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**Nottingham Trent University**

BUSI48907: Consultancy Experience Project

Consultancy Final Project Report for CPMG

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**Team Name**: NZ

**SUPERVISOR NAME:** Matthew Willett

**Team Number**: 62

**Team Members:**

AMSHU CHAITRA RAMESH - N0931733

DEEKSHA DEEPAK - N0912331

DUC THANG BUI – N0978564

KIRAN KUMAR REDDY KASU N1051933

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# EXECUTIVE SUMMARY

This consultancy report incorporates the secondary research for CPMG to build a framework for achieving NetZero by 2040. A wide range of strategies are analysed as part of the research and the report is focused on reducing the carbon footprint for CPMG in shorter periods considering key contributors ( Transport and Work from Home ).

Since 1997, Nottingham-based CPMG Architects has been designing award-winning buildings. Their head office is located in Nottingham, with satellite offices in London and Birmingham, and China. As part of the journey towards NetZero, the company has achieved carbon neutrality and now heading towards the set target. In this process, a consultancy report is prepared with recommendations for reducing carbon footprint considering the key contributors as per the data from CPMG and the NTU sustainability report for CPMG, identifying key performance indicators and monitoring the KPIs with help of IoT/AI (smart buildings) to achieve the set target.

Key Recommendations:

1. Generation of renewable energy on-site (Solar, Geothermal heat pumps and Air heat pumps)
2. Adopting energy-efficient mechanisms in CPMG’s office building
3. Usage of cloud services and sustainable data centres for data storage
4. Work from Home strategies
5. Strong HR policies to be implemented by adopting Green Human Resource Management practice.

* Business travel
* The sustainable approach in infrastructure building
* Adopting lean culture
* Awareness program’s

Key Performance Indicators:

1. Renewable energy produced on-site
2. Energy efficiency
3. Effective implementation of HR policies for Transport and Work from Home

Monitoring, Control and Review:

Adopting smart technologies like IoT and Artificial intelligence for collecting the data, controlling the emissions and systematic review of the reliable data and adopting Green Human Resource Management practice for inducing lean culture across the organisation. Also, helps in transforming sustainable practices into policies for achieving the target set by the organisation with a major concentration on the working from home policies and transport policies.

# 1. INTRODUCTION

This report focuses on CPMG wanting to create a formal plan to reach net zero carbon emissions per the SME Climate hub and UN race to zero framework.

CPMG, an award-winning architecture practice, achieved carbon neutrality in 2017 and has set a target of reaching net zero by 2040. To be more elaborate Net zero refers to the condition in which human-caused greenhouse gas emissions are essentially neutral. It is sometimes used interchangeably with the phrases "carbon neutrality" and "climate neutrality," although the scientific meanings of these terms differ. (Aiming for zero: a growing business movement, n.d.). When the whole cost of carbon emissions is included, many of these solutions are already cost-competitive; all that remains is to accelerate their adoption. Energy decarbonisation, electrification of road transport, and building renovation to the best 'net zero carbon ' standard are all critical elements.

Effective approaches for zero direct emissions are now available in most business sectors. Also, since the building industry now contributes to 40% of UK greenhouse gas emissions, there is an enormous opportunity for the construction industry to contribute to a greener, healthier, and more sustainable future (Zero, 2020).

The UK government has pledged to reach net zero carbon emissions by 2050. To minimise carbon emissions, the company has already developed several procedures and undertaken a few steps. CPMG has adapted to renewable energy, zero gas in the workplace, third-party data storage, and ventilation measures in their new office facility in Nottingham. Net Zero is based on three scopes, the first two of which are connected to direct emissions and the third to indirect emissions.

### 1.1 AIMS AND OBJECTIVE

This report aims to prepare a framework that will guide CPMG to keep track of carbon reductions and attain NetZero within 2040. It also aims to create transparency by being considerable to communicate with staff, suppliers, and customers.

OBJECTIVE

* Finding the key contributors to target and what is needed to implement.
* Estimating the time required to get net zero.
* What financing, return on investment, and influence over the larger supply chain and client base are available.
* Recommendations and conclusions required to reach net zero by 2040.

# 2. RESEARCH METHODOLOGY

Secondary research includes understanding and locating data resources connected to the prior research challenge, as well as retrieving data that is beneficial to current research problems. This comprises officially statistical data, administrative records, and other accounts maintained regularly by the organisation. (Hox and Boeije 2005).

Secondary data can be divided into two, internal secondary data research and external secondary data research. In this report the team chose to use both secondary research data types, that is using company information as well as, government statistics on carbon emissions, various scholarly articles, journals, news, and other successful company strategies that have been implemented to attain net zero and statistical databases to come up with the recommendations suggested. The report also uses descriptive and predictive methods for analysing existing data and carbon emissions to reach appropriate conclusions. (Qualtrics, 2021)

### 2.1 CURRENT DATA ANALYSIS

**Indirect emissions**

-Emissions come from sources that not directly under an organizations control but a related with its activity.

Direct emissions

**Indirect emissions**

-Electricity usage in the site.

Purchased and supplied

### 2.2 Descriptive analysis

Based on Figure 1, 2018 had the highest total carbon emissions with 115.25 tCO2e. 2017 was the second highest total carbon emissions with 111.38 tCO2e. Then the total carbon emissions have started to decrease since 2019 because of the pandemic with 74.10 tCO2e in 2020 and 46.01 tCO2e in 2021. After the pandemic, 2022 experienced only 27.74 tCO2e which is lower than the pre-covid periods. Because since 2021, CPMG moved the office to another building and eliminated the gas. Moreover, they also applied the hybrid working with 3 days office and 2 days home. These policies also contributed to the decrease in total carbon emissions (not including working from home).

Figure 1:Total Carbon Emissions (CPMG’s data)

Based on Figure 2, the major contributors to carbon emissions before the pandemic were gas, electricity, and business travel. Then after the pandemic, the major contributors were electricity, business travel and working from home. CPMG stopped using gas when they moved to the new office and installed their building fully electric systems which included electric heating and cooling. This explained the increase in percentage emissions of electricity. The business also decreased because of the restriction on transportation, especially aeroplanes. Therefore, CPMG could not fly to China, one of their offices, for business purposes. Furthermore, because of the hybrid working, the carbon emissions from working from home increased dramatically from 2% to 41%.

Figure 2:Carbon emissions of some major factors (NTU’s report)

Table 1 Carbon emissions of some major factors (NTU’s report)

|  |  |
| --- | --- |
| **2021-2022 Gross Carbon Emissions** | |
| **Category** | **Emission (tCO2e)** |
| Electricity | 16.3 |
| Transport | 21.81 |
| Water and wastewater | 0.03 |
| Waste | 0.02 |
| Refrigerants | 1.59 |
| Working from Home | 28.6 |
| Material Use (Paper) | 0.17 |
| Third-Party Data Servers | 1.42 |
| **Total Gross Emissions** | **69.94** |

### 2.3 Predictive Analysis:

By strengthening the strategic position, raising the financial performance, maximising the use of equipment and assets, and many other ways, forecasting improves corporate performance (Toor and Dhir, 2011). From the CPMG’s data, the forecasting for the total carbon emissions and some major factors was constructed to support the company's preparation for the future.

According to figures 3 and 4, the carbon emissions tend to reach zero in 2026, except for transportation which will be remained steadily around 9-10 tCO2e per year. However, the forecast below is just a reference and they are not correct. Because Covid-19 since 2019 caused a major decrease in carbon emissions in every factor, this led to a disruption in the data which explains an unreasonable decrease in the carbon emissions for the next 5 years. However, not every forecast is incorrect. The forecast for gas and transportation is still reasonable because CPMG has eliminated the gas in the building so it will remain zero unless there is a major change in their strategy. Furthermore, stable emissions of transportation explain a hybrid working policy used by CPMG which allows the employees to work two days at home and only three days at the office.

Although working from home also contributed 41% of carbon emissions (Figure 2), it is difficult to create a forecast for this factor because of the lack of data during the research. However, with the hybrid policy, the consultants predict that the carbon emissions from working from home will be increased in the next 3-4 years.

Figure 3: Total Carbon Emissions Forecast for the next 6 years

Figure 4: Carbon Emissions for Electricity, Gas, and Transportation for the next 5 years

STRATEGY FOR CPMG

Diagram

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# 3. RECOMMENDATIONS

### 3.1 Draft Proofing

Heating, ventilation, and air conditioning account for up to 60% of total energy usage, thus it is critical to control the temperature within the workplace as well as while working from home (Hughes, 2014), By insulating the loft and walls, we can ensure that the temperature remains stable both in summer and winter, resulting in reduced energy use, a lower carbon footprint, and lower costs.

#### 

### 3.2 Switch to renewables

We can now discover energy suppliers that provide greener tariffs, or we can lower our scope 1, 2, and 3 emissions by switching to these resources, or we can install solar panels, geothermal energy, or wind energy. The UK government is offering incentives to deploy these low-maintenance renewable resources. Renewables produce more energy than they consume and emit fewer emissions than other power sources during their lifespan. Over their lifespan, renewable energy sources generally release 50g or less of CO2 emissions per kWh, compared to around 1000 g CO2/kWh for coal and 475 g CO2/kWh for natural gas (Downstream, 2013)

Table 2: Renewable energy options, (Bleicher, Goodwin and Blake, 2021)

Table

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### 3.3 Electrical System

Table 3:Key action points for electrical systems referring (Bleicher, Goodwin and Blake, 2021)

Table

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### 3.4 Water

Table 4: Key action points on water & cleaning referring (Bleicher, Goodwin and Blake, 2021)

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### 3.5 Smart Building

The smart building consumes 46% of energy and emits 70% less carbon than compared to other office/home buildings. Such buildings are usually fed by data points connecting to the sensors, IoT devices, servers as well as data from the weather station. Because of occupant interaction, the building operating system is in charge of tracking scope 3 emissions such as how individuals travel to and exit the building. Installing sensors in the bike storage area or having reception personnel utilise a touch-screen device to record visitors' means of transportation to and from the workplace allows for this.

Graphical user interface

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Some advantages of switching to smart buildings

* The building management system enables remote management of the structure.
* Allows lighting systems to automatically change brightness and colour based on the time of day and identified occupancy.
* Indoor and outside conditions are detected, and temperature and ventilation are changed in the most energy-efficient manner.
* The smart node technology in the building allows it to store power in a battery during off-peak hours for usage during peak hours.
* Such a structure can track every kilowatt of power consumed and compare its performance to that of other structures.
* These are the first buildings to receive the highest sustainable building certification designations from both LEED and BREEAM, saving roughly £500,000 per year.

### 3.6 Business Travel

##### 

##### Developing a sustainable business travel strategy

This approach strives to identify and describe all business demands to develop a framework for business travel that will yield time, efficiency, and cost savings.

Diagram

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Figure 5: The flow diagram below summarises a proposed procedure for building a corporate travel strategy

Table : proposed procedure for building a corporate travel strategy( Elites, 2021)

**Table

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### 3.7 Work from Home

Working remotely can provide numerous sustainability benefits; however, according to the CPMG report on carbon emissions, this part falls under scope 3 emissions; work from home employees have smaller carbon footprints because they do not have to commute as frequently; let us look into more opportunities to reduce environmental impact while working from home.

###### Sustainability tips to reduce carbon emissions (Lawrence, 2021):

* Use recycled paper for office work if required or go digital, Rocket book looks and feels like a regular notebook, but is erasable and reusable. Also, it stores any notes in google drive, dropbox and one note (Lawrence, 2021).
* Thermostat - use an energy-efficient thermostat that conserves energy automatically. Nest's smart thermostat learns your preferred temperatures and creates a schedule to conserve energy and money (Lawrence, 2021).
* Plugged-in devices draw energy from the grid, which adds unnecessary stress to the environment, so unplug them when not in use.
* To save water and energy, fill the dishwasher, use the eco setting, and wash dishes by hand once a day, rather than after every meal.
* Turn off standby. The refrigerator and freezer must be kept running at all times, although microwaves, dishwashers, washing machines, and ovens can all be shut off at the mains (Lawrence, 2021).
* Don't overfill the kettle when making hot drinks; boil just as much water as you need or fill a flask to last all day.
* Video streaming, emails, and online searches all produce a carbon footprint, so giving your eyes a rest will also save energy. When buying or replacing electronic items, look for energy-efficient models and choose eco settings (Lawrence, 2021).
* With solar panels, one can use the 'free' electricity during daylight hours to run appliances like washing machines, dishwashers, vacuum cleaners, etc.
* Lowering the brightness of your computer monitor can save up to 20% of its electricity. Less energy means less environmental stress (Lawrence, 2021).

### 3. 8 Funding

Table : Funding options guided by (Energy Magazine 2022)Smart buildings – the self-financing potential, 2022) & (Center for sustainability energy, 2022) and (Ground Sun | Delivering smarter buildings for the future, 2019).

Table

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### 3.9 Sustainable Data storage

Nowadays more companies are switching to cloud-based data centres because they provide flexibility, cost-effectiveness, and scalability. This in turn can reduce the usage of physical servers on-site and which leads to less energy usage. World-renowned google and apple are leading their way within this area, both companies continue to use their influence to push governments as well as their utility and IT sector vendors to increase access to renewable energy for their operations. On average, a Google data centre uses 50% less energy than a typical data centre uses and also takes part in the circular economy on the server management level. The circular economy is the alternative to the traditional linear economy (make, use, dispose of) in which resources are being (re)used for as long as possible. Google is committed to achieving Zero Waste to Landfill and reuses server materials multiple times. Google data centre is twice as energy efficient as a typical enterprise data centre, and they deliver six times as much computing power for the same amount of electrical power, compared with five years ago (Google cloud, 2022).

### 3.10 GREEN HRM

Green Human Resource Management (GHRM) has become an integral part of business strategies for important firms when it comes to being green at work. Besides promoting environmental awareness, green HRM also fosters the social and economic well-being of employees and the company. (Ahmad 2015).

Diagram

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Figure 6: Green HRM, (Renwick, Redman, and Maguire, 2008)

Table : Green HRM, (Renwick, Redman, and Maguire, 2008)

Table

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# 4. INFLUENCE ON SUPPLY CHAIN, SUPPLIERS AND CUSTOMER BASE

Green supply chain management (GSCM) is a driver of sustainability in the construction industry. GSCM has emerged as an antidote to industry sustainability. The key reasons that motivated corporations to embrace GSCM methods were cost savings, brand image creation, and acquiring a competitive edge. The primary challenges to GSCM implementation were shown to be a lack of resources, supplier opposition to change, and a lack of understanding. From the extraction of raw materials to the destruction and disposal of its components, sustainable construction entails building goods using best-practice clean and resource-efficient procedures. Despite the benefits of GSCM in construction, there remain obstacles to its application (Ojo, Mbowa and Akinlabi, n.d.). Taking this decision of implementing GSCM to CPMG IT can widely influence their wider supply chain and suppliers. To reduce supply chain emissions, suppliers frequently need to work together more closely. This is done by educating them on decarbonization levers, offering technical guidance, enabling longer-term asset improvements, and encouraging continuous improvement. Some businesses prefer to let suppliers define their standards. Walmart, for example, does not enforce requirements; instead, it lets suppliers set specified, quantifiable, attainable, and reasonable emission reduction objectives for themselves. Last year, suppliers avoided a total of 230 million tonnes of CO2e. 36 (JANUARY 2021 In collaboration with Boston Consulting Group, n.d.).

If CPMG implemented GSCM these would be the barriers their wider supply chain would face: Lack of resources, lack of markets for recyclable materials, Lack of knowledge about environmental impacts, Lack of information sharing between construction firms and suppliers, Poor commitment by the top management, Lack of legal enforcement by the government, Lack of sustainable practices in the organization’s vision and mission. (Oji, Mbowa and Akinlabi, n.d.)

Every construction project's success primarily depends on the clients' level of dedication. However, the five most important aspects were: client knowledge and awareness; cost implications and financial involvement; economic value and return on investment; client perception and choice; and health and safety consequences. The degree to which these elements affect public and private clients' commitment to sustainable construction varies significantly. The discrepancy is brought on by the public and private clients' varying levels of understanding, awareness, involvement, and commitment to the sustainable construction idea. To increase client commitment to sustainable building techniques, it is crucial to maximise the level of client knowledge and understanding regarding the costs, advantages/profits, and health and safety implications of sustainable practices. To increase the clients' commitment and desire to demand more sustainable projects, it is advised for acceptable client involvement throughout the project and an awareness program, championed by relevant government agencies and professional organisations through different public programmes (Okoye 2021).

# 5. KEY PERFORMANCE INDICATORS (KPIS):

After analysing the carbon footprint of CPMG and considering the possibilities of implementing the recommendations, the team has identified three major KPIs

1. Renewable energy is produced on-site from Solar Energy and Air Heat pumps.
2. Energy efficiency in the building
3. Effective implementation of the HR policies set for Business travel and Working from Home

Moreover, the team also identified some minor KPIs and categorised them, along with three major KPIs, into three categories: environmental, social, and economy. According to Hristov and Chirico (2019), the environment is a fundamental factor of sustainability, so to achieve net-zero carbon by 2040 and follow the SDGs, it is essential to define the environmental goals. Therefore, the first KPI in the environmental category is renewable resources rate with the strategic goal being to improve the use of renewable energy (Hristov and Chirico, 2019). Based on the report by NTU sustainability (2022), CPMG has eliminated the carbon emissions of electricity through renewable energy tariffs. However, CPMG can improve the rate of renewable energy by installing a solar system. Therefore, instead of purchasing electricity from the provider, CPMG can produce clean energy onsite. We have calculated the cost and benefits of installing the solar system in the table below. Unfortunately, the outcome of this KPI will take a long period because the payback period for the system is 13 years (Rawson, 2022). However, after the payback period, CPMG already has a strong foundation for renewable energy and can easily achieve net-zero carbon by 2040.

Table 8: Cost-benefit analysis of solar system (Energysavingtrust, 2020 and GOV.UK, 2022)

|  |  |  |  |
| --- | --- | --- | --- |
| **Method** (Placeholder1)**ology ​​** | **Typical Installation Costs​​** | **Cost Saving​​** | **Carbon saving​​** |
| **Solar PV (10kW)​​** | **£12,993 - £16,850​​** | **£658 - £1277​​** | **1,406 kg/year​​** |

The second KPI in the environment is the efficiency of resources used rate. From that, CPMG can reduce their resource consumption. We suggest that CPMG can measure the KPI by calculating the electricity used per thousand product units, and also water consumption and other resources per thousand product units (Hristov and Chirico, 2019). The target for this KPI is to reduce 5% of resources used per year, which is 25% per period. With the elimination of gas and installation of utilities such as double-glazed windows, sensor-controlled taps, and waterless urinals, CPMG has reduced 36% of gross carbon emissions (NTU,2022). Therefore, if these two KPIs are achieved we estimated that CPMG can reduce 25-30% of carbon footprint after 5 years each (Figure 7)

Figure 7: Total Carbon Emissions Target

The second category is Social with the major KPI being HR policies set for Business travel and Working from home. The strategic goal for this KPI is to reduce the carbon emissions from Business travel and Working from home. The difficulty of this KPI is that different employees have different awareness of sustainability. CPMG cannot guarantee that 100% of employees will accept and follow the sustainable policies for Travelling and Working from home within 10 years. However, if CPMG aims that each year, 1-2 employees will understand and follow the policies, it is possible to achieve net-zero carbon for scope 3. At the moment, CPMG has 43 employees; and we calculated the amount of tCO2e CPMG can reduce per period (after every 5 years) CPMG can reduce 5 tCO2e for working from home and 6 tCO2e for transportation (Figure 8). Therefore, by 2040 CPMG only have 6.4 tCO2e for working from home, and 4 tCO2e for transportation which are 77% and 90% reductions respectively.

Figure 8: Working from home and Transportation Target

Along with the HR policies is the minor KPI: employee satisfaction rate. CPMG must guarantee that the cultural change of the new policies will encourage the employees to accept and improve the working conditions (Hristov and Chirico, 2019). CPMG can keep track of the KPI through a questionnaire sent to the employees once per quarter and improve the HR policies. The target for this KPI will support the HR policies target (Figure 8) which at least 2 people per year are satisfied and willing to follow the policies.

The last factor is the Economy which is the ability to sustainably increase the major economic indicators, provide income and employment, maintain population size while improving territorial distinctiveness, and effectively utilise resources (Simmonds, 1983). This factor contains two minor KPIs which we mentioned in the Appendix.

ROADMAP TO ACHIEVE NET ZERO BY 2040

Timeline

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# 6. CONCLUSION

Based on the research conducted by the team with reference to a wide range of sources, it is suggested to implement the recommendations to reduce carbon emissions in the CPMG’s head office, Nottingham. After careful analysis of the carbon footprint from CPMG, key contributors are identified and recommendations are shared to reduce carbon emission rate considerably over the years. Generation of renewable energy on-site and energy efficient measures and powerful HR policies for Work from Home and Transport will help reduce the carbon footprint. The KPIs identified are to be monitored, controlled and reviewed by deploying smart technologies in the organisation like the usage of IoT/AI (Smart Building). A strong review mechanism to be built and the process to take place in a frequency of monthly, quarterly, yearly and 5 years once. Also, adopting practices like Green HRM and Green Supply chain Management will help the organisation deal with Work from Home, Transport and suppliers carbon emissions. The roadmap or framework to NetZero by 2040 is to be reviewed every 5 years till 2037 with a buffer of 3 years (buffer is allowed to compensate for any breaches in the framework) and make changes to the KPIs accordingly. The sustainability team for CPMG to follow the set strategy to deal with major contributors from Scope3 emissions (WFH, Transport and Data Storage) to reach Net Zero.

# 7.REFERENCES

Ahmad, S., 2015. Green human resource management: Policies and practices. Cogent Business & Management, 2 (1), 1030817.

Azhar, S. and Brown, J., (2009). BIM for sustainability analyses. International Journal of Construction Education and Research, 5(4), pp.276-292.

Banister, D., Newson, C. and Ledbury, M.(2007). The Costs of Transport on the Environment–the role of teleworking in reducing carbon emissions. Transport Studies Unit, Oxford University. http://www. tsu. ox. ac. uk/pubs/1024-banister-et al. Pdf.

Bleicher, D., Goodwin, C. and Blake, N.(2021). Environmental good practice in facilities management. London: Ciria.

Cse.org.uk. (2022). Funding your project.<https://www.cse.org.uk/local-energy/funding-your-project> .

Eltis.org. (2021). <https://www.eltis.org/sites/default/files/trainingmaterials/sustainable-business-travel.pdf>

EM Magazine. (2022). Smart buildings – the self-financing potential. <https://www.energymanagermagazine.co.uk/smart-buildings-the-self-financing-potential/>

Energysavingtrust.org.uk. (2020). Solar Energy Calculator | Energy Saving Trust. [online] Available at: https://www.pvfitcalculator.energysavingtrust.org.uk/ [Accessed 14 Jul. 2022].

For, D. (2014). Solar photovoltaic (PV) cost data. [online] GOV.UK. Available at: https://www.gov.uk/government/statistics/solar-pv-cost-data [Accessed 14 Jul. 2022].

Google Cloud.( 2022). Sustainability | Google Cloud. <https://cloud.google.com/sustainability> [Accessed 22 July 2022].

Ground Sun | Delivering smarter buildings for the future. (2019). Grants and Incentives for renewable energy technogies - heat pumps, solar thermal, biomass | Ground Sun. [online] Available at: https://groundsun.co.uk/grants-and-incentives/ [Accessed 22 Jul. 2022].

Hristov, I., Chirico, A., 2019. The role of sustainability key performance indicators (KPIs) in implementing sustainable strategies. Sustainability (Basel, Switzerland), 11(20), p.5742–. 10.3390/su11205742.

Hughes, B.R., Chaudhry, H.N. and Calautit, J.K.(2014). Passive energy recovery from natural ventilation air streams. Applied Energy, 113, pp.127-140.

ICS Learn. (2021). 7 Ways HR Can Help Build Net Zero Organisations | Human Resources. [online] Available at: https://www.icslearn.co.uk/blog/human-resources/7-ways-hr-can-help-build-net-zero-organisations/ [Accessed 14 Jul. 2022].

King, J. and Perry, C., 2017. Smart buildings: Using smart technology to save energy in existing buildings. Amercian Council for an Energy-Efficient Economy Washington, DC, USA.

Lawrence, K., (2021). How to be more eco-friendly while you're working from home - Which? News. <https://www.which.co.uk/news/article/long-term-sustainability-tips-if-youre-still-working-from-home-aLKXg5p0CZKO> [Accessed 22 July 2022].

Mirzania, P., Ford, A., Andrews, D., Ofori, G. and Maidment, G.(2019). The impact of policy changes: The opportunities of Community Renewable Energy projects in the UK and the barriers they face. Energy Policy, 129, pp.1282-1296.

NTU, S., 2022. Environmental and Carbon Assessment Report. Nottingham: Nottingham Trent University.

Okoye, P.U., 2021. Factors Influencing Clients’ Commitment to Sustainable Construction Practices. International Journal of Sustainable Development and Planning, 16 (1), 39-48.

Ojo, E., Mbowa, C. and Akinlabi, E. (n.d.). Barriers in Implementing Green Supply Chain Management in Construction industry. [online] Available at: http://ieomsociety.org/ieom2014/pdfs/432.pdf.

Rawson, J., 2022. Photovoltaic (PV) Solar Panels - Centre for Alternative Technology. [online] Centre for Alternative Technology. Available at: https://cat.org.uk/info-resources/free-information-service/energy/solar-photovoltaic/ [Accessed 20 July 2022].

Renwick, D., Redman, T. and Maguire, S.(2008). Green HRM: A review, process model, and research agenda. University of Sheffield Management School Discussion Paper, 1(1), pp.1-46.

Sagepub.com. (2018). The SAGE Encyclopedia of Communication Research Methods. [online] Available at: https://methods.sagepub.com/reference/the-sage-encyclopedia-of-communication-research-methods/i13206.xml [Accessed 4 Jul. 2022].

Simmonds, N.W. Building a Sustainable Society. By Lester, R.B. New York and London: Norton, p. 433. Exp. Agric. 1983, 19, 111.

The Carbon Trust. (2019). Briefing: What are Scope 3 emissions? [online] Available at: https://www.carbontrust.com/resources/briefing-what-are-scope-3-emissions#:~:text=Scope%201%20covers%20direct%20emissions,in%20a%20company’s%20value%20chain. [Accessed 4 Jul. 2022].

Toor, T.P.S. and Dhir, T., 2011. Benefits of integrated business planning, forecasting, and process management. Business Strategy Series.

Zero (2020). Pinchin Architects. [online] Pinchin Architects. Available at: https://www.pinchinarchitects.com/biodiversity-and-zero-carbon [Accessed 22 Jul. 2022].

## 8. APPENDIX

## APPENDIX 1: GRAY TABLE OF TOP CLOUD PROVIDERS

Application

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Figure :\*Greenpeace report 2017 - Clicking clean: who is winning the race to build a green internet?

## APPENDIX 2: SMART BUILDING DESIGN

**Graphical user interface

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## APPENDIX 3

**A picture containing diagram

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## APPENDIX 4

The last factor is the Economy with the Return on Investment (ROI) related to environmental protection and additional revenue through cost-saving. The strategic goal for the ROI is to be positive and increase each year because a high positive ROI indicates a more lucrative investment. After using the cost analysis, the target ROI for each year is 7% for solar systems and 30% for the heat pump. Moreover, when all the KPIs are achieved, especially the efficient resourced used rate, the revenue can increase each year. Because when CPMG use the resources efficiently, they can decrease the resourced consumption which will reduce the cost. The reducing cost will be added back to the revenue. We expect that CPMG can increase at least 12% of additional revenue through cost-saving.

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| **Methodology** | **Cost** | **Saving** | **ROI** |
| Solar System | £12,993 - £16,850 | £658 - £1,277 | 5.1%-7.6% |