McDonald’s Restaurant
Kelty
LZC Report
16 March 2022

Approval and Revision History

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Contents

1 Abbreviations and Terms

Abbreviation	Description
LZC	Low and Zero Carbon
DHW	Domestic Hot Water
EPC	Energy performance Certificate
BER	Building Emission Rate
TER	Target Emission Rate
HVAC	Heating, Ventilation and Air Conditioning
SFP	Specific Fan Power
AHU	Air Handling Unit
NCM	National Calculation Methodology
ASHP	Air Source Heat Pump
PV	Photovoltaic
CHP	Combined Heat and Power
GSHP	Ground Source Heat Pump

2 Introduction

This low carbon report has been carried out by Mautasim Mohammed who has studied Bachelor of Technology in Mechanical Engineering and holds MSc in Mechanical Engineering from University of Plymouth. The author has gained over 10 years of experience as a Mechanical Engineer working with some of the UK's leading environmental consultants including PHA Consult, Foster and Partners and Atkins. He has been involved in carrying out thermal modelling, energy analysis, feasibility studies, and design of low and zero carbon systems such as solar thermal and PV panels for wide variety of schemes for commercial, retail, residential and mixed-use developments. The author is also a registered low carbon energy assessor for level 5 buildings.

The main objective of this report is to satisfy the planning conditions for the new proposed McDonalds restaurant in Kelty with regards to Fife plan policy 11 stated in section 3.1 of Low Carbon Fife Supplementary Guidance.

The importance of LZC technologies is becoming ever greater as we aim to reduce the stress on natural resources along with minimising the impact of carbon emission on the environment. The LZC technologies are most efficient and cost effective when they are used to meet the energy demands already minimised through efficient design and use of energy conservation measures.

The proposed restaurant is a standard single story modular type building – NG100 which consists of kitchen, dining, office, WC's, plant and BOH areas with total area of approximately 350m².

The baseline energy consumption figures used for this study were derived from SBEM results that had been used to assess compliance with Section 6 of the Scottish Building Regulations 2015. The potential of using renewable and low/zero carbon technologies to reduce building related CO_2 emissions and meet to the Fife planning requirements of has been evaluated.

The following pages provide analysis of the applicable LZC technologies and anticipated performance to achieve a reduction in energy demand and carbon emissions. We would advise that all the figures at this stage are preliminary and should be verified upon final selection of renewable and low energy option. This applies to actual installation costs, actual performance of the selected equipment and on-site conditions.

3 Local Planning Requirements

Low Carbon Fife Supplementary Guidance (Jan 2019) requires new development to demonstrate that: "The proposal meets the current CO2 emissions reduction target (as set out by Scottish Building Standards) and those generating technologies will contribute at least 15% of these savings from 2016 and at least 20% from 2020.

The requirement applies to all building with the following exceptions.

- Development proposals which are not heated or cooled (other than heating for frost protection).
- Conversions of buildings.
- Temporary buildings with an intended life of less than 2 years.

4 Calculation Methodology

Both Part L and EPC calculations are based on annual predicted CO2 emissions due to energy consumed by fixed building services. These regulated loads include heating and cooling plant, fans, pumps, and lighting. Unregulated loads such as portable appliances (small power), vertical transportation and external lighting are not accounted for.

In order to satisfy Scottish Building Regulations, all new buildings must achieve regulated carbon emissions equal to or lower than a specified target. The building's regulated carbon emissions is known as the Building Emission Rate (BER) and is calculated based on the actual building 'as constructed' using standard occupancy patterns, operating conditions and fuel CO2 emission rates, with corrections applied to give credit for power factor correction and energy metering capability. The Target Emissions Rate (TER) is based on the performance of a notional building of the same size and shape as the actual building, using the same occupancy patterns, operating conditions, and fuel CO2 emissions rates but with predefined building performance criteria.

The building energy compliance calculation has been performed based on the design of HVAC systems, lighting systems using EDSL TAS. The results of this study will demonstrate if the building meets the four criteria's namely TER, building fabric thermal performance, limiting the effects of heat gains in summer, building performance consistency with the BER and providing energy efficient operation of the building. The report will highlight areas where changes are required in the design if it does not meet the compliance criteria.

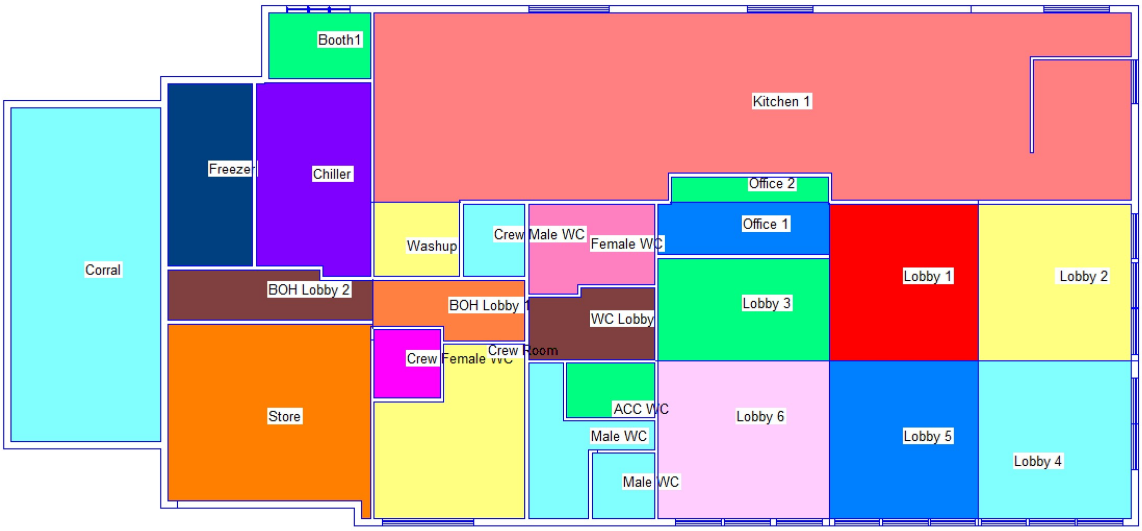
The EPC Asset Rating is calculated in a similar way, in this case by comparing the predicted emissions from the actual building with a Standard Emission Rate (SER). The SER is mined by applying a fixed improvement factor to the emissions from a reference building. The reference building is identical to the Part L notional building except that heat is always provide by gas and all spaces are mixed mode, cooled to 27°C irrespective of the systems in the actual building.

4.1 Thermal Model

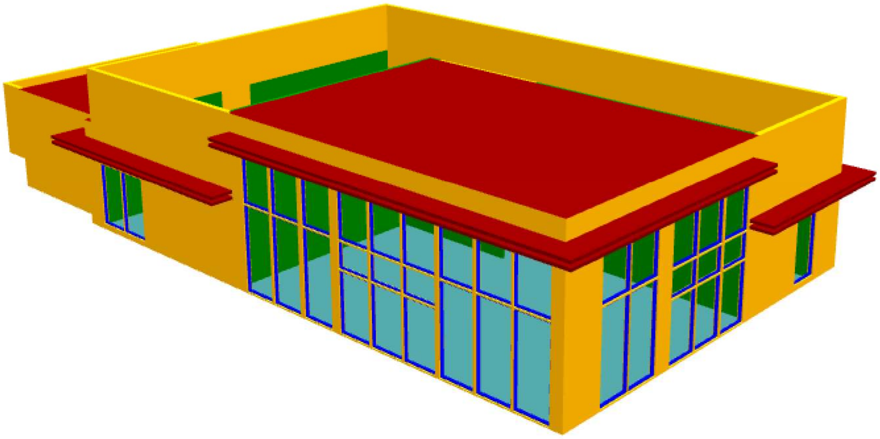
The calculations for this assessment were carried out using EDSL TAS 9.5.2, a dynamic thermal simulation package approved for the purposes of undertaking Part L and EPC Level 5 calculations. The 3D model (below) was constructed in the TAS 3D Modeller with reference to the 2D plans and sections available at the time of the analysis.

The model was zoned in accordance with the NCM guidance based on internal condition, servicing strategy, solar orientation, and daylight access. Day lit spaces were divided into two sub-zones: the first representing the day lit space within 6m of the building façade, the second representing the non-day lit space beyond 6m from the façade.

The below images show 3d model and internal zoning for ground floor extracted from the TAS model.



Ground Floor



3D model

5 Energy Benchmarking

5.1 Option1 - Base Case

This option has the standard HVAC system configuration that has been implemented in McDonald's stores for this type of modular buildings. It consists of Mitsubishi Air Source heat pumps serving kitchen AHU (S1) and ground floor lobby AHU (S2)

Air source heat pump is a system which transfers heat from outside to inside of the building or vice versa. It works on the principle of vapour compression refrigeration and uses a refrigerant system involving compressor and condenser to absorb heat from one place and discharge it to another.

The heat pump units provide both heating and cooling to meet the building load in order to maintain internal conditions. Both S1 and S2 AHU's are supply only AHU's with no form of heat recovery and therefore does not include an exhaust fan as part of the AHU.

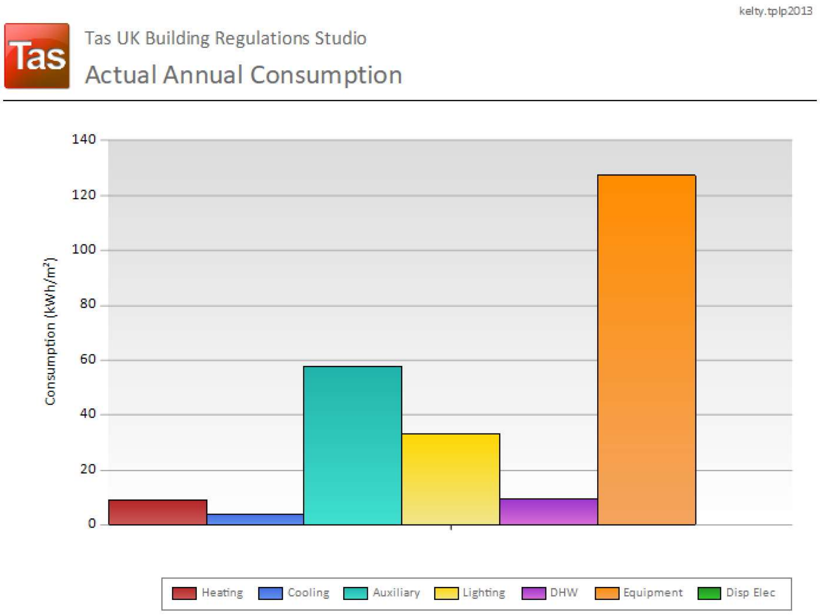
A separate kitchen extract fan is used to extract from the cooking canopies along with general extract from the wash-up, beverage cell and storeroom.

Make-up air to the WC areas is provided by S2 unit with a separate toilet extract fan to achieve the designed extract rates. Cooling and heating to the crew room and manager's office is provided by Mitsubishi split a/c units with fresh air served from the S2 unit.

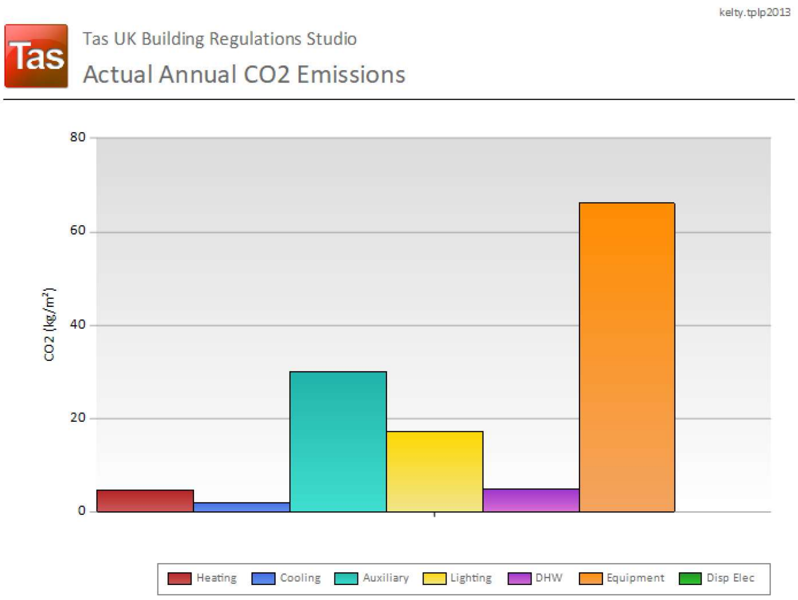
Air source heat pump is used to provide DHW. One of the main advantages of using this type of system is higher coefficient of performance compared to an electric DHW system.

Air source heat pump DHW system was modelled in TAS as a primary heat source to meet 100% of the hot water demand of the building. A notional efficiency of 4.0 was used for the assessment based on the AO smith heat pump system (ref – HRYO Pi Series)

In order to assist with assessment of different renewable technologies a computational building model used for building compliance calculations under Section 6 of the Scottish Building Regulations 2015 has been used to predict energy use and carbon dioxide emissions. The building operational characteristic was defined in accordance National Calculation Method (NCM) profiling.



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	9.11	3.71	57.84	33.15	9.60	127.15	0.00



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO2 (kg/m²)	4.73	1.93	30.02	17.21	4.98	65.99	0.00

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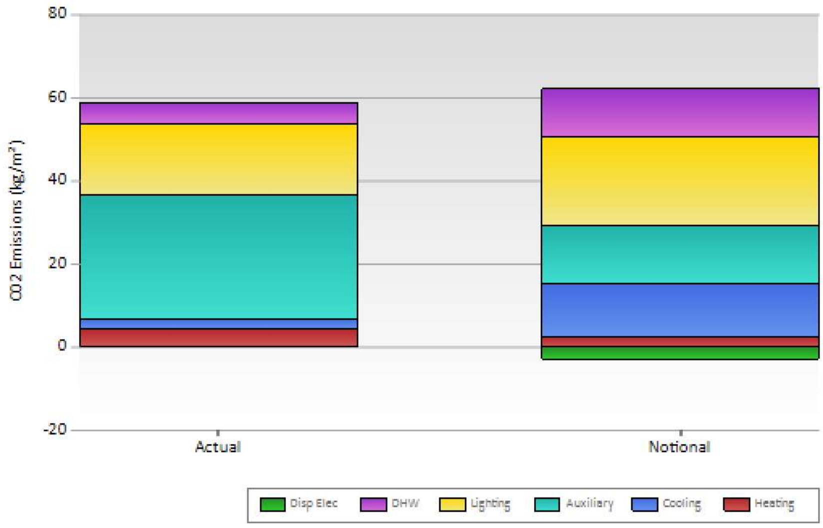
Tas UK Building Regulations Studio

Annual CO2 Emissions Comparison



	Actual	Notional
Heating (kgCO2/m²)	4.73	2.63
Cooling (kgCO2/m²)	1.93	12.86
Auxiliary (kgCO2/m²)	30.02	13.68
Lighting (kgCO2/m²)	17.21	21.76
DHW (kgCO2/m²)	4.98	11.29
Displaced Electricity (kgCO2/m²)	0.00	-2.80
*Equipment (kgCO2/m²) **	*65.99*	*64.34*
Total (kgCO2/m²)	58.86	59.41
Total Floor Area (m²)	350.53	350.53

*Energy used by equipment does not contribute to total value - it is presented here for comparison only

The base case results show that the carbon emissions for the building is 0.85% (0.5 KgCO2/m2) lower than the notional building. The improvements have been achieved by using improved fabric and glazing U values combined with energy efficient LED lighting.

Please refer to section 9.1 Option 1 – Base Case BRUKL

6 LZC Technology Options

6.1 Summary of the Technical Feasibility Assessment of Renewable and LZC Options

A summary of low carbon and renewable technologies have been considered as part of this report is shown in the table below

Technology	Description	Benefits	Issues/Limitation	Consider for site
Solar photovoltaic	Solar photovoltaic systems convert energy from sun into electricity through semiconductor cells.	Low maintenance costs Can be integrated into the building design Modules connected to inverter can convert DC to AC to be used in buildings.	Orientation of the building or roofs and available orientation of south facing roof and façade. Integration into roof, façade, and shading devices. Solar access to the site and potential obstacles such as buildings and trees.	Yes
Solar thermal	Solar water heating systems use the energy from the sun to heat water most commonly for hot eater needs. There are two standard types of collectors used: flat plate and evacuated tube.	Low maintenance costs Can be easily integrated with the existing hot water system	Large surface area required to meet the hot water demands of the building. May require additional gas or electric booster during winter	No
Air Source Heat Pumps	An air source heat pump extracts ambient heat energy in outside air and use this for heating and cooling and to produce domestic hot water.	Heat pumps can provide cooling in summer, as well as heating Heat pump requires less maintenance than a combustion-based heating system	Not suitable for use with conventional radiators. High Capital costs	Yes
Ground Source Heat Pump	Ground source heat pump uses the ground as the source of heat, with the building water circuit as the heat sink.	Seasonal performance of GSHP is better than air source heat pumps Can provide both heating and cooling Less maintenance	High Capital costs A detailed ground survey required to be conducted to determine the geology. Implementation of this system is easier at an early stage so that it can be incorporated with piling foundations.	No
Wind Turbine (Stand-alone)	Building mounted or free-standing wind turbines can be used for onsite electricity generation and any excess power can be stored in batteries or exported to the grid.	Low maintenance costs	Planning issues Roof space requirements and safe distance from other buildings.	No

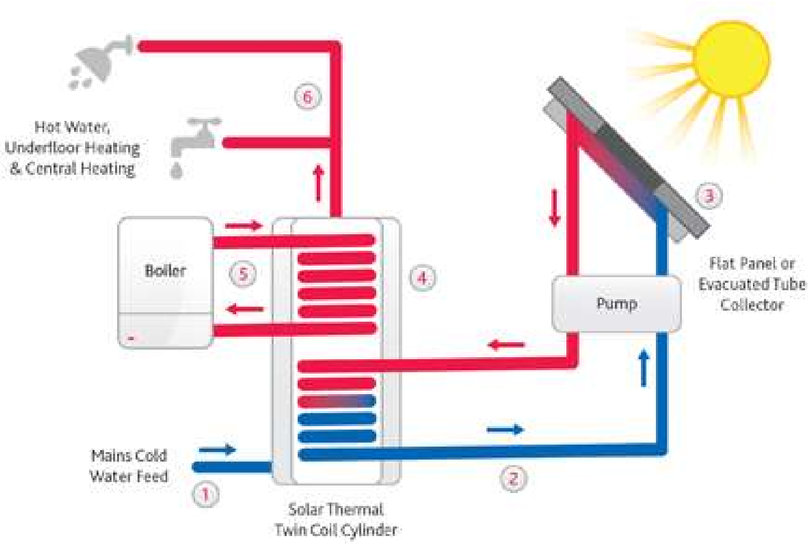
Technology	Description	Benefits	Issues/Limitation	Consider for site
Biomass	Biomass is an alternative solid fuel to conventional fossil fuels and has an impact on carbon emissions that is close to neutral.	Potential to reduce CO_2 emissions	Complex feeding mechanism Significant area required for fuel delivery and storage	No
Gas Fired CHP	CHP is a process involving simultaneous generation of heat and electricity where heat generated from the process is harnessed via heat recovery equipment for heating or cooling.	Can be fuelled by natural gas, biofuels or biomass. Excess electricity can be exported to the grid Can simultaneously meet heating and electricity demands.	High maintenance required Suitable for constant electricity and heating applications. Plant space required	No

6.2 Technical Feasibility of Low Carbon Technology Options

6.2.1 Solar thermal

Solar water heating systems use energy from the sun to heat water to meet hot water needs. The system consists of a heat collector heat collector mounted on the roof or south facing façade in which fuel is heated by the sun. The fluid used to heat water is generally stored in a twin coil hot water cylinder with the second coil providing the top up heating from a conventional boiler. The collectors should ideally be placed on the roof at an angle of 30° from the horizontal facing south-east/south-west orientations.

The two standard types of heat collectors are flat plate and evacuated tube collectors Flat plate collectors are simple in design, robust and cheaper than evacuated tube collectors but require more roof space. Evacuated tube collectors have higher operating temperatures and efficiencies, lower weight and more compact compared to flat plate collectors.



Solar thermal hot water system

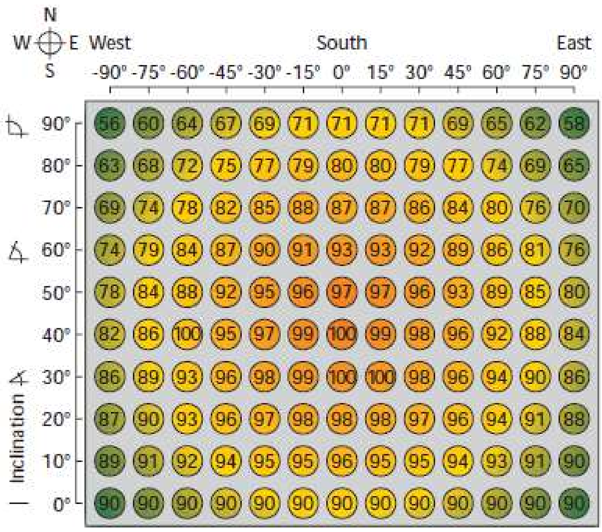
The above figure shows solar hot water system connected as a secondary loop to provide pre heat to solar thermal twin coil cylinder.

NCM assumes large amount of water consumption for restaurants due to Kitchens and public WCs, however in reality the hot water demand in the McDonald's restaurants is found to be considerably less. Due to low hot water demand and higher payback for this type of system, it is therefore not considered viable for this project.

6.2.2 PV Panels

Solar photovoltaic (PV) systems convert energy from sun into electricity through semiconductor cells. This system consists of semiconductor cells and mounted into modules which are connected to an inverter to convert their direct current (DC) in to alternating current (AC).

Power generation from PV cells rely on good access to solar radiation and ideally should face south inclined at an angle of 30º to the horizontal, although orientation of 45º of south are acceptable. Typically, in UK 1kWp polycrystalline system will generate around 750 kWh of electricity a year.



Photovoltaic energy yield relative to inclination and orientation

Photovoltaic technology can be implemented into the building design at an early stage with low maintenance and initial costs. As this LZC report has been carried out at an early stage the installation can be incorporated on the roof of the building if suitable free area is available for the installation. This will be coordinated with the proposed HVAC plant and other services.

Typical PV panel installation

A nominal 40m² of PV panels with a nominal efficiency of 20% was modelled in TAS to assess the reduction in carbon emission. The PV panels can be located on the roof facing south at an angle of 35º. The energy consumption and carbon emission results are shown below kelty.tplp2013

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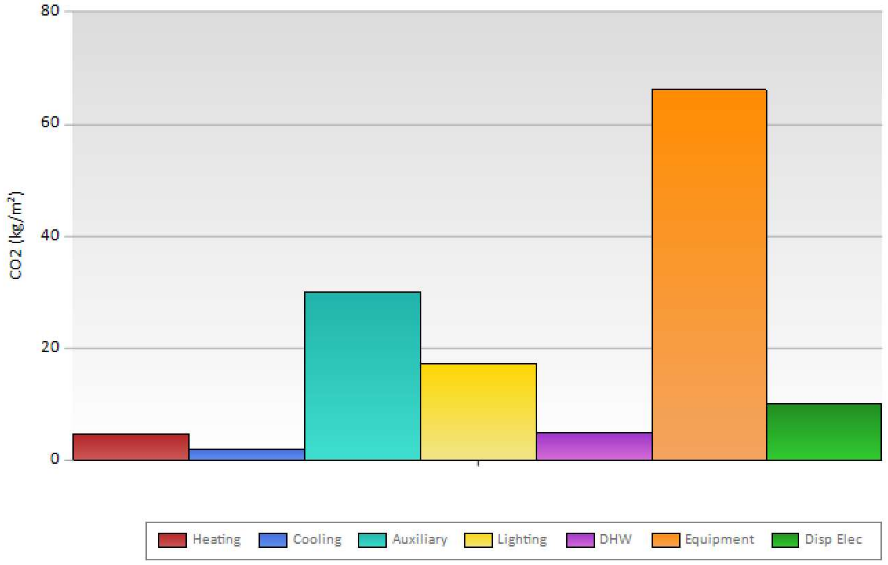
Actual Annual CO2 Emissions



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO_2 (kg/m²)	4.73	1.93	30.02	17.21	4.98	65.99	10.14

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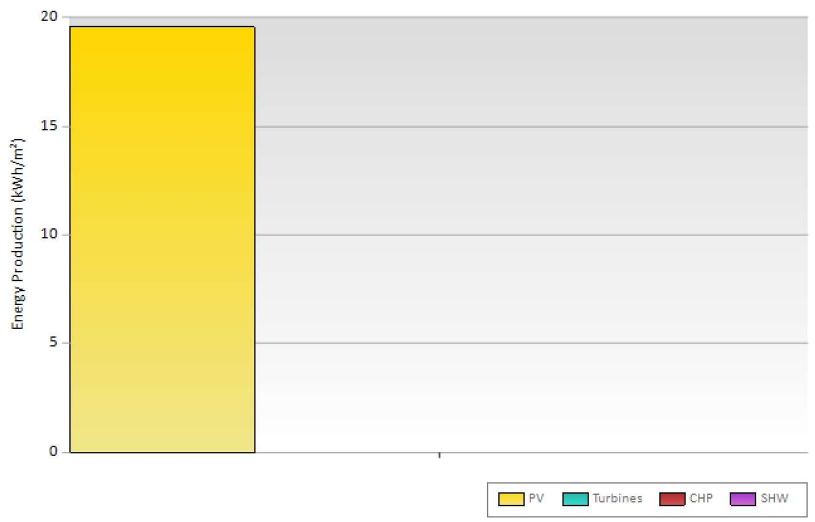
Tas UK Building Regulations Studio

Renewables Breakdown



Photovoltaic Systems (kWh/m²)	19.54
Wind Turbines (kWh/m²)	0.00
CHP Generators (kWh/m²)	0.00
Solar Thermal Systems (kWh/m²)	0.00
Total (kWh/m²)	19.54
Total Floor Area (m²)	350.53

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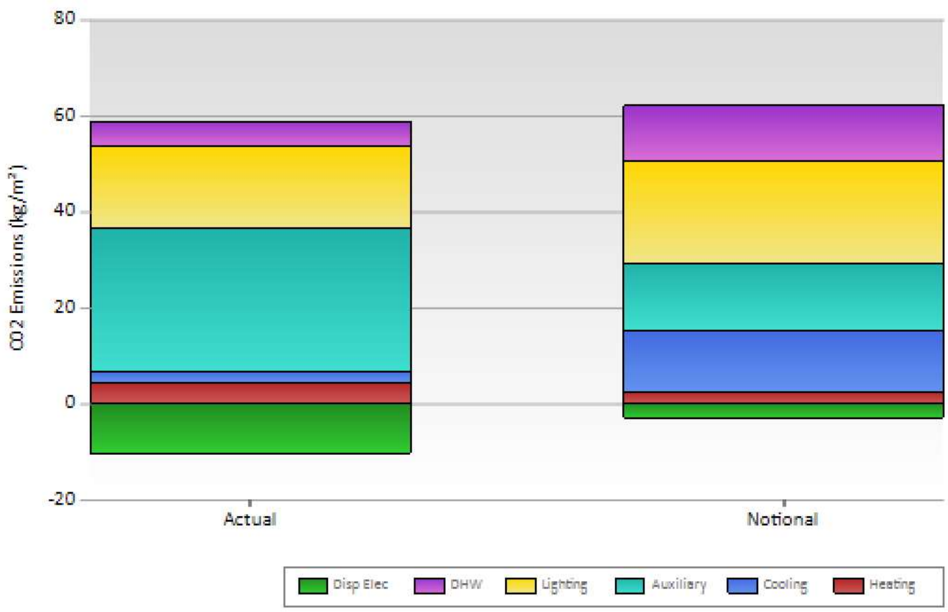
Tas UK Building Regulations Studio

Annual CO2 Emissions Comparison



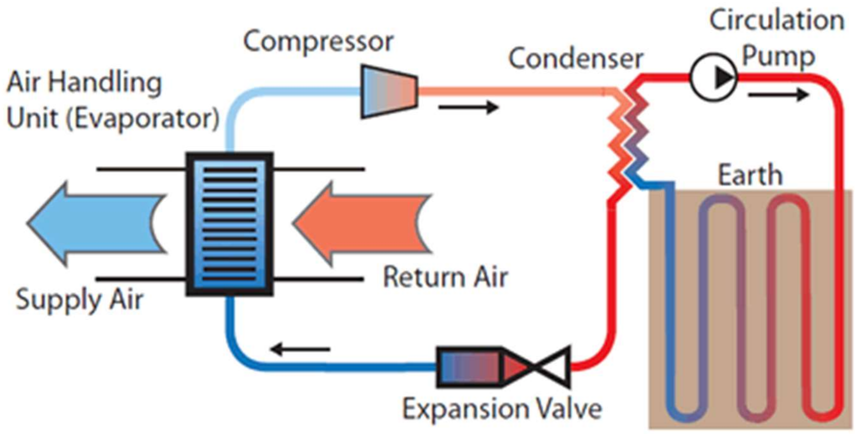
	Actual	*Notional*
Heating (kgCO2/m²)	4.73	2.63
Cooling (kgCO2/m²)	1.93	12.86
Auxiliary (kgCO2/m²)	30.02	13.68
Lighting (kgCO2/m²)	17.21	21.76
DHW (kgCO2/m²)	4.98	11.29
Displaced Electricity (kgCO2/m²)	-10.14	-2.80
*Equipment (kgCO2/m²) **	*65.99*	*64.34*
Total (kgCO2/m²)	48.72	59.41
Total Floor Area (m²)	350.53	350.53

** Energy used by equipment does not contribute to total value - it is presented here for comparison only*

The results indicate that 40m² PV panels can generate 19.54 kWh/m2 of energy which can reduce the carbon emissions by 21.97 % (10.7 KgCO/m2) when combined with Option 1 – Base case.

6.2.3 Ground Source Heat Pump

Ground source heat pump system (GSHP) uses ground as the source of heat, with building water circuit as the sink. In reversible system, in cooling mode the building water circuit is the cooling circuit and the heat source, and ground as heat sink.



Ground Source Heat Pump

The main advantage of ground source heat pump is that beyond a certain depth of ground surface, the temperatures are constant between 10°C - 14°C in the UK. Heat pump performance is better when the source and sink temperatures is lower. The seasonal performance of the ground source heat pump is better than air source heat pump as air temperature is often below 12°C during winter.

Ground source heat pump system can be open and closed loop. The open loop system direct abstraction and use of ground water, typically found in aquifers. Water is abstracted via one or more bore holes and passed through heat exchanger and is returned via a separate borehole, discharged to foul water drainage. With no aquifers in proximity of the site and abstraction licence requirement open loop has been identified as unsuitable.

It should be noted that GHSP's generally deliver water at temperatures of 50°C which is ideal for under floor heating systems which is not used in McDonald's restaurants due to slow thermal response and lack of temperature control. Therefore, GSHP is not considered to be a viable renewable technology for this development.

6.2.4 Wind Turbine

Wind power is one of the most successful and fastest growing renewable energy technologies in the UK with number of individual and group installations of varying size, capacity, and location. Typically, turbines are installed in non-urban areas to harness large offshore wind farms.

Electricity generated at any one time by a wind turbine is largely dependent on the speed of the wind at the site of the turbine. The speed is in turn dependant on various factors such as location within the UK, nearby obstructions, and height of turbine. According to British Wind Energy Association notes that an average speed of 7m/s is required for viable systems and most small wind turbines start to generate electricity in wind speed of 3-4m/s. A professional assessment of the local wind speed needs to be undertaken for a full year at the exact location where turbine is to be installed. In practice, this may be difficult, expensive and time consuming and therefore the client runs the risk of installing an expensive technology that fails to meet the required energy production figures.

Small scale micro-turbines have a diameter of 2m and require mounting a pole which increases the turbine overall height. Wind turbines are usually visible and have implications on planning especially in conservative areas and therefore are likely to raise objections from neighbouring occupants and council.

Noise levels are generated from wind turbines will be required to be assessed in relation to existing and predicted background noise levels for this site. The assessment will need to be carried out both during the day and night to determine noise levels. Despite the maturity of the wind industry there is no official guidance on separation to be maintained between turbine and surrounding development. In view of these issues wind turbines are not considered as a suitable option for this site.

6.2.5 Biomass

Biomass is a solid, liquid or gaseous fuel that is derived from biomass and has been processed on some way into more convenient form, principally to increase energy density. Biomass in the form of wood chips and pellets is often considered as a carbon neutral fuel, as carbon dioxide emitted during the burning process is relatively absorbed by the atmosphere by photosynthesis an no fossil fuel is involved.

Biomass

The current site layout there is no suitable location for fuel store. Any fuel store has to be in close proximity of the boiler. At present this is not feasible due to existing plant room locations. Incorporation of biomass boiler would require redesign of external space around the site and relocation of plant room close to fuel store.

Wood pallet deliveries will be required regular access and designated unloading space which can be problematic due to limited existing car park and drive through space. Further objections from the residents may be experienced due to location of biomass flue within the site which will be more prominent than a gas boiler flue.

Typically, the cost of installing a Biomass boiler is considerably more expensive than an equivalent gas fired boiler as the cost of storage and spatial requirements needs to be considered. The fuel costs are not much lower than gas fuel costs so the payback may not break even over the lifetime of the boiler.
The cost of biomass fuel is not expected to change considerably in the future as transportation and production costs are being aligned to gas and oil prices.
In the view of these issues, we do not consider the biomass boiler plant as a preferred as a low carbon technology.

6.2.6 Combined Heat and Power (CHP)

CHP units burn gas or oil to generate both heat and power and are therefore a much more efficient way of producing energy.

CHP unit

To be economically viable in terms of reducing emissions it is recommended that CHP plant should run a minimum of 4000 hours per year. The proposed development does not have a constant base hot water demand and therefore is not considered viable for this development

6.2.7 District Heating Network

Currently there are no operational or proposed district heating network close to the proposed development as shown in the Scotland heat maps below. Therefore, district heating is not considered viable for this project

7 Summary of Carbon Reductions

The table below shows a summary of calculated carbon emission and % improvement for the options considered viable for the site.

System Options	BER (KgCO2/m2)	TER/notional building (KgCO2/m2)	% Improvement	Consideration for the site
Option 1 – Base Case	58.9	59.4	0.85	Yes
Option 2 – Option 1 +PV Panels	48.7	59.4	21.97	Yes

8 Conclusion

Several LZC technologies have been assessed to reduce the carbon emissions of the building to achieve a minimum carbon reduction of 20% as stated in policy 11 of Fife Low Carbon Fife Supplementary Guidance (Jan 2019). The standard base system described in Base case Option 1, included air source heat pumps as a preferred renewable and low carbon technology to meet the total heating, cooling and DHW demand of the building, reducing overall carbon emissions by 0.85% compared to the notional building. Additionally, improved U values for the fabric combined with energy efficient LED lighting was used to achieve compliance.

Solar thermal panels have been discounted for this project due to insignificant hot water demands in the restaurant.

GSHP produces mid-range temperature of 40-50°C ideally suited to low temperature systems such as under floor systems which are not used in McDonald's Restaurants due to low thermal response and lack of temperature control. Due to the reasons mentioned above and high capital costs and long payback period this low carbon technology has not been considered for this project.

Wind turbine technology has been discarded as it requires to be mounted on the roof at elevated heights with a 2m diameter which can raise objections from neighbourhood and council. Moreover, a professional assessment of the wind speed needs to be conducted at the intended location of wind turbine installation to determine wind speeds as it requires at least 3m/s wind speed to start generating electricity. Therefore, this technology has been found to be unsuitable for this site on a cost to benefit ratio.

Cost of installing a Biomass boiler is considerably more expensive than an equivalent gas fired boiler as the cost of storage and spatial requirements needs to be considered. The fuel costs are not much lower than gas fuel costs so the payback may not break even over the lifetime of the boiler. The cost of biomass fuel is not expected to change considerably in the future as transportation and production costs are being aligned to gas and oil prices. In the view of these issues, we do not consider the biomass boiler plant as a preferred low carbon technology.

A Gas fired CHP unit installation would have high capital cost and additional maintenance costs when compared with other competing technologies. The simple payback period for this technology is 23 years based on the electricity generated by running the system. Excessive capital cost and less annual operating hours of the system due to low hot water demand makes this technology unsuitable for this development.

A PV installation of 40m² would provide an overall carbon reduction of 21.97% when added to the base option 1. This technology is proposed to be implemented as it can be installed on the roof, with relatively limited maintenance and low ongoing costs.

Based on the assessment of all the low and zero carbon technologies, Air source heat pumps are proposed to be used for the development as a preferred renewable and low carbon technology to meet the total heating, cooling and DHW demand of the building, combined with 40m² PV Panels to reduce the overall carbon emissions by 21.97% compared to the notional building. By using the proposed renewable and low carbon technologies, conditions stated in Policy 11 of Low Carbon Fife Supplementary Guidance will be satisfied, where carbon emission reduction of 20% is required for new developments after 2020. BRUKL document attached in Appendix 9.2, shows that the building complies with 2015 regulations and achieves the carbon reduction target.

9 Appendix

9.1 Option 1 – Base Case BRUKL & EPC

TAS Specification Information

Scottish Building Regulations 2015 Section 6 Guidance
Carbon Dioxide Emissions, U-Values, Air Permeability, and HVAC

Project name **Modular and Portable**

McDonalds Restaurant Kelty

Date: Wed Mar 16 07:51:22 2022

Administrative information

Building Details

Address: M90 J4, Kelty, Fife, KY4 0JR

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.2"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.2

Compliance check version: v5.6.b.0

Agent details

Name: Mautasimuddin Mohammed

Telephone number: 07515440169

Address: 49 Dane Road, Ashford, TW15 1QJ

1- Predicted CO2 emission from proposed building

1.1	Calculated CO2 emission rate from notional building	59.4 KgCO2/m2.annum
1.2	Target CO2 Emission Rate (TER)	59.4 KgCO2/m2.annum
1.3	Building CO2 Emission Rate (BER)	58.9 KgCO2/m2.annum
1.4	Are emissions from building less than or equal to the target?	BER =< TER YES

2- The performance of the building fabric and the building services systems

2.1 How do the U-values compare with Section 6 guidance?

The building follows guidance in Scottish Building Regulations 2015

Element	$U_{a\text{-Limit}}$	$U_{a\text{-Calc}}$	$U_{i\text{-Limit}}$	$U_{i\text{-Calc}}$	Surface where this maximum value occurs*
Wall	0.27	0.24	0.7	0.24	External Wall
Floor	0.22	0.22	0.7	0.22	Ground Floor
Roof	0.2	0.18	0.35	0.18	Roof
Windows**, roof windows, and rooflights	2	1.14	3.3	1.16	West Elv Side door Bot
Personnel doors	2	-	3.3	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	1.5	-	No vehicle doors in project

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [W/(m2K)]
$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m2K)]
$U_{i\text{-Limit}}$ = Limiting individual element U-values [W/(m2K)]
$U_{i\text{-Calc}}$ = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface exceeding the limiting standards.
** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Air permeability

Air Permeability	This building's value
m3/(h.m2) at 50 Pa	5

2.3 Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- S1 Kitchen (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7.43	-	1.5	-
Standard value	2.5*	2.6	N/A	1.6^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- S2 Lobby

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7.49	-	0.9	-
Standard value	2.5*	2.6	N/A	1.6^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- Crew (Crew Room)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.59	4.57	-	0.3	-
Standard value	2.5*	2.6	N/A	1.1^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- Office (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	4.57	-	-	-
Standard value	N/A	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

5- Mechanical Vent (7 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	-	-	1.3	-
Standard value	2.5*	N/A	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4	0
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Lobby 1	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 2	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 3	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 4	-	0.9	-	-	-	-	-	-	-	-	N/A
Office 1	-	-	-	-	-	-	-	0.3	-	-	N/A
Crew Room	-	-	-	-	-	-	-	0.3	-	-	N/A
Store	-	-	-	1.3	-	-	-	-	-	-	N/A
Male WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Female WC	-	-	-	1.3	-	-	-	-	-	-	N/A
ACC WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Crew Male WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Crew Female WC	-	-	-	1.3	-	-	-	-	-	-	N/A
WC Lobby	-	-	-	1.3	-	-	-	-	-	-	N/A
Washup	-	-	-	1.5	-	-	-	-	-	-	N/A
Booth1	-	-	-	1.5	-	-	-	-	-	-	N/A
Kitchen 1	-	-	-	1.5	-	-	-	-	-	-	N/A
Lobby 5	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 6	-	0.9	-	-	-	-	-	-	-	-	N/A
Office 2	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Lobby 1	-	100	100	41
Lobby 2	-	100	100	49
Lobby 3	-	100	100	39

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Lobby 4	-	100	100	49
Office 1	90	-	-	115
Crew Room	90	-	-	143
Store	90	-	-	29
Male WC	-	100	-	68
Female WC	-	100	-	37
ACC WC	-	100	-	24
Crew Male WC	-	100	-	22
Crew Female WC	-	100	-	22
WC Lobby	-	100	-	33
BOH Lobby 1	-	90	-	18
Freezer	90	-	-	65
Chiller	90	-	-	79
Washup	-	100	-	52
Booth1	-	100	-	92
Kitchen 1	-	100	-	827
Lobby 5	-	100	100	41
Lobby 6	-	100	100	53
BOH Lobby 2	-	90	-	29
Office 2	90	-	-	38

3- The solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lobby 1	YES (+33%)	NO
Lobby 2	YES (+62%)	NO
Lobby 3	YES (+43%)	NO
Lobby 4	YES (+8%)	NO
Office 1	NO (-63%)	NO
Crew Room	NO (-35%)	NO
Washup	NO (-88%)	NO
Booth1	NO (-81%)	NO
Kitchen 1	NO (-84%)	NO
Lobby 5	YES (+27%)	NO
Lobby 6	YES (+33%)	NO
Office 2	NO (-83%)	NO

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

PARTNERSHIP

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m2]	351	351
External area [m2]	1059	1059
Weather	GLA	GLA
Infiltration [m3/hm2@ 50Pa]	5	3
Average conductance [W/K]	324	327
Average U-value [W/m2K]	0.31	0.31
Alpha value* [%]	0	0

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential schools
	Residential Institutions: Universities and colleges
	Secure Residential Institutions
	Residential spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m2]

	Actual	Notional
Heating	9.11	5.19
Cooling	3.71	25.41
Auxiliary	57.84	27.03
Lighting	33.15	43
Hot water	9.6	22.32
Equipment*	127.15	127.15
TOTAL**	**113.42**	**122.94**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m2]

	Actual	Notional
Photovoltaic systems	0	5.4
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m2]	235.58	377.57
Primary energy* [kWh/m2]	348.19	367.99
Total emissions [kg/m2]	58.9	59.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Single-duct VAV, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	52.7	112	3.3	4.2	73.1	4.5	7.43	4.5	7.43
	Notional	1.1	688.3	0.2	53.1	44.3	1.57	3.6	----	----
[ST] Single-duct VAV, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	354.5	15.4	21.9	0.6	111.8	4.5	7.49	4.5	7.49
	Notional	47	219	8.3	16.9	36.6	1.58	3.6	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	66.4	96.7	4	5.9	1.6	4.59	4.57	4.59	4.57
	Notional	37.5	146.5	6.6	11.3	4.8	1.57	3.6	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1237.6	0	75.2	1.6	0	4.57	0	4.57
	Notional	0	1808.2	0	139.5	4.8	0	3.6	----	----
[ST] Constant volume system (variable fresh air rate), [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	103.2	0	6.4	0	18.4	4.5	0	4.5	0
	Notional	50	0	8.8	0	14.8	1.58	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

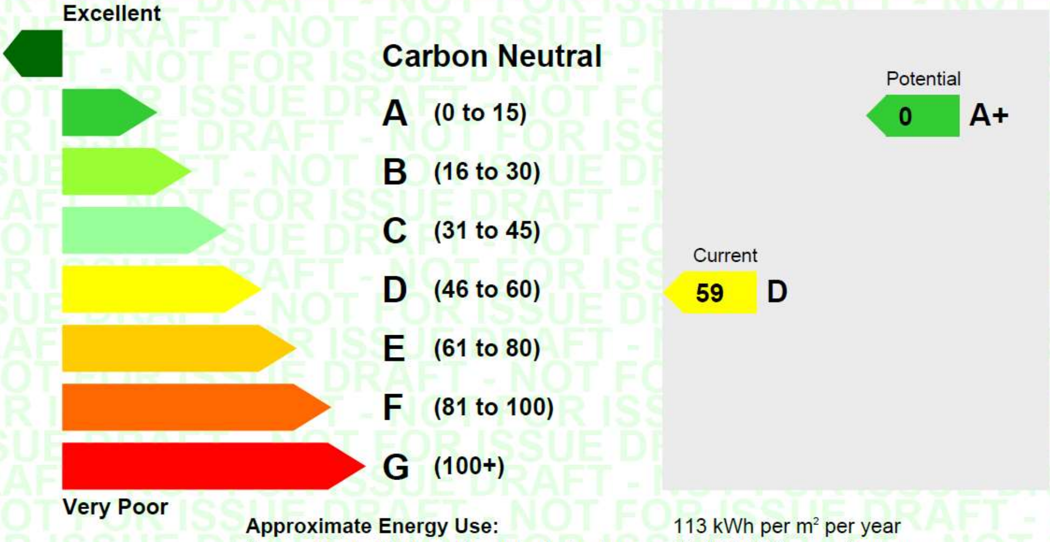
Energy Performance Certificate — Scotland

Non-Domestic buildings and buildings other than dwellings

M90 J4, Kelty, Fife, KY4 0JR

Date of assessment:	15 Mar 2022	**Reference number:**	9421-9577-2630-5308-0203
Date of certificate:	16 Mar 2022	**Building type:**	Restaurant/Cafes/takeaway
Total conditioned area:	351 m²	**Assessment software:**	EPCgen, v5.6.b.0
Primary energy indicator:	348 kWh/m².yr	**Approved organisation:**	

Building Energy Performance Rating



Approximate Energy Use:	113 kWh per m² per year
Approximate Carbon Dioxide Emissions:	58.86 kgCO_2 per m² per year

The building energy performance rating is a measure of the effect of a building on the environment in terms of carbon dioxide (CO2) emissions. The better the rating, the less impact on the environment. The current rating is based upon an assessor's survery of the building. The potential rating shows the effect of undertaking all of the recommended measures listed below. The Recommendations Report which accompanies this certificate explains how this rating is calculated and gives further information on the performance of this building and how to improve it.

Benchmark

A building of this type built to current building regulations at the date of issue of this certificate would have a building energy performance rating of: 59 D

Recommendations for the cost-effective improvement of energy performance

THIS PAGE IS THE ENERGY PERFORMANCE CERTIFICATE WHICH MUST BE AFFIXED TO THE BUILDING AND NOT BE REMOVED UNLESS REPLACED WITH AN UPDATED CERTIFICATE.

9.2 Option 2 – Base Case + PV Panels BRUKL & EPC

TAS Specification Information

Scottish Building Regulations 2015 Section 6 Guidance
Carbon Dioxide Emissions, U-Values, Air Permeability, and HVAC

Project name — Modular and Portable

McDonalds Restaurant Kelty

Date: Wed Mar 16 08:20:19 2022

Administrative information

Building Details

Address: M90 J4, Kelty, Fife, KY4 0JR

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.2"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.2

Compliance check version: v5.6.b.0

Agent details

Name: Mautasimuddin Mohammed

Telephone number: 07515440169

Address: 49 Dane Road, Ashford, TW15 1QJ

1- Predicted CO2 emission from proposed building

1.1	Calculated CO2 emission rate from notional building	59.4 KgCO2/m2.annum
1.2	Target CO2 Emission Rate (TER)	59.4 KgCO2/m2.annum
1.3	Building CO2 Emission Rate (BER)	48.7 KgCO2/m2.annum
1.4	Are emissions from building less than or equal to the target?	BER =< TER YES

2- The performance of the building fabric and the building services systems

2.1 How do the U-values compare with Section 6 guidance?

The building follows guidance in Scottish Building Regulations 2015

Element	$U_{a\text{-Limit}}$	$U_{a\text{-Calc}}$	$U_{i\text{-Limit}}$	$U_{i\text{-Calc}}$	Surface where this maximum value occurs*
Wall	0.27	0.24	0.7	0.24	External Wall
Floor	0.22	0.22	0.7	0.22	Ground Floor
Roof	0.2	0.18	0.35	0.18	Roof
Windows**, roof windows, and rooflights	2	1.14	3.3	1.16	West Elv Side door Bot
Personnel doors	2	-	3.3	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	1.5	-	No vehicle doors in project

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [W/(m2K)]
$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m2K)]
$U_{i\text{-Limit}}$ = Limiting individual element U-values [W/(m2K)]
$U_{i\text{-Calc}}$ = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface exceeding the limiting standards.
** Display windows and similar glazing are not required to meet the standard given in this table.

2.2 Air permeability

Air Permeability	This building's value
m3/(h.m2) at 50 Pa	5

2.3 Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- S1 Kitchen (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7.43	-	1.5	-
Standard value	2.5*	2.6	N/A	1.6^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- S2 Lobby

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7.49	-	0.9	-
Standard value	2.5*	2.6	N/A	1.6^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- Crew (Crew Room)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.59	4.57	-	0.3	-
Standard value	2.5*	2.6	N/A	1.1^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- Office (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	4.57	-	-	-
Standard value	N/A	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

5- Mechanical Vent (7 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	-	-	1.3	-
Standard value	2.5*	N/A	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4	0
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
Lobby 1	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 2	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 3	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 4	-	0.9	-	-	-	-	-	-	-	-	N/A
Office 1	-	-	-	-	-	-	-	0.3	-	-	N/A
Crew Room	-	-	-	-	-	-	-	0.3	-	-	N/A
Store	-	-	-	1.3	-	-	-	-	-	-	N/A
Male WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Female WC	-	-	-	1.3	-	-	-	-	-	-	N/A
ACC WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Crew Male WC	-	-	-	1.3	-	-	-	-	-	-	N/A
Crew Female WC	-	-	-	1.3	-	-	-	-	-	-	N/A
WC Lobby	-	-	-	1.3	-	-	-	-	-	-	N/A
Washup	-	-	-	1.5	-	-	-	-	-	-	N/A
Booth1	-	-	-	1.5	-	-	-	-	-	-	N/A
Kitchen 1	-	-	-	1.5	-	-	-	-	-	-	N/A
Lobby 5	-	0.9	-	-	-	-	-	-	-	-	N/A
Lobby 6	-	0.9	-	-	-	-	-	-	-	-	N/A
Office 2	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Lobby 1	-	100	100	41
Lobby 2	-	100	100	49
Lobby 3	-	100	100	39

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Lobby 4	-	100	100	49
Office 1	90	-	-	115
Crew Room	90	-	-	143
Store	90	-	-	29
Male WC	-	100	-	68
Female WC	-	100	-	37
ACC WC	-	100	-	24
Crew Male WC	-	100	-	22
Crew Female WC	-	100	-	22
WC Lobby	-	100	-	33
BOH Lobby 1	-	90	-	18
Freezer	90	-	-	65
Chiller	90	-	-	79
Washup	-	100	-	52
Booth1	-	100	-	92
Kitchen 1	-	100	-	827
Lobby 5	-	100	100	41
Lobby 6	-	100	100	53
BOH Lobby 2	-	90	-	29
Office 2	90	-	-	38

3- The solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lobby 1	YES (+33%)	NO
Lobby 2	YES (+62%)	NO
Lobby 3	YES (+43%)	NO
Lobby 4	YES (+8%)	NO
Office 1	NO (-63%)	NO
Crew Room	NO (-35%)	NO
Washup	NO (-88%)	NO
Booth1	NO (-81%)	NO
Kitchen 1	NO (-84%)	NO
Lobby 5	YES (+27%)	NO
Lobby 6	YES (+33%)	NO
Office 2	NO (-83%)	NO

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	351	351
External area [m²]	1059	1059
Weather	GLA	GLA
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	324	327
Average U-value [W/m²K]	0.31	0.31
Alpha value* [%]	0	0

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential schools
	Residential Institutions: Universities and colleges
	Secure Residential Institutions
	Residential spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	9.11	5.19
Cooling	3.71	25.41
Auxiliary	57.84	27.03
Lighting	33.15	43
Hot water	9.6	22.32
Equipment*	127.15	127.15
TOTAL**	**113.42**	**122.94**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	19.54	5.4
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	235.58	377.57
Primary energy* [kWh/m²]	348.19	367.99
Total emissions [kg/m²]	48.7	59.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Single-duct VAV, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	52.7	112	3.3	4.2	73.1	4.5	7.43	4.5	7.43
	Notional	1.1	688.3	0.2	53.1	44.3	1.57	3.6	----	----
[ST] Single-duct VAV, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	354.5	15.4	21.9	0.6	111.8	4.5	7.49	4.5	7.49
	Notional	47	219	8.3	16.9	36.6	1.58	3.6	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	66.4	96.7	4	5.9	1.6	4.59	4.57	4.59	4.57
	Notional	37.5	146.5	6.6	11.3	4.8	1.57	3.6	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1237.6	0	75.2	1.6	0	4.57	0	4.57
	Notional	0	1808.2	0	139.5	4.8	0	3.6	----	----
[ST] Constant volume system (variable fresh air rate), [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricit										
	Actual	103.2	0	6.4	0	18.4	4.5	0	4.5	0
	Notional	50	0	8.8	0	14.8	1.58	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Energy Performance Certificate

Non-Domestic buildings and buildings other than dwellings

Scotland

M90 J4, Kelty, Fife, KY4 0JR

Date of assessment:	15 Mar 2022	**Reference number:**	9421-9577-2630-5308-0203
Date of certificate:	16 Mar 2022	**Building type:**	Restaurant/Cafes/takeaway
Total conditioned area:	351 m^2	**Assessment software:**	EPCgen, v5.6.b.0
Primary energy indicator:	348 kWh/m^2.yr	**Approved organisation:**	

Building Energy Performance Rating

Excellent

Carbon Neutral

A (0 to 15)

B (16 to 30)

C (31 to 45)

D (46 to 60)

E (61 to 80)

F (81 to 100)

G (100+)

Very Poor

Potential: **0 A+**

Current: **49 D+**

Approximate Energy Use:	113 kWh per m^2 per year
Approximate Carbon Dioxide Emissions:	48.72 kgCO_2 per m^2 per year

The building energy performance rating is a measure of the effect of a building on the environment in terms of carbon dioxide (CO2) emissions. The better the rating, the less impact on the environment. The current rating is based upon an assessor's survery of the building. The potential rating shows the effect of undertaking all of the recommended measures listed below. The Recommendations Report which accompanies this certificate explains how this rating is calculated and gives further information on the performance of this building and how to improve it.

Benchmark

A building of this type built to current building regulations at the date of issue of this certificate would have a building energy performance rating of: **59 D**

Recommendations for the cost-effective improvement of energy performance

THIS PAGE IS THE ENERGY PERFORMANCE CERTIFICATE WHICH MUST BE AFFIXED TO THE BUILDING AND NOT BE REMOVED UNLESS REPLACED WITH AN UPDATED CERTIFICATE.