MATER MISERICORDIAE UNIVERSITY HOSPITAL
CLIMATE ACTION ROADMAP

Table of Contents

PREFACE

The intention of this report is to define the Mater Misericordiae University Hospital's scope 1 and scope 2 carbon footprint, and develop a pathway to net-zero. This report details the historical and current utility performance, followed by the identification, analysis and high-level design of carbon reduction projects. This report takes into consideration the Gap-to-target published by SEAI. It proposes a logical sequencing of the reduction initiatives and outlines the recommended next steps.

01

Introduction

HISTORY

The Mater Misericordiae University Hospital (the Mater Hospital) is one of the reference hospitals in Dublin's north inner city. Since it was founded in 1852 by the Sisters of Mercy, it has become an important piece of the Irish healthcare system, providing a wide range of frontline and specialist services on a national and regional level.

Over the more than 160 years of history since it opened its doors in 1861, the Mater Hospital has witnessed dramatic diseases such as the cholera and Spanish flu, as well as the most recent COVID-19 pandemic just a few years ago.

The mission and the values of the hospital remain the same as when it was founded: to care for the sick with professionalism and compassion, respect the dignity of human life and promote excellence, quality and accountability through all the activities and personnel.

The Hospital provided treatment to 25,502 inpatients, 250,827 outpatients in the last year, dealing with 100,103 visits to the emergency department. Those high numbers were possible due to the 3,830 employees and the facilities that the hospital owns. The Mater Hospital offers 714 inpatient beds plus another 205 extra beds for day care, and a total number of 14 operating theatres.

The Mater Hospital promotes excellence, quality and accountability across all its activities including sustainability, healthcare, research and education. Being part of the Ireland East Hospital Group (IEHG) and in conjunction with its academic partner, University College Dublin (UCD), the Mater Hospital actively pursues the delivery of world class healthcare standards together with a commitment to the environment and sustainability.

SITE OVERVIEW

After the extension carried out in 2012 that doubled the size of the complex and the last building added in 2022, the Mater Hospital currently comprises 145,500 m2 of total useful floor area. The total energy consumption of electricity, natural gas and diesel from 2009 to 2022 is represented in Figure 1:

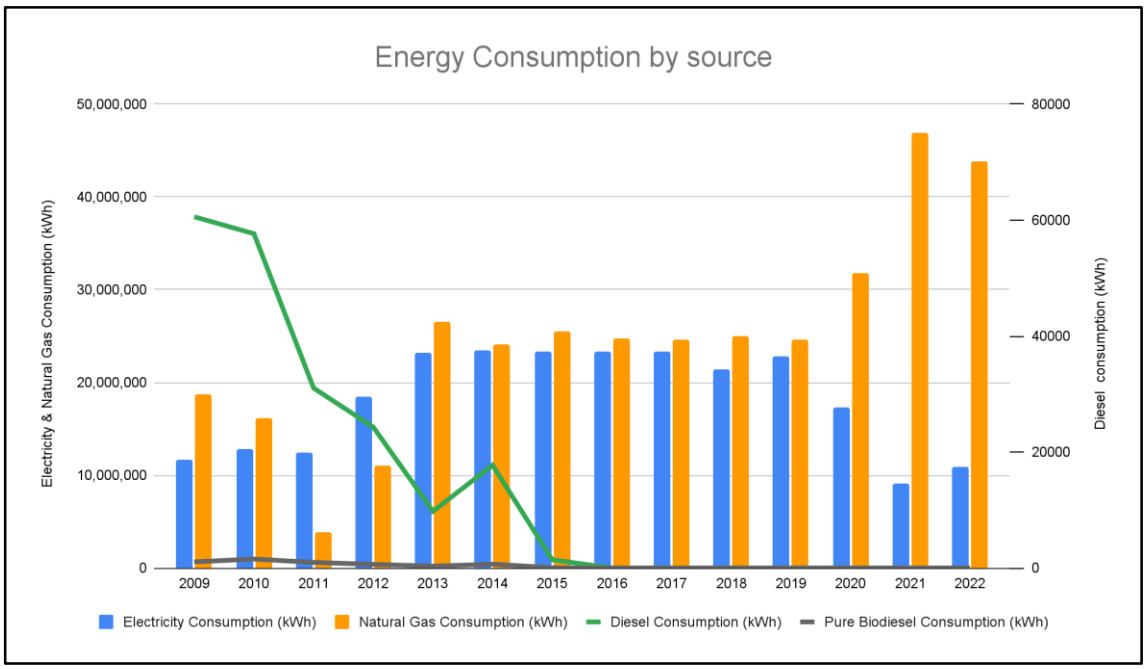

Fig.1: Energy Consumption by source 2009 - 2022

Diesel usage decreased from 2012 onwards, while electricity and gas consumption increased. When the hospital doubled its size in 2012, it relied on more updated technologies, for instance natural gas, in order to cover the basic energy needs in terms of space heating and domestic hot water.

In general terms, the electricity consumption didn't experience a significant variation from 2013 to 2019 although it did in 2020 when the Combined Heat & Power (CHP) engine was installed. The CHP allows the Hospital to generate its own electricity and become less dependent on the electrical grid, at the expense of increasing gas consumption.

LEGAL REQUIREMENTS

The Government's Climate Action Plan 2023 is the second update to the original Climate Action Plan 2019. This annually updated report outlines the energy efficiency and energy related greenhouse gas (GHG) emissions reduction targets for public sector bodies. This annual report along with the Climate Action and Low Carbon Development (Amendment) Bill 2021 is aligned with the European Green Deal. The European Green Deal is the European Union's long-term growth strategy to make Europe climate-neutral by 2050. The two European directives, Energy Performance of Buildings Directive and the Energy Efficiency Directive are reflected in the Climate Action Plan 2023.

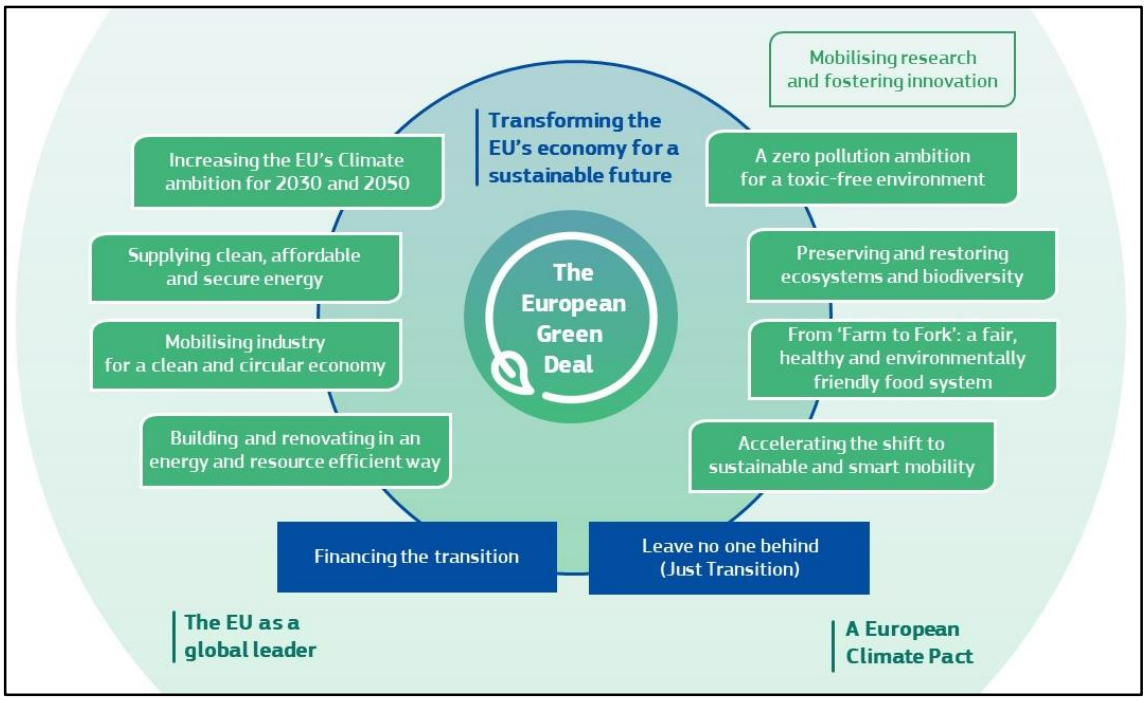

Fig.2: The European Green Deal

This Climate Action Roadmap report communicates how the Mater Hospital meets the requirements of the Climate Action Mandate 2022 ("Mandate") and the Hospital's plan for its 2030 carbon and energy efficiency targets. The requirements of the Mandate include:

- Climate Action and Low Carbon Development (Amendment) Act 2021, which requires all public bodies to perform their functions in a manner consistent with Ireland's climate ambition.

- SI393/2021 Energy Performance of buildings, which requires installation of Building Automation and Control by 2025, for buildings with HVAC rated output over 290kW; requires installation of electric vehicle charging points in car parks for new or refurbished buildings with more than 10 car parking spaces.

- SI381/2021 Clean Vehicles Directive, which sets targets for the procurement of clean light and heavy-duty vehicles, with the first target falling in 2025 and the second in 2030. The definition of clean vehicle changes to zero emission vehicles in 2025.

- SI4/2017 Energy Performance of Buildings, which requires all new public sector buildings built since 2018 to be “nearly zero emissions”.

- SI646/2016, which requires that public bodies procure only energy using products and vehicles that are on the Triple E register.

- SI426/2014, which requires the public sector to demonstrate exemplary energy management and requires public bodies to undertake energy audits every four years.

As per the Mandate the public sector overall target is to reduce GHG by 51% in 2030 compared to the baseline year average of 2016 to 2018. Another target set out by the Mandate is to increase the improvement of energy efficiency from 33% in 2020 to 50% by 2030.

INTERRELATIONSHIPS

This Roadmap will be updated annually and will support delivery of the strategic objective of net zero no later than 2050. It will also form an integral part of and support the strategic objectives of the wider HSE Climate Action and Sustainability Strategy which will include an approach to reducing supply chain carbon emissions and emissions associated with the provision of medical and clinical services.

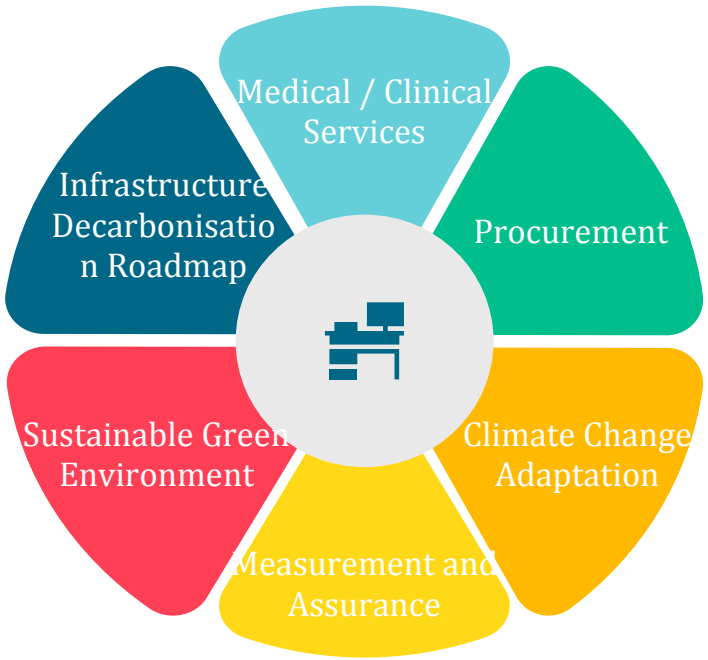

Fig.3: Infrastructure Decarbonisation Roadmap process

This Roadmap builds on existing workstreams progressed by the Sustainable Energy Authority of Ireland (SEAI), outlining next steps and significant deeper actions that will be required. Continuation of this SEAI partnership approach and support will be critical to the Mater Hospital achieving its decarbonisation targets. The Government's Climate Action Plan notes that reducing our Greenhouse gas emissions will require significant public and private capital investment. The Mater Hospital recognises that significant funding will be required to support the actions that are outlined in this Roadmap. During this initial stage, estimated costs are used. However, going forward with the work outlined in this Roadmap, this will provide evidence-based cost reporting.

CARBON EMISSIONS

The Greenhouse Gas Protocol is a widely used standard that sets out how to account for GHG emissions. It categorises emissions into three 'scopes'. The targets set for the Public Sector do not include any non-energy related Scope 3 emissions. It is expected that such emissions may be included in future updates of the Government's Climate Action Plan but they are not currently.

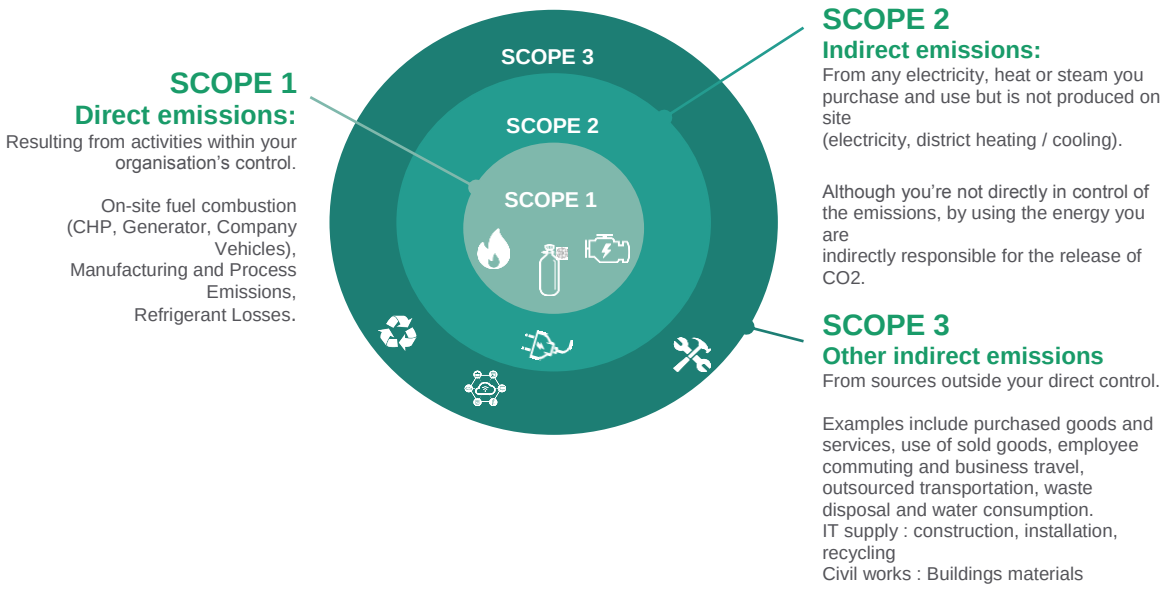

Fig.4: The Greenhouse Gas Protocol

The carbon emission factors are available through SEAI. Future C02 emission factors are developed based on grid fuel/ renewable mix forecasts and the requirement for electricity to be generated from 80% renewable energy as committed to by the Irish Government. The C02 emission factors used for this analysis can be found in the Appendix of this report.

The carbon emission values for electricity and natural gas from 2023 to 2030 are assumptions based on a large number of variables that may change over the years. The electricity carbon emissions especially are sensitive to change due to the wind availability at the time as well as electrical demand.

BASELINE CARBON EMISSIONS

A baseline must be established in terms of carbon impact of the development in addition to analysing the impact of a range of different renewable technologies. The baseline takes into account all electricity and gas meters associated with the Mater Hospital. In total, there are 22 electricity meters and 25 natural gas meters. The full list of MPRN and GPRN meters are outlined in the Appendix., Table 9.

The benchmarking of the baseline will align with the Mandate baseline of 2016 - 2018 average. Table 1 below highlights the baseline average carbon emissions for the period 2016 - 2018. The baseline average carbon emissions for the period 2016-2018 is **14,962,541 kgCO2/Year.**

Table 1: Baseline Carbon Emissions (2016 - 2018)

Year	Natural Gas			Electricity			Total (kgCO2/Year)
	Natural Gas Consumption (kWh)	Carbon Emission Factors (kgCO2/kWh)	Natural Gas Carbon Emissions (kgCO2/Year)	Electricity Consumption (kWh)	Carbon Emission Factors (kgCO2/kWh)	Electricity Carbon Emissions (kgCO2/Year)	
2016	24,778,716	0.2047	5,073,219	23,313,424	0.4845	11,295,004	16,368,223
2017	24,614,732	0.2047	5,039,645	23,327,998	0.4396	10,255,758	15,295,403
2018	25,036,250	0.2047	5,125,947	21,463,956	0.3773	8,098,050	13,223,997
Total							**44,887,623**
Average							**14,962,541**

ENERGY CONSUMPTION

Energy efficiency targets are measured in terms of Total Primary Energy Requirement (TPER). The TPER differs from the Total Final Consumption (TFC) in the fact that it accounts for the energy consumed/lost in generating and distributing electricity, whereas the TFC comes directly from the metres and utility bills.

The use of TPER as an indicator of the energy use of an organisation allows us to consider the inherent value of the types of energy. For instance, electricity has a higher value than fossil fuels as it is necessary to apply several transformations to them in order to generate electricity.

Typically, three times more cost is needed to generate the unit of electricity than the unit of natural gas. In terms of TFC both are counted as 1 kWh while TPER counts electricity as 1.90 kWh and natural gas as 1.1 kWh. For this transformation, Primary Energy Factors (PEF) are applied to TFC in order to get the equivalent TPER.

The Primary Energy Factors for different types of fuels are listed below in Table 2. They represent an approximation of the primary energy used for its transformation. The electricity PEF is calculated considering the primary energy inputs to electrical power generation during a year, so it depends on the efficiency of the electrical generation mix. As it is expected for the electricity system to be more efficient with time, the PEF will decrease over the years. The PEF for electricity for the next ten years are listed in Table 3.

Table 2: Primary Energy Factors for fuels

Fossil Fuel	PE Factor
Liquids: petroleum, biofuel/bioliquid, blended	1.1
Solid: fossil fuels (petroleum coke, coal, peat), biomass (pellets, chips)	1.1
Gas: natural gas (gross and net calorific value)	1.1

Table 3: Primary Energy Factors for Electricity (2020 - 2023)

Year	PE Factor for Electricity
2020	2.1
2021	2.1
2022	2.0
2023	2.0
2024	1.9
2025	1.8
2026	1.7
2027	1.7
2028	1.7
2029	1.6
2030	1.6

Another aspect to consider when discussing the energy performance of an organisation is the activity metrics. The reduction of the TPER does not necessarily imply an improvement in the energy efficiency, as the number itself does not give a complete assessment of how efficient the organisation, for instance the Mater Hospital, uses the energy.

The SEAI defines the activity metrics as a measure of the activity undertaken by the organisation. The Total Useful Floor Area (TUFA) is the metric chosen for tracking the energy performance of the Mater Hospital. This metric is widely used within the public sector and it is aligned with the requirements of the Energy Performance of Buildings Directive from the European Commission.

Once the TPER and the TUFA has been measured, the Energy Performance Indicator (EnPI) can be calculated as the quotient of the two of them. This ratio indicates the performance of energy use and it is the way of measuring the accomplishment of energy efficiency targets.

Thus, there are two approaches that can be taken when implementing new projects to meet the energy efficiency target. On the one hand, the Mater Hospital can focus the strategy on developing projects that reduce the primary energy consumption or, on the other hand, the strategy can be oriented towards extending the floor area covered by a determined amount of primary energy.

ENERGY EFFICIENCY BASELINE

In the same line as for the Carbon Emissions, a baseline must be established for energy efficiency targets. The HSE sets the total primary energy requirement of 2009 as the reference year and energy consumption.

The energy efficiency baseline takes into account the Total Final Consumption of all the meters (electricity and gas) associated with the Hospital as well as the energy consumption of other sources such as transport. Then applying primary energy conversion factors, transforms it into Total Primary Energy Requirement. Table 4 highlights the Energy Efficiency Baseline of the Hospital in terms of TPER:

Table 4: Baseline Energy Efficiency (2009)

Energy Category	Energy Type	Unit	Energy Efficiency Baseline (2009)
Electricity	Net Electricity Imports	kWh	26,975,100
Thermal	Natural Gas	kWh	20,268,816
Transport	Total	kWh	67,797
	Transport Fuels: Road Diesel	kWh	66,633
	Transport Biofuels: Biodiesel	kWh	1,164
Total Primary Energy Requirement (TPER)		kWh	**47,311,713**

02

Approach and Action to Date

LEADERSHIP

The leadership of the Mater Hospital is outlined in Figure 5 below.

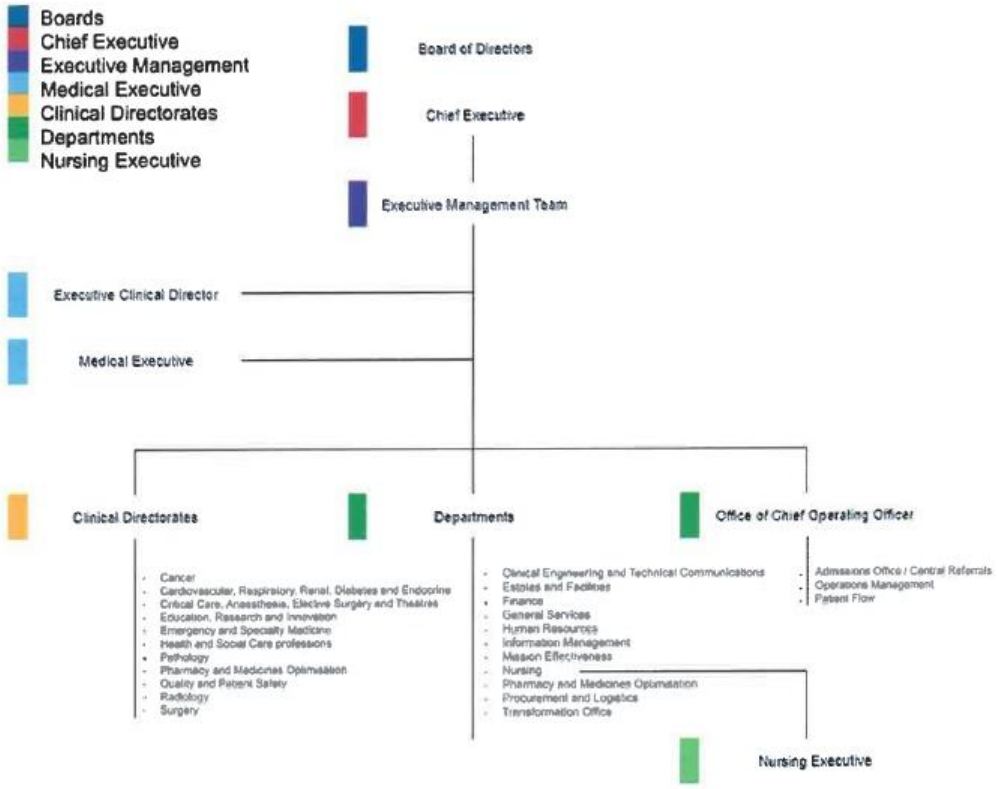

Fig.5: Leadership structure

The energy management team in place is outlined in the table below. The reporting structure is the Director of Estates, Stuart Dunne, reports to the Executive Management Team on a monthly basis.

Stuart Dunne	Director of Estates
Climate Action & Sustainability Manager	Seeking Support from Resourcing Perspective

Current Energy Management System Structure

The current Energy Management System (EnMS)

Metering - Sub metering installed & linked to Hubgrade. The full metering list can be found in the Appendix below.

Utility bills - Collection and reporting of main electricity & gas meter

Reporting - Monthly, Quarterly, Annually

Operations - Monthly operational meetings

CURRENT APPROACH AND ACHIEVEMENTS TO DATE

To date the Mater Hospital has carried out two main energy projects:

1. **Lighting Energy Savings in the year 2010:** this project encompassed electricity savings achieved by changing the lights in the different buildings for a more efficient set. It also included the review of lighting controls, allowing a more efficient way of lighting performance in the Hospital. Once it was fully implemented, it gave a total of 7,779.13 MWh Total Primary Energy Requirement (TPER) savings.

2. **Energy Performance Contract (EPC):** it started in December 2019 and it will extend its guaranteed energy savings for 15 years. This contract encompasses several energy efficiency measures, such as: AC Unit and Doors Replacement, windows and fabric update, CHP and High Efficiency Pumps installation and Building Management System optimization. During the three years that the project has been in operation, it has provided a total of 57,645.59 MWh TPER savings.

With ambitious future perspectives and the desire to meet the target of 2030 and 2050, the current approach of the hospital is now more on looking at a complete decarbonisation of the complex.

In 2015, the Mater Hospital partnered with Veolia and entered an Energy Performance Contract (EPC). The contract is designed to install energy conservation measures to reduce carbon emissions and achieve substantial guaranteed annual cost savings.

The Mater Hospital has an extensive boundary with a large number of services throughout the various buildings. To understand the energy usage across the Hospital better, the largest energy users are focused on.

To date the Mater Hospital has completed:

- BMS Upgrade
- Door Replacement
- AC unit replacement
- CHP installation (more on cost savings than CO2 savings)
- Windows and fabric update
- LED lighting retrofit

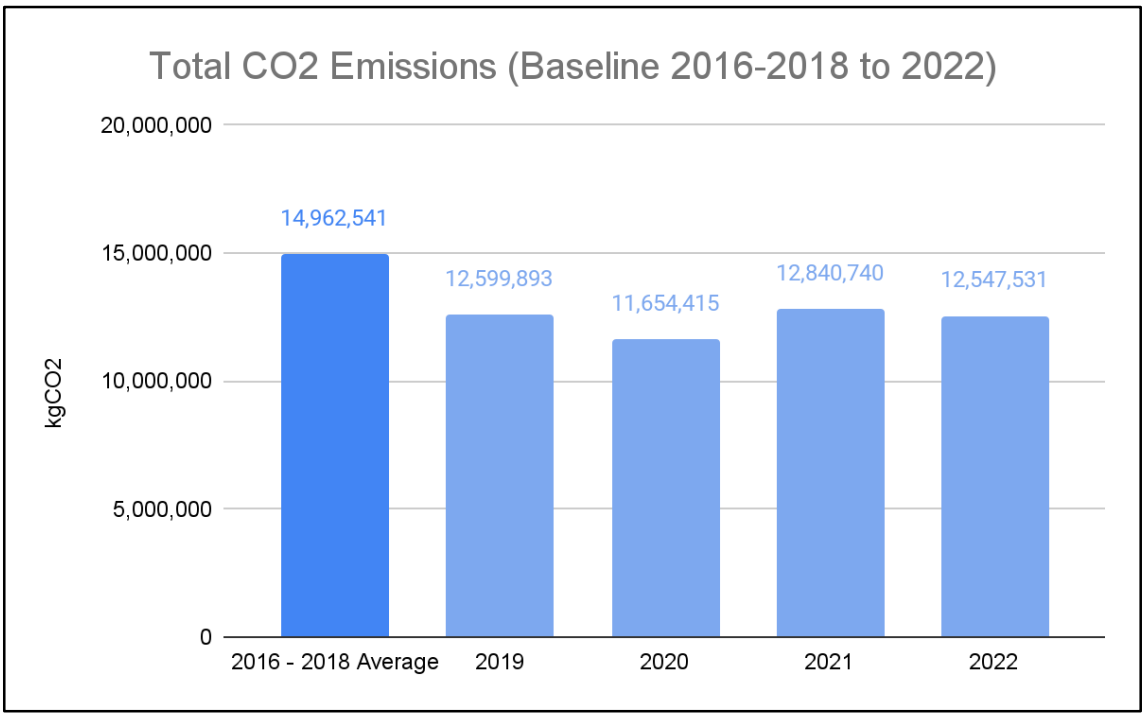

Fig.6: Total CO2 Emissions (Baseline Average - 2022)

At the end of 2022, the Mater Hospital achieved a reduction of **2,415,010 kgCO2** or **16.14%** of the 51% target emissions reduction by 2030 set out in the Climate Action Plan 2022 (against a 2016 - 2018 average baseline).

03

Decarbonisation Plan

TARGETS

The Government's Climate Action Plan 2021 and the Climate Action and Low Carbon Development (Amendment) Bill 2021 is aligned with the European Green Deal, which sets out European Commission policy initiatives with the overarching aim of making the European Union (EU) climate neutral by 2050. Energy policy and directives such as the Energy Performance of Buildings Directive and the Energy Efficiency Directive are being updated under the European Green Deal and will be reflected in the Irish Government's annual updating of the Climate Action Plan.

The Government's Climate Action Plan sets out the energy efficiency and energy related Greenhouse Gas (GHG) emissions reduction targets which Public Sector Bodies in Ireland are legally obliged to meet, and mandates the HSE as a Public Body to develop a Roadmap setting out how it will deliver these targets.

This Decarbonisation Roadmap has been developed by the Mater Hospital in response to this obligation. It outlines the work undertaken by the HSE to date and the Mater Hospital's approach to continuing to reduce carbon emissions from its buildings and operations by reducing energy usage and shifting the HSE's Energy sources from fossil fuels towards renewable and carbon zero energy sources.

Decarbonisation Targets and Scope:

Reduce energy related GHG emissions by 51% by 2030 (against a baseline of 2016-2018 average emissions)

Assist to increase the improvement in energy efficiency in the Public Sector from the 33% target in 2020 to 50% by 2030 (against a 2009 baseline)

A net zero energy related emissions target for 2050

These targets relate to:

Scope 1 Emissions:
Direct energy related emissions from fuel (Oil, Gas, Coal etc.) used by owned buildings, vehicles and equipment (including energy used for heating, catering, and the delivery of clinical services).

AND

Scope 2 Emissions:
Indirect energy related emissions from electricity used by owned buildings, vehicles and equipment.

AND

Energy related emissions from fuel (Oil, Gas, Coal etc.) and electricity used by leased and controlled buildings, vehicles and equipment also.

The target at present does not relate to scope 3 emissions:

Scope 3 Emissions:
Other indirect energy related emissions from sources outside the direct control of the building including business travel, waste disposal and water consumption.

Through the Hospital's annual reviews of this report and consequently the Mater Hospital's Carbon Roadmap and action areas, the inclusion of scope 3 emissions will be reviewed.

GAP TO TARGET - CARBON EMISSIONS

As stated in the previous section, through the Climate Action Plan 2023, the Government requires the public sector to achieve various energy and emission targets by 2030. As part of the Sustainable Energy Authority of Ireland (SEAI)'s new 2030 Monitoring and Reporting (M&R) system, a statutory greenhouse gas (GHG) emissions target must now be met in addition to the pre-existing energy efficiency target. The SEAI has decided to implement this as a 51% reduction in direct GHG emissions from transport and thermal fuels. Indirect GHG emissions related to electricity have been excluded from this target, as they are already expected to fall by at least 77.4% due to the high level of decarbonisation of the national grid supply by 2030.

To summarise, by 2030, every public sector organisation is required to achieve:

- 51% reduction in energy-related greenhouse gas (GHG) emissions
- 51% reduction in thermal (heating and transport) related greenhouse gas emissions

The graph below illustrates MMUH's carbon emission related targets. Details of these targets are below:

2016-2018 Baseline = 14,962,542 kgC02 (5,079,606 kgC02 non-electrical emissions - 9,882,936.1 kgC02 electrical emissions)

Progress to 2022 = 12,547,531.4 kgC02 (8,973,381 kgC02 non-electrical emissions - 3,574,149.9 kgC02 electrical emissions)

Targets:

Total Target Emissions by 2030 = 4,719,809.4 kgC02 (Reduction of 10,242,732.7 kgC02)

Non Electricity Emissions Target by 2030 = 2,489,006.9 kgC02 (Reduction of 2,590,599.1 kgC02)

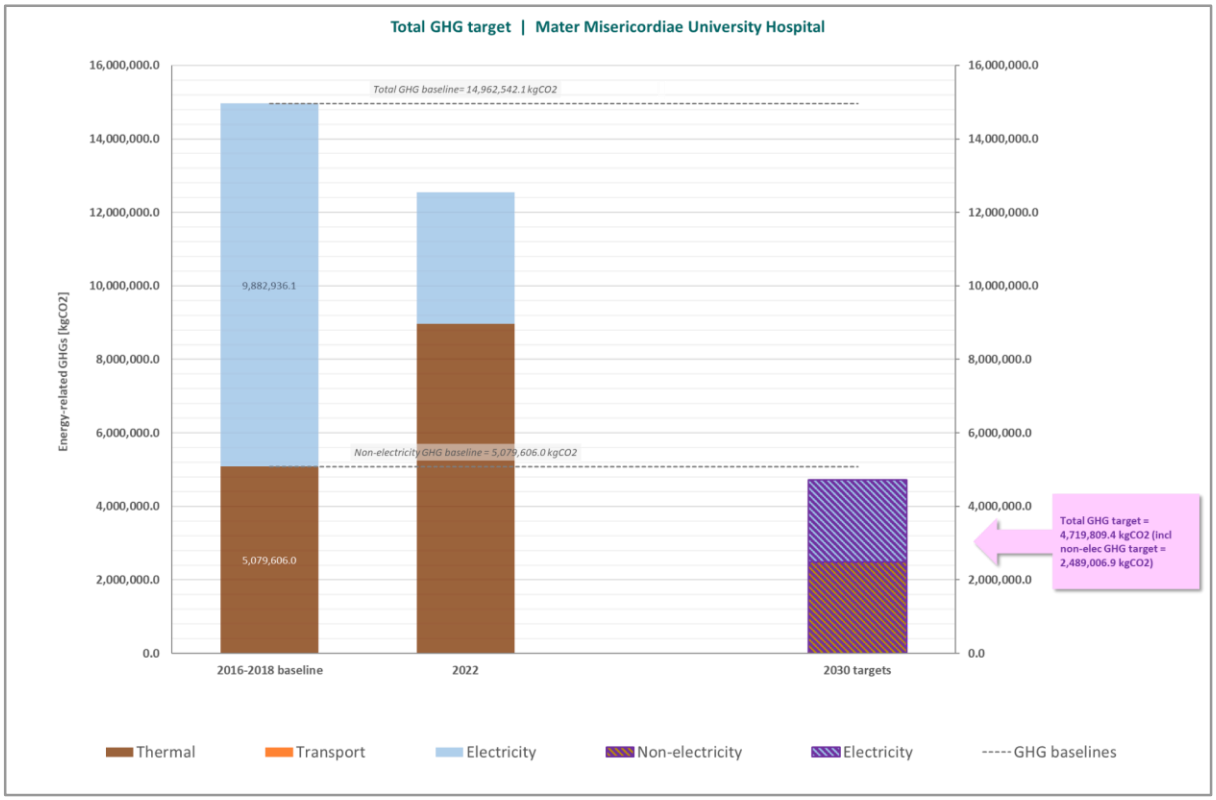

Fig.7: MMUH Total GHG Targets

GAP TO TARGET - ENERGY EFFICIENCY

Along with the new carbon emissions target are the pre-existing energy efficiency targets. This is a requirement to achieve 50% in energy efficiency improvement against the baseline year of 2009.

The graph shown highlights the Mater Hospital's gap-to-target in relation to its energy efficiency targets towards 2030. The targets shown are based on a 50% improvement in energy efficiency. All reductions are expressed in terms of the Hospital's EnPI (kWh Primary Energy/ Total Floor Area) and from the baseline year of 2009 to the most recent reporting year of 2022.

According to the Sustainable Energy Authority of Ireland (SEAI)'s Monitoring and Reporting (M&R) system, the hospital has improved its energy efficiency by almost 29.8%, compared to the baseline year. Therefore, this requires that MMUH achieve a further energy efficiency improvement of 20.2%.

This equates to a reduction of 14,871,544.2 kWh of primary energy between 2022 and 2030.

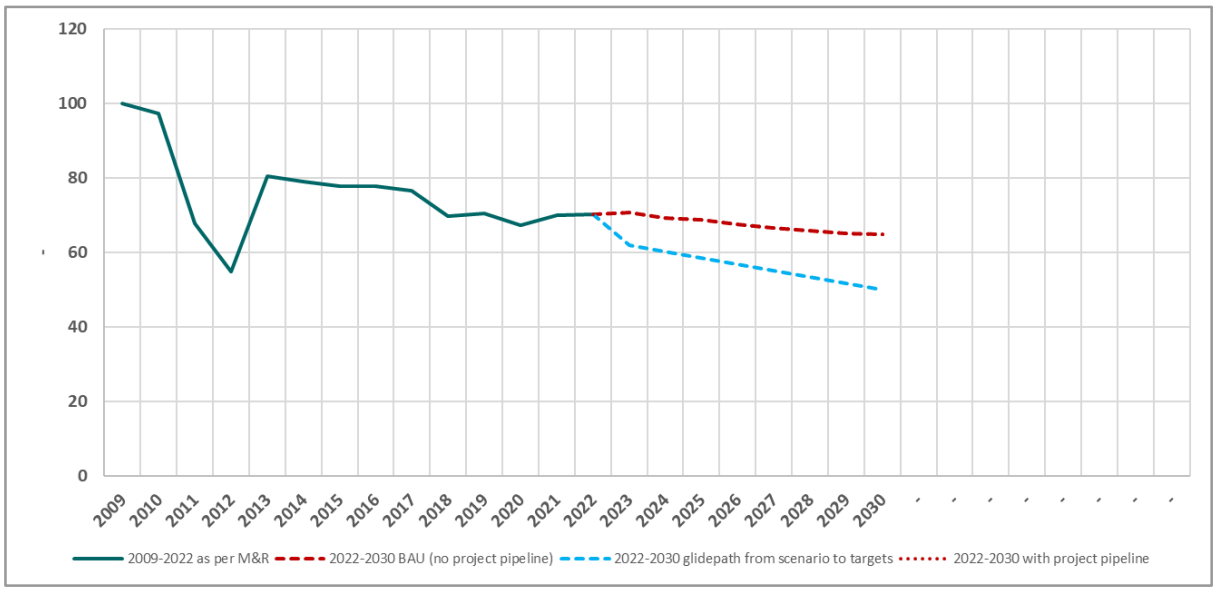

Fig.8: MMUH Energy Efficiency Targets

ACTION PLAN

A number of actions have been identified that target both MMUHs carbon reduction and energy efficiency targets in the Hospital. Subject to funding, these actions focus on the following:

Whitty Lighting Project

A total of 9,335 light fittings are proposed to be replaced throughout the Whitty Building in 2025. The electricity AUP is assumed 0.0971 €/kWh for the annual electricity savings. The estimated annual electricity savings are 1,610,779 kWh. This equates to a total of 467.79 annual tCo2 savings.

Solar PV Installation

The Mater Hospital has an abundance of roof space across the various buildings that is suitable for the installation of solar PV. Based on detailed modelling, it is suitable for 277.16 kWp. This is the optimal installation size with consideration given to shading, roof load-bearing capacity, skylighting and obstructions, and generation yield per panel. This model allows for the installation of approximately 676 x 410 W panels, or 277.16 kWp. The timeframe for the installation is 2024. The estimated annual electricity savings are 226,238 kWh. This equates to a total of 66.97 annual tCo2 savings.

ISO 50001 Certification

A plan for the progression to and achievement of formal accreditation of ISO 5001 Energy Management System. The timeframe for the implementation is 2024. The estimated annual natural gas savings are 5,042,674 kWh and estimated electricity savings of 1,236,638 kWh. This equates to a total of 1,296.92 annual tCo2 savings.

Deep Retrofit of the Misericordiae Building

The total area to be included in the deep retrofit is 26,224 m2. The timeframe for the implementation is 2029. The estimated annual natural gas savings are 818,020 kWh. This equates to a total of 165.98 annual tCo2 savings.

Geothermal Heat Pump Installation

Geothermal Heat Pumps use a refrigeration cycle to absorb heat from the ground and distribute it throughout the heating system within the building. Heat from the sun is stored within the earth's surface throughout the year and it is then captured and upgraded by use of the heat pump. Constant year-round soil temperatures mean that there is a heat source which can be utilised at all times. The timeframe for the implementation is 2027. The estimated annual natural gas savings are 17,520,000 kWh and estimated electricity dissaving of 4,380,000kWh. This equates to a total of 2,628.91 annual tCo2 savings.

Air Source Heat Pump Installation

Air Source Heat Pumps are electrical devices which convert energy from the air outside into useful heat, in the same way a fridge extracts heat from its inside. In well insulated buildings, they are very economical to run. Heat Pumps use a refrigeration cycle to absorb heat. The timeframe for the implementation is 2028. The estimated annual natural gas savings are 12,102,417 kWh and estimated electricity dissaving of 4,034,139 kWh. This equates to a total of 1,577.35 annual tCo2 savings.

Sewage Waste Heat Recovery System

The timeframe for the implementation is 2027. The estimated annual natural gas savings are 600,000 kWh and estimated electricity dissaving of 150,000 kWh. This equates to a total of 1,120 annual tCo2 savings.

Ecological & Biodiversity Actions

The Mater Hospital's Estates team has also drafted a Biodiversity Masterplan & report in partnership with a local Ecologist. The plan has outlined 8 key objectives noted below.

Key Objectives

1. Implement immediate actions to minimise threats to existing biodiversity on the site.
2. Commission a whole site, time-defined and budgeted landscape plan that aims to connect the site across its entire perimeter via planting of species that are native to Ireland.
3. Bearing in mind existing societal and cultural importance attached to certain plant species on the site and within society in general, to include within the green network on campus four key plant species at various locations.
4. Improve nesting potential on the site for song birds and swifts and include drinking/washing points on the campus for birds were appropriate.
5. Adopt and implement actions arising from the All-Ireland Pollinator Plan to support and increase the site's pollinator population.

6. Commission a review of artificial light at night (ALAN) on the campus with the aim of reducing the use of light when and where it is not needed and adopting technologies and fittings to minimise impacts of ALAN on wildlife.
7. Raise awareness and provide educational supports on biodiversity to ground staff/landscape contractors/hospital staff/patients/visitors.
8. Foster collaborations with relevant agencies, organisations, local community and other stakeholders.
9. Ensure the plan is implemented in a timely manner.
10. Set a framework for monitoring biodiversity on the campus to measure improvements over time and revise targets where necessary.

DECARBONISATION MODEL

The Mater Hospital's decarbonisation model has been developed by utilising SEAI's gap to target tool. The gap-to-target model (GTT model) is a spreadsheet model for use by public sector bodies to evaluate their energy efficiency (EE) performance and energy-related greenhouse gas (GHG) emissions over time, using data and methodologies from SEAI's Public Sector Monitoring & Reporting (M&R) system.

Several key calculations, including the target configuration calculations for GHGs and the gap-to-target calculations for EE and GHGs are very sensitive to forecasts for future values of the primary energy conversion factor and the CO2 emission factor for Ireland's electricity system. SEAI prepares forecasts for both these factors, which are refined continually. The forecasts incorporate a large number of variables and assumptions.

All the actions identified in the previous section have been entered into the model to generate the forecast results from their implantation and the resulting contributions to the Mater Hospital's carbon reduction targets.

The graph shown highlights the Mater Hospital's gap-to-target analysis for emission reductions towards 2030. The targets shown are based on a 51% reduction in non-electricity emissions and a reduction in electricity emissions, in line with anticipated supply-side gains from electricity system decarbonisation by 2030, which is equivalent to a 68% reduction in electricity emissions. All reductions are expressed from a 2016-2018 baseline. The modelled forecast takes account of anticipated savings from the highlight actions in the previous section.

Graph Figures Detailed Below:

2016-2018 Baseline = 14,962,542 kgC02 (5,079,606 kgC02 non-electrical emissions - 9,882,936.1 kgC02 electrical emissions)

2022 = 12,547,531.4 kgC02 (8,973,381 kgC02 non-electrical emissions - 3,574,149.9 kgC02 electrical emissions)

Targets:

Total Target Emissions = 4,719,809.4 kgC02

Non Electricity Emissions Target = 2,489,006.9 kgC02

Modelled Scenario = 3,178,682.6 kgC02 (1,822,231.5 kgC02 non-electrical emissions - 1,356,451.2 kgC02 electrical emissions)

The highlighted action areas will result in savings of 11,783,859.4 kgC02.

This results in a reduction of 75% in the total emission reduction target. This is broken down to a 62% reduction in the electricity emissions targets and an 80% reduction in the non-electricity emissions targets.

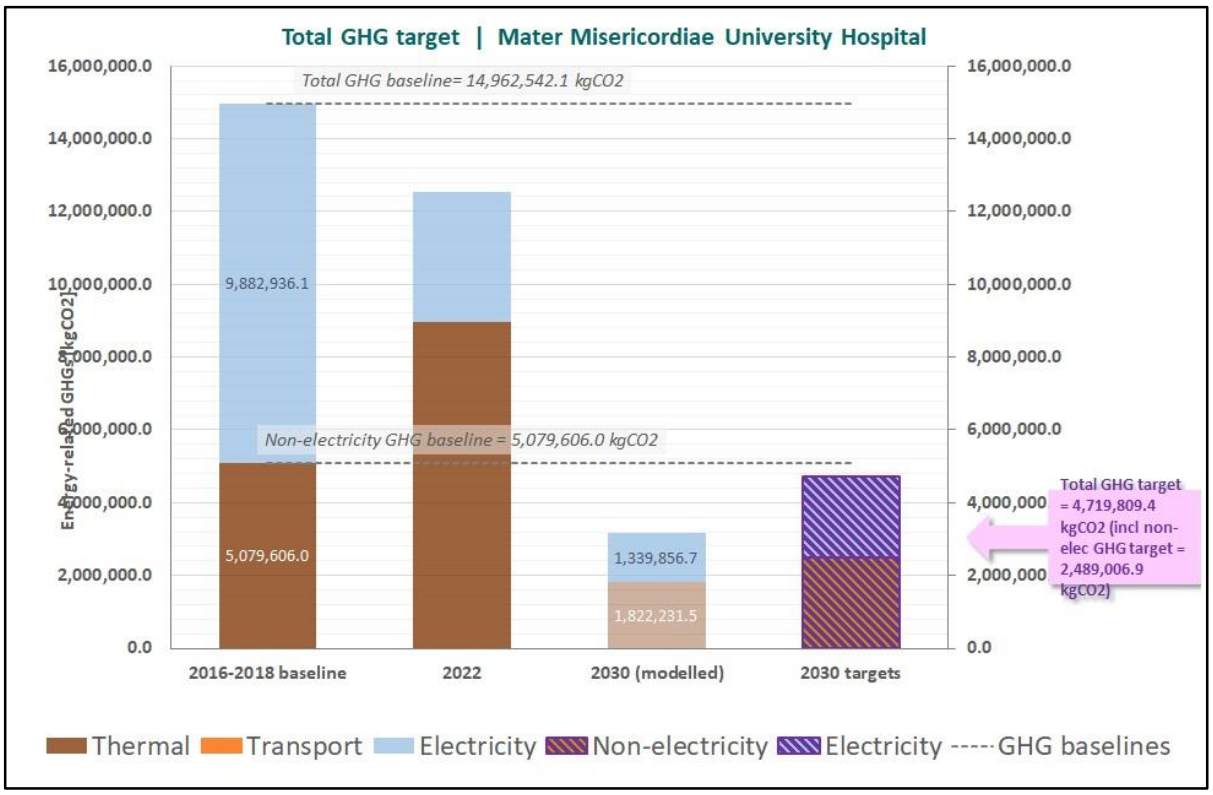

Fig.9: Total GHG Target for 2030

The below graph illustrates the modelled 2030 total emissions targets broken down by the contributions from the different action areas.

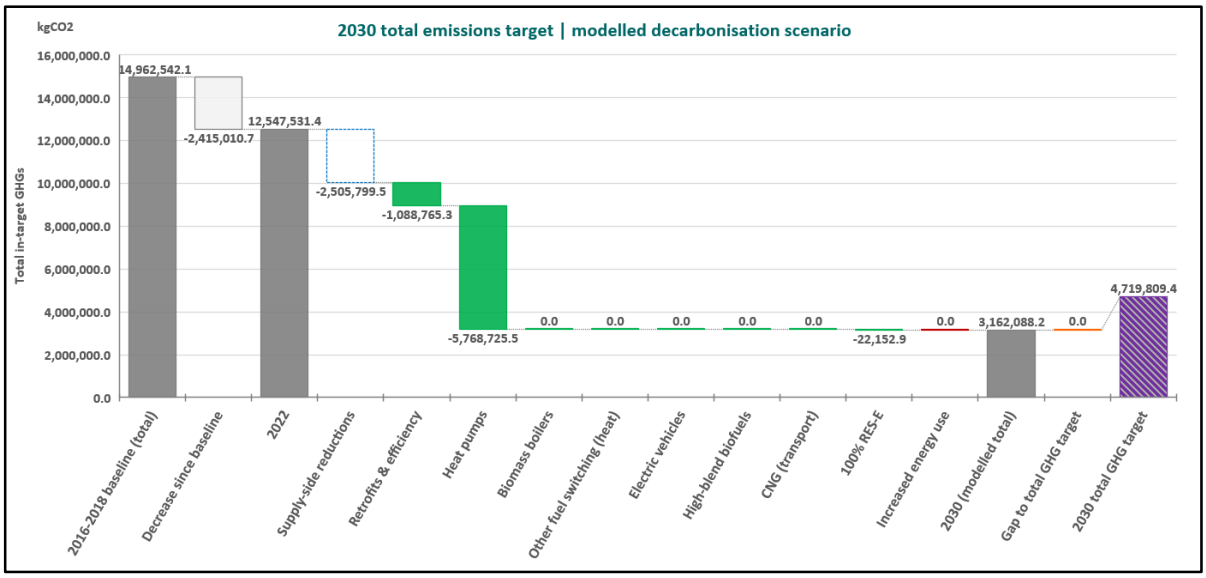

Fig.10: 2030 total emissions target

The graph below illustrates the results of the GTT in relation to the Mater Hospital's energy efficiency targets. The listed action areas, when implemented, will result in 67.5% in energy efficiency savings to enable the Mater Hospital to achieve its energy efficiency obligations by 2030.

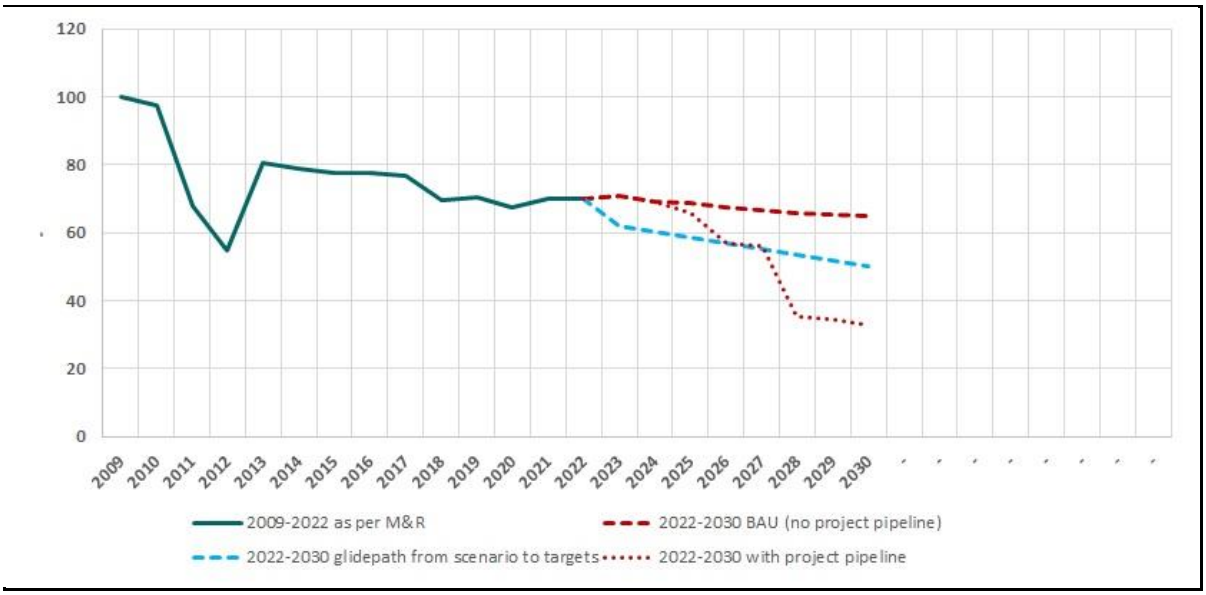

Fig.11: GTT from current year (2022) to 2030 highlighting the different scenarios

04

Roadmap Action Areas

ACTION AREAS

The tables below highlight the action areas for the Mater Hospital. Table 5 outlines the list of projects, subject to ongoing funding, that have been identified along with a description, the status of each project as well as the possible timeframe to implement each project.

Table 5: Action areas outlined along with the status and timeframe

No	Action	Description	Status	Timeframe
1	Solar PV	277.16 kWp solar PV installation	Report Complete	2024
2	Whitty building lighting upgrade	LED Upgrade on 9,335 light fittings	Report Complete	2025
3	ISO 50001	Implement ISO 50001	Under Investigation	2024
4	Deep Retrofit Misericordiae Building	Total area of 26,224m2	Under Investigation	2029
5	Geothermal Heat Pump	Installation of ground source heat pump	Under Investigation	2027
6	Air Source Heat Pump	Installation of air source heat pump	Under Investigation	2028
7	Sewage Waste Heat Recovery System	Implement heat recovery	Under Investigation	2027
8	Carbon offset with ecological actions	Ecological & biodiversity target	Identified	2025

Table 6 highlights the estimated annual carbon savings associated with each identified project.

Table 6: Action areas outlined along with the estimated annual carbon savings

No	Action	Fuel Type	kWhe	kWht	tCO2
		Totals:	**-5,490,484**	**36,083,111**	**7,332.92**
1	Solar PV	Electricity	226,238	0	66.97
2	Whitty building lighting upgrade	Electricity	1,610,779	0	476.79
3	ISO 50001	Other	1,236,638	5,042,674	1,296.92
4	Deep Retrofit Misericordiae Building	Other	0	818,020	165.98
5	Geothermal Heat Pump	Other	-4,380,000	17,520,000	2,628.91
6	Air Source Heat Pump	Other	-4,034,139	12,102,417	1,577.35
7	Sewage Waste Heat Recovery System	Other	-150,000	600,000	1,120
8	Carbon offset with ecological actions	Other	TBC	TBC	TBC

05 Conclusion

The Mater Hospital has identified seven action areas (projects). Progression of these projects provides a roadmap for the Mater Hospital to achieve the targets set out in the Climate Action Plan.

The Roadmap builds on the approach to date to reduce the Mater Hospital's existing energy usage load and shifts the Mater Hospital's use of energy away from fossil fuels and towards renewable and carbon zero energy sources.

The Roadmap will be updated annually and will be directed, coordinated and informed by the implementation of the Mater Hospital and it will support delivery of the strategic objective to develop the Mater Hospital to reach net zero no later than 2050. Going forward there will be yearly progress reports updating the progress on the action areas as well as updating the Gap-to-Target.

APPENDIX

Table 7: Electricity carbon emission factors 2009 - 2030

Electricity Carbon Emission Factors			
Year	Carbon Emission Factors (kgCO2/kWh)	Year	Carbon Emission Factors (kgCO2/kWh)
2009	0.5553	2020	0.2977
2010	0.5584	2021	0.3570
2011	0.5177	2022	0.3276
2012	0.5542	2023	0.3144
2013	0.5202	2024	0.2556
2014	0.5087	2025	0.2388
2015	0.4911	2026	0.1912
2016	0.4845	2027	0.1591
2017	0.4396	2028	0.1341
2018	0.3773	2029	0.1122
2019	0.3322	2030	0.0979

Table 8: Natural gas carbon emission factors 2009 - 2030

Natural Gas Carbon Emission Factors			
Year	Carbon Emission Factors (kgCO2/kWh)	Year	Carbon Emission Factors (kgCO2/kWh)
2009	0.2047	2020	0.2047
2010	0.2047	2021	0.2047
2011	0.2047	2022	0.2047
2012	0.2047	2023	0.2047
2013	0.2047	2024	0.2047
2014	0.2047	2025	0.2047
2015	0.2047	2026	0.2047
2016	0.2047	2027	0.2047
2017	0.2047	2028	0.2047
2018	0.2047	2029	0.2047
2019	0.2047	2030	0.2047

Table 9: List of 22 electricity meters associated with the Mater Hospital

MPRN	Location
	Mater Old Hospital
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Mater Accounts payable, Eccles street
	Mater Hospital, St. Vincent Street North
	Mater Hospital, St. Vincent Street North
	Mater Hospital, North Circular Road
	Mater Hospital, Leo Street
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Eccles Street
	Eccles Street
	Mater Hospital, St. Joseph's Parade
	Mater Hospital, Eccles Street
	Mater Accounts payable Plaza, Swords
	Mater Hospital, Nelson Street
	Mater Technical Services Department, James Joyce Street
	Mater Hospital Family Therapy Clinic, James Joyce Street
	Mater Public Hospital, James Joyce Street
	Mater Hospital Whitty Building

Table 10: List of 25 natural gas meters associated with the Mater Hospital

GPRN	Location
	Mater Hospital, Centre for Nurses Education, Eccles Street
	Mater Hospital Hostel
	Mater Misericordiae University, Mortuary OPD, North Circular Rd.
	Mater Hospital, Eccles Street.
	Mater Hospital, Metropolitan Building, James Joyce Street
	Mater Public Hospital, Misericordiae Main Entrance, Eccles Street
	Mater University Hospital, Eccles Street, Phase 1A Entrance
	Mater Misericordiae Technical Services Department, North Circular Road
	Mater Hospital, Accounts Payable, Eccles Street
	Berkley Street, Phibsborough, Dublin 7
	Mater Hospital, Eccles Street
	Mater, Old A&E, NCR Eccles Street
	Mater Hospital, Eccles Street
	Mater Misericordiae Hospital St Vincents Street
	Mater Hospital, Eccles Street
	Mater Hospital CSSD Unit, Eccles Street
	Mater Hospital, OPD North Circular Road
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Mater Hospital, Eccles Street
	Mater University Hospital, Eccles Street
	Mater Hospital, Vincent Street House, Eccles Street
	Mater Hospital, Eccles Street
	Dorset Street
	Mater Misericordiae Hospital, Creditors Department, Eccles Street