An exploratory investigation of barriers and enablers affecting investment in renewable companies and technologies in the UK

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Abstract/Summary

The last few years has seen considerable research expenditure on renewable fuel technologies. However, in many cases, the necessary sustained and long term funding from the investment community has not been realised at a level needed to allow technologies to become reality. According to global consulting firm Deloitte's recent renewable energy report [1] many renewable energy projects stalled or were not completed because of issues including the global economy, the state of government finances, difficulties in funding, and regulatory uncertainty. This investigation concentrates on the funding aspect and explores the perceived barriers and enablers to renewable technologies within the investment and renewables community. Thematic analysis of 14 in-depth interviews with representatives from renewable energy producers, banks, and investment companies identified key factors affecting the psychology of investor behaviour in renewables. 8 key issues are highlighted including a range of barriers and enablers, the role of the government, balance between cost/risk, value/return on investment, investment timescales, personality/individual differences of investors, and the level of innovation in the renewable technology. It was particularly notable that in the findings the role of the government was discussed more than other themes and generally in quite critical terms highlighting the need to ensure consistency in government funding and policy and a greater understanding of how government decision making happens. Specific findings such as these illustrate the value of crossing disciplinary boundaries and highlights potential further research in this interdisciplinary field. Behavioural science and economic psychology in particular has much to offer at the interface of other disciplines such as political science and financial economics.

Keywords: renewables, investment, in-depth interviews, technology, funding, economic psychology

Introduction

The last few years has seen considerable research expenditure on renewable fuel technologies. Yet, despite multi-million pound projects such as the UK Carbon Trust Algae Biofuel Challenge, as well as substantial venture capitalist funding, the necessary large-scale, long term funding needed by the investment community has not been realised at a level needed to allow many technologies to become reality. If we consider the case of algae biofuels as a representative example, financing is identified as a key challenge for the industry in the US National Algae Association 2010 Review. The review identifies an article written by Will Thurmond of Emerging Markets Online as summing up the situation quite well. According to this article, the "Big 4" algae labs in San Diego, Sapphire Energy, Scripps Institute of Oceanography, Synthetic Genomics, and SD-CAB at UC-San Diego affiliated with the DOE's CAB-COMM, represent nearly $1 billion in funding from private and public sector investment, despite the fact that none of these ventures is yet in commercial production.

Thus it appears that the only way the renewable sector will grow at the scale needed is for stakeholders to invest significant funds. However, it seems that because of the deep-seated perceptions about the renewable sector, realising this investment might be a challenge. A small number of investment banks have emerged specialising in renewable and sustainable development investment portfolios, such as Piper Jaffrey in the US, and Earth Capital Partners in the UK. From informal communications with those in the sustainable energy sector it has been commented that investments in sustainable, renewable and clean technologies tend to be resilient with respect to market volatility compared to many other investments. As a result, investors such as pension fund managers and high net worth individuals have yet to take up these investment products. Since the present investigation aims to explore the perceived barriers and enablers to investment in renewable technologies in UK, a short review of the market growth and policies is introduced below.

The UK government has a number of policies designed to support the renewables industry and is “committed to increasing the proportion of energy we use from renewable sources…The government will help business develop in this area to put the UK at the forefront of new renewable technologies” [2]. UK policy has included financial incentives (for example feed in tariffs (FITs)) but like many other countries government subsidies have been reduced due to plunging green energy technology prices and economic austerity measures. Alongside the UK policies and legislation the European Union’s Renewables Directive proposed the adoption of national targets for renewables. The latest of these, the Renewable Energy Directive (Directive 2009/29/EC) (‘RED’) stated that in the UK, 15% of final energy consumption- calculated on a net calorific value basis, and with a cap on fuel used for air transport- should be accounted for by energy from renewable sources by 2020.

The UK is making some progress in renewables with a 2% increase in electricity generation from renewable sources between 2009 and 2010, an increase of 75% during 2010 in offshore wind generation and a 17% increase during 2010 of heat from renewable sources. Using the method required by the Renewables Directive 3.3% of energy consumption in 2010 came from renewable sources, up 3% from 2009 (RESTATS, the Renewable Energy STATisticS database)[3].

However as the Department for Energy and Climate Change (DECC) states "investment decisions over the next decade in nuclear, renewable and fossil-fuel powered infrastructure, will play an essential part in determining whether or not long-term targets to decarbonise the energy system are met" (p 13)[2]. In 2011 the US was the biggest investor in green energy with more than $48bn invested in the sector, up from $34bn in 2010. Globally there was $263bn investment in 2011, up 6.5% from 2010 levels. The UK was 7th with $9.4bn of investment in 2011 [4].

DECC states that at least $270 trillion of investment will be required globally between now and 2050 with £79 billion needed in the UK to meet the government's ambitious renewable energy target of 30GW of additional capacity [5] although the UK's binding commitments – under the 2008 Climate Change Act and the EU's 2009 renewable energy directive – could be met with just 19GW of extra capacity, costing £51 billion. The report estimates that around £14.5 billion of capital has already been committed which reduces this figure to £36.6 billion and estimates that around £19.6 billion will be required between 2013 and 2015, given the assumption that the current Renewables Obligation Certificate (ROC) support regime for onshore and offshore wind will remain in place until 2017, and the timing of finance needed for projects. The report also warns that "there are a limited number of investors who understand this space – particularly newer technologies such as offshore wind – and are willing to commit large sums to its construction. With the anticipated spike in capital demand occurring with such a short lead time (2013), there is some doubt as to the number of new investors who will have come up to speed sufficiently to invest in this capital intensive and somewhat unproven technology (pp.11-12)[5]."

While the UK government states that it supports the need for further investment; "if we are to make the UK more energy secure, help protect consumers from fossil fuel price fluctuations, drive investment in new jobs and businesses and keep us on track to meet our carbon reduction objectives for the coming decades" [6], there are some who suggest that the government "has totally failed to grasp the financial necessity of building a low-carbon future" [7]. Goldsmith [8] stated that uncertainty over the government's commitment was harming the UK's transition to a low carbon economy and that in particular changes in policy were "the one risk all investors highlight when they consider putting funds into clean technology" [8]. Moreover, according to global consulting firm Deloitte's recent renewable energy report [1] many renewable energy projects stalled or were not completed because of issues ranging from the global economy, the state of government finances, difficulties in funding and regulatory uncertainty.

This research seeks to clarify the position and view of renewable energy investment from the investment and renewable communities and to highlight the barriers and enablers in ensuring the necessary investment in this area is forthcoming. In doing so the research also seeks to explore whether the criticisms about government policy and its effects on renewables investment are evidenced by the experiences and perspectives of those involved at the heart of the process. While this research focuses on investment specific to renewables it is important to note that this falls within a wider literature on the psychology of investment behaviour as well as drawing from behavioural economics and economic psychology and highlights the interdisciplinary of this area of research. A short literature review is provided here to highlight the current project's contribution to the evidence base in relation to the following areas: general investment behaviour, ethical investment, motivations behind ethical investments and green investments.

Literature Review

Research on the *generic investment behaviour* of both individuals and companies covers a wide range of literatures and perspectives. One is behavioural finance, which attempts to better understand and explain how emotions and cognitive errors influence investors and the decision-making process. The study of psychology and other social sciences can shed considerable light on the efficiency of financial markets as well as explain many stock market anomalies, market bubbles, and crashes. For example, the outperformance of value investing results from investor's irrational overconfidence in exciting growth companies and from the fact that investors generate pleasure and pride from owning growth stocks. It is a key area of research in investment behaviour and involves work looking at Bayes Rule, Expected Utility Theory and the importance of arbitrage [9], the Efficient Market Hypotheses [10], and Prospect Theory [11] amongst others. Recent work has also explored investor behaviour through neuroscience exploring areas as extensive as value [12], detection of patterns [13], and the prediction of the unpredictable [14].

Within the study of investment behaviour a particular type of investment has gained interest, that of *ethical or socially responsible investment* (SRI). Ethical investing dates back to the nineteenth century and to religious movements such as the Quakers, the Methodist Church, and the Church of England who, when investing on the Stock Exchange, wanted to avoid companies involved in tobacco and gambling. In 1971 the Pax World Fund was set up in the USA, this famously avoided investments associated with the Vietnam War and in the 1980s many companies who had strong links with South Africa and the apartheid regime were avoided by investors. The demand for SRI funds is increasing with evidence pointing towards a situation where consumers consider both the environmental and individual consequences of products and services before making a purchase decision [15]. Handcock [16] asked individuals which of the following were important when investing: environmental sustainability, positive relationships with stakeholders, human rights, labour standards and working conditions and countering bribery. Notably out of these considerations environmental sustainability scored the highest at 33%. While these types of SRI funds have become popular there is research that suggests that consumers perceive them to be less profitable [16] although the objective evidence for this is mixed [17-19].

Other studies have looked at the *motivation behind SRI*. Lewis and Mackenzie [20] conducted a questionnaire which was completed by 1146 ethical investors from within the UK. When they looked at the profile of these ethical investors they found that they were much the same as for standard investors, with most having professional qualifications and being over the age of 45. However, more than expected by chance voted either liberal democrat or labor, had experience in a caring profession such as health or education and were actively involved in charities or religious/environmental groups. In subsequent research Lewis [21] carried out two sets of focus groups. The first consisted of 45 ‘standard’ investors, the second consisted of 49 ethical/green investors, each of these groups were broken into 7 focus groups. Discussions centered on motivations for investment, moral dilemmas faced and what they were hoping to achieve. Both groups were not happy to attribute investments to solely economic reasons, with the ethical group expressing unease with capitalism and the UK government, feeling their investment choices were required due to government failure. Lewis [21] also notes three main motivations for SRI are

precaution (security and stability), foresight (preparation for old age) and calculation (capital growth) supporting their earlier research.

Havermann and Webster [22] argue that financial return for some ethical investors is not of primary importance, with some willing to forgo a greater profit in order to fulfill these beliefs; this can be seen on a smaller scale by the fact that many consumers are happy to pay more for a fair trade product. Havermann and Webster [22] carried out a consumer questionnaire with the results indicating that 94% of respondents had paid more for higher price fair trade products and 65% suggested that they would not sacrifice values for profit. When asked which issue is the most important to you when investing your money (the choices being profit, long term goals, regular income, low risk and ethicality), low risk scored the highest at 31%, with only 19% stating profit as the most important factor.

Green or environmental investment has been highlighted as an important component of SRI [16], but this area has received little specific attention in the literature at the individual or company levels. Past research was often concerned with wider issues of environmental sustainability of companies, rather than specifically investment within the renewables industry. For example a number of studies explore how corporate social responsibility (CSR) and environmental reporting in companies affects the behaviour of investors. Wang, Qui, and Kong [23] found that a firm's CSR performance is only likely to affect the decisions of institutional investors after an environmental incident (such as the BP spillage) and this effect is not observed for individual investors. Ahmed, Islam, Mahtab, and Hasan [24] studied specifically how CSR performance affects institutional investment, based on the idea that they take a longer term view compared to individual investors; they cannot reshuffle their portfolios without significant loss of value, so will be interested in long term stability. Overall they found a positive relationship between increased CSR and institutional investment in socially responsible companies.

In terms of environmental reporting, Berthelot, Coulmont, and Serret [25] found that investors value sustainability reports. Holm and Rikhardsson [26, 27] found that environmental information has the potential to affect investment decisions - although this is affected by the investment timescale, the experience of the investor, and whether the information provided is qualitative or quantitative. However, Koeller, Weber, Fenchel, and Scholz [28] suggested that there is a need for a reliable comparative assessment of sustainability of ethical funds, which is not currently available, to support investment choices. In addition, Demirel and Kesidou [29] highlight the need for specific environmental regulations which stimulate investments in Environmental Research and Development (ECORD), by working in the area of eco-innovations, that is "the creation or implementation of new, or significantly improved products (goods and services), processes, marketing methods, organisational structures and institutional arrangements which-with or without intent-lead to environmental improvements compared to relevant alternatives" (p 19)[30].

While some of the above literature points to issues of interest in general sustainable investment and environmental performance of companies, it does not specifically look at investments in renewable companies. As this is an area of importance for meeting energy targets, this investigation concentrates on these investments.

Methodology

As an exploratory study, in-depth semi-structured interviews were determined to be the best data collection strategy. In-depth semi-structured interviews are used within work exploring end users of products, as well with business decision making environments [e.g., 31-33]. Therefore this strategy was deemed appropriate for this study.

Sample: The semi-structured interviews sought to explore the barriers and enablers affecting investment in renewable technologies. Our sample was composed of company representatives who were interviewed, if possible, in their offices or work environments to ensure they felt relaxed and at ease. Fourteen in-depth interviews were carried out between August 2011 and June 2012, each of which lasted between 30 and 80 minutes. Three main groups of companies were included within the interviews: investment companies, banks, and renewable technology companies (who had and had not been successful in gaining funding: see Table 1 for further details). A registered charity supporting renewables investment was also included, as well as a stockbroker and a law firm who had experience in renewable investment and advice. Selection of participants was by convenience sample with participants recruited through pre-existing contacts with the Durham Energy Institute. In addition, following each interview, the interviewee would be asked if they had any further contacts that would be happy to be approached. Such an informal approach was used because in the early stage of data collection this was found to be more effective than 'cold calling', as it built the trusted relationship required for open and honest discussion. Many more people were contacted than were interviewed with the time constraints of the potential interviewee being the main reason for the contact not resulting in an interview.

To reflect the different viewpoints of the groups interviewed, three different interview schedules were used (and adapted for other types of companies) which covered similar topics including: personal and company background, the decision making process (including use of information, preferences and influences), systems and procedures, strategies, and the future. The interviews were semi-structured, with participants encouraged to talk beyond the outline topics and to discuss what they thought was important in renewables investment. Participants were sent the interview schedule and introductory information prior to the interview and were reminded of the confidentiality of the discussion on the day. Each interview was carried out with either one or two researchers, these interviews were carried out face to face in most instances, when this failed a telephone interview was carried out. The interview always began with an overview of the purpose of the project and how it was funded. Anonymity was highlighted and consent was obtained from each participant.

Table 1: Participants and Interview Details

Participant Type	*Energy relationship*	*Representative of Company*	*Date of Interview*
Investment and Advisory	Investment	Associate	6th Dec 2011
Investment and Advisory	Investment Consultant and Advisor	Partner	29th Nov 2011
Investment and	Independent Financial	Managing Director	9th Feb 2012

Advisory	Advisor		
Investment and Advisory	Investment Company specialising in environmental investment	Partner	8th Aug 2011
Investment and Advisory	Investment Company	Partner	15th Aug 2011
Bank	Bank	Alternatives Analyst	15th Aug 2011
Bank	Bank	Branch Manager	16th Aug 2011
Renewables Technology	Renewables Company (Biofuels)	Director	8th Aug 2011
Renewables Technology	Renewables Company (Tidal)	Director	2nd Sept 2011
Renewables Technology	Renewables Company (wind)	CEO	16th Aug 2011
Renewables Technology	Registered Charity promoting and supporting sustainable development	Director	29th Nov 2011
Renewables Technology	Law and Advisory	Partner	11th June 2012
Renewables Technology	Stockbroker	Associate	30th April 2012

Analysis: Interviews were audio-taped and transcribed verbatim. The data collected was analysed by thematic analysis using NVivo software. Thematic analysis was used to analyse the data and is one of the most commonly used methods of qualitative analysis. In thematic analysis [34] the task of the researcher is to identify a limited number of themes which adequately reflect their data. Thematic analysts create their codes by defining what they see in the data and codes emerge as the data is scrutinised. Hence, coding is a fluid process in which codes may be modified or altered as ideas develop. Themes which integrate sets of codes are then defined by the researchers and illustrated in the report results below with examples (and further examples in the appendix). Eight main themes were identified as being of central importance to all categories of participants and will be discussed in the next section.

Results

Results of the thematic analysis are presented here following the eight main themes: Barriers, Enablers, Role of Government, Cost/Risk, Value/Return on Investment, Timescale, Personality/Individual Values, and Level of Innovation. Each of these was identifiable in the majority of the interviews and will be discussed in turn[1]. Illustrative examples for the most common themes are provided below – with more examples shown in the Appendix.

[1] Seven other minor themes (the investment organisation, other stakeholders, society/public opinion, role of the media, size of the investment, importance of reputation and importance of the management team) were also identified within the interviews and for some of the respondents played a part in their decision making, behaviour and attitudes. These themes did not come out in every interview but were seen across some and therefore are not identified as as important as the main themes outlined above. Due to space constraints these are not reported here.

Barriers: A number of specific types of barriers were identified. The most prevalent of these were cost barriers, communication barriers, fiduciary duty barriers, and poor communication from government over policy and concerns over the government's future commitment to policy:

> *"… we don't mind what policy we're set within reasonable bounds, but if you set it, make it last for at least ten years, because whatever policy you set we can work around." (Specialist Investment Company)*

The issue of fiduciary duty and SRI investment has been explored [35, 36] especially in relation to the United Nations Environment Programmes' Finance Initiative (UNEP FI), commonly known as the Freshfields Report. They support that fiduciary duty is often cited as the reason why environmental and SRI issues are not taken into account in investment decisions. A survey of pension fund trustees [37] notes that as many as 45% of respondents indicated that considerations of fiduciary duty were their main reason for not engaging more actively in SRI. The Freshfields report was heralded as a turning point suggesting that SRI issues should and could be taken into account within the law but Sandberg however suggests that this optimism may not be completely warranted as only *some* 'environmental, social and governance' (ESG) considerations can only be taken into account *sometimes* [35, 36]. He suggests that the report actually rules out exactly the type of SRI which proponents of social responsibility and environmental sustainability should hold in highest regard: proactive cases and socially effective investment strategies. Unfortunately this potentially rules out investment in risky innovative technologies, methods or ideas and hence many renewable technologies. He in turn notes that legal reform is needed to overcome this barrier. However, it is pleasing to note that one respondent commented on stakeholders who are in some cases looking beyond this:

> *"…because their stakeholders were starting to say, look, okay so you have a fiduciary duty to deliver a financial return to us, but actually practically we want you to take other things into consideration…."(Specialist Investor)*

Enablers: As well as a number of barriers, some enablers, i.e. things that had or could help investment in companies, were also identified within the interviews. The strongest enabler was the importance of having appropriate knowledge and skills. It was clear that in order for investors to be interested in a company, the company had to show it had the appropriate knowledge and skills to succeed, although this did not always have to be in relation to a past history of renewables.

Knowledge and skills of the investor also acted as both an enabler and a barrier (as above). It was also certainly the case that some companies do not always have the knowledge and skills they need initially, but this also links to another enabler that was noted, that of network and contacts where companies can gain or use the knowledge and skills needed. Having a support network of people who could share and provide knowledge as well as helping get a 'foot in the door' was noted as of vital importance in successful ventures. However, one company was an exception, by being sceptical of the advisors used by governments, and especially concerned by a lack of heterogeneity among these advisors, stating that:

> *"Over the last four years it's seemed inevitable that if you go for the European Investment Bank you end up with the same four imminent consultant engineering*

techno-advisers; and if you go for capital or one of the banks…..they end up with the same techno-advisors." (Renewables Company (Biofuels))

A number of companies also talked about schemes already in place that were helpful and noted schemes that could potentially be used to support the industry. This finding links to the role of government - another theme highlighted within the interviews.

Role of Government: The role of government was commented on in every interview and it was generally felt that the government had an important role to play. However there was debate as to whether the government was doing a good or bad job in this respect. Problems with government commitment, uncertainty, and communications were highlighted above. Two roles of government-based themes were noted: policy and funding. The majority of the respondents called for clear and consistent policy, and felt that this was not being provided at present but was vital for continued investment.

"That is problem number one, the problem of a lack of consistent policy!" (Investment Advisory, Corporate Finance and Banking)

These findings are in line with REN21's recent analysis which found that stable renewable energy policies continue to be a driving force behind the development of green power capacity [3]. A number of respondents also commented on the support, particularly financial support, given to the industry. It was generally seen that there was a place for both subsidies and loans. However, consistency of the subsidies, as with policy, was seen as important with changes in past subsidies making investors more cautious. It appeared that the more established companies preferred loans as a way of getting investment.

"We would prefer loans; we don't think grants are the way forward. Grants disjoint or effect the processing." (Renewables Company (Biofuels)).

A number of respondents also discussed the 'green investment bank' but were uncertain of the basis on which they would operate and therefore whether it would help the industry effectively.

Cost/Risk: As with any investment decision the balance between cost and risk played a large part. Risk for renewables seems to come in part from the 'fear of the unknown' which links to the knowledge elements of enablers discussed above, and a number of individuals saw in particular that certain renewables were more risky to investors than others:

"..if I was putting equity money in you really have to be prepared to lose it in anything but wind. And I think if you look at how many successful investments there've been in biomass, you can count with one hand…." (Bank)

Value/Return on Investment: Alongside risk many of the respondents also commented on the potential return on any investment made in renewables. Many respondents noted that for most investors it is simply about the rate of return, above any environmental considerations. However, it was noted that philanthropic investors would differ in their approach:

"..private investors, philanthropically they feel that it is the right thing to do, so that is when like one of our investors that I work with has a personal pot of 17million that he puts into wave and tidal and he knows that be probably won't make a return but he is trying to push the industry along." (Investment Advisory, Corporate Finance and Banking)

Timescale: Timescale appeared to be of great importance for investments, especially in terms of government policy and subsidies. There also seems to be a disjoint between the timing investors want in terms of return, the timings of government subsidies and support, and the timescales used by renewables companies:

"…we projected too far into the future and we set standards based on what we think best practice will be five years away…when actually the market is only prepared to really look two or three years ahead" (Specialist Investor)

It seems important that everyone works on the same timescales, primarily those acceptable to investors for investment to continue.

Personality/Individual Values: Two aspects of personality appear to be important: the personality of investors, and the personality of those working within renewables (the respondents within the study). There was concern voiced over the personality of the City in particular and its lack of fit with renewable investment and green technologies:

"…I mean, if you ever want one sentence to describe the City, the City is built on ego, testosterone and macho chest building. If you understand that then it all starts to fall into place, and then you can understand why selling renewable energy is a really hard job. And until we can make something that people want to beat their chests on it's always going to be a hard sell." (Specialist Investor)

This is in line with researchers who have commented on the influential factor of masculinity on the US financial crisis [38] and the hyper-masculine culture of Wall Street that glorifies extreme risk taking [39, 40].

The motivations of the respondents did seem in part, more for some than others, to be based on their own environmental beliefs, although this was balanced for most investors with other aspects of return and risk.

Level of Innovation: The development stage of the renewables in question is also of importance to investors and companies' ability to get investment. While some renewables are perceived as developed (e.g. wind) and are therefore seen as less risky (see comment regarding cost/risk above) most renewables are often seen as innovative and therefore high risk. As such, it seems important that different strategies are taken for companies at different levels of actual and perceived innovation. However the DECC Science and Innovation Strategy [2] notes that "science, technology and innovation are at the heart of the transition to a low-carbon future" (p 5) and therefore the added importance of innovative projects for the ability to meet renewables targets is key.

Discussion and Conclusions

Each of the eight identified themes plays an important role in affecting the behaviour of investors within the renewables industry. More specifically the potential for much needed investment rests on addressing the perceived barriers. Some barriers appear to be more important than others, with the role of the government being discussed more than other themes and generally in more critical terms.

It is clear that government plays a role as both an enabler and a barrier to investment in renewables, and stability and longevity of policy plays an important role in investment decisions and in particular reduced risk. The latest DECC Science and Innovation strategy (April 2012)[2] is vague when it talks about investment and although it notes that "we aim to achieve national and international action towards this goal [a safe and secure transition to low-carbon] by mobilising investment in low carbon infrastructure, by setting an appropriate framework of regulation, by providing incentives and information, and by building a broad coalition for change" (p 3) it does not state how this might be achieved and does not seem to take into account the issues raised within this research. The UK Bioenergy Strategy 2012 (Department for Transport, DECC, DEFRA) [41] is also relatively vague in terms of 'incentivising and driving investment' but does note that "policy decisions [must] be sensitive to the longer timescale over which investment decisions are made" (p 15) and that "we are clear that we must not act in a way which might undermine longer term investment decisions through hasty policies, unless this is an unavoidable response to EU legislation" (pp 56) suggesting that there is some understanding of the importance of stable policy and time periods to be considered. DECC [2] does note the Green Investment Bank (with £3billion to help companies fund clean energy schemes and encourage private sector investment) but does not state how the bank would operate and a number of the respondents were sceptical as to whether it would work. Further research should study reactions to and success of the Green Investment Bank.

There is also a need to examine what the problem is more specifically in government policies, and would need to study how decisions are made about policy and which departments can and do play a role in this. For example a recent BBC report has suggested that MPs blame the treasury for making changes to the draft energy bill that will put off investors by increasing their risks [42]. There are multiple factors and pressures at work within government and how energy policy is determined and how views from investors can be fed back is of vital importance. It also appears that communication is key, both within different stakeholder groups but also to and from government.

In addition to general policy there is a clear difference between companies who are established and those which utilise more innovative technologies, those at lower technology readiness levels. Government needs to think more carefully about the different policies for investment for companies at different stages of development as it is clear that investors see these very differently in terms of both risk and value. In this study more innovative companies generally appeared to welcome grants while more established companies generally welcomed loans. There was little agreement over the role of subsidies but it is clear that they have an effect on investment behaviour.

It is also clear that like any other investment decision there is a balance between risk and return but individual values do seem to play a part. How far personality and individual values play a

part however needs further exploration. This is supported by researchers [43] who suggest that further studies should be aimed at the potential influence of environmental information on investment allocation decisions in the contexts of investment styles, investor types, information processing capabilities, decision aids and experience levels. All of the people questioned had some experience in renewables, in fact some were specialist investors, and therefore it would be useful to explore how and why they differ from investors with less or no experience in this area.

Further Research: This research makes an important step towards understanding the behaviour of investors in relation to renewables companies and technologies. While this project has indicated some significant issues that are likely to be of interest to researchers from a range of disciplines which have an interest in the psychology of investor behaviour (e.g., behavioural economics, behavioural finance, economic psychology, political science), further research is required to explore these in more depth and to explore the overlapping and interdisciplinary nature of the area. For example, it would be of value to extend this research to include other types of investors such as institutional investors (e.g. pension funds) and high net worth individuals (HNWI). As Sandberg [35] notes "institutional investors really are the major players in the world's financial markets…"(p 143) and as such their opinions are very important. HNWI are also of importance as it appears from comments of financial advisers in this study that they may be the type of investor willing to support new and emerging technologies for more philanthropic motives.

This research also provides us with a framework from which to develop quantitative modelling via a large scale questionnaire of barriers, enablers and forces affecting investment in renewable companies. As a starting point this work has identified potential variables of importance but a quantitative model needs to be built to show how these variables fit with one another and link/interact with one another. This type of modelling would also allow further segmentation of investor types (individual or institutional) and specific types of renewables in determining investment levels and strategies. Work of this style would also highlight the important interfaces between elements of government policy, technology, investment and individual behaviour rather than studying these aspects in isolation.

Returning to the initial aims of the study outlined in the introduction, the research has highlighted a range of barriers and enablers to investment and has highlighted the central role of government in ensuring that barriers are reduced and enablers are appropriate for the technology level and type. With regards the criticism at government which was noted, this appears for many of the respondents to be true but a small number of the respondents were supportive of what the government was doing and felt that improvements could be made. The research also showed similarities to the wider behaviour of green investors, those looking at the overall sustainability of companies in that investors are affected by the investment timescale and the experience (knowledge and skills) of the investor also plays a part. In other words, this research pointed out issues at both macro and micro level that slow down the rate of renewable investment among both businesses and consumers. Attempts should be made to tackle these problems simultaneously in order to avoid further delay in rate of investment in renewables and in time to support capital growth over the next few years. While revised policies could facilitate interest from investors, specific training programmes could be offered to employees who should aim to improve their knowledge and skills. Information should not only be disseminated via formal channels such official reports, government strategy documents but also via informal channels and in a more 'user friendly'

format for the interested investors. Furthermore, given the high risks and costs entailed by renewable investments the government should consider subsidising private investors.

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Appendix: **Further illustrative quotation examples for themes discussed in the results section**

(1) Barriers

- Cost

"….Initial cost for him was about 20k but you can't estimate the cost of electricity going forward so don't know how long it will take to pay off which is a major problem…." (Independent Financial Advisor)

- Effect of Government

"…the fact that the government doesn't seem to be able to spot that not only dropping commitments but dropping commitments with no notice that investors will run for the hills like nothing else." (Investment consultant and advisor)

"…we don't mind what policy we're set within reasonable bounds, but if you set it, make it last for at least ten years, because whatever policy you set we can work around." (Specialist Investment Company)

"….then for the government to introduce this uncertainty….regards what the future is for solar…it was a disincentive for people to invest in solar….Effectively froze the development of that area." (Bank)

- Communication

"Personally speaking I think that the government is doing the right thing, but I think that the communication is appalling…in fact the communication is often confusing" (Investment Advisory)

"..Osborne made a comment about not writing cheques willy-nilly for a carbon agenda, a throw away remark in a political speech, but that caused them [the investors] to stop and think are we wasting our time here and it is as simple as that." (Investment Consultant an Advisor)

- Fiduciary Duty

"…it doesn't matter what I think as a human being. Yes, I would like to do this stuff, but the simple fact is that the law as it currently stands means that anyone who works in finance has a fiduciary duty to deliver a return to the people that they advise; whether that's a pension fund or an investment bank or an asset manager." (Specialist Investment Company)

"…because their stakeholders were starting to say, look, okay so you have a fiduciary duty to deliver a financial return to us, but actually practically we want you to take other things into consideration…."(Specialist Investor)

(2) Enablers

- Knowledge and Skills

"…it does come back down to it's an experienced team…." (Renewables Company (Wind))

"…the reference point of experience is important but it doesn't mean that they have spent the last 20 years doing what they are about to do. XXX is a good example of that as you have a very capable management team all from an engineering perspective, they had no experience or in depth knowledge of the off shore wind market, that wasn't a problem to me as I could bring that to them, but it did mean that I could sit there with some confidence and say that these guys understand the operational side of what they are proposing to the market and therefore having made the investment you can a) believe that they will build the plant and b)be able to operate it satisfactorily." (Investment Consultant and Advisor)

"To me the other difference between the Virgin Green Fund and another is that I need to spend less time with virgin green fund explaining the market place before they look at the proposition, and that's where I find myself battling against the background knowledge."(Investment Consultant and Advisor)

"The next problem is for the investor to know where they can go to get sector knowledge and experience to help them consider the opportunity in front of them or to use for due diligence." (Investment Company and Advisor)

"..I think most companies recognise that to deliver some of this work there's a need to come together." (Renewables Company (Wind))

"Over the last four years it's seemed inevitable that if you go for the European Investment Bank you end up with the same four imminent consultant engineering techno-advisers; and if you go for capital or one of the banks…..they end up with the same techno-advisors." (Renewables Company (Biofuels))

- Schemes

"…we go on to an incubator scheme as well which was extremely useful for us because not only do they cash flow and lot of stuff in the early days, but it provided us with a network, a professional network that allowed us to behave like a big company….then we were able to ……attract the investment, because…you look a little bigger, more professional." (Renewables Company (Tidal))

"…the idea of a 'grandfathering system'….a situation in which an old rule continues to apply to some existing situations, while a new rule will apply to all future situations." (Investment Company)

(3) Role of the Government

- Consistency

"That is problem number one, the problem of a lack of consistent policy!" (Investment Advisory, Corporate Finance and Banking)

"I don't think it is just having a stable policy I think it is also having a clear message" (Investment Consultant)

"Basically you want transparency, longevity and consistency….set a level that was sustainable for ten years and do it that way, because you get proper long-term investors moving in; not a bunch of cowboys trying to rip you off."(Specialist Investment Company)

- Subsidies/loans and funding

"The stability of that subsidy is absolutely key to secure further investment in the sector" (Bank)

"….we were caught out but it is understanding the cycle, we bought too early and didn't see the scale of the subsidies being withdrawn, so yes it will; make us more cautious going forward." (Stockbroker)

"We would prefer loans; we don't think grants are the way forward. Grants disjoint or effect the processing." (Renewables Company (Biofuels)).

"Interviewer: What do you feel about the proposals for the green investment bank? Respondent: It would be good if we could do it, well it remains to be seen on what basis they will operate. Interviewer: In principle, do you think it's a good thing? Respondent: Well as long as it's not just another bank, but then again it's going to be under the same sort of pressures as another bank." (Renewables Company (Tidal))

(4) Cost Risk

"..the perceived risks of renewables are massively high. The obvious ones are around feed-in-tariffs or cost of operation or unproven technologies; not many of them particularly valid, but it's the fear of the unknown." (Specialist Investment Company)

"..if I was putting equity money in you really have to be prepared to lose it in anything but wind. And I think if you look at how many successful investments there've been in biomass, you can count with one hand…." (Bank)

(5) Value and level of return

"It's unfortunate but it's just the reality of people having money saying where am I going to get best value for it?" (Bank)

"These people are not stupid; they have made their money by being very canny investors. When you have got a £1 do you think do I put it into one project which is highly risky or another project where I know I can turn a huge profit…?" (Investment Advisory, Corporate Finance and Banking)

"..private investors, philanthropically they feel that it is the right thing to do, so that is when like one of our investors that I work with has a personal pot of 17 million that he puts into wave and tidal and he knows that be probably won't make a return but he is trying to push the industry along." (Investment Advisory, Corporate Finance and Banking)

(6) Timescale

"…we projected too far into the future and we set standards based on what we think best practice will be five years away…when actually the market is only prepared to really look two or three years ahead" (Specialist Investor)

(7) Personality/Individuality

"…I mean, if you ever want one sentence to describe the City, the City is built on ego, testosterone and macho chest building. If you understand that then it all starts to fall into place, and then you can

understand why selling renewable energy is a really hard job. And until we can make something that people want to beat their chests on it's always going to be a hard sell." (Specialist Investor)

"…so sympathetic but not fanatic is where I would put myself" (Law Firm)

"It was more of from a business point of view, but you know I am somebody who has an environmental conscience as it was and saw that it seemed like a…you know worthwhile for me as an individual to get myself involved." (Renewables Company (Tidal))

(8) Innovation

"If you look at most things within renewables there are some things which are very focused on a new technology or a new methodology, they will always be high risk because those things always are." (Investment Consultant and Advisor)

"The other biggest problem that I have seen is that 'it is new' and because it is new then funders don't understand it, and that comes at a time when funding itself is very short." (Law Firm)