable sources. For the first time however, in addition to geothermal energy, aerothermal and hydrothermal energy are also recognised as renewable energy sources.

There are two main types of ASHP:

AIR-TO-WATER SYSTEM

Air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are more suitable for underfloor heating systems than radiator systems. Although some ASHP systems are capable of heating the water to the higher temperature, the efficiency is higher when using low temperature underfloor heating or low temperature fan convectors.





AIR-TO-AIR SYSTEM

Air-to-air system uses the heat to warm the indoor air. The air is heated through individual fan-coils or centrally and then distributed to rooms via ductwork.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Air source heat pumps have been considered, however have been ruled out due to lower efficiency compared to ground source heat pump, as well as potential problems with noise from the outdoor unit.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE – SOLAR PHOTOVOLTAICS (PV)

GENERAL INFORMATION

This system uses semi-conductor cells to convert solar energy into electricity. Two main types of PV panels are available: - Monocrystalline – More expensive and more efficient

- Polycrystalline – Less expensive and less efficient

Depending on type, the output of 1 kWp (kilowatt peak) can be achieved by panels with area between 5 and 20 m2.

The use of PV panels generally requires relatively large unshaded roof area where they can be mounted facing south, ideally having between 15° and 35° inclination.



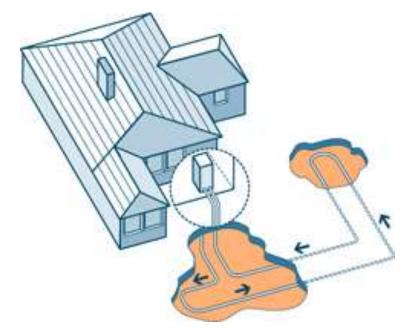
RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

It is proposed to install a PV system with a total peak output of 4.4 kWp with horizontally mounted PV panels on the inner roof slopes. An example of this system would be 11 No PV panels Sunpower Maxeon 400. BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE – GROUND SOURCE HEAT PUMP (GSHP)

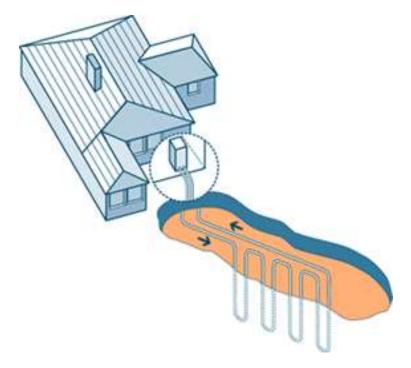
 $General\ information$

Ground source heat pumps use a buried ground loop which transfers heat from the ground into the building through heating distribution system. GSHP technology can be used both for heating and cooling. Two main types of GSHP are available:

- Horizontal loop is suitable for applications where sufficient area is available to accommodate horizontally buried pipes



- Vertical loop system can be used where ground space is limited, but will require boreholes typically 15-150m deep, and is consequently more expensive to install than horizontal systems.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

It is proposed to install a closed loop vertical borehole ground source heat pump system which will serve as the main heating system through wet underfloor heating, as well as a part cooling source. It will be backed up by high efficiency gas fired boilers for the heating systems. BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE – BIOMASS/ BIOFUELS

GENERAL INFORMATION

Producing energy from biomass has both environmental and economic advantages. It is a carbon neutral process as the CO2 released when energy is generated from biomass is balanced by that absorbed during the fuel's production.

There are two main ways of using biomass to heat a domestic property:

- Standalone stoves providing space heating for a room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 6-12 kW in output, and some models can be fitted with a back boiler to provide water heating.

- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW.

RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Biofuels are ruled out due to negative impact on air quality and environmental issues surrounding liquid biofuels as currently there are no established standards relating to the sustainability of biofuels.

WATER	
	Internal Water consumption will be reduced by specification of water efficient fittings. The water consumption will be reduced to 105 litres per person per day or less by specifying water fittings with the following parameters:
	WC's: All dual flush capacity 3/6 Litres or less Kitchen taps flow aret: 6 l/min or less Bathroom taps flow rate: 5 l/min or less Bath capacity to overflow: 140 l or less Showers flow rate: 9 l/min or less Dishwasher consumption: 0.5 Litres per place setting or less Washing machine consumption: 5.5 litres per kg dry load or less
MATERIALS	Environmental impact of construction materials will be taken into account. Where possible, construction materials will be sourced from local producers and suppliers with environmental impact certification. All timber will be FSC (or equivalent) certified.
Energy	Besides the energy efficiency measures relating to regulated energy, which are described in the energy statement, there will be additional energy saving measures implemented in the development:
	- Energy efficient white goods will be used
	- Low energy external lighting
WASTE	Adequate internal and external storage of recycled and non- recycled waste will be ensured. The external storage will be sized according to the frequency of collection, based on guidance from the recycling scheme operator. Construction waste will be minimised by implementing a site waste management plan containing procedures to minimise and divert waste from landfill.

Section 2.0

MECHANICAL SERVICES

2.1 INCOMING UTILITY SERVICES

New gas and water utility supplies/meters will be provided to the building. The gas meter will be external to the building in a ventilated space and the water meter externally in an underground pit. (Soil conditions will confirm the water pipe material).

These will be sized to meet the demands of the building.

An additional kW/hr gas sub-meter will be provided with a remote visual display installed to assist in energy monitoring and management as part of the BMS/ audio visual system.

An additional water flow meter (I/s) will be provided with a remote visual display installed to assist in water monitoring and management as part of the BMS/ audio visual system.

2.2 DESIGN CONDITIONS

External temperatures:

Winter	-8°C saturated
Summer	32°C (DB) 20°C (WB)

Internal Temperatures:

21°C
21°C
19°C
23°C
30°C
19°C
16°C

2.3 BUILDING REGULATIONS PART L1A (2013/16)

The current part 'L1A' of the Building Regulations (2013/16), consists of minimum requirements for dwellings, briefly consisting of the following:

- Walls, roofs and ceilings need to have adequate resistance to loss of heat.
- Sufficient control needs to be provided for occupants to vary lighting levels, to avoid unnecessary energy use and maximise natural daylight.
- Adequate user control should be available for heating and cooling to avoid unnecessary energy use and maximise passive measures.

Part 'L1A' of the Building Regulations (April 2013/16), is also concerned with the conservation of fuel and power and its aim is to maximum the possible contribution that can be made to the Government's target for reducing CO₂ production whilst allowing flexibility for designers. This philosophy will be followed in our designs.

The measures to be implemented/ investigated to reduce energy consumption are:

- Specifying an efficient heating system and if gas boilers utilised, these are to be high efficiency condensing boilers with very low NOX levels. This also includes low NOX levels for CHP units.
- Optimising the boiler selection for the building occupancy and reducing energy consumption through controls and management.
- Installing responsive controls and sub-zoning of the building to allow the part load, low energy and economical use of the system. (Adaptive to user occupancy).
- Review of thermal insulation techniques, limits and air tightness.
- Review of renewable energy sources to comply with the limits dictated by The Local Planning Authority and The Adopted London Plan.
- Minimising the effect of solar gain in a passive manner, to provide comfort conditions.

- Limiting fan power usage to noted requirements.
- Reviewing extract fan systems and utilising heat recovery and passive natural ventilation where possible.
- If cooling is utilised, to provide through a very efficient system and utilised only at peak times.

2.4 HEATING

The main space heating system will be led by a high efficiency GSHP vertical borehole system with water source heat pumps (Mitsubishi CRHV), with a COP of 5.08 complete with buffer vessel and thermal check meter. With backup/ top up from condensing boilers with ultra low NOX levels (eg Broag Remeha Quinta ACE). 90% of the heating load will be produced by the GSHP system.

The GSHP/ boilers system will serve LTHW pressurised supplies to the majority of underfloor heating systems in the principal living and bedroom areas (High thermal mass concrete floors). Radiators to secondary areas and towel rails to bathrooms will be served via a separate summer circuit. LTHW supplies will also provide the heat for the HWS system and the pool AHU/ water systems.

All internal pipework to be copper insulated and pex to underfloor systems.

All flues to discharge above main roof level by balanced flues/separate flues. Fresh air and plantroom cooling via louvers at ground floor level.

All heating zones/spaces will be provided with zone valves, re-heaters, thermostat control or TRV's (Thermostatic radiator valves), to ensure efficient energy use.

All heating zones/spaces will also be controlled by user interface controls to programme occupancy, holiday periods and set back times; again to ensure efficient energy use.

Future heating network pipework connections and plate heat exchanger space to be included within the scheme.

2.5 WATER SERVICES

A fully pressurised water system will be provided throughout the property to ensure continuity of supply. If after testing a mains water pressure system is acceptable; this will be adopted. The system is to be installed in copper pipework to the sanitary/kitchen appliances.

The general pressure available throughout the system will be approximately 3 bar at the mixers/taps with flow rates accommodated to the sanitary appliances and shower mixer valves in accordance with the Part 'G' calculator; low flow/restrictors.

The system will operate on a variable speed pump principle to maintain a constant pressure throughout the system and limit energy use. Pressure regulating devices will be required to some areas. All sanitary fittings/plant will be individually and zone valved. All pipework to be copper insulated.

Consideration will be given to a leak detection system to provide early warning of any leaks in the systems, to minimise any water loss.

2.5.1 Domestic Cold Water

Sufficient cold water will be stored and boosted to provide continuity of supply. Filtered mains drinking water will be provided to the main kitchens and the basins within each principle en-suite bathroom.

A water softener will be provided within the main basement plantroom providing softened water to the hot water cylinders, as well as all the baths and shower accommodation. (Softened water will ensure optimum energy performance due to limiting scale build up in plant/pipework).

2.5.2 DOMESTIC HOT WATER

Hot water cylinders located in the basement plantroom will be provided with boosted and conditioned cold water. The hot water cylinders will be complete with a pumped return system. The system will be heated by the boiler system.

Hot water production shall be strictly controlled by weather compensation, timeclock control for occupancy holiday times and maximisation of plant duty. (Conditioned water will ensure optimum performance due to limiting scale build up in plant/pipework).

All basins, baths and sinks will be protected by TMV2/3 valves (Thermostatic mixing valves), above the minimum Part 'G' requirements.

2.6. RECYCLED RAINWATER

Rainwater recycling is not currently proposed, to be considered as the project progresses.

2.7 NATURAL VENTILATION

Background habitable room passive ventilation is generally to be provided by trickle vents incorporated into windows or walls to the building above ground level. The LGF will be provided with an MVHR system.

Rapid ventilation to spaces will be provided by openable windows/ continuous ventilation.

Consideration will be given to a PSV (Passive stack ventilation), system to bathrooms (wet areas), with humidity controlled trickle vents to habitable spaces.

2.8 FRESH AIR SYSTEMS

Habitable rooms located within the LGF area with no windows will be provided with fresh air by mechanical ventilation heat recovery units with highly efficient counter flow heat exchangers. Mechanical ventilation system will be fully compliant with Part 'F' of the Building Regulations. Ductwork to be pre-insulated PVC and galvanised steel with insulation or Kool duct.

The swimming pool hall will have an AHU with heat recovery/ humidity control ventilation (By others).

2.9 BATHROOMS, CLOAKROOMS, STORE AND KITCHEN VENTILATION

Mechanical Extract Ventilation (MEV or intermittent) units will be provided for the purposes of sanitary accommodation, kitchen and utility ventilation. These dedicated fan systems shall comprise of isolated (low noise) ducted fan units located either within plant areas and discharge to the main roof areas or via external walls. Ductwork to be pre-insulated PVC and galvanised steel with insulation.

2.10 COMFORT COOLING

Firstly, the building has been designed to limit heat gains by; orientation, thermal mass, ventilation provision, tree shading, semi underground spaces and overhanging slabs/ roofs.

Cooling may also be considered to certain rooms/spaces.

This is proposed to be via a high efficiency GSHP system (5.84 EER), with water heat pumps located in the basement plantroom.

The type of cooling for each room will be provided by fancoils mounted either within joinery or false wall/ceiling details.

Pre-insulated discharge ductwork will be attached to these units to discharge through high induction linear grilles incorporated within joinery and wall finishes at high level. The system will have very low noise levels, which is generally to be targeted at NR25 throughout the building.

A refrigerant gas sensor system will be incorporated to provide safety/protection in accordance with FGAS requirements, to all bedrooms and other rooms/spaces.

Internal pipework to be copper insulated, externally PE pipework.

Each room/space will have individual control via a remote room controller to each fan coil, controlled via a discrete room sensor for operation or modification to the set point of the controllers. Cooling and heating will be automatically controlled to ensure no system fighting and undue energy use (interlocked). Overall occupancy and holiday controls to also be provided to ensure efficient energy use and management.

2.11 AUTOMATIC CONTROLS

Automatic control systems will be provided for all of the mechanical services. It is anticipated this will be installed as a complete BMS/ DDC electronic system supervised by a touch screen control/PC positioned within the basement plantroom.

The client will also have the facility for zoned overrun of various systems and time switch control separate to the main plantroom, via a PC interlink situated within the study.

Full remote off site access will also be provided via a modem to this system enabling an ongoing maintenance contract to be provided with the system installers and for the occupiers to efficiently control the systems.

The system will have remote interface modules which will allow the client operation of the heating and cooling, lighting and other systems via the audio visual keypads. Where this is not provided, individual room control will be provided with more basic visual/manual controls.

Controls are to be zoned to provide more efficiency, occupancy control and management.

2.12 ABOVE GROUND DRAINAGE

The above ground drainage system shall be provided to serve all the sanitaryware accommodation.

It is anticipated that in the house cast iron/HDPE silent pipework will be provided, fully insulated for both thermal and acoustic reasons, with individual local run-outs to the sanitary accommodation being in Upvc pipework. Installation of leak detection systems will be considered to detect leaking water hidden in areas such as voids and shower trays etc. This is being considered to protect the building fabric and internal fixtures and fittings.

2.13 RAINWATER DRAINAGE

All rainwater pipes will be routed from roof level to drain points at ground/lower ground floor levels. All roof outlets will be sized to take a rainfall intensity of 108 mm per hour. All pipes shall have access before connecting to underground drains. All external rainwater stacks are to be either aluminium or cast iron and where installed internally, the stacks/drains shall be thermally/ acoustically insulated.

2.14 UNDERGROUND DRAINAGE

By others.

Section 3.0

ELECTRICAL SERVICES

3.1 INCOMING UTILITY SUPPLY

A new main incoming TP&N supply connection will be provided to serve the property which will be sized to suit the anticipated maximum building load.

The energy usage at the incoming position will be measured and inter-linked to the AV system providing the end-user with accurate power consumption data displayed on a visual display screen. This facility will provide the owner with a user-friendly interface for energy monitoring and management within the house. The PV system electrical load is envisaged to be utilised on site, however G99 export details TBA with UKPN. A PV generation meter and a GSHP thermal meter will be installed.

3.2 SUB-MAIN DISTRIBUTION

Sub-main distribution boards will be installed to serve various areas within the building. This will reduce cable material costs and installation time. Sub metering to Part L will be provided. The local sub-distribution boards will incorporate suitably rated MCBs and RCBOs to suit the circuit

type and loading. Separate dedicated feeds will be supplied to life safety systems, such as fire alarm equipment in

Separate dedicated feeds will be supplied to life safety systems, such as fire alarm equipment in suitable fire rated cabling.

Sub-main distribution cabling will be multi-core armoured with XLPE outer sheath and LSF inner sheath with copper conductors.

Adequate spare capacity will be provided within the distribution network for any future expansion of the system, avoiding the need for any significant re-modification works at a later period.

3.3 FINAL CIRCUIT DISTRIBUTION

Final circuit distribution cabling will be multi-core flat twin & earth XLPE/LSF sheathed copper conductors and will not be of the PVC/PVC type.

The XLPE (cross-linked polyethylene) cable material offers superior electrical performance to PVC and the LSF insulation produces 'low smoke and fumes' when exposed to fire.

RCBOs will be used which combine Residual Current and Overcurrent protection within a single device. Consequently each circuit will be individually RCD protected avoiding any nuisance tripping of unaffected circuits as would be the case if a split load distribution arrangement were adopted whereby many circuits are protected by a single RCD.

3.4 SMALL POWER INSTALLATIONS

Single and twin 13A Switched Socket outlets will be provided at various positions within the property for general purpose use and to serve fixed electrical equipment.

The outlets will be positioned to offer the greatest flexibility for different interior space planning options and will be mounted at a suitable height for ease of access conforming to the Building Regulation Part M requirements.

Where the room/spaces are used as 'home offices' (e.g. where computers, printers etc. are installed causing potential earth leakage currents) then socket outlets will be of the Dual Earth connection type. 13A switched/un-switched fused connection units with neon lamps will be installed to serve various fixed items of electrical equipment.

All small power faceplate outlets will be sourced from a reputable manufacturer such as 'MK Electric' incorporating the required electrical safety standards and allowing ease of installation.

3.5 INTERIOR LIGHTING INSTALLATIONS

The lighting scheme will utilise the latest low energy compact fluorescent and long life LED/CFL lighting technologies in order to achieve a minimum of 100% low energy lighting throughout the property, exceeding the requirement as stipulated in the Building Regulations Part L.

Dimming control will be provided to the majority of the lighting systems in the form of pre-set scene setting controlled from individual wall plates in each room/space and via a wireless/ hardwired visual display screen as part of the AV control system.

Consideration is also being given to allow energy usage from the lighting system to be monitored via the AV system.

In room/spaces with sufficient natural lighting, day-linked control of the artificial lighting is also being evaluated. Computational daylight investigation will be carried to principle living areas to ascertain the benefit of day-linked dimming controls.

Room/spaces which are not lit by natural daylight, in particular escape routes and the LGF/ basement areas will incorporate emergency standby lighting with up to 3hr battery back-up. Consideration for additional emergency lighting to all escape routes will be taken.

Special attention will be made to bathrooms and the pool area lighting scheme, ensuring the correct level of Ingress Protection (IP) rating is provided in accordance with the 'zoning' requirements of the IEE Regulations.

3.6 EXTERIOR LIGHTING INSTALLATIONS

The external lighting installation will comprise of a combination of low energy compact fluorescent and LED lighting. (Light outputs will not exceed Regulations).

Luminaires will be mounted inground and away from the building for night time perimeter security lighting and will be of the wall-wash type to avoid direct light pollution into the neighbouring community.

Ground recessed and low level ground mounted garden amenity lighting will also be provided which will be limited in numbers to avoid excessive lighting and light pollution to the night sky.

All external lighting will be daylight-linked via an adjustable external photocell and only switch on during periods of insufficient daylight. Manually adjustable time-clock control will also be provided to allow the occupier to adjust the time period and to switch off the lighting when not required.

3.7 AUDIO VISUAL SYSTEMS

The Audio Visual installation will generally include the following systems:

- Lighting control and management via user-friendly wireless/hardwired touch screen visual display panels located throughout building to occupiers requirement.
- Building energy monitoring via touch screen panels with scope for split monitoring of various loads e.g. lighting & power.
- Heating, comfort cooling and ventilation control via touch screen panels.
- Terrestrial and Satellite TV installation and control. For signal reception each TV will receive a single CAT 5e/6 cable input allowing multi-service viewing. Conventional coax cabling will not be installed saving on material and installation cost.
- Hardwired broadband and telephone service in CAT 5e/6 cabling.
- CCTV security monitoring around the vicinity of the building in CAT 5e/6 cabling with digital recording facility.
- Security, audio and visual access control systems to main building entrances.

3.8 SECURITY SYSTEM

A wired intruder alarm system will be provided comprising suitable room/space movement detectors, magnetic contacts to perimeter doors and window/door break glass detection. The system will be linked to a 24hr central monitoring station via a dedicated BT Redcare line and GSM. The design and installation will conform to ACPO policy and DD243 requirements for police response service.

3.9 FIRE DETECTION AND ALARM SYSTEM

The building may come under the requirements of BS5839 Part 6. The final installation design will be agreed with the relevant parties, including the Local Fire Office (Fire Brigade) and Local Council District Surveyor.

To provide the highest degree of life and property protection a 'Type L1' category system may be employed and be appropriately zoned, allowing the local fire brigade to promptly identify the location/source of fire occurrence.

The system will have the appropriate level of standby battery back-up to operate under mains power failure.

All cabling will be fire rated to the appropriate required standard.

Generally smoke detectors, incorporating base sounder units will be installed throughout the premises except within the kitchen area, plant spaces and gallery – these will be heat detectors; to avoid nuisance alarm conditions. The plant room/kitchen areas will also have carbon monoxide (CO) detectors installed.

Consideration will be given to an 'lon' based (Air sampling - Vesda), detection system in some principal areas including for CO detection.

3.10 EARTHING & BONDING

All extraneous conductive parts will be bonded to the main building earth terminal with main equipotential and supplementary earth bonds as required.

Supplementary earth bonding will be provided to areas of increased electric shock risk including bathrooms, shower rooms, swimming pool area and plant rooms.

A separate additional earth electrode system will be provided for earth bonding of the swimming pool areas as required by the IEE Regulations.

3.11 LIGHTNING PROTECTION

A lightning protection system will be installed to prevent damage to the building structure and mitigate; injury to people, physical damage (e.g. fire, explosion) and failure of internal electrical systems. The system will be designed to intercept the lightning strike and safely discharge the high voltage current to earth via a network of lightning rods and metal conductors or the building frame, connected to an earth electrode designed to provide a low resistance path to earth.

To protect sensitive electronic equipment within the property from damage and failure resulting from transient over voltages (surges), caused by lightning strikes; a suitable surge arrester will be installed at the main supply intake and on data/phone lines and for sensitive equipment.

3.12 ELECTRICAL APPLIANCES & MECHANICAL SYSTEM EQUIPMENT

Most 'white goods', including the refrigerator/freezer, cooker, microwave oven, washing machine/dryer and dishwasher will be 'A' rated (or higher) energy efficient items under the EU energy label classification.

Other major electrical plant, including condenser units and water booster pumps sets will be selected where available and or practicable to incorporate energy efficient motors and intelligent energy saving controls.

Section 4.0

M&E SUSTAINABILITY ITEMS

4.1 DAYLIGHTING

The proposed house has high levels of natural daylighting due to the glazing areas.

All main habitable rooms (Living rooms, kitchen and study), will achieve the minimum daylight factors and view of the sky.

4.2 RECYCLABLE MATERIALS

Each product/material for the M&E services shall be evaluated against Environmental impacts and life cycle costing. The following is a typical list of proposed M&E materials/products that will be utilised;

- Water pipework
- Copper (Recvclable).

Valves

- Brass (Recyclable).
- Electrical cables
- PVC twin & earth (XLPE/LSF) (Recyclable)
- Pipework insulation •
- •
- Rock wool (Recyclable) - Phenolic foam – (Recyclable)
- Pipework Insulation
- Concrete Portland cement based (Recyclable)
- Light fittings LED's/compact fluorescent (Recyclable)

4.3 SALVAGE/REUSE OF EXISTING MATERIALS

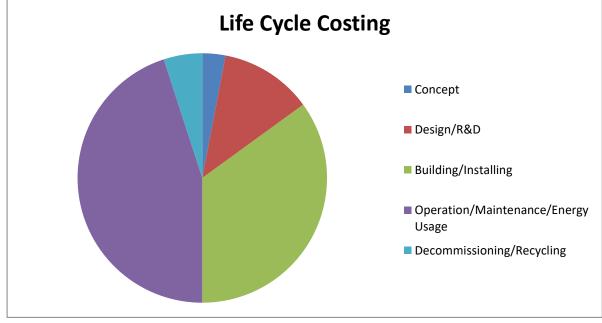
Each existing material/product will be evaluated for possible salvage/reuse when existing items/materials are removed for the proposed works.

Reuse will have priority over salvage; an economic, viability and safety assessment will be made for each item/material.

4.4 LIFE CYCLE COSTING

Each product/material proposed shall be evaluated on a life cycle costing basis. Recyclable materials shall be utilised where possible in preference to non-Recyclable.

The particular areas of the life cycle to be addressed for M&E Services are:



Building & Installing the system/product, Operation/Maintenance, Energy Usage and finally, Decommissioning/Recycling.

Below is a graph indicating the lift cycle phases;

Typically the majority of the life of a material/product is spent in the Operation/Maintenance phase. It is in this phase that it creates the value contribution but also absorbs the vast proportion of the costs through maintenance and energy usage.

Products/materials shall be selected on the basis of particularly reducing the impact of this phase, for example, a pump, by selecting long term reliability and low energy usage over initial cost.

The ease and speed of building/installing different products/systems shall also be compared to reduce this phase.

4.5 NOISE & VIBRATION

Noise and vibration associated with moving mechanical services plant, e.g. Pumps, fans, condensers, pipes/ducts, lifts and boilers shall be limited to acceptable levels as follows;

- Pumps: Inverter drives providing slow low impact start/stop cycles, intelligent controls, anti-vibration couplings/supports, dense block wall constructed plantrooms.
- Fans: Low speed intermittent ventilation fans, flexible duct connections, remote plantroom/cupboard mounting, attenuators and anti-vibration fixings.

Boilers/ GSHP: Low noise units and internally mounted within plant areas.

Pipes: Anti-vibration/flexible couplings to plant, expansion joints/anchors and smooth bends/straight lines.

Ducts: Inline attenuators, anti-vibration/flexible couplings to plant, and smooth bends/straight lines.

An Acoustic Consultant shall further advise on noise, vibration and acoustic items.

4.6 SOLAR GAINS

In compliance with the new Part 'L' of the Building Regulations (April 2013/16 edition) solar gains shall be reduced by the building being designed to limit heat gains by; orientation, thermal mass, provision of green roofs, tree shading, semi underground spaces, overhanging slabs/roofs and higher performance double glazed windows with solar tinting/low emissivity coating and Argon gas filled cavities to the South, East & West Elevations.

Additionally, internal blinds to the South, East & West Elevations may be provided as part of the development for occupiers to assist in compliance with Solar Gains.

Section 5.0

DISCLAIMER

This non-assignable report has been prepared solely for the client as a pre-planning report for the proposed development. The contents and views expressed in this report remain the copyright and opinion of ME7 Ltd. The client is to check and verify the contents with no admission of liability, duty of care or warranty to any Third Party.

This report is based on the information provided/available at the time of production.

ME7 October 2021

APPENDIX (i)

SAP L1A 2013/16 REGULATIONS

(DER Worksheet)

		User Details:				
Assessor Name: Software Name:	Ondrej Gajdos Stroma FSAP 2012	Stroma N Software	171-1 C.S.	251000	006629 on: 1.0.5.7	
	P	roperty Address: 28.	Avenue Road			
Address :	28, Avenue Road, LONDON	, NW8 6BU				
1. Overall dwelling dime	ensions					
		Area(m ²)	Av. Height(m)	Volume(m ³)
Basement		789.3 (1a)	× 3.3	(2a) =	2604.69	(3a
Ground floor		617 (1b)	× 5.5	(2b) =	3393.5	(3)
First floor		570.3 (1c)	x 4.2	(2c) =	2395.26	(30
Second floor		549 (1d)	× 3.1	(2d) =	1701.9	(30
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 2525.6 (4)	-			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)	+(3n) =	10095,35	(5)
2 Ventilation rate:						
	main secondar heating heating	y other	total		m ³ per hou	IF.
Number of chimneys	0 + 0	+ 0	= 0	x 40 =	Ũ	(68
Number of open flues	0 + 0	• 4	* 4	x 20 =	80	(6)
Number of intermittent fa	ans		16	x 10 =	160	(7)
Number of passive vents	1		0	x 10 =	0	(7)
Number of flueless gas f	īres		0	x 40 =	0	0
				Airct	hanges per ho	ur
Infiltration due to chimne	eys, flues and fans = (6a)+(6b)+(7	a)+(7b)+(7c) =	240	+ (5) =	0.02	(8)
	been carried out or is intended, proceed		(7875).	1.66	0.02	
Number of storeys in t			and one of the prints	1	0	(9)
Additional infiltration	1.25210.25			[(9)-1]x0.1 =	0	(11
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry co	onstruction	Strew -	0	(1
if both types of wall are p deducting areas of open	resent, use the value corresponding to	the greater wall area (af	ter			_
	floor, enter 0.2 (unsealed) or 0.	1 (sealed), else ente	er 0		0	1(1)
If no draught lobby, er	nter 0.05, else enter 0	14-1428			0	1(1)
이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이	s and doors draught stripped				0	1(1
Window infiltration		0.25 - [0.2 x (1	4) + 100] =		0	(1)
Infiltration rate		(8) + (10) + (11	1) + (12) + (13) + (15)	=	0	(1)
			re motro of couch	ope area	4	1
Air permeability value,	q50, expressed in cubic metre	s per hour per squar	te mene or enven			_
	q50, expressed in cubic metre lity value, then (18) = [(17) + 20]+(8		re metre of enven	100016056	0.22	(1)
If based on air permeabl	q50, expressed in cubic metre lity value, then (18) = [(17) + 20]+(8 es if a pressurisation test has been don	8), otherwise (18) = (16)		NICHARDS &	0.22	(1
If based on air permeabl Air permeability value applie	lity value, then (18) = [(17) + 20]+(8 es if a pressurisation test has been don	8), otherwise (18) = (16)		vices inter a	0.22	(1
If based on air permeabl Air permeability value applie	lity value, then (18) = [(17) + 20]+(8 es if a pressurisation test has been don	8), otherwise (18) = (16)	ability is being used	1999-1999-1999 1 1 1 1 1		(1
If based on air permeabi Air permeability value applie Number of sides shelter	lity value, then (18) = [(17) + 20]+(8 es if a pressurisation test has been don ed	8), otherwise (18) = (16) le or a degree air permea	abrilly is being used 75 x (19)] =		0	_

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(22)m=	5.1	5	4.9	4,4	4.3	3.8	3.8	3.7	4	4.3	4.5	4,7		
						-								
Wind F	actor (2	22a)m =	(22)m +	4		_								
22a)m-	1.27	1.25	1.23	1,1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjuste	ed infiltr	ation rat	e (allowi	ng for sl	helter an	d wind s	speed) =	(21a) x	(22a)m					
[0.29	0.28	0.27	0.25	0.24	0.21	0.21	0.21	0.22	0.24	0.25	0.26		
		ctive air al ventila	change i ition:	ate for t	he appli	cable ca	ise		30 - 33			 ۱	0	(23a
If exha	aust air h	eat pump	using Appe	endix N, (2	(23a) = (23a	a) × Fmv (equation (I	N5)), othe	rwise (23b) = (23a)		ī	0	(23b
If bala	nced with	heat reco	overy: effic	iency in %	allowing I	for in-use f	factor (from	n Table 4h) =			ĩ	0	(230
a) If I	balance	d mech	anical ve	ntilation	with he	at recov	erv (MV)	HR) (24;	a)m = (2)	2b)m + (23b) × [1 - (23c)	1.50	_
24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a
		-			-	0 heat red			Í de la compañía de l	0	0	<u> </u>		(24a
b) If t		-			-	0 heat rec			0	0	0	<u> </u>	1012124	Processo in
b) If t 24b)m=	balance 0	d mecha 0	anical ve	ntilation 0	without 0	0	covery (I	0 (24t	0 0)m = (2) 0	0 2b)m + (0	<u> </u>		Prom.
b) If t 24b)m= c) If v	0 whole h	ouse ex	anical ve 0 tract ver	entilation o utilation o	without 0 or positiv	0 ve input	covery (f	VIV) (24t	0 0)m = (2) 0	0 2b)m + (0	0 23b) 0	<u> </u>		Processo in
b) If t 24b)m= c) If v if	0 whole h	ouse ex	anical ve 0 tract ver	entilation o utilation o	without 0 or positiv	0 ve input	covery (f	VIV) (24t	0 0)m = (2: 0 outside	0 2b)m + (0	0 23b) 0	<u> </u>		(241
b) If t 24b)m= c) If v if 24c)m= d) If r	balance 0 whole h f (22b)n 0 natural	od mecha ouse ex n < 0.5 × 0 ventilatio	anical ve o tract ver (23b), t o on or wh	ontilation o tilation o hen (24) o ole hous	without 0 or positiv c) = (23t 0 se positiv	0 ve input b); othen 0 ve input	covery (/ o ventilatio wise (24 o ventilatio	MV) (248 0 on from (c) = (221 0 on from	0 0)m = (2: 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2b)m + (0 5 × (23t	0 23b) 0	0		(24b
b) If t 24b)m= c) If v if 24c)m= d) If r if	o whole h f (22b)n o natural f (22b)n	ouse ex ouse ex n < 0.5 × 0 ventilation n = 1, the	anical ve tract ver (23b), t 0 on or wh en (24d)	ntilation ntilation of hen (24) of hous of hous m = (22)	without 0 or positiv c) = (23t 0 se positiv b)m othe	0 ve input 0); othen 0 ve input erwise (2	ventilatio ventilatio vise (24 0 ventilatio	MV) (24t 0 c) = (22t 0 0 from 0 0.5 + [(2	0 0)m = (2: 0 0 0 0 0 0 0 10ft 22b)m ² x	0 2b)m + (0 5 × (23t 0 0.5]	23b) 0 0			(24b (24c
b) If t 24b)m= c) If v if 24c)m= d) If r if 24d)m=	balance 0 whole h f (22b)n 0 natural f (22b)n 0.54	od mecha ouse ex n < 0.5 × 0 ventilatio n = 1, the 0.54	anical ve tract ver (23b), t (23b), t (23b), t (23b), t (24d) (0.54	ntilation o hen (24) o ole hous m = (22) 0.53	without 0 or positiv c) = (23t 0 se positiv b)m othe 0.53	0 ve input 1 0); othen 0 ve input envise (2 0.52	ventilatio wise (24 0 ventilatio ventilatio 24d)m = 0.52	MV) (24t 0 on from (c) = (22t 0 0 on from 0.5 + [(2 0.52	0 b) m = (2: 0 outside b) m + 0 0 loft (2b)m ² x 0.53	0 2b)m + (0 5 × (23t	0 23b) 0	0		(24a (24b (24c (24d
(24b)m= c) If v if (24c)m= d) If r if (24d)m=	balance 0 whole h f (22b)n 0 natural f (22b)n 0.54	od mecha ouse ex n < 0.5 × 0 ventilatio n = 1, the 0.54	anical ve tract ver (23b), t 0 on or wh en (24d)	ntilation o hen (24) o ole hous m = (22) 0.53	without 0 or positiv c) = (23t 0 se positiv b)m othe 0.53	0 ve input 1 0); othen 0 ve input envise (2 0.52	ventilatio wise (24 0 ventilatio ventilatio 24d)m = 0.52	MV) (24t 0 on from (c) = (22t 0 0 on from 0.5 + [(2 0.52	0 b) m = (2: 0 outside b) m + 0 0 loft (2b)m ² x 0.53	0 2b)m + (0 5 × (23t 0 0.5]	23b) 0 0			(24b (24c

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m ^a	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			6.28	x 1.3 =	8.164		(26
Windows Type	1		4.79	x1/[1/(1.3)+ 0.04] =	5.92		(27
Windows Type	2		13.04	x1/[1/(1.3)+0.04] =	16,11		(27)
Windows Type	3		16.83	x1/[1/(1.3)+ 0.04] =	20.8		(27)
Windows Type	4		7.19	x1/[1/(1.3)+ 0.04] =	8,88		(27)
Windows Type	5		3,38	x1/[1/(1.3)+0.04] =	4.18		(27)
Windows Type	6		2.73	x1/[1/(1.3)+ 0.04] =	3.37		(27)
Windows Type	7		1.96	x1/[1/(1.3)+ 0.04] =	2.42		(27)
Windows Type	8		5.58	x1/[1/(1.3)+ 0.04] =	6.9		(27)
Windows Type	9		3.38	x1/[1/(1.3)+ 0.04] =	4,18		(27)
Windows Type	10		2.73	x1/[1/(1.3)+ 0.04] =	3.37		(27)
Windows Type	11		1.96	x1/[1/(1.3)+ 0.04] =	2.42		(27)
Windows Type	12		11.16	x1/[1/(1.3)+ 0.04] =	13.79		(27)
Windows Type	13		5.58	x1/[1/(1.3)+ 0.04] =	6.9		(27)

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Windo	ws Type	14				2.73	×1	(1/(1.3)+	0.04] =	3.37				(27)
Windo	ws Type	15				5.4	x1	/[1/(1.3)+	0.04] =	6.67	7			(27)
Windo	ws Type	16				1.96	x1	11(13)-	0.04] =	2.42	1			(27)
Windo	ws Type	17				4.08	x1	/[1/(1.3)+	0.04] =	5.04	1			(27)
Windo	ws Type	18				3.38	x1	/[1/(1.3)*	0.04] =	4.18	=			(27)
Windo	ws Type	9 19				5.58	x1	(1/(1.3)=	0.04] =	6.9	٦.			(27)
Windo	ws Type	20				2.73	x1	(1/(1.3)+	0.04] =	3.37				(27)
Windo	ws Type	21				3.9	×1	/[1/(1.3)+	0.04] =	4.82				(27)
Windo	ws Type	22				1.96	x1	11/(13)+	0.04] =	2.42				(27)
Rooflig	phts					46.34	4 x1	/[1/(1.3) +	0.04] =	60.242	21			(27b
Floor 1	Гуре 1					789.3	3 X	0.12	=	94.716				(28)
Floor	Type 2					29.2	x	0.12		3.504				(28)
Walls '	Type1	350	79	0		350.7	x e	0.15	-	52.62				(29)
Walls	Type2	1116	81	275.5	51	841.3	3 x	0.18	-	151.43			i 🖂	(29)
Walls	Туре3	123	.7	33.4	8	90.22	2 ×	0.18		16.24			1	(29)
Roof 1	Type1	153	.3	0		153.3	3 X	0.12	=	18.4				(30)
Roof '	Type2	21	3	0		21.3	×	0.12	=	2.56				(30)
Root	ГуреЗ	360	3	46.3	4	313.7	6 ×	0.12		37.65				(30)
Roof	Туре4	263	.8	0		263.8	8 x	0.12		31.66				(30)
Roof 7	Туре5	37)	6	0		37.6	×	0.12	=	4.51				(30)
Total a	area of e	lements	i, m²			3245	9							(31)
							lated using	formula 1	/[(1/U-val)	ue)+0.04] a	is given in	paragraph 3	.2	
			sides of it = S (A x	itemal wai 141	is and par	ubons :		(26)(30	5 + (32) =			Ē	852.78	(33)
		Cm = S(-						(30) + (32	2) + (32a).	.(32e) =	052.70	(34)
	10-10-1			⊃ = Cm ·	+ TFA) ir	ı kJ/m²K	8		100	stive Value	and in the	F	250	(35)
		St. 1993.	양양 감독 관계 위험					ocisely the	e indicative	e values of	TMP in Ta	able If		
			tailed calc				9					_		_
		1220		culated		1.0	ĸ					L	74.78	(36)
	abric he		are not sr	10wn (36) -	- 0.05 x (5	9			(33) +	(36) =		Г	927.56	(37)
Ventila	tion hea	at loss ca	alculated	d monthi	y				(38)m	n = 0.33 = (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	1801.33	1796.06	1790.9	1766.66	1762.12	1741.01	1741.01	1737.1	1749,14	1762.12	1771.3	1780.89		(38)
Heat to	ansfer o	coefficie	nt, W/K				N		(39)m	n = (37) + (3	38)m	10 <u>0</u> 04 25 - 54		
(39)m=	2728.89	2723.63	2718.46	2694.22	2689.69	2668.57	2668.57	2664.66	2676.71	2689.69	2698.86	2708.45		- 22
		2.7								Average *	2000 000 000	u/12#	2694.2	(39)
(40)m=	1.08	1.08	HLP), W. 1.08	1.07	1.06	1.06	1.06	1.06	(40)m	1 = (39)m +	(4)	1.07		
Inchina.	1.00	1.00	1.00	3.99	1.00		1.00	1,00		Average =			1.07	(40)
Numb	er of day	s in mo	nth (Tab	le 1a)									1.72	1
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

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	ator 110a	ling ener	igy requi	irement:								kWh/yea	B/C	
if TF		and the part of the second		[1 - exp	(-0.0003	149 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13	1.0.0	03		(42)
1001000		1				14 11 11 11 11 11 11 11		(25 x N) to achieve	Contraction of the second second	se farget o		7.3		(43
			person per											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot wat	er usage i	n litres per	day for ea	ch month	Vd,m = fa	ctor from	Table 1c x	(43)						
44)m=	195.03	187.94	180.84	173.75	166.66	159.57	159.57	166.66	173.75	180.84	187.94	195.03		
112425		1010000	1.000							Total = Su	m(44), or		2127.58	(44
nergy	content of	hot water	used - cal	culated m	ovithly = 4.	190 x Vd,	n x nm x l	07m / 3600						
45)m=	289.22	252.96	261.03	227.57	218.36	188.43	174.61	200.36	202.75	236.29	257.93	280.1		
	. <u> </u>								-	Total = Su	m(45)		2789.6	(45
Instan	itaneous w	ater heatly	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)				L		
46)m=	43.38	37.94	39.15	34.14	32.75	28.26	26.19	30.05	30.41	35.44	38.69	42.01		(46
Nater	storage	loss:									-			
Storag	ge volum	e (litres)	includin	ig any si	olar or W	/WHRS	storage	within sa	ame ves	sel		2000		(47
f com	munity h	eating a	ind no ta	nk in dw	velling, e	nter 110) litres in	(47)						
Other	wise if no	stored	hot wate	er (this ir	cludes i	nstantar	neous co	liod idmo	ers) ente	er '0' in (47)			
Vater	storage	loss:												
a) If n	nanufact	urer's de	eclared I	oss facte	or is kno	wn (kWł	n/day):				6	67		(48
empe	erature f	actor fro	m Table	2b							0.	54		(49
nerg	v lost fro	m water	storage	. kWh/w	ear			(48) x (49)				-		100
								(+C) X (+3)			3	6		(50
b) If n	nanufact	urer's de	eclared o			or is not	known:				3	.6		(50
2011/01/01			eclared of factor fr	ylinder	loss fact							0		
Hot wa	ater stor munity h	age loss leating s	factor fr	cylinder om Tab	loss fact									
lot wa f com /olum	ater stor munity h le factor	age loss leating s from Tal	factor fr ee section ble 2a	cylinder om Tabi on 4.3	loss fact				-					(51
Hot wa f com /olum	ater stor munity h le factor	age loss leating s from Tal	factor fr	cylinder om Tabi on 4.3	loss fact				-			0		(51 (52
Hot wa f com /olum Fempi	ater stor munity h le factor erature f	age loss leating s from Tal actor fro	factor fr ee section ble 2a	cylinder om Tabi on 4.3 2b	loss fact le 2 (kW					53) =		0		(51 (52 (53
Hot wa f com /olum Tempe Energ	ater stor munity h le factor erature f y lost fro	age loss leating s from Tal actor fro	factor fr ee sectiv ble 2a m Table storage	cylinder om Tabi on 4.3 2b	loss fact le 2 (kW					53) =		0		(51 (52 (53 (54
Hot wa f com /olum Fempi Energ Enter	ater stor munity h le factor erature f y lost fro (50) or (age loss leating s from Tal actor fro om water (54) in (5	factor fr ee sectiv ble 2a m Table storage	cylinder om Tabi on 4.3 2b , kWh/ye	loss fact le 2 (kW ear) x (52) x (0 0 0		(51 (52 (53 (54
Hot wa f com /olum Fempe Energ Enter Water	ater stor munity h le factor erature f y lost fro (50) or (age loss leating s from Tal actor fro om water (54) in (5	factor fr ee section ble 2a m Table storage 55)	cylinder om Tabi on 4.3 2b , kWh/ye	loss fact le 2 (kW ear			(47) x (51)) x (52) x (0 0 0		(51 (52 (53 (54 (55
Hot wa f com /olum Tempi Enterg Enter Water 56)m=	ater stor munity h le factor erature f y lost fro (50) or (storage 111.66	age loss leating s from Tal actor fro om water (54) in (5 loss cal 100.85	factor fr ee section ble 2a m Table storage 55) culated f 111.66	cylinder I om Tabi on 4.3 2b , kWh/ye for each 106.05	loss fact le 2 (kW ear month 111.66	h/litre/da	iy) 111.68	(47) x (51) ((56)m = (111.66) x (52) x (55) × (41) 108.05	m 111.66	108.05	0	H	(51 (52 (53 (54 (55
Hot wa f com /olum Tempi Energ Enter Vater 56)m= f cylind	ater stor munity h le factor erature fi y lost fro (50) or (storage 111.66 er containe	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate	factor fr ee secti- ble 2a m Table storage 55) culated f 111.66 d solar sto	cylinder i om Tabi on 4.3 2b , kWh/ye for each 108.05 rage, (57)	loss fact le 2 (kW ear month 111.66 m = (56)m	h/litre/da 108.05 x ((50) - (111.66 H11)] = (5	(47) x (51) ((56)m = (111.66 0), else (5)) x (52) x (55) × (41) 108.05 7)m = (56)	m 111.66 m where (108.05 H11) is fro	0 0 0 .6 111.66 m Appendix	:H	(51 (52 (53 (54 (55
Hot wa f com /olum Tempi Energ Enter Vater 56)m= f cylind	ater stor munity h le factor erature f y lost fro (50) or (storage 111.66	age loss leating s from Tal actor fro om water (54) in (5 loss cal 100.85	factor fr ee section ble 2a m Table storage 55) culated f 111.66	cylinder I om Tabi on 4.3 2b , kWh/ye for each 106.05	loss fact le 2 (kW ear month 111.66	h/litre/da	iy) 111.68	(47) x (51) ((56)m = (111.66) x (52) x (55) × (41) 108.05	m 111.66	108.05	0 0 0 6 111.66	:H :	(51 (52 (53 (54 (55
Hot wa f com /olum Tempo Energ Enter Vater 56)m= f cylind 57)m=	ater stor munity h e factor erature f y lost fro (50) or (storage 111.66 er contain	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85	factor fr ee secti- ble 2a m Table storage 55) culated f 111.66 d solar sto	ylinder i om Tabi on 4.3 2b , kWh/ye for each 108.05 rage, (57) 108.05	loss fact le 2 (kW ear month 111.66 m = (56)m	h/litre/da 108.05 x ((50) - (111.66 H11)] = (5	(47) x (51) ((56)m = (111.66 0), else (5)) x (52) x (55) × (41) 108.05 7)m = (56)	m 111.66 m where (108.05 H11) is fro	0 0 0 .6 111.66 m Appendix	H	(51 (52 (53) (54 (55) (56)
Hot wa f com /olum Tempo Energ Enter & Atter 56)m= f cylind 57)m= Primai	ater stor munity h e factor erature fi y lost fro (50) or (storage 111.66 r contain 111.66 ry circuit	age loss leating s from Tai actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 loss (an	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 anual) fro	cylinder i om Tabi on 4.3 2b , kWh/ye for each 108.05 rage, (57) 108.05 om Table	loss fact le 2 (kW ear <u>month</u> <u>111.66</u> <u>111.66</u> 3 3	108.05 x ((50) - (108.05	111.66 H11)] = (5 111.66	(47) x (51) ((56)m = (111.66 0), else (5)) x (52) x (55) × (41) 108.05 7/m = (56) 108.05	m 111.66 m where (108.05 H11) is fro	0 0 0 .6 111.66 m Appendix 111.86	н	(51 (52 (53 (54 (55 (56)
Hot wa f com /olum Tempe Energ Enter Vater 56)m= f cylind 57)m= Primal	ater stor munity h e factor erature f y lost fro (50) or (storage 111.66 er contain 111.68 ry circuit ry circuit	age loss leating s from Tai actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 loss (an loss cal	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 anual) fro culated f	cylinder I om Tabl on 4.3 2b , kWh/ye for each 108.05 rage, (57) 108.05 om Table for each	loss fact le 2 (kW ear 111.66 m = (56)m 111.68 3 month (108.05 x ((50) - (108.05 59)m = (111.66 H11)] = (5 111.66 (58) + 36	(47) x (51) ((56)m = (111.66 0), else (5) 111.66) x (52) x (55) × (41) 108.05 7/m = (56) 108.05	m 111.66 m where (111.66	108.05 1108.05	0 0 0 .6 111.66 m Appendix 111.86	:H	(51 (52 (53) (54 (55) (56)
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Hot wa f com /olum Fempi Enter Enter Water 56)m= 56)m= Primai (mo 559)m=	ater stor munity h e factor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit y circuit dified by 23.26	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate loss cal loss cal loss cal factor fr 21.01	factor fr ee sective ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 anual) fro culated f rom Table	cylinder I om Tabl on 4.3 2b for each 108.05 rage, (57) 108.05 om Table for each le H5 if t 22.51	loss fact le 2 (kW ear month 111.66 m = (56)m 111.68 e 3 month (here is s 23.26	108.05 x ((50) - (108.05 59)m = (solar wai 22.51	111.66 H11)] = (5 111.66 (58) + 3(ter heati 23.26	(47) x (51) ((56)m = (111.66 0), eise (5 111.68 35 x (41) ng and a 23.26) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m a cylinde	m 111.66 m where (111.66 r thermo	108.05 H11) is fro 108.05	0 0 0 .6 111.66 111.66 111.66 0	:н :	(51 (52 (53 (54 (55 (56) (56) (57) (58)
fot wa f com /olum rempi Energ Enter Water roylind S6jm= roylind S7jm= Primai (mo S59jm= Comb	ater stor munity h e factor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit y circuit dified by 23.26	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate loss cal loss cal loss cal factor fr 21.01	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 innual) fro culated f	cylinder I om Tabl on 4.3 2b for each 108.05 rage, (57) 108.05 om Table for each le H5 if t 22.51	loss fact le 2 (kW ear month 111.66 m = (56)m 111.68 e 3 month (here is s 23.26	108.05 x ((50) - (108.05 59)m = (solar wai 22.51	111.66 H11)] = (5 111.66 (58) + 3(ter heati 23.26	(47) x (51) ((56)m = (111.66 0), eise (5 111.68 35 x (41) ng and a 23.26) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m a cylinde	m 111.66 m where (111.66 r thermo	108.05 H11) is fro 108.05	0 0 0 .6 111.66 111.66 111.66 0	н	(51 (52 (53) (54 (55) (55) (57) (58)
Hot with f common formation of the forma	ater stor munity h le factor erature f y lost fro (50) or (storage 111.66 ry circuit 111.66 ry circuit dified by 23.26 i loss cal 0	age loss leating s from Tai actor fro m water (54) in (5 loss cal 100.85 s dedicater 100.85 loss (an loss cal factor fr 21.01 iculated 0	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 innual) fro culated f rom Tabl 23.26 for each 0	ylinder i om Tabi on 4.3 2b , kWh/ye for each 108.05 7age, (57) 108.05 for each le H5 if t 22.51 month 0	loss fact le 2 (kW ear month 111.66 m = (56)m 111.68 a 3 month (here is s 23.26 (61)m = 0	108.05 x [(50) - (108.05 59)m = (colar wai 22.51 (60) + 30 0	111.66 H11)] + (5 111.66 (58) + 30 ter heati 23.26 85 × (41 0	(47) x (51) ((56)m = (111.66 0), else (5) 111.68 355 × (41) ng and a 23.26)m 0) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m cylinde 22.51 0	m 111.66 m where (111.66 r thermo 23.26 0	108.05 H11) is fro 108.05 Stat) 22.51	0 0 0 0 0 .6 111.66 111.66 111.66 0 23.26 0		(51 (52 (53 (54 (55 (56) (56) (57) (58) (59) (59)
Hot wa f com /olum Energ Enter Water S6)m= r cylind S7)m= Primau (mo S5)m= Comb 61)m= Fotal I	ater stor munity h refactor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit dified by 23.26 i loss ca 0 neat requ	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 loss (an loss cal factor fr 21.01 culated 0 uired for	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 innual) fro culated fr rom Tab 23.26 for each 0 water he	ylinder 1 om Tabl on 4.3 2b , kWh/ye for each 108.05 rage, (57) 108.05 om Table for each le H5 if t 22.51 month 0 eating ca	ear month 111.66 m = (56)m 111.68 3 month (here is s 23.26 (61)m = 0 alculated	108.05 x [(50) - (108.05 59)m = (colar wai 22.51 (60) + 3 0 i for eac	111.66 H11)] + (5 111.66 (58) + 36 ter heati 23.26 85 × (41 0 h month	(47) x (51) ((56)m = (111.66 0), else (5) 111.66 35 × (41) ng and a 23.26)m 0 (62)m =) x (52) x (55) × (41) 108.05 7)m = (56) 108.05 m cylinde 22.51 0 0.85 × 1	m 111.66 m where (111.66 r thermo 23.26 0 (45)m +	108.05 H11) is fro 108.05 (108.05 (108.05 (108.05 (108.05) (108.05	0 0 0 0 0 0 111.66 m Appendix 111.86 0 23.26 0 (57)m + (H 59)m + (61	(51 (52 (53 (54 (55 (56) (57) (58) (59) (61)
Hot was f composed for the formation of the formation of the formation of the formation of the formation of the formation of the formation of the formation of the formation of	ater stor munity h refactor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit dified by 23.26 i loss cal 0 heat requ 424.14	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 loss (an loss cal factor fi 21.01 iculated 0 uired for 374.82	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 d solar sto 111.66 anual) fro culated f culated f culated f 23.26 for each 0 water he 395.95	ylinder i om Tabl on 4.3 2b , kWh/ye for each 108.05 rege, (57) 108.05 om Table for each le H5 if t 22.51 month 0 eating ca 358.14	ear month 111.66 m = (56)m 111.66 3 month (here is s 23.26 (61)m = 0 alculated 353.28	108.05 × ((50) - (108.05 59)m = (50lar wat 22.51 (60) + 3(0 1 for eac 318.99	111.68 H11)] = (5 111.66 (58) + 3(111.66 (58) + 3(111.66) (58) + 3(111.66 (58) + 3(111.66) (58) + 3(111.66) + 3(111.66) (5	(47) x (51) ((56)m = (111.66 0), else (5) 111.68 35 × (41) ng and a 23.26)m 0 (62)m = 335.28) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m cylinde 22.51 0 0.85 × (333.32	m 111.86 m where (111.88 r thermo 23.26 0 (45)m + 371.21	108.05 H11) is fro 108.05 22.51 0 (46)m + 388.5	0 0 0 0 0 0 111.66 0 111.66 0 23.26 0 (57)m + (415.01		(51 (52 (53 (54 (55 (56) (57) (58) (59) (61)
Hot wa f com /olum Energ Enter Water 56)m= f cylind 57)m= Primar (mo 59)m= Comb 61)m= Comb 61)m= Total H	ater stor munity h refactor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit dified by 23.26 i loss cal 0 heat requ 424.14 HW input of	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 s dedicate 100.85 loss (an loss cal factor fr 21.01 iculated 0 uired for 374.82 calculated	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 d solar sto 111.66 anual) fro culated f rom Table 23.26 for each 0 water hu 395.95 using App	ylinder I om Tabl on 4.3 2b for each 108.05 rage. (57) 108.05 om Table for each le H5 if t 22.51 month 0 eating ca 358.14 endix G oi	loss fact le 2 (kW ear month 111.66 m = (56)m 111.68 e 3 month (here is s 23.26 (61)m = 0 alculated 353.28 Appendix	108.05 x ((50) - (108.05 59)m = (50)ar wai 22.51 (60) + 3(0 1 for eac 318.99 H (negati	111.66 H111)] = (5 111.66 (58) + 30 ter heati 23.26 85 × (41 0 h month 309.52 ve quantit	(47) x (51) ((56)m = (111.66 0), else (5) 111.68 35 x (41) ng and a 23.26)m 0 (62)m = 335.28 y) (enter '0) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m cylinde 22.51 0 0.85 × (333.32 ' if no sola	m 111.86 m where (111.88 r thermo 23.26 0 (45)m + 371.21	108.05 H11) is fro 108.05 22.51 0 (46)m + 388.5	0 0 0 0 0 0 111.66 0 111.66 0 23.26 0 (57)m + (415.01		(51 (52 (53 (54 (55 (56) (57) (58) (59) (61)
Hot was f com Volum Tempi Energ Enter Water 56)m= f cylind 57)m= Primai (mo 58)m= Comb 61)m= Total H 62)m=	ater stor munity h refactor erature f y lost fro (50) or (storage 111.66 er contain 111.66 ry circuit dified by 23.26 i loss cal 0 heat requ 424.14 HW input of	age loss leating s from Tal actor fro m water (54) in (5 loss cal 100.85 s dedicate 100.85 s dedicate 100.85 loss (an loss cal factor fr 21.01 iculated 0 uired for 374.82 calculated	factor fr ee sectiv ble 2a m Table storage 55) culated f 111.66 d solar sto 111.66 d solar sto 111.66 anual) fro culated f rom Table 23.26 for each 0 water hu 395.95 using App	ylinder I om Tabl on 4.3 2b for each 108.05 rage. (57) 108.05 om Table for each le H5 if t 22.51 month 0 eating ca 358.14 endix G oi	loss fact le 2 (kW ear month 111.66 m = (56)m 111.68 e 3 month (here is s 23.26 (61)m = 0 alculated 353.28 Appendix	108.05 x ((50) - (108.05 59)m = (50)ar wai 22.51 (60) + 3(0 1 for eac 318.99 H (negati	111.66 H111)] = (5 111.66 (58) + 30 ter heati 23.26 85 × (41 0 h month 309.52 ve quantit	(47) x (51) ((56)m = (111.66 0), else (5) 111.68 35 × (41) ng and a 23.26)m 0 (62)m = 335.28) x (52) x (55) × (41) 108.05 7/m = (56) 108.05 m cylinde 22.51 0 0.85 × (333.32 ' if no sola	m 111.86 m where (111.88 r thermo 23.26 0 (45)m + 371.21	108.05 H11) is fro 108.05 22.51 0 (46)m + 388.5	0 0 0 0 0 0 111.66 0 111.66 0 23.26 0 (57)m + (415.01		(50 (51 (52 (53 (54 (55) (56) (56) (57) (58) (59) (61) (61) (62) (63)

	424.14	374.82	395.95	358.14	353.28	318.99	309.52	335.28	333.32	371.21	388.5	415.01		
					8 33		9 C	Outp	out from wa	ater heate	r (annual)	-	4378.15	(64
leat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m] + 0.8 >	(46)m	+ (57)m	+ (59)m	1	
55)m=	204.1	181.6	194.73	180.12	180.54	167.1	165.99	174.55	171.87	186.5	190.21	201.07		(65
inclu	de (57)	m in calc	culation of	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity he	eating	
5. In	ternal or	ins (see	Table 5	and 5a	1									
220.00	100	123102	5), Wat	3										
notab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
56)m=	301.26	301.26	301.26	301.26	301.25	301.26	301.26	301.26	301.26	301.26	301.26	301.26		(64
ightin	a dains	(calcula)	ted in Ap	pendix	equat	ion L9 o	r L9a), a	so see	Table 5					
57)m=		144.39	117.43	88.9	66.45	56.1	60.62	78.8	105.76	134.29	156.74	167.09		(6
	<u> </u>	ns (calc	ulated in	Append	fix Lea	uation L	13 or 1 1	3a) also	see Tai	ble 5				
	1703.06		1676.19		1461.71	1349.23		1256.41	1300.95	1395.76	1515.43	1627.91		(6)
		Cop course	ited in Ap	nnendix	L equat	ion 15	or L 15a	also se	e Table	5				
69)m=	53.13	53.13	53.13	53.13	53.13	53.13	53.13	53.13	53.13	53.13	53.13	53.13		(6)
Section of the			(Table 5											1.00
70)m=	6	6 6	6	6 6	6	6	6	6	6	6	6	6		(7
				2000			ĕ		. č			<u> </u>		145
71)m=	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01		(7
			Contraction (2001.011	-291.04	-241.01	1241.01	3293.01	5241.01	-241.01	-241.01	-641.03		1.
72)m=	274.33	gains (T 270.23	261.73	250.17	242.66	232.09	223.11	234.62	238.71	250.67	264.19	270.25		(7
		0102010		230,17	242.00									10
		gains =		2039.83	1890.2	1756.8	m + (67)m	1689.21		1900.1				12
	2259.33													
	1.000	2234.73	2174.73	2009.00	1000.2	1730.0	10/7-12	1009.21	1764.8	1900.1	2055.73			(7)
8. So	lar gains	1	1. v		o		8 S		a 38			a s		(/
6 So Solar g	tar gains gains are d	alculated	using sola	r flux from	o	and assoc	iated equa		nvert to th		le orientat	a s	Gaios	(/
6 So Solar g	tor gains gains are d ation: A	1	using solar Factor		o	and assoc Flu	iated equa	tions to co	a 38	e applicat		a s	Gains (W)	(/
6 So Solar g Drient	tor gains gains are d ation: A	alculated Access F Table 6d	using solar actor	r flux from Area m²	Table 6a i	and assoc Flu Tal	iated equa IX ble 6a	tions to co	nvert to th g_ able 6b	e applicat	FF able 6c	a s	(W)	
8 Solar g Solar g Drient	ar gaint gains are d ation: A T	alculated Access F Fable 6d 0.77	using solar Factor	r flux from Area m ²	Table 6a i	and assoc Flu Tal	iated equa IX ble 6a	tions to co T	g_ able 6b	e applicat	FF able 6c 0.7	ion.	(W) 72,53	_0
6 So Solar g Drienti Iorth	ation: A 0.9x	alculated Access F Table 6d 0.77 0.77	actor	r flux from Area m ² 11.	Table 6a a	and assoc Flu Tal x 1 x 1	iated equa IX ble 6a 10.63	tions to co T X	nvert to th g_ able 6b 0.63 0.63	e applicat	FF able 6c 0.7 0.7	ion.	(W) 72.53 90.67	
6 So Solar g Drient Iorth Iorth	ation: A 0.9x [0.9x [0.9x]	Access F Fable 6d 0.77 0.77 0.77	using solar Factor	r flux from Area m ² 11. 5.5 2.7	Table 6a 1 16 3	and assoc Flu Tal × 1 × 1 × 1	iated equa IX ble 6a 10.63 10.63	tions to co	0.63 0.63	e applicat	FF able 6c 0.7 0.7 0.7	tion.	(W) 72.53 90.67 53.23	
8 Solar g Solar g Drient lorth lorth lorth	ation: A 0.9x [0.9x [0.9x [0.9x [0.9x [0.9x [alculated Access F Table 6d 0.77 0.77 0.77 0.77	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5.	Table 6a i 16 3 4	and assoc Flu X 1 X 1 X 1 X 1 X 1 X 1	iated equa IX ble 6a 10.63 10.63 10.63	tions to co	0.63 0.63 0.63 0.63	e applicat T. 	0.7 0.7 0.7 0.7 0.7	ion.	(W) 72,53 90.67 53.23 17.55	
8 Solar g Solar g Drient: lorth lorth lorth lorth	tor gains gains are o ation: A 0.9x [0.9x [0.9x [0.9x]	alculated Access F Fable 6d 0,77 0,77 0,77 0,77 0,77		r flux from Area m ² 111. 5.5 2.7 5.0 1.9	Table 6a i 16 18 13 4	and assoc Flu X 1 X 1 X 1 X 1 X 1 X 1 X 1	iated equa IX ble 6a 10.63 10.63 10.63 10.63 10.63	T T X X X X	nvert to th g_ able 6b 0.63 0.63 0.63 0.63 0.63	e applicat	ele orientat FF able 6c 0.7 0.7 0.7 0.7 0.7	ion.	(W) 72.53 90.67 53.23 17.55 25.48	
8 So Solar g Drient Iorth Iorth Iorth Iorth	lar gains gains are o ation: A 0.9x [0.9x [0.9x [0.9x] 0.9x [Contraction Contractico Contra	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5. 2.7 5. 4.0	Table 6a i 16 18 13 14 16	and assoc Flu X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	iated equa IX Dole 6a 10.63 10.63 10.63 10.63 10.63	tions to co	nvert to th 9_ able 6b 0.63 0.63 0.63 0.63 0.63 0.63		FF able 6c 0.7 0.7 0.7 0.7 0.7 0.7 0.7		(W) 72.53 90.67 53.23 17.55 25.48 13.26	
6 So Solar g Drients lorth lorth lorth lorth lorth lorth	Lar gains gains are o ation: A 0.9x [0.9x [0.9x [0.9x [0.9x [0.9x]	Access F Fable 6d 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.7	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5.4 1.9 4.0 11.	Table 6a (16 13 13 4 16 16	and assoc Flu X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	iated equa ix ble 6a 10.63 10.63 10.63 10.63 10.63 10.63 10.63	tions to co	nvert to th g_ able 6b 0.63 0.63 0.63 0.63 0.63 0.63 0.63		le orientat FF able 6c 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		(W) 72.53 90.67 53.23 17.55 25.48 13.26 138.61	
6 So Solar g Drient: lorth lorth lorth lorth lorth lorth	lor gains gains are o ation: A 0.9x [0.9x [0.9x [0.9x [0.9x [0.9x [0.9x] 0.9x [Access F able 6d 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.7	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5. 4.0 11. 5.5	Table 6a i 16 18 13 14 16 16 18	and associ Flu X 1 X 1 X 1 X 1 X 1 X 1 X 1 X 1	iated equa ix ble 6a 0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63	tions to co	0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63		ele crientat FF able 6c 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	ion.	(W) 72.53 90.67 53.23 17.55 25.48 13.26 138.61 173.27	
6 Solar g Solar g Drient North North North North North North North	lar gains gains are o ation: A 0.9x [0.9x [0.9x] 0.9x [0.9x] 0.9x [0.9x] 0.9x [0.9x]	Cable 6d 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.7	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5.4 1.9 4.0 11. 5.5 2.7	Table 6a i 16 13 14 16 16 18 16 18 18 18	and associ Flu Tal x 1 x 1 x 1 x 1 x 1 x 1 x 1 x 1	iated equa ix ble 6a 0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63	tions to co	P		e crientat FF able 6c 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		(W) 72.53 90.67 53.23 17.55 25.48 13.26 138.61 173.27 101.73	
6 So Solar g Drient: lorth lorth lorth lorth lorth lorth	lor gains gains are o ation: A 0.9x [0.9x [0.9x [0.9x [0.9x [0.9x [0.9x] 0.9x [Access F able 6d 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.7	using solar Factor	r flux from Area m ² 11. 5.5 2.7 5. 4.0 11. 5.5	Table 6a i 16 3 4 16 16 16 18 3 3 4	and assoc Flu Tal x 1 x 1 x 1 x 1 x 1 x 1 x 1 x 1	iated equa ix ble 6a 0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63	tions to co	0.63 0.63 0.63 0.63 0.63 0.63 0.63 0.63		ele crientat FF able 6c 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	ion.	(W) 72.53 90.67 53.23 17.55 25.48 13.26 138.61 173.27	

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x

4.08

North

0.9x

0,77

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(74)

25.34

0.7

=

x

x

0.63

20.32

×

North	0.9x	0.77	×	11.16] × [34.53] × [0.63] × [0.7	- [235.54	(74)
North	0.9x	0,77	×	5.58	ī×[34.53	Ī×Ī	0.63] × [0.7	ī - Ē	294.43	(74)
North	0.9x	0.77	×	2.73		34.53] × [0.63		0.7] = [172.86	(74)
North	0.9x	0.77	×	5.4] × [34.53] × [0.63	X	0.7] = [56.99	(74)
North	0.9x	0.77	×	1.96] × [34,53] × [0.63] × [0.7	<u>]</u> - [82.73	(74)
North	0.9x	0.77	×	4.08] × [34.53] × [0.63] × [0.7] = [43.06	(74)
North	0.9x	0.77	x	11.16	x	55.46] × [0.63] × [0.7] - [378.34	(74)
North	0.9x	0.77	×	5.58] × [55.46] * [0.63] × [0.7] = [472,92	(74)
North	0.9x	0.77	× [2.73) × [55.46] * [0.63] * [0.7] = [277,65	(74)
North	0.9x	0.77	×	5,4	× [55.46] × [0.63		0,7] = [91,53	(74)
North	0.9x	0.77	×	1.95	×	55.46] × [0.63] × [0.7] = [132.89	(74)
North	0.9x	0.77	×	4.08	× [55.46] × [0.63) × [0.7] - [69.16	(74)
North	0.9x	0.77	×	11.16) × [74.72) × [0.63] × [0.7] - [509.66	(74)
North	0.9x	0.77	×	5.58) × [74.72) × [0.63] × [0.7] - [637.07	(74)
North	0.9x	0.77	×	2.73] × [74.72] × [0.63] × [0.7] = [374.02	(74)
North	0.9x	0.77	×	5,4	× [74.72] × [0.63] * [0.7] = [123,3	(74)
North	0.9x	0.77	× [1,96	×	74,72] * [0.63] * [0.7	=	179.02	(74)
North	0.9x	0.77	x	4.08	x	74.72] × [0.63] * [0.7	- [93.16	(74)
North	0.9x	0.77	*	11.16	× (79.99) × [0.63	× [0.7] - [545.6	(74)
North	0.9x	0.77	×	5.58	×	79.99] × [0.63] × [0.7	- [682	(74)
North	0.9x	0.77	x	2.73	x	79.99) × [0.63] × [0.7] = [400.4	(74)
North	0.9x	0,77	×	5.4	×	79.99	× [0.63] × [0.7] = [132	(74)
North	0.9x	0.77	×	1.96	×	79.99] × [0.63] × [0.7	=	191.65	(74)
North	0.9x	0.77	×	4.08	x	79.99] × [0.63		0.7] • [99.73	(74)
North	0.9x	0.77	×	11.16	×	74.68] × [0.63] × [0,7] - [509.39	(74)
North	0.9x	0.77	×	5.58	X	74.68] * [0,63] × [0.7] - [636.74	(74)
North	0.9x	0.77	×	2.73	×:	74.68] × [0.63] × [0.7] = [373.83	(74)
North	0.9x	0.77	×	5.4	×	74.68] × [0.63	×	0.7] = [123.24	(74)
North	0.9x	0.77	×	1.96	x	74.68	_ × [0.63] × [0.7	=	178.93	(74)
North	0.9x	0.77	×	4,08	×	74.68	×	0.63	×	0.7	-	93.11	(74)
North	0.9x	0.77	×	11.16	×	59,25] × [0.63	×	0.7	-	404.14	(74)
North	0.9x	0.77	×	5.58	x	59.25	×	0.63] × [0.7	-	505.17	(74)
North	0.9x	0.77	×	2.73	×	59.25	×	0.63	×	0.7] = [296.58	(74)
North	0.9x	0.77	×	5.4	×	59.25	×	0.63	×	0.7	=	97.77	(74)
North	0.9x	0.77	×	1,96	X.	59.25	×	0.63	×	0.7	=	141.95	(74)
North	0.9x	0.77	×	4,08	x	59.25	×	0.63	×	0.7	=	73.87	(74)
North	0.9x	0.77	×	11.16	_ × [41.52] × [0.63] * [0.7] - [283.2	(74)
North	0,9x	0.77	×	5.58	×	41.52] × [0.63	× [0.7] = [354	(74)
North	0.9x	0.77	×	2.73	×	41.52	× [0.63] × [0.7] - [207.83	(74)
North	0.9x	0.77	×	5.4	× [41.52] × [0.63] × [0.7] = [68.52	(74)
North	0.9x	0.77	x	1.96	×	41.52] × [0.63	×	0.7	=	99.47	(74)

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North	0.9x	0.77	×	4.08] × [41.52] × [0.63] * [0.7	-	51.77	(74)
North	0.9x	0,77	×	11.16	Ī×Ī	24.19	Ī×Ī	0.63	Ī×Ē	0.7	ī - Ē	165	(74)
North	0.9x	0.77	×	5.58] × [24.19] × [0,63] × [0.7] = [206.25	(74)
North	0.9x	0.77	×	2.73	X	24.19] × [0.63] × [0.7] = [121.09	(74)
North	0.9x	0.77	×	5.4] × [24.19] × [0.63] × [0,7	<u>]</u> - [39.92	(74)
North	0.9x	0.77	x	1.96] × [24.19	Ī×[0.63	Ī×Ē	0.7	ī - [57.96	(74)
North	0.9x	0.77	x	4.08	x	24.19] × [0.63] × [0.7	ī - Ē	30.16	(74)
North	0.9x	0.77	x	11.16] × [13.12] × [0.63] × [0.7] = [89.48	(74)
North	0.9x	0.77	×	5.58] × [13.12] * [0.63] * [0.7] = [111.85	(74)
North	0.9x	0.77	×	2.73] × [13.12] × [0.63] × [0,7] = [65.67	(74)
North	0.9x	0.77	x	5.4	x	13.12] × [0.63	×	0.7	=	21.65	(74)
North	0.9x	0.77	×	1.96	×	13.12] × [0.63) × [0.7] - [31.43	(74)
North	0.9x	0.77	ं×ः	4.08	. x:	13.12) × [0.63] × [0.7] - [16.36	(74)
North	0.9x	0.77	×	11.16	x	8.86) × [0.63] × [0.7] = [60.47	(74)
North	0.9x	0.77	x	5,58] × [8.86] × [0.63] * [0.7] = [75.58	(74)
North	0.9x	0.77	×	2.73	× [8,86] × [0.63] * [0.7] = [44.38	(74)
North	0.9x	0.77	× [5.4	× [8.86] × [0.63] * [0.7	=	14.63	(74)
North	0.9x	0.77	x	1.96	x	8.86] × [0.63] * [0.7	- [21.24	(74)
North	0.9x	0.77	*	4.08	× [8,86) × [0.63) × [0.7] - [11.05	(74)
East	0.9x	0.54	x	4,79	×	19.64] × [0.63] × [0.7	- [20.16	(76)
East	0.9x	0.54	x	13.04	x [19.64) × [0.63] × [0.7] = [54.89	(76)
East	0.9x	0.54	×	16.83] × [19.64	× [0.63] * [0,7	=	70.84	(76)
East	0.9x	0.54	×	7.19	×	19.64	×	0.63] × [0.7	=	30.27	(76)
East	0.9x	0.77	×	3.38	x	19.64] × [0.63		0.7] - [20.29	(76)
East	0.9x	0.77	x	5.58] × [19.64] × [0.63] × [0,7	- [200.96	(76)
East	0.9x	0.77	×	2.73	× [19.64] × [0,63] * [0.7] - [81.93	(76)
East	0.9x	0.77	×	3.9	×	19.64] × [0.63] × [0.7] = [46.82	(76)
East	0.9x	0.77	x	1.96	x	19.64) × [0.63	× [0.7] = [35.29	(76)
East	0.9x	0.54	×	4.79	x	38.42	× [0.63] * [0.7	=	39.44	(76)
East	0.9x	0.54	×	13.04	×	38.42	×	0.63	_ × [0.7	- [107.38	(76)
East	0.9x	0.54	×	16.83	×	38.42	×	0.63] × [0.7	-	138.59	(76)
East	0.9x	0,54	×	7,19	x	38.42	×	0.63] * [0.7	-	59.21	(76)
East	0.9x	0.77	×	3.38	X	38.42] × [0.63] × [0.7] = [39.69	(76)
East	0.9x	0.77	×	5.58	×	38.42) × [0.63] × [0.7	=	393.12	(76)
East	0.9x	0.77	×	2.73	X.	38.42	× [0.63	×	0.7	=	160.28	(76)
East	0.9x	0.77	×	3.9	×	38.42	×	0.63	×	0.7	=	91.59	(76)
East	0.9x	0.77	×	1.96] × [38.42	×	0.63] × [0.7	- [69.04	(76)
East	0.9x	0,54	×	4,79	×	63.27	X [0.63] × [0.7	- [64.96	(76)
East	0.9x	0,54	×	13.04	×	63.27	× [0.63] × [0.7] - [176.84	(76)
East	0.9x	0.54	× [16.83	×	63.27] × [0.63] × [0.7] = [228.23	(76)
East	0.9x	0.54	x	7.19	. ×:[63.27] × [0.63] × [0.7	=	97.5	(76)

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DER WorkSheet: New dwelling design stag	DER WorkSheet:	New d	welling	design stag	ge
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East 0.9x	1.001.0.035	1 1										
	0.77	×	3.38	x	63.27	×	0.63] × [0.7	-	65.36	(76)
East 0.9x	0.77	×	5.58	×	63.27	×	0.63] × [0.7	7 - [647.41	(76)
East 0.9x	0.77	×	2.73	x	63.27	x	0.63] × [0.7] = [263.95	(76)
East 0.9x	0.77	×	3.9	x	63.27	x	0.63] x [0.7] = [150.83	(76)
East 0.9x	0.77	x	1.96	×	63.27	×	0.63] × [0,7] - [113.7	(76)
East 0.9x	0.54] × [4.79	×	92.28	x	0.63] × [0.7] = [94.74	(76)
East 0.9x	0.54	x	13.04	x	92.28	x	0.63] × [0.7] - C	257.91	(76)
East 0.9x	0.54	×	16.83	x	92.28	x	0.63] × [0.7] = [332,86	(76)
East 0.9x	0.54	×	7,19) ×	92.28] x	0.63] × [0.7] = [142.2	(76)
East 0.9x	0.77	×	3.38] ×	92.28	x	0.63] × [0,7] = [95.32	(76)
East 0.9x	0.77	x	5,58] x	92.28	x	0.63] × [0,7] = [944.2	(76)
East 0.9x	0.77	x :	2.73	x	92.28	×	0.63] × [0.7] - [384.96	(76)
East 0.9x	0.77	ं×ः	3.9	x	92.28	x	0.63] × [0.7	- [219.98	(76)
East 0.9x	0.77	×	1.96	x	92.28	X:	0.63] × [0.7] = [165.83	(76)
East 0.9x	0.54	×	4.79	x	113.09	×	0.63] × [0.7	=	116,1	(76)
East 0.9x	0.54	×	13.04	×	113.09	×	0.63] × [0.7] = [316,07	(76)
East 0.9x	0.54	×	16.83	x	113.09	×	0.63] × [0,7] = [407.94	(76)
East 0.9x	0.54	×	7.19	x	113.09	x	0.63] × [0.7] • [174.28	(76)
East 0.9x	0.77	*	3.38	× [113.09	X	0.63] × [0.7] • [116.82	(76)
East 0.9x	0.77	×	5.58) ×	113.09	x	0.63] × [0.7] - [1157.16	(76)
East 0.9x	0.77	x	2.73	x	113.09	x :	0.63] × [0.7] = [471.78	(76)
East 0.9x	0.77	×	3.9) ×	113.09	x	0.63] × [0.7] = [269,59	(76)
East 0.9x	0.77	×	1.96	×	113.09	×	0.63] × [0.7] = [203.23	(76)
East 0.9x	0.54	×	4.79	x	115.77] × [0.63] * [0.7] • [118.85	(76)
East 0.9x	0.54	×	13.04] x	115.77	x	0.63] × [0.7] - [323.56	(76)
East 0.9x	0.54	x	16.83) ×	115.77] ×	0.63] × [0.7] - [417.6	(76)
East 0.9x	0.54	ं 🛛	7:19) ×	115.77	x	0.63] × [0.7] = [178.4	(76)
East 0.9x	0.77	x	3.38	x	115.77	x	0.63] × [0.7] = [119.59	(76)
East 0.9x	0.77	×	5.58	x	115,77	×	0.63] × [0.7] = [1184,56	(76)
East 0.9x	0.77	×	2.73	×	115,77	× [0.63] × [0.7] = [482,95	(76)
East 0.9x	0.77	×	3.9	×	115.77	×	0.63] × [0.7] - [275.97	(76)
East 0.9x	0.77	×	1,96	x	115.77	x	0.63] * [0.7	-	208.04	(76)
East 0.9x	0.54) × [4,79) ×	110.22	X	0.63] × [0.7] = [113.15	(76)
East 0.9x	0.54	x	13.04] ×	110.22) x	0.63] × [0.7] = [308.04	(76)
East 0.9x	0.54	×	16.83	x.	110.22	x	0.63] × [0.7	=	397.57	(76)
East 0.9x	0.54	× [7.19	x [110.22] × [0.63] × [0.7] = [169.85	(76)
East 0.9x	0.77	×	3.38	×	110.22] × [0.63] × [0.7] - [113.85	(76)
East 0,9x	0.77	×	5.58	×	110.22	*	0.63] × [0.7] = [1127.74	(76)
East 0.9x	0.77	x	2.73] ×	110.22	x	0.63] × [0.7] = [459.79	(76)
East 0.9x	0.77	×	3,9	x	110.22	x	0.63] × [0.7] = [262.74	(76)
East 0.9x	0.77	x	1.96	×	110.22	1 x	0.63	l x [0.7	T = [198.06	(76)

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East	0.9x	0.54	×	4.79) × [94.68] × [0.63] * [0.7	=	97.2	(76)
East	0.9x	0.54	×	13.04) × [94.68] × [0.63] × [0.7] - [264.6	(76)
East	0.9x	0.54	×	16.83	×	94.68] × [0.63] × [0.7	=	341.51	(76)
East	0.9x	0.54	×	7.19] × [94.68	×	0.63] × [0.7] = [145.9	(76)
East	0.9x	0.77	×	3,38	×	94.68	×	0.63] × [0,7] - [97.8	(76)
East	0.9x	0.77) × [5.58	×	94.68	x	0.63] × [0.7] = [968.72	(76)
East	0.9x	0.77	x	2.73	x	94.68	x	0.63] × [0.7	- [394.95	(76)
East	0.9x	0.77	×	3.9] × [94.68] × [0.63] × [0.7] = [225.69	(76)
East	0.9x	0,77	× [1.96) × [94.68] * [0.63] * [0.7] = [170.13	(76)
East	0.9x	0.54	×	4.79] * [73.59] × [0.63] × [0.7] = [75.55	(76)
East	0.9x	0.54	×	13.04) × [73.59] × [0.63] × [0.7	=	205.67	(76)
East	0.9x	0.54	×	16.83) × [73.59] × [0.63] × [0.7] - [265.44	(76)
East	0.9x	0.54	×	7.19	× [73.59	×	0.63] * [0.7] - [113.4	(76)
East	0.9x	0.77	×	3.38) × [73.59] × [0.63] × [0.7] = [76.02	(76)
East	0.9x	0.77	×	5,58] × [73.59] × [0.63] * [0.7] = [752.96	(76)
East	0.9x	0.77	×	2.73] × [73.59] × [0.63] × [0.7] = [306,99	(76)
East	0.9x	0.77	×	3.9	×	73.59] × [0.63] × [0,7	=	175,42	(76)
East	0.9x	0.77	×	1,96	x	73.59] × [0.63] × [0.7	- [132.24	(76)
East	0.9x	0.54	*	4.79] × [45.59] × [0.63] * [0.7] - [46.8	(76)
East	0.9x	0.54	×	13.04) × [45.59] × [0.63] × [0.7	- [127.41	(76)
East	0.9x	0.54	x	16.83	× [45.59] × [0.63] × [0.7] = [164.45	(76)
East	0.9x	0.54	×	7,19	X [45.59	× [0.63] * [0.7] = [70.25	(76)
East	0.9x	0.77	× [3.38] × [45.59	X	0.63] * [0.7	= [47.09	(76)
East	0.9x	0.77	×	5.58	x	45.59] * [0.63] * [0.7] = [466,47	(76)
East	0.9x	0.77	×	2.73] × [45.59] × [0.63] × [0.7	- [190.18	(76)
East	0.9x	0.77	×.	3.9	× [45.59] × [0,63] * [0.7] - [108.67	(76)
East	0.9x	0.77	×	1.96) × [45.59) × [0.63] × [0.7] = [81.92	(76)
East	0.9x	0.54	×	4.79	× [24.49] × [0.63	× [0.7] = [25.14	(76)
East	0.9x	0.54	×	13.04	×	24.49	×	0.63] × [0.7	=	68.44	(76)
East	0.9x	0.54	×	16.83	×	24,49	×	0.63) × [0.7	- [88.33	(76)
East	0.9x	0.54	×	7.19	×	24.49] × [0.63] × [0.7	- [37.74	(76)
East	0.9x	0.77	×	3.38	x	24.49) × [0.63] × [0.7	-	25.3	(76)
East	0.9x	0.77	×	5.58) × [24.49] × [0.63] × [0.7] = [250.57	(76)
East	0.9x	0.77	×	2.73] × [24.49] × [0.63] × [0.7	=	102.16	(76)
East	0.9x	0.77	×	3.9	X [24.49	X [0.63	×	0.7	=	58.38	(76)
East	0.9x	0.77	×	1,96	x	24.49	×	0.63	×	0.7	=	44.01	(76)
East	0.9x	0.54	×	4,79] × [16.15] × [0.63] × [0.7	- [16.58	(76)
East	0.9x	0.54	×	13.04	×	16.15] × [0.63		0.7] = [45.14	(76)
East	0.9x	0.54	x	16.83] × [16.15] × [0.63] × [0.7] - [58.26	(76)
East	0.9x	0.54	× [7.19) × [16.15] × [0.63] × [0,7] = [24.89	(76)
East	0.9x	0.77	×	3.38	×	16.15	×	0.63	X	0.7	=	16.68	(76)

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East	0.9x	0.77	×	5,58	x	16.15] * [0.63] * [0.7	- [165.26	(76)
East	0.9x	0,77	×	2.73	×	16.15] × [0.63] × [0.7] = [67.38	(76)
East	0.9x	0.77	×	3.9	x	16.15) × [0.63] × [0.7	=	38.5	(76)
East	0.9x	0.77	×	1.95	×	16.15	×	0.63	X	0.7] = [29.02	(76)
South	0.9x	0,77	×	3,38	×	46.75] × [0.63] * [0,7] - [386.35	(78)
South	0.9x	0.77	x	2,73	× [46.75] × [0.63] × [0.7] = [351.06	(78)
South	0.9x	0.77	x	1.96	x	46.75) × [0.63] × [0.7] - [140.02	(78)
South	0.9x	0.77	×	3,38] × [76.57] * [0.63] × [0.7] = [632.74	(78)
South	0.9x	0.77	×	2.73	×	76.57] * [0.63] × [0.7] = [574.94	(78)
South	0.9x	0.77	×	1.96	× [76.57] × [0.63		0,7] = [229,32	(78)
South	0.9x	0.77	×	3.38	X [97.53] × [0.63] × [0,7] = [806	(78)
South	0.9x	0.77	×	2.73	× [97.53] × [0.63] × [0.7] - [732.37	(78)
South	0.9x	0.77	ं×ं	1.96	×.	97.53) × [0.63] * [0.7] - [292.11	(78)
South	0.9x	0.77	×	3.38	x	110.23) × [0.63] × [0.7] - [910.95	(78)
South	0.9x	0.77	x	2.73	×	110.23) × [0.63] * [0.7	= [827.74	(78)
South	0.9x	0.77	×	1.96	×	110.23] × [0.63] × [0.7] = [330,15	(78)
South	0.9x	0.77	×	3.38	×	114.87] × [0.63] × [0,7	=	949.27	(78)
South	0.9x	0.77	x	2.73	x	114.87) × [0.63] × [0.7	- [862.56	(78)
South	0.9x	0.77	× [1.96	× [114.87] × [0.63] * [0.7] • [344.04	(78)
South	0.9x	0.77	×	3.38	×	110.55] × [0.63] × [0.7	- [913.54	(78)
South	0.9x	0.77	x	2.73	x	110.55] × [0.63] × [0.7] = [830.09	(78)
South	0.9x	0.77	×	1,96	×	110.55] × [0.63] × [0,7] = [331.09	(78)
South	0.9x	0.77	×	3.38	×	108.01] × [0.63] * [0.7] = [892.59	(78)
South	0.9x	0.77	×	2.73	x	108.01] × [0.63] * [0.7] • [811.05	(78)
South	0.9x	0.77	×	1,96] × [108.01] × [0.63] × [0.7] - [323.5	(78)
South	0.9x	0.77	× [3.38) × [104.89] * [0,63] × [0.7] - [866.82	(78)
South	0.9x	0.77) ×	2.73	× [104.89] * [0.63] × [0.7] = [787.64	(78)
South	0.9x	0.77	× [1.96	×	104.89] × [0.63] × [0.7] = [314.16	(78)
South	0.9x	0.77	×	3.38	× [101.89] × [0.63] × [0.7] = [841.96	(78)
South	0.9x	0.77	× [2.73	×	101.89] × [0.63] × [0.7] = [765.05	(78)
South	0.9x	0.77	× [1.96	×	101.89] * [0.63] * [0.7] - [305.15	(78)
South	0.9x	0.77	×	3.38	x	82.59] × [0.63] * [0.7	- [682.47	(78)
South	0.9x	0.77) × [2.73) × [82.59] × [0.63] × [0.7] - [620.13	(78)
South	0.9x	0.77	× [1.96) × [82.59] × [0.63] × [0.7] = [247.34	(78)
South	0.9x	0.77	×	3.38	X.	55.42] * [0.63	_ × [0.7	= [457.95	(78)
South	0.9x	0.77	× [2.73	_ x [55.42] × [0.63] × [0.7] = [416.12	(78)
South	0.9x	0.77	×	1.96	×	55.42] × [0.63] × [0.7] - [165.97	(78)
South	0.9x	0.77] × [3.38	×	40.4] × [0.63] × [0.7] - [333.84	(78)
South	0.9x	0.77] × [2.73] × [40.4] × [0.63] × [0.7] - [303.35	(78)
South	0.9x	0.77] × [1,96) × [40.4] × [0.63] × [0.7] = [120.99	(78)
West	0.9x	0.77	×	5.58] × [19.64	Ī×Ī	0.63	Ī×Ē	0.7] = [133.97	(80)

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West	0.9x	0.77] × [3,38] × [19.64] × [0.63] × [0.7] - [40.58	(80)
West	0.9x	0.77	×	2.73	٦×٦	19.64	Ī×Ī	0.63	1 × [0.7	ī - ī	98.32	(80)
West	0.9x	0.77	×	1,96		19.64	1×1	0,63	1 . [0.7] = [35.29	(80)
West	0.9x	0,77	×	5.58] × [38.42] × [0.63] × [0.7	ī - [262.08	(80)
West	0.9x	0.77	×	3.38	ī × [38.42	1 × [0.63	i × ľ	0.7	ī - Ē	79,37	(80)
West	0.9x	0.77	×	2.73] × [38.42] ×[0.63	Ī×Ē	0.7	٦ - F	192.33	(80)
West	0.9x	0.77	×	1.96] × [38.42] × [0.63] × [0.7	<u>-</u>	69.04	(80)
West	0.9x	0.77	×	5.58] × [63.27] × [0.63] × [0.7] = [431.6	(80)
West	0.9x	0.77	×	3,38] × [63.27] * [0.63] * [0.7] = [130.72	(80)
West	0.9x	0.77	×	2.73] × [63.27] × [0.63] × [0,7] = [316,74	(80)
West	0.9x	0.77	×	1.95	×	63.27] × [0.63] × [0,7] = [113.7	(80)
West	0.9x	0.77	×	5.58) × [92.28] × [0.63] × [0.7] - [629.47	(80)
West	0.9x	0.77	ं×ं	3.38	x	92.28) × [0.63] * [0.7] - [190.65	(80)
West	0.9x	0.77	×	2.73	x	92.28) × [0.63] × [0.7] - [461.95	(80)
West	0.9x	0.77	×	1.96	×	92.28] × [0.63] * [0.7] = [165,83	(80)
West	0.9x	0.77	×	5,58) × [113.09] * [0.63] * [0.7] = [771.44	(80)
West	0.9x	0.77	× [3.38	×	113.09] × [0.63] * [0.7	=	233.64	(80)
West	0.9x	0.77	x	2.73	x	113.09] × [0.63] × [0.7	-	566.14	(80)
West	0.9x	0.77	*	1.96	× (113.09] × [0.63] × [0.7] - [203.23	(80)
West	0.9x	0.77	x	5.58	×	115.77] × [0.63] × [0.7	- [789.7	(80)
West	0.9x	0.77	x	3.38	x	115.77) × [0.63] × [0.7] = [239.18	(80)
West	0.9x	0.77	x	2.73	×	115,77	× [0.63] × [0,7	=	579,54	(80)
West	0.9x	0,77	×	1.96	×	115,77] × [0.63] * [0,7] = [208.04	(80)
West	0.9x	0.77	×	5.58	x	110.22] × [0.63] * [0.7] • [751.83	(80)
West	0.9x	0.77	×	3.38	×	110.22] × [0.63] × [0,7] - [227.7	(80)
West	0.9x	0.77	× (2.73	. ×	110.22] * [0,63] * [0.7] - [551.75	(80)
West	0.9x	0.77	×	1.96	×	110.22	×	0.63] × [0.7	- [198.06	(80)
West	0.9x	0.77	×	5.58	×	94.68] × [0.63) × [0.7] = [645.81	(80)
West	0.9x	0.77	×	3.38	×	94.68	×	0.63] × [0.7	=	195.59	(80)
West	0.9x	0.77	×	2.73	×	94.68	× [0.63] × [0.7] = [473.94	(80)
West	0.9x	0.77	×	1.96	×	94.68	×	0.63	×	0.7	-	170.13	(80)
West	0.9x	0.77	×	5.58	x	73.59	×	0.63	× [0.7	-	501.97	(80)
West	0.9x	0.77	×	3.38	×	73.59	×	0.63	×	0.7	_ = [152.03	(80)
West	0.9x	0.77	×	2.73	×	73.59	×	0.63	×	0.7	=	368.38	(80)
West	0.9x	0.77	×	1,96	x	73.59	×	0.63	×	0.7	=	132.24	(80)
West	0.9x	0.77	×	5.58	×	45.59] × [0.63	×	0.7	=	310.98	(80)
West	0.9x	0.77	×	3.38	×	45.59	×	0.63] × [0.7	- [94.18	(80)
West	0.9x	0.77	×	2.73	×	45.59	X	0.63	×	0.7	[228.22	(80)
West	0.9x	0.77	×	1.96	×	45.59	× [0.63] × [0.7] - [81.92	(80)
West	0.9x	0.77	×	5,58	×	24.49] × [0.63] × [0.7	=	167.05	(80)
West	0.9x	0.77	×	3.38	x	24.49	×	0.63	×	0.7	=	50.59	(80)

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West	0.9x	0.77	х	2.7	3	x	24.49	x	0.63	×	0.7		122.59	(80
/est	0.9x	0,77	×	1.9	8	x	24.49	×	0.63] × [0.7	-	44.01	(80
est	0.9x	0.77	×	5.5	58	×	16.15	×	0,63] * [0.7	=	110,17	(80
est	0.9x	0.77	×	3,2	18	×	16.15	x	0.63] × [0.7	=	33.37	(80
est	0.9x	0.77	×	2.3	73	x	16.15	×	0.63] × [0,7	-	80.85	(80
est	0.9x	0.77	×	t.t	86	x	16.15	×	0.63	ī×Ē	0.7	=	29.02	(80
oofligh	nts 0.9x	1	×	46	34	x	26	×	0.63] × [0.7	-	478.2	(83
oofligh	nts 0.9x	1	×	48.	34	x	54	1×	0.63] × [0.7	-	993.19	(8)
oofligh	nts p. 9x	1	×	46	34	×	96	1×	0.63] × [0.7	=	1765.67	(8)
oofligh	nts 0.9x	1	×	46.	34	*	150	×	0.63	1 × [0.7	=	2758,85	(8)
oofligh	nts o.9x	1	×	46.	34	x	192	i × 🗆	0.63	٦×٢	0.7	=	3531.33	(8)
oofligh	ts 0.9x	1	×	46.	34	x	200	i x 🗖	0.63	٦×٢	0.7	-	3678.47	(8)
loofligh	ts 0.9x	1	×	46	34	x	189	×	0.63	ī×Ē	0.7		3476.15	(8)
loofligh	ts 0.9x	1	×	46.	34	x	157	i x 🗖	0.63	ī × ī	0.7		2887.6	(8)
toofligh	nts 0.9x	1	×	46	34	×	115	i x 🗖	0.63	ī×Ē	0.7	=	2115.12	(8)
Roofligh	ts 0.9x	1	×	46.	34	×	66	i x 🗖	0.63	ī×ī	0.7		1213.89	(8)
toofligh	ts 0.9x	1	×	46	34	×	33	i x 🗖	0.63	ī×Ē	0.7	-	606.95	(8)
toofligh	ts o. ax	1	×	46.	34	x [21	i . E	0.63	1 . Γ	0.7	- - i	386.24	(8)
(3)m= [otal ga (4)m= [2497.96 ains – i 4757.29	4852.51 nternal a 6907.24	7283 29 ind sola 9458.02	r (84)m =	12610.84 = (73)m 14501.04	12930 56 + (83)m 14687.36	12298.66 , watts	10567.68	Sum(74)m 8350.37 10115.16	5402.78	3067.73 5123.47	2086.89 4271.52		102
83)m= [fotal ga 84)m= [7 Me Tempo	2497.96 ains – ii 4757.29 an inter erature	4852 51 nternal a 6907 24 nal term during h	7283 29 ind sola 9458.02 Cinturn neating (10336.08 r (84)m = 12375.92 (heating periods in	12610.84 = (73)m 14501.04 n the livi	12930 56 + (83)m 14687.36) ng area	12298.66 , watts 13975.85 from Tat	10567 68	10115.16	5402.78			21	(8-
33)m= [otal ga 54)m= [7 Me Tempo	2497.96 ains – in 4757.29 an inter erature ition fac	4852.51 nternal a 6907.24 hal tern during h tor for g	7283 29 ind sola 9458.02 Sintun eating p ains for	10336.08 r (84)m = 12375.92 (heating periods in living are	12610.84 = (73)m 14501.04 h the livi ea, h1,m	12930 56 + (83)m 14687 36 ng area t (see Ta	12298.66 , watts 13975.85 from Tat able 9a)	10567 68 12256 81 ble 9, Th	10115.16 10115.16	5402.78 7302.88	5123.47	4271.52	21	(8) (84) (85)
i3)m= [otal ga i4)m= [7. Me Tempi Utilisa	2497.96 ains – ii 4757.29 an inter erature	4852 51 nternal a 6907 24 nal term during h	7283 29 ind sola 9458.02 Cinturn neating (10336.08 r (84)m = 12375.92 (heating periods in	12610.84 = (73)m 14501.04 n the livi	12930 56 + (83)m 14687.36) ng area	12298.66 , watts 13975.85 from Tat	10567 68	10115.16	5402.78			21	(8)
83)m= [otal ga 84)m= [7. Mea Tempo Utilisa 86)m= [2497.96 ains – in 4757.29 an Inter erature tion fac Jan 1	4652 51 nternal a 6907 24 nal terrio during h tor for g Feb 1	7283 29 Ind sola 9458.02 Perature leating p ains for Mar 1	10336.08 r (84)m = 12375.92 theating periods in living are Apr 1	12610.84 = (73)m 14501.04 1563501 h the livi ea, h1,m May 0.98	12930 56 + (83)m 14687 36 ng area i (see Ti Jun 0.9	12298.66 , watts 13975.85 from Tat able 9a) Jul 0.76	12256 81 12256 81 ble 9, Th Aug 0.84	1 8350.37 10115.16 11 (°C) Sep 0.98	5402.78 7302.88 Oct	5123.47 Nov	4271.52 Dec	21	(8)
53)m= [otal ga 54)m= [7. Mer Tempi Utilisa 56)m= [Mean	2497.96 ains – in 4757.29 an Inter erature tion fac Jan 1	4652 51 nternal a 6907 24 nal terrio during h tor for g Feb 1	7283 29 Ind sola 9458.02 Perature leating p ains for Mar 1	10336.08 r (84)m = 12375.92 (heating periods in living are 1 living are	12610.84 = (73)m 14501.04 1562501 n the livii ea, h1,m May 0.98 ea T1 (fe	12930 56 + (83)m 14687.36 ng area (see Ta Jun 0.9 ollow ste	12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 aps 3 to 7	12256 81 12256 81 ble 9, Th Aug 0.84	1 8350.37 10115.16 11 (°C) Sep 0.98 0.98	5402.78 7302.88 Oct	5123.47 Nov	4271.52 Dec	21	(8) (8)
83)m= [fotal ga 84)m= [7. Mea Tempi Utilisa 86)m= [Mean 57)m= [2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 internal 19.8	4652 51 Internal a 6907 24 Internal during h tor for g Feb 1 Lemper 19.9	7283 29 ind sola 9458.02 eating p ains for Mar 1 ature in 20.1	10336.08 r (84)m = 12375.92 (helaunp beriods in living are Apr 1 living are 20.38	12610.84 = (73)m 14501.04 14501.0	12930 56 + (83)m 14687 36 ng area 1 (see Ta Jun 0.9 cliow sta	12298.66 , watts 13975.85 from Tat able 9a) Jul 0.76 aps 3 to 7 20.92	10567 66 12256 81 ble 9, Th Aug 0.84 7 in Tab 20.9	1 8350.37 10115.16 11 (°C) Sep 0.98 le 9c) 20.71	5402.78 7302.88 Oct 1	5123.47 Nov 1	4271.52 Dec 1	21	(8-
\$3)m= [otal ga \$4)m= [7. Mer Tempi Utilisa \$6)m= [Mean \$7;m= [Tempi	2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 internal 19.8 erature	4652 51 Internal a 6907 24 Atal Lemm during h tor for g Feb 1 Lemper 19.9 during h	7283.29 and sola 9458.02 Peating p ains for Mar 1 ature in 20.1	10336.08 r (84)m = 12375.92 (hetalum beriods in living and Apr 1 living and 20.38 periods in	12610.84 = (73)m 14501.04 14501.0	12930 56 + (83)m 14687.36 ng area (see Ta Jun 0.9 cllow ste 20.84 dwelling	12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 eps 3 to 7 20.92 g from Ta	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T	1 8350.37 10115.16 11 (°C) Sep 0.98 16 9c) 20.71 7h2 (°C)	5402.78 7302.88 Oct 1 20.36	5123.47 Nov 1 20.03	4271.52 Dec 1 19.78	21	(8- (8: (80 (87
\$3)m= [fotal ga 54)m= [7. M= Tempi Utilisa 56)m= [Mean 57)m= [Tempi 58)m= [2497.96 ains – in 4757.29 an Inter erature tion fac Jan 1 internal 19.8 erature 20.02	4652 51 Internal a 6907 24 And temp during h tor for g Feb 1 I temper 19.9 during h 20.02	7283.29 ind sola 9458.02 Produce eating (ains for Mar 1 ature in 20.1 reating (20.02	10336.08 r (84)m = 12375.92 thenune periods in living are 20.38 periods in 20.03	12810.84 = (73)m 14501.04 14501.04 192301 n the livit ea, h1,m May 0.98 ea T1 (for 20.64 n rest of 20.03	12930 56 + (83)m 14687.36 ng area (see Ta Jun 0.9 collow ste 20.84 dwelling 20.04	s 12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 eps 3 to 7 20.92 g from Ta 20.04	12256.81 12256.81 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04	1 8350.37 10115.16 11 (°C) Sep 0.98 le 9c) 20.71	5402.78 7302.88 Oct 1	5123.47 Nov 1	4271.52 Dec 1	21	(8) (8)
83)m= [fotal ga 84)m= [7. Mes 7. Mes 7. Mes 86)m= [86)m= [Mean 87)m= [7. Mean 87)m= [7. Mean 88)m= [0. Mean 1. Mean	2497.96 ains – ii 4757.29 an Inter erature tion fac Jan 1 internal 19.8 erature 20.02 ation fac	4652 51 Internal a 6907 24 Internal during h tor for g Feb 1 I temper 19.9 during h 20.02 tor for g	7283 29 and sola 9458.02 Produce eating p ains for Mar 1 ature in 20.1 eating p 20.02 ains for	10336.08 r (84)m = 12375.92 (Heating periods in living and Apr 1 living and 20.38 periods in 20.03 rest of d	12810.84 = (73)m 14501.04 14501.04 1522501 n the livit ea, h1,m May 0.98 ea T1 (for 20.64 n rest of 20.03 welling,	12930 56 + (83)m 14687.30 ng area a (see Ta Jun 0.9 collow ste 20.84 dwelling 20.04 h2,m (s	12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 aps 3 to 7 20.92 g from Ta 20.92 g from Ta	12256.81 12256.81 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 99a)	 8350.37 10115.16 11 (°C) Sep 0.98 90) 20.71 20.03 	5402.78 7302.88 Oct 1 20.36 20.03	5123.47 Nov 1 20.03 20.03	4271.52 Dec 1 19.78 20.02	21	(8- (8: (8) (8)
\$3)m= [fotal ga \$4)m= [7. M= Tempi Utilisa \$6)m= [Mean \$7;m= [Tempi \$8)m= [Utilisa	2497.96 ains – in 4757.29 an Inter erature tion fac Jan 1 internal 19.8 erature 20.02	4652 51 Internal a 6907 24 And temp during h tor for g Feb 1 I temper 19.9 during h 20.02	7283.29 ind sola 9458.02 Produce eating (ains for Mar 1 ature in 20.1 reating (20.02	10336.08 r (84)m = 12375.92 thenune periods in living are 20.38 periods in 20.03	12810.84 = (73)m 14501.04 14501.04 192301 n the livit ea, h1,m May 0.98 ea T1 (for 20.64 n rest of 20.03	12930 56 + (83)m 14687.36 ng area (see Ta Jun 0.9 collow ste 20.84 dwelling 20.04	s 12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 eps 3 to 7 20.92 g from Ta 20.04	12256.81 12256.81 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04	1 8350.37 10115.16 11 (°C) Sep 0.98 16 9c) 20.71 7h2 (°C)	5402.78 7302.88 Oct 1 20.36	5123.47 Nov 1 20.03	4271.52 Dec 1 19.78	21	(8- (8- (8- (8- (8-)
83)m= [fotal ga 84)m= [7 Me 7 Me 7 Me 86)m= [Mean 86)m= [7 Mean 88)m= [Utilisa 89)m= [Mean	2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 tion fac 1 interna	4652 51 nternal a 6907 24 nal territor during h tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1 temper 19.9	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 20.1 reating p 20.02 ains for 1 ature in	10336.08 r (84)m = 12375.92 (heating periods in living an 20.38 periods in 20.03 rest of d 0.99 the rest	12610.84 = (73)m 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 1000 100	12930 56 + (83)m 14687.36 ng area 6 (see Ta Jun 0.9 20.84 dwelling 20.04 h2,m (s 0.84 ing T2 (12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 20.92 g from Ta 20.04 ee Table 0.83 follow ste	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73 eps 3 to	8350.37 10115.16 11 (°C) Sep 0.98 e 9c) 20.71 h2 (°C) 20.03 0.97 7 in Tabl	5402.78 7302.88 Oct 1 20.36 20.03 1 e 9c)	5123.47 Nov 1 20.03 20.03	4271.52 Dec 1 19.78 20.02	21	(8) (8) (8) (8) (8) (8)
53)m= [otal ga 54)m= [7 Me 7 Me 7 Me 1 Composition 56)m= [Mean 57)m= [1 Composition 1 Compositio	2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 tion fac 1	4652 51 nternal a 6907 24 fail (entried) tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 ature in 20.1 reating p 20.02 ains for 1	10336.08 r (84)m = 12375.92 (102000 periods in living and Apr 1 living and 20.38 periods in 20.03 rest of d 0.99	12610.84 = (73)m 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 0.98 0.98 0.98	12930 56 + (83)m 14687.30 ng area 1 (see Tr Jun 0.9 20.84 dwelling 20.04 h2,m (s 0.84	12298.66 , watts 13975.85 from Tat able 9a) Jul 0.76 aps 3 to 7 20.92 g from Ta 20.04 ee Table 0.63	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73	8350.37 10115.16 11 (°C) Sep 0.98 20.71 h2 (°C) 20.03 0.97 7 in Tabl 19.71	5402.78 7302.88 Oct 1 20.36 20.03 1 e 9c) 19.21	5123.47 Nov 1 20.03 20.03 1 18.72	4271.52 Dec 1 19.78 20.02 1 18.35		(8) (8) (8) (8) (8) (8) (9)
53)m= [otal ga 54)m= [7 Me 7 Me 7 Me 1 Composition 56)m= [Mean 57)m= [1 Composition 1 Compositio	2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 tion fac 1 interna	4652 51 nternal a 6907 24 nal territor during h tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1 temper 19.9	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 20.1 reating p 20.02 ains for 1 ature in	10336.08 r (84)m = 12375.92 (heating periods in living an 20.38 periods in 20.03 rest of d 0.99 the rest	12610.84 = (73)m 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 14501.04 1000 100	12930 56 + (83)m 14687.36 ng area 6 (see Ti Jun 0.9 20.84 dwelling 20.04 h2,m (s 0.84 ing T2 (12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 20.92 g from Ta 20.04 ee Table 0.83 follow ste	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73 eps 3 to	8350.37 10115.16 11 (°C) Sep 0.98 20.71 h2 (°C) 20.03 0.97 7 in Tabl 19.71	5402.78 7302.88 Oct 1 20.36 20.03 1 e 9c) 19.21	5123.47 Nov 1 20.03 20.03	4271.52 Dec 1 19.78 20.02 1 18.35	21	(8- (8: (80 (87
53)m= [otal ga 54)m= [7. M= 7. M= 7. M= 1. Tempi Utilisa 66)m= [Mean 57)m= [Utilisa 58)m= [Utilisa 59)m= [Mean 90)m= [2497 96 ains - in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 ition fac 1 interna 18.36	4652 51 nternal a 6907 24 and Lender during h tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1 temper 18.52	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 ature in 20.1 eating p 20.02 ains for 1 ature in 18.81	10336.08 r (84)m = 12375.92 (1020000 periods in living and Apr 1 living and 20.38 periods in 20.03 rest of d 0.99 the rest 19.22	12610.84 = (73)m 14501.04 14501.04 14501.04 14501.04 1552501 n the livi ea, h1,m May 0.98 0.98 0.98 0.98 0.98 0.98 of dwelling, 19.61	12930 56 + (83)m 14687 36 ng area a (see Tr Jun 0.9 20.84 dwelling 20.04 h2,m (s 0.84 ing T2 (19.87	12298.66 , watts 13975.85 from Tal able 9a) Jul 0.76 20.92 g from Ta 20.04 ee Table 0.83 follow ste	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73 eps 3 to 19.93	8350.37 10115.16 11 (°C) Sep 0.98 e 9c) 20.71 n2 (°C) 20.03 0.97 7 in Tabl 19.71	5402.78 7302.88 Oct 1 20.36 20.03 1 e 9c) 19.21	5123.47 Nov 1 20.03 20.03 1 18.72	4271.52 Dec 1 19.78 20.02 1 18.35		(8) (8) (8) (8) (8) (8) (9)
53)m= [otal ga 54)m= [7- M= 7- M= 7- M= 56)m= [000 m= [Mean 50)m= [Mean 50)m= [Mean	2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 ition fac 1 interna 18.36 interna	4652 51 nternal a 6907 24 and Lender during h tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1 temper 18.52	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 ature in 20.1 eating p 20.02 ains for 1 ature in 18.81	10336.08 r (84)m = 12375.92 (1020000 periods in living and Apr 1 living and 20.38 periods in 20.03 rest of d 0.99 the rest 19.22	12610.84 = (73)m 14501.04 14501.04 14501.04 14501.04 1552501 n the livi ea, h1,m May 0.98 0.98 0.98 0.98 0.98 0.98 of dwelling, 19.61	12930 56 + (83)m 14687 36 ng area a (see Tr Jun 0.9 20.84 dwelling 20.04 h2,m (s 0.84 ing T2 (19.87	12298.66 , watts 13975.85 from Tat able 9a) Jul 0.76 aps 3 to 7 20.92 g from Ta 20.04 ee Table 0.63 follow ste 19.95	10567 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73 eps 3 to 19.93	8350.37 10115.16 11 (°C) Sep 0.98 e 9c) 20.71 n2 (°C) 20.03 0.97 7 in Tabl 19.71	5402.78 7302.88 Oct 1 20.36 20.03 1 e 9c) 19.21	5123.47 Nov 1 20.03 20.03 1 18.72	4271.52 Dec 1 19.78 20.02 1 18.35		(8) (8) (8) (8) (8) (8) (9) (9)
\$3)m= [otal ga \$4)m= [7- M= Tempo Utilisa \$6)m= [Mean \$7)m= [Utilisa \$9)m= [Utilisa \$9)m= [Mean 90)m= [Mean 92)m= [2497.96 ains – in 4757.29 an inter erature tion fac Jan 1 interna 19.8 erature 20.02 tion fac 1 interna 18.36 interna 18.43	4652 51 hternal a 6907 24 hal territe during h tor for g Feb 1 temper 19.9 during h 20.02 tor for g 1 temper 18.52 temper 18.59	7283.29 ind sola 9458.02 Partition peating p ains for Mar 1 ature in 20.1 eating p 20.02 ains for 1 ature in 18.81	10336.08 r (84)m = 12375.92 (heating periods in living an 20.38 periods in 20.03 rest of d 0.99 the rest 19.22 or the wh 19.28	12610.84 = (73)m 14501.04 = (73)m 14501.04 = (73)m 14501.04 = (73)m = (73)m	12930 56 + (83)m 14687 36 ng area (see Ti Jun 0.9 collow ste 20.84 dwelling 20.04 h2,m (s 0.84 ing T2 (19.87 lling) = 1 19.92	12298.66 , watts 13975.85 from Tat able 9a) Jul 0.76 aps 3 to 7 20.92 g from Tat 20.04 ee Table 0.63 follow stee 19.95 fLA × T1 20	tos67 66 12256 86 ble 9, Th Aug 0.84 7 in Tab 20.9 able 9, T 20.04 9a) 0.73 eps 3 to 19.93 + (1 - f 19.98	8350.37 10115.16 11 (°C) 5ep 0.98 e 9c) 20.71 h2 (°C) 20.03 7 in Tabl 19.71	5402.78 7302.88 Oct 1 20.36 20.03 1 20.03 1 9.20 19.21 LA = Livir 19.26	5123.47 Nov 1 20.03 20.03 1 18.72 g area + (4	4271.52 Dec 1 19.78 20.02 1 18.35 6) =		(8-) (8-) (8-) (8-) (8-) (8-) (9-) (9-)

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a
Stroma SAP 2012 Vertical 1. Mar (SAP APC) May Jun Jul Aug Sep Oct Nov Dec

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Utilisa	ation fac	tor for g	ains, hn	n:										
(94)m=	1	1	1	0.99	0.96	0.83	0.62	0.72	0.96	1	1	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (8	4)m									
95)m=	4757.22	6906.49	9449.88	12286.56	13863.63	12168.2	8731.49	8854.13	9697.66	7292.73	5123.2	4271.49		(95)
Month	hly aver	age exte	ernal ten	nperatur	e from T	able 8	-							
=m(89)	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	-			-				x [(93)m		<u> </u>				
(97)m=	38571.4	37294,47	33649.62	27959.38	21399.65	14192.09	9061.79	9541.08	15137.08	23299.7	31529.76	3 38515.46		(97)
		-		-		Wh/mon	th = 0.02	24 x [(97)m - (95	the state of the s				
(98)m=	25157.75	20420.72	18004.61	11284.43	5606.8	0	0	0	0	11909.18	19012,72	2 25477.51		-
								Tota	ai per year	(kWh/year	() = Sum(i	98)	136873.73	(98)
Space	e heatin	g requir	ement ir	i kWh/m	²/year							ſ	54.19	(99)
Sc S	nace co	oling rea	uiremei	nt										-110
					See Ta	ble 10b								
-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rat	e Lm (ca	lculated	using 2	5°C inte	mal tem	perature	and ext	ernal ter	nperatur	e from	Table 10)		
(100)m=	0	0	0	0	0	25084.6	19747.45	20251.45	0	0	0	0		(100
Utilisa	ation fac	tor for lo	oss hm											
(101)m=	0	0	0	0	0	0.65	0.76	0.68	0	0	0	0		(101
Usefu	l loss, t	mLm (V	Vatts) =	(100)m :	x (101)m	i i	<u>м</u> – – – – – –	_	03 - 12					
(102)m=	0	0	0	0	0	16427.14	14919.22	13710.78	0	0	0	0		(102
Gains	s (solar	gains ca	lculated	for appl	icable w	eather n	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	17208.77	16388.15	14477.1	0	0	0	0		(103
				v month < 3 × (98		fwelling,	continu	ous (kW	/h) = 0.0	24 x [(10	03) <i>m</i> – ((102)m] x	(41)m	
(104)m=	0	0	0	0	0	562.77	1092.88	0	0	0	0	0		
	11	2	00 - D	16. 	20 X	<u>.</u>	24 - 3		Tota	I = Sum(104)	=	1655.65	(104
	1 fractio								fC=	cooled	area + (4) =	0.59	(105
	-	actor (T	-	i —										20
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		-
				1	110.0	HAR			Tota	I = Sum(104)	=	0	(106
(107)m		requirer	ment for	month =	(104)m	83.56	× (106)		0	0	0			
(107/m)-			u		0	65.50	102.27		10.000	1 = Sum(245.83	(107
												- ļ		-
				kWh/m²/) + (4) =	-		0.1	(108
1.000			nts – Ind	lividual h	eating s	ystems (including	1 micra-C	CHP)					
1.10	e heati ion of sp		at from s	econdar	y/supple	mentary	system					Г	0.1	(201
Fract	ion of sp	bace hea	at from n	nain sys	tem(s)			(202) = 1	- (201) =			ĺ	0.9	(202
Fract	ion of m	ain heat	ting from	i main sy	/stem 2							ł	0.1	(203
				main sy				(204) = (2	02) + [1 -	(203)1 =		ł	0.81	(204
			-	-				(205) = (2	and some inter	SA MILER CO		ł		-
				main sy				[200] = [2	ue) ~ (200	121		ļ	0.09	(205
Efficie	ancy of	main spa	ace heat	ting syst	em 1							l	319.7	(206

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Efficie	ncy of i	main spa	ace heat	ing syste	em 2							Γ	93.3	(207)
Efficie	ncy of s	seconda	ry/suppl	ementar	y heatin	g systen	n, %					[80	(208)
Coolin	ng Syste	em Ener	gy Effici	ency Ra	tio							[6.75	(209)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
				alculate		<u> </u>								
			-	11284.43		0	0	0	0	11909.18	19012.72	25477.51		
211)m	= {[(98)m x (20	(4)] } x 1	100 + (20			2							(211)
	6374.03	5173.85	4561.69	2859.05	1420.55	Ð	0	0	0		4817.11			_
								Tota	i (kWh/ye	ar) =Sum(3	211) _{1.3.W.3}	- L	34678.67	(211)
			x 100 +											
(13)m=	2426.79	1969.84	1736,78	1088.53	540.85	0	0	0	0	1148.8	and the second sec	2457.64		-
								Tota	ii (kWh/ye	ar) =Sum(3	213), ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,	Č L	13203.25	(213)
		-		y), kWh/	month									
	and the second se	and the second se	00 + (20	the second se	700.05					4400.05	0070 50			
10)m=	3144.72	2002.09	2250.58	1410.55	700.85	0	0	0	0	1468.60 ar) =Sum(1		3184.69		-
2000								TOUS	i frann Am	ary-sump	C10/1.4.0.3	e L	17109.22	(215)
	heating	Sector sectors	ten fanle											
utput	424.14	374.82	ter (calc 395.95	ulated a 358.14	353.28	318.99	309.52	335.28	333.32	371.21	388.5	415.01		
fficien		ater hea	L							1			79.6	(216)
217)m=		88.29	87.98	87.24	85.56	79.6	79.6	79.6	79.6	87.28	88.11	88.48		(217)
10.00			kWh/m	-		0.00		1.476						1.501
) + (217)											
19)m=	479.66	424.53	450.05	410.51	412.88	400.74	388.85	421.21	418.74	425.3	440.93	469.06		
								Tota	l = Sum(2	19a), ₁₀ =			5142.47	(219)
• • • • • • • • • • • • • • • • • • •	100 100 Co. 100 P		Wh/mor	nth.								62		20
ſ)m+ (209	-									-		
221)m-	0	0	0	0	0	12.38	24.04	0 Tota	0	0	0	0	20.10	Lanu
								Tota	i = Sum(2	2174 # #			36.42	(221)
	I totals				2					k	Wh/year	Г _Г	kWh/yea	r l
pace	neating	tuel use	id, main	system	1							Ľ	34678.67	
space	heating	fuel use	ed, main	system	2							L	13203.25	
pace	heating	fuel use	ed, seco	ndary								E	17109.22	
Vater i	heating	fuel use	d									[5142.47	
pace	cooling	fuel use	bd									Ē	36.42	
lectric	ity for p	oumps, f	ans and	electric	keep-ho	t						10		
centra	l heatin	ig pump										60		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
otal e	lectricity	y for the	above, l	kWh/yea	r			sum	of (230a)	(230g) =	6		105	(231)
lectric	ity for li	ighting										ř	2871.02	(232)
lectric	ity gen	erated b	y PVs									Ē	-3346.17	(233)
12020200	00 (M. 192	2002/01/07	CULTURE (1997)										10000000	a times

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DER WorkSheet:	New	dwelling	design stage
----------------	-----	----------	--------------

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519 =	17998.23 (26
Space heating (main system 2)	(213) x	0.216 =	2851.9 (26)
Space heating (secondary)	(215) x	0.216	3695.59 (26)
Water heating	(219) x	0.216 =	1110.77 (26
Space and water heating	(261) + (262) + (263) + (264) =	25656.5 (26)
Space cooling	(221) x	0.519 =	18.9 (26)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	54.5 (26)
Electricity for lighting	(232) x	0.519 =	1490.06 (26)
Energy saving/generation technologies Item 1		0,519 =	-1736.66 (26)
Total CO2, kg/year		sum of (265)(271) =	25483.29 (27)
Dwelling CO2 Emission Rate		(272) + (4) =	10.09 (27)
El rating (section 14)			87 (274

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APPENDIX (ii)

SAP L1A 2013/16 REGULATIONS

(SAP Worksheet)

		User Details:					
Assessor Name: Software Name:	Ondrej Gajdos Stroma FSAP 2012	Stroma Softwar			107000000	006629 n: 1.0.5.7	
		Property Address: 2	8, Avenu	e Road			
Address :	28, Avenue Road, LONDO	N, NW8 6BU					
1 Overall dwelling dim	ensions:						
		Area(m ²)	_	v. Height(r		Volume(m ³	-
Basement		789.3 (1	a) x	3.3	(2a) =	2604.69	(3,4
Ground floor		617 (1	b) x	5.5	(2b) =	3393.5	(3)
First floor		570.3 (1	c) x	4.2	(2c) =	2395.26	(30
Second floor		549 (1	d) x (b	3.1	(2d) =	1701.9	(30
Total floor area TFA = (1	1a)+(1b)+(1c)+(1d)+(1e)+(1	In) 2525.6 (4)				
Dwelling volume			3a)+(3b)+(3	ic)+(3d)+(3e)-	+(3n) =	10095.35	(5)
2. Ventilation rate:	and a second	the stilles		stal		mlasshow	
Number of chimpsus	main seconda heating heating	<u> </u>	= [otal	×40 =	m ³ per hou	19
Number of chimneys	0	* 0		0	1	Ð	(6a
Number of open flues	0 * 0	* 4		4	×20 =	80	(66)
Number of intermittent fa	ans		3	16	×10 =	160	(74
Number of passive vent	5			0	× 10 =	0	(76
Number of flueless gas	fires			0	x 40 =	D	(70
					Air ch	anges per ho	our
Infiltration due to chimne	eys, flues and fans = (6a)+(6b)+	(7a)+(7b)+(7c) =	1	240	+ (5) =	0.02	(8)
	been carried out or is intended, proce	ed to (17), otherwise cor	stinue from	(9) to (16)			
Number of storeys in Additional infiltration	the dwelling (ns)					0	(9)
	0.25 for steel or timber frame of	or 0.35 for masonry	construct		((9)-1)x0.1 =	D	(10
	present, use the value corresponding			2011	4	0	101
deducting areas of open							-
	floor, enter 0.2 (unsealed) or	0.1 (sealed), else er	nter 0			0	(12
If no draught lobby, er					4	0	(13
-	vs and doors draught stripped			0		0	(14
Window infiltration		0.25 - [0.2 x				0	(15
Infiltration rate	aEQ supressed in subis make			+ (13) + (15) =		D	(16
	, q50, expressed in cubic metr ility value, then (18) = [(17) + 20]*			e or envelo	pe area	4	(17
	es if a pressurisation test has been do			eina used	4	0.22	(18
Number of sides shelter		ne a a cogree as perm	cacany is p	on of soon	l l	0	(19
Sheiter factor		(20) = 1 - [0.	075 x (19)]	-		1	(20
Infiltration rate incorpora	ting shelter factor	(21) = (18) ×	(20) =			0.22	(21
Infiltration rate modified	for monthly wind speed						

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22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
	_					105-201		21310		001000	1	1 (2468150) 1 (2468150) 1 (2468150)		
Mind F	actor (2	22a)m =	(22)m +	4										
22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1,18		
diuste	ed infiltr	ation rat	e (allowi	na for sl	helter an	d wind s	speed) =	(21a) x	(22a)m			5		
]	0.29	0.28	0.27	0.25	0.24	0.21	0.21	0.21	0.22	0.24	0.25	0.26		
			change i	rate for t	he appli	cable ca	\$ 0	10000			2 V	<u> </u>		_
		al ventila				1 2 3							0	(23)
			using App			1992 - 1992 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 - 1994 -) = (23a)			Ø	(23t
	model with	heat race	overy: effic	iency in %	allowing t	lor in-use f	actor (fron	n Table 4h) =				D	(230
If bala	inceu wis	199205 1994	arenj. onio									1	v	1201
			12		1.5					2b)m + (23b) × [1 – (23c) +		lest
a) if t			12		1.5					2b)m + (0	23b) × [1 - (23c) +		_
a) If t 24a)m=	balance 0	d mech o	anical ve	entilation 0	with he	at recov	ery (MVI	HR) (24a	a)m = (22	0	0			_
a) If t 24a)m=[b) If t	balance 0	d mech o	anical ve 0	entilation 0	with he	at recov	ery (MVI	HR) (24a	a)m = (22	0	0			(24)
a) if t 24a)m= b) if t 24b)m=	balance o balance o	ed mech o ed mech o	anical ve 0 anical ve	entilation o entilation o	with he o without o	at recov 0 heat rec 0	ery (MV) 0 covery (M 0	HR) (24a 0 MV) (24a 0	a)m = (22 0 0)m = (22 0	0 2b)m + (0 23b)			(24)
a) if t 24a)m b) if t 24b)m (c) if v	balance o balance o whole h	d mech o d mech o ouse ex	anical ve o anical ve o	entilation o entilation o ntilation (with he	at recov o heat rec o ve input	ery (MVI o covery (f o ventilatio	HR) (24a 0 MV) (24a 0 0 from (a)m = (22 0)m = (22 0 0 0 0 0 0	0 2b)m + (0	0 23b) 0			(24)
a) if t 24a)m=[b) if t 24b)m=[c) if v if	balance o balance o whole h	d mech o d mech o ouse ex	anical ve o anical ve o tract ver	entilation o entilation o ntilation (with he	at recov o heat rec o ve input	ery (MVI o covery (f o ventilatio	HR) (24a 0 MV) (24a 0 0 from (a)m = (22 0)m = (22 0 0 0 0 0 0	0 2b)m + (0	0 23b) 0			(24)
a) If t 24a)m= b) If t 24b)m= c) If v if 24c)m=	balance 0 balance 0 whole h f (22b)n 0	ed mech o d mech o ouse ex n < 0.5 x	anical ve anical ve anical ve tract ver (23b), t	entilation entilation tilation hen (24	with he without or positiv c) = (23t	at recov 0 heat rec 0 ve input 0); other 0	ery (MVI o covery (f ventilatio wise (24 0	HR) (242 0 MV) (242 0 0 from (c) = (221 0	a)m = (2) 0)m = (2) 0 0 utside 0) m + 0. 0	0 2b)m + (0 5 × (23t	0 23b) 0	0		(24) (24)
a) if t 24a)m= b) if t 24b)m= c) if v if 24c)m= d) if r	balance 0 balance 0 whole h f (22b)n 0 natural	ed mech o d mech ouse ex n < 0.5 x o ventilati	anical ve anical ve tract ver (23b), t	entilation entilation ntilation (hen (24 0 ole hous	with he without or positive c) = (23t o se positive o	at recover at recover heat recover a point of the technology of the technology technology technology at recover a point of technology at recover at recover	ery (MVI 0 covery (f ventilatio wise (24 0 ventilatio	HR) (242 0 MV) (242 0 0 from (c) = (22) 0 0 from	a)m = (22 0)m = (22 0 0 utside 0) m + 0. 0 0 tt	0 2b)m + (0 5 × (23t	0 23b) 0	0		(24) (24)
a) if t 24a)m= b) if t 24b)m= c) if v if 24c)m= d) if r if	balance 0 balance 0 whole h f (22b)n 0 natural	ed mech o d mech ouse ex n < 0.5 x o ventilati	anical ve anical ve tract ver (23b), t on or wh	entilation entilation ntilation (hen (24 0 ole hous	with he without or positive c) = (23t o se positive o	at recover at recover heat recover a point of the technology of the technology technology technology at recover a point of technology at recover at recover	ery (MVI o covery (f ventilatio wise (24 o ventilatio	HR) (242 0 MV) (242 0 0 from (c) = (22) 0 0 from	a)m = (22 0)m = (22 0 0 utside 0) m + 0. 0 0 tt	0 2b)m + (0 5 × (23t	0 23b) 0	0		(24) (24)
a) if t 24a);m=[b) if t 24b);m=[c) if v if 24c);m=[d) if r if 24d);m=[balance 0 balance 0 whole h f (22b)n 0 natural f (22b)n 0.54	ed mech o ed mech ouse ex n < 0.5 3 0 ventilati n = 1, th 0.54	anical ve anical ve tract ver < (23b), t 0 on or wh en (24d)	entilation 0 entilation 0 hen (24 0 ole hous m = (22 0.53	with he without o without o o o o o o o o o o o o o	at recover 0 heat rec 0 ve input 0 ve input ve input 0 ve input 0 ve input 0 ve input 0 0 0 0 0 0 0 0 0 0 0 0 0	ery (MVI 0 covery († 0 ventilatic wise (24 0 ventilatic 24d)m = 0.52	HR) (247 0 MV) (248 0 on from (c) = (228 0 0 on from (0.5 + [(2 0.52	a)m = (22 0 0)m = (22 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2b)m + (0 5 × (23t 0 0.5]	0 23b) 0) 0	0		(24) (24) (24)
a) if t 24a)m= b) if t 24b)m= c) if v if 24c)m= d) if r if 24d)m=	balance 0 balance 0 whole h f (22b)n 0 natural f (22b)n 0.54	ed mech o ed mech ouse ex n < 0.5 3 0 ventilati n = 1, th 0.54	anical ve 0 anical ve 0 dract ver × (23b), 1 0 on or wh en (24d) 0.54	entilation 0 entilation 0 hen (24 0 ole hous m = (22 0.53	with he without o without o o o o o o o o o o o o o	at recover 0 heat rec 0 ve input 0 ve input ve input 0 ve input 0 ve input 0 ve input 0 0 0 0 0 0 0 0 0 0 0 0 0	ery (MVI 0 covery († 0 ventilatic wise (24 0 ventilatic 24d)m = 0.52	HR) (247 0 MV) (248 0 on from (c) = (228 0 0 on from (0.5 + [(2 0.52	a)m = (22 0 0)m = (22 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2b)m + (0 5 × (23t 0 0.5]	0 23b) 0) 0	0		(24) (24) (24)

ELEMENT Gross area (m²)	Openings m ²	Net Area A ,m ^a	U-value W/m2K	A X U (W/K)	k-value kJ/m²-K	A X k kJ/K
Doors		6.28	x 1.3 =	8.164		(26)
Windows Type 1		4.79	x1/[1/(1.3)+0.04] =	5.92		(27)
Windows Type 2		13,04	x1/[1/(1.3)+0.04] =	16,11		(27)
Windows Type 3		16.83	x1/[1/(1.3)+0.04] =	20.8		(27)
Windows Type 4		7.19	x1/[1/(1.3)+0.04] =	8.88		(27)
Windows Type 5		3.38	x1/[1/(1.3)+0.04] =	4.18		(27)
Windows Type 6		2.73	x1/[1/(1.3)+0.04] =	3.37		(27)
Windows Type 7		1.96	x1/[1/(1.3)+0.04] =	2.42		(27)
Windows Type 8		5.58	x1/[1/(1.3)+0.04] =	6.9		(27)
Windows Type 9		3.38	x1/[1/(1.3)+0.04] =	4.18		(27)
Windows Type 10		2.73	x1/[1/(1.3)+0.04] =	3.37		(27)
Windows Type 11		1.96	x1/[1/(1.3)+0.04] =	2.42		(27)
Windows Type 12		11.16	x1/[1/(1.3)+0.04] =	13.79		(27)
Windows Type 13		5.58	x1/[1/(1.3)+0.04] =	6.9		(27)

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Windo	ws Type	a 14				0.70		/1/(1.3)+	0.041 -	0.07				(27)
	ws Type					2.73	=	/[1/(1.3)+	and the second	3.37 6.67	=			(27)
	ws Type					5.4	- 20	/[1/(1.3)+	1. 1. 1. 1.		=			1.11
	ws Type					1.98	=	A1/(1.3)+	Sec.	2.42	=			(27)
	ws Type					4.08	=	/[1/(1.3)+		5.04	-			(27)
						3.38	=	Same Ma	and the second	4.18	=			(27)
	ws Type					5.58	=	/[1/(1.3)+	19312	6.9	4			(27)
	ws Type					2.73	=	/[1/[1.3)+		3.37	-			(27)
	ws Type					3.9	=	/[1/(1.3)+		4.82	_			(27)
	ws Type	8 22				1.95	_	/[1/(1.3.)+	535 A	2.42				(27)
Rooflig						46.34	4 x1	/[1/(1.3) +	0.04] =	60.242	╡.			(27b
Floor 1	Type 1					789.3	3 ×	0.12	=	94,716				(28)
Floor 7	Type 2					29.2	x	0.12	-	3.504				(28)
Walls '	Type1	350.	79	0		350.7	9 X	0.15	•	52.62				(29)
Walls '	Type2	1118	81	275.5	51	841.3	x	0.18	-	151.43				(29)
Walls '	ТуреЗ	123	.7	33.4	8	90.22	2 X	0.18	=	16.24				(29)
Roof 7	Type1	153	.3	0		153.3	3 X	0,12	-	18.4				(30)
Roof 1	Гуре2	21	3	0		21.3	×	0.12	=	2.56				(30)
Roof 1	Гуре3	360	.1	46.3	4	313.7	x 8	0.12	-	37.65	ור			(30)
Roof 1	Type4	263	.8	0	=	263.6	s x	0.12		31.66	i F		ī Ē	(30)
Roof 7	Type5	37	6	0		37.6	×	0.12	-	4.51	i F		i —	(30)
Total a	rea of e	elements	, m²			3245	9							(31)
		t root wind as on both					lated using	formula 1	A(1/J-val	ve)+0.04] s	is given in	paragraph 3	3.2	
		ss, W/K						(26)(30) + (32) =			Г	852.78	(33)
Heat c	apacity	Cm = S	(Axk)	10					((28).	(30) * (3)	2) + (32a).	(32e) =	0	(34)
		parame		P = Cm ·	TFA) ir	n kJ/m²K	8		Indica	tive Value	Medium	Ē	250	(35)
For desi	gn asses:		ere the de	tails of the	1			ecisely the	indicative	e values of	TMP in T	able 1f		1241
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix	ĸ					Г	74.78	(36)
if details	of therm	al bridging	are not kn	own (36)	= 0.05 x (3	17)						3.		_
Total f	abric he	at loss							(33) •	(36) =		. [927.56	(37)
Ventila	tion hea	at loss ca	alculated	d monthl	У				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(4.2.B)
(38)m=	1801.33	1796.06	1790.9	1766,66	1762.12	1741.01	1741.01	1737.1	1749.14	1762.12	1771.3	1780.89		(38)
Heat tr	-	coefficie							(39)m	1 = (37) + (38)m			
(39)m=	2728.89	2723.63	2718.46	2694.22	2689.69	2668.57	2668.57	2664,66				2708.45		-
Heat Ir		ameter (H		1m216						Average =) = (39)m +		u/12#	2694.2	(39)
(40)m*	1.08	1.08	1.08	1.07	1.06	1.06	1.06	1.06	1.08	1.06	1.07	1.07		
Cashine.		1.00	1.94	2000	1.00	1.88	1.00	1.89		Average =			1.07	(40)
Numbe	er of day	ys in mo	nth (Tab	le 1a)									2011	-
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

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4. W	ater heat	ing ene	igy requ	irement:								kWh/yea	ari	
if TF	ned occu A > 13.9 A £ 13.9), N = 1		(1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (TFA -13		.03		(43
Annua Reduce	l averag	e hot wa l average	hot water	usage by	5% if the a		designed i	(25 x N) to achieve		se target o		7.3		(43
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
for wat	er usage ir	ittres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
44)m=	195.03	187.94	180.84	173.75	166.66	159.57	159.57	166.66	173.75	180.84	187.94	195.03		
2973526	1000000			enanas	11370112	Sector		10000100			m(44)1_12		2127.58	(44
nergy	content of	hot water	used - cal	culated m	onthiy = 4.	190 x Vd,r	n x nm x L	0Tm / 3600	2 kWh/mor	ith (see Ti	ables 1b, 1	ic, 1d)		
45)m=	289.22	252.96	261.03	227.57	218.36	188.43	174.61	200.36	202.75	236.29	257.93	280.1		_
linstan	faneous w	ater heati	ng at point	t of use (no	hot water	storage).	enter 0 in	boxes (46		Total = Su	m(45))	-	2789.6	(48
46)m=	43.38	37.94	39.15	34.14	32.75	28.26	26.19	30.05	30.41	35.44	38.69	42.01		(46
	storage	11110101-	39.10	34,14	36.13	20.20	8.0.19	30.03	30,41	33.44	30.03	42.01		1.
Storag	e volum	e (litres)) includir	ng any s	olar or V	WHRS	storage	within sa	ame ves	sel		2000		(47
com	munity h	eating a	and no ta	ank in dv	velling, e	nter 110	litres in	(47)						
	N. 1997 N. 1997	1210181			CONTRACTOR OF			mbi boil	ers) ente	er 'O' in ((47)			
	storage													
a) If n	nanufact	urer's de	eclared I	loss fact	or is kno	wn (kWf	v/day):				6	.87		(4
emp	erature fa	actor fro	m Table	2b							0	.54		(4
				, kWh/y		10-230 Mil	wanad	(48) x (49) =		3	5.6		(50
S				2010/01/01 01:0		or is not h/litre/da								Je.
		12010101	ee secti		C & (KAA	(Will Code	97					0		(5
	e factor											0		(5)
emp	erature fa	actor fro	m Table	2b								0		(5
nerg	lost fro	m water	r storage	, kWh/y	ear			(47) x (51) x (52) x (53) =		0		(5
Enter	(50) or (54) in (55)								3	5.6		(5
Vater	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
56)m=	111.66	100.85	111.66	108.05	111.66	108.05	111.66	111.66	108.05	111.66	108.05	111.66		(56
cylind	er contains	dedicate	d solar sto	irage, (57)	m = (56)m	x [(50) - (H11)] + (5	0), else (5	7)m = (58)	m where (H11) is fro	m Appendia	(H)	
57)m=	111.66	100.85	111.66	108.05	111.66	108.05	111.66	111.66	108.05	111.66	108.05	111.66		(57
brima	v eireuit	loce (or	nun fr	om Table	. 2							0		(58
	5 Con 10 Co		- 60 R.Ga			59)m = ((58) + 36	35 × (41)	m					
	1							ng and a		r thermo	stat)			
59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59
omb	loss cal	culated	an-anali	Common part	(61)m =	(60) + 36	35 x (41)m	20		9 S			
31)m=	0	0	0	0	0	0	0	0	0	0	0	0		(6
1	0.115 (107)			a 1.0384.00.025		1000000	100000000			1000000000			59)m + (61)r	
otal I		374.82	395.95	358.14	353,28	318.99	309.52	335.28	333.32	371.21	388.5	415.01	53/m + (01)	10
		1014/04C	242,92	0.00.14	000.20	010.00	3915 G.C.		C 12 10 10 10	STILL	000,0	410.01		
52)m=	424.14	alculated	uting Aire	ondix C a	Annont	Hissart	An encoded to	A looker to	Office colo	e oo sidered	ion to work.	(onlined so		m (63
62)m= Iolar Di	HW input o		42.222.03			1969-996-9				r contribut	ion to wate	er heating)		
62)m= Solar Di	HW input o		42.222.03			1969-996-9		y) (enter '0 pendix (0		e contribut	ion to wate	er beating)		

-		10.551 20.01	358.14	353.28	318.99	309.52	335.28	333.32	371.21	388.5	415.01		
		D		0		0 0	Outp	put from w	ater heate	r (annual)	-10	4378.15	(64
ns from	n water	heating.	kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)π	1] + 0.8)	x [(46)m	+ (57)m	+ (59)m]		
204.1	181.6	194.73	180.12	180.54	167.1	165.99	174.55	171.87	186.5	190.21	201.07		(6.5
e (57)r	n in calo	ulation	of (65)m	only if c	ylinder i	s in the d	twelling	or hot w	ater is fr	om com	munity hea	ating	
mal ga	ins (see	Table 5	and 5a	1	•								
ic gain	s (Table	5) Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
361.51	361.51	361.51	361.51	361.51	361.51	361.51	361.51	361.51	361.51	361.51	361.51		(66
gains	(calculat	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see '	Table 5		2 - C			
106.42	360.98	293.57	222.25	166.13	140.26	151.55	197	284.41	335.73	391.84	417.72		(67
es gai	ns (calc	ulated in	Append	tix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
541.88	2568.25	2501.78	2380.28	2181.66	2013.78	1901.62	1875.25	1941.71	2083.22	2261.84	2429.72		(68
gains	(calcula	ted in A	ppendix	L. equat	ion L15	or L15a	, also se	e Table	5				
77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18		(65
and fan	is gains	(Table 5	ja)										
6	6	6	6	6	6	6	6	6	6	6	6		(70
e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)	1		6					
241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01	-241.01		(71
eating	gains (T	able 5)									· · · · ·		
274.33	270.23	261.73	250.17	242.66	232.09	223.11	234.62	238.71	250.67	264.19	270.25		(72
ternal	gains =	i.			(66)	m + (67)n	+ (68)m +	+ (69)m +	(70)m + (7	1)m + (72)	im		
426.31	3403.15	3260.76	3036.38	2794.13	2589.81	2479.96	2510.54	2648.51	2873.3	3121.55	3321.37		(73
r gains	20	- 2		14 B		8 A)		8 S		10 DO	C 79-		
	alculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	e applicat	vie orientat	tion.		
ion: A	ccess F	actor	Area		Flu	x		g		FF		Gains	
	(57)r (57)r (10)	e (57)m in calc nal gains (Table Jan Feb cigains (Table Jan Feb 61.51 361.51 gains (calculation) 360.98 esigains (calculation) 370.23 email gains (calculation) 3403.15 gains (calculation) 3403.15	(57)m in calculation (nal gains (see Table 5), Wat c gains (Table 5), Wat Jan Feb Mar 61.51 361.51 361.51 gains (calculated in Ap 06.42 360.98 293.57 es gains (calculated in Ap 06.42 360.98 293.57 es gains (calculated in Ap 041.88 2568.25 2501.78 gains (calculated in Ap 77.18 77.18 77.18 77.18 77.18 77.18 6 6 6 .9. evaporation (negains (Table 5) 6 74.33 270.23 261.73 emal gains = 126.31 3403.15 3260.76 gains: calculated using sola 501.76 gains: access Factor 501.76	e (57)m in calculation of (65)m nal gains (see Table 5 and 5a) c gains (Table 5), Watts Jan Feb Mar Apr 61.51 361.51 361.51 361.51 gains (calculated in Appendix 06.42 360.98 293.57 222.25 es gains (calculated in Appendix 06.42 360.98 293.57 222.25 es gains (calculated in Appendix 06.42 360.98 293.57 222.25 es gains (calculated in Appendix 06.42 360.98 293.57 222.25 es gains (calculated in Appendix 77.18 77.18 77.18 77.18 71.18 77.18 77.18 77.18 77.18 nd fans gains (Table 5a) 6 6 6 .9. evaporation (negative value 41.01 -241.01 -241.01 ating gains (Table 5) 74.33 270.23 261.73 250.17 emal gains = 126.31 3403.15 3280.76 3036.38 gains: sare calculated using solar flux from on: Access Factor Area	e (57)m in calculation of (65)m only if c nal gains (see Table 5 and 5a) c gains (Table 5), Watts Jan Feb Mar Apr May 61.51 361.51 361.51 361.51 361.51 361.51 gains (calculated in Appendix L, equat 06.42 360.98 293.57 222.25 166.13 gains (calculated in Appendix L, equat 06.42 360.98 293.57 222.25 166.13 gains (calculated in Appendix L, equat 06.42 268.25 2501.78 2360.28 2161.66 gains (calculated in Appendix L, equat 7.18 77.18 77.18 77.18 7.18 77.18 77.18 77.18 17.18 nd fans gains (Table 5a) 6 6 6 6 .9. evaporation (negative values) (Table 41.01 -241.01 -241.01 -241.01 ating gains (Table 5) 74.33 270.23 261.73 250.17 242.66 emal gains =	e (57)m in calculation of (65)m only if cylinder is nal gains (see Table 5 and 5a). c gains (Table 5), Watts Jan Feb Mar Apr May Jun 61.51 361.51 361.51 361.51 361.51 361.51 361.51 gains (calculated in Appendix L, equation L9 or 06.42 360.98 293.57 222.25 166.13 140.26 es gains (calculated in Appendix L, equation L 541.88 2568.25 2501.78 2380.28 2181.66 2013.78 gains (calculated in Appendix L, equation L 15 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 6 6 6 6 6 6 6 6 .g. evaporation (negative values) (Table 5) 141.01 -241.01 -241.01 -241.01 -241.01 41.01 -241.01 -241.01 -241.01 -241.01 -241.01 ating gains (Table 5) 74.33 270.23 261.73 250.17 242.66 232.09 emal gains = (65) 3036.38 2794.13 <	e (57)m in calculation of (65)m only if cylinder is in the onal gains (see Table 5 and 5a) c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul 61.51 361.62 371.62 </td <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling nal gains (see Table 5 and 5a). c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug 61.51 36</td> <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot wenal gains (see Table 5 and 5a). c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep 61.51 361.51</td> <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is front calculated in 50 moles c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct 61.51 361.51</td> <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from commany content of the second second</td> <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat nal quins (see Table 5 and 5a) c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 61.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 06.42 360.98 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 06.42 360.98 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 141.89 2568.25 2501.78 2380.28 2181.66 2013.78 1901.62 1875.25 1941.71 2083.22 2261.84 2429.72 gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 7.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 17.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 19. 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6</td> <td>e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculated in Appendix L, equation L 9 or L9a), also see Table 5 (64) (300.68 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (41.88 2688.25 2601.78 2380.28 2181.68 2013.78 1901.62 1875.25 1941.71 2083.22 2261.84 2429.72 gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (7.18 7</td>	e (57)m in calculation of (65)m only if cylinder is in the dwelling nal gains (see Table 5 and 5a). c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug 61.51 36	e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot wenal gains (see Table 5 and 5a). c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep 61.51 361.51	e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is front calculated in 50 moles c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct 61.51 361.51	e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from commany content of the second	e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat nal quins (see Table 5 and 5a) c gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 61.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 361.51 gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 06.42 360.98 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 06.42 360.98 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 141.89 2568.25 2501.78 2380.28 2181.66 2013.78 1901.62 1875.25 1941.71 2083.22 2261.84 2429.72 gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 7.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 17.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 77.18 19. 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	e (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating nal calos. c (37)m in calculated in Appendix L, equation L 9 or L9a), also see Table 5 (64) (300.68 293.57 222.25 166.13 140.26 151.55 197 284.41 335.73 391.84 417.72 es gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (41.88 2688.25 2601.78 2380.28 2181.68 2013.78 1901.62 1875.25 1941.71 2083.22 2261.84 2429.72 gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (7.18 7

	1.8	ible od		m*		Table 6a		Table 6D	13	able oc		(VV)	
North	0.9x	0,77	×	11.16] × [10.63] × [0.63) × [0.7] = [72.53	(74)
North	0.9x	0.77	×	5.58	- ×	10.63] × [0.63	×	0.7	=	90.67	(74)
North	0.9x	0.77	×	2.73	×	10.63] × [0.63	x	0.7] • C	53.23	(74)
North	0.9x	0.77	×	5.4] × [10.63] × [0.63	x	0.7] = [17.55	(74)
North	0.9x	0.77	×	1.96	×	10.63] × [0.63	×	0.7] = [25.48	(74)
North	0.9x	0.77] × [4.08] × [10.63] × [0.63	×	0.7] = [13.26	(74)
North	0.9x	0,77	×	11.16] × [20.32	1×[0.63	×	0.7	<u>]</u> - [138.61	(74)
North	0.9x	0.77] × [5.58	٦× [20.32	i × Ē	0.63	×	0.7	ī - [173.27	(74)
North	0.9x	0.77	Ī×Ī	2.73	Ī×Ī	20.32	Í׾	0.63	×	0.7	ī - Ē	101.73	(74)
North	0.9x	0.77	Ī×Ī	5.4	Ī×Ī	20.32	i × Ē	0.63	×	0.7	ī = [33.54	(74)
North	0.9x	0,77	٦×٢	1.96	ī×Ē	20.32	ĺ×Γ	0.63	×	0.7	ī = Ē	48.69	(74)
North	0.9x	0.77	1 × [4.08	ī × ī	20.32	i × ľ	0.63	×	0.7	1 = [25.34	(74)

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SAP WorkSheet:	New	dwelling	desig	in stage	2
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North	0.9x	0.77] × [11.16] × [34.53	1 × [0.63	×	0.7	1 - [235.54	(74)
North	0.9x	0,77	ī × ī	5.58	1 ×	34.53	x	0.63	×	0.7	í - ľ	294.43	(74)
North	0.9×	0.77	ī × ī	2.73	1×	34.53	1 ×	0.63	×	0.7	i - i	172.86	(74)
North	0.9x	0.77	ī × ī	5.4	1 ×	34.53	×	0.63	×	0.7	i - i	56.99	(74)
North	0.9x	0,77	ī × ī	1.95	×	34.53	×	0.63	x	0.7	i = i	82.73	(74)
North	0.9x	0.77	Ī×Ī	4.08	x	34.53	x	0.63	×	0.7	1 - Î	43.06	(74)
North	0.9x	0.77	Ī×Ī	11.16	[x]	55.46	×	0.63	x	0.7	í - ľ	378.34	(74)
North	0.9×	0.77	٦×٢	5.58	1×	55.46	1 ×	0.63	×	0.7	í - í	472.92	(74)
North	0.9x	0,77	×	2.73	×	55.46	×	0.63	×	0.7	1 = [277.65	(74)
North	0.9×	0.77] × [5.4	×	55.46] ×	0.63	×	0.7] = [91.53	(74)
North	0.9×	0.77] × [1,95	×	55.46	×	0.63	×	0.7] = [132.89	(74)
North	0.9x	0,77] × [4.08	.×	55.46	×	0.63	×	0,7] = [69.16	(74)
North	0.9x	0.77] × [11.16	x	74.72	×	0.63	x	0.7] = [509.66	(74)
North	0.9x	0.77) × [5.58	x	74.72	×	0.63	×	0.7] - [837.07	(74)
North	0.9×	0.77] × [2.73	×	74.72	x	0.63	×	0.7] = [374.02	(74)
North	0.9x	0.77) × [5.4	×	74.72	x	0.63	×	0.7] = [123.3	(74)
North	0.9x	0,77] × [1.96	×	74.72] ×	0.63	x	0.7] = [179.02	(74)
North	0.9x	0.77] × [4.08	×	74.72] × [0.63	x	0.7] = [93.16	(74)
North	0.9x	0.77	_ × [11.16	×	79.99	×	0.63	x	0.7] - [545.6	(74)
North	0.9x	0.77] × [5.58	×	79.99	x	0.83	x	0.7] = [682	(74)
North	0.9x	0.77	×	2.73	×	79.99	×	0.63	×	0.7] = [400.4	(74)
North	0.9×	0.77) × [5.4] × [79.99	×	0.63	×	0.7] = [132	(74)
North	0.9x	0.77) × [1.96	×	79.99	×	0.63	×	0.7] = [191.65	(74)
North	0.9×	0.77] × [4.08	×	79.99) ×	0.63	×	0.7] = [99.73	(74)
North	0.9x	0.77	×	11,16	×	74.68	×	0.63	×	0.7] - [509.39	(74)
North	0.9x	0.77	_ × [5.58	×	74.68	×	0.63	×	0,7] - [636,74	(74)
North	0.9x	0,77] × [2.73] ×	74.68	×	0.63	x	0.7] = [373.83	(74)
North	0.9×	0.77	x	5.4	×	74.68	×	0.63	×	0.7] = [123.24	(74)
North	0.9x	0,77	×	1.96	×	74.68	×	0.63	×	0.7] = [178.93	(74)
North	0.9×	0.77	×	4,08	×	74.68	×	0.63	×	0.7	=	93.11	(74)
North	0.9x	0.77	×	11.16	×	59.25	×	0.63	×	0.7] • [404.14	(74)
North	0.9x	0.77	×	5.58	×	59.25	×	0.63	×	0.7] - [505.17	(74)
North	0.9x	0.77	×	2.73	ं	59.25	×	0.63	×	0.7] = [298.58	(74)
North	0.9x	0,77	x	5.4	 x 	59.25	×	0.63	×	0.7	=	97.77	(74)
North	0.9×	0.77	×	1.96	×	59.25	×	0.63	×	0.7	=	141,95	(74)
North	0.9×	0,77	x	4,08	×	59.25	×	0.63	×	0.7	=	73.87	(74)
North	0.9x	0.77	× [11.16	×	41.52	×	0.63	×	0.7] = [283.2	(74)
North	0.9x	0.77] × [5.58	×	41.52	×	0.63	×	0.7] • [354	(74)
North	0.9x	0,77	×	2.73	. ×	41.52] ×	0.63	×	0.7] = [207.83	(74)
North	0.9x	0.77	×	5.4	ं	41.52	×	0.63	×	0.7] = [68.52	(74)
North	0.9x	0.77	x	1.96	×	41.52	×	0.63	x	0.7] = [99.47	(74)

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SAP WorkSheet: N	ew dwelling	design stage
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North	0.9x	0.77] × [4.08	1 *	41.52	1 × [0.63	×	0.7	1 - [51.77	(74)
North	0.9x	0,77	זֿ × וֹ	11.16	1 ×	24.19	1 x	0.63	×	0.7	i - i	165	(74)
North	0.9×	0.77	i × r	5.58	×	24.19	i x	0.63	×	0.7	i = i	206.25	(74)
North	0.9×	0.77	ז × ו	2.73	1 ×	24.19	1 ×	0.63	×	0.7	1 - Ì	121.09	(74)
North	0.9x	0,77	ī x ī	5.4	i ×	24.19	×	0.63	×	0.7	1 = ľ	39.92	(74)
North	0.9x	0.77	ī×ī	1.96	x	24.19	x	0.63	×	0.7	1 - Ì	57.96	(74)
North	0.9x	0.77	ī×ĭ	4.08	ĺ×	24.19	j x	0.63	x	0.7	i - i	30.16	(74)
North	0.9×	0.77	וֹ×וֹ	11.16	1×	13.12	1 ×	0.63	×	0.7	1 - Î	89.48	(74)
North	0.9x	0,77	×	5.58	×	13.12	×	0.63	×	0.7] = [111.85	(74)
North	0.9x	0.77] × [2.73	×	13.12] × [0.63	×	0.7] = [65,67	(74)
North	0.9×	0.77] × [5,4	×	13.12	×	0.63	×	0.7] = [21.65	(74)
North	0.9x	0,77) × [1,96	. ×	13.12	×	0.63	×	0,7] = [31.43	(74)
North	0.9x	0.77] × [4,08	(x)	13.12	×	0.63	x	0.7] * [16.36	(74)
North	0.9x	0.77	×	11.16	x	8.86	×	0.63	×	0.7] = [60.47	(74)
North	0.9×	0,77] × [5.58	×	8.86	×	0.63	×	0.7] = [75.58	(74)
North	0.9x	0.77] × [2.73) ×	8,86) ×	0.63	×	0.7] = [44.38	(74)
North	0.9x	0,77] × [5.4	×	8.86	×	0.63	x	0.7] = [14.63	(74)
North	0.9x	0.77] × [1.96) ×	8.86	×	0.63	×	0.7] = [21.24	(74)
North	0.9x	0.77] × [4.08	×	8.86) ×	0.83	×	0.7] - [11.05	(74)
East	0.9x	0.54] × [4,79] x	19.64	x	0.83	x	0.7] = [20.16	(76)
East	0.9×	0.54	×	13.04	×	19.64	×	0.63	x	0.7] = [54.89	(76)
East	0.9×	0.54) × [16.83] ×	19.64	×	0.63	×	0.7] = [70.84	(76)
East	0.9x	0,54	× [7.19] ×	19.64] × [0.63	×	0.7] = [30.27	(76)
East	0.9×	0.77] × [3.38	×	19.64	×	0.63	×	0.7] = [20.29	(76)
East	0.9x	0.77	×	5.58	×	19.64	×	0.63	×	0.7] = [200.96	(76)
East	0.9×	0.77	×	2.73	×	19.64	×	0.63	×	0,7] - [81.93	(76)
East	0.9x	0,77] × [3.9) ×	19.64	×	0.63	x	0.7] = [46.82	(76)
East	0.9x	0.77	×	1.96	×	19.64	×	0.63	×	0.7] = [35.29	(76)
East	0.9x	0.54	×	4.79	×	38.42	×	0.63	×	0.7	=	39.44	(76)
East	0.9×	0.54	×	13.04	×	38.42	×	0.63	×	0.7] = [107.38	(76)
East	0.9x	0.54	×	16.83	×	38.42	×	0.63	×	0.7	•	138.59	(76)
East	0.9x	0.54	×	7.19	×	38.42	×	0.63	×	0.7] - [59.21	(76)
East	0.9x	0.77] × [3.38] ×	38.42	x	0.63	×	0.7] = [39.69	(76)
East	0.9x	0.77	×	5.58] ×	38.42	×	0.63	×	0.7] = [393.12	(76)
East	0.9×	0.77	x	2.73	x	38.42	x	0.63	x	0.7] = [160.28	(76)
East	0.9×	0.77	x	3.9	×	38.42	×	0.63	×	0.7	=	91.59	(76)
East	0.9x	0.77] × [1.96	x	38.42] × [0.63	×	0.7] = [69.04	(76)
East	0.9x	0.54] * [4.79] × [63.27] × [0.63	×	0.7] - [64.96	(76)
East	0.9x	0.54	× [13.04	. ×	63.27] × [0.63	×	0.7] = [176.84	(76)
East	0.9x	0.54] × [16.83) ×	63.27	×	0.63	×	0.7] = [228.23	(76)
East	0.9x	0.54	×	7,19	×	63.27	×	0.63	x	0.7] = [97.5	(76)

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SAP	WorkSheet:	New	dwelling	design	stage

East	0.9x	0.77	x	3.38	×	63.27	1 × 1	0.63	×	0.7	1 - [65.36	(76)
East	0.9x	0.77	1 × I	5.58	×	63.27	×	0.63	×	0.7	i - i	647.41	(76)
East	0.9×	0.77	×	2.73	×	63.27	×	0.63	×	0.7	1 = 1	263.95	(76)
East	0.9x	0.77	x	3.9	x	63.27	x	0.63	x	0.7	i - i	150.83	(75)
East	0.9x	0,77	×	1.96	×	63.27	×	0.63	x	0.7	1 = [113.7	(76)
East	0.9x	0.54	×	4.79	x	92.28	x	0.63	×	0.7	i - i	94,74	(76)
East	0.9x	0.54	i x i	13.04	Í x	92.28	x	0.63	x	0.7	i - i	257.91	(76)
East	0.9×	0.54	i × i	16.83	×	92.28	×	0.63	×	0.7	1 = 1	332.88	(76)
East	0.9x	0,54	×	7.19	×	92.28	×	0.63	×	0.7	1 = [142.2	(76)
East	0.9x	0.77] × [3.38	×	92.28	×	0.63	×	0.7] = [95.32	(76)
East	0.9×	0.77	×	5.58	×	92.28	×	0.63	×	0.7] = [944.2	(76)
East	0.9x	0,77	×	2.73	×	92.28	×	0.63	x	0,7] = [384.96	(76)
East	0.9x	0.77	ं	3.9	×	92.28	×	0.63	x	0.7] * [219.98	(76)
East	0.9x	0.77	x	1.96	x	92.28	×	0.63	x	0.7] = [165.83	(76)
East	0.9×	0.54	×	4.79	×	113.09	×	0.63	×	0.7] = [116.1	(76)
East	0.9×	0.54	×	13,04) ×	113.09) ×	0.63	×	0.7] = [316.07	(76)
East	0.9x	0,54	×	16.83	×	113.09	×	0.63	×	0.7] = [407.94	(76)
East	0.9x	0,54	×	7,19	×	113.09	×	0.63	×	0.7] = [174.28	(76)
East	0.9x	0.77	x	3.38	×	113.09	×	0.63	x	0.7] - [116.82	(76)
East	0.9x	0,77	x	5.58) ×	113.09	x	0.63	x	0.7] = [1157.18	(76)
East	0.9x	0.77	x	2.73	×	113.09	×	0.63	x	0.7] = [471.78	(76)
East	0.9x	0.77	×	3.9] ×	113.09	×	0.63	×	0.7] = [269.59	(76)
East	0.9x	0.77	×	1.96	×	113.09	×	0.63	×	0.7] = [203.23	(76)
East	0.9×	0.54	×	4.79	×	115.77	×	0.63	×	0.7] = [118.85	(76)
East	0.9x	0.54	×	13.04	×	115.77	×	0.63	x	0.7] = [323.56	(76)
East	0.9x	0.54	×	16.83] ×	115.77	×	0.63	×	0,7] - [417.6	(76)
East	0.9x	0.54	×	7,19	×	115.77	×	0.63	х	0.7] = [178.4	(76)
East	0.9×	0.77	x	3.38) ×	115.77	×	0.63	x	0.7] = [119.59	(76)
East	0.9×	0.77	×	5.58] ×	115.77	×	0.63	×	0.7] = [1184.56	(76)
East	0.9x	0.77	×	2.73	x	115.77	×	0.63	×	0.7] = [482.95	(76)
East	0.9x	0.77	×	3.9	×	115.77	×	0.63	×	0.7] = [275.97	(76)
East	0.9x	0.77	×	1.96	x	115.77	×	0.63	×	0.7] - [208,04	(76)
East	0.9x	0.54	×	4,79	x	110.22	×	0,63	×	0.7	=	113,15	(76)
East	0.9x	0.54	×	13.04) ×	110.22	×	0.63	×	0.7] = [308.04	(76)
East	0.9×	0.54	x	16.83	×	110.22	×	0.63	x	0.7] = [397.57	(76)
East	0.9×	0.54	x	7.19	×	110.22	×	0.63	×	0.7	=	169.85	(76)
East	0.9x	0.77	×	3.38	×	110.22	×	0.63	×	0.7] = [113,85	(76)
East	0.9x	0.77	×	5.58	×	110.22	×	0.63	×	0.7] - [1127.74	(76)
East	0.9x	0,77	×	2.73	×	110.22	×	0.63	×	0.7] = [459.79	(76)
East	0.9x	0.77	×	3.9	× .	110.22	×	0.63	×	0.7] = [262.74	(76)
East	0.9x	0.77	×	1.96	×	110.22	×	0.63	x	0.7] = [198.06	(76)

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SAP WorkSheet: New dwelling design sta
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East	0.9x	0.54] × [4.79	1 *	94.68	1 × [0.63	×	0.7	1 - F	97.2	(76)
East	0.9x	0.54	ī×ī	13.04	1 ×	94.68	1 x	0.63	×	0.7	1 - T	264.6	(76)
East	0.9×	0.54	ī×ī	16.83	×	94.68	1 ×	0.63	×	0.7	1 - F	341.51	(76)
East	0.9x	0.54	٦×١	7.19	1 ×	94,68	×	0.63	×	0.7	1 - F	145.9	(76)
East	0.9x	0,77	٦×٢	3.38	×	94.68	×	0.63	x	0.7	ī = Ē	97.8	(76)
East	0.9x	0.77	٦×٢	5.58	i ×	B4.68	x	0.63	×	0.7	1 - T	968.72	(76)
East	0.9x	0.77	Ī×Ī	2.73] ×	94.68	X	0.63	x	0.7	ī - Ē	394.95	(76)
East	0.9x	0.77] × [3.9	×	94.68	1 ×	0.63	×	0.7] = [225.69	(76)
East	0.9x	0.77	×	1.96	×	94.68	×	0.63	×	0.7] = [170.13	(76)
East	0.9x	0.54] × [4,79	×	73.59] × [0.63	×	0.7] = [75.55	(76)
East	0.9x	0.54	×	13.04	×	73.59	×	0.63	×	0.7] = [205.67	(76)
East	0.9x	0.54	×	16.83	.×	73.59) ×	0.63	x	0,7] = [265.44	(76)
East	0.9x	0.54	x	7.19) ×	73.59	×	0.63	x	0.7] * [113.4	(76)
East	0.9x	0.77	×	3.38) ×	73.59	×	0.63	×	0.7] - [76.02	(76)
East	0.9×	0.77	×	5.58	×	73.59	×	0.63	×	0.7] = [752.96	(76)
East	0.9x	0.77	*	2.73] ×	73.59	x	0.63	×	0.7] = [306,99	(76)
East	0.9×	0.77) × [3.9	×	73.59) ×	0.63	×	0.7] = [175.42	(76)
East	0.9x	0.77	×	1.96	×	73.59	×	0.63	×	0.7] = [132.24	(76)
East	0.9x	0.54	×	4.79	×	45.59	X	0.83	×	0.7] - [46.8	(76)
East	0.9x	0.54] × [13.04] ×	45.59	x	0.63	x	0.7] = [127.41	(76)
East	0.9x	0.54	x	16.83	×	45.59	×	0.63	x	0.7] = [164.45	(76)
East	0.9x	0.54	×	7,19] ×	45.59	×	0.63	×	0.7] = [70.25	(76)
East	0.9x	0.77	×	3.38	×	45.59	×	0.63	×	0.7] = [47,09	(76)
East	0.9x	0.77	×	5.58	×	45.59	×	0.63	×	0.7] = [466.47	(76)
East	0.9x	0.77	×	2.73	×	45.59	×	0.63	×	0.7] = [190.18	(76)
East	0.9x	0.77	×	3.9	X	45.59	×	0.63	×	0,7] - [108.67	(76)
East	0.9x	0,77	×	1.96) ×	45.59	×	0.63	x	0.7] = [81.92	(76)
East	0.9x	0.54	×	4.79	×	24.49	×	0.63	×	0.7] = [25.14	(76)
East	0.9x	0.54	×	13.04	×	24.49	×	0.63	×	0.7	=	68.44	(76)
East	0.9x	0.54	×	16.83	×	24.49	×	0.63	×	0.7	=	88.33	(76)
East	0.9x	0.54	×	7,19	×	24.49	×	0.63	×	0.7	-	37.74	(76)
East	0.9x	0.77	×	3.38	×	24.49	×	0.63	×	0.7] - [25.3	(76)
East	0.9x	0.77	×	5.58	×	24.49	×	0.63	×	0.7] = [250.57	(76)
East	0.9x	0,77	×	2.73	×	24.49	×	0.63	×	0.7	=	102.16	(76)
East	0.9×	0.77	×	3.9	×	24.49	×	0.63	×	0.7	=	58.38	(76)
East	0.9×	0,77	x	1,96	×	24.49	×	0.63	×	0.7	=	44.01	(76)
East	0.9x	0.54	× [4,79	×	16,15	×	0.63	×	0.7] = [16.58	(78)
East	0.9x	0.54	×	13.04	×	16.15	×	0.63	×	0.7] - [45.14	(76)
East	0.9x	0.54	×	16.83	. ×	16.15] × [0.63	×	0.7] = [58.26	(76)
East	0.9x	0.54	×	7.19] ×	16.15	×	0.63	×	0.7] = [24.89	(76)
East	0.9x	0.77	×	3.38	×	16.15	×	0.63	x	0.7] = [16.68	(76)

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SAP WorkSheet: New dwelling design stage	SAP	WorkSheet:	New	dwelling	desig	n stage
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East	0.9x	0.77] × [5.58	1 × [16.15	1 × [0.63	×	0.7	1 - [165.26	(76)
East	0.9x	0,77	ī * [2.73	1 ×	16.15	1 ×	0.63	×	0.7	1 - Ì	67.38	(76)
East	0.9x	0.77	1×1	3.9	1×	16.15	1 ×	0.63	×	0.7	i = i	38.5	(76)
East	0.9×	0.77	1×1	1.96	1 ×	16.15	×	0.63	×	0.7	1 - Ì	29.02	(75)
South	0.9x	0,77	ī × ī	3.38	×	46.75	×	0.63	x	0.7	1 = ľ	386,35	(78)
South	0.9x	0.77	Ī×Ī	2.73	i x	48.75	x	0.63	×	0.7	1 - Î	351.08	(78)
South	0.9x	0.77	ī × ī	1.96	Í×	46.75	i x	0.63	x	0.7	i-i	140.02	(78)
South	0.9x	0.77	ī×[3.38	Í×.	76.57	1 ×	0.63	×	0.7	1 - Î	632.74	(78)
South	0.9x	0,77	×	2.73	×	76.57	×	0.63	×	0.7	1 = ľ	574,94	(78)
South	0.9x	0.77] × [1.96	×	76.57	1 ×	0.63	×	0.7] = [229.32	(78)
South	0.9x	0.77	X	3.38	1×	97.53	1 ×	0.63	×	0.7] = [806	(78)
South	0.9x	0,77	× [2.73	×	97.53	×	0.63	x	0,7] = [732.37	(78)
South	0.9x	0.77	×	1.96] ×	97.53	× [0.63	x	0.7] = [292.11	(78)
South	0.9x	0.77	×	3.38] ×	110.23	×	0.63	×	0.7] - [910.95	(78)
South	0.9x	0.77	×	2.73	×	110.23	×	0.63	×	0.7] = [827.74	(78)
South	0.9×	0.77	*	1.96] ×	110.23	×	0.63	×	0.7] = [330.15	(78)
South	0.9x	0,77] × [3.38] ×	114.87] ×	0.63	×	0.7] = [949.27	(78)
South	0.9x	0.77] × [2.73	x	114.87] × [0.63	×	0.7] = [862.56	(78)
South	0.9x	0.77) × [1.96	×	114.87) ×	0.63	×	0.7] - [344.04	(78)
South	0.9x	0,77] × [3.38] ×	110.55] x	0.63	x	0.7] = [913,54	(78)
South	0.9x	0.77	x	2.73) ×	110.55) × [0.63	×	0.7] = [830.09	(78)
South	0.9x	0.77	×	1,96] ×	110.55	×	0.63	×	0.7] = [331.09	(78)
South	0.9x	0.77	×	3.38	×	108.01	×	0.63	×	0.7] = [892.59	(78)
South	0.9x	0.77] × [2.73	×	108.01] ×	0.63	×	0.7] = [811.05	(78)
South	0.9x	0.77	×	1.96	×	108.01] ×	0.63	×	0.7	- [323.5	(78)
South	0.9x	0.77	×	3.38) ×	104.89) ×	0.63	×	0,7] - [866.82	(78)
South	0.9x	0,77	×	2.73) ×	104.89	×	0.63	х	0.7] = [787.64	(78)
South	0.9x	0.77	x	1.96	×	104.89	×	0.63	×	0.7] = [314.16	(78)
South	0.9x	0,77	×	3.38] ×	101.89	×	0.63	×	0.7] = [841,96	(78)
South	0.9×	0.77	×	2.73	x	101.89	×	0.63	×	0.7] = [765.05	(78)
South	0.9x	0.77	×	1.96	×	101.89	×	0.63	×	0.7	•	305.15	(78)
South	0.9x	0.77	×	3.38	×	82.59	×	0.63	×	0.7] - [682.47	(78)
South	0.9x	0.77	× (2.73	×	82.59	×	0.63	×	0.7	=	620,13	(78)
South	0.9x	0,77	x	1.96	×	82.59	×	0.63	×	0.7	=	247.34	(78)
South	0.9x	0.77	×	3.38	×	55.42	×	0.63	×	0.7	=	457,95	(78)
South	0.9x	0,77	×	2.73	×	55.42	×	0.63	×	0.7	=	416,12	(78)
South	0.9x	0.77] × [1.96	×	55.42] ×	0.63	×	0.7] = [165.97	(78)
South	0,9x	0.77	× [3.38] ×	40.4	×	0.63	×	0.7] - [333.84	(78)
South	0.9x	0,77	×	2.73	. ×.	40.4] ×	0.63	×	0.7] = [303.35	(78)
South	0.9x	0.77	.×	1.96	. ×	40,4	×	0.63	×	0.7] = [120.99	(78)
West	0.9x	0.77	x	5.58	×	19.64	×	0.63	x	0.7] = [133.97	(80)

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SAP WorkSheet:	New	dwelling	desig	yn stag	е
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West	0.9x	0.77] × [3.38	1 *	19.64	1 × [0.63	×	0.7	1 - F	40.58	(80)
West	0.9x	0.77	זֿ × ר	2.73	×	19.64	i x	0.63	×	0.7	i - F	98.32	(80)
West	0.9×	0.77	i × i	1.96	×	19.64	i x	0.63	×	0.7	i = F	35.29	(80)
West	0.9×	0.77	ז _י וֹ	5.58	1×	38.42	1 ×	0.63	×	0.7	i - F	262.08	(80)
West	0.9x	0,77	ī . ī	3.38	i ×	38.42	×	0.63	x	0.7	1 = 1	79.37	(80)
West	0.9x	0.77	ī×ī	2.73	1 ×	38.42	x	0.63	×	0.7	i - F	192.33	(80)
West	0.9x	0.77	ī×ĭ	1.96	Í×	38.42	i x	0.63	x	0.7	i - F	69.04	(80)
West	0.9×	0.77	וֹ×וֹ	5.58	1×	63.27	1 ×	0.63	x	0.7	1 - T	431.6	(80)
West	0.9x	0,77	1 × [3,38	×	63.27	×	0.63	×	0.7	1 - F	130.72	(80)
West	0.9x	0.77] × [2.73	×	63.27] × [0.63	×	0.7] = [316.74	(80)
West	0.9×	0.77] × [1,95	×	63.27	×	0.63	×	0.7] = [113.7	(80)
West	0.9x	0,77] × [5.58] ×	92.28) ×	0.63	x	0,7] = [629.47	(80)
West	0.9x	0.77]×[3.38	×)	92.28	×	0.63	x	0.7] * [190.65	(80)
West	0.9x	0.77] × [2.73) ×	92.28	×	0.63	×	0.7] = [461.95	(80)
West	0.9x	0.77] × [1,96	×	92.28	x	0.63	×	0.7] = [165,83	(80)
West	0.9x	0.77] * [5.58) ×	113.09) ×	0.63	×	0.7] = [771.44	(80)
West	0.9x	0,77] × [3.38	×	113.09] ×	0.63	×	0.7] = [233.64	(80)
West	0.9x	0.77] × [2.73) ×	113.09] × [0.63	×	0.7] = [566.14	(80)
West	0.9x	0.77] × [1.96	×	113.09] ×	0.83	×	0.7] - [203.23	(80)
West	0.9x	0,77] × [5.58] ×	115.77	x	0.83	x	0.7] = [789.7	(80)
West	0.9×	0.77) × [3.38	×	115.77	×	0.63	x	0.7] = [239.18	(80)
West	0.9×	0,77] × [2.73] ×	115,77	×	0.63	×	0.7] = [579.54	(80)
West	0.9x	0.77] × [1.96] ×	115.77] × [0.63	×	0.7] = [208.04	(80)
West	0.9x	0.77] × [5.58	×	110.22) ×	0.63	×	0.7] = [751.83	(80)
West	0.9x	0.77	×	3.38	×	110.22	×	0.63	×	0.7] = [227,7	(80)
West	0.9×	0.77	×	2.73) ×	110.22	×	0.63	×	0,7] - [551.75	(80)
West	0.9x	0.77	×	1.96	×	110.22	×	0.63	х	0.7		198.06	(80)
West	0.9×	0.77	×	5.58	×	94.68	×	0.63	×	0.7	=	645.81	(80)
West	0.9x	0,77	×	3.38	×	94.68	×	0.63	×	0.7	=	195.59	(80)
West	0.9×	0.77	×	2.73	×	94.68	×	0.63	×	0.7	=	473.94	(80)
West	0.9x	0.77	×	1.96	×	94.68	×	0.63	×	0.7] • [170.13	(80)
West	0.9x	0.77	×	5.58	×	73.59	×	0.63	×	0.7] - [501.97	(80)
West	0.9x	0.77] × [3.38] ×	73.59	×	0.63	×	0.7] = [152.03	(80)
West	0.9×	0.77	×	2.73) ×	73.59	×	0.63	×	0.7] = [368.38	(80)
West	0.9×	0.77	_ × [1.96	×	73.59	×	0.63	×	0.7] = [132.24	(80)
West	0.9×	0,77	×	5.58	×	45.59	×	0.63	×	0.7	=	310,98	(80)
West	0.9x	0.77] × [3.38	×	45.59] × [0.63	×	0.7] = [94,18	(80)
West	0,9x	0.77] × [2.73	×	45.59	x	0.63	×	0.7] • [228.22	(80)
West	0.9x	0,77) × [1.96	×.	45.59) ×	0.63	×	0.7] = [81.92	(80)
West	0.9x	0.77] × [5.58) ×	24.49	×	0.63	×	0.7] = [167.05	(80)
West	0.9x	0.77] × [3.38] ×	24.49	x	0.63	×	0.7] = [50.59	(8G)

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	0.77	х	2.7	0	x	24.49	x	0.63	X	0.7		122.59	(80
Vest 0.9x	0.77	×	1.9	96	×	24.49	i × Г	0.63	1 × [0.7	- i	44.01	(80
Aest 0.9x	0.77	×	5.5	58	×	16.15	×	0.63	1 × Γ	0.7	=	110.17	(80
lest 0.9x	0.77	×	3.3	38	×	16.15	i × Г	0.63	ī × ī	0.7	- 1	33.37	(80
lest 0.9x	0,77	×	2.7	73	×	16.15	×	0.63	ī × ī	0.7	i	80.85	(80
Vest 0.9x	0.77	×	1.0	96	×	16.15	×	0.63	٦×٢	0.7	- i	29.02	(80
offights 0.9x	1	×	46.	34	×	26	i×Ē	0.63	i × i	0.7	- i	478.2	(82
ooflights 0.9x	1	×	46.	34	×	54	i × E	0.63	≓ × È	0.7	-i - i	993.19	(82
ooflights p.gx	1	- ×	46.	34	×	96	i . E	0.63	≓ . F	0.7	-i - i	1765.67	(82
oflights o.ex	1	- ×	46.	34	× [150	i x 🗖	0.63	⊣ . F	0.7	- i - i	2758.85	(83
oflights 0.9x	1	×	45.	34	×	192	i × Ē	0.63	i × F	0.7	- i	3531,33	(83
oflights 0.9x	1	×	46.	34	×	200	i × E	0.63	i × F	0.7	-i - i	3678.47	(83
ooflights 0.9x	<u></u> 1	×	46.	34	×	189	i x E	0.63	≓ × ř	0.7	- i - i	3476.15	(83
offights 0.9x	1	×	46.	34	×	157	i x E	0.63	≓ × ř	0.7	≕i - i	2887.6	(82
oflights 0.9x	1	- ×	46.	34	×	115	i×E	0.63	ī×Ē	0.7	= =	2115.12	(8)
oflights p.gx	1	*	46.	_	×	66	×	0.63	1 × 1	0.7		1213.89	(8)
ooflights 0.9x	1	- ×	46		×	33		0.63	٦×٢	0.7		606.95	(8
ooflights p.ax	1	×	46.	_	. —	21	i . E	0.63		0.7	- 1	386.24	(8)
3)m= 2497.98 otal gains – in 4)m= 5924.26 7. Mean intern	4652.51 7 ternal an 8055.65 11	7283 29 d solar 0544.05 rature (10338.08 (84)m = 13372.46	12610.84 = (73)m 15404.97 Season	+ (83)m 15520.36	14778.62	10567.6	8350.37	. (82)m 5402.78 8276.07	0.000	2086.89		(8
3)m= 2497.96 otal gains – in 4)m= 5924.26 7. Mean intern Femperature o	4652.51 7 ternal an 8055.65 11 httemps during he	d solar 0544.05 rature (ating p	10336 08 (84)m = 13372 46 (neating eriods ir	12610.84 = (73)m 15404.97 Season n the livit	+ (83)m 15520.36 Ng area	from Tal	10567.6	8350.37	5402.78	0.000		21	(8-
3)m= 2497.96 otal gains – in 4)m= 5924.26 7. Mean intern Femperature o	4652.51 7 ternal an 8055.65 11 httemps during he	d solar 0544.05 rature (ating p	10336 08 (84)m = 13372 46 (neating eriods ir	12610.84 = (73)m 15404.97 Season n the livit	+ (83)m 15520.36 Ng area	from Tal	10567.6	8350.37	5402.78	0.000		21	(83
3)m= 2497.96 otal gains — in 4)m= 5924.26 A Mean Intern Cemperature of Jtilisation fact	4652 51 7 ternal an 8055 65 11 htternes during he or for gai	7283 29 d solar 0544 05 rature ating p ns for l	10338.08 (84)m = 13372.46 (n=1100 eriods in iving are	12610.84 = (73)m 15404.97 Eseason n the livin ea, h1,m	+ (83)m 15520.36 ng area (see Ta	, watts 14778.62 from Tal able 9a)	10567.6/ 13078.2: ble 9, Ti	8350.37 10998.88 11 (°C)	5402.78 8276.07	6189.28	5408.26	21	(8)
3)m= 2497.96 otal gains - in 4)m= 5924.26 Comperature of Utilisation fact 5)m= 1	4652 51 7 ternal an 8055 65 11 Al Lennee during he or for gai Feb	2283.29 d solar 0544.08 rature (ating p ns for li Mar 1	(84)m = (84)m = 13372.46 (herating eriods ir iving are Apr 0.99	12610.84 = (73)m 15404.97 Besson h the livin ea, h1,m May 0.97	+ (83)m 15520.36 ng area (see Ta Jun 0.88	from Tal able 9a) Jul 0.73	13078.2 13078.2 ble 9, Ti Aug 0.81	8 8350 37 10998.88 n1 (°C) Sep 0.97	5402.78 8276.07 Oct	6189.28 Nov	5408.26 Dec	21	(8)
3)m= 2497.96 otal gains in 4)m= 5924.26 A Mean Intern Cemperature of Utilisation fact Jan 6)m= 1 Mean internal	4852.51 7 ternal an ao55.65 11 at tempe during he or for gai Feb 1 temperat	2283.29 d solar 0544.08 rature (ating p ns for li Mar 1	(84)m = (84)m = 13372.46 (herating eriods ir iving are Apr 0.99	12610.84 = (73)m 15404.97 Besson h the livin ea, h1,m May 0.97	+ (83)m 15520.36 ng area (see Ta Jun 0.88	from Tal able 9a) Jul 0.73	13078.2 13078.2 ble 9, Ti Aug 0.81	8 8350 37 10998.88 n1 (°C) Sep 0.97	5402.78 8276.07 Oct	6189.28 Nov	5408.26 Dec	21	(8- (8: (84
3)m= 2497.96 otal gains – in 4)m= 5924.26 Mean intern Cemperature of Utilisation fact Jan 6)m= 1 Mean internal 7)m= 19.83	4852 51 7 ternal an 8055 55 11 htternee during he or for gai Feb 1 temperat 19.94	283 29 d solar 0544 05 rature (ating p ns for li Mar 1 ture in l 20.13	10336.08 (84)m = 13372.46 (1020110) eriods ir iving are 0.99 iving are 20.4	12610.84 = (73)m - 15404.97 1563501 n the livit ea, h1,m May 0.97 ea T1 (for 20.66	+ (83)m 15520.38 ng area (see Ta Jun 0.88 0llow ste 20.85	rom Tal able 9a) Jul 0.73 eps 3 to 7 20.92	10567 8/ 13078 2: ble 9, Ti Aug 0.81 7 in Tab 20.9	s 8350 37 10996.88 11 (°C) Sep 0.97 le 9c) 20.73	5402.78 8276.07 Oct 1	6189.28 Nov 1	5408.26 Dec 1	21	(8) (8)
3)m= 2497.96 otal gains - in 4)m= 5924.26 7. Mean intern Femperature of Utilisation fact 0,m= 1 1 Mean internal 7)m= 19.83 Femperature of	4852.51 7 ternal an ab55.65 1 httemperat during he or for gai Feb 1 temperat 19.94 during he	reases d solar 0544.08 relure / ating p ns for li Mar 1 ture in l 20.13 ating p	10336.08 (84)m = 13372.46 (neating) eriods ir iving are Apr 0.99 iving are 20.4 eriods ir	12610.84 = (73)m - 15404.97 = (73)m - 15404.97	+ (83)m 15520.36 ng area (see Ta Jun 0.88 010w ste 20.85 dwelling	from Tal able 9a) Jul 0.73 eps 3 to 20.92 g from Ta	10567 84 13078 2 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1	s sssp 37 10998.88 11 (°C) Sep 0.97 le 9c) 20.73 h2 (°C)	5402.78 8276.07 Oct 1 20.39	6189.28 Nov 1 20.06	5408.26 Dec 1	21	(8) (8) (8) (8)
3)m= 2497.96 otal gains – in 4)m= 5924.26 7. Mean Intern Femperature of Jtilisation fact 0, Jan 6)m= 1 Mean internal 7)m= 19.83 Femperature of 8)m= 20.02	4852 51 7 ternal an 8055 65 11 Al tempe during he or for gai Feb 1 19.94 during he 20.02	rating p ms for i Mar 1 20.13 ating p 20.02	10336.08 (84)m = 13372.46 (1000 sir iving are Apr 0.99 iving are 20.4 eriods ir 20.03	12610.84 = (73)m 15404.97 15404.97 15404.97 1560501 n the livit ea, h1,m May 0.97 ea T1 (for 20.66 n rest of 20.03	+ (83)m 15520.38 ng area (see Ta Jun 0.88 billow ste 20.85 dwelling 20.04	, watts 14778.62 from Tal able 9a) Jul 0.73 eps 3 to 7 20.92 g from Ta 20.04	10567.84 13078.22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.04	s 8350 37 10996.88 11 (°C) Sep 0.97 le 9c) 20.73	5402.78 8276.07 Oct 1	6189.28 Nov 1	5408.26 Dec 1	21	(8) (8) (8) (8)
a)im= 2497.96 otal gains — in 4)im= 5924.26 A Mean Intern Femperature of Utilisation fact Jan 6)im= 1 Mean internal 7)im= 19.83 Femperature of 8)im= 20.02 Utilisation fact	4852 51 7 ternal an 8055 55 11 Al temperat during he or for gai Feb 1 19.94 during he 20.02 or for gai	rating p ns for i Mar 1 20.03 ating p ns for i Mar 1 20.03 ating p 20.02 ns for r	10336.08 (84)m = 13372.46 (1231/12) eriods ir iving are Apr 0.99 iving are 20.4 eriods ir 20.03 est of dh	12610.84 = (73)m 15404.97 15404.9	+ (83)m 15520.36 ng area (see Ta Jun 0.88 billow ste 20.85 dwelling 20.04 h2,m (s	from Tal able 9a) Jul 0.73 20.92 g from Ta 20.92 g from Ta 20.04	10567.54 13078.22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.04 9a)	s 8350.37 10998.88 11 (*C) Sep 0.97 le 9c) 20.73 h2 (*C) 20.03	5402.78 8276.07 Oct 1 20.39 20.03	6189.28 Nov 1 20.06 20.03	5408.26 Dec 1 19.81 20.02	21	(B- (8) (8) (8) (8)
3)m= 2497.96 otal gains in 4)m= 5924.26 7. Mean intern 7. Mean intern 6)m= 1 7. Mean internal 7. Mean int	4852 51 7 ternal an a055 65 11 at temper during he or for gai Feb 1 temperat 19.94 during he 20.02 or for gai 1	rature (d solar 0544.08 rature (ating p ns for i Mar 1 20.13 ating p 20.02 ns for r 1	10336.08 (84)m = 13372.46 (1000 minute eriods in 0.99 iving and 20.4 eriods in 20.03 est of do 0.99	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - (73)m -	+ (83)m 15520.36 ng area (see Ta Jun 0.88 20.85 dwelling 20.04 h2,m (s 0.81	rom Tal able 9a) Jul 0.73 aps 3 to 20.92 g from Ta 20.94 ee Table 0.6	10567.84 13078.22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.04 9a) 0.7	s ss50.37 10968.88 11 (*C) Sep 0.97 le 9c) 20.73 h2 (*C) 20.03	5402.78 8276.07 Oct 1 20.39 20.03	6189.28 Nov 1 20.06	5408.26 Dec 1	21	(B- (8) (8) (8) (8)
3)m= 2497.96 otal gains - in 4)m= 5924.26 7. Mean intern 7. Mean intern 5. Jan 6)m= 1 1 Mean internal 7)m= 19.83 Temperature 0 8)m= 20.02 Utilisation fact 9)m= 1 Mean internal	4852.51 7 ternal an 8055.65 11 Al Lempe during he or for gai Feb 1 temperat 19.94 Juring he 20.02 or for gai 1 temperat	rature (mating p ns for i Mar 1 ture in 1 20.13 ating p 20.02 ns for r 1 ture in t	10336.08 (84)m = 13372.46 (1000 minute eriods in 0.99 iving and 20.4 eriods in 20.03 est of dh 0.99 the rest	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - = (+ (83)m 15520.36 ng area (see Ta Jun 0.88 ollow ste 20.85 dwelling 20.04 h2,m (s 0.81 ing T2 (i	rom Tal able 9a) Jul 0.73 aps 3 to 20.92 g from Ta 20.94 ee Table 0.6 follow ste	10567 84 13078 22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, T 20.04 9a) 0.7 eps 3 to	a 8350.37 10998.88 11 (*C) Sep 0.97 20.73 h2 (*C) 20.03 7 in Tabl	5402.78 8276.07 Oct 1 20.39 20.03 1 le 9c)	6189.28 Nov 1 20.06 20.03	5408.26 Dec 1 19.81 20.02	21	(8) (8) (8) (8) (8) (8)
a)m= 2497.96 a)m= 2497.96 a)m= 5924.26 Alman Intern Comperature of Julisation fact Jan 6)m= 1 Mean internal 1 Amount internal 1 Amount internal 20.02 Jtilisation fact 20.02 Jtilisation fact 1 Amount internal 20.02 Jtilisation fact 1 Amount internal 1 Jtilisation fact 1 Amount internal 1 Jtilisation fact 1 Amount internal 1	4852 51 7 ternal an a055 65 11 at temper during he or for gai Feb 1 temperat 19.94 during he 20.02 or for gai 1	rature (d solar 0544.08 rature (ating p ns for i Mar 1 20.13 ating p 20.02 ns for r 1	10336.08 (84)m = 13372.46 (1000 minute eriods in 0.99 iving and 20.4 eriods in 20.03 est of do 0.99	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - (73)m -	+ (83)m 15520.36 ng area (see Ta Jun 0.88 20.85 dwelling 20.04 h2,m (s 0.81	rom Tal able 9a) Jul 0.73 aps 3 to 20.92 g from Ta 20.94 ee Table 0.6	10567.84 13078.22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.04 9a) 0.7	a son arr son arr arr arr arr arr arr arr arr	5402.78 8276.07 Oct 1 20.39 20.03 1 19.25	6189.28 Nov 1 20.06 20.03 1 18.76	5408.26 Dec 1 19.81 20.02 1 18.4		(8) (8) (8) (8) (8) (8) (8) (8)
3)m= 2497.96 otal gains - in 4)m= 5924.26 7. Mean intern 7. Mean intern 5. Jan 6)m= 1 1. Mean internal 7)m= 19.83 7. Comperature of 8)m= 20.02 Jtilisation fact 9)m= 1 Mean internal 9)m= 1	4852.51 7 ternal an 8055.65 11 Al Lempe during he or for gai Feb 1 temperat 19.94 Juring he 20.02 or for gai 1 temperat	rature (mating p ns for i Mar 1 ture in 1 20.13 ating p 20.02 ns for r 1 ture in t	10336.08 (84)m = 13372.46 (1000 minute eriods in 0.99 iving and 20.4 eriods in 20.03 est of dh 0.99 the rest	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - = (+ (83)m 15520.36 ng area (see Ta Jun 0.88 ollow ste 20.85 dwelling 20.04 h2,m (s 0.81 ing T2 (i	rom Tal able 9a) Jul 0.73 aps 3 to 20.92 g from Ta 20.94 ee Table 0.6 follow ste	10567 84 13078 22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, T 20.04 9a) 0.7 eps 3 to	a son arr son arr arr arr arr arr arr arr arr	5402.78 8276.07 Oct 1 20.39 20.03 1 19.25	6189.28 Nov 1 20.06 20.03	5408.26 Dec 1 19.81 20.02 1 18.4	21	(8) (8) (8) (8) (8) (8) (8) (8)
a)m= 2497.96 a)m= 5924.26 a)m= 5924.26 a)m= 5924.26 a)m= 5924.26 a)m= 1 a)m= 1 b)m= 1 b)m= 1 b)m= 1 b)m= 1 comperature of the second secon	4852 51 7 ternal an a 8055 65 11 all temperaturing he a femperaturing he a 19.94 a during he a 20.02 a or for gain a 1 a 1 a 1 b 1 a 1 a 1 a 1 b 1 a 1 a 1 a 1 a 1 a 1 a 1 a 1 a 1 a 18.57 a	rating p ns for i Mar 1 20.13 ating p 20.02 ns for r 1 1 8.86	10336.08 (84)m = 13372.46 (1000 minutes) eriods in 0.99 iving and 20.4 eriods in 20.03 est of do 0.99 the rest 19.28	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - (73)m -	+ (83)m 15520.36 ng area (see Ta Jun 0.88 20.85 dwelling 20.04 h2,m (s 0.81 ng T2 (1 19.88	rom Tal able 9a) Jul 0.73 20.92 g from Ta 20.92 g from Ta 20.94 ee Table 0.6 follow ste 19.95	10567 81 13078 22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, T 20.9 able 9, Ti 20.9 able 9, T	8 8350 37 10968.88 11 (°C) Sep 0.97 20.73 h2 (°C) 20.03 7 in Tabl 19.74	5402.78 8276.07 Oct 1 20.39 20.03 1 8 9c) 19.25 TLA = Livit	6189.28 Nov 1 20.06 20.03 1 18.76	5408.26 Dec 1 19.81 20.02 1 18.4		(8) (8) (8) (8) (8) (8) (8)
a)m= 2497.96 a)m= 5924.26 a)m= 5924.26 a)m= 5924.26 a)m= 5924.26 a)m= 1 a)m= 1 b)m= 1 b)m= 1 a)m= 1 b)m= 1 a)m= 1 b)m= 1 a)m= 1 b)m= 18.41 b)m= 1	4852 51 7 ternal an as so55.65 11 htternee during he or for gai 1 temperat 19.94 during he 20.02 or for gai 1 temperat 1 18.57 1	rating p ns for i Mar 1 20.13 ating p 20.02 ns for r 1 1 8.86	10336.08 (84)m = 13372.46 (1000 minutes) eriods in 0.99 iving and 20.4 eriods in 20.03 est of do 0.99 the rest 19.28	12610.84 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - 15404.97 = (73)m - (73)m -	+ (83)m 15520.36 ng area (see Ta Jun 0.88 20.85 dwelling 20.04 h2,m (s 0.81 ng T2 (1 19.88	rom Tal able 9a) Jul 0.73 aps 3 to 20.92 g from Ta 20.92 g from Ta 20.94 ee Table 0.6 follow ste 19.95	10567 81 13078 22 ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, T 20.9 able 9, Ti 20.9 able 9, T	8 8350 37 10968.88 11 (°C) Sep 0.97 20.73 h2 (°C) 20.03 7 in Tabl 19.74	5402.78 8276.07 Oct 1 20.39 20.03 1 8 9c) 19.25 TLA = Livit	6189.28 Nov 1 20.06 20.03 1 18.76	5408.26 Dec 1 19.81 20.02 1 18.4		(8) (8) (8) (8) (8) (8) (9) (9)
a)m= 2497.96 a)m= 5924.26 A)m= 5924.26 A Mean Intern Comperature of Julisation fact Jan 1 Gemperature of Jan 1 Mean internal 7 Temperature of Jan 1 Mean internal 1 Jun= 1 Mean internal 20.02 Jtilisation fact 9 9/m= 1 Mean internal 0 9/m= 1 Mean internal 1 Mean internal 1 Mean internal 1 Mean internal 2 Jun= 18.41	4852 51 7 ternal an an 8055.65 11 All temperaturing he an feb 1 temperaturing he 1 19.94 1 during he 20.02 or for gain 1 temperaturing he 20.02 or for gain 1 temperaturing he 1 18.94 1 temperaturing he 1 18.97 1	1283.29 d solar 0544.05 relure (ating p ns for li Mar 1 20.13 ating p 20.02 ns for r 1 1 18.86 ture (fo 18.92	10336.08 (84)m = 13372.46 (1016)m = riods ir iving are Apr 0.99 iving are 20.4 eriods ir 20.03 est of de 0.99 the rest 19.26 r the wh 19.32	12610.84 = (73)m - 15404.97 15404.97 15404.97 15404.97 15404.97 15404.97 10.97 ea T1 (for 20.03 welling, 0.95 of dwelli 19.69 19.69	+ (83)m 15520.36 ng area (see Ta Jun 0.88 ollow ste 20.85 dwelling 20.04 h2,m (s 0.81 ng T2 (i 19.88 ting) = t 19.93	rom Tal able 9a) Jul 0.73 aps 3 to 7 20.92 g from Ta 20.04 ee Table 0.6 follow ste 19.85	13078 2: 13078 2: ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.9 able 9, 1 20.9 able 9, 1 20.04 9a) 0.7 eps 3 to 19.94 + (1 - 1 19.99	a saso ar 10998.88 11 (°C) 20.73 h2 (°C) 20.03 0.95 7 in Tabl 18.74 19.78	5402.78 8276.07 Oct 1 20.39 20.03 1 20.03 1 9.25 TLA = LIMI 19.3	6189.28 Nov 1 20.06 20.03 1 18.76 ng ares + (*	5408.26 Dec 1 19.81 20.02 1 18.4 4) =		(84
otal gains - in 4)m= 5924.26 7. Mean intern Temperature of Utilisation fact (b)m= 1 Mean internal (7)m= 19.83 Temperature of (8)m= 20.02 Utilisation fact (9)m= 1 Mean internal (0)m= 18.41 Mean internal (0)m= 18.41	4852 51 7 ternal an as s055.65 11 All temperaturing he as feb 1 temperaturing he as 19.94 as during he as 20.02 as or for gain 1 temperaturing he as 10.94 as during he as as as 1 as as	1283.29 d solar 0544.05 relure (ating p ns for li Mar 1 20.13 ating p 20.02 ns for r 1 1 18.86 ture (fo 18.92	10336.08 (84)m = 13372.46 (1016)m = riods ir iving are Apr 0.99 iving are 20.4 eriods ir 20.03 est of de 0.99 the rest 19.26 r the wh 19.32	12610.84 = (73)m - 15404.97 15404.97 15404.97 15404.97 15404.97 15404.97 10.97 ea T1 (for 20.03 welling, 0.95 of dwelli 19.69 19.69	+ (83)m 15520.36 ng area (see Ta Jun 0.88 ollow ste 20.85 dwelling 20.04 h2,m (s 0.81 ng T2 (i 19.88 ting) = t 19.93	rom Tal able 9a) Jul 0.73 aps 3 to 7 20.92 g from Ta 20.04 ee Table 0.6 follow ste 19.85	13078 2: 13078 2: ble 9, Ti Aug 0.81 7 in Tab 20.9 able 9, 1 20.9 able 9, 1 20.9 able 9, 1 20.04 9a) 0.7 eps 3 to 19.94 + (1 - 1 19.99	a saso ar 10998.88 11 (°C) 20.73 h2 (°C) 20.03 0.95 7 in Tabl 18.74 19.78	5402.78 8276.07 Oct 1 20.39 20.03 1 20.03 1 9.25 TLA = LIMI 19.3	6189.28 Nov 1 20.06 20.03 1 18.76 ng ares + (*	5408.26 Dec 1 19.81 20.02 1 18.4 4) =		(8) (8) (8) (8) (8) (8) (9) (9)

Utilisa	tion fa	ctor for g	ains, hn	n:		Б.		s:			a de			
(94)m=	1	1	1	0.99	0.95	0.8	0.6	0.69	0.94	1	1	1		(94)
Usefu	l gains	, hmGm	, W = (9	4)m x (8	4)m									
95)m=	5924.02	8053.79	10528.89	13237.59	14566.72	12485.01	8804.95	9009.13	10387.53	8255.44	6188,45	5408.13		(95)
100000000		rage exte	-	1							_			
96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		-						x [(93)m						
		837421.82		-	-	_	-					38641.03		(97)
		4 19735.32	-				-	24 x [(97)	_	-	-	24725.28		
anim=	24380.1	419/35.32	17290.96	106/5.85	5142.82	0	0	0	0					1
								Tota	t per year	(kWh/year	r) = Sum(8	(8):	131558.49	(98)
Space	e heatii	ng requir	ement in	i kWh/m	/year							L	52.09	(99)
80. Sp	ace o	ooling rea	quireme	nt										- 10
Calcu	lated fo	or June,	July and	August.	See Ta	ble 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Contraction of the second		1	alculated	1			-	and exte	_			1		141640
(100)m=	0	0	0	0	0	25084.6	19747.45	20251.45	0	0	0	0		(100
50000		ctor for le	-			2.02		120257						
(101)m=	0	0	0	0	0	0.65	0.76	0.68	0	0	0	0		(101
200		hmLm (V		-			L		-	1.2	1	<u> </u>		14.00
102)m=	0	0	0	0	0	1	1	13710.78	0	0	0	0		(102
1000	(solar	gains ca	liculated o	for appl	cable w	-	-	ee Table	10)	Ó	Ó	0		(103
(103)m=									C		1.00		(ddlm)	tros
		o zero if				rwening	continu	ous (KW	m) = 0.0	24 X [[10	<i>J3)m – (</i>	102)m] x	(41)m	
(104)m=	0	0	0	0	0	562.77	1092.88	0	0	0	0	0		
	3		S 2		20 T	6	18		Tota	= Sum	(104)	=	1655.65	(104
Cooled	fractio	n							fC=	cooled	area + (4) =	0.59	(105
Intermi	ttency	factor (T	able 10b)	_				_					-
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
101	15	127	1722	63	19220	1162	1000000		Tota	I = Sum(104)	=	0	(106
		require						-						
(107)m=	0	0	0	0	0	83.56	162.27	0	0	0	0	0		-
										I = Sum((107)	-	245.83	(107
Space	cooling	g require	ment in I	kWh/m²/	year				(107) + (4) =			0.1	(108
9a. Ene	ingy re	quireme	nts – Ind	ividual h	eating s	ystema	including	g micro-C	HP)					
	e heati on of s	ing: pace hei	at from s	econdar	y/supple	ementary	y system	E				Г	0.1	(201
Fracti	on of s	pace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =			Ē	0.9	(202
		nain heal		사실이 하면	120573							F	0.1	(203
		otal heat						(204) = (2)	02) × [1-	(203)] =		F	0.81	(204
		otal heat						(205) = (2)	1111.021.00	200.1977.02		F	0.09	(205
			Sec. 10.	Same								F	117.0	(205
CILICIE	ncy of	main sp	ace near	ing syste	em 1								319.7	(20

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	2012/10/12/00/12											-		
Title in	ncy of i	main spa	ice heat	ing syste	em 2								93.3	(207
Efficie	ncy of :	seconda	ry/suppl	ementar	y heatin	g systen	n, %					Ē	80	(208
Coolin	ng Syste	em Ener	gy Effici	ency Rat	tio							[6.75	(209
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g require	ement (o	alculated	d above									
	24386.14	19735.32	17290.95	10875.85	5142.82	0	0	0	0	11271.88	18330.24	24725.28		
211)m	= {[(98			00 + (20	6)									(211
	6178.53	5000.19	4380.88	2704.88	1303	0	0	0	0	2855,87	4644.2	6264.48		1
								Tota	I (kWh/yea	ar) =Sum()	211)	r L	33331.99	(211
		n x (203)	-							11235272				
213)m=	2352.36	1903.73	1667.94	1029.82	496.09	0	0	0	0		1768.19	and the second		
								Tota	I (KVVh/ye)	ar) =Sum(3	213)	- L	12690.53	(213
10.000.000		T		y), kWh/	month									
)1)]}x1			640.85					1408.00	2204 28	2000.00		
215jm=	3048.27	2466.91	2161.37	1334,48	642.85	0	0	0	0	1406.98 ar) =Sum(2	2291.28	and the second se	10111.01	100
2312111	21.00474							1004	i (www.yes	ary -oung	ET 2/1_218_10	L	18444.81	(21)
	heating	No. 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1	las fasta	stated at										
Jutput	424.14	374.82	395.95	ulated at 358.14	353.28	318.99	309.52	335.28	333.32	371.21	388.5	415.01		
L Efficien		ater hea	ter										79.6	(216
217)m-	88.38	88.23	87.9	87.12	85.33	79.6	79.6	79.6	79.6	87.16	88.04	88.43		(217
21030	rwater	heating.	kWh/m	onth			17122001	_3202_						
		m x 100												
219)m=	479.93	424.8	450.43	411.08	413.99	400.74	388.85	421.21	418.74	425.89	441.25	469.31		
								Tota	l = Sum(2	19a), ,,, =		L	5146.22	(219
Space	cooling			atta										
		g fuel, k		un.										
221)m	= (107)m+ (209	9)		0	13.94	24.04		0	0				
221)m				0	0	12.38	24.04	0 Tota	0	0	0	0	96.19	7(22)
221)m 221)m	0 = (107)m+ (209 0	9)		0	12.38	24.04		0 I = Sum(2	21),,, =		-	36.42	
221)m 221)m 221)m	i = (107 0)m+ (209 0	9) 0	0		12.38	24.04			21),,, =	0 Wh/year	-	kWh/yea	
221)m 221)m Annua Space	e (107 0 I totals heating)m+ (209 0 fuel use	9) o d, main	o system	1	12.38	24.04			21),,, =		-	kWh/yea 33331.99	
221)m 221)m Annua Space Space	i = (107 0 I totals heating heating)m+ (209 0 fuel use fuel use	9) o d, main	0 system system	1	12.38	24.04			21),,, =		-	kWh/yea 33331.99 12690.53	
221)m 221)m Annua Space Space Space	I totals heating heating heating)m+ (209 0 fuel use fuel use	ed, main ed, main ed, seco	0 system system	1	12.38	24.04			21),,, =		-	kWh/yea 33331.99	
221)m 221)m Annua Space Space Space Water I	I totals I totals heating heating heating)m+ (209 0 fuel use fuel use fuel use	ed, main ed, main ed, seco d	0 system system	1	12.38	24.04			21),,, =		-	kWh/yea 33331.99 12690.53	
221)m 221)m Annua Space Space Space Water I	I totals I totals heating heating heating)m+ (209 0 fuel use fuel use	ed, main ed, main ed, seco d	0 system system	1	12.38	24.04			21),,, =		-	kWh/year 33331.99 12690.53 16444.81	
221)m 221)m Annua Space Space Space Water I Space	I totals heating heating heating heating cooling)m+ (209 o fuel use fuel use fuel use fuel use	e) o d, main d, main d, seco d d	0 system system	1 2		24.04			21),,, =		-	kWh/year 33331.99 12690.53 16444.81 5146.22	
(221)m (2	I totals heating heating heating heating cooling city for p)m+ (209 o fuel use fuel use fuel use fuel use	9) 0 ed, main ed, seco d d ans and	o system system	1 2		24.04			21),,, =		-	kWh/year 33331.99 12690.53 16444.81 5146.22	
221)m 221)m Space Space Space Vater I Space Electric centra	I totals heating heating heating cooling city for p)m+ (209 o fuel use fuel use fuel use fuel use pumps, fi	ed, main ed, main ed, seco d d ans and	0 system system ndary electric	1 2		24.04			21),,, =			kWh/year 33331.99 12690.53 16444.81 5146.22	(230
221)m 221)m Space Space Space Vater I Space Electric centra boiler	I totals heating heating heating cooling cooling tity for p I heatir with a f)m+ (209 o fuel use fuel use fuel use fuel use pumps, fi ig pump: fan-assis	a) 0 d, main d, main d, seco d d ans and ted flue	0 system system ndary electric	1 2 keep-ho		24.04	Tota	I = Sum(2	21),,, =	Wh/yea		kWh/year 33331.99 12690.53 16444.81 5146.22	(230
(221)m (221)m Space Space Space Water I Space Electric centra boiler Total e	I totals heating heating heating cooling cooling tity for p I heatir with a f)m+ (209 o fuel use fuel use fuel use fuel use pumps, fi ig pump: fan-assis	a) 0 d, main d, main d, seco d d ans and ted flue	o system system ndary electric	1 2 keep-ho		24.04	Tota	I = Sum(2	k	Wh/yea		kWh/yeau 33331 99 12690 53 16444 81 5146.22 36.42	(221 (230 (230 (231 (232

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10a. Fuel costs - individual heating syste	m5.		
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) ×	13.19 × 0.01	= 4396.49 (240
Space heating - main system 2	(213) x	3.48 × 0.01	= 441.63 (241)
Space heating - secondary	(215) ×	3,48 × 0.01	= 572.28 (242)
Water heating cost (other fuel)	(219)	3.48 × 0.01	179.09 (247)
Space cooling	(221)	13.19 × 0.01	= 4.8 (248
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01	= 13.85 (248)
(if off-peak tariff, list each of (230a) to (230 Energy for lighting	0g) separately as applicable (232)	and apply fuel price according 13.19 × 0.01	
Additional standing charges (Table 12)			120 (251
	one of (233) to (235) x) 13.19 × 0.01	= -441.36 (252)
Appendix Q items: repeat lines (253) and Total energy cost	(254) as needed 245)(247) + (250)(254) =	20 - 10	5665.47 (255)
11a. SAP rating - individual heating syste			0000.47
	ddia a		1
Energy cost deflator (Table 12) Energy cost factor (ECF)	(255) x (256)] + [(4) + 45.0] =		0.42 (256)
SAP rating (Section 12)	enn) x (enn)] - [(4) + 45.0] -		0.93 (257) 87.09 (258)
12a. CO2 emissions - Individual heating	systems including micro-CH	P	
	University of the second s	a second a second as a second as the second s	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519 *	17299.3 (261
Space heating (main system 2)	(213) ×	0.216 =	2741.15 (262
Space heating (secondary)	(215) ×	0.216 =	3552.08 (263)
Water heating	(219) x	0.216 =	1111.58 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	24704.12 (265
Space cooling	(221) ×	0.519	18.9 (266
Electricity for pumps, fans and electric kee	ep-hot (231) x	0.519 =	54.5 (267
Electricity for lighting	(232) ×	0.519 =	1490.06 (268)
Energy saving/generation technologies Item 1		0.519 =	-1736.66 (269
Total CO2, kg/year		sum of (265)(271) =	24530.91 (272)
CO2 emissions per m ²		(272) + (4) =	9.71 (273)
El rating (section 14)			87 (274
13a. Primary Energy			

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	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	3.07	=	102329.21 (261
Space heating (main system 2)	(213) x	1.22	=	15482.45 (262
Space heating (secondary)	(215) x	1.22	-	20062.67 (263
Energy for water heating	(219) x	1.22	-	6278.39 (264
Space and water heating	(261) + (262) + (263)	+ (264) =		144152.72 (265
Space cooling	(221) x	3.07	-	111.81 (266
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	F.	322.35 (267
Electricity for lighting	(232) ×	0	=	8814.02 (268
Energy saving/generation technologies Item 1		3.07	-	-10272:74 (269
'Total Primary Energy		sum of (265)(271) =		143126.16 (272
Primary energy kWh/m²/year		(272) + (4) =		56.67 (273

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APPENDIX (iii)

SAP L1A 2013/16 REGULATION COMPLIANCE REPORT

(SAP Checklist)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.7 Printed on 05 October 2020 at 16:29:29

Project Informatio	on:			
Assessed By:	Ondrej Gajdos (STR0006629)	Building Type:	Detached House
Dwelling Details:	ł.			
NEW DWELLING	DESIGN STAGE		Total Floor Area:	2525.6m²
Site Reference :	28AR		Plot Reference:	28, Avenue Road
Address :	28, Avenue Roa	d, LONDON, NW8 6BU		
Client Details:				
Name: Address :				
		within the SAP calculations. lations compliance.		
1a TER and DER				
and the second se		icity (mains gas used for second	dary heating)	
Fuel factor: 1.55 (e	electricity (mains g	as used for secondary heating))	
Target Carbon Dio	xide Emission Ra	te (TER)	13.6 kg/m²	
Dwelling Carbon D	the balance of the state of the	Rate (DER)	10.09 kg/m ²	0
1b TFEE and DF	the factor of the second se			
Target Fabric Ener			66.5 kWh/m ²	
Dwelling Fabric En	ergy Efficiency (D	FEE)	55.5 kWh/m²	
T Tabala M contra				0
2 Fabric U-value			/ 1 PH-14 P/07/2010 1	
Element		Average	Highest	
External v Floor	waii	0.17 (max. 0.30)	0.18 (max. 0.70)	0
Roof		0.12 (max. 0.25) 0.12 (max. 0.20)	0.12 (max. 0.70) 0.12 (max. 0.35)	0
Openings		1.30 (max. 2.00)	1.30 (max. 3.30)	0
2a Thermal bride		noo (maxi zioo)	1.00 (1103: 0.00)	
1	ALC: NOT YOUR LANSAGE STORE	from linear thermal transmittan	ces for each junction	
3 Air permeabilit	taken and a state of the state	Thom most thomas transmittas	ices for each junction	
	bility at 50 pascals	1	4.00 (design val	lue)
Maximum	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		10.0	0
4 Heating efficie	псу			
Main Heatin		Heat pumps with radiators Ground source heat pump		
			1999 - De la Brand, B Brand, Brand, B	
Main Heatir	ng system 2:	Database: (rev 465, produc	t index 016566):	
		Boiler systems with radiato	rs or underfloor heating - m	ains gas
		Brand name: Remeha		
		Model: Quinta Pro 65		
		Model qualifier: (Regular)		
		(Regular) Efficiency 89.3 % SEDBUK	2009	
		Endoney 08.9 /0 OEDBOR		

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Regulations Compliance Report

Secondary heating system:	Room heaters - gas		
	Data from manufacturer -	lana d R	
	Gas fire or wall heater, ba	lanced flue	
	Efficiency 80.0 % Minimum 63.0 %		OK
ylinder insulation	A REAL PROPERTY OF A REAL PROPER		UK
Hot water Storage:	Measured cylinder loss: 6	.67 kWh/day	
	Permitted by DBSCG: 9.5	4 kWh/day	OK
Primary pipework insulated:	Yes		OK
ontrois			
Course burget and and	TT20 by all only in a set of		OK
Space heating controls	TTZC by plumbing and el		OK
Space heating controls 2:		ne control by suitable arrangement of plu	
Hot water controls: ow energy lights	Cylinderstat		ок
Percentage of fixed lights with	low-energy fittings	100.0%	
Minimum		75.0%	OK
lechanical ventilation			
Not applicable			
ummertime temperature			
Overheating risk (Thames valle	ey):	Not significant	OK
ed on:			
Overshading:		Average or unknown	
Windows facing: East		4.79m ²	
Windows facing: East		13.04m²	
Windows facing: East		16.83m*	
Windows facing: East		7.19m²	
Windows facing: South		27.04m²	
Windows facing: South		24.57m ²	
Windows facing: South		9.8m*	
Windows facing: West		22.32m ²	
Windows facing: West		6.76m ²	
Windows facing: West		16.38m ²	
Windows facing: West		5.88m²	
Windows facing: North		22.32m ^a	
Windows facing: North		27.9m²	
Windows facing: North		16.38m²	
Windows facing: North		5.4m ^a	
Windows facing: North		7.84m²	
Windows facing: North		4.08m ²	
Windows facing: East		3.38m²	
Windows facing: East		33.48m²	
Windows facing: East		13.65m ³	
Windows facing: East		7.8m²	
Windows facing: East		5.88m ²	

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Ventilation rate:	4.00	
ey features		
Thermal bridging	0.023 W/m ^a K	
Roofs U-value	0.12 W/m ² K	
Floors U-value	0.12 W/m ² K	
Floors U-value	0.12 W/m ² K	
Photovoltaic array		
Fixed cooling system		
Secondary heating (mains gas)		

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APPENDIX (iv)

PEA – PREDICTED ENERGY ASSESSMENT (PRE-EPC)

Predicted Energy Assessment

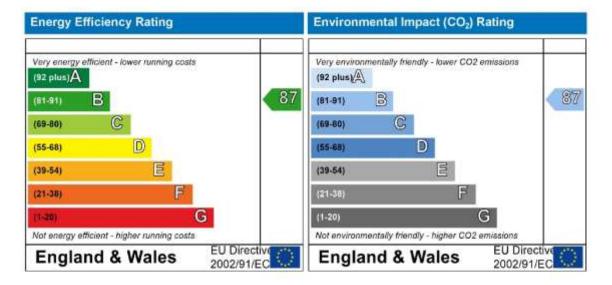


28, Avenue Road LONDON NW8 6BU

Dwelling type: Date of assessment: Produced by: Total floor area: Detached House 02 October 2020 Ondrej Gajdos 2525.6 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

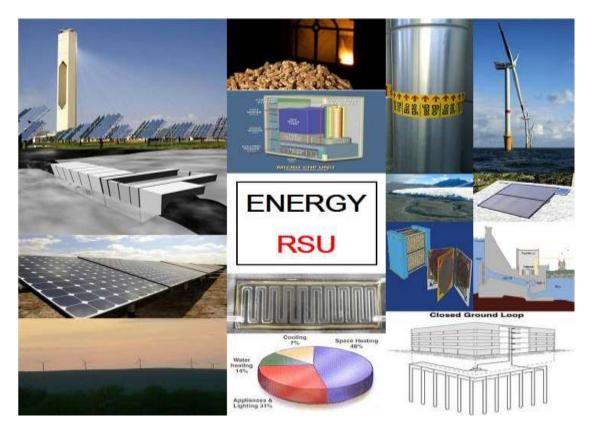
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be. The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

APPENDIX (v)

ENERGY RSU – RENEWABLES & SUSTAINABILITY UNIT



ENERGY RSU is an integrated energy sustainability unit able to provide the following:

- SAP Calculations & Certificates L1A&B New/Existing Buildings (NHER certified)
- SBEM Calculations & Certificates L2A&B New/Existing Buildings (BRE certified)
- EPC & DEC Certificates New Build (CIBSE certified)
- Rd SAP Survey EPC Certificates Existing Buildings (NHER certified)
- Commercial EPC Survey certificates Existing Buildings (BRE certified) Level 3, 4 & 5
- Energy Statements & Renewable Reports for Planning
- LEED/ BREEAM assessments (USGBC/BRE certified)
- Low/Zero Carbon (LZC) and Sustainability Appraisals/designs (CIBSE Low Carbon Consultant)
- Renewable Energy Appraisals and Designs
- Carbon Rating assessments
- 2D/3D CFD and Dynamic Thermal Simulations
- EPBD Air Conditioning Inspections (Article 20) and EPBD Asset Ratings & Certificates
- Energy Usage (Running Costs)
- Utility/ Bill Analysis and Recommendations
- Advice on Green and Environmental Issues Relating to M&E Building Services
- Code for Sustainable Homes New Build and Domestic Refurbishment (BRE certified)



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M&E Consultants

Energy Consultants