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# Green energy defaults

## Too effective or not effective enough?

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# Abstract

Green energy defaults (where the uptake of renewable energy is promoted among households by opt-out tariffs) are gaining increasing interest with policy makers, due to the high enrolment rates shown in (experimental) studies. Such default choices are often justified on normative and behavioural grounds as although consumers express a desire and willingness to pay for green energy, they often fail to act on such preferences. However, what has yet to be identified is whether the defaults actually classify those consumers according to their preferences. This study presents the results of a randomised controlled experiment, in which a sample of Scottish energy deciders ($n$=518) were randomly allocated to one of three treatment conditions for renewable electricity (opt-in, opt-out and an active choice). The choices made under the hypothetical markets were then compared with the normative preferences of the participants. Findings reveal two important aspects: a) not all consumers who would like a green tariff remain with it when it is the default, and b) consumers who would not like a green tariff stick with it when it is the default. The first finding suggests that such behaviour is due to scepticism in the green default when originating from an untrustworthy choice architect (e.g. supplier). The second finding proposes that green defaults may have the potential to manipulate consumers into energy contracts against their actual preference. Findings offer new and valuable insights into the workings of green energy defaults never before studied. The findings highlight significant research and policy implications surrounding the role of green defaults. It is concluded that green defaults are rather context- and market-specific and, if not designed carefully, can lead to unwanted policy outcomes. Whereas the experience with green energy defaults indicates untapped potential for behavioural change, the results also suggest that default settings should been seen as a panacea. Ultimately, this study highlights the need for further research on green energy defaults to become part of public policy.

**Keywords:** Green defaults; Behavioural economics; Renewable energy; Pro-environmental behaviour; Energy policy; Preferences

# Executive Summary

## Background

The largest contributor of anthropogenic greenhouse gas (GHG) emissions is the energy supply sector, responsible for approximately 35% of all global GHG emissions in 2010 (IPCC, 2014). Despite recent efforts to reduce the growth of GHG emissions, the annual growth of energy supply sector emissions rose from 1.7%/yr in 1990 – 2000 to 3.1%/yr in 2000 – 2010 (IPCC, 2014). Such growth rates are expected to continue with $CO_2$ emissions from the energy supply sector predicted to increase from 14.4 $GtCO_2$/yr in 2010 to between 24–33 $GtCO_2$/yr in 2050 (IPCC, 2014). In terms of emissions, the building sector was responsible for 9.18 $GtCO_2$ eq in 2010 and made up 19% of total global emissions (Lucon et al., 2014). Most of the GHG emissions from buildings are indirect $CO_2$ emissions from electricity use (6.02 Gt), which residential contributes the majority (3.50 Gt). This shows a steady and significant rise from 0.8 Gt in 1970 and 2.11 Gt in 1990 (Lucon et al., 2014). Along with emissions, residential buildings also contributed to 24% of global final energy use in 2010 (Lucon et al., 2014) and 25.4% of total energy consumption in EU in 2015 (Eurostat, 2017a).

Reducing this increase in GHG emissions can be achieved through various measures, such as energy efficiency improvements, fossil fuel switching and emission reductions in fuel extractions (IPCC, 2014). However, stopping the rise of GHG concentrations requires more than a shift from coal to gas and improvements of fossil fuel power stations, but a shift to low GHG energy technologies such as renewable energy. The rapid decarbonisation of the electricity mix is a vital component of mitigation strategies aimed at achieving low-stabilisation levels and is seen as a more cost-effective strategy which can occur more rapidly than in the construction, industry or transport sectors (IPCC, 2014). To meet low-stabilization targets, the share of low-carbon electricity supply needs to increase to 80% by 2050, with almost all fossil fuel generation without CCS phased out by 2100 (IPCC, 2014).

To promote the generation of renewable energy, the European Union (EU) has committed to a binding target of 20% of energy consumed in the EU to come from renewable sources by 2020. Mandatory national targets vary depending on previous performance and feasibility, with a 15% target for renewable energy set for the UK. However in 2016, renewable sources accounted for only 8.9% of all energy consumed, putting the UK 26$^{th}$ out of the 28 EU countries. Looking beyond 2020 the EU has set a binding target for emissions reduction of at least 40% compared to 1990 levels by 2030 and sets out a new EU binding target of at least 27% for all energy consumed in the EU to come from renewable energy by 2030. Despite voting to leave the EU, the UK has an even greater commitment to renewable energy, having recently adopted the legally binding target representing a 57% reduction in GHG emissions relative to 1990 for the period 2028-2032 (stricter than the EU's 2030 target). The new budget is aimed to enable the UK to meet its target of 80% emission reductions compared to 1990 levels by 2050.

Although RE technologies have experienced significant cost reductions and performance improvements over recent years, significant investment is still needed to meet such targets. However, investments in UK renewable energy are set to decline by 95% between 2017 and 2020, with investment in UK renewable energy falling by £1.1bn in 2016 alone. This is coupled with a withdrawing of government support for many RE technologies, raises concerns over future investments and its ability to meet its RE targets.

Green electricity tariffs —where some or all of the electricity supplied is matched by renewable sources by the energy supplier— offer a favourable solution (Diaz-Rainey & Ashton, 2008) as they are financed from those consumers that can both afford and are willing to pay (WTP) a

premium for renewable electricity. Green electricity tariffs are also an attractive option as studies have shown that consumers have a significant WTP a premium for renewable electricity in a number of countries, with surveys showing that between 50-90% of respondents are WTP a premium for renewable energy (Pichert and Katsikopoulos, 2008; Kaenzig et al., 2013). In the UK studies have shown up to 42% of individuals would be prepared to pay a premium for renewable electricity.

However, this willingness rarely translates into actual uptake. In the UK, studies have predicted the green electricity market at less than 1%, with similar figures from many other countries. Furthermore, such low uptake has seen many energy suppliers abandon their green tariffs completely. To address this perceived market gap between willingness and actual uptake, several studies have examined the effect of having the green energy supply as the automatic 'default' tariff given to the consumer. These have all reported high enrolment figures in green energy when presented as the default, ranging from 39 to 69%. As a result, green energy defaults are becoming an increasing focus of attention from policy makers, practitioners and organisations interested in promoting the uptake of green electricity.

**Problem definition**

However, despite positive results, to date, all the studies into green energy defaults have heavily focus on the total enrolment figures in green tariff. What has not been examined in detail is whether the greater enrolment observed in green defaults are actually from the same individuals who have expressed a WTP for green energy. In other words, under a green energy default scenario, do all of those who expressed a WTP stick with the green default, and secondly are there any who stick with the green default even though it is not their preference? In short, does a green energy default accurately classify individuals according to their actual preferences?

In addition, the use of defaults has been subject to ethical concerns, not least their potential to manipulate individuals into making choices against their preference. Studies have highlighted the need for further research into the role of workings of the defaults and their influences, with such ethical concerns also attracting the attention of the public-policy sector. Knowing whether green energy defaults accurately classify consumers to their preferences is critical if such defaults continue to be promoted and are implemented in actual electricity markets. If the effectiveness from green energy defaults is instead from enrolling those against their preference, then serious ethical issues may arise, questioning the legitimacy of this policy approach. Secondly, if there are still consumers who are WTP for green energy but choose to opt-out of a green tariff, identifying and examining the reasons behind such behaviour would be key for policy makers to increase the effectiveness of such green defaults.

**Aim**

The objective of this thesis is to increase our understanding of how green energy defaults work, primarily by identifying how decisions made under default treatments match the revealed preference of the consumer. The experimental design is consistent with similar studies to allow for comparison. The thesis aims to contribute to the growing interest in green energy defaults from both academics and policy makers, particularly in the context of sustainable energy use and climate mitigation. The following the questions guided this study:

- How do electricity tariff decisions made under different default settings reflect a consumer's actual/normative preference?
- What are the main policy implications for green energy defaults?

As a result, the aim of this thesis is not to establish the specific contributing factors for the observations, but only to record results and provide hypothesis from literature.

**Methods**

This study presents the results of an online experiment, in which a sample of Scottish energy deciders (n=518) were randomly allocated to one of three treatment conditions for renewable electricity (opt-in, opt-out and a neutral choice). The choices made under the hypothetical markets were then compared with the actual preferences of the participants.

**Main findings**

The results show that 42.6% chose to enrol green energy tariff under the green default setting, compared to 47.6% under the standard default and 24.2% when given an active choice. Despite the standard default being higher than the green default, this difference was not statistically significant. Although these results vary from other studies, by examining how those decisions related to the actual preferences of the participants, possible explanations were identified (details below).

A second key finding is that of those participants who stated a WTP for renewable energy, when this option was presented as the default, almost a fifth (18.9%) chose to opt-out. Although this study was not able to examine the exact reasons for such behaviour, several hypotheses are proposed. Of these, the setting of the experiment may have had a significant impact on the behaviour. UK energy consumers have very low trust in energy suppliers due to a reputation of excessive profiteering. Furthermore, many of those suppliers have a controversial history of providing premium green tariffs that offered little environmental benefits. Thus, although a consumer may be WTP for energy from renewable sources, if this is presented as a more expensive green default from an untrustworthy agent, then consumer scepticism may result in choosing an alternative.

The results of this study support the key hypothesis that the longer a participant took on the decision, the more in line their choice was with their preferences. Secondly the results suggest that the lack of trust in the perceived choice architect, resulted in the participants spending more time and effort on decisions, even when the default matches their preference. As a result, this study supports previous research that claims that when consumers are sceptical about the default, this encourages more time and effort to be allocated into the decision making, thus better matching the choices made with actual preferences.

A further finding is that over a quarter (25.9%) of those who chose to stick with a green tariff when presented as a default, were from participants who expressed that this would not be WTP for a green tariff in real life. Although without the resources to identify the exact motivations for such behaviour, there are several hypotheses including participant irrationality or unconstructed preferences. However, the results cannot overlook the identification of potential manipulation by the default setting. That those factors which make the default a powerful tool (e.g. inertia, guilt, endorsement) may be strong enough to override the actual preference of the individual. Such results have serious philosophical, phycological and socioeconomic concerns.

## Conclusion

This study aimed to increase our understanding on whether green energy defaults accurately match consumer behaviour to their preferences. The results highlight two key policy implications. First green defaults should not be seen as a panacea, and need to be accompanied by other policy measures to increase their effectiveness. Secondly, that the success of green energy defaults may work by manipulating those against their preference, with potentially serious ethical and socioeconomic implications. Both these implications need to be further investigated and researched before green defaults can be seen as a viable tool for environmental policy.

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# Abbreviations

BE - Behavioural Economics

BIT - Behavioural Insight Team

CCS - Carbon Capture and Storage

$CO_2$ - Carbon Dioxide

$CO_2e$ - Carbon Dioxide equivalent

EU - European Union

EUT - Expected Utility Theory

GHG - Greenhouse gases

LP - Libertarian Paternalism

OFGEM - Office of Gas and Electricity Markets

RCT - Randomized Control Trial

RE - Renewable energy

RES - Renewable energy sources

RP - Revealed preferences

RQ - Research questions

SP - Stated preferences

WTA - Willingness to accept

WTP - Willingness to pay

# 1 Introduction

This chapter introduces the background against which this research is conducted. The research problem which this thesis contributes to solving is defined as well as its significance explained. The objectives and guiding questions which this research aims to answer are then presented. The scope of the research is then described along with the audience for whom this work is relevant. The ethical considerations involved in conducting this research are then outlined. Finally, a disposition outlining the arrangement of the research concludes this chapter.

## 1.1 Background

The largest contributor of anthropogenic greenhouse gas (GHG) emissions is the energy supply sector[1], responsible for approximately 35% of global GHG emissions in 2010 (IPCC, 2014). Despite recent efforts to reduce the growth of GHG emissions from the sector[2], the annual growth of emissions rose from 1.7%/yr in 1990 – 2000 to 3.1%/yr in 2000 – 2010 (IPCC, 2014). This accelerated growth can be attributed mainly to rapid economic growth (subsequent higher demand for heat, power and transport) and an increased use of coal in the global energy mix. Such growth rates are predicted to continue with $CO_2$ emissions from the energy supply sector predicted to increase from 14.4 $GtCO_2$/yr in 2010 to between 24–33 $GtCO_2$/yr in 2050 (IPCC, 2014). The available supply of fossil fuels alone will not be enough to limit the concentrations of $CO_2$ to 450 ppm, 550 ppm, or 650 ppm levels[3]. Residential buildings are one of the largest consumers of energy, contributing to 24% of global final energy use in 2010 (Lucon et al., 2014). In terms of emissions, the building sector was responsible for 9.18 $GtCO_2$ eq in 2010 and made up 19% of total global emissions (Lucon et al., 2014). Most of the GHG emissions from buildings are indirect $CO_2$ emissions from electricity use (6.02 Gt), which residential contributes the majority (3.50 Gt). This represents a steady and significant rise from 0.8 Gt in 1970 and 2.11 Gt in 1990 (Lucon et al., 2014). In the European Union (EU), households contributed to 25.4% of total energy consumption in 2015 (Eurostat, 2017a). Despite recent improvements, electrical consumption by EU householders has fallen just 0.9% from 2005-2015 (Eurostat, 2017a).

Reducing the increase in GHG emissions can be achieved through various measures, such as energy efficiency improvements, fossil fuel switching and emission reductions in fuel extractions (IPCC, 2014). However, stopping the rise of GHG concentrations requires a radical transformation of the conventional energy supply systems (IPCC, 2014). A shift from coal to gas and improvements of fossil fuel power stations are not enough to stabilize the concentrations (IPCC, 2014). Such stabilization can only occur if $CO_2$ concentrations in the atmosphere peak and decline towards zero. For this to happen, low GHG energy technologies such as renewable energy are essential to achieving this (IPCC, 2014).

Decarbonizing the generation of electricity and is a vital component of mitigation strategies aimed at achieving low-stabilisation levels (430–530 ppm $CO_2$ eq), and is seen as a more cost-effective strategy which can occur more rapidly than in the construction, industry or transport sectors (IPCC, 2014). To meet low-stabilization scenarios, the share of low-carbon electricity supply needs to increase to 80% by 2050, with almost all fossil fuel generation without CCS phased out by 2100 (IPCC, 2014). Along with reduced GHG emissions, renewable energy can

[1] The energy supply sector comprises "all energy extraction, conversion, storage, transmission, and distribution processes that deliver final energy to the end-use sectors (industry, transport, and building, as well as agriculture and forestry)" (IPCC, 2014, p. 516).

[2] Such efforts include the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC).

[3] $CO_2$ concentration levels of 450, 550, or 650 ppm, correspond to respective ranges of global warming of around 1.2° to 2.3°C, 1.5° to 2.9°C, and 1.7° to 3.2°C over the next 100yrs (O'Neill & Oppenheimer, 2002).

have many co-benefits over conventional fossil fuels. These include economic benefits such as increased energy security and increased local employment (Bruckner et al., 2014). There are also social benefits such as reduced air pollution, fewer mining accidents and increased energy access. Renewable energy can also lead to further environmental benefits to ecosystems, such as reduced air and water pollution (Bruckner et al., 2014). However, RE technologies can also have adverse side-effects depending on their technology and location[4].

To combat climate change, global leaders have committed to measures to promote the generation of renewable energy. The EU has committed to a binding target of 20% of energy consumed in the EU to come from renewable sources by 2020[5]. Mandatory national targets vary depending on previous performance and feasibility, with targets ranging from 10% for Malta to a high of 49% for Sweden. For the UK the target is 15%, based on previous rates of 1.3% in 2005. To achieve the 15% target for renewable energy, the UK Renewable Energy Plan has set targets for renewable contributions in various sectors, which include 30% renewable electricity generation, 12% renewable heat and 10% renewable transport by 2020[6]. In 2016, renewable sources accounted for 24.6% of electricity, 6.2% of heat, and 4.5% of transport fuel consumption, equating to 8.9% of all energy[7]. This puts the UK 26th out of the 28 EU countries and lags behind the EU renewable electricity average of 28.8% (Eurostat, 2017b).

Looking beyond 2020 the EU has set a binding target for emissions reduction of at least 40% compared to 1990 levels by 2030. The new framework also sets out a new EU binding target of at least 27% for all energy consumed in the EU to come from renewable energy by 2030[8]. Despite the UK voting to leave the EU it is unlikely that this will reduce the UK's environmental commitment to renewable energy. Shortly after the UK voted to leave the EU, the UK government adopted the legally binding 5th Carbon Budget for the period 2028-2032[9]. Carbon budgets set a restriction on the maximum level for the total GHG emissions the UK can emit over a five-year period. The 5th budget set a target representing a 57% reduction in GHG emissions relative to 1990 levels (1,725 MtCO2e). Although the budget is lower that the Climate Change Committee's[10] 2015 recommendation of 1,765 MtCO2e, this is stricter than the EU's carbon emissions target of 40% by 2030 the UK had signed up to. The new budget is aimed to enable the UK to meet its target of 80% emission reductions compared to 1990 levels by 2050 as part of the 2008 Climate Change Act. The UK has already committed to reaching its next renewable electricity target due to the long lead in times associated with many RE technologies, with subsidy contracts and planning permission granted to many new wind farms needed to reach the 30% renewable electricity goal. However as mentioned significant investment is needed. Studies have found that investment in UK renewable energy between 2017 and 2020 is

[4] These include matching demand with supply from solar PV and wind, human displacement from large hydro, habitat impact of hydro, wildlife and landscape impacts from wind, as well as increased use of critical metals (Bruckner et al., 2014). Though many of these impacts cannot be eliminated completely, they can be minimised and mitigated through appropriate selection of RE technology, positioning of facilities and operational adjustments.

[5] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[6] National Renewable Energy Action Plan for the United Kingdom. Article 4 of the Renewable Energy Directive 2009/28/EC

[7] Digest of UK Energy Statistics (DUKES) 2016, Renewable sources of energy, Renewable sources data used to indicated progress under the 2009 EU Renewable Energy Directive.

[8] Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast) COM/2016/0767 final/2 - 2016/0382 (COD)

[9] The Carbon Budget Order 2016

[10] The Committee on Climate Change (CCC) is an UK independent, statutory body established under the Climate Change Act 2008. Its purpose is to advise both the UK and devolved Government and Parliaments on emissions targets and to report to Parliament on the progress in reducing GHG emissions as well as preparing for climate change.

set to decline by 95% (Benton, 2016). Investment in UK renewable energy fell by £1.1bn in 2016 alone, attributed not to the reduced cost of renewables but to a reduction of planned projects. This is coupled with a withdrawing of government support for many RE technologies such as onshore wind[11] and solar PV[12], raising concerns over future investments and ability for the UK to meet its targets.

### *Investment*

Renewable energy (RE) technologies have experienced significant cost reductions and performance improvements over recent years (IPCC, 2014). This has not only allowed substantial large scale deployment for renewable energy technologies but also cost competitiveness with conventional energy sources (IRENA, 2015). The levelized cost of solar PV and offshore wind has fallen dramatically in the last 10 years so that they have reached grid parity in certain situations. However, such trends have not been observed for other RE technologies. While policies aimed at driving RE have been successful, many still need direct financial support such as feed-in tariffs, quota obligations and auctioning, or from indirect support from carbon taxes and other methods to internalize externalities (IPCC, 2014).

Diaz-Rainey and Ashton (2008) mention several ways that investments in renewable electricity can be promoted. The first is through general taxation, however this is unlikely in many countries due to the political implications of raising taxes and inefficiency of subsidies. Second a universal levy on all electricity consumers. However, this is also controversial regarding conflicts with those in poverty and already struggling to pay their energy bills. Third, setting a mandated minimum limit for energy generation to come from renewable sources. However similar to previous policy, the extra costs are ultimately passed on to consumers through higher electricity rates. Finally, there are green electricity tariffs, where some or all of the electricity supplied is matched by renewable sources by the energy supplier (Diaz-Rainey & Ashton, 2008). Such tariffs are favoured as they allow consumers that can both afford and are willing to pay (WTP) a premium for renewable electricity the opportunity to choose a green energy tariff. As a result, the costs of the renewable energy generation are borne by those consumers, reducing the levy on those that either cannot afford, or do not want a green tariff (Diaz-Rainey & Ashton, 2008). Furthermore, in a liberalized market, competition between suppliers can keep the costs competitive for consumers.

### *Green electricity tariffs*

The green electricity tariff is an attractive option as studies have shown that consumers have a significant willingness to pay a premium for renewable electricity in a number of countries (Table 1), with surveys showing that between 50-90% of respondents are willing to pay a premium for RE (Pichert and Katsikopoulos, 2008; Kaenzig et al., 2013). Diaz-Rainey and Ashton (2008) carried out a survey in the UK in 2003 and found that 42% of participants would be willing to pay 5-10% more for green electricity from renewable sources. This is similar to an earlier survey by Batley et al. (2000) which found that for those who identified as being environmentally aware, 35.9% would be willing to pay extra for energy from renewable sources, with an average premium of 19.1%.

[11]Written statement to Parliament. Ending new subsidies for onshore wind (2015). https://www.gov.uk/government/speeches/ending-new-subsidies-for-onshore-wind

[12]Press release. Controlling the cost of renewable energy (2015). https://www.gov.uk/government/news/controlling-the-cost-of-renewable-energy

*Table 1 Studies finding positive WTP for renewable energy*

| Country | Author (year) | Country | Author (year) |
|---|---|---|---|
| Australia | Ivanova (2013) | Japan | Nomura and Akai (2004) |
| Canada | Rowlands et al. (2003) | Norway | Navrud and Brate (2007) |
| Chile | Aravena et al. (2012) | Slovenia | Zoric and Hrovatin (2012) |
| China | Guo et al. (2014) | South Africa | Oliver et al. (2011); Chan et al. (2012) |
| China | Zhang and Wu (2012) | South Korea | Yoo and Kwak (2009); Kim et al. (2012); Lee and Heo (2016) |
| Finland | Kosenius and Ollikainen (2012) | Spain | Solino et al. (2009); Hanemann et al. (2011); Gracia et al. (2012) |
| Germany | Pichert and Katsikopoulos. (2008); Kaenzig et al. (2013) | Sweden | Hansla et al. (2008) |
| Greece | Zografakis et al. (2010); Kontogianni et al. (2013) | UK | Batley et al. (2000); MacMillan et al. (2006); Diaz-Rainey and Ashton (2008); Longo et al. (2008); Scarpa and Willis (2010) |
| Italy | Bollino (2009); Cicia et al. (2012); Bigerna and Polinori (2014) | US | Borchers et al. (2007); Duffy et al. (2007); Whitehead and Cherry (2007); Li et al. (2009) Komarek et al. (2011); Mozumder et al. (2011) Susaeta et al. (2011); Aldy et al. (2012) |

However, this willingness rarely translates into uptake. Although actual figures on the market share of green electricity is not available for the UK, Diaz-Rainey and Ashton (2008) find that the results from their survey indicated the UK green energy market figures at only around 0.3%. This is similar to earlier UK studies such as Bately et al. (2000), which reported similar market shares (0.5%). In more recent studies, Hast et al. (2014) estimate the uptake of green tariffs in the UK was less than 1% in 2011. Similar low enrolments have been found in other countries offering green tariffs, including Finland (0.4%), Switzerland (2%), Australia (1%), and 2.8% in the US (Bird et al., 2001; Hetter & Nicholas, 2013).

In the UK, this gap between WTP and actual behaviour has had a significant effect. Previously many of the major UK energy suppliers offered a green tariff in one form or another (Graham, 2006). However, by 2015 all the major energy companies had abandoned their green electricity tariffs (Bawden, 2015). This coincided with UK legislation limiting the number of tariff offerings to four (OFGEM, 2014a). Although the UK energy regulator stated that this was not itself a ban on green tariffs (OFGEM, 2013), considering the low uptake it was not surprising the green tariffs were dropped. As those major energy companies currently make up 85% of the market share (OFGEM, 2015), current availability of green tariff is limited to smaller specialist suppliers (OFGEM, 2016) whose premiums in most cases are significantly greater than those that were offered by the major companies (Graham, 2006; GreenElectricityMarketplace). Therefore the lack of green tariffs currently offered by the major suppliers can be seen as a potentially significant barrier to green energy uptake.

## 1.2 Problem definition

In order to address the perceived market gap between willingness and actual uptake, several studies have examined the effect of having the green energy supply as the automatic default given to the consumer. A default can be defined as *"the alternative the consumer receives if he/she does not explicitly request otherwise"* (Brown and Krishna, 2004, p. 530). Thus, in the context of renewable energy, a green energy default is when the automatic tariff provided to the consumer is supplied from a greater share of renewable electricity than the standard tariff (more details of

defaults and green tariffs can be found in chapter 2). Such studies into green energy defaults have all reported high enrolment figures in green energy when presented as the default, ranging from 39 to 69% (Pichert & Katsikopoulos, 2008; Momsen & Stoerk, 2014; Hedlin & Sunstein, 2015; Ebeling & Lotz, 2015; Vetter & Kutzner, 2016;). As a result, green energy defaults are becoming an increasing focus of attention from policy makers and organisations interested in promoting the uptake of green electricity (Carlsson & Johansson-Stenman, 2012).

However, what has not been examined in scientific literature is whether the greater enrolment in a green default is from the same individuals who have expressed a WTP for green energy. In other words, under a green default scenario, do all of those who expressed a WTP stick with the green default, and secondly are there any who stick with the green default even though it is not their preference? In short, does a green energy default accurately classify individuals according to their actual preferences?

Such concerns regarding the effect of defaults were first raised by Johnson and Goldstein (2003) in arguably the most well-known study into default effects, that on automatic enrolment for organ donation. Although not examined in the scope of their study, they highlight that defaults can lead to two types of misclassification; willing donors that are not identified and those that become organ donors against their wishes. Johnson and Goldstein (2003) state that balancing these errors leads to delicate ethical and psychological questions about the default effect. They highlight the need for further research into the role of workings of the defaults and their influences. Such ethical concerns are also highlighted by Brown and Krishna (2004), who state that the default has attracted a lot of interest from the public-policy sector due to concerns it can be made to cause consumers to unintentionally deviate from their true preferences depending on the default setting.

Knowing whether green energy defaults accurately classify consumers to their preferences is critical if such defaults continue to be promoted and are implemented in actual electricity markets. As green energy tariffs are in most cases more expensive than the standard offering (Hast et al., 2014), policy evaluation is needed so policy makers have better information about expected outcomes and (potential) adverse effects. With many energy users (even in the Western world) living below the poverty line and struggling to pay energy bills (Pye et al., 2015), policy makers would want evidence to show that green defaults work effectively by enrolling those who have expressed a preference towards paying for a premium green tariff. If the effectiveness from green energy defaults instead comes from recruiting those that cannot afford, are unaware, or are influenced against their preference, serious ethical issues may arise. Secondly, if there are still consumers who are WTP for green energy but choose to opt-out of a green tariff, identifying and examining the reasons behind such behaviour would be key for policy makers to increase the effectiveness of such green defaults.

## 1.3 Objective and Research Questions

The aim of this thesis is to increase our understanding on how green energy defaults work, primarily by identifying how decisions made under default treatments match the actual preference of the consumer. In particular, emphasis is placed on the green default tariff. The research was conducted in Scotland for a number of reasons. First, there was no language barrier, as well as an existing knowledge of the local energy market. Secondly, Scotland has one of the highest proportion of internet users in Europe, therefore increasing the validity for the use of online survey experiments. Furthermore, the sample size required for Scotland matched the resources of this thesis. Finally, as part of the UK, Scotland has a liberalized energy market similar to many other countries, increasing the external validity of the study.

To that end, an online survey experiment of Scottish energy decision makers (n=518) was condicted. Participants were randomly assigned to one of three experimental conditions, green default, standard default or active choice. Participants were then asked whether their electricity tariff in real life was green or standard and, if not already green, would they like a green tariff at a premium. Finally for those participants who stated they would not like a green energy tariff in real life, they were asked to provide the main reasons.

The structure of the experimental conditions was designed to reflect real life markets without being too specific to a Scottish context that it would reduce the external validity of the findings. As a result, the findings may be applicable to other countries with similar liberalized energy markets. However as discussed in the findings, the results may be influenced by the low trust and previous controversial experience of green electricity in the UK energy supply sector, which could limit generalizability. The experimental design is in line with similar studies to allow for comparison. However, emphasis was placed on real world setting and representative market prices. The data was collected through an online panel, however there are various methodological challenges related to this approach, which are discussed in more detail in chapter 5.6.

The following research questions guide this research:

- RQ 1. How do electricity tariff decisions made under different default settings reflect a consumer's actual/normative preference?

- RQ 2. What are the main policy implications for green energy defaults?

As a result, the aim of this thesis is not to establish the specific contributing factors for the observations, but only to record results and provide hypothesis from literature. As most other studies on green energy defaults have been from largely hypothetical market settings or from participants not representative of the population, by examining energy decision makers specifically, and in a different setting to other experiments, it is expected the results to deviate somewhat from previous studies.

## 1.4 Scope

The participants for the online survey came from a panel of the Scottish population. The study was designed to reflect a real-world market scenario and energy prices. However the survey design was not designed to be so specific to the Scottish context that it reduced the external validity. The study is only examining electricity from renewable sources and not other forms of renewable energy. The data was collected via an online survey conducted over one week in July 2017. The timing of the data collection is not expected to have influenced the results. The participants were Scottish householders and members of an online panel company, who was hired to gather the data. The data only includes those participants who identified themselves as responsible for the energy decisions in their household. As no data exists or is available on the demographics of Scottish energy customers, it is unclear how representative the sample is of the target population. The research data was from an online randomised control experiment, followed up by questions regarding revealed preferences. The sample size is large enough for the effect size observed (see methodology).

It is not within the scope of this thesis to test for specific causations of the observations. Such testing is complex and requires greater resources than this thesis had access to. However, the thesis will suggest and provide hypotheses on potential contributing factors in accordance with relevant literature. This will give the grounds for further research.

## 1.5 Audience

This research is primarily intended for *energy policy makers* considering the use of green energy defaults. Given the design of the experiment, the results are applicable to not only policy makers in the UK, but also in other countries with similar liberalized residential energy markets. The results will not only add to existing research on potential enrolment from a green default, but will highlight key policy implications previously unstudied. By examining how green defaults classify consumers according to their preferences, this research will highlight any potential ethical issues that green defaults may produce. By highlighting such issues, this will serve as to inform how policy makers can design a green energy default that is both effective and fair.

Secondly *academics and researchers* can benefit from the findings of this thesis as it serves to assess whether the current practice of assessing the performance of green energy defaults on total enrolment is a viable indicator of their success. Results from this thesis could justify that approach or call for a new assessment method. Furthermore, by examining such behaviour can generate new avenues of future research.

Lastly, the results of this study can be of benefit to *energy suppliers*. Energy suppliers considering introducing voluntary green energy defaults, can like policy makers, use these results to better design such initiatives. Secondly, even if not considering green defaults, the results still provide valuable information regarding the current demand, WTP, and attitudes towards for green electricity tariffs.

## 1.6 Ethical considerations

The ethical considerations can be split into two parts. First the ethics involved in conducting online survey experiments. Consent by participants to be in the survey can be established through their voluntary membership of the panel provider and were free to choose whether to take part in the survey or not. A brief description of the survey was provided so that participants could decide whether they wished to participate or not. Participants were free to withdraw from the survey at any time. All participants were 18 or over. All participants were anonymous, this was stated at the beginning of the survey. Although a response ID was recorded, there was no way of identifying the individual participant from this ID. No identifying or sensitive data was recorded (i.e. name, home address, phone, email address or IP address). The funding source for the research is clearly stated in the acknowledgements. The full survey is provided in the appendix including the exact wording and sequencing of questions. A description of how the sample size was calculated, selected and the location and date of data collection are all provided.

The second ethical consideration regards the concept of the subject of the thesis, nudging (an agent aiming to influence an individual's preference through changing how a decision is framed or presented). There is a growing debate regarding the ethics of default settings in policy making which are discussed in more detail in chapter 2.

## 1.7 Disposition

This paper is organised as follows: Chapter 2 provides a background to behavioural economics and its use in policy, as well as a description of the key theories guiding this research. Furthermore a review of the existing research in this area which set this thesis in context with other studies is provided. Finally, an overview of the key ethical considerations regarding the topic under analysis is provided. Chapter 3 describes the experimental design used in this study and the research methods for data collection and analysis. Chapter 4 presents the main results of the research. Chapter 5 discusses the findings in relation to the research questions and other research. Hypothesis of the results observed are presented in relation to current theory and

knowledge. Finally, chapter 6 summarizes the main findings of this research and its implications for both academia and policy makers, ending with avenues for further research.

# 2 Conceptual Framework

This chapter first introduces the principal theoretical premise and concepts that guide this study. Then it shows how those theories and concepts, along with others, are applied to environmental policy making. A review of published studies on the subject is then presented. Finally, a brief overview of the main ethical considerations of using such policy tools are presented.

## 2.1 Behavioural Economics

Neoclassical economics has long been the dominant force in economic theory, assuming that individuals make rational decisions acting in their own self-interest. Behavioural economics (BE) is a relatively new and growing field of modern economics (Thaler, 2015), which contrasts neoclassical economic theory using phycological insights into human behaviour to better explain economic decision-making[13]. Carlsson and Johansson-Stenman (2012) state three key assertions of BE:

1. Human behaviour can be influenced by perceived fairness and social norms, as a result personal behaviour is not motivated by utility maximisation alone.
2. People act in a social context; an individual's behaviour is motivated through issues such as social status and approval by others.
3. Individuals have cognitive limitations and abilities, which can result in irrational decision making.

The remainder of this chapter will provide more detail of these key concepts of behavioural economics related to this study, before later describing how they are applied in public policy.

### *Bounded Rationality*

An adoption of neoclassical economics is rational choice theory, which states that individual choices and preferences are based on the assumption that individuals are rational choosers (von Neumann & Morgenstern, 1944). Rational choice theory states that individuals have clear preferences that are unaffected by how alternatives are framed or described. Furthermore, that individuals have access to all available information regarding the costs and benefits of each alternative. Based on this, individuals can compare the utility of all available alternatives and will choose based on the option that maximises their utility.

However, many studies have shown that human behaviour repeatedly violates the principals of RCT, most notably the works of Nobel prizing winning Daniel Kahnemann and Amos Tversky (Tversky, 1969; Tversky & Kahneman, 1981; Kahneman & Tversky, 1979; 84; Kahneman et al., 1991; Kahneman, 2003; Tversky & Shafir, 1992). Their research built on the earlier work of another Nobel prize winner, Herbet Simon, who in the 1950s argued that due to the cognitive limitations in processing information and the complexity of the environment, utility maximising is almost always unrealistic (1955; 56). This led Simon to coin and define the theory of bounded rationality (1955; 57; 79). In Simon's theory of bounded rationality there are two factors, one

[13] For a more complete definition, Herbet Simon in his 1982 book, Models of Bounded Rationality: Empirically grounded economic reason, states that "Behavioural economics is concerned with the empirical validity of these neoclassical assumptions about human behaviour and, where they prove invalid, with discovering the empirical laws that describe behaviour correctly and as accurately as possible. As a second item on its agenda, behavioural economics is concerned with drawing out the implications, for the operation of the economic system and its institutions and for the public policy, of departures of actual behaviour from the neoclassical assumptions. A third item on its agenda is to supply empirical evidence about the shape and content of the utility function (or of whatever construct will replace it in a empirically valid behavioural theory) so as to strengthen the predictions that can be made about human economic behaviour. Thus, behavioural economics is best characterized not as a single specific theory but as a commitment to empirical testing of the neoclassical assumptions of human behaviour and to modifying economic theory on the basis of what is found in the testing process" (p. 278)

cognitive and the other ecological; *"Human rational behaviour is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor"* (Simon, 1990, p. 7).

One of the main consequences of the theory of bounded rationality is satisficing behaviour. Originally proposed by Simon (1956), it claims that decision makers satisfice (a combination of satisfy and suffice), stating that *"organisms adapt well enough to 'satisfice'; they do not, in general, "optimise""* (p. 129). Therefore, individuals can satisfy a number of specific needs without elaborate decision-making mechanisms such as utility functions or calculations for marginal rates of substitution[14]. Satisficing claims that individuals have limited information, time and computational abilities, and therefore when a search finds the first alternative which meets or exceeds the conditions of the search, the search is stopped and the action for that condition will be performed. As a result, satisficing results in decision making which is "good enough", as opposed to the outcome with the maximum benefits[15].

Simon suggests that under the satisficing approach individuals use heuristics to aid the choice of alternatives (Simon, 1972). Heuristics are cognitive strategies that use mental shortcuts to simplify decision making. When individuals are making decisions under uncertainty they apply heuristics, with associated cognitive bias (Tversky & Kahneman, 1973;74). Tversky and Kahneman (1974) conclude by stating that *"these heuristics are highly economical and usually effective, but they lead to systematic and predictable errors"* (p. 1131). However certain authors (most notably Gerd Gigerenzer) have argued more in favour of heuristics (Gigerenzer & Selten, 2002; Gigerenzer, 2008). Gigerenzer has argued that heuristics are not always irrational and that one-reason making heuristics[16] used in such satisficing behaviour can in certain situations outperform the classical rationality (Gigerenzer & Goldstein, 1996)[17].

### *Prospect Theory*

In their seminal paper, Kahneman and Tversky (1979) develop a descriptive model and technique for decision making under risk which they called Prospect Theory. This explained some of the major violations of the previous expected utility theory (EUT) as a model for decision making under risk. EUT had previously dominated as the descriptive model for decision making under uncertainty. Tversky and Kahneman (1992) later developed a newer version of prospect theory, called cumulative prospect theory. This incorporates the cumulative functional also incorporate uncertain as well as risky prospects.

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[14] The utility function ranks alternatives according to both the welfare and preferences of an individual, while the marginal rate of substation is the rate at which an individual can exchange one good for another without diminishing the level of utility.

[15] However, utility maximising behaviour can have downsides as those who maximise can be less satisfied than those non-maximisers (satisficers) with consumer decisions, as well as negative correlations between maximization and optimism, happiness, self-esteem and life satisfaction. (Schwartz et al, 2002)

[16] "*One-reason decision making" is a label for a class of fast and frugal heuristics that base decisions on only one reason. These heuristics do not attempt to optimally fit parameters to a given environment; rather, they have simple structural features and "bet" that the environment will fit them*." Gigerenzer et al. (2008)

[17] Indeed, Gerd Gigerenzer presents a negative view of behavioural economic in general, stating that *"Despite producing prolific documentation of deviations from neoclassical norms, behavioural economics has produced almost no evidence that deviations are correlated with lower earnings, lower happiness, impaired health, inaccurate beliefs, or shorter lives."* (Berg & Gigerenzer, 2010)

In prospect theory, value is assigned to the gains or losses, as opposed to the final assets. There are three key elements of the value function of prospect theory:

1) **Reference dependence**. The value function is defined through deviations from the reference point.
2) **Diminishing sensitivity**. The curve is concave for gains and convex for losses. Hence the marginal value of both gains and losses decreases as their size increases. The impact of a change diminishes the further the distance from the reference point.
3) **Loss aversion.** The slope of the value function at the origin is significantly steeper in the negative domain than in the positive domain. As a result, losses loom larger than corresponding gains.

As a result, the value function of prospect implies an asymmetrical S shape curve, as depicted in Figure 1 below;

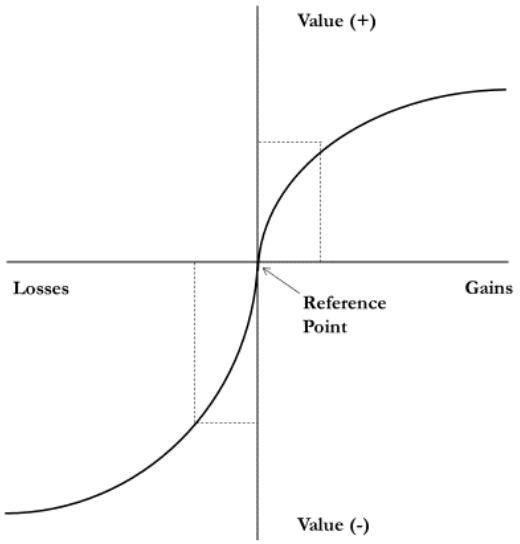


*Figure 1 Value function in prospected theory*

*Source: adapted from Kahneman and Tversky (1979)*

### *Loss aversion*

As mentioned, loss aversion was first formalised in prospect theory. Individuals deviate from EUT by interpreting outcomes as gains and losses in relevance to a reference point, as well being more sensitive to losses than corresponding gains. This leads to a basic phenomenon that choice under risk and uncertainty results in losses looming larger than corresponding gains (Kahneman and Tversky, 1984; Tversky and Kahneman; 1991). This has been found to account for differences of up to 2 :1 (Tversky and Kahneman, 1991). As preferences are dependent on how the outcomes are framed, this violates the key conditions of utility theory (Samuelson & Zeckhauser, 1988). Loss aversion has been found in a range of field data (Camerer, 2000) including housing markets (Genesove & Mayer, 2001) and investment decisions (Barberis et al., 2001). These risks, costs or losses can be not only financial, but also social, environmental and time (Frederiks et al., 2015). Loss aversion implies a status quo bias and can help produce inertia (Thaler & Sunstein, 2008, p. 37). However as discussed later, the bias towards the status quo can be induced in the absence of loss aversion.

### Endowment effect

Classical economic theory assumes that (when income effects are small and no transaction costs), differences between an individual's maximum willingness to pay (WTP) for a good and their minimum compensation or willingness to accept (WTA) should be negligible. However, studies have shown discrepancies observed between WTA and WTP, that the minimum compensation an individual demands to give up a good can be several times greater than the maximum amount they are WTP (Knetsh & Siden, 1984). This increased value of a good through ownership was defined by Thaler (1980) who labelled this discrepancy as the 'endowment effect'. The endowment effect is a key consequence of loss aversion in that the associated utility of giving up a good is greater than the utility gained by receiving it (Tversky & Kahneman, 1979; 91).

Responding to earlier studies that reported that the endowment effect can be diminished with experience (Coursey et al., 1987), Kahneman et al. (1990) examined whether the endowment effect still occurs in market settings when consumers have the chance to learn. Not only did they show that the endowment effect still occurs, but they also find evidence of what they term 'instant endowment', that the consumer's reference point is shifted instantaneously when given possession of a good. This based on previous work which had only looked at goods that had been in possession for a lengthy period of time.

However, although endowment can have a significant effect, studies have shown that other factors such as market experience or knowledge can reduce the endowment effect (List, 2003; Löfgren et al., 2012). However, as Kahneman et al. (1990) state, endowment effects and loss aversion are fundamental characteristics of human behaviour and cannot be truly eliminated by experience or market discipline.

### Status Quo Bias

Loss aversion and the endowment effect can influence inertia, however they are not the only factors. First termed by Samuelson and Zeckhauser (1988), the status quo bias hypothesises that decision makers exhibit a significant preference for the status quo alternative. Samuelson and Zeckhauser show how the status quo bias can be explained through three main categories; (1) rational decision making; (2) cognitive misconceptions; and (3) psychological commitment.

1) It is important to note that sticking with the status quo can be explained as rational decision making in many situations (Samuelson and Zeckhauser, 1988). First, where the switch from the status quo occurs costs that exceed the potential gain from a more beneficial alternative. These transaction costs can occur in many ways. On a social level, the economic costs of switching to more productive practices can outweigh the alternative benefits. Examples include switching from the imperial to metric systems. Private transaction can also occur if an economic transaction leads to an investment that cannot be fully reversed (Samuelson and Zeckhauser, 1988). For example, if an employee had to undergo substantial training unique for that specific position/company, then both the employee and employer would be linked in irreversible mutual investment.

When the possible alternatives in the decisions making process are uncertain or unknown, then prevalence to the status quo can also occur. Samuelson and Zeckhauser (1988) use the example that an individual will remain at a low paying job if the process of finding a better paid one is uncertain. Uncertainty also exists in the utility derived from the alternative. As long as the choice provides an adequate level of utility and proves reliable, then individuals will remain loyal even if potentially more optimal alternatives exist. For example, the utility that a new holiday destination provides can be seen as uncertain; therefor individuals will instead accept certain

negative aspects of a previous destination and keep returning year on year as long as meets a certain level of utility.

Choosing to undertake an analysis to determine whether to switch from the status quo can be seen as a decision itself (Samuelson and Zeckhauser, 1988). As a result, if the cost of the decision analysis is deemed high, an individual may not make the decision analysis every time, but once or infrequently and refer back to that result in subsequent situations (except in the event of substantial changes). For example, an individual may refrain from making a new decision analysis, referring back to a previous decision outcome even if they cannot remember the exact details or why they ended up with that result.

These experiments by Samuelson and Zeckhauser (1988) proved that there are other factors influencing results in the absence of transaction costs or uncertainty. Samuelson and Zeckhauser (1988) conclude that unless participants were themselves adding these factors into the decisions in the experiment, then the rational decision choice cannot explain the status quo effects observed.

2) Loss aversion can play a key role in determining that individuals remain with the status quo. If the individual takes the status quo as the reference point then the potential losses from switching loom larger than the potential gains. As a result, the findings of status quo bias run in parallel to those of loss aversion. However, there is a key difference between the status quo bias and loss aversion. Through a series of experiments Samuelson and Zeckhauser (1998) show how the status quo bias exists in the absence of any explicit gain or loss framing effects, for example with car colour. The participants were asked to imagine they have put themselves on a waiting list for a car that is in high demand. As a result, they have decided to accept any colour the car comes in. They are told that a car has arrived in a certain colour however once arriving they are told that cars in other colours have also just arrived, however despite new options available, they still stick with the original colour. They conclude that the status quo bias is, although consistent with loss aversion, not solely prompted by it.

3) Samuelson and Zeckhauser (1988) highlight several other factors influencing the status quo bias, including sunk costs, regret avoidance (Kahneman and Tversky, 1982), drive for consistency and control. However as none of these are deemed to have significant role for this thesis, they are not discussed here. In summary, the status quo bias is pervasive and deviates from the theories of rational choice. Although parallel to loss aversion, there are several factors including, transaction costs, cost of information processing and phycological commitments to previous choices that induce a status quo bias in the absence of loss aversion.

## 2.2 BE policy implications

Although the potential use of behavioural phycology in economic decision making isn't a new concept (Simon, 1959), governments and institutions have recently become increasingly interested in the use behavioural economics in policy. The UK was the first country to formally recognise the role behavioural economics in policy through the establishment of the Behavioural Insights Team (BIT). Since its establishment in 2010, the BIT has led to significant improvements in employment, healthcare, energy conservation and other areas (Halpern, 2015). The BIT have identified interventions which are estimated to save at least £300m, resulting in savings of around 22 times the cost of the BIT (UK Government, 2012). Behavioural economics has also been of interest to the UK energy market regulator OFGEM (OFGEM, 2011) and used to justify new energy policy (OFGEM, 2013). The BIT has been seen as a model for other countries including the US, which in 2014 launched the Social and Behavioural Sciences Team. In 2015 President Obama formally accepted BE by signing the Executive Order 'Using

Behavioural Science Insights to Better Serve the American People'[18]. The executive order encouraged executive departments and agencies to identify where behavioural science can be most effective in improving public welfare and develop strategies to apply those insights into programs. Other notable behavioural policy units include Australia's Behavioural Insights Unit[19] and Denmark's Mind Lab[20].

According to Whitehead et al. (2013), 136 countries have used behavioural sciences in some part of public policy, with 51 having developed policy initiatives directly influenced by the new behavioural sciences. Furthermore, behavioural insights in public policy has been of interest to the EU (European Commission, 2010; 2012) and major organisations such as the OECD (OECD, 2017a; 2017b). This increase of behavioural informed initiatives has produced what some refer to as 'the rise of the phycological state' (Jones et al., 2013).

### *Nudging, choice architecture and the default*

Nudging is one of the key concepts in behavioural science[21]. The concept of a nudge comes from the seminal book by Thaler and Sunstein (2008). Although the exact definition of a nudge is debated (Hansen, 2016)[22], Thaler and Sunstein (2008, p. 6) define a nudge in this context as;

> *"any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting the fruit at eye level counts as a nudge. Banning junk food does not.".*

Thus, a nudge can be any element of the environment in which decisions are made that influences peoples choices, without restricting options (Thaler and Sunstein, 2008). The definition also defined the term 'choice architecture', where the choice architect has the *"responsibility for organizing the context in which people make decisions"* (2008, pp. 3). Thaler and Sunstein use of the fictional example of Carolyn, a cafeteria director at a local school. She has the responsibility of arranging how food options are displayed. Carolyn also knows that how the food is displayed, either randomly or intentionally, can be a usefully tool to either maximise profits or increase healthy choices. Carolyn and other choice architects set the background conditions against which people make their choices. Sunstein (2015a) argues that such choice architecture is inevitable and cannot be avoided. Therefor choice architects can use nudges to promote behaviour that is personally or socially desirable.

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[18] Executive Order -- Using Behavioral Science Insights to Better Serve the American People (2015)

[19] http://bi.dpc.nsw.gov.au/

[20] http://mind-lab.dk/en/

[21] Behavioural economics and nudges are not the same, one is a scientific principle the other a way to apply its principles to policy (Lunn, 2014).

[22] Hansen (2016) provides an ulterior definition *"A nudge is a function of (1) any attempt at influencing people's judgment, choice or behaviour in a predictable way (1) that is made possible because of cognitive boundaries, biases, routines and habits in individual and social decision-making posing barriers for people to perform rationally in their own declared self-interests and which (2) works by making use of those boundaries, biases, routines, and habits as integral parts of such attempts"* (p. 4).

As a result, a green nudge can be defined as a nudge that gently promotes environmental behaviour, with Schubert (2017) differentiating the following 3 types of green nudge;

1. "*Green nudges that capitalize on consumers' desire to maintain an attractive self-image through 'green' behaviour, by either simplifying product information or by making certain product characteristics more salient*
2. *Green nudges that exploit people's inclination to 'follow the herd', i.e. to imitate the behaviour of their peers; this can be done, e.g., by conveying certain social norms through peer comparison. It can also be done by stimulating social status competition through, e.g., encouraging consumers to signal green behaviour to others.*
3. *Green nudges that exploit the behavioural effects of purposefully set defaults that stipulate what happens if people don't actively choose"* (p. 331).

As highlighted above, the default setting is one example of a nudge that exploits the behavioural effects previously discussed. Brown and Krishna (2004) define a default as *"the alternative the consumer receives if he/she does not explicitly request otherwise"* (p. 530). Therefore, green energy defaults refer to where the automatic energy tariff provided to the consumer is supplied from a greater share of renewable energy than the other available alternatives. The default is a useful tool of the choice architect (Thaler 1980; Thaler & Sunstein, 2008) as despite not limiting a consumer's choices, the default has been found to have a large effect, in some cases even greater the than financial incentives (Chetty et al., 2012).

### *Why defaults work*

The BE concepts and theories discussed previously in section 2.1 all contribute to the default effect;

*Satisficing* behaviour by consumers may lead to defaults being used as heuristics to reduce the cognitive effort in decision making (Johnsen et al., 2002). If the default is presented to the consumer prior to other choices, and if it matches or exceeds the values the consumer is searching for, then the consumer will not search for other alternatives and stick with the default.

The default rule is key to *loss aversion* as the default is seen as the reference point, thus the default determines what is a gain and what is a loss. As a result, although the actual financial value is the same, the loss occurred by switching from standard to green energy (paying more) outweighs the gains of switching from green to standard (paying less). Therefore, those individuals whose feeling/value/utility is within the values of the difference are the ones most affected by the default rule for loss aversion.

The *endowment effect* has significant relevance to the effects of defaults. The endowment effect is closely related as the default is what the individual is endowed with, and as shown can occur instantaneously (Dinner et al., 2011). Although most commonly associated with goods, the endowment effect can be applied to the provision of services, such as green energy defaults (Pichert and Katsikopoulos, 2008). As a result, an individual will value the default more than other alternatives, making it more likely to remain with the default option.

The *status quo bias* can have a significant effect on the power of defaults. Decision makers may stick to the default or even defer making the decision entirely (inertia). This is especially true if the decision is technical, difficult or morally charged (Sunstein & Reisch, 2013). As a green energy decision can be seen as complex, involving trade-offs between environmental and economic goods, decision makers may instead defer such decision making and decide to stick with the status quo. Indeed the status quo bias has been found to have a significant effect in consumer valuation of electricity services (Hartman et al., 1991; Brennan, 2007).

However, the default effect is also influenced by several other factors, including endorsement, social norms and guilt. A brief overview and their relevance to the default will be discussed below.

### Endorsement

Decision makers may stick with the default if they infer that the default was selected by the choice architect for a good reason (unless in possession with information supporting an alternative). The consumer therefore sees the default as an implicit recommendation from the choice architect (Sunstein & Reisch, 2013). McKenzie et al. (2006) showed through a number of experiments regarding organ donation and retirement plans, that individuals perceived the default as the implicit recommendation of the policy maker. Furthermore, they show that the implicit recommendation of the default had an effect on the decision of individuals. In a study into retirement plans, Brown et al. (2011) found that 20% of individuals stuck with the default, as they perceived it to be an endorsement from their employer. Furthermore, they found a significant positive correlation between those defaulting due to perceived endorsement and those who defaulted because of the decision being too complex. As a result, a combination of the endorsement effect and decision complexity could increase the strength of the default. Tannebaum and Ditto (2012) found similar results, showing that individuals are more likely to perceive endorsement when the default is an automatic enrolment default. When the default is a non-enrolment, an individual is less likely to perceive that it was chosen for a specific reason.

As highlighted, implicit endorsement can be both identified by consumers and found to influence their behaviour. A key contributing factor to the influence of implicit endorsement by the default is the level of trust the individual has for the choice architect. If the consumer has low levels of trust in the choice architect, then this can reduce the default and even cause backlash (more on this in 2.3.4 Reactance).

### Social Norms

Thaler and Sunstein (2003) propose that individuals could interpret that the option chosen as the default has been selected because it is the most common choice. This is backed up by Everett et al. (2015), who found that the default choice was perceived by individuals as the socially normative option[23]. There have been a number of studies examining the role of social norms in pro-environmental behaviour. Nolan et al. (2008) found that normative social influence led to increased energy conservation more than standard information campaigns, such as financial savings, environmental benefits or social responsibility. This was despite participants identifying the descriptive norm as having the least impact. These results are similar to Goldenstein et al. (2007) who found that the participation of guests in a hotel's linen-reuse programme was greater with descriptive norms than environmental or social responsibility appeals. The impact of social norms was also examined by Alcott (2011) who found that when the electricity use of neighbours was provided for comparison, energy consumption was reduced by 2%. Schultz et al. (2007) found a similar effect with high energy users, but also a boomerang effect with low energy users. However, they found that injunctive norms eliminated this boomerang effect. Injunctive norms specify what should be done, as opposed to what is done, through morally approved and disapproved social conduct (Cialdini et al., 1990). Costa and Kahn (2010) show that the boomerang effect can depend on political ideologies, with low energy conservatives more likely to increase their consumption if informed that they are lower than their neighbours, while political liberals decrease their consumption. Cialdini (2003) highlights how negative social norms (i.e. informing how many others are undertaking socially unacceptable behaviour) can

[23] Cialdini and Trost (1998) define social norms as *"rules and standards that are understood by members of a group, and that guide and/or constrain social behaviour without the force of laws"* (p. 152).

cause this boomerang effect, and as such descriptive norms need to be accompanied with injunctive norms.

### *Guilt*

Guilt can be a motivator of pro-environmental behaviour through the anticipated negative effect motivating individuals to act in line with their subjective norms (theory of planned behaviour (Ajzen, 1991)) or personal norms (Norm Activation Model (Schwartz, 1977)).

The theory of planned behaviour (TPB) states there are three independent determinants of intention (Ajzen, 1991). These are the attitude toward the specific behaviour (how favourable or unfavourable the evaluation or appraisal of the behaviour is), subjective norms (the perceived social pressure to either perform or not to perform the behaviour) and the degree of perceived behavioural control (the perceived level of ease or difficulty of performing the behaviour based on past experiences and anticipated obstacles). In most cases, an individual is more likely to perform a behaviour when the attitude and subject norm are more favourable and there is greater perceived behavioural control. However, the relative importance of each determinant varies depending on situations and behaviours. Therefore, as Ajzen states *"in some applications it may be found that only attitudes have a significant impact on intentions, in others that attitudes and perceived behavioural control are sufficient to account for intentions, and in still others that all three predictors make independent contributions"* (p. 188). Using the TPB, studies have found that moral attitude and subjective norms influence pro-environmental behaviour for organic food purchase (Arvola et al., 2008) and engagement in environmental activism (Fielding et al., 2008), however the moral norm was not found for recycling (Tonglet et al., 2004), while moral attitude, and not subjective norms, was found to influence energy conservation behaviour (Macovei, 2015).

The Norm Activation Model (NAM) developed by Schwartz (1997) explains both altruistic and pro-environmental behaviour. The theoretical model explains why individuals often fail to act. NAM is based on two determinates of personal norms a) the awareness of the consequences of performing (or not performing) the activity and b) is the responsibility felt by performing the behaviour. Thus, violation of an individual's own personal norms can invoke negative emotions such as guilt. However, as Thøgersen (2006) state, personal norms cannot be represented as guilt alone. The anticipated guilt and negative moral emotions can cause individuals to act in line with pro-environmental personal norms (Mallet, 2012; Onwezen et al., 2013, Rees & Bamberg, 2014; Rees et al., 2015). However, using guilt in environmental issues can backfire and that framing around moral emotions can evoke a defensive emotional focus and avoidance of the topic (Täuber & Van Zomeren, 2013). As a result, for those who recognise the need to undertake pro-environmental behaviour, guilt can be a significant motivator. However, for those individuals that have not accepted responsibility for environmental actions, Bedford et al. (2011) argue that the motivations should be more extrinsic, such as shame or financial penalties.

With regards to green default studies, Theotokis and Manganari (2014) showed that increased anticipated guilt in opt-out policies resulted in a higher enrolment than with opt-in. In their first study, participants were faced with an opt-in and opt-out policy for towel reuse in a hypothetical hotel. In the opt-in condition, they had to leave a card informing the hotel not to replace their towels that day. In the opt-out, they had to leave a card informing the hotel to replace their towels that day (instead of every three days). They found that the likelihood of reusing towels was influenced by both the default policy, with the opt-out condition producing a higher participation rate than the opt-in. Furthermore, they found that higher environmental consciousness of the participant the greater the likelihood of participation in the program. Finally, they showed that defaults had more effect with those with lower environmental consciousness. In their second study, they test their hypothesis that active choosing will lead to increased enrolment in electronic bank statements, as consumers need to think in order to make

such a decision which could augment perceived accountability and therefore anticipated guilt. However, their results only partially support this, as although active choice resulted in the highest enrolment, the difference was only significantly greater than the opt-in policy. Hedlin and Sunstein (2016) suggest that the reason the results were not significant was due to the small sample size of only 107 students split into three conditions. In a third study into e-billing, Theotokis and Manganari (2014) find similar results, with both the opt-out and active choice significantly greater likelihood of participation with no difference between active choice and opt-in.

Hedlin and Sunstein (2016) have also investigated the role of guilt in green defaults, specifically for green energy defaults. They found that although the increased level of guilt between active choice and standard default was only marginally significant ($p<0.1$), there was a significantly greater level of guilt experienced in the active choice setting than the green default. Secondly, they found a large and significant positive relationship between the average level of guilt and enrolment in a green energy programme. However, they state that guilt cannot be only contributing factor as even though there was less guilt in the green default it still produced higher enrolment than the standard default. Finally, they find that, as expected, there is less guilt in not enrolling in green energy when it costs more, than when both a) no information is provided on the cost or quality differences and b) when the costs and quality are the same.

## 2.3 Review of literature

### *Green energy defaults*

Pichert and Katsikopoulos (2008) were the first to study how green energy defaults influenced enrolment in green energy programs. Targeting a sample of younger adults (between 18-35 with a mean age of 25), 225 participants were asked to imagine they had relocated to a new town and had to choose a new electricity provider, either a green or standard energy supplier. The green supplier was more expensive than the standard energy supplier (€30 v €25/month). Participants were randomly assigned one of three groups, a green default (opt-out), standard default (opt-in) and a neutral (active choice). Their results showed that 68% of participants stuck with the green contract when presented as the default (opt-out), compared to only 41% in the opt-in and 67% in the active choice (Pichert & Katsikopoulos, 2008). Statistical analysis revealed that both the green and neutral were statistically different from the standard default treatment, but no difference between the green and neutral treatments was found.

Vetter and Kutzner (2016) replicated closely the survey experiment by Pichert and Katsikopoulos (2008). Their results showed that the green default treatment substantially and significantly increased the choice of green electricity by over 4 times. Their study expanded on Pichert and Katsikopoulos's original design to test whether there was a relationship between the environmental attitude of the respondent and choice of electricity, however their results found no significant relationship.

Hedlin and Sunstein (2015) conducted an online survey of 1,037 respondents (average age was 33 (range 18-71), 61% male and a median household income of $25,000-$50,000). The respondents were randomly assigned one of nine groups based on a 3x3 design. The design combined a policy of either a green energy default, standard energy default or active choice, with either a more expensive green energy ($25/month), no information regarding price or quality, or information stating the price and quality is identical. The results showed that when combining all nine groups, 82% chose green energy in the active choice, 76% in the green default and 69% in the standard energy default. However, for the scenario where the extra cost was stated, these figures dropped to 56% actively choosing, 39% green default and 26% standard default.

Ebeling and Lotz (2015) carried out a randomized controlled trial (RCT) of 41,952 German households in a 4.5 week long trial. The RCT was embedded into a nationwide energy suppliers' web page and targeted prospective customers of that company. The participants were randomly assigned one of two treatments. In the control treatment, respondents were asked to choose between two contracts with differing service quality and costs. In both contracts there was an additional option for 100% green energy, which was unselected (opt-in). In the experimental condition, the same choices and price were presented, however the box for 100% green energy was defaulted as pre-selected (opt-out). In both cases the renewable energy was slightly more expensive at 0.3 EUR cents per unit (representing a premium of 1.4% and 1.3% depending on service contract). Their results showed a large and significant effect from the default option. Of those that that purchased a contract, only 7.2% purchased a green contract in the opt-in, while that number rose to 69.2% for the opt-out treatment. To check whether individuals realised they were choosing green energy they carried out a supplementary experiment. In this awareness check they found that (n=168) in the opt-in treatment 100% were able to recall that they chose green energy, while in the opt-out 84.13% were unaware of making the decision.

Lastly, Momsen and Stoerk (2014) conducted a study where they asked respondents to imagine they have just moved to a new flat in a new neighbourhood. After being given some hypothetical information regarding their income and expenditures, they are told that there are two energy contracts available to them; a 100% conventional energy contract at €30/month, and a 50% renewable/50% conventional energy contract at 45€/month. In a default group, respondents were told that if they do not make an active choice they would keep the contract using 50% renewable energy, while in the control group participants had to make an active choice. Results showed that the green default led to an 44.6% increase in renewable energy uptake (control of 48.2% (n=33) compared to the green default of 69.7% (n=85)).

### *Other green defaults*

Araña and León (2013) conducted a field experiment into the role of defaults in carbon offsetting programs. 1,680 participants were randomly allocated one of two treatments, an opt-in treatment where individuals were asked if they would be willing to pay extra for carbon offsetting, and an opt-out where individuals were asked if they would like to deduct the carbon offset fee. The fee was randomly generated for each participant (either 10, 20, 40 or 60 euros). Results showed that as the fee increases, the number of those who accepted to pay decreases for both treatments. Furthermore, they found that overall 45% chose to pay extra in the opt-in and 57% in the opt out (p=0.017). The results were significantly different for the 10 and 20 euro bids but not the larger 40 and 60 euro bids. The mean WTP was 31.29€ for opt-out and 25.5€ for the opt-in.

Löfgren et al. (2012) conducted a field experiment with 240 environmental economists to investigate the robustness of the default effect. The participants were split randomly into 3 groups relating to carbon offsetting. The option whether to offset was preselected for the two defaults (either opt-in or opt-out) and not for the active choice. Results showed that the active choice had the highest level of participation (46.8%) followed by the default to offset (43.2%) and lastly the default not to offset (39.3%). However statistical analysis revealed that there was no difference between the treatments. They conclude that the greater environmental awareness within the sample reduces the impact of the default. Their results back up other studies (List, 2003) and conclude that policy makers should focus on inexperienced individuals when determining the default policy as those are likely to be the most affected.

The effects of defaults have also been tested for energy efficiency. In a RCT, Brown et al. (2013) manipulated the default setting of thermosets in OECD offices over a six-week period in winter. They found that a 1°C decrease in the default temperature setting resulted in a reduction of the

chosen temperature setting by an average of 0.38 (of which occupant behaviour contributed 65%). Furthermore, they found that the reduction of 1°C led to a greater reduction in chosen settings than a 2°C default setting the temperature. Individuals actively respond and overrode the default effects more often under the 2°C default setting. Although not able to test the reasons behind such behaviour, they provide three hypotheses. First that individuals did not recognise small temperature difference associated with 1°C but did with 2°C. Second, they did perceive temperature differences in both cases, but the cognitive and physical effort outweighed their perceived gains of just 1°C. Finally, the slight reduction expanded the comfort preferences, reshaping their preferences, which they recognised but were happy with it. The authors also highlight the potential ethical implications of the last hypothesis.

Egebark and Ekström (2016) conducted a natural field experiment to test the effects of a moral appeal message and a default setting to encourage double sided printing. They found that the moral appeal had no impact, however the default setting resulted in a 15% reduction in paper use. Furthermore, they collected over six months after the change which showed the same levels, indicating that the behaviour influenced by the default was long-term. Lastly, they report that demand for printing was unchanged throughout the experimental period.

Toft et al. (2014) investigated whether defaults are an effective policy tool for participation in SmartGrids. They conducted an online experiment with electricity consumers from Denmark, Norway and Switzerland (n=3802). The participants were randomly allocated one of three conditions, two defaults and one active choice treatments. The default manipulation was framed as tick boxes, where the participant had to the tick the box if they wanted to opt-in *"YES, I would like to have a smart meter with remote control installed in my home"* or opt-out where they would have to tick the box *"NO, I would not like to have a smart meter with remote control installed in my home"* (p. 117). In the active choice treatment, the participants had to choose one of the alternatives. Their results found that both the opt-out and active choice were most effective in participation rates. They state that "*the standard opt-in framing makes inaction the default and many people procrastinate because they are not motivated to invest the mental effort needed to make the decision. This means that many people refrain from signing up even if this would be in their own best interest.*" (p. 121). The theoretical assumptions provided by Toft et al. claims that both the active choice and opt-out treatments result in greater cognitive effort invested in making the decision. In the active choice treatment consumers are forced to make a choice, and in the opt-out consumers recognise that something will change if they don't make a decision, thus triggers more cognitive effort by the consumer. As a result, decisions under such situations are more likely to reveal the real preferences. When less cognitive effort is required the participants are more likely to make a random choice.

Along with studies into the role of green defaults, it is important to highlight arguably the most well-known example of the effect of defaults, that of organ donation[24]. Johnson and Goldstein (2003) conducted an online experiment in which 161 respondents were put into three treatment groups, an opt-in, opt-out and neutral condition. Results showed that 82% consented to be organ donors in the opt-out setting and 79% in the neutral (not significantly different). These were almost twice as high as the opt-in condition, with only 42%.

[24] Arguably second most cited on defaults is retirement saving plans (Madrian &Shea,2001), which found significant participant under automatic enrolment. Similar findings have been backed up by Choi et al. (2003;2004) and Beshears et al. (2005). Defaults have also been found to produce significant effects in other areas, such as increasing charitable donations (Goswami & Urminsky, 2016), receiving vaccinations (Keller et al, 2011), healthier food choices (Downs, et al, 2009), future correspondence with websites (Johnson et al, 2002) and choice of add-on features when buying a car (Park et al, 2000).

## 2.4 Ethical considerations

There is a growing debate regarding the ethics of nudging in public policy. This is a complex subject and whole theses could easily be devoted to it (and have been). As such only the key arguments relevant to this thesis are discussed, albeit briefly.

As stated previously, nudging can be defined as "*any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives"* (Thaler & Sunstein, 2008, p. 6). Thaler and Sunstein (2003) therefore advocate nudging as what they describe as a form of 'libertarian paternalism'. Whereby libertarian refers to liberty-preserving, so that the individual's freedom of choice is not reduced, and paternalism refers to it being legitimate for the choice architects to attempt to improve people's lives by influencing their behaviour (Thaler & Sunstein, 2008). These are therefore self-conscious actions taken by private or public institutions, that attempt to make people's lives better off as judged by the choice architect. Cass Sunstein's 2014 book 'Why Nudge the Politics of Libertarian Paternalism', refers to hard paternalism as "*actions of government that attempt to improve people's welfare by imposing material costs on their choices"* while soft paternalism they refer to as "*actions of government that attempt to improve people's welfare by influencing their choices without imposing material costs on those choice*s" (p. 58). As a result, nudges can be seen as a form of soft paternalism as advocated by Thaler and Sunstein.

However, several authors have argued against libertarian paternalism as defined by Thaler and Sunstein (Goodwin, 2012; McCrudden & King, 2015; Hausman & Welch, 2010). Mitchel (2005), presents three main arguments against such paternalism. Firstly, that paternalism is not inevitable all situations. Secondly, that libertarian paternalism fails to justify the choice of putting welfare over liberty. And finally, there is a disregard of the potential redistributive effects which libertarian paternalism can produce. Mitchell (2005) therefore claims that libertarian paternalism is an oxymoron and offers nothing different to conventional paternalism. However, are such discussions surrounding paternalism relevant in the study of green nudges, aimed at promoting pro-environmental behaviour? Thaler and Sunstein's definition of paternalism refers to that it being legitimate for the choice architects to attempt to improve people's lives by influencing their behaviour (Thaler & Sunstein, 2008, p5). Thus paternalism in the philosophical sense as used by Thaler and Sunstein, refers to protecting the individual from harm. However as Schubert (2017) argues, the aim of a green nudge is not to increase the welfare of the individual (paternalistic) but increase social welfare (non-paternalistic). Therefore the use of paternalism, as advocated by Thaler and Sunstein would infer that green nudges should only be used when green nudges also improve the lives of the individual. As this is not the case for all green nudges, and difficult to prove, there is a danger of using the definition that, that nudges should 'improve the lives'. In the sense of green nudges, paternalism should more reflect the preferences and satisfaction of individual welfare[25].

### *Autonomy*

A key ethical consideration of nudges involves the libertarian concept and autonomy. Thaler and Sunstein's claim that libertarian paternalism (LP) is liberty-preserving has been challenged by other authors (Grüne-Yanoff, 2012). Grüne-Yanoff (2012) argues that LP violates the core liberal principals as it both limits freedom, and that the justification of LP as a trade-off between liberty and human welfare, is not compatible with liberal principals as LP respects neither the subjectivity or the plurality of human values.

[25] This is more in line with Dworkin's (1972) definition of paternalism "interference with a person's liberty of action justified by reasons referring exclusively to the welfare, good, happiness, needs, interests, or value" (p. 65).

When examining the autonomy of defaults specifically, Smith et al. (2013) state *"under defaults, the consumer generally cedes some independence of choice to the marketer, and consumer autonomy is diminished"* (p. 163). If the forces of the default effect are seen as hidden persuaders that are inconsistent with consumers ability to exercise their choice, this has resulting implications on the consumer's sovereignty to make their own decisions. Autonomy is reduced when the reasons for the default effect are due to the cognitive bias of the individual and in situations where individuals do not perceive the default as a choice (costs of switching are too high). However, Smith et al. state that autonomy is maintained when the effect of the default is due to effort or when it is due to a correct assumption of an endorsement by the choice architect. This is because in such cases the individual is acting in line with preferences regarding ease and convenience of decision making or intentionally defer to the judgement of the choice architect. Evans et al. (2017) conclude similar findings with green defaults, in that they do impede, in some degree, on consumer autonomy due to the external forces of the default effects which distort the ability of the individual's decision-making process based on their own motivations and values.

Sunstein (2015a) states that active choice is often superior over defaults as the best choice architecture to preserve autonomy. Preserving freedom of choice alone is not enough to prevent default rules infringing on autonomy, especially if the likely choices are not tracked. Sunstein highlights that if the forces behind the default effect (e.g. inertia) are powerful enough, individuals might not reject potentially harmful defaults. As a result, individuals may end up with outcomes they did not specifically select, intruding on their autonomy. However, Sunstein also states that in some situations the default is superior to active choice for protecting autonomy, as *"if people choose not to choose, or if they would make that choice if asked, it is an insult to their autonomy to force them to choose"* (Sunstein, 2015a, p. 30).

### *Manipulation*

Manipulation is one of the biggest ethical concerns with nudges (White, 2013). Sunstein (2015a) defends such criticism by saying that an effort to merely altering one's behaviour is not manipulation in itself. However the debate regarding the potential for nudges to manipulate choices is complex and most of it stems from differing definitions of manipulation (Wilkinson, 2012). This led Hansen and Jespersen (2013) to develop a framework to outline the manipulation of different nudges. In the framework, they categorise nudges into transparent or non-transparent, as well as Type 1 or Type 2. They provide the following definitions;

> *Both types of nudges aim at influencing automatic modes of thinking. But while type 2 nudges are aimed at influencing the attention and premises of – and hence the behaviour anchored in – reflective thinking (i.e. choices), via influencing the automatic system, type 1 nudges are aimed at influencing the behaviour maintained by automatic thinking, or consequences thereof without involving reflective thinking (p14).*

> *"A transparent nudge is defined as a nudge provided in such a way that the intention behind it, as well as the means by which behavioural change is pursued, could reasonably be expected to be transparent to the agent being judged as a result of the intervention" (p.17)* while a *"non-transparent nudge, on the other hand, will be defined as a nudge working in a way that the citizen in the situation cannot reconstruct either the intention or the means by which behavioural change is pursued." (p. 18)*

As a result, Hansen and Jespersen (2013) identify that green defaults can be either transparent type 1 or non-transparent type 1. For transparent type 1, they give the example of changing the default settings of a printer as an example and are more ethically defensible. The changing of the background defaults (opt-in or opt-out) constitutes a type 1 non-transparent nudge. Thus, green energy defaults have the potential to manipulate behaviour, not choice. As they are non-transparent to the individual, they apply both technical and psychological manipulation,

intending to alter behaviour[26]. Therefore, they conclude that for such defaults that not only the 'ends' for which the default is used is carefully calibrated to the best interests of the individuals, but that also the intentions and the 'means' of the default are actively disclosed. This would then clarify that the responsibility of the default effects and potential side effects are those of the choice architect, not the consumer.

McCrudden and King (2015) state that Sunstein fails to acknowledge how manipulative nudging can be if not designed with the level of care that he advocates. They make several arguments to support their claim. The first is the presumption in favour of nudging as being the default strategy is unjustified. McCrudden and King see nudging as less successful than mandates (which rarely offend personal autonomy) and that the reliance in nudging on the cognitive failures offends human dignity more than bans or mandates (which rarely offend personal autonomy). Secondly, the lack of acknowledgement of the potential manipulatory power of nudging if not designed with due care is not addressed. Furthermore, due to the previous arguments, nudging might be subject to legal challenges, resulting in a weak regulatory intervention likely to be challenged by powerful interest groups. As such, those in favour of the outcomes of nudges should instead pursue regulatory approaches, which they claim is more transparent, effective and democratic.

### *Transparency*

As mentioned transparency is a key factor in the ethical concerns over potential manipulation. Boven (2009) assesses the moral ethics of Thalers and Sunstein's *Nudge* (2008), and concludes that nudges by governments are morally acceptable when the nudge is transparent so manipulation can be revealed, and when it brings decisions in line with preferences. However, Boven highlights concerns with the use of nudges with consumers who lack strong or coherent preferences. In such situations the nudge works by substituting the preference and values of the choice architect for those of the individual. This can result in what Boven describes as fragmented selves, where the individual becomes unrecognisable to themselves. Fragmented selves can be limited if the nudge changes the individual's preference to that of the choice architect, however that raises potentially greater ethical implications (fragmentation versus autonomy). Furthermore, Boven highlights concerns that nudging could lead to individuals' incapable of acting on their preferences and self-command. Boven also suggests that more sustainable long-term behaviour may be better created with freer choices. Finally, if the person is actively choosing to put themselves in a potential situation rich with nudges (which they can identify) then nudging is more acceptable. Therefore, according to Boven (2009), nudges should both be transparent and aim to align consumers with their preferences, not the preference of the choice architect.

A number of recent papers have supported nudges being transparent, by examining the effect of transparency on the default effect. These studies have shown that disclosing either the presence or purpose of the default has no difference on the effectiveness (Loewenstein et al., 2015; Kroese et al., 2016; Steffel et al., 2016). Furthermore, the effect of transparency has been studied in green defaults specifically. Bruns et al. (2016) investigate the default effect in contributions of carbon reductions. They find that the default effect increases the contributions, and the additional information on the transparency (influence, purpose or both) has no significant effect. Finally, they find no evidence that greater transparency regarding the influence or purpose of the default triggers phycological reactance (discussed below). These studies have

[26] Psychological manipulation as the "sense of intending to change the perception, choices or behaviour of others through underhanded deceptive, or even abusive tactics" while technical as "the intentional manipulation of a straightforward cause-and-effect relationship" (Hansen & Jespersen, 2013, p. 18)

been used to alleviate concerns from private actors who are worried that transparency would reduce the effect of a default (Goldstein et al., 2008).

### Reactance

Not only are there ethical issues regarding autonomy and manipulation, but such factors can also reduce the effect of the default through reactance. Reactance theory states that *"when individuals' freedom is restricted or removed, psychological reactance will be activated and individuals will strive to restore the lost freedom"* (Shen, 2014, p. 967). The result of such psychological reactance can increase in the attractiveness of the constrained alternative, as well as reduced level of evaluation in the source of the restriction (Fitzsimons & Lehmann, 2004). Despite a default rule not actually restricting the freedom of an individual, as the individual has free choice and the ability to opt-in or out (hence libertarian paternalism), a perception of constraint may exist (Hedlin & Sunstein, 2016).

A threat to freedom can also be a persuasive attempt to shape, change or reinforce responses (Miller, 2013). Brehm and Brehm (1981) state that any action that makes it more difficult for an individual to exercise their freedom can constitute a threat. Shen (2014) found that threats to freedom through strongly worded messages clearly intended to persuade, activate greater phycological reactance than milder messages. Furthermore, they found that the phycological reactance was greater when the message was framed as a loss than a gain. In the loss framing the messages emphasised the negative implications of non-compliance (e.g. increased risk of skin cancer) while in the gain frame, highlighted the benefits of compliance (e.g. lower risk of skin cancer). Furthermore, reactance can occur without loss of freedom if the individual is felt pressured to act in a certain way (Brehm, 1966) or if the individual feels that losing freedom in this instance may lead to future loss of freedoms (Brehm, 1989).

In some cases, reactance to a default setting can cause individuals act against their preferences. Arad and Rubenstein (2015) conducted a hypothetical study of the creation of a special savings account which offered high-interest rates but the money would not be available after 10 years. They found significant protest to governmental involvement to the extent that many chose to opt-out even if they would have participated without governmental involvement. When the individuals are told beforehand that the government is employing choice architecture to increase savings, then fewer individuals chose the savings arrangement. Reiter et al. (2012) found that in a hypothetical study for defaults in US school vaccinations, parents were more likely to consent to vaccination in the opt-in situation rather than the opt-out situation or the neutral condition. They suggest that a possible reason is that the opt-out condition could be seen as a violation of their parental autonomy. This could be emphasized by the controversial situation regarding school vaccination in the US at that time. They also find that the default conditions had no effect on those parents undecided. Miller (1976) found that the exposure to excessive information can constitute a threat if it makes the ability to make a preferred decision more difficult. They suggest that phycological reactance is the likely reason for the observations.

Hedlin and Sunstein (2016) found that active choice conditions for green electricity received lower approval rating than either a green or standard energy default. This appears to contradict the above discussion on reactance and freedom. They suggest one possible reason is in the framing of their question which could have been interpreted as the state government has cancelled their current plan and if they do not make a choice they will not receive any energy plan. Furthermore, when they compare the approval ratings of both default scenarios, they find no significant difference when the costs are the same, but a significantly lower approval rating with the green default when it is stated it costs extra. They note that as they found a positive correlation between approval rating and enrolment, and that the green default had significantly higher enrolment than the standard, this too appears contradictory. However, they suggest that

this is due to a minority who opted-out of the green default and gave the condition they lowest possible approval rating, which could indicate reactance. Finally, they suggest that reactance can reduce guilt.

### *Justification of nudging*

Others have argued not over the ethics of nudging process, but over the justification of using nudges in the first place. Thaler and Sunstein's (2003, 2008) justification of using nudging as a policy tool is based on the assertion of correcting irrational behaviour. However, Gigerenzer (2015) claims that as bounded rationality is not necessarily irrational, thus the use of nudges to counter what he sees as rational behaviour in decision making is unethical[27].

The ethical justification of the use of nudges has also been criticised in other ways. Nudges alter decisions people make under the justification these would be the decisions they would make if they were not different people (i.e. if they were not loss averse, biased towards the status quo and used mental shortcuts to make decisions). However White (2013) argues here in lies the issue, that if they were a different person to who they actually are, which White argues is no different to value substitution.

### *Consent to be nudged*

A key ethical consideration is whether society wishes to be nudged. Johnson and Goldstein (2003) highlight that as most Americans favour organ donation, this gives a form of consent for nudging, *"as noted earlier, both national surveys and the no-default condition in our experiment suggest that most Americans favour organ donation. This implies that explicit consent policies impose the costs of switching on the apparent majority"* (p. 1339).

Reisch and Sunstein (2016) found that UK participants responded favourably to nudges, including both encouraging and mandatory green energy defaults (Table 2). These were seen as more favourable than other defaults such as charity donations and carbon offsets (approval ratings of 25% and 46% respectively), but less than requiring grocery stores to place healthy foods prominently (71%). The results from European nations match those found the US, which showed that 75% favoured automatic enrolment into green energy programmes, however approval varied with political party preferences (Sunstein, 2015b).

*Table 2 Approval rating of green energy defaults by country*

| Country | Encouraging green energy (%) | Mandatory green energy (%) |
|---|---|---|
| UK | 65 | 65 |
| Italy | 76 | 74 |
| France | 61 | 57 |
| Germany | 69 | 67 |
| Hungary | 72 | 65 |
| Denmark | 36 | 55 |

*Source: Reisch and Sunstein (2016)*

The results from Reisch and Sunstein (2016) show that there is strong support for green energy defaults in both the UK and other European countries. This coupled with a high WTP (see introduction), can provide some form of consent for green energy defaults in the UK.

[27] Gigerenzer (2015) quotes Herbet Simon in that "Bounded rationality is not irrationality. ... On the contrary, I think there is plenty of evidence that people are generally quite rational; that is, they usually have reasons for what they do" (p. 361)

# 3 Methodology

The purpose of this section is to outline the methodological processes involved in conducting this research, to the extent that the survey can be replicated. The experimental design and reference to the design of similar experiments are initially presented. Relevant to the problem under analysis and applicable to policy analysis. A detailed description of the data collection methods is then presented as well as an analysis of the representativeness of the sample against the population. Finally, the methods for data analysis are explained and justified.

## 3.1 Experimental design and treatment of participants

The experimental design in this study considered the methodology of all published green energy default studies (Pichert & Katsikopoulos, 2008; Momsen & Stoerk, 2014; Ebeling & Lotz, 2015; Hedlin & Sunstein, 2015; Vetter & Kutzner, 2016), as well as other non-energy green default studies. However, the design more closely follows that of Pichert and Katsikopoulos, (2008). This is the most well known of all green energy default studies and the survey design by has been replicated by other studies (Vetter & Kutzner, 2016). This was done in order to ensure methodological consistency with the existing research as well as allowing the results to be compared with others. The majority of green default studies randomly assign participants into different treatment groups, usually one control and then one or two manipulation treatment. The majority of green default studies (Pichert & Katsikopoulos, 2008; Hedlin & Sunstein, 2015; Vetter & Kutzner, 2016) frame the surveys as the default was a different energy supplier (who is either referred to as more environmentally friendly or sources energy from renewable sources). Ebeling and Lotz (2015) however present the green default not as a separate energy supplier, but as an additional option when choosing standard tariff to have the energy come from renewable sources (the default is whether the box is pre-ticked or not).

Academic studies in choice behaviour are dominated by two main data methods: Stated Preference (SP) and Revealed Preference (RP). SP is a common method to obtain information based on a hypothetical market setting. In most SP experiments, the participants are presented with a number of hypothetical choices, each with a finite number of alternatives and are then asked to choose the one they prefer the most. RP data consists instead of choices made on the real market. RP data can be observational or self-reported. RP data can be either with or without experimental influence, with experiments often used to replace a lack of available data in a real market setting (Fifer et al., 2014). There are many examples as to when a participant's revealed preference should also be interpreted as their normative preference. Normative preferences represent the participant's true interests (Beshears et al., 2008). However, Beshears et al. (2008) highlight various factors that can increase the disparity between revealed and normative preferences. Of these the passive choice/default is one such situation, whereby the acceptance of the default could be from a meaningful and conscious decision, or instead influenced by other forces (e.g. inertia). As a result, preferences regarding whether a consumer would like to have a green tariff can be seen as a normative preference, while whether they actually do or not is their revealed preference.

This experiment itself can be categorised as a 'laboratory experiment', where the control and experimental groups are subject to exactly the same environment apart from the experimental intervention (de Vaus, 2001 p56). This ensures that the only feasible reason for observed differences is the intervention. In addition, the experiment can be further categorised as a randomised control trial (RCT). RCTs randomly assign participants to two or more groups, usually one receiving the control and the others a treatment or intervention. By measuring the outcomes, this allows for a quantitative, controlled and comparative experiment for one or more interventions under analysis.

The survey design itself started with an initial welcome page, which provided the title, information regarding anonymous responses, and a thank you message for taking part. The welcome page was kept brief so as not to frame the responses in any way. Colours and graphics were kept on the neutral default recommendation so as not to influence the responses in any way (for example a green background could influence answers).

An initial screening question was applied to eliminate those not responsible for the electricity decisions in the households. Those eliminated did not count towards the final survey. The reasoning is that research has shown that the willingness to pay for renewable energy can be related to whether the respondent is a bill payer or not (Zarnikau, 2003; Hite et al., 2008).

Participants were then randomly allocated one of three treatments. A hidden, random number generator question drew an integer number from 1 to 3, which allocated participants automatically to one of three treatments. At the beginning of each treatment, the participants were asked to take their time and to answer as if they would in a real-life situation. This was to reduce (to the possible extent) the potential for hypothetical bias. In all three treatments participants were asked to imagine they had just moved to a new town and were informed by the local energy supplier of the available tariffs. The three treatments were as follows:

a) A green energy default treatment, where a green electricity tariff was the tariff the participant would be put on unless instructed otherwise.

"Please take your time to carefully read the question and respond as if you would in a real-life setting. Assume you have moved to a new town. You receive a letter from the local electricity supplier of that area. They inform you that unless instructed otherwise you will be automatically put on their green electricity tariff, where 100% of the electricity comes from renewable sources (e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables). If you would like to switch to the standard tariff you are asked to notify the company. What do you do?"

- o Stay on the assigned green electricity tariff
- o Switch to the standard electricity tariff

b) A standard energy default treatment, where a standard electricity tariff was the tariff the participant would be put on unless instructed otherwise.

"Please take your time to carefully read the question and respond as if you would in a real-life setting. Assume you have moved to a new town. You receive a letter from the local electricity supplier of that area. They inform you that unless instructed otherwise you will be automatically put on their standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables). They also inform you about their green tariff where 100% of the electricity is generated from renewable sources (e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff. If you would like to switch to the green tariff you are asked to notify the company. What do you do?"

- o Stay on the assigned standard electricity tariff
- o Switch to the green electricity tariff

c) An active choice treatment, where a choice had to be made between the two tariffs without either being provided as a default.

"Please take your time to carefully read the question and respond as if you would in a real-life setting. Assume you have moved to a new town. You are informed by the local electricity provider of the available tariffs. These are a standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables) and a green electricity tariff (where the electricity comes from 100% renewable sources, e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff. You are asked to make an active choice, which do you choose?"

- o Green electricity tariff
- o Standard electricity tariff

The definition of a standard energy tariff was given to avoid confusion, as a standard tariff in a UK context can also refer to the pricing structure (OFGEM, 2013). However exact details of the contribution of each source in the energy mix was not given as this would be unlikely to happen in a real market setting. Furthermore, the exact mix of renewables would only be an approximation, and this could influence results as a number of studies have shown that WTP for renewable energy is affected by the type of RE (Borchers et al., 2007; Garcia et al., 2012; Kosenius & Ollikainen, 2013; Navrud & Bråten, 2007).

Participants were then asked whether their actual tariff was a standard or green electricity tariff. Participants who answered standard or did not know where asked if they would be willing to switch to a green electricity tariff at the same premium as the stated experiment. Participants who stated that they would not like to pay for a green tariff were asked for their reasons. The possibility for open-ended questions was not included due to practicalities with coding up to 500 answers. Furthermore, other authors had highlighted the complexity of this approach (Pichert & Katsikopoulos, 2008). As a result, eight closed answer categories were provided. These questions were chosen based on the most common answers in previous literature and the key theories of behavioural economics. Although 12 possible answers were identified from literature, eight were deemed as the most likely for the UK context. The option of an "other" response with the possibility to add text was included. It is acknowledged that the pre-selection of answer options has limitations, this is discussed more in the methodological issues chapter. Participants were given the option to select multiple reasons.

- Unwilling to spend any more on electricity than currently am
- Effort and time switching
- Content enough with my current tariff
- Not enough information given on green tariffs
- Do not see the need for a green tariff
- Environmental benefits do not justify the costs
- Mitigating climate change is not my responsibility
- Do not know anyone else with a green tariff
- Other: _____

The wording of the treatments was created to reflect what would occur on a real market, however attention was given to not be so specific that the design reduces the external validity of the results to other settings with similar energy markets. Several OFGEM proposals on

default renewal notice were used, these included that the supplier should not encourage the consumer to choose one particular tariff, to clearly explain what happens in the default treatment if the consumer does nothing, and a personal projection of the default and switching cost comparisons (OFGEM, 2013).

A key factor of this study was to replicate a real-world pricing premium for green electricity in a UK context. However, as previously mentioned none of the large incumbent suppliers currently offer green tariffs. Therefore, in order to provide a realistic premium in the event of the reintroduction of green tariffs, information was sourced from historic tariff data, personal communication with energy companies, and relevant published studies (Table 3). Based on these, a price premium of 5% was selected, relating to a current price premium of around £2.50/month based on average electricity bills in Scotland in 2016. Monthly price was chosen as the most realistic to how bills are charged in Scotland. Although data for the current rates of green tariffs offered by smaller specialist suppliers is available, this was not used. The principal reason for this is that this study focuses on the potential reintroduction of green tariffs by incumbent suppliers as the default (the rates offered by the incumbent suppliers were in most cases significantly lower than the specialist suppliers (Graham, 2006)).

*Table 3 UK studies on the premiums for green electricity tariffs*

| Authors | Finding |
|---|---|
| *Hast et al. (2014)* | Premium of typically between 0-5%, |
| *Diaz-Rainey and Ashton (2008)* | 2.1% premium |
| *Graham (2007)* | 0-5% premium for the major energy companies, (6-12% for smaller, specialist green energy companies) |
| *Dale et al. (2004)* | 5% premium over conventional forms for most competitive RES, wind |
| *Bird et al. (2002)* | Premiums varied between 0-15% with the majority between 2-10% |

The final survey design was peer reviewed by a panel of energy experts and academics working in the field.

## 3.2 Methods for data collection

The survey was designed and hosted on the open source online survey application LimeSurevey. LimeSurvey was chosen over other popular survey software programmes as it was the only programme identified that allowed access to the design features required whilst within the financial resources of this study. Results from an academic search engine revealed that LimeSurvey has been used extensively in research.

Before the experiment was launched, a power analysis was conducted to ensure the sample would result in a power of at least 0.8 at an estimated effect size of 0.26 with a significance level of 0.05 (Cohen, 1988). In the absence of a pilot study, the estimated effect size is based on the findings from other literature on green energy defaults (Pichert and Katsikopoulos, 2008; Vetter and Kutzner, 2016). As there are only a few studies reporting the effect size of green electricity defaults, the final sample size required was increased to allow for uncertainty, resulting in a final sample required of 500.

### *Participants*

Participants were recruited from an online panel provided by ResearchNow. Research Now is a global online sampling and data collection company with over 11 million panellists. An academic search revealed that Research Now has been used extensively in research including many Scottish studies. The possibility to set survey quotas for gender and age was offered by the panel provider. However, as no data was available on the demographics of energy deciders in Scotland to set such quotas against, quota sampling was not applied. Time checks were applied to the survey, recording when the participant started and exited the survey. As with industry practice, all those that completed the survey in less than 1/3 of the median time were eliminated from the survey. These participants were replaced to make up the sample size required.

The survey was first distributed to fellow EMP students to test the design and functioning of the survey. After any issues had been resolved the final survey underwent a "soft" launch, where it was distributed initially to 10% (n=50) of the total participants. This was to test that the survey was also working in the live version (for example to test end links and timing data). After the soft launch, the survey was sent to the remain 90% participants. There were no significant changes made between the soft launch and full launch; therefor it is viable to use results from both stages.

In total 518 participants completed the survey according to the survey standards. The demographics of the panel and their representativeness to the Scottish population is presented in Table 4. In the absence of data on the demographics of Scottish energy deciders the representativeness was assessed by comparing to the overall Scottish average. It was not possible to obtain demographics for those responsible for the energy decisions in their households. The categories were chosen were the same as the Scottish Household Survey 2015 to allow for comparison. This is deemed more representative and up to date than the 2009 census. However, household size statistics were instead used from the census, as the data from the Scottish Household Survey was in an inappropriate format for this study.

Participants were asked to provide information on the following demographic attributes;

1. Gender (male; female)
2. Age (18-24; 25-34; 35-44; 45-59; 60-74; 75+)
3. Education (Degree, professional qualification; HNC/HND or equivalent; Higher, A level or equivalent; Standard Grade, O Grade or equivalent; Other qualification; No qualification; Qualification unknown)
4. Net household income (£0 - £6000; £6001 - £10000; £10001 -£15000; £15001 - £20000; £20001 - £25000; £25001 - £30000; £30001 - £40000; £40001+)
5. Location (Large urban area; Other urban area; Small town; Rural)[28]
6. Household size (1;2;3;4;5;6;7 or more)
7. Household tenure (owner occupied; social rented; private rented; other)

Socioeconomic and demographic attributes were chosen as each of the variables have been shown to relate to attitude towards WTP for renewable electricity; **income** (Kosenius & Ollikainen, 2013; Rowlands et al., 2003; Zarnikau, 2003; Ladenburg & Dubgaard, 2007; Zhang & Wu, 2012; Štreimikienė & Baležentis, 2015; Sundt and Rehdanz, 2015), **age** (Kosenius & Ollikainen, 2013; Hanemann et al., 2011; Borchers et al., 2007), **gender** (Bately et al, 2000; Bollino, 2009; Ivanona, 2013; Kosenius & Ollikainen, 2013), **education** (Rowlands et al, 2003; Longo et al, 2008; Sundt & Rehdanz, 2015), **household size** (Longo et al, 2008; Aldy, 2012; Koundouri et al, 2009; Bigerna & Polinori, 2014), **home owner** (Bollino, 2009; Abdullah & Jeanty, 2011) and **location** (Kim et al, 2012; Kosenius & Ollikainen, 2013).

The panel is representative of the Scottish population for gender (Table 4). For age, the sample is not representative of the adult population, however this is to be expected. In the sample, there are a relatively low number of young adults under 25yr old (1.3% v 14%), however as many young people either live with their parents or at university/college accommodation, they would be less likely to be responsible for the energy decision. Furthermore, the sample is underrepresented in those over 75 (2.7% v 9%). This would also be expected as a large number of those may either be living in retirement homes or with family, and as a result no longer make energy decisions. The sample has a greater share of participants in the higher income categories than the Scottish average. This could be expected due to similar reasons as with the age differences. With less young people who are either in further education or in lower paid entry level jobs and fewer participants in retirement age, it could be expected that the energy deciders have higher income levels than the Scottish average. The sample has more participants with a degree level qualification (40.7% v 29%), as well as more homeowners (71.8% v 61%). The sample also has fewer participants who live on their own (20.5% v 35%) and more who live in small towns (24.1% v 12%).

[28] Descriptions of each category were provided in the survey. See appendix for details

*Table 4 Demographic characteristics of the study sample (n=518) compared to the adult Scottish population.*

| Characteristics | Survey (%) | Scotland Average (%) |
|---|---|---|
| *Gender* ($\chi^2$=0.21, *d.f.*=1, *p*=0.885) | | |
| Male | 47.7 | 48 |
| Female | 52.3 | 52 |
| | | |
| *Age* ($\chi^2$=96.672, *d.f.*=5, *p*<0.001) | | |
| 16-24 | 1.3* | 14 |
| 25-34 | 14.5 | 16 |
| 35-44 | 18.5 | 15 |
| 45-59 | 35.9 | 26 |
| 60-74 | 25.1 | 20 |
| 75+ | 2.7 | 9 |
| | | |
| *Highest qualification* ($\chi^2$=75.899, *d.f.*=6, *p*<0.001) | | |
| Degree | 40.7 | 29 |
| HNC | 12.7 | 11 |
| Higher | 19.7 | 17 |
| Standard | 19.3 | 20 |
| Other | 3.3 | 4 |
| No | 5.0 | 17 |
| Unknown | 0.2 | 1 |
| | | |
| *Annual net household income* ($\chi^2$=85.295, *d.f.*=7, *p*<0.001) | | |
| £0-6000 | 4.4 | 3 |
| £6001-10000 | 3.9 | 9 |
| £10001-15000 | 8.9 | 18 |
| £15001-20000 | 15.4 | 16 |
| £20001-25000 | 14.5 | 12 |
| £25001-30000 | 11.4 | 9 |
| £30001-40000 | 19.1 | 15 |
| £40000+ | 22.4 | 18 |
| | | |
| *Household tenure* ($\chi^2$=34.350, *d.f.*=3, *p*<0.001) | | |
| Owner occupied | 71.8 | 61 |
| Social rented | 12.5 | 23 |
| Private rented | 14.5 | 14 |
| Other | 1.2 | 1 |
| | | |
| *Household location* ($\chi^2$=73.653, *d.f.*=3, *p*<0.001) | | |
| Large urban | 32.2 | 36 |
| Other urban | 27.8 | 35 |
| Small town | 24.1 | 12 |
| Rural | 15.3 | 17 |
| | | |
| *Household size* ($\chi^2$=54.543, *d.f.*=6, *p*<0.001) | | |
| 1 | 20.5 | 35 |
| 2 | 40.1 | 34 |
| 3 | 19.5 | 15 |
| 4 | 14.9 | 11 |
| 5 | 2.9 | 4 |
| 6 | 1.0 | 0.8 |
| 7 or more | 0.4 | 0.3 |

### *Timing data*

Another benefit of online surveys is the ability to the record the time taken to answer specific questions. Measuring response time in online surveys has several benefits, including ease of implementation and cost efficiency, is obtrusive and not perceived by the respondent (eliminating potential bias by the respondent), and such additional information is sourced without additional questions (Mayerl, 2013). The time it takes to answer a survey question is generally accepted to be a reflection of the cognitive effort required to arrive at an answer (Lenzner et al., 2010) and such measures are often used as a measure of effort in online surveys, including other default studies (Dinner et al., 2011). However, it is important to highlight the use of response time in measuring cognitive ability is subject to influence by other factors (Kyllonmen & Zu, 2016). These include that a slow response time could reflect a slow processing speed or carefulness. A quick and correct answer might be through a lucky guess. If the respondent answer incorrectly it could be through not knowing the answer, not spending enough time processing the information, or haven gotten confused by the question or answer. Although there is a trade-off between speed and accuracy, such a trade-off is not fixed across populations or tasks. Furthermore, this thesis will measure the response time from first being presented with the question to answering the question. It is important to highlight that the length of the experimental treatment questions were slightly different (123, 132, 107 words). Although the questions were designed to be relatively similar in length, excessive wording or information may have increased the difficulty or framed the question in a different manner (Lenzner et al., 2010).

## 3.3 Methods for data analysis

In order to analyze the data, various statistical methods were applied. All statistical analysis was carried out in IMB SPSS Statistics version 24.

To compare the representativeness of the sample against the Scottish adult population a chi-square ($\chi^2$) goodness-of-fit test was applied. The chi-square goodness-of-fit test can be used to determine whether the distribution of participants in a single categorical variable follows a known distribution with unequal portions. As a result, it is a common method for assessing the representative of samples against a known population.

As with other green energy default studies (Pichert and Katsikopoulos, 2008; Ebeling and Lotz, 2015; Vetter and Kutzner, 2016), a Pearson's chi-square ($\chi^2$) test was applied to test the differences in tariff enrolment rates between the three treatments. The Pearson's chi-square test evaluates how likely a difference between two or more sets of categorical data arose by chance.

To compare the whether the time it took participants to answer the different treatment questions was significantly different, a one-way analysis of variance (ANOVA) was applied. A one-way ANOVA is applied when testing whether the differences between the means of two or more groups vary significantly. In accordance with standard practice extreme outliers that lied without the intervals were removed ($Q_1$ - 3x IQR, $Q_3$ + 3x IQR, where IQR = $Q_3$ - $Q_1$) (Tukey, 1977). This resulted in the removal of 22 data sets from this analysis. Full results of the data analysis is provided in Appendix III and IV.

# 4 Results

The following chapter presents the key findings from the experiment and resulting stated and actual preferences along with the various statistical analysis conducted. First the results from the choices made in experimental treatments and their statistical difference are presented. Secondly, the results of the participant's normative preferences are compared to how they chose under the three treatments. Finally, the reasons given for those against a green tariff and an analysis of the socio-economic variables are presented.

## 4.1 Stated *and* normative preferences

### *Stated choices*

When it comes to *stated* choices, Figure 2 shows the results from the treatment groups. In the green default treatment, 81 out of 190 participants (42.6%) chose to stay with the green tariff. In the standard default treatment, 81 out of 170 participants (47.6%) chose to opt out and switch to the green tariff. In the treatment requiring an active choice, 37 out of 128 participants (24.2%) choose the green tariff.

To test the statistical significance of the effects, a 3 x 2 $\chi^2$ test showed a significant overall effect of all of the treatment groups on the choices of the participants, $\chi^2(2) = 22.57$, $p < .001$. Then in order to assess which of the treatments were statistically significant, three separates 2 x 2 $\chi^2$ tests were calculated. Comparing the two defaults revealed there was no significant difference in frequency of choosing the green tariff, $\chi^2(1) = 0.912$ and $p = .340$. When compared with the active choice treatment, and contrary to what the emerging literature indicates, more participants chose the green tariff in the standard default treatment, $\chi^2(1) = 20{,}82$, $p < .001$, with a medium effect size ($\Phi = .25$). Comparing between the green default treatment and the active choice treatment, significantly more participants choose the green tariff in the green default condition $\chi^2(1) = 14.21$, $p < .001$, $\Phi = .20$).

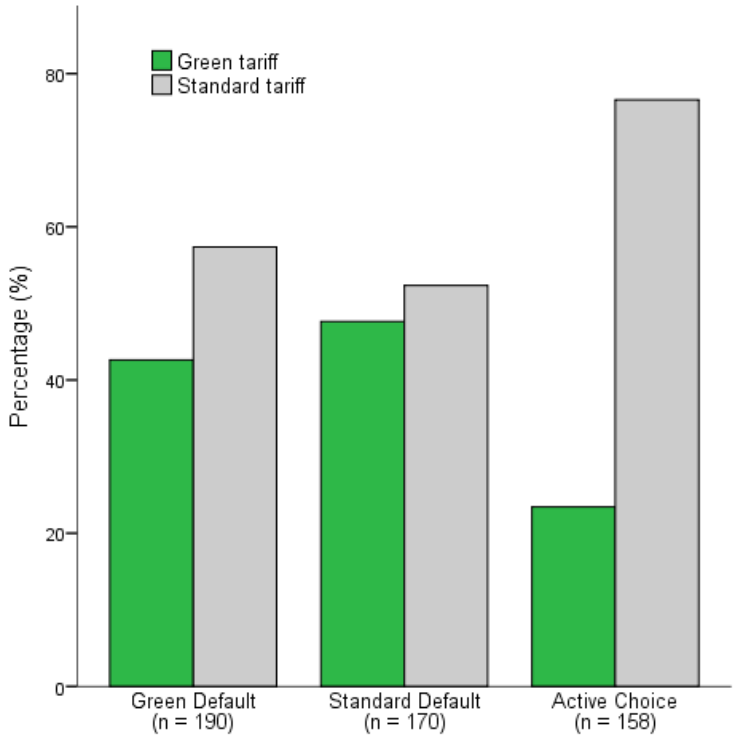


*Figure 2 Choices of electricity tariff in the three treatment groups*

Regarding *normative* choices, participants were asked whether their electricity tariff in real life was a standard or green tariff. Figures show that 78% (*n*=404) of the participants had a standard energy tariff, while 8.9% (*n*=46) had a green tariff and 13.1% (*n*=68) did not know. For those who had a standard tariff or did not know, when asked if they would be willing to switch to a green tariff (at the same premium used in the study), 37.7% (*n*=178) stated they would. When combined with those that already had a green tariff, this accounts for 43.2% of the total sample.

### *Stated versus Normative preference*

To answer the second research question, the choice of tariff the participants made in the different experimental settings was compared to their normative preference in real-life. As mentioned previously, as those who already have a green tariff are likely to have paid a premium greater than the one used in this study therefore also WTP £2.50 and as a result, can be combined with those who currently do not have but are WTP for a green tariff. This was because although the price premium reflects what the major energy suppliers used to charge, in reality as 100% green is only offered by a number of small companies with far higher premiums, the question not applicable. [29]

Results show that *green default* treatment produced tariff choices different to their actual preference. In the green default, of those who either had or would like to have a green tariff (*n*= 74), 81.1% (*n*=60) stayed with the green default, while 18.9% (*n*=14) actively opted-out of the green tariff and chose the standard tariff (Figure 3a). While for those who were not willing to pay for a green tariff in real life (*n*=116), 18.1% (*n*=21) stayed with the green tariff default, while 81.9% switched (*n*=95). As a result, of those that stayed with the green default (*n*=81), 25.9% (*n*=21) expressed that in real life they would not like a green default (Figure 3b). For those that chose to switch to the standard tariff (*n*=109), 12.8% (*n*=14) said they would be willing to pay for a green tariff in real life.

In the s*tandard default*, participants chose the tariffs that matched their preference more than in the green default. Of those who either had or would like to have a green tariff (*n*= 84), 89.2% (*n*=75) actively opted-out of the standard tariff (Figure 3c). While for those who did not want a green tariff in real life (*n*=86), 93.0% (*n*=80) stayed with the standard tariff default. As a result, of those that chose to stay on the standard default tariff (*n*=89), 89.9% (*n*=80) stated this is the tariff they would like in real life (Figure 3d). Of those that chose to switch to the green tariff (*n*=81), 92.6% (*n*=75) stated this is what they would like in real life.

In the *active choice* treatment, of those that had expressed a positive willingness to pay for green energy (*n*=66), 50% (*n*=33) chose the green tariff (Figure 3e). While of the participants who stated that they would not like a green tariff (n=92), 95.7% chose the standard default (n=88). As a result, of those that chose the green tariff (*n*=37), 89.2% (n=33) stated this is what they would like in real life (Figure 3f). While of those that chose the standard tariff (n=121), 72.7% (n=88) stated that this is the tariff they would like in real life.

[29] Green Electricity Marketplace is an online price comparison website for suppliers offering green electricity in the UK. The comparison was run using the locations of major population areas. Based on the median household UK electricity use of 3,300kWh

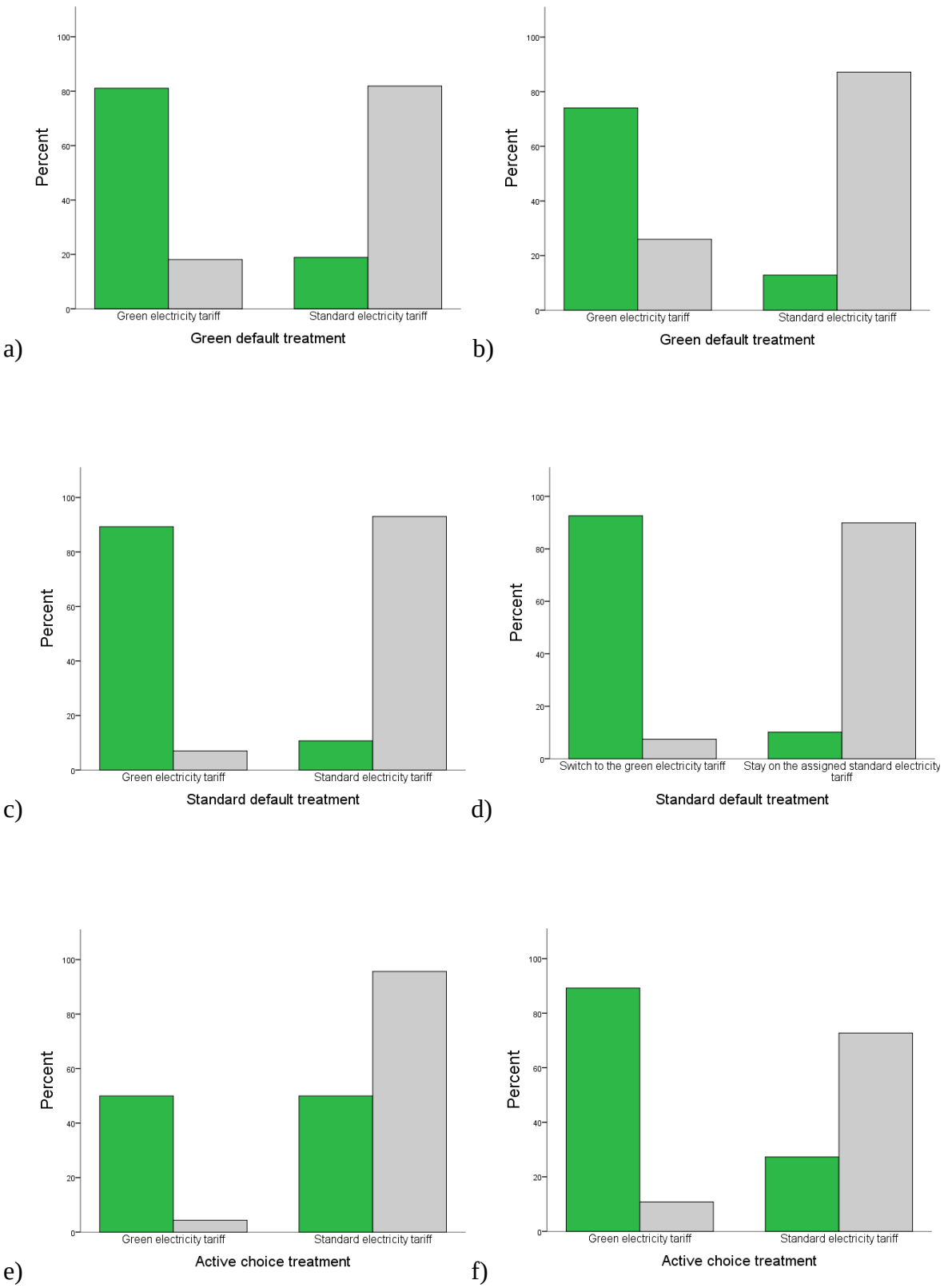


*Figure 3 How participants chose according to their actual presence (a,c,e) and how this represents the proportions of total enrolment in each tariff (b,d,f). (Green = WTP; grey = not WTP)*

In order to examine whether each treatment group had a similar percentage of participants WTP or not for green electricity, the treatments were compared to analyses (Figure 4). Results showed that 38.9% of participants in the green default treatment would be WTP in real life, in the standard default treatment 49.4% and in the active choice treatment 43.2%. To test whether the differences were significant, a 3 x 2 $\chi^2$ test was conducted, which showed no significant overall difference between all treatment groups, $\chi^2(2) = 4.204$, $p < .122$, suggesting no overall difference in actual preferences between the treatment groups. However, when comparing the two default treatments specifically, a 2 x 2 $\chi^2$ tests revealed a significant difference between the two default treatments ($\chi^2(1) = 3.990$, $p = .0.46$). This suggests that the standard default treatment had a significantly greater proportion of those who would be WTP for green energy than the green default treatment. When compared with the active choice treatment, there was no significant difference compared to the green treatment ($\chi^2(1) = 0.286$, $p = .593$) or the standard default condition ($\chi^2(1) = 1{,}926$, $p = .165$).

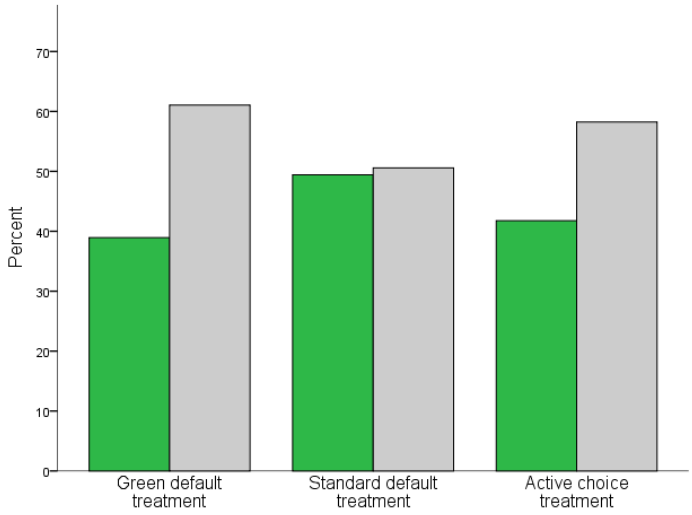


*Figure 4 Percentage of each experimental treatment group that were WTP for renewable energy (green) or not (grey).*

## *Timing data*

As a proxy for cognitive effort, the latent time it took for each participant to answer the treatment questions were analysed. Results indicate that there was a statistically significant difference between each treatment group as determined by one-way ANOVA ($F(2,493) = 30.757$, $p < .001$). A Tukey post hoc test revealed that the time to answer the question was statistically and significantly longer for both the green default (mean=29.3, SD = 16.6 seconds, $p < .001$) and standard default treatments (mean=31.0, SD=18.4 seconds, $p < .001$) compared to the active choice treatment (mean = 17.5, S.D = 14.2 seconds). There was no statistically significant difference between the green default and standard default treatments ($p = .587$). A concern was that some participants might have answered too quickly. When these were removed (<5 seconds, n=27), this had no effect on the overall significance levels ($F(2,466) = 23.073$, $p < .001$) or on the statistical difference between both defaults and the active choice ($p < .001$), while no statistical difference between the two default treatments ($p = .868$). The results suggest that those results can be kept in the analysis.

Secondly the timing data was analysed to examine whether there was a difference between the time taken between those participants who chose to stick with a default and those who decided to opt-out (Table 5). Participants who stuck with the default took the same time in making that

decision as those who chose to opt-out in both default treatments. In the active choice treatment, those who chose green spent significantly longer on that decision than those who actively chose the standard tariff. This suggests that participants took just as long to decide to stick with a default, then those who decided to opt-out. However, in the active choice treatment, those who chose the green tariff took almost twice as long over the question than those who chose the standard tariff.

*Table 5 Time taken to answer based on decision made*

| Treatment condition | Decision | Mean time in seconds (SD) |
|---|---|---|
| Green default | Green tariff | 28.7 (15.5) |
| *F(1,179)=0.179, p=.673* | Standard tariff | 29.7(17.4) |
| Standard default | Green tariff | 30.1 (18.1) |
| *F(1,159) =.410, p=.523* | Standard tariff | 31.9 (18.7) |
| Active choice | Green tariff | 26.7 (15.2) |
| *F(1,152)=21.396, p=.000* | Standard tariff | 14.8 (12.8) |

Next, the timing data was analysed to examine if those that had a normative preference for green tariffs took the same time in deciding as those that did not want a green tariff. Results showed no significant difference irrespective of treatments ($F(1,494) = 2.693$, $p = .101$). When the timing data was analysed within each treatment, there was a significant difference in the green treatment, but not in the standard default or active choice (Table 6). In the green default, those who would like a green tariff in real life took a shorter time in deciding than those who did not. This suggests that those already with a preference for a green energy took less in choosing under the green default treatment, but not under the standard or active choice treatments.

*Table 6 Time taken to answer based on WTP for green energy*

| Treatment | WTP for a green tariff | Mean time in seconds (SD) |
|---|---|---|
| Green | Yes | 23.9 (13.1) |
| *F(1,179) = 12.943, p <.001* | No | 32.7 (17.7) |
| Standard | Yes | 30.1 (18.4) |
| *F(1,159) = .414, p =.521* | No | 32.0 (18.5) |
| Active choice | Yes | 18.9 (16.5) |
| *F(1,152) = 1.105, p =.315* | No | 16.5 (12.4) |

Finally, the timing data for those who revealed a preference for green tariffs in the active choice treatment was analysed depending on whether they chose accordingly to their preference or not. Those who had an actual preference for green tariffs and chose a green tariff took on average 26.5 seconds, while those whose actual preference for green tariffs but chose a standard tariff took on average 11.7 seconds. Analysis revealed a significant difference between the times ($F(1,62) = 15.657$, $p < .001$). A binary logistic regression then predicted preference choice with the continuous time on the probability of choosing their preference was significant ($p < .001$). It was not possible to run the same analysis in either of the default treatments as the majority acted according to their preferences resulting in low samples.

### *Stated reasons against green tariffs*

Table 7 shows that reasons given by those not willing to pay for a green tariff (*n*=294). The majority of participants who did a want green tariff in real life stated that *price* was a key reason. Of those that listed price as one of the main reasons (*n*=203), 49.8% (*n*=101) mentioned it as the sole reason against the green tariff. A *lack of information* on green tariffs and being *content enough with current tariff* were the next most mentioned reasons. Very few stated that mitigating the effects of climate change was not their responsibility. Nine participants chose to answer 'another' in addition to the answer categories provided, these answers were coded categorised or removed (see Appendix II for the details).

*Table 7 Participants reasons for not wanting a green tariff (n = 294)*

| Reason | Frequency (%) |
|---|---|
| Unwilling to spend any more on electricity than currently am | 69 |
| Not enough information given on green tariffs | 27 |
| Content enough with my current tariff | 26 |
| Environmental benefits do not justify the costs | 21 |
| Do not see the need for a green tariff | 16 |
| Do not know anyone else with a green tariff | 12 |
| Effort and time switching | 9 |
| Mitigating climate change is not my responsibility | 3 |

As with other studies (Pichert & Katsikopoulos, 2008) price was by far most common reason given for those unwilling to pay for a green tariff in real life (69%). This supports other studies which state that electricity competition in the UK is still very price driven with cost by far the most important factor in switching behaviour (Diaz-Rainey & Ashton, 2008; Hast et al., 2014). However, of those that mentioned an unwillingness to spend any more, around half of those also stated at least one other reason for not wanting a green energy tariff. Therefore although the price is an important factor, even if green tariffs were to reach grid parity a significant sector would still be unwilling to choose green tariffs due to other factors.

The second most common reason for not wanting green energy was a lack of information on green tariffs (27%), which can be seen as high in relation to other studies (Pichert & Katsikopoulos, 2008). This could be as a result of the controversy regarding previous green tariffs from energy suppliers in the UK. This result would further support the hypothesis that a lack of trust is influencing behaviour. Very few of those who do want a green tariff saw mitigating climate change as not their responsibility (3%).

# 5 Discussion

The following chapter will present a reflection and interpretation of the results observed.. The discussion is framed according to (potential) hypothesis of observed results rather than breakdowns of each treatment due to overlapping influences. A reflection on the methodological issues of the study is also provided.

## 5.1 Overall enrolment

Contrary to similar studies (Table 8), the results show that there was no statistical difference between a green default and a standard default for the total enrolment of green electricity tariffs. Furthermore, both defaults had statistically and significantly greater effect on enrolment of green tariffs than the active choice treatment. However, it is important to stress each study had several major differences including experimental design, participant demographics, price premiums (ranging from 5 to 50%) and sample size.

*Table 8 Comparison of results for enrolment of green energy default studies*

| Study | Green Default (%) | Standard Default (%) | Active choice (%) |
|---|---|---|---|
| This thesis | 42 | 48 | 24 |
| Pichert & Katsikopoulos (2008) | 68 | 41 | 67 |
| Hedlin & Sunstein (2016) | 39 | 26 | 56 |
| Momsen & Stork (2014) | 70 | *Did not investigate* | 48 |
| Ebeling & Lotz (2015) | 69 | 7 | *Did not investigate* |

The results from Vetter and Kutzner (2016) were not included as they are presented in format that is non-comparable

One potential reason for the high enrolment in green energy under the standard default treatment, is that it had a significantly greater proportion of participants WTP for green energy (49.4%) compared to the green default treatment (38.9%). However, this would only partially explain the dissimilarities with other studies. By examining the relationship between the choices made in the treatments and the revealed preferences in real life, this can begin to offer some further explanations of the observed results.

## 5.2 Choice architect and lack of trust?

An important result of the green default treatment was that 18.9% of participants who stated they would be willing to pay for green tariff in real life, choose to act against that preference and actively opt-out of the green default tariff. This suggests a significant presence of policy backfiring in the green default treatment. Although not able to determine the exact reasons for such behaviour in this study, from previous studies and theories one potential reason is due to the trust in the choice architect (see chapter 2.4.4.).

Neither the identity of the choice architect or the reasons for the default were given. The reason the agent is not provided was twofold: to prevent any potential framing from the outset and it is unknown who this agent would be in real life (mandatory regulation or a voluntary scheme by the energy supplier). Also, most talk is in the realm of governments (Lehner et al.) in the case of the Pichert and Katsikopoulos (2008)real life example. The purpose of the default is not given so as comparable with other studies. This is supported by other studies showing that revealing the influence purpose of the default does effectiveness (Loewenstein et al., 2015; Bruns et al., 2016; Kroese et al., 2016; Steffel et al., 2016).

It is important to highlight that the reasoning behind the existence of the green default (i.e. the identity of choice architect) was excluded from the study, which may have led participants to interpret that the energy supplier as the choice architect. Furthermore, as stated the authors of

the survey were not presented so to avoid pre-framing which may have influenced results. Therefore participants might also have perceived the survey to originate from an energy supplier. To examine how the lack of trust may have influenced the results, it is first necessary to provide a short background into the energy market in the UK and its history of green tariff offerings.

### *Overview of trust and green tariffs in the UK*

Studies have shown that consumer trust in the UK energy sector is very low (Which, 2013; CarbonBrief, 2014; uSwitch, 2013) with media outlets often reporting on skyrocketing profits while householder bills continue to rise (Metro, 2013). As a result, the UK energy sector is one of the least trusted industries in the UK and one of the least trusted energy sectors in Europe (Edelman, 2014; Citizens Advice, 2015). This lack of trust is often cited as a consequence of the rising energy prices (Edelman, 2014) and as a result, there is a common perception by consumers of excessive profiteering by UK energy companies (OFGEM, 2013).

As stated in the problem definition, all the major energy suppliers had previously offered green tariffs in one form or another. However, before these were abandoned, they were not without controversy. First, there was confusion over what was meant by a green tariff. There was no specific definition of a "green" tariff, with five broad categories which UK energy suppliers marketed individually or in combination, which Diaz-Rainey and Ashton (2008) define as;

- *Green source* (the energy supplier guarantees to buy between 10% and 100% of energy generated by renewable sources for every unit of electricity used by the consumer);
- *Green source large hydro* (the supplier matches every unit of electricity used by the consumer with hydro-electric generated electricity);
- *Green fund new renewables* (electricity may not be derived from renewable energy, yet funds are invested in renewable generation projects);
- *Green fund other environmental* (these tariffs provide funds to support environmental causes or new research and development projects);
- *Carbon offsets* (supplier donates to a carbon reduction project in the UK or internationally in order to offset the impact of the households' carbon footprint)."

This lead to confusion with customers, with few being aware of exactly what a green tariff meant or that different types of green tariffs even existed (OFGEM, 2014b).

Secondly, there were claims that the environmental benefits of green tariffs were being double counted by the energy suppliers (Hast et al., 2014). The renewable obligation system in the UK legally obliged to energy companies to source or produce a specific share of their energy from renewable sources. To pay for this, the extra cost was added to the standard tariff bills. However, energy suppliers were not making it clear to customers that they were already paying to support renewables through their standard energy bills (Graham, 2006). The renewable electricity they were obliged to source or produce, would then be sold to customers through a voluntary green tariff, often at a premium. As a result, energy companies were both profiteering as well as double counting the environmental benefits of the renewable energy, with those customers on the green energy tariff having little impact on increasing overall renewable energy generation (Hast et al., 2014).

This confusion and controversy led governmental consultations in 2005 (OFGEM, 2005) and 2007 (OFGEM, 2007) eventually leading to OFGEM introducing the 2009 "Green Supply Guidelines" (OFGEM, 2009) aimed at providing certainty and transparency to energy users that the product was "green". The guidelines were voluntary and implemented through the "Green

Energy Supply Certification Scheme" (GESCS). However not all suppliers signed up which saw in the years following the green electricity market diverged into an GESCS accredited and non-accredited market. This lead to in 2014 OFGEM improving consumer protection for all green tariffs (OFGEM, 2014c). However, despite such efforts at improving credibility, it is possible that a lack of trust in green tariff offerings still remains in the UK.

### *Default effect when a lack of trust in CA*

As described there is a low level of trust in the UK energy sector and that the choice architect of the default may well have been perceived as being an energy company. If the participants therefore perceived that the choice architect was untrustworthy, this could explain the backlash observed. Individuals who trust the policy maker (or expert advice) are more likely to stick with the default, while those who distrust more likely to leave (Tannenbaum & Ditto, 2012). As mentioned, the default can be interpreted as an endorsement by the agent, providing a recommendation to the individual. However if such recommendations are unsolicited by the individual, this can activate individual reactance, which can lead to a backlash in which the individual can both ignore the recommendation but also intentionally contradict such advice (Fitzsimons & Lehmann, 2004).

As highlighted there is a common perception that UK energy suppliers are guilty of excessive profiteering. Therefore the participants may have inferred that the default is the one the energy company prefers to sell, especially due to the higher price (Brown and Krishna, 2004). Therefore, due to the lack of trust previously mentioned, and perception of the default, participants could interpret a profiteering strategy by the energy company and ulterior motive. Sunstein (add date) shows that individuals reject nudges if they are perceived to have such illicit motivations, even if the nudge is supporting their own choice (for example political party or religion).

Campbell and Kirmani (2000) propose that when a consumer becomes apprehensive that the seller is acting illicitly, then persuasion knowledge is used. Persuasion knowledge is based on Friestad and Wright's (1994) 'Persuasion Knowledge Model', a theory on how consumers respond to a seller's attempt at persuasion[30]. Campbell and Kirmani (2000) propose that consumer use of persuasion knowledge is based on two factors: i) the accessibility of the motives of the persuasion, and ii) the cognitive capacity of the consumer. They show through a series of experiments how the accessibility of an ulterior motive increases the use of persuasion knowledge. If a consumer becomes concerned about illicit motivations then 'marketplace metacognition' (MM) will be more prominent to cope with marketers perceived persuasion attempt. Wright's (2002) concept of marketplace metacognition and social intelligence[31] refers to MM as "*everyday individuals' thinking about market-related thinking. This includes people's beliefs about their own and others' mental states and processes and their beliefs about other people's beliefs on those topics as these beliefs pertain to the specific domain of marketplace cooperation and manipulation."* (Wright, 2002, p. 667).

Marketplace metacognition can not only include consumer theories regarding what products are suitable, but it can also change cognitive processes regarding decision making (Brown & Krishna, 2004). As a result, invoking MM may cause consumers to consider more the alternative

[30] "Persuasion knowledge refers to consumers' theories about persuasion and includes beliefs about marketers' motives, strategies, and tactics; effectiveness and appropriateness of persuasion tactics; psychological mediators of tactic effectiveness; and ways of coping with persuasion attempts." (Campbell & Kirmani (2000) p1).

[31] ""Marketplace social intelligence refers to the cognitive routines and con- tents dedicated to achieving marketplace efficacy that are accessible to individuals by virtue of functionally specialized evolutionary processes and the development of this functionally specialized expertise over an individual's life span"

choices of a decision in a default setting. This could potentially reduce the effect of satisficing behaviour and lead to the consumer choosing the maximum utility. A key implication is that when MM is invoked, consumers are sceptical and their cognitive effort used in decision-making increases (Brown & Krishna, 2004). Wegner and Petty (1995) argue that when cognitive effort is low (or related decisions are infrequent), consumers are more likely to accept a default. However, when consumers invoke perceptions of persuasion attempts, cognitive effort is enhanced, and consumers are more likely to contrast such efforts. Furthermore, the accessibility of MM may not only make consumers more sceptical, it may also increase their motivational reasoning (Kunda, 1990). Therefore, the presence of a default from a choice architect which the consumer may be sceptical, it likely to increase the cognitive effort he/she puts into making the decision (Brown & Krishna, 2004). This leads to consumers being more alert and more careful consideration of the choices.

To address cognitive efforts, the time it takes an individual to answer questions has been used to as a proxy for cognitive effort in previous default studies (Dinner et al., 2011). In this case, results show that participants took considerably longer in answering in both the green default (29.3 seconds) and standard default treatments (31.0 seconds) than those in the active choice treatment (17.5 seconds). This suggests that due to the lack of trust in UK energy suppliers, consumers were more sceptical about a default and its intentions which led to them spending more time on the decision, which in turn results in a better match of their preferences (default effect is reduced). As a result, the default may work because it requires consumers to put more effort into the decisions than under the active choice scenario.

Furthermore, there was no time difference between sticking with the default or switching in either the green default (28.7 v 29.7 seconds) or in the standard default (31.9 v 30.1 seconds). This goes against other studies which suggested that individuals who stick with the default spend less time on that decision than those who actively decide to opt-out. The results support the hypothesis that the lack of trust in the perceived choice architect is resulting in the participants spending more time and effort on decisions, even when the default matches their preference.

Furthermore, the results from regression analysis in the active choice treatment show that the more time a participant who has a normative preference for green energy spends on answering the question, the more likely they will choose the green tariff. This is in line with the general acceptance that the more effort an individual puts into a decision, the more in line their final decision is with their actual preference. The results go against the hypothesis that the active choice would result in one of the higher enrolments. The hypothesis was based on studies such as Hedlin and Sunstein (2016), who found that forcing participants to make an active choice resulted in a high enrolment in green energy, due in part to participants felt guiltier having to actively chose 'against' a green tariff. In this case however, without any additional information regarding the benefits of renewable electricity, or even explicitly stating that the green was more environmentally friendly, guilt may not have been triggered in this study to the same degree. Furthermore, the shorter time spent may not be enough to trigger comparison with social norms, thus reducing the impact of guilt, with price weighing more heavily. It has been suggested that the active choice treatment leads to the highest match between attitude and behaviour as it forces the individual to make a choice rather than one being made for them. The results from this study would argue against that argument. Timing data revealed that participants took statistically and significantly shorter on the active choice treatment than in the defaults.

## 5.3 Potential manipulation

An important result is that those that stayed with the green tariff when it was the default, were not just those who had expressed a preference to pay, but also those who had not. For those whose preference was not wanting a more expensive green tariff, 18.1% stayed with the green

default even though it was not their actual preference. As a result far more of those participants who stated they would not like a green tariff, chose the green tariff when it was the default treatment, then either in the standard default (7%) or the active choice (4.3%) treatment. Furthermore, when viewed as the total of enrolment in a green tariff when it is the default, those that for whom it is not their preference make up over a quarter (25.9%) of the total enrolment in green energy. Therefor the (potential) success of the green tariff over the active choice, can be attributed in part to enrolling those for whom it was not their preference.

Although the study could not determine the exact reasons behind such behaviour, it does highlight a previously overlooked impact of green energy defaults that may occur. Although this is not conclusive evidence of manipulation, it does suggest the possible presence of such. As discussed in the ethics section the definition of manipulation is complex and difficult to assess. However, Hansen and Jergensen (2013) state that for nudges such as green energy defaults, choice architects "should [not only] make sure that the ends pursued are carefully calibrated with what citizens judge to be in their interests." (p 26). Furthermore, nudging by governments is only morally acceptable when it brings consumers decisions in line with their preferences (Boven, 2009). Thus, comparing decisions made under a default scenario with the actual preference of the individual provides a reasonable indication of potential manipulation.

As discussed defaults work through various factors which can significantly influence behaviour. The results of this study suggest that such factors (inertia, guilt, endorsement, satisficing) may override the actual preference of the individual, resulting in choosing a more expensive energy tariff which they would. As a result this also highlights the other green default studies that have found high enrolment rates with green defaults. Are the high enrolments in green defaults from those who are willing to pay, or are others being influenced into choices against their preference?

## 5.4 Other potential factors affecting the results

There are several other factors that could have resulted in the behaviour observed. As with the previous discussion the study was not able to test their specific influence, however such factors are important to highlight.

### *Irrationality, learning and constructed preferences*

The discrepancies observed between choices made in the experimental treatments and actual preferences could also be through irrational behaviour. Due to the hypothetical nature of the survey, participants may have not been taking the survey seriously or been paying attention, although the removal of those that spent too little time on the survey would counter the later. However, Carlsson (2010) highlights that unstable preferences throughout an experiment does not imply irrational behaviour. Instead, the respondent could be learning their preferences throughout the experiment. As this study created a hypothetical market setting, some respondents may not have fully developed their preferences during the treatment. Therefore, between answering the treatment questions and revealing their real life preference, respondents may be forming or even changing their preference (Carlsson, 2010).

### *Responsibility*

The high number of the participants WTP for green energy who opted out in the standard tariff could be reactance to the perception of the energy provider actively encouraging and promoting of a non-environmental tariff. If a participant makes such inferences, this may motivate the consumer to override those cognitive limitations and biases that would have otherwise caused them to stick with the default. The energy companies have a large responsibility in mitigating climate change (CDP, 2017) and if consumers interpret that they are actively trying to get out of that responsibility, by actively restricting the green energy market, this could encourage such

consumers to act on their preference. Furthermore, to avoid pre-framing, the purpose and actor behind the survey were kept from the participants. This might have affected results if consumers thought the results could go towards an energy supplier's policy (strategic bias), they may have been worried that if they did not choose green, then the suppliers would not offer the option of having a green tariff.

### *Freedom of choice*

Another reason for the possible backfiring that occurred in the green default treatment could be from a perceived threat to autonomy, as mentioned in the ethics chapter. As mentioned in the ethical implications, even though a default does not limit choice, a perception of violation of autonomy or freedom can still exist as well as indicate a lack of freedom in the future. However, there were lower levels of potential backfiring in the standard default. Therefore, either 1) the behaviour was not due to a perceived violation of autonomy; 2) violation of autonomy was perceived in both treatments, but reactance was overruled by other factors in the standard default treatment (such as price); 3) violation of autonomy was only perceived in the green default treatment (due possibly to the price premium of the green default). The latter is supported by Hedlin and Sunstein (2015) who found greater reactance with green defaults only when they cost extra than with standard energy defaults. Thus, it is possible that Scottish consumers do not perceive defaults as a loss of autonomy, however, do object when the default costs more.

### *Consumer experience*

The disparity of the default effects to other studies may also be as a result of the existing market experience of the participants. Studies have shown that the effects of defaults are reduced by individual experience on the topic (List 2003, Löfgren et al., 2012). This is supported by Brown and Krishna (2004) who found that knowledge and/or previous experience can influence whether individuals stick with a default. The UK has one of the highest switching rates for electricity in Europe (ACER/CEER, 2014), with multiple campaigns and regulations encouraging such behaviour (such as *Ofgem's 2011 campaign,*[32] *The Big Switch*[33]*, Energy best deal*[34]) As a result, as UK consumers are relatively used to switching, this may have influenced the different behaviour in the default, reducing the impact of such effects such as the status quo bias and the endowment effect.

### *Disruption*

A key contributing factor to the default effect is the status quo bias. However, studies have shown that the status quo bias can be disrupted by significant life events such as moving to a new house. As the experimental survey asked participants to imagine such a scenario, this could have contributed to the similarities between the two default situations.

[32] https://www.ofgem.gov.uk/ofgem-publications/76314/energy-best-deal-video-release-pdf

[33] https://www.theguardian.com/money/2012/feb/07/big-switch-campaign-cheaper-energy-bills

[34] https://www.gov.uk/government/news/switch-to-save-27-billion-up-for-grabs-by-switching-energy-supplier

## 5.5 WTP for renewable electricity in Scotland

43.2% of the participants either had a green electricity tariff or would be willing to pay a premium for one. This supports previous studies such as (Diaz-Rainey & Ashton, 2008) who found in the UK 42% of participants would be willing to pay 5-10% more for green electricity from renewable sources. However, the sample used in this study did contain a large number of participants already with a green tariff (8.9%). Given the low market share of those companies which currently offer green tariffs, these results suggest the sample is overrepresented with participants with a green tariff.

## 5.6 Methodological Issues

The hypotheses presented in this study rest on several key assumptions. Firstly, that preferences misclassification can be an indicator for potential manipulation by the default. However, the study stresses that such hypotheses are treated with caution and makes no claim to prove any relationship. Secondly that time taken in answering the experimental treatment is an indicator for cognitive effort. Although this is supported by other literature, there are many assumptions in uses such information as a proxy. These were clearly stated in the methodology. Finally, this study is not able to prove any of the factors that influence the default effect caused the behaviour observed. Such studies are very difficult. The study acknowledges that such results could occur through irrational behaviour and hypothetical bias associated with online survey experiments.

There are a number of methodological issues regarding the experimental design also. In reality consumers would unlikely make a decision so quickly and if not the sole energy decider, would discuss such decisions with co-deciders. Furthermore consumers in reality rarely experience a dichotomous choice for electricity tariff between green and standard tariffs, they would also face differing price structures which may impact the result. Such tariffs were not implemented as it was deemed to be too specific to the UK and thus reduce the external validity. Furthermore, from a policy perspecitve it would be unrealistic to rapidly adjust energy mix to match a sudden enrolment in green tariffs via a default policy. Finally, due to a lack of available demographic data on energy deciders, it is unclear how representative panel is of the target population.

The use of online surveys have several advantages over other methods that make it applicable to this study. These include; low costs, short response time, large samples, ease of statistical data transfer, ability to perform randomized block design, suitable for non-linear design and reduced interview bias (Ilieva et al., 2002; Evans & Marthur, 2005; Szolnoki & Hoffmann, 2013). As with any experiment, it is necessary to keep in mind all possible bias in the research. The bias can be split into bias regarding the experiment design and selection bias regarding the survey population (Table 9).

*Table 9 Potential bias and mitigation measures*

| Bias | Comments |
|---|---|
| Hypothetical bias * | As there is no real consequence in this study there is the potential for hypothetical bias. Participants were asked to answer as if they would in real life to reduce such bias. However previous default studies have shown close results between hypothetical stated preferences and real-life observations (Johnson & Goldstein, 2003) |
| Social desirability bias * | It was clearly stated that all responses would be anonymous, thus reducing behavioural bias (List et al., 2004) |
| Researcher/ Interviewer bias * | The identity of the institution was not provided to reduce potential of manipulation (Levitt & List, 2007) |
| Survey bias* | In order to remove survey bias the order that the answers appeared were randomized. Secondly the wording of the default treatments was designed to be as similar as possible. |
| Respondent fraud/bias * | Each respondent was allocated a unique ID from the panel company which was recorded in the survey and reported back to the panel company. |
| Coverage bias ** | Online surveys are limited to internet users. However, the UK has a high internet use with 89% users (87% Scotland) with only 9% never having used the internet (Office for National Statistics, 2017). |
| Self-selection/panel bias ** | Not everyone on the internet will be on a panel. Although there is a possibility to include quota sampling, this was not chosen as the sample of decision makers is unknown. As a result, it is not possible to accurately accept or reject self-selection bias and the representativeness of the study to the Scottish population. As a result, the demographics of the sample are clearly stated. |
| Nonresponse bias ** | Not everyone on the panel who is invited will take part and of those who do some may drop out. However as only 3% dropped out when completing the survey this should minimize the potential for nonresponse bias (Huggins et al., 2002). |

* experimental design bias, ** online survey bias

# 6 Conclusion

Green nudges are seen by many as an attractive option for promoting pro-environmental behaviour, offering a low-cost and effective tool without resorting to reducing individual freedoms. As such, green nudges are becoming an increasing component of environmental policy conversations in countries and institutions around the globe. Of such green nudges, the green default for household electricity supply is an often-cited example of how to effectively increase pro-environmental behaviour. However, these arguments have been based on only a few studies, with those that have only examining the effectiveness through total enrolment figures alone. This study is first to the author's knowledge that examines how consumer choice of green electricity made under different default situations, reflect their actual real-life preferences.

## 6.1 Main findings

The study shows that energy decision makers are more likely to choose a green tariff when it is presented as the default, than when presented as an active choice. However, the study also reports a surprising result that, contrary to other studies, enrolment in green tariffs in the standard energy default produced similar results to that of the green default. As a result, the findings of this study only partially support the findings of other studies in this field. Although the treatment group for the standard default did have more participant that were WTP for green energy than the green default treatment, there are a number of other reasons which may have produced such behaviour (as explained when answering the second research question). By examining how participants decision under the different treatments reflected their actual preference, hypothesis for the observed behaviour can been formulated.

### *RQ 1. How do electricity tariff decisions made under different default settings reflect a consumer's actual/normative preference?*

Overall, a green energy default does not appear to effectively match consumers to their normative preferences. First, of those participants who stated a WTP for green energy in real life, when this option was presented as the default, almost a fifth (18.9%) chose instead to opt-out. Although this study was not able to examine the exact reasons for such behaviour, several hypotheses are proposed. First the setting of the experiment may have had a significant impact on the behaviour. Previous studies have shown that when consumers are sceptical over the purpose of the default and if from an untrustworthy source (especially when at a premium), this can cause consumers to choose against the default even if it was their preferred choice. UK energy consumers have very low trust in energy suppliers due to a reputation of excessive profiteering. Furthermore, many of whom have a controversial history of offering premium green tariffs that offered little environmental benefits. Thus, although a consumer may be WTP for energy from renewable sources, if this is presented as a more expensive green default from an untrustworthy agent, then consumer scepticism will result in choosing an alternative. A key hypothesis is that the longer a participant took on the decision, the more in line the choice is with their preferences. This is supported by the results of the active choice treatment. Secondly the hypothesis that the lack of trust in the perceived choice architect is results in the participants spending more time and effort on decisions, even when the default matches their preference. This hypothesis is also supported by the results. As a result, this study supports previous research that, along with other cognitive theories, defaults when perceived low trust agent, also work by encouraging more time and effort to be allocated into the decision making, thus better matching the choices made with actual preferences.

A further finding is that over a quarter (25.9%) of those who chose to stick with a green tariff when presented as a default, were from participants who expressed that this would not be WTP for a green tariff in real life. Although without the resources to identify the exact motivations

for such behaviour, there are several hypotheses including participant irrationality or unconstructed preferences. However, the results cannot overlook the identification of potential manipulation by the default setting. That those factors which make the default a powerful tool (e.g. inertia, guilt, endorsement) may be strong enough to override the actual preference of the individual. Such results have serious philosophical, phycological and socio-economic concerns.

It is important to stress that this thesis did not have the resources to identify the exact motivation of such behaviour. Furthermore the several assumptions are made in the classification of preferences. However the results from this study provides a valuable motivation for further research into the suggested factors discussed.

### *RQ 2. What are the policy implications for green energy defaults?*

This research raises a number of important policy issues for the role of green energy defaults. Green energy defaults have been receiving a lot of attention from policy makers recently despite a relatively few number of studies. This study, strongly suggests that defaults are very context and market-specific and thus can behave differently to expected from other studies. The behaviour of green default may be very dependent to the market setting, trust, price and the mechanism. The findings and potential motivations from this study highlight two important policy implications.

#### *Green defaults are not a panacea*

The first key finding is that not all consumers who are WTP for a green tariff remain with the green default. The results show that although green energy defaults lead to greater enrolment than active choices in enrolment according to preferences, there are still those who chose to opt-out. This is an important finding not previously identified by other studies.

Policy makers therefor need be able to identify the motivation behind such behaviour and thereby design a green default to mitigate such effects. Although this study was not able to identify the exact cause, from other research and the previous market experience, the lack of trust in UK energy companies, coupled with previous controversy and confusion with green tariffs, may have produced such results. This is supported by previous studies examining the disparities between a WTP and behaviour in the UK, which found that the low uptake of green tariff was not just due to cognitive limitations, but also due to low trust in energy suppliers, consumer confusion and a lack of effective guidelines (Boardman et al. 2006; Graham 2006; Diaz-Rainey & Ashton, 2008). If such factors remain in the present market, then the effectiveness of a green default will undoubtedly be restricted.

Therefore, one of the main policy implications from this research is that a green energy default should not be seen a single solution to correcting the attitude-behaviour gap. That a green default does not by itself fully correct the attitude behaviour gap for WTP for green energy for which it is justified. Therefor from a policy perspective, it is recommended that the introduction of a green energy default should be seen as a supportive policy measure aiming to address various issues that could be limiting the uptake of green energy. However as discussed in the next policy implication, green energy defaults should not be designed to be powerful enough to overcome concerns such as lack of trust, consumer confusion and lack of information, as these are all valid and rational reasons against choosing a green tariff despite being WTP extra for renewable electricity.

The lack of trust in energy suppliers and its implications should not be ignored by policy makers. Consumer scepticism in the UK of energy suppliers has had a negative impact on previous energy policy aimed at reducing carbon emissions (Mundaca, 2007; Murray, 2014). Consumer distrust in energy providers reduced uptake of smart meters, as consumers are sceptical about

why energy suppliers are encouraging them to use less energy (when this their main business model). However policy makers should not be aware of the levels of trust in the energy suppliers, but also the levels of trust in governments. For example in the US where energy companies have higher trust, studies have shown that governmental endorsement can instead consumer backfire behaviour (Arad & Rubnstein, 2015). As a result, such default energy policy should be country specific, and identify how trust in different stakeholders may impact consumer behaviour of such policies. Despite this, the policy recommendations still provide good practice for those in other liberalized energy markets even with higher trust level.

Finally, policy makers should focus not only on increasing green energy enrolment through reducing potential backfiring, but also be focusing on the removing the barriers of those against a green tariff. Although the main reason against wanting a green tariff was the extra price, there were a number of other factors which public policy should focus which present a more cost-effective strategy. These include a lack of information and consumer attitude towards renewable energy and climate change. By addressing such issues, this could not only increase consumer preference for green tariff, but could also lead to increased pro-environmental behaviour in other areas (e.g. educating consumers regarding the need to reduce fossil fuel use could also lead to increased public transport use). Focusing on the default alone would overlook such additional benefits.

### *Ethics and fuel poverty*

As discussed, the results show that a green default can result in consumers choosing a green tariff against their preferences. These preferences are based on valid reasons including an unwillingness to spend anymore and a lack of information. This highlights a serious issue for policy makers considering the introduction of a green energy default. Not only does this pose serious moral and ethical issues regarding manipulation, as green tariffs are in most cases more expensive this could have serious socio-economics implications. Of those that chose to remain on the green default despite not willing to in real-life, over half of the participants (n=11) stated the reason that in real life they were unwilling to spend any more on their electricity bills. Although the sample is too small to show significance, a greater proportion of those participants were in the income brackets most associated with fuel poverty[35]. Fuel poverty is defined by the Scottish Government as *"a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use"* (Scottish Executive, 2002, p. 6).

To highlight the important policy implications of defaults potentially enrolling energy consumers who cannot afford them, a brief summary of the current social landscape in Scotland is provided. Fuel poverty is a serious issue in Scotland with the most recent statistics showing that in 2015, 30.7% (or 748,000) of households in Scotland were in fuel poverty, and 8.3% (or 203,000 households) were living in extreme fuel poverty (20% or more of income on energy bills). Although this is a reduction from 34.9% in 2014, over half of the 4.2% reduction was due to reduction in fuel costs (2.3 percentage points), which came from a reduction in heating oil, not electricity (Scottish Government, 2016). As a result, fuel poverty remains a serious issue especially for those who use electricity for heating. Currently 12 % of Scottish households use electricity as their primary fuel (Scottish Government, 2017) and over half are fuel poor (54%), contributing to 21% of the total fuel poor (Scottish Government, 2016).

Fuel poverty has serious health effects with a direct association with excess winter deaths (or increased winter mortality) due to the association with low indoor temperatures (NRS, 2016).

[35] Although this study did not test fuel poverty, income closely associated with fuel poverty (Scottish Government, 2016).

For the winter of 2015/16 there were 2,850 excess winter deaths in Scotland (NRS, 2016). Maintaining high indoor temperatures can help reduce other significant health risks, including reduced cardiovascular disease (Khaw, 1995) and respiratory conditions (Howden-Chapman et al., 2007), improving mental health (Green & Gilbertson, 2008), as well as reducing environmental problems such as mould and condensation (Walker et al, 2006). As expected fuel poverty is sensitive to energy prices with a governmental report suggesting that a 5% increase in energy prices (similar the green premium used in this study) could push an extra 46,000 households (or 2% of total households) in Scotland into fuel poverty (Scottish Government, 2010). Therefore, it is vital from a policy perspective that those unwilling to spend extra for a premium green energy default are able to act according to their preferences.

Proponents of green nudging may argue that the most vulnerable in society can identify when they are being nudged and that their financial awareness will override the default effects. However, research does not support this. Vulnerable consumers are found to be over-represented in groups of consumers who do not actively switch energy suppliers (Boardman, 1991, p 96). Research had shown that living in poverty can have a greater cognitive load on an individual which can diminish their performance at decision making (Shal et al, 2012; Mullainathan & Shafir, 2014). Lorenc et al. (2013) carried out a study examining the switching behaviour in UK consumers who identify as fuel poor. They found that most common reason for not switching was apathy or "not bothered", this was based on reasons such as content with the current situation, too tired or stressed, and too old. Other reasons include lack of time, loyalty, fear and scepticism. Such behaviour in not switching tariffs could also apply to sticking with a default despite not being the preferred choice, countering the argument that nudges are fair as they affect all equally[36].

As shown, there is a significant possibility that a green default can manipulate those living in fuel poverty to choose a green tariff against their preference, with potentially serious implications. From a policy perspective, it is therefore logical to assume that it is unlikely a democratic country with high levels of fuel poverty, would introduce a more expensive green energy default without evidence that is does not harm some of the most vulnerable in society. The introduction of a new policy must be seen as cohesive with existing policies. In Scotland, affordable energy is one of main policy aims at reducing fuel poverty[37]. Those policy makers and organisations campaigning for more affordable energy, would want research showing that a green default does not harm the most vulnerable in society (arguably the most susceptible). Policy makers considering the introduction of green energy defaults cannot overlook this concern.

Therefore one of the key policy implications from this study is that a green energy default may be 'too effective', and manipulate consumers into a green tariff against their preference. Although not able to examine the exact motivations of why consumers stuck with the more expensive green tariff, it is hypothesised that those reasons behind the default effects (such as inertia, guilt, endorsement) could be overriding preferred decision making. As a result more research is needed into the reasons and whether, if so, a default can be designed to minimise such effects. As a result, public policy makers should carefully consider the power of a default and the potential adverse effects. One hypothesis to reduce manipulation is in line with ethical

[36] "Moreover, nudges are fairly easy to understand, and they do not seem to raise strong fairness concerns, as they are equally applied to all." Croson & Treich (2014, pp338).

[37] The statutory duty on the Scottish Government to eradicate fuel poverty by 2016 through the 2001 Housing (Scotland) Act was missed. In 2016 both the '*A Scotland without fuel poverty is a fairer Scotland: Four steps to achieving sustainable, affordable and attainable warmth and energy use for all*' and *An Action Plan To Deliver Affordable Warmth In Rural Scotland* were published to reduce fuel poverty.

concerns and to disclose not only the 'ends' but also the 'means' of the default. By stating that the reason for the default is for people that have expressed a willingness to pay and can afford it, this might reduce guilt for those who cannot. Furthermore, the green tariff should be easy to opt-out of and occur no financial cost in doing so. This draws attention back to the first policy recommendation, which states that green defaults should come with greater transparency and environmental information regarding the environmental benefits. Such information would likely increase the strength of the default effects, potentially increasing adverse effects such as manipulation. However, with further research into the effects, motivations and their strengths, the two policy recommendations can be complimentary. Balancing these two factors will be paramount if green energy defaults are to become part of public policy.

### *Other policy implications*

Overall green energy defaults have been shown to not accurately classify consumers to their preferences. This result also draws attention to other studies that have found high enrolment rates with green defaults. Without identifying whether such high enrolment occurs only from those who are actually WTP for RE, policy makers should be cautious in using such findings.

Furthermore, policy makers should recognise that there are low levels of consumer trust in many energy markets and as a result defaults in a real market setting may react differently to other green nudges and hypothetical studies (Brown & Krishna, 2004). The surprise results from the standard default should not be interpreted as an error, but should highlight the how defaults can produce very different results depending on context. Accordingly the hypothesis that the results in the standard treatment rest in exploiting a lack of trust in the agent, is not a recommended approach to environmental policy making. Instead there is a need for further research which can replicate real market settings.

For a default specific policy perspective, it is therefore recommended that along with the general requirements for a green tariff (as discussed in chapter 1.1), the introduction of a green energy default should adhere to the following principals;

1. **Transparency of the choice architect**. When framing a default choice setting, it should be clearly stated the identity of the agent behind the decision to adopt a default option. For example whether the default decision is due to mandatory regulatory requirements, or is a voluntary initiative from the supplier.
2. **Transparency over the aim of the default (the "ends").** To increase trust in the default, the aim of the default and the justification of the extra cost (if incurred) should be given. This is especially important when the default is more expensive than the other alternatives. To reduce the concern of profiteering. Consumers should be provided with the level of information they require to make an informed choice, thus reducing confusion and scepticism.
3. **Transparency over the default effect (the "means").** If defaults are to implemented in public policy making then individuals should be made aware of the why the default is used and its effects. Furthermore, by identifying that the default is aimed specifically at those who are WTP for a green tariff, this might reduce the potential of manipulation. For example those that cannot afford a green tariff might feel less guilty about opting out if they know the green tariff is aimed only at those who can.

### *Implications for researchers and energy suppliers*

For *researchers,* the findings recommend that future studies into the role of green defaults no longer only assess the success of such tools through total enrolment alone, but instead assess through comparing decisions made when subject to such nudges against the actual preference of the participant. Although such studies may yield uncomfortable results, understanding the relationships and driving factors will undoubtedly lead to better designed policy tools which can be effective and ethical. Furthermore, as this research has shown, behavioural economists and energy policy makers can benefit from incorporating more of the works of consumer research, especially in environments with low consumer trust, into their research.

For *energy suppliers* the results show there is a substantial demand and willingness to pay a premium for renewable electricity from energy consumers in Scotland (43%). However, this figure is similar to other studies conducted whilst the major energy companies offered green tariffs, yet this rarely translated into uptake. As a result, in a UK context, it is unlikely that energy companies would consider reintroducing green tariffs, especially as now they are limited to supplying only four tariffs. If those supporters of green energy defaults are advocating that energy suppliers voluntarily promote green default tariffs, then policy interventions are needed to reduce risk to the suppliers.

Finally, the main policy implication is not that policy makers and researchers should abandon green energy defaults, but that careful assessment of the default effects is critically needed to better design and improve their effectiveness and limit adverse effects. Such defaults can be designed however further research is needed to satisfy the concerns over the potential adverse effects. If anything, these results show a clear need for further research in this area before policy makers consider implementing green defaults in actual energy markets.

## 6.2 Future research

The findings of this thesis create a departure point for many avenues of new research, however the following areas represent arguably the greatest need for further research:

1) Further studies into the potential for manipulation by green energy defaults and methods to reduce such occurrence. Such studies could focus the effect of green energy defaults in the most vulnerable consumers.
2) Further research into the motivation for consumers who still opt-out of a green default despite it being their normative preference. This could examine the role of information and transparency (see Loewenstein et al, 2015; Bruns et al, 2016 ; Kroese et al, 2016; Steffel et al, 2016, for possible methodologies).
3) In general, develop a robust test to better examine whether stated preference match normative preferences. Such a test can be then conducted by future research, which can be used to show whether green nudges can be effective as well as ethical.

## 6.3 Critical reflections and final remarks

Although this thesis did hypothesis that the results of this study would vary from other studies due to the different setting, the degree in which the results varied was unexpected. Although the survey design was constructed in accordance with other published studies, and approved by a panel of energy experts and academics in the field, there are some critical reflections to present. First, given the results, collecting the reasons behind why some participants chose a tariff in the default that was not their preference would have added value to the study. Although such data would by itself not prove specific behavioural theories, such information would have provided more insight and strengthened hypotheses. Secondly a better understanding of to what degree the results are context dependent could have improved the generalizability of the results. Furthermore, providing an option for "no (strong) preference" when asking the participant their normative preference could have provided additional benefits. Examining whether those who do not have strong preferences react differently under the default situation could have added to the policy implications. Furthermore additional data on consumer experience of switching tariffs, as well as environmental awareness, could have provided further insight into the working of the default effect.

Finally, this study is the first to the author's knowledge to examine the role of green energy defaults through reflecting how the choices made under such situations match actual preferences. Although the results suggest that such defaults may not be as effective as previously thought (and may even manipulate choices), it is important to stress that these results do not argue against a green energy default, but instead highlight the need for careful design and further research. It should be the aim of a green energy default to increase enrolment amongst those willing, while at the same time protecting the most vulnerable of society. A green energy default should not be seen as a tool to encourage enrolment against preferences, instead it should be the role of institutions and policy makers should address such concerns, while the role of default is to then match such preferences with behaviour. A green energy default should correct market failure, not contribute to it.

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# Appendix

## Appendix I

**Electricity tariffs and purchase preferences in Scotland**

This survey aims to collect data on consumer behaviour and electricity tariff choices in Scotland. All responses are anonymous.

Thank you for your participation

**Are you involved in the decisions regarding the electricity tariff and provider in your household?**

- ○ Yes
- ○ No

**Demographics**

Please fill out the following information to the best of your ability

**Gender**

- ○ Male
- ○ Female

**Age**

- ○ 16-24
- ○ 25-34
- ○ 35-44
- ○ 45-59
- ○ 60-74
- ○ 75+

**Your highest level of qualification**

- ○ Degree, professional qualification
- ○ HNC/HND or equivalent
- ○ Higher, A level or equivalent
- ○ Standard Grade, O Grade or equivalent
- ○ Other qualification
- ○ No qualification
- ○ Qualification unknown

**Net annual household income (i.e. after taxation and other deductions)**

- ○ £0 - £6000
- ○ £6001 - £10000
- ○ £10001 - £15000
- ○ £15001 - £20000
- ○ £20001 - £25000
- ○ £25001 - £30000
- ○ £30001 - £40000
- ○ £40001+

**Household location**

- ○ Large urban area (settlement of 125,000 people or more)
- ○ Other urban area (settlement of 10,000 to 124,999 people or more)
- ○ Small town (settlement of 3,000 to 9,999 people)
- ○ Rural (settlement of less than 3,000 people)

**Household tenure**

- ○ Owner occupied
- ○ Social rented
- ○ Private rented
- ○ Other

**Household size**

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7 or more

**Green Default Treatment**

Please take your time to carefully read the question and respond as if you would in a real-life setting.

Assume you have moved to a new town. You receive a letter from the local electricity supplier of that area. They inform you that unless instructed otherwise you will be automatically put on their green electricity tariff, where 100% of the electricity comes from renewable sources (e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables). If you would like to switch to the standard tariff you are asked to notify the company. What do you do?

- ○ Stay on the assigned green electricity tariff
- ○ Switch to the standard electricity tariff

**Standard Default Treatment**

Please take your time to carefully read the question and respond as if you would in a real-life setting.

Assume you have moved to a new town. You receive a letter from the local electricity supplier of that area. They inform you that unless instructed otherwise you will be automatically put on their standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables). They also inform you about their green tariff where 100% of the electricity is generated from renewable sources (e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff. If you would like to switch to the green tariff you are asked to notify the company. What do you do?

- ○ Stay on the assigned standard electricity tariff
- ○ Switch to the green electricity tariff

**Active Choice Treatment**

Please take your time to carefully read the question and respond as if you would in a real-life setting.

Assume you have moved to a new town. You are informed by the local electricity provider of the available tariffs. These are a standard electricity tariff (where the electricity comes from a mix of nuclear, fossil fuels and renewables) and a green electricity tariff (where the electricity comes from 100% renewable sources, e.g. hydro, wind, solar, bioenergy). Based on average electricity use, the green tariff is expected to cost £2.50/month more than the standard electricity tariff. You are asked to make an active choice, which do you choose?

- ○ Green electricity tariff
- ○ Standard electricity tariff

**In reality, is your current electricity tariff a standard energy tariff or green tariff?**

- ○ Green tariff
- ○ Standard energy tariff
- ○ Don't know

**Would you like to switch to a 100% green electricity tariff (with an extra cost of £2.50/month)?**

- ○ Yes
- ○ No

**What is the reason(s) for not switching to a green tariff?**

- ☐ Unwilling to spend anymore on electricity than currently am
- ☐ Effort and time switching
- ☐ Content enough with my current tariff
- ☐ Not enough information given on green tariffs
- ☐ Do not see the need for a green tariff
- ☐ Environmental benefits do not justify the costs
- ☐ Mitigating climate change is not my responsibility
- ☐ Do not know anyone else with a green tariff
- ☐ Other: _____

Survey completed. Thank you for your time.

# Appendix II

| Reason | Allocation |
|---|---|
| "Unable to afford any more." | Unwilling to spend anymore on electricity than currently am |
| "Price" | Unwilling to spend anymore on electricity than currently am |
| "Moving" | Ommited |
| "locked in at moment" | Ommited |
| "it shouldn't cost more" | Unwilling to spend anymore on electricity than currently am |
| "I live next door to the third largest onshore windfarm in the UK, I know all about the environmental destruction that goes with wind farms and other so called green technology, my life is a green as I can get it electricity notwithstanding" | Environmental benefits do not justify the cost |
| "Cost" | Unwilling to spend anymore on electricity than currently am |
| "economically challenged but with different financial circumstances I would choose the green tariff" | Unwilling to spend anymore on electricity than currently am |
| "believe that "standard" Electrical suupy comes from mixed sources anyway" | Ommited |

# Appendix III

## Total group time

**Descriptives**

Group time all

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Green | 181 | 29.2737 | 16.58840 | 1.23301 | 26.8407 | 31.7067 | 2.89 | 95.28 |
| Standard | 161 | 31.0375 | 18.41272 | 1.45113 | 28.1716 | 33.9033 | 2.73 | 98.67 |
| Active Choice | 154 | 17.5060 | 14.24469 | 1.14787 | 15.2383 | 19.7737 | 2.91 | 80.66 |
| Total | 496 | 26.1925 | 17.51993 | .78667 | 24.6469 | 27.7381 | 2.73 | 98.67 |

**ANOVA**

Group time all

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 17117.807 | 2 | 8558.903 | 31.297 | .000 |
| Within Groups | 134821.419 | 493 | 273.471 | | |
| Total | 151939.226 | 495 | | | |

**Multiple Comparisons**

Dependent Variable: Group time all

Tukey HSD

| (I) Scenario | (J) Scenario | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|
| Green | Standard | -1.76375 | 1.79150 | .587 | -5.9752 | 2.4477 |
| | Active Choice | 11.76773* | 1.81292 | .000 | 7.5059 | 16.0296 |
| Standard | Green | 1.76375 | 1.79150 | .587 | -2.4477 | 5.9752 |
| | Active Choice | 13.53148* | 1.86397 | .000 | 9.1496 | 17.9133 |
| Active Choice | Green | -11.76773* | 1.81292 | .000 | -16.0296 | -7.5059 |
| | Standard | -13.53148* | 1.86397 | .000 | -17.9133 | -9.1496 |

*. The mean difference is significant at the 0.05 level.

### Timing data according to decision

## *Green default treatment*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Stay on the assigned green electricity tariff | 77 | 28.67 | 15.456 | 1.761 | 25.16 | 32.17 | 3 | 72 |
| Switch to the standard electricity tariff | 104 | 29.72 | 17.439 | 1.710 | 26.33 | 33.11 | 3 | 95 |
| Total | 181 | 29.27 | 16.588 | 1.233 | 26.84 | 31.71 | 3 | 95 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 49.367 | 1 | 49.367 | .179 | .673 |
| Within Groups | 49482.110 | 179 | 276.436 | | |
| Total | 49531.478 | 180 | | | |

## *Standard default treatment*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Switch to the green electricity tariff | 77 | 30.07 | 18.085 | 2.061 | 25.96 | 34.17 | 3 | 83 |
| Stay on the assigned standard electricity tariff | 84 | 31.93 | 18.772 | 2.048 | 27.85 | 36.00 | 6 | 99 |
| Total | 161 | 31.04 | 18.413 | 1.451 | 28.17 | 33.90 | 3 | 99 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 139.434 | 1 | 139.434 | .410 | .523 |
| Within Groups | 54105.087 | 159 | 340.284 | | |
| Total | 54244.521 | 160 | | | |

## *Active choice treatment*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Green electricity tariff | 35 | 26.70 | 15.177 | 2.565 | 21.49 | 31.92 | 5 | 78 |
| Standard electricity tariff | 119 | 14.80 | 12.817 | 1.175 | 12.47 | 17.13 | 3 | 81 |
| Total | 154 | 17.51 | 14.245 | 1.148 | 15.24 | 19.77 | 3 | 81 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 3830.859 | 1 | 3830.859 | 21.396 | .000 |
| Within Groups | 27214.562 | 152 | 179.043 | | |
| Total | 31045.420 | 153 | | | |

## Timing data according to WTP

### *TOTAL*

**Descriptives**

Group time all

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Yes | 215 | 24.7193 | 16.81584 | 1.14683 | 22.4588 | 26.9798 | 2.73 | 83.02 |
| No | 281 | 27.3197 | 17.98832 | 1.07309 | 25.2074 | 29.4321 | 2.95 | 98.67 |
| Total | 496 | 26.1925 | 17.51993 | .78667 | 24.6469 | 27.7381 | 2.73 | 98.67 |

**ANOVA**

Group time all

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 823.660 | 1 | 823.660 | 2.693 | .101 |
| Within Groups | 151115.566 | 494 | 305.902 | | |
| Total | 151939.226 | 495 | | | |

### *GREEN DEFAULT*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Yes | 71 | 23.93 | 13.057 | 1.550 | 20.84 | 27.02 | 3 | 71 |
| No | 110 | 32.72 | 17.728 | 1.690 | 29.37 | 36.08 | 4 | 95 |
| Total | 181 | 29.27 | 16.588 | 1.233 | 26.84 | 31.71 | 3 | 95 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 3339.890 | 1 | 3339.890 | 12.943 | .000 |
| Within Groups | 46191.588 | 179 | 258.054 | | |
| Total | 49531.478 | 180 | | | |

## *STANDARD DEFAULT*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Yes | 80 | 30.10 | 18.417 | 2.059 | 26.00 | 34.19 | 3 | 83 |
| No | 81 | 31.97 | 18.475 | 2.053 | 27.88 | 36.05 | 6 | 99 |
| Total | 161 | 31.04 | 18.413 | 1.451 | 28.17 | 33.90 | 3 | 99 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 140.938 | 1 | 140.938 | .414 | .521 |
| Within Groups | 54103.583 | 159 | 340.274 | | |
| Total | 54244.521 | 160 | | | |

## *ACTIVE CHOICE*

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Yes | 64 | 18.88 | 16.543 | 2.068 | 14.75 | 23.01 | 3 | 81 |
| No | 90 | 16.53 | 12.360 | 1.303 | 13.94 | 19.12 | 3 | 56 |
| Total | 154 | 17.51 | 14.245 | 1.148 | 15.24 | 19.77 | 3 | 81 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 206.000 | 1 | 206.000 | 1.015 | .315 |
| Within Groups | 30839.421 | 152 | 202.891 | | |
| Total | 31045.420 | 153 | | | |

## Timing data for those WTP in active choice treatment

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Green electricity tariff | 31 | 26.48 | 15.196 | 2.729 | 20.91 | 32.06 | 5 | 78 |
| Standard electricity tariff | 33 | 11.73 | 14.618 | 2.545 | 6.55 | 16.92 | 3 | 81 |
| Total | 64 | 18.88 | 16.543 | 2.068 | 14.75 | 23.01 | 3 | 81 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 3476.361 | 1 | 3476.361 | 15.657 | .000 |
| Within Groups | 13765.665 | 62 | 222.027 | | |
| Total | 17242.025 | 63 | | | |

## Timing data analysis for those not WTP in the green default

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Green electricity tariff | 19 | 36.46 | 20.203 | 4.635 | 26.72 | 46.20 | 7 | 72 |
| Standard electricity tariff | 91 | 31.95 | 17.189 | 1.802 | 28.37 | 35.53 | 4 | 95 |
| Total | 110 | 32.72 | 17.728 | 1.690 | 29.37 | 36.08 | 4 | 95 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 320.156 | 1 | 320.156 | 1.019 | .315 |
| Within Groups | 33938.310 | 108 | 314.244 | | |

| | | | | | |
|---|---|---|---|---|---|
| Total | 34258.465 | 109 | | | |

## Timing data analysis for those WTP in the green default

**Descriptives**

Group time:

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Green electricity tariff | 58 | 26.11 | 12.758 | 1.675 | 22.76 | 29.47 | 3 | 71 |
| Standard electricity tariff | 13 | 14.17 | 9.745 | 2.703 | 8.28 | 20.06 | 3 | 29 |
| Total | 71 | 23.93 | 13.057 | 1.550 | 20.84 | 27.02 | 3 | 71 |

**ANOVA**

Group time:

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 1515.664 | 1 | 1515.664 | 10.039 | .002 |
| Within Groups | 10417.458 | 69 | 150.978 | | |
| Total | 11933.122 | 70 | | | |

## Timing data when those that answered the treatment questions in less than five seconds were removed

**Descriptives**

Group time all

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| Green | 174 | 30.3040 | 16.08353 | 1.21929 | 27.8974 | 32.7106 | 5.82 | 95.28 |
| Standard | 160 | 31.2144 | 18.33274 | 1.44933 | 28.3520 | 34.0768 | 5.45 | 98.67 |
| Active Choice | 135 | 19.4136 | 14.20992 | 1.22299 | 16.9948 | 21.8325 | 5.01 | 80.66 |
| Total | 469 | 27.4798 | 17.15006 | .79192 | 25.9237 | 29.0360 | 5.01 | 98.67 |

**ANOVA**

Group time all

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 12402.912 | 2 | 6201.456 | 23.073 | .000 |
| Within Groups | 125247.332 | 466 | 268.771 | | |
| Total | 137650.245 | 468 | | | |

**Multiple Comparisons**

Dependent Variable: Group time all

Tukey HSD

| | | Mean Difference | | | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| (I) Scenario | (J) Scenario | (I-J) | Std. Error | Sig. | Lower Bound | Upper Bound |
| Green | Standard | -.91035 | 1.79568 | .868 | -5.1324 | 3.3117 |
| | Active Choice | 10.89039* | 1.88031 | .000 | 6.4694 | 15.3114 |
| Standard | Green | .91035 | 1.79568 | .868 | -3.3117 | 5.1324 |
| | Active Choice | 11.80075* | 1.91591 | .000 | 7.2960 | 16.3055 |
| Active Choice | Green | -10.89039* | 1.88031 | .000 | -15.3114 | -6.4694 |
| | Standard | -11.80075* | 1.91591 | .000 | -16.3055 | -7.2960 |

*. The mean difference is significant at the 0.05 level.

# Appendix IV

**Regression in active choice**

**Variables in the Equation**

| | | B | S.E. | Wald | df | Sig. | Exp(B) | 95% C.I.for EXP(B) Lower | Upper |
|---|---|---|---|---|---|---|---|---|---|
| Step 1[a] | Group time all | -.088 | .027 | 10.756 | 1 | .001 | .916 | .869 | .965 |
| | Constant | 1.588 | .516 | 9.470 | 1 | .002 | 4.892 | | |

a. Variable(s) entered on step 1: Group time all.

**Classification Table[a]**

| | | | Predicted Decision | | |
|---|---|---|---|---|---|
| | Observed | | Green electricity tariff | Standard electricity tariff | Percentage Correct |
| Step 1 | Decision | Green electricity tariff | 23 | 8 | 74.2 |
| | | Standard electricity tariff | 5 | 28 | 84.8 |
| | Overall Percentage | | | | 79.7 |

a. The cut value is .500

**Model Summary**

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 72.225[a] | .226 | .302 |

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.