Barriers to achieving net zero sustainability target for Edinburgh City: private property owners' perspective.

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Abstract

The recent successes made at the 28th Conference of Parties (COP) held in Dubai is a testament that governments globally are committed to combating climate change. United Kingdom is no different and its various devolved powers have made carbon reduction commitments, with Scotland committing to achieving net-zero by 2045. Although the specifics of this target are unclear, Edinburgh the capital of Scotland's ambition of leading the way with a 2030 target faces the unique challenge of balancing between its prestigious world heritage status and forging the way forward with carbon emissions. This paper explores the challenges faced in meeting this net zero target from the perspective of property owners within the city. Anchored on quantitative research design, the paper uses structured questionnaire survey to solicit responses from 178 selected private property owners within the city. A total of 101 valid responses were retrieved to give a response rate of 57%. Descriptive and inferential statistics were used to analyse the barriers. Findings indicate that "knowledge deficiency regarding the end results in terms of energy efficiencies", "disruption caused by home adaptations during installation", the attendant cost of the net zero technologies and resources, "difficulty in finding impartial advice", "complicated decision-making process when making modifications for listed buildings, conservation zones, and UNESCO sites", and "lack of clarity over who is delivering climate change targets for the various districts of Edinburgh city" were the top rated barriers in each of the 6 categories. The paper among others, concludes that although there is awareness of Scotland's target to achieve net-zero by 2045 (UK's countrywide target is 2050), the more ambitious target being pursued by the Edinburgh City Council is not widely understood. Consequently, confidence levels around this knowledge are low, and knowledge on how to act and make the changes is low, suggesting there will be limited progress without knowledge sharing and empowering programmes. The paper therefore recommends among others, that project communication plans should be adopted to ensure that private property owners are fully engaged as stakeholders and contributors to the net zero target project.

Key Words: Edinburgh**,** net zero, carbon emissions, barriers, property owners.

1. Introduction

Climate change, climate crisis, emissions, net zero are terms that have continued to resonate in the modern world through all media channels ostensibly on account of the fact that clearly and unequivocally, planet Earth is facing a climate emergency (Ripple et al., 2020). Indeed, Hossain (2017) notes that it has now been established that climate change has affected every continent. There are equally signs of action being taken, with national governments almost universally pledging to achieve net zero emissions (Lenzi, et al., 2021). The most compelling global target in relation to climate change is the Paris Agreement, which the United Kingdom (UK) government signed on 22nd April 2016 (UN, 2016) and has subsequently legally committed to achieving net zero emissions of greenhouse gases by 2050, based upon the emissions of the baseline year, 1990 (Pye et al., 2017; Climate Change Committee, 2023; Ripple, et al., 2020; Seifhashemi and Elkadi, 2022). To achieve this, it is broadly acknowledged that emissions need to be reduced by reducing consumption and switching to renewable energy sources (Seifhashemi and Elkadi, 2022, Haigh, 2019).

With the devolved powers bringing devolved responsibilities, the Scottish Government are ambitious: claiming to have "one of the most ambitious legislative frameworks for emissions reduction in the world" (Scottish Government, 2023). They have set themselves the stretch target of achieving "net zero emissions of all greenhouse gases by 2045 which is five years ahead of the UK-wide target. Currently bound by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (Legislation, 2023), it sets out what the long term and interim targets are, how emissions will be measured, emissions accounting, reporting strategies, and more. What is irrefutable, however, is that everyone has a role to play. The city of Edinburgh is the capital of Scotland and there has been an interesting paradox in the city as it grapples with some unique challenges in achieving net zero targets. Edinburgh is a historic city, with the ancient Edinburgh Castle dominating the skyline, and protected by its two prestigious UNESCO World Heritage Site designations (UNESCO, 2023). This status is safeguarded by several

stringent planning and development policies such as The Town and Country Planning (Scotland) Act 1997 and The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997). According to Snugg Energy (2023), the UK has some of the oldest housing stock in Europe further noting that Edinburgh is no exception. Evidently, it is important to understand how the City of Edinburgh will manage achieving net zero targets whilst protecting its World Heritage sites and the history of the buildings surrounding the City.
The two highest contributors to the UKs household emissions are Transportation (34%) and Housing and Power (30%) (Climate Change Data, 2021). The focus of this paper therefore is to assess and provide the most updated documentation of the barriers to achieving the net zero target from the perspective of the Edinburgh private property owners who have a significant contribution to make, both to solutions to the climate crisis and the preservation of the heritage of their city. The next section develops a review of extant literature on barriers to net zero carbon emissions targets to situate the research problem. This is followed by an explanation of the research methods to achieve the stated objectives. This is followed by presentation of results and discussion of findings. The final section focuses on the conclusion and set of recommendations based on findings of the study.

2. Literature Review

Literature suggests that there are several barriers which are causing slow progress against policy targets (Fylan and Glew, 2022). This section considers the existing barrier-related evidence and will also consider some of the barriers which may be specific to Edinburgh property-owners based upon the literature available, establishing the case for some further study. In their 2019 study, Singh, Walsh and Mazza (2019) categorised barriers to adoption of net zero in Ontario, Canada, as follows: Knowledge-related; Relative Advantage; Compatibility and Economic Feasibility. This paper adopts the same categorisation identified by Singh, Walsh and Mazza (2019), while also incorporating other barriers that are unique to Edinburgh city.

2.1 Knowledge-related barriers

Knowledge deficiency regarding the science of the technology" (Singh, Walsh and Mazza, 2019) is identified as the primary knowledge-related barrier. Whilst recognising that there is a desire to learn, there is a lack of adequate information" available to homeowners to empower them into deciding. There is also lack of 'how to' knowledge with regards to what needs to be done. Anon (2021) discuss the "gap in holistic" view of what needs to be done to retrofit a home to net zero energy. Lack of knowledge over the end-results also featured in the list. Shabha et al. (2021) discussed "liveability", and claimed that "customers have concerns about attaining and maintaining a comfortable indoor temperature" and that a lack of knowledge with regards to the end results hinders them from making the decision. The final appearance of any changes to make to the home is also broadly unknown and Seifhashemi and Elkadi (2022) identified that aesthetic benefits to home renovations are as important as cost and energy saving. This lack of knowledge therefore may make consumers question the benefits of going ahead with home retrofitting for energy efficiency. Overall, there is a lack of confidence to make the decision to change. In Scotland, Changeworks Scotland (2023) recognise that there is "market paralysis", caused by the "wide range of options and the difficulty in finding impartial advice". Whilst there is acknowledgement that knowledge barriers are challenging and need to be overcome, there is little evidence of what should be done to break down the barriers. Identified knowledge barriers therefore are (1) knowledge deficiency regarding the science of the technology, (2) lack of knowledge over what needs to be done to create a net zero home, (3) lack of knowledge over how to use modern technology in net zero homes, (4) Knowledge deficiency over the end results in terms of energy efficiencies and (5) knowledge deficiency over the end results in terms of appearance.

2.2 Economic Feasibility Barriers

Concern remains high with regards to the construction costs related to making homes net zero, or even more energy efficient. Anon (2021) believes costs to be "considerably higher than those estimated by the Climate Change Committee" (2023), with an estimate of £17,000 - £24,000 just to upgrade an Energy Performance Certificate (EPC) rating from a C to a low B. They also assert that the cost of retrofitting a property is 65% more expensive than building the efficiencies into a new home. They are clear in the assertion that costs are deterring homeowners and tenants from undergoing the retrofit process. In Scotland, costs for SWI (solid wall insulation) vary greatly, but are generally high and this is a significant barrier to wider uptake (Changeworks Scotland, 2023). Consumers are also concerned that the lack of choice may create a monopoly, and Shabha et al. (2021) believe this to be a barrier. The hesitance is that with lack of choice, there may be over-charging by those firms which are in the market, and consumers are aware of this. Singh, Walsh and Mazza (2019) discuss market forces and the lack of options being presented by the construction industry to the consumer, as a barrier to uptake. Identified economic barriers (1) costs are deterring homeowners and tenants from undergoing the retrofit process, (2) uncertainty about achieving the expected energy efficiency and cost savings, (3) lack of choice driving prices up and (4) lack of comparison or others doing the same.

2.3 Disruption to Life Barriers

There are similarities between the knowledge barriers identified earlier in this paper and some of the disruption to life barriers, which often relate to lack of knowledge. However, the barriers identified below are unique, and specifically relate to those concerns about the changes to one's life either during installation or after the process is complete. Focusing on the installation of internal wall insulation, Changeworks Scotland (2023) recognise that "disruption during installation" may include "a need to move out temporarily" which not only requires significant effort from the homeowner but also adds cost to the process. They also believe that a concern regarding reduced floorspace or reduced light ingress after installation of wall insulation puts people off (internal wall insulation). A further concern following energy-efficiency changes to a property is being faced with the inability to hang or affix products to insulated walls. Identified disruption to life barriers include (1) disruption during installation, (2) reduction in floorspace or light ingress and (3) reduced aesthetic enjoyment of the home (inability to affix to the walls).

2.4 Relative Advantage Barriers

Already mentioned in relation to cost barriers, Singh, Walsh and Mazza (2019) identify that without immediate tangible benefits, consumers tend to justify their purchase based on the immediate viable costs. In other words, they do not tend to consider future benefits or savings as an offset to the upfront expenditure. This, they believe, is proving one of the most significant barriers to uptake. Gudde et al. (2021) argue that the wider population will not buy into the necessary action, much of it intrusive, if the local authorities cannot effectively engage to show the relevance of tackling climate change which the public may never fully engage. There is further suggestion that there is a general lack of awareness of the benefits of upgrading homes 9Shabha et al., 2021). When considered against the discussion from Rennie and Protheroe (2020), it's important that the purchasing public are guided to the correct path from that messy middle which they mention. Present information suggests that the public are not seeing the benefits outweighing the status-quo and so are not making the decision to move. In summary, identified relative advantage barriers are (1) difficulty in finding impartial advice, (2) trust in the technology and (3) concern over the quality of installation.

2.5 Compatibility Barriers

The suitability of each property for conversion to net zero varies greatly, as do the requirements to achieve the target. There is no blueprint on what needs to be done to achieve net zero and as noted by Snugg Energy, there is no silver-bullet or one-size-fits-all approach to achieving greater energy efficiency. They attempt to combat this by dividing the housing population into "tribes". The tribes they identify are: Nifty Newbuilds, Gorgeous Georgians, Toasty Tenements, Breeze-free Bungalows and Mid-century Marvels (Snugg Energy, 2023). Within the City of Edinburgh, there are significant compatibility questions to be raised with regards to the housing stock. Where permissions are needed from multiple tenants and owners in multi-tenure blocks (Changeworks Scotland, 2023), the prospect of having to gain agreement and buy-in from all property owners within the same building is likely to put many off. Edinburgh is a city with a high percentage of flatted housing stock. The 2011 census suggests that approximately 64% of households in the city live in flatted accommodation (edinburgh.gov.uk, 2014) and indeed a further 26% live in semi-detached or terraced properties, leaving only 10% of households living in detached properties. The assumption here being that only 10% of households don't have to consider others when making external changes to their property (such as adding external wall insulation). It is therefore reasonable to accept that this high proportion of shared buildings will have greater impact on decision making process of the city's residents with regards to property adaptations. It is worth noting that national percentage of households living in flatted accommodation is approximately 38% and up to 21.5% in detached properties (National Records for Scotland, 2023), with Edinburgh facing a unique situation with its higher percentage of multi-tenure buildings. In summary, identified compatibility barriers are (1) multi-tenure flatted accommodation requiring collaborated effort, (2) listed buildings and conservation zones and (3) buildings with significant changes required to meet challenging targets.

2.6 Mandatory / Regulatory / Policy Barriers

Lack of mandatory requirement, regulation, or policy may also be contributory to a lack of action. Kumar et al. (2023) recognise this in their paper in relation to changing the habits of the Indian automotive industry towards electric vehicles (EVs). Shabha et al. (2021) made a connection between this behaviour and the UK housing market, asserting "the UK will fail to reach their net-zero carbon 2050 targets if government legislation fails to address the need to reduce energy consumption of the average living in UK household". In summary, identified mandatory / regulatory / policy barriers include (1) lack of clear government legislation to reduce consumption, (2) lack of clarity over who is in charge and (3) lack of collaboration between authority and citizens.

2.7 Brief history of Edinburgh City

According to Independent Schools Cultural Alliance (ISCA, 2024), Edinburgh has been the royal and political capital of Scotland in United Kingdom since the 15th century. The old town part of the city was erected in the late 1480s and was characterised by frequent outbreak of deadly diseases resulting from excessively high population densities (said to be some of the highest in Europe then) and lack of basic sanitation afforded by the vastly overcrowded residences (ISCA, 2024). However, in 1767, James Craig worn a competition floated by Georgian Drummond, the then councillor for Edinburgh to develop 100 acres of city-owned farmland into a new town. It was built to the north of the city to allow wealthier residents to escape the overcrowded, filthy streets of the Old Town and live in a healthier and cleaner environment. Declared a UNESCO World Heritage Site in 1995, Edinburgh's Old and New Town are one of the most complete and unspoilt examples of Georgian architecture and town planning in the world. The city is one of the most attractive tourist destinations in the world on account of its natural heritages such as Edinburgh castle, princess Gardens, the Andrew Square and famous events such as the Fringe festival and Edinburgh International festival.

Figure 1: Princess Street, Edinburgh City, United Kingdom

As Scotland's capital and economic centre, the city of Edinburgh council has been strategizing to ensure that a cleaner, greener and fairer future for the city is achieved and have set an ambitious target for Edinburgh to become a net zero city by 2030 (www.edinburgh.gov.uk, 2023). Only recently, the council has placed restriction on use of certain types of cars for some areas of the city called Low Emission Zones (LEZs). Although, it is a very commendable initiative, many barriers have tendered to put a plug on these ambitious targets. The essence of this study is to assess these factors.

3. Research Methodology

The paper adopted a quantitative research design anchored on structured questionnaire approach. The survey was conducted online while the survey questionnaire was prepared using Edinburgh Napier University's NoviSurvey platform. The sample frame was first drawn from the database of the Royal Institute of Chartered Surveyors (RICS) and then filtered using Microsoft Excel to include only those in the postal code EH1-EH17 and EH28-EH30 which aligned with those individuals eligible to take part in the survey. Copies of the questionnaire was then sent through dedicated email invitation and links to 178 identified respondents within the database. They were purposively selected on the basis that they are private houseowners and have requisite knowledge about the net zero commitments of Scottish government in Edinburgh city. The study questionnaire was in two parts. Part one solicited background information from respondents while part two solicited responses from participants on barriers hindering achievement of net zero sustainability targets in Edinburgh city. The questions were rated on 1 to 5 point Likert scale (1 = strongly disagree 2= disagree 3= agree 4 = slightly agree 5 = strongly agree). A total

of 101 respondents validly completed the online questionnaire to give an overall response rate of 57%. Data generated were analysed using descriptive and inferential statistics.

4. Results and discussion of findings

In order to assess barriers to achieving net zero carbon emission targets for Edinburgh city, 21 factors grouped into 6 categories were sourced from the literature and subjected to the views of private property owners (landlords) in the city. Results of analysis showing the mean score of their responses, standard deviation and rankings of the mean scores are presented in Table 1.

Table 1: Result of analysis for barriers to achieving net zero targets in Edinburgh

Code	Barrier	Mean	Standard deviation	Rank
	Knowledge barriers			
KB01	Knowledge deficiency regarding the science of net zero technology	2.551	0.962	4
KB02	Lack of knowledge on what needs to be done to create a net zero home	3.862	0.995	2
KB03	Lack of knowledge on how to use modern technology in net zero homes	3.116	0.842	3
KN04	Knowledge deficiency on the end results in terms of energy efficiencies	4.214	1.103	1
KB05	Knowledge deficiency regarding the end results in terms of appearance	2.418	1.001	5
	Economic barriers			
EB01	Costs are deterring homeowners and tenants from undergoing the retrofit process	4.332	0.852	1
EB02	Uncertainty about achieving the expected energy efficiency and cost savings	4.035	0.944	3
EB03	Lack of choices driving prices up	2.913	0.803	4
EB04	Lack of information on economic comparison with others doing the same.	4.281	0.888	2
	Disruption of life barriers			
LB01	Disruption caused by home adaptations during installation	3.012	0.775	1
LB02	Reduction in floorspace or light ingress and other aesthetics	2.181	0.997	3
LB03	Reduced aesthetic pleasure of the home.	2.850	1.110	2
	Relative advantage barriers			
AB01	Difficulty in finding impartial advice	4.229	0.852	1
AB02	Trust in the RE/net zero technology	4.117	0.993	2
AB03	Concern over quality of installation	3.726	1.115	3
	Compatibility barriers			
CB01	Multi-tenure flatted accommodation requiring collaborated effort	2.729	0.779	3
CB02	Complicated decision-making process when making modifications for listed buildings, conservation zones, and UNESCO sites.	4.318	0.801	1
CB03	Lack of clarity on buildings with significant changes required to meet challenging targets.	3.288	0.883	2
	Regulatory barriers			
RB01	Lack of clear government legislations to reduce consumption	3.442	1.001	2
RB02	Lack of clarity over who is delivering climate change targets for the various districts of Edinburgh city.	3.877	0.999	1
RB03	Lack of collaboration between authority and citizens	3.204	0.957	3

The result indicates that “knowledge deficiency regarding the end results in terms of energy efficiencies” was the top ranked. This is to the effect that majority of respondents who are mainly house owners in the city have not been able to get a full understanding of the benefits of the clamour for reduced carbon emission o meet net zero targets. This tallies with the findings of Shabha et al. (2021) who discovered that “customers have concerns about

attaining and maintaining a comfortable indoor temperature" by wholly relying on renewables, with further concerns acknowledged by Seifhashemi and Elkadi (2022) who argued that aesthetic changes were as important as energy saving to the consumer. However, "lack of knowledge on what needs to be done to create a net zero home" and "lack of knowledge on how to use modern technology in net zero homes" were respectively ranked second and third barriers by respondents. Plausibly, there is need for stakeholders to have basic knowledge of the nature of resources and renewable technologies needed to be installed in the homes to meet the net zero targets set by the government. Although the government are making efforts to enlighten stakeholders, that may not have been yielding the required results.

In terms of economic barriers, the issue of the attendant cost of the net zero technologies and resources constitute the most significant factor. This is because "costs are deterring homeowners and tenants from undergoing the retrofit process", "lack of information on economic comparison with others doing the same" and "uncertainty about achieving the expected energy efficiency and cost savings" were ranked first, second and third respectively in this category. This is to the extent that Anon (2021) was clear in their assertion that costs were a deterrent to homeowners and tenants from undergoing the retrofit process and this was supported by others in the industry (Changeworks Scotland, 2023 and Kumar et al., 2023). Survey respondents unanimously affirmed "yes" in their responses when asked if the costs involved were too great for them to proceed with making energy efficiency changes to their property. Additionally, they were concerned, but not overly so, with nature of value to their property as a result of making changes. What is indisputable is that respondents to the survey want to know more. For instance, when asked whether they would like to have easier access to information regarding the financial impacts of making such changes, 91% responded with "yes". Therefore, the survey have supported the theory in relation to economic barriers to an extent that there is a clear belief that the costs involved in making changes to the properties in response to meeting net zero targets are prohibitive to moving forward. However, "lack of choices to make for meeting net zero targets by respondents" did not hold up so strongly when considered against the questionnaire responses. Additionally, whilst respondents are confident that costs are prohibitive, they demonstrated lack of awareness of what the costs were. What is clear, however, is that people want greater and better access to information, and specifically impartial details on what they can expect in terms of costs and financial benefits, to enable the decision-making process.

In terms of disruption to life barriers, "disruption caused by home adaptations during installation" was the top rated. What this implies is that respondents were reluctant to adapt the net zero technologies because of the significant disruption installation would cause in terms of way of life, aesthetics and the uncertainty that accompanies it. The other two factors were not considered significant in representing disruption of life barriers because their mean scores were less that the median threshold of 3 for a Likert scale of 5 points.

In terms of relative advantage barriers, "difficulty in finding impartial advice" was the top rated factor. This was closely followed by "trust in the RE/net zero technology" and "concern over quality of installation" in that order. The lack of confidence demonstrated by respondents to the question about relative advantage barriers supports the clear desire for greater, impartial, levels of information and which shows that the public want to learn as asserted by Singh, Walsh and Mazza (2021). Furthermore, when considered in parallel with the findings of Rennie and Protheroe (2020), who argue for guiding the purchasing public to the correct path, the result suggests that the guidance is missing. In addition to finding impartial advice, having trust in the technology behind low emission homes is a key factor to success. This is in addition to evidence suggesting that installations "fail technical monitoring" (Fylan and Glew, 2022). Therefore, property owners are wary of "receiving a product that underperforms" as noted by Singh Walsh and Mazza (2019). In conclusion, the evidence suggests that trust is low, and the perception is that impartial information is not readily available, as a result, people are not opting to take the plunge towards making a change in their properties.

For compatibility barriers, consideration was placed on the suitability of each property for energy efficiency changes. As pointed out by Snugg Energy (2023), "there is no silver-bullet or one-size-fits-all approach". Therefore, questions were designed to understand the variety of properties within the city, and challenges facing the different states of energy efficiency, and supplementing this with Energy Performance Certificate (EPC) ratings information which is available publicly. Accordingly, a number of sub-questions were posed to respondents. On the general question of compatibility barriers, "complicated decision-making process when making modifications for listed buildings, conservation zones, and UNESCO sites" was rated first while "lack of clarity on buildings with significant changes required to meet challenging targets" was rated second. The rating for "multi-tenure flatted accommodation requiring collaborated effort" was however insignificant as the mean score was below the mean threshold of 3 for a 5 point Likert scale. This implies that respondents who are mainly property owners are concerns about the very complicated process for modifying properties and the uncertainty surrounding the nature of changes to meet the challenging net zero targets. For instance, a significant proportion

of respondents (50% of all surveyed) live in buildings that are protected 50% (which is greater than the statistics found in the literature) while 60% are in a shared buildings. One can then appreciate the complexities facing individuals who wish to adapt their properties in such a significant way. To gauge an understanding of the concerns facing those who live in buildings which present such complexities, those who answered "yes" to living in a protected building were asked to list what would affect their decision-making process with regards to making changes to the property. Permission and listed building consent account for 57% of responses. The implication of this finding is that it tallies with suggestion in the literature review that the more complex nature of Edinburgh's properties is indeed a barrier to progression to net zero. It should be noted that Edinburgh City Council (ECC) uses the EPC as a measure of compliance with targets (Scottish Government (2023b). Thus, the survey sought to understand the EPC ratings of the respondents' properties. The results showed some interesting, and somewhat unexpected results. As noted, many of the properties (70%) have not had an EPC conducted. This is however not entirely surprising as currently, it's only mandatory to have one conducted for specific purposes. However, where an EPC was known to have been conducted, almost 50% of respondents did not know the energy efficiency rating, significantly more did not know the environmental impact rating. However it was difficult to make any conclusion from these results given the information available is limited. In conclusion, the responses to the questions probing compatibility with net zero serve to highlight the challenge facing the City of Edinburgh in achieving the targets. Not only is there a wide range of property types, but they are also in different states in terms of energy efficiency and environmental impact.

Finally, for regulatory barriers, "lack of clarity over who is delivering climate change targets for the various districts of Edinburgh city" was the top rated factor. This was closely followed by "ack of clear government legislations to reduce consumption" and "lack of collaboration between authority and citizens" at second and third. The findings tally with concerns in the literature which have identified lack of mandatory requirement, regulation, or policy as a barrier to achieving climate change targets (Kumar et al, 2023). Shabha et al. (2021) echoed this in relation to the UK housing market, asserting that "the UK will fail to reach their net-zero carbon 2050 targets" without suitable legislation in place which the UK householders can strive towards. In a question on awareness, the study notes that there is good awareness of the UK-wide target to achieve net zero emissions by 2050 (82% of respondents were aware). However, the awareness for the awareness for the city of Edinburgh to become net zero as a city by 2030 was not so strong as only 55% of respondents were aware of this. Evidently, this implies lack of communication which lend credence to the need for synergy between stakeholders in a project. As key stakeholders, the public should be fully engaged and equally be kept aware of who is in charge.

5. Conclusion and recommendations

The paper concludes that although there is awareness of Scotland's target to achieve net-zero by 2045 (UK's countrywide target s 2050), the more ambitious target being pursued by the Edinburgh City Council was not widely understood. Consequently, confidence levels around this knowledge are low, and knowledge on how to act and make the changes is low, suggesting there will be limited progress without knowledge sharing and empowering programmes. Additionally, as the City of Edinburgh is complex, varied in their age and construction type, aging and of energy and environmental efficiency, the paper concludes that obtaining listed building consent, planning permission, or the consideration of living in a shared building features highly in the decision-making process of the respondents and as such is a significant hindrance to net zero target commitments of Edinburgh city. This is in addition to the fact that the additional costs associated with living in buildings which require such a delicate approach to change is a significant barrier.

The paper therefore recommends that project communication plans should be adopted to ensure that private property owners are fully engaged as stakeholders and contributors to the net zero target project. This could be done by first recognising that property owners are stakeholders, and then setting out a clear path to success for all to work towards. This will potentially create opportunity for group activities in which individuals make their own contribution for a greater good of the city. Additionally, consumers should have more access to educate themselves as to what needs to be done and how much this should cost or benefit them in the future. The fact remains that the costs are high, and support needs to be offered to those who must make changes to their property, at significant expense. For further research, a broader study conducted across the city, and encompassing more respondents would be beneficial in achieving a greater depth of information. Besides, there would be need to conduct and publish in-depth studies with volunteers to identify different categories of properties, and develop detailed retrofit plans, and current costings, to provide tangible information to those wishing to make those changes. Meanwhile, it is recommended that a study be carried out into the feasibility of changing planning rules to ease the process of making changes to properties which are listed or within conservation areas. This should consider the impact on those factors which have led to the protection of these buildings, such as the UNESCO world heritage status.

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