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The energy transition: Acquirer announcement returns for acquisitions of clean energy targets in the power sector

An event study approach

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PREFACE AND ACKNOWLEDGEMENTS

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ABSTRACT

This study investigates acquirer shareholder value creation for acquisitions of clean energy targets by power sector acquirers in Europe and North America. Using a database of 263 public and private deals, cumulative abnormal returns ("CARs") are calculated with a market model and a market model adjusted for generalised autoregressive conditional heteroscedasticity ("GARCH"). A positive CAR is identified over a 3-day event window. The effect of acquirer nation's Regulatory Indicators for Sustainable Energy scores and oil prices is investigated but not found to be significant. No supportive evidence is found for any difference between homogeneous and heterogeneous deals, oil acquirers and non-oil acquirers, and European and North American acquirers.

Keywords: Mergers and acquisitions, event study, cumulative abnormal returns, clean energy

JEL Classification: G14, G30, G34, Q42

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1 Introduction

Almost daily articles are published on the advancement of climate change, but also on initiatives to create more sustainable homes and businesses, and the progress of decarbonisation of industries. As global energy demand is expect to rise by 30% between today and 2040, the power sector in particular has a huge responsibility in transitioning from fossil fuel-fired energy generation to renewable energy and increasing energy efficiency to accommodate for this increase in demand in a sustainable fashion (IEA, 2017). Although just at the beginning of the process, the power sector is estimated to have the potential to achieve 90% of necessary carbon reductions through the energy transition (IRENA). Although the technologies are not quite there yet, some major steps have already been taken, especially in recent years. At this moment for example, some of the technologies to generate renewable energy are actually at the same cost or even cheaper than energy generation using fossil fuels (IRENA, 2018).

This thesis aims to shed light on the developments in the clean energy sector in terms of acquirer shareholder value creation through mergers and acquisitions. Merger, acquisition and buyout activity is considered to be an indicator of liquidity and maturity of a sector (Usher, 2008), and an important manifestation of change in modern market economies (Kwoka & Pollitt, 2010). Furthermore, an increase in M&A activity suggests that decision makers are using mergers and acquisitions as a central strategy to enable economic and policy shifts, while companies may view it as an effective way to enter a new industry and benefit from expected growth (Palmquist & Bask, 2016). Increased activity can thus prove to be crucial in increasing the speed of developments in the sector. This paper zooms in on acquirer abnormal returns for announcements of acquisitions of clean energy targets. In particular, this thesis aims to answer the following research question:

Do shareholders of acquirers of public and private clean energy targets earn a positive cumulative abnormal return upon announcement of the acquisition?

This is investigated using a database of 263 deals with public acquirers active in the power sector in Europe and North America announcing the acquisition of a public or private clean energy target. Cumulative abnormal returns (“CAR”) are calculated and a number of variables are investigated to identify key drivers for the level of abnormal returns that are earned. These analyses will shed light on investor sentiment regarding acquisitions of public and private clean energy targets, as well as providing an incentive for increased deal activity and investments. Cumulative abnormal returns are modelled using the market model and a market model adjusted for generalised autoregressive conditional heteroskedasticity (“GARCH”). The significance of CARs is tested using a range of tests to improve robustness. The obtained CARs are regressed using a number of explanatory variables and control variables. In particular the impact of acquirer nation's Regulatory Indicator for Sustainable Energy ("RISE") scores and oil prices is analysed, and differences between homogeneous and heterogeneous deals, oil acquirer returns and non-oil acquirer returns and European and North American acquirer returns are investigated.

It is found that companies active in the power sector in Europe or North America that acquire a public or private clean energy target earn on average 1.7-1.8% cumulative abnormal returns over a 3-day event window depending on the modelling method. This means shareholder value is created through the acquisition and investors in general react positively to announcements of such deals. Any link between abnormal returns and RISE scores and oil prices as expected based on Shah, Hiles and Morley (2018) was not found to be significant. Furthermore, no evidence was found for the outperformance of homogeneous deals in comparison to heterogeneous deals, and no significant difference between oil acquirers and non-oil acquirers was identified either. Lastly, although political sentiment in Europe is more favourable for development of the renewable energy sector compared to North America, no significant difference was found between deals announced in Europe and deals announced in North America.

This thesis builds upon a small but quickly expanding body of research specifically focussed on abnormal returns for acquisitions of clean energy targets. Palmquist and Bask (2016), for example, looked at buyout acquisitions in the renewable energy and cleantech sectors. Yoo, Lee, and Heo (2013) looked at acquisitions of renewable energy firms and identified homogeneous M&A activity to have the biggest impact on enterprise value. In contrast, Eisenbach, Ettenhuber, Schiereck, Flotow and Paschen (2011) found acquirers from outside the renewable energy sector to perform better. In addition to this literature, there is a large body of literature focussed on identifying the nature of renewable energy firms and their associated (share price) performance and risk. Compared to the amount and depth of research on M&A activity in other sectors, the renewable energy sector still offers a lot of research potential. Research is crucial to the success of a timely energy transition, as it can provide insights into opportunities for renewable energy companies to expand and companies from outside the industry to enter the sector. Although this paper fails to identify clear driving forces for announcement returns, it has been found that acquirers on average earn positive announcement returns, therefore emphasising the investment potential to be found in the clean energy sector.

The remaining part of this thesis will be structured as follows. Chapter 2 provides an overview of the current state of the power sector and the energy transition in particular as well as an overview of the current literature on renewable companies. Chapter 3 subsequently zooms in on theories on mergers and acquisitions, and specifically literature on mergers and acquisitions in the renewable energy, oil and gas, and utilities sectors. The process of data collection and descriptive statistics are provided in chapter 4. In chapter 5 hypotheses are developed and laid out, and chapter 6 describes the methodology used to investigate the hypotheses. Chapter 7 presents the results, conclusions, limitations and recommendations for further research can be found in chapter 8.

2 The future of the energy sector

When working towards a carbon emission free economy, the energy sector is a key factor, and the one sector that will potentially have to undergo the largest shift. The World Resources Institute states that the energy sector was responsible for 72% of greenhouse gas emissions in 2013 (Friedrich, Ge, & Pickens, 2017). According to the International Energy Agency's World Energy Outlook 2017, the global energy demand will rise by 30% between today and 2040. The way these needs will be met is expected to shift to natural gas, a rapid upcoming of renewables and improved energy efficiency. The latter has a huge impact, as with current levels of efficiency, production would need to double in order to meet demand. Renewables are expected to become the cheapest source of new energy generation, and two-thirds of global investment in power plants will be reserved for renewable plants up to 2040, resulting in renewables being able to capture 40% of the increase in primary energy demand (IEA, 2017). Also in the shorter term, renewables are predicted to show exponential growth. In their Renewables 2018 report, the International Energy Agency estimates the share of renewables in meeting global energy demand to grow by one-fifth to 12.4% in 2023. Surprisingly, it is bioenergy that currently accounts for the largest share of renewable energy production (IEA, 2018).

In addition to environmental benefits, the increased use of renewable energy sources adds to economic and national security, for example through reduction of energy price volatility and because decreased dependence on fossil fuels reduces vulnerability to political instabilities, trade disputes and embargoes. Developmental benefits of renewable energy include reduced outflow of money, electrification of remote areas and job creation (Menegaki, 2008). Critics of renewable energy often point towards visibility and noise of wind turbines, disruption of ecosystems because of wind turbines or hydropower terminals, the production and disposal of hazardous materials in solar PV panels, or air pollution from burning biofuels. On this topic, Wustenhagen, Wolsink, and Burer (2007) note that although ambitious government targets have been set, and are leading to a rise in the share of renewable energy in numerous countries, it is also recognised more and more that social acceptance is often a restraining factor in achieving targets. It is a "not in my backyard" issue, with resource extraction for fossil fuel or nuclear energy generation happening underground and out of sight, while renewable energy generation happens closer to where the consumer lives. Renewable energy also has a hard time competing in terms of externalities, as this often boils down to a trade-off between short-term costs and long-term benefits. A way to separate the issue of social acceptance from market adoption might be found in the emergence of green power marketing, inducing consumers to increasingly demand green power (Wustenhagen, Markard, & Truffer, 2003; Bird, Wustenhagen, & Aabakken, 2002). Furthermore, technological challenges lie in the widespread integration of renewable energy in electricity grids. In many cases, national electricity grids are not yet ready for the integration of the numerous new power generating facilities, let alone being able to stabilise the network with the high levels of fluctuations that come with renewable energy generation (Hart, Stoutenburg, & Jacobson, 2012).

The question remains, however, whether these developments and expectations will be enough to stay within the agreed 1.5°C rise in temperature as laid down in the Paris agreements. Discouraging news has been published with global CO_2 emmissions having risen for two consequtive years (Jackson et al., 2018) and IPCC's Special Report on Global Warming of 1.5°C sketches a daunting image of life on earth under temperature increases of more than 1.5°C (IPCC, 2018). With these news flashes, the promising role of renewable energy sources but also the pusling need for huge investments is made clear. Although governments and intergovernmental organisations alike are working on reaching agreements and setting goals, many question whether public decisionmaking is fast enough and sufficient, evidenced by the outcome of the Dutch climate case. In this case, environmental organisation Urgenda challenged the Dutch government on its duty of care in court and won. Parallel to public efforts, the private sector is 'waking up' and many companies and sectors, are starting to work together to tackle issues of climate change and pollution. In light of the above mentioned huge share of greenhouse gas emissions attributed to the power sector, this sector in particular has large steps to take and a big change to make. On their website, the International Renewable Energy Agency (IRENA) describes the energy transition as follows: "a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO_2 emissions to limit climate change. […] Renewable energy and energy efficiency measures can potentially achieve 90% of the required carbon reductions. The energy transition will be enabled by information technology, smart technology, policy frameworks and market instruments".

2.1 The cleantech revolution

The cleantech revolution is a major driving force behind the energy transition, and is expected to be of pivotal importance to the success of reducing greenhouse gas emmissions in the power sector. According to Pernick and Wilder (2009), the cleantech revolution is fuelled by six major forces: costs, capital, competition, China, consumers and climate. Looking at costs, the IRENA states global weighted average costs for electricity from all renewable technologies except concentrated solar power ("CSP") are now in line with the cost of generating electricity using fossil fuel. Onshore wind is now one of the cheapest sources of new power, and solar PV costs have fallen by 73% over the the period 2010-2017 (IRENA, 2018). The global weighted average cost of electricity in 2017 was USD 0.05 per kilowatt-hour (kWh) for new hydropower projects, USD 0.06/kWh for onshore wind and 0.07/kWh for bioenergy and geothermal projects. These cost reductions are due to technology improvements, competitive procurement and a large number of experienced, international project developers. Also, solar and wind technologies are now in a phase of rapid scale-up and maturity, promising further cost reductions. As mentioned before, financial capital is expected to become more and more available for the renewable energy sector, as the increased capability of renewables to compete with fossil fuels will make them a more lucrative investment. This has also led to a shift from predominantly government investments, to more and more involvement from private investors. The investments have proven to be quite cyclical in the past, as investments slowed down considerably during the last financial crisis (Sadorsky, 2012), but surprisingly, they quickly picked up again in 2010 with an annual growth rate of 30% (Bloomberg New Energy Finance, 2011). China and India will account for the largest share of energy demand increase, however, renewable energy generation costs there are also on average lower than in the rest of the world (IRENA, 2017). Additionally, China has overtaken the US as a global wind energy leader with domestic installed capacity having doubled in 2010 alone (Wustenhagen & Menichetti, 2012). Consumer wealth is increasing around the world, allowing consumers to not only care about their own consumption, but also to start thinking about the future of their children, thus making more conscious consumption decisions. Market liberalisations have actually made it possible for customers to directly influence the way their electricity is generated by demanding specific products, such as green power. Interestingly, customers buying green power do not get a physically different product like consumers buying organic food or other sustainable green products. Instead, consumers' purchasing decisions will create different monetary flows, resulting in a change in the electricity mix (Wustenhagen & Bilharz, 2006). Issues arise in the difficulty to verify product characteristics as a result of information asymmetry, creating a need for an independent labelling scheme or signalling based on suppliers' reputations (Truffer, Markard, & Wustenhagen, 2001). Lastly, increased focus on the adverse effects of climate change is one of the main drivers behind the fast emergence of renewable energy technologies. All in all, these conditions underline the current favourable environment for the development and large scale implementations of clean technologies.

2.2 Investing in clean energy

As pointed out by Nicholas Stern (2007), investments in clean energy are vital. He stated that all investments in the next 10-20 years will have a significant effect on our climate in the second half of this century and the next century. In order to attract the interest of entrepreneurs, and encourage their risk-taking and investments, profitability is required (York & Venkataraman, 2010). Renewable energy has yet to produce a highly profitable company, but investments in renewable energy stocks have become increasingly popular, following global environmental deregulation and increased public spending to promote cleantech. Investing in renewables might enhance portfolios through diversification, both between conventional and renewable assets, and between different types of renewable assets (Markowitz, 1952). Furthermore, as renewable electricity generation is dependent on natural resources, diversification can help mitigate risks of environmental change. Alternatively, investors are looking to simply boost a sector that is in need of large-scale deployment of capital markets in addition to political support in order to facilitate the decarbonisation of the power sector.

When looking at investments in renewables from a risk and return perspective, it is clear renewables are still disadvantaged compared to conventional energy sources, due to the increased risk that is perceived. Investors will have to be compensated with higher returns, or government policy has to intervene in order to make renewables investing more attractive, such as through feed-in-tariffs (increased returns) or loan guarantees (risk reduction) (Wustenhagen & Menichetti, 2012).

Investors can choose to either invest directly or indirectly in renewables projects. As interest in clean energy investments has spurred over the years, several portfolios and ETFs of clean energy stocks have been brought to market to accommodate for investors who are not yet ready to invest in these stocks directly. The WilderHill Clean Energy ETF, for example, is the oldest and largest of these, consisting of a portfolio of 52 publically traded clean energy companies. Many of these ETFs have quite a volatile history, with a large share dropping significantly during the global financial crisis in 2008. For example, the Guggenheim Solar ETF dropped approximately 65% from its original price. The ETF struggled during the period 2009-2012, only to gain 128% in 2013. La Monaca, Assereto and Byrne (2018) find that renewable energy ETFs only provide minimal diversification benefits. Recently, a new investment option that has become available is investments in yieldcos, which are publicly traded spin-offs from developers holding generation assets. So far, yieldcos have not been found to offer any diversification benefits to investors (La Monaca, Assereto, & Byrne, 2018).

Decades of research into behavioural finance has shown that although risk-return frameworks are important in explaining and predicting investor behaviour, more important are perceptions and biases (Tversky & Kahneman, 1974). Applying this to renewable energy investments means looking at the impact of policies on perceived levels of risk and return, but also the impact of investments on factors such as reputation and long-term strategies. Masini and Menichetti (2012) have investigated the decision-making process for clean energy investments. They have found that investors' beliefs, policy instrument preferences and attitudes towards technological risk all contribute to the likelihood to invest in renewable energy projects. Furthermore, they identify that portfolio performance increases with an increase in the share of renewable energy in a portfolio. Walker (2008) and Bomberg and McEwen (2012) also found that investors' interest in renewable energy investing is driven by their knowledge and individual perception of climate change issues.

The general perception is that the renewable energy sector closely follows and is influenced by what happens in the oil sector (The Economist, 2007). In particular, it is believed that higher oil prices will increase interest in renewables, and this interest will fade away as oil prices drop. Although it is impossible to deny some relationship between the two, there are other factors and specifically other sectors that can be linked to renewables as well. In fact, the renewables sector actually has more in common with the technology sector and it is found that renewable energy share prices react stronger to shocks in technology than to oil price shocks (Henriques & Sadorsky, 2008; Inchauspe, Ripple, & Truck, 2015). With alternative energy stocks being considered similar to technology stocks, it is generally expected that alternative energy stocks also closely follow business cycles, as do technology stocks. Since oil prices are a large component of business cycles, Henriques and Sadorsky (2008) hypothesised that stock prices for technology, clean energy and general economic stocks should follow an upward trend as oil prices are rising. This relationship has been found and confirmed. It could also be expected that alternative energy stocks follow carbon emission prices, however, this relationship has not been found to be significant (Kumar, Managi, & Matsuda, 2012). The economic viability of renewable energy projects is largely dependent on energy prices, therefore a relationship between energy prices and clean energy stocks is to be expected. In this regard, Reboredo and Ugolini (2018), find that oil prices and electricity prices are strong contributors to the movements of clean energy stocks in the USA and Europe. Lastly, Shah, Hiles and Morley (2018) looked into country-specific macroeconomic differences and found that in countries with lower levels of support for renewable energy, investments depend more strongly on macroeceonomic factors and substitutes such as oil. This implies in low-support countries, renewable energy investments follow the oil market more closely than in countries with stronger support for the renewable energy sector.

All in all, not all decisions made by players in terms of energy investments are equally impactful, especially considering the time frame these decisions often entail. For example, an oil company's decision to shift its strategy to incorporate clean energy options has further reaching implications than another company's decision to add an extra assembly line. Similarly, a utility's decision to invest in a renewable source of energy instead of developing a new coal-fired plant impacts decades to come (Wustenhagen & Menichetti, 2012)

2.2.2 The green premium

There has been a growing awareness about the way businesses can have negative effects on society and environment, and there has been a trend of investors shifting towards investments in businesses scoring high on corporate social responsibility rankings. With the growing attention to global climate change, there is a heavier focus on the pollution caused by industries and businesses. The green premium refers to the way firm value is affected by an environmentally friendly image. It has been found that companies with high environmental scores have higher market capitalisations than comparable companies with lower scores (Blumenshine & Wunnava, 2010). Chan and Walter (2014) argued green companies are considered to be less prone to corporate social crises and environmental distasters and may therefore earn a premium compared to non-green firms. Additionally, acquirers in 'green' deals are found to perform better financially post-acquisition than acquirers in other sectors, implying 'green' transactions may boost external growth and operating and financial results, as well as providing a way to obtain a 'green' identity (Salvi, Petruzzella, & Giakoumelou, 2018).

2.2.3 Risk of renewable energy companies

If renewable energy is to profit fully from low-cost capital provided by stock markets, investors require appropriate compensation for risks they are taking (Salm, 2018). Currently however, general opinion is that alternative sources of energy are risky investments, which do not so far appropriately reward for this risk in comparison to conventional alternatives, therefore impeding the amount of capital that flows towards these new energy sources (IRENA, 2016). It is likely that a risk reduction and an increase in value to future investors will create support for robust clean energy prodution (Wustenhagen & Menichetti, 2012). Alternatively, increasing the level of alternative energy investments in a portfolio can actually lower the risk of an energy supply portfolio, by alleviating fossil fuel price volatility and capital, and operating and carbon costs (Bhattacharya & Kojima, 2012).

A large part of the high risk level associated with renewable energy investments stems from capital costs. There is a discrepancy between the timing of costs and the timing of profits made, as construction and raw material costs are to be paid upfront, while revenues and profits only start flowing in once the generational asset is operational. The construction process itself also adds uncertainty, especially in the case of more complicated procedures such as offshore construction. Additionally, the average lifespan of a renewable energy asset is quite substantial, resulting in uncertainties regarding future electricity prices. Investment timing is very important, meaning investments should be made when capital costs are low and electricity prices are high (Boomsma, Meade, & Fleten, 2012).

There are several ways in which systematic risk of renewable energy companies can be reduced. Many of these measures are government driven, as incentives need to be provided for new technologies to become viable. One way of reducing risk is for governments to either directly create stable demand through government buying or indirectly create demand by inducing customers to buy renewable energy. As more consumers and government agencies become ‘green minded’, renewable energy companies will see their sales increasing, allowing them to continue operations and continue investing. Other government measures may take the form of pull policies, such as feed-in-tariffs, green subsidies, green rebates, and alternative energy portfolio criteria. In addition to generating demand and creating incentives, governments can deincentivice the use of fossil fuels by imposing a fossil fuel consumption tax or a carbon tax. Such measures might also reduce the effect of oil price volatility on renewable energy company financing and investing (Sadorsky, 2012).

2.3 What is a ‘clean energy’ company?

With the increased focus on climate change and sustainability, all kind of firms now boast about the greenness of their business. It is not always clear whether a business is truly making efforts in reducing pollution and greenhouse gas emissions or whether there is a large marketing component to claims. The Economist (2007) already reported this trend but, interestingly, pointed out oil companies and power generators, both huge emitters of CO_2 are actually more reluctant in claiming they run green businesses. When it comes to ‘clean energy’, it is easier to classify which companies fall in this category. For this study, however, the definition used is quite broad, including not just solar, wind and hydro power, but also biofuel, waste management and battery companies. Biofuels and waste treatment are both renewable sources of energy, while battery development and manufacturing companies are considered essential to the success of the energy transition.

Natural gas has long been and is still considered to be a close substitute to refined petroleum products, and natural gas prices follow crude oil prices (Brown & Yucel, 2008). Many utilities companies have also made a switch over the years to a more heterogeneous business model by adding natural gas activities. While gas cannot be considered a renewable source of energy, and the burning of natural gas emits greenhouse gasses, it is still included in this research. In addition to the popularity of natural gas as a substitute for oil and coal in power production and its reputation as a ‘cleaner’ fuel in comparison to oil and gas, natural gas in fact plays a major role in the energy transition. Because renewable energy resources such as solar and wind power are hugely dependent on natural climatic circumstances, energy generation using only these sources is unstable and requires back-up generation, often in the form of natural gas combustion (Bright-R, 2018).

3 Theories on mergers and acquisitions

3.1 Do mergers and acquisitions create value?

Returns for mergers and acquisitions have been a popular topic for research in the past decades. In order to find out whether M&A activity creates or destroys value, long-term and short-term returns for both acquirers and targets have been investigated extensively. However, despite the efforts made to unravel the mysteries of the return anomalies, uncertainties remain. Generally, it is found that target firm stockholders earn positive returns following a deal announcement, regardless of the type of deal (Franks, Harris, & Titman, 1991; Schwert, 1996). These results are a lot less clear-cut for acquiring firms, as some research produces negative returns in the short-term (Morck, Shleifer, & Vishny, 1990; Servaes, 1991) and in the long-term (Franks, Harris, & Titman, 1991), while other literature finds zero or positive returns (Schwert, 1996; Lang, Stulz, & Walkling, 1989). Caves (1989) considers negative returns in the long run as a sign of “second throughts” by acquirer shareholders and the publication of new information about the deal. Recently, Martynova and Renneboog (2011) have found evidence of positive abnormal returns for both targets and acquirers. Andrade, Mitchell and Stafford (2001) have summarized their findings as follows: “mergers create value for stockholders of the combined firms, with the majority of gains accruing to the stockholder of the target”. Bruner (2002) concludes that “buyers essentially break-even”.

There are many reasons that can explain why firms engage in merger and acquisition activities. Firstly, it is argued that firms engage in M&A activity in pursuit of synergies (Hayward & Hambrick, 1997). It is also argued that firms aim to obtain intangible assets and external resources through acquisitions (Gupta & Roos, 2001). Furthermore, companies may be looking to access new (foreign) markets or gain economies of scale (Anand & Singh, 1998; Coyle, 2000). Other drivers are growth, industry shocks including deregulation, and diversification, amongst others. Additionally, theories of corporate governance name issues such as empire building or managerial overoptimism as reasons for deal activity (Morck, Shleifer, & Vishny, 1990). Jensen (1986) described the agency theory as conflicts of interest between the management of a firm and its shareholders, resulting in management decisions that are not always in line with shareholders’ interests. In the case of M&A, this will often result in a clash between management’s short-term vision and shareholders’ long-term vision. In trying to explain differences in returns, research usually points to the underlying objectives. For example, it is to be expected that acquirer returns are positive for deals seeking synergies or increased market power, whilst deals made in pursuit of empire building will have negative returns. Interestly, however, research has found that trying to expand market position through mergers and acquisitions does not actually yield improved performance (Ravenscraft & Scherer, 1987; Mueller, 1985; Eckbo, 1992). In line with Myers and Majluf’s (1984) pecking order theory, which states that when making financing decisions firms use a pecking order, it has been found that the method of payment in a deal also influences returns (Franks, Harris, & Titman, 1991). According to Moeller, Schlingemann and Stulz (2007), another driver of mixed results concerning the announcement returns of mergers is information assymmetry. After all, the efficient market hypothesis states that abnormal returns can only be explained by new information that follows from the announcement. This information entails an insight into the way synergies will be split between the firms post-merger (Barraclough, Robinson, Smith, & Whaley, 2013). Lastly, Pereira and Rodrigues (2015) argue that merger timing also influences announcement returns.

One explanation for merger activity refers to levels of activity over the years, and identifies that mergers occur in waves, and that within these waves, activity groups together by industry (Mitchell & Mulherin, 1996). In line with this, Andrade, Mitchell and Stafford (2001) link merger waves to industry shocks such as deregulation. Concurrently, mergers, acquisitions and management buyout activity is considered to be an indicator of liquidity and maturity of a sector, with low activity levels implying even successful investments are probably not easy to sell (Usher, 2008). Additionally, mergers are important manifestations of change in modern market economies (Kwoka & Pollitt, 2010).

3.1.1 Diversification effect

In light of the increased merger and acquisition activity in the renewable energy sector, an important aspect to look at is the effect of activity focused on diversification. A deregulatory environment often leads to diversification, however, literature states diversifying mergers are more likely to lead to a decline in aggregate entity value compared to non-diversifying mergers, therefore suggesting diversification is value destroying (Leggio & Lien, 2000). Diversification is often motivated by risk-spreading objectives and can be considered a hedging strategy against shocks in the primary industry (Palmquist & Bask, 2016). The value destroying nature of diversification might flow from the observations that in a non-regulated environment, diversification is likely to lead to agency issues. These issues include wasting excess free cash flows on non-value adding business lines, leading to the subsidisation of value-destroying divisions by profitable units (Berger & Ofek, 1995). Furthermore, the decline in value also makes sense intuitively, as merger gains often originate from financial and operational synergies or savings from the economics of the merging firms. Coincidentally, Melicher and Rush (1973) have provided proof for the fact that conglomerate firms have higher risk levels for a given rate of return, while Mason and Goudzwaard (1976) found conglomerates' performance to be statistically worse based on return on assets and return on equity. Explanations for these findings include lack of managerial expertise in a new industry and lack of obvious synergies (Leggio & Lien, 2000).

Opposingly, a number of studies have found positive effects of certain diversification strategies. Especially related diversification has been found to boost business profitability and reduce risk. For example, research shows constrained diversification by a firm that shares common core skills, resources and strengths with its target outperforms other types of diversification (Rumelt, 1974; Christensen & Montgomery, 1981; Palepu, 1985). Moreover, systematic risk for unrelatedly diversified firms was higher than for other diversfiers (Montgomery & Singh, 1984). In contrast, factors such as headquarter resources and industrial structures have been named as driving forces behind the success of unrelated diversification (Gottschalg & Degenhard, 2006; Christensen & Montgomery, 1981).

3.1.2 Corporate social responsibility

According to the World Business Council for Sustainable Development (1998), corporate social responsibility ("CSR") entails "The continuing commitment of businesses to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large". The Financial Times names topics such as human rights, corporate governance, health and safety, environmental effects, working conditions and contribution to economic development as some of the factors included in CSR. In light of the huge contribution of the power sector to greenhouse gas emissions and therefore climate change and pollution, the environmental effects aspect of CSR is an area where large steps (still) can and need to be made. The effect of CSR on firm performance is unclear, with research finding it can improve or deteriorate performance, or have no influence at all (Schuler & Cording, 2006; Orlitzky, Schmidt, & Rynes, 2003; Margolis, Elfenbein, & Walsh, 2011). Regarding the effect of CSR on M&A activity and returns, Aktas, Bodt & Cousin (2001) found the relationship between the CSR activities of the target firm and the acquirer announcement returns to be positive. According to them, the target firm's social and environmental performance is a value-adding factor in performance of a merger or acquisition. Conversely, from an acquirer's point of view, a highly performing acquirer can add value through improved risk management and taking into account social and environmental factors in addition to just 'looking at the numbers' (Meckl & Theuerkorn, 2015). Hanly (1992) stated mergers and acquisitions should not be pursued just for shareholder gain, but instead all stakeholders should be considered during M&A decision making (Donaldson & Preston, 1995). In extension to this, it has been found that CSR can lead to increased shareholder willingness to support operations and decision-making, therefore adding value to M&A performance through stakeholder value maximization (Deng, Kang, & Low, 2013).

3.2 Mergers and acquisitions in the power sector

3.2.1 The sustainable energy sector

With the increased focus on climate change and sustainability initiatives, the number of renewable energy companies has grown over the past years. With that, the deal flow in the sector has also shown a substantial increase. In 2009, PwC stated in their annual review of renewable deals that they expected temporal consolidation through international mergers and acquisitions. Already then, an increase in deal flow had been acknowledged (PricewaterhouseCoopers, 2009). Now, ten years later, it is clear that the sector has gained momentum with newspapers publishing articles on new developments almost daily and new technologies following up rapidly. A large part of the M&A activity in the sector is driven by traditional energy businesses trying to acquire new capabilities and institutional investors looking for predictable, stable returns. Driven by diversity, the oil and gas industry is now entering the scene too, while utilities are trying to keep up with the high demands from consumers to fix the climate problem (KPMG, 2018). The surge in M&A activity in the sector also suggests that mergers and acquisitions are becoming a central strategy for decisionmakers to enable the economic and policy shift. Additionally, acquisitions are considered an effective way for companies to enter the renewable energy and cleantech sectors and benefit from the expected growth (Palmquist & Bask, 2016). These transactions can be viewed as acquisitions of growth options. When looking at geographical distribution of deal activity, KPMG (2018) found senior-level investors in renewable energy believe 47% of M&A activity in 2019 will take place in the EMA region, followed by 40% in ASPAC, 8% in Latin America, and only 5% in North America. Furthermore, the United States are found to have the least favourable policies for investing in renewables amongst the advanced economies.

When looking at mergers and acquisitions activity in the sustainable energy sector specifically, three types of targets can generally be identified: capacity, technology and other targets. Capacity targets entail the acquisition of renewable power generation projects, technology targets are companies developing or manufacturing products and services and other targets include carbon management firms, amongst others (Usher, 2008). As activity in the sector is fairly new, research on renewable energy deals is limited, however, some studies have been performed already. Palmquist and Bask (2016), for example, looked at 273 announced and 54 completed buyout acquisitions in the renewable energy and cleantech sectors. They found renewable energy and cleantech deals to be outperformed by the traditional energy and mining sector in homogenous deals. This is contrary to expectations, as the backing of public funding implies there should be a green premium and the fast growing nature of the cleantech sector suggests superior performance. In line with expectations, they also found that homogenous deals outperformed heterogenous deals. Yoo, Lee and Heo (2013) find homogeneous M&A activity to have the biggest impact on enterprise value. This makes senese considering renewable energy firms are establishing new value chains and markets for alternative energy sources, thus needing homogeneous M&A to increase profits through increased firm size. They also find M&A activity with participation of financing companies has the second biggest impact on enterprise value, suggesting renewable energy is considered to be a potentially interesting investment. When existing energy industries engage in renewable energy M&A, however, this has a negative impact on enterprise value, which is suggested to be a result of strict regulations regarding the use of clean energy causing energy companies to incur elevated costs. Eisenbach, Ettenhuber, Schiereck, Flotow and Paschen (2011) found that acquirers of renewable energy firms from outside the renewable industry tend to earn positive abnormal returns. An interesting development in the renewable energy sector is the interest in 'capital recycling' methods for financing the construction of new capacity by utilities to deal with the high pressure of shifting to green energy production. This means assets are sold when they are ready to begin production and have therefore derisked, leading to increased levels of deal activity (Medium, 2017). Driving forces for renewable energy M&A are expected to be: (i) mitigation of relatively high cash flow volatility, (ii) rapid growth facilitating firm financing, with economies of scale in financing reducing cost of capital transactions, (iii) operational synergies leading to economies of scale and scope boosting technological development (Yoo, Lee, & Heo, 2013).

3.2.2 The oil and gas industry

Crude oil is considered the most important commodity because of its hugely influential role in the world economy, especially the effects on economic downturns and inflation (Elder & Srletic, 2010; Stock & Watson, 2003). Oil is indispensable for many industries, such as industrials, transportation and agriculture, and oil price fluctuations have been known to spill over into other commodity markets (Kang & Yoon, 2013) and financial markets (Balcilar & Ozdemir, 2013). Chen, Cheng and Demirer (2017) have also found that stock market anomalies driven by informational inefficiencies can be predicted using oil returns and volatility.

The oil and gas industry has been the scene for some hefty merger waves and has seen some of the largest deals, resulting in today's mega corporations, with the top 25 oil and gas companies on the Forbes Global 2000 list accounting for $144.6 billion of sales in the 12-month measuring period (Poole, 2018). During the period 1996-2000, for example, the oil and gas industry saw a staggering $500 billion in global transactions with the formation of companies such as BP (merger of British Petroleum, Amoco and Burmah Castrol), ExxonMobil Corp. (merger of Exxon and Mobil) and TotalFinaElf SA (merger of Total, Petrofina and Elf Aquitaine) (Cassidy, Lohman, & Weissgarber, 2001). According to financial economics literature, it is industry factors such as oil price fluctuations, overcapitalisation, higher market capitalisations, economic shocks to other industries, and other increased risks that have driven the consolidations in the oil and gas industry. Historically, oil and gas firms have used mergers and acquisitions as a primary strategy for cost reduction, with the acquisitions of Amoco by BP showing that market value increases, even if only a fraction of cost reductions are achieved.

There are several distinct features characterising the oil and gas markets. Firstly, they are global markets and they account for the largest percentage of world trade, with oil accounting for over 10% of commodity trade. Secondly, they are strategically very important industries in industrial, diplomatic and military sense. Furthermore, the Organisation of Oil Exporting Counties (OPEC) has always exerted significant influence on the markets, although its influence has been weakening. The industry is also burdened by heavy costs as a result of strict environmental and regulatory legislation, and lastly, price instability is a quite unique feature (Weston, Johnson, & Siu, 1999).

An important driving force behind oil and gas M&A activity is vertical integration. Technically speaking, vertical integration is not a definite must, however, practice actually provides some strong rationales. Oil refining, for example, is a low-margin business and requires a continuous flow of crude oil. Although this supply could be ensured through backward integration or long-term contracts, transaction costs and limited production sources with varying crude oil characteristics make it a lot more efficient and profitable to have a vertically integrated refining business. Volatile oil prices in recent years, combined with rising production costs and cash flows turning negative, have spurred another takeover wave (Reddy & Xie, 2017). Other recurring themes surrounding M&A activity in the oil and gas industries are geopolitical pressures, diversification efforts, divestments and restructuring. In their paper, Ng and Donker (2013) have taken a different approach by hypothesizing that natural resource endowment and global commodity markets may influence firms' decision making, suggesting M&A activity in the oil and gas industry is driven by broader economic and environment factors than just traditional managerial and firm features. They found supportive evidence that takeover activity, value and performance in the oil and gas industry is affected and caused by energy reserves and prices. They argue that firms are motivated to acquire reserves, while targets are motived to sell based on market timing. Alternatively, Bos, Demirer, Gupta and Tiwari (2018), have found oil & gas M&A activity to be a predictor for oil returns and volatility. Regarding performance of oil M&A activity, Choi and Song (2007) found negative effects.

Oil companies have already been experimenting with (investments in) renewable energy generation. Pinkse and Van den Buuse (2012), for example, identified that oil companies have been early movers in the solar industry, but they have not been very successful in rolling out this strategy. They argue the solar industry's technologies have been too disruptive, causing a misfit with oil companies' main-stream business models. Kolk and Pinkse (2008) therefore state that in order for oil and gas companies to successfully move into this new industry, they will have to develop new resources and competences. Current themes and outlooks for oil companies according to A.T. Kearny are as follows:

“Energy transition and changing demand expectations will push oil companies to shift their strategies, and digitalization will allow companies to reduce costs with new capabilities. Other factors spurring deal making include collaboration, diversification, and the expanding role of financial investors such as private equity firms”. On the same topic, EY has stated: “The continued preference trend toward cleaner energy will drive interest in natural gas and LNG. In the longer-term we see more nations pressing for fuel oil power generation conversion to natural gas, which will drive LNG development infrastructure”.

3.2.3 Electrical utilities

The electricity market has historically been a heavily-regulated industry, with utilities regulation creating artificial monopoly situations in some regions, while restructuring through mergers and acquisitions has traditionally been difficult due to strict regulations, limiting the distribution of value creation to shareholders. Traditional rate-of-return regulation has ensured that the greater part of benefits resulting from any mergers and acquisitions activities by utilities was passed on to the rate payer (Norris, 1990). The electric utility sector can be divided in four vertical stages: generation, transmission, distribution and retailing, with the transmission and distribution stages still considered to be traditional network industries. The generation stage is associated with the largest competition concerns (Keller, 2010). Furthermore, demand in the electricity market is characterised by inelasticity (Soft, 2002).

In the past decades, deregulations have fuelled restructuring of the American and European markets, resulting in a number of merger waves especially at the distribution stage (Kwoka & Pollitt, 2010; Verde, 2008). However, the industry is still considered to be heavily regulated, and pending mergers require strict approval by corresponding regulators. The same trends have been identified in other industries that underwent deregulations, such as airlines, banking, telecommunications and railroads. Here too, there were conflicting directions taken following deregulation, resulting in companies looking to consolidate to strengthen their market position, while regulators showed reluctance to decrease the number of competitors for fear of monopolistic situations (Leggio & Lien, 2000). Merger and acquisition trends in the utilities sector following the deregulation have shown mainly an increase in inter-industry activity, such as the creation of utilities-gas combinations. In Europe, geographical trends have shown the creation of pan-European players and oppositely, the formation of “national champions” (Verde, 2008). Foreign competition is extremely limited due to the lack of interconnected networks between states, which is especially true for Europe, where geographic markets for electricity often stop at the national borders. Coincidentally, the electricity market is characterised by high barriers to entry as a result of large sunk costs and complicated application and approval procedures, meaning it is not a contestable market.

In terms of performance of mergers and acquisitions in the utilities sector, Ray and Thompson (1990), and Leggio and Lien (2000) both found target shareholders to benefit modestly, with most benefits still being transferred to consumers. Kwoka and Pollitt (2010) looked at efficiency gains and found that pre-merger target firms often have greater operating cost efficiency, while acquiring firms do not perform any better than non-acquiring firms. The target's superior efficiency is often lost as efficiency decreases towards the norm post-merger. A similar pattern is identified for total controllable costs. These findings are completely opposed to the efficient merger hypothesis. Additionally, the before-mentioned adverse agency cost of diversification effect found in non-regulated industries, might be partially offset by the positive cross-subsidisation effect of diversifying in a regulated business as found by Berger and Ofek (1995). Through the sharing of resources between divisions, diversification may lead to an increase in the size of the utility's rate base and therefore in the revenues allowed by the regulator.

In addition to deregulation, other explanations for the merger waves in the electrical utilities sector are an increase in cash liquidity, stronger attention for short-term creation of shareholder value, protectionism and taking advantage of scale or scope economies (Verde, 2008; Fraquelli, Piacenza, & Vannoni, 2005). Increased cash liquidity follows from more efficient and cheaper power productions thanks to technological advancements, with lower capital expenditures freeing up cash flows (Leggio & Lien, 2000). Furthermore, liberalisation of the European market has led to geographical mergers and acquisitions in this region, in anticipation of integration of the different markets following the opening of the borders.

3.2.3.1 Deregulation in the United States

In 1992, the Energy Policy Act (EPA) was introduced in the United States, signalling the federal interest in wider markets. This was followed by market reformations by the Federal Energy Regulatory Commission resulting in open access, more rational transmission pricing and reginal transmission planning. In 1996, the FERC presented new guidelines for mergers, following the guidelines used by the Antitrust Division of the Department of Justice and the Federal Trade Commission. During some of the prior merger reviews, non-economic issues played a significant role, and the new rules were perceived to limit the importance of such issues. Subsequently, in most states pressure was exerted on traditional vertically integrated utilities to focus on distribution and divest upstream assets. The aim was to pull away the generation sector by creating a market with divested assets and new entrants. Distribution companies would keep ownership of transmission, but FERC rules and later the Independent Service Operators and Regional Transmission Organisations increasingly governed the operating control of transmission. Distribution companies could now merge more easily with other companies, which often took the form of adding operating subsidiaries under an existing holding company umbrella. In 2005, the Public Utilities Holding Company Act was repealed, lifting several restraints on the nature of mergers and acquisitions in the industry (Kwoka & Pollitt, 2010).

The convergence of the natural gas industries and electricity industries started in the 1990s in the United States following deregulations of the markets, advances in technology increasing the efficiency of gas usage for generation of electricity and downstream cost savings (McLaughlin & Mehran, 1995; Bergstrom & Callender, 1996). Additionally, regulations in the United States actually support the formation of dual-fuel utilities (Verde, 2008).

3.2.3.2 Deregulation in Europe

In Europe, transmission and distribution remain heavily regulated classical network industries, however, deregulation and the introduction of increased competition has emerged in the generation and retail stages. An EU-wide liberalisation process started in 1996 when the European Commission entered Directive 96/92/EC and sped up with Directive 2003/54/EC (Keller, 2010).

In 2004, the new European Community Merger Regulation (ECMR) (EC Council Regulation 139/2004) became effective. Although the number of largely impactful changes is limited, it did increase legal certainty in merger assessment cases in markets characterised by tight oligopoly, such as the electricity sector (Verde, 2008).

In the pre-crisis years 2005-2007 in Europe, a surprising trend of policy favouring the formation of “national champions” emerged. Theories trying to explain this trend focus on the importance of size to benefit from globalisation, efficiencies, and economies of scale, but also the importance of keeping the industry within country borders in order to secure economic activity (Geroski, 2005). It has been found that electricity restructuring in Europe has often overlooked issues of market power (Newbery, 2007).

4 Data

4.1 Sample selection

The Thomson One database was used to compile a dataset of all merger and acquisition activity with a clean energy target. The first general search, using a listed acquirer and target with SIC-code 499A as the only criteria, generated 1368 deals. Subsequently, this raw set of data has been filtered down to remove unwanted data points. Firstly, only acquirers active in the power sector are included using SIC-codes 499A, 1311-1389, 2911-2999 and 4911-4939 to narrow the set down to one industry, reducing the number of results to 751 deals. Using only acquirers from the power industry improves and facilitates comparison. Duplicates, share buybacks, debt restructuring, minority stake acquisitions, and rumoured deals are removed, taking out 235 deals. Companies without at SEDOL-code were removed, as this code is necessary for obtaining stock price data, resulting in a decrease of 70 deals. All targets have been checked manually to ensure the company or asset can be considered 'clean energy', removing another 55 deals for which classification was unclear from publicly available information or for which oil or coal assets were involved. Since the power sector is often heavily regulated and constructions with government involvement can sometimes be quite unclear, all non-North American or non-European acquirers, a total of 84 companies, have been removed from the dataset.

Acquirer stock price data and returns were obtained using DataStream's Event Study Tool. For each country included in the dataset, returns for a major index linked to the national stock market were downloaded (Table 6 in Appendix A). Accounting data was obtained using WRDS and Compustat, with 3 acquirers lacking financials and therefore being removed from the dataset. Some 12 companies made announcements for multiple acquisitions on the same day. These deals have been merged. Lastly, for 29 companies there was not enough stock price data available to obtain the necessary estimation period of 120 trading days to calculate the cumulative abnormal returns, leaving the final number of deals included in the database at 263. Acquirers and targets were not filtered based on size. An overview of the complete filtering process including all selection criteria is provided in Table 1.

Additional variables used are oil prices and Word Bank Regulatory Indicators for Sustainable Energy ("RISE"). Crude oil prices consist of West Texas Intermediate ("WTI") daily spot prices for North American companies and Brent North Sea Crude daily spot prices for European companies downloaded from Bloomberg in US Dollars. RISE scores are obtained from the World Bank website, and are available for the years 2010-2017. For 2018, new scores are not yet available, so the 2017 scores have been used. The renewable energy score rates nations on: (i) legal framework for renewable energy, (ii) planning for renewable energy expansion, (iii) incentives and regulatory support for renewable energy, (iv) attributes of financial and regulatory incentives, (v) network connection and use, (vi) counterparty risk and (vii) carbon pricing and monitoring (RISE World Bank, 2018).

Table 1: Sample selection

Overview of the steps taken to filter the data and the selection criteria used to narrow the database down to the final set of 263 deals. Data was downloaded from the Thomson One database using listed acquirer and target with SIC-code 499A only as search criteria, resulting in a raw dataset of 1368 deals.

Selection criteria	Number of deals removed	Number of deals remaining
All deals with a listed acquirer and target with SIC-code 499A		1368
Acquirers with SIC-codes 499A, 1311-1389, 2911-2999 and 4911-4939 only	617	751
Remove duplicates	9	742
Remove share buy-backs	44	698
Remove debt restructurings	3	695
Remove minority stake acquisitions	168	527
Remove rumoured deals	11	516
Remove all deals without an acquirer SEDOL	70	446
Remove all deals with a target that cannot be classified as a clean energy target	55	391
European and North-American acquirers only	84	307
Remove all deals without sufficient financial information for acquirers	3	304
Merge announcements for multiple acquisitions on the same day	12	292
Remove deals without sufficient share price data to calculate CARs	29	**263**

4.2 Descriptive statistics

Out of the 263 deals in the dataset, 154 have a European acquirer and 109 have a Northern American acquirer (Table 6 in Appendix A). Targets are both private and publicly listed companies, and the dataset consists of 5 deals involving a public target and 258 deals involving a private target.

Table 7 and Graph 1 in Appendix A give the temporal distribution for the data sample. The sample follows the trends described in the theoretical framework stating a clear increase in deal activity in recent years, with 4.2% of the deals taking place in the period 1990-1999, 30.8% taking place between 2000 and 2009, while the majority of the data (65.0%) is concentrated in 2010-2018. Interestingly, although there is a slight dip in number of deals around the financial crisis in 2008, this decrease is smaller than one would initially expect. The dip was also more severe in North America than in Europe. The number of European deals per year is higher in most years than the number of North American deals, especially in recent years. Table 2 shows the summary statistics for the dataset. Acquiring firms earned a +1.7% or +1.8% CAR(-1,1), a +1.6% or +1.7% CAR(-2,2) and a +1.7% or +1.8% CAR(-5,5) on average depending on the method of calculation. CARs were substantially higher in North American deals compared to European deals on average with North American deals, for example, earning on average a +2.6-2.9% CAR(-1,1) while European deals earn on average +1.0-1.1% CAR(-1,1). Some other interesting observations regarding the summary statistics are that acquirers are relatively highly levered and earn a negative free cash flow on average. Both observations make sense considering acquirers are active in the power sector, which is considered to be very capital intensive. European acquirers are on average larger, earn less negative free cash flows and are less highly levered than North American acquirers. Europe also has a higher RISE score on average than North America, providing evidence for the notion that the policy environment in Europe is more favourable for renewable energy development than in North America. Graphs 2, 3 and 4 in Appendix A show the development of abnormal returns around the announcement date for the full 11-day event window.

4.3 Data limitations

There are several limitations in the data sample used, starting with the large variety in acquiring firms. Acquiring firms range from small renewable energy firms, to mega corporates such as BP Plc. Furthermore, the target companies in the set also have large differences, as some acquisitions merely include renewable energy assets such as wind parks, and both public and private targets have been included. As a discount is usually applied to the acquisition price of a private target due to illiquidity, acquirer returns are more likely to be positive in comparison to acquisitions of public targets. As only 5 out of 263 deals in the dataset concern a public target, this illiquidity discount is likely to have affected the results. Limitations mostly originate in the limited availability of data, and the immaturity of the sector. This also translates to the relatively small size of the database with just 263 deals. Another limitation follows from the fact that some acquirers in the dataset made multiple acquisitions in close time proximity, potentially leading to spill-over effects. Additionally, the data was collected using multiple databases, potentially decreasing the consistency of data measurement, while some data points were also collected and merged manually, creating a risk of errors in variables. These errors, however, are not systematic. Some companies announced mergers on the weekends, therefore lacking stock price data. For these companies the next trading day was used.

Table 2: Summary statistics

Summary statistics for the dependent, independent and control variables in the dataset. The sample consists of all merger and acquisition activity involving a clean energy target and a power sector acquirer in the Thomson One database. Dependent variables are market model ("MM") and GARCH-adjusted market model ("GMM") 3-day, 5-day and 11-day cumulative abnormal returns. Independent variables are oil prices represented by the WTI daily spot price (North American deals) or the Brent North Sea Crude daily spot price (European deals) in US Dollars, RISE scores denoting the acquirer nation's World Bank Regulatory Indicators for Sustainable Energy score, a heterogeneity dummy with value 1 for homogeneous deals and 0 for heterogeneous deals, an oil dummy with value 1 for oil acquirers, and a European dummy with value 1 for European acquirers. Control variables are Tobin's Q calculated by dividing acquirer market capitalisation by the book value of its assets, firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets, acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation, a cash dummy with value 1 for deals with all cash payments, and deal value as the natural logarithm of the deal value. The table presents variable averages, medians, and standard deviations (SD) for the entire sample, as well as for subsamples of European deals and North American deals.

	All deals			**European deals**			**North American deals**		
	Mean	Median	(SD)	Mean	Median	(SD)	Mean	Median	(SD)
CAR(-1,1) MM	0.017	0.00	(0.097)	0.011	0.01	(0.045)	0.026	0.00	(0.140)
CAR(-2,2) MM	0.016	0.00	(0.112)	0.007	0.00	(0.052)	0.030	0.00	(0.162)
CAR(-5,5) MM	0.017	0.00	(0.161)	0.014	0.00	(0.110)	0.022	0.00	(0.213)
CAR(-1,1) GMM	0.018	0.00	(0.098)	0.010	0.01	(0.042)	0.029	0.00	(0.144)
CAR(-2,2) GMM	0.017	0.00	(0.114)	0.007	0.00	(0.049)	0.032	0.00	(0.166)
CAR(-5,5) GMM	0.018	0.00	(0.170)	0.015	0.00	(0.112)	0.023	0.00	(0.228)
Oil price	73.229	73.51	(27.671)	74.935	72.46	(26.885)	70.817	73.93	(28.696)
RISE score	69.367	54.00	(14.902)	72.990	76.00	(15.935)	63.851	58.00	(11.204)
Homogeneity dummy	0.510	1.00	(0.501)	0.532	1.00	(0.501)	0.477	0.00	(0.502)
Oil dummy	0.129	0.00	(0.336)	0.110	0.00	(0.314)	0.156	0.00	(0.364)
European dummy	0.586	1.00	(0.494)						
Tobin's Q	1.045	0.54	(1.757)	1.080	0.53	(0.782)	0.992	0.55	(1.696)
Firm size	7.491	8.02	(2.828)	7.531	7.93	(2.816)	7.433	8.07	(2.859)
Free cash flow	-9.780	-2.00	(22.696)	-7.853	-1.00	(20.738)	-12.754	-3.00	(25.255)
Leverage	82.222	64.00	(79.855)	77.477	53.00	(78.232)	88.775	66.00	(81.967)
Cash dummy	0.244	0.00	(0.430)	0.231	0.00	(0.423)	0.263	0.00	(0.443)
Deal value	3.784	4.08	(1.689)	3.653	3.94	(1.642)	3.911	4.21	(1.737)

5 Hypothesis development

From the literature review, a few key points can be gathered. First, consensus on acquirer announcement returns of mergers and acquisitions is missing, with some studies finding positive returns, and others finding zero or negative returns. There is a limited amount of research available specifically on the topic of acquisitions of clean energy assets. However, using theories on returns linked to rationales behind M&As, hypotheses can be formulated. Often, negative acquirer returns are found for acquisitions built on corporate governance deficiencies, such as empire building. Empire building is in many cases a manifestation of discrepancies between management's short-term vision and shareholders' long-term vision. Acquisition of clean energy assets, however, might suggest a long-term vision, in anticipation of the upcoming energy transition and climate change. This could be viewed as the acquisition of growth options in anticipation of future increases in clean energy sales. Furthermore, clean energy acquisitions can be linked to corporate social responsibility, with renewable energy targets scoring high on environmental factors. As found by Aktas, Bodt & Cousin (2001) it is therefore to be expected that acquirers of a renewable energy firm will earn positive returns. The first hypothesis is formulated as follows:

Hypothesis 1: Acquirer shareholders on average earn positive announcement returns for acquisitions of clean energy assets.

Differences between countries in terms of renewable energy policies and regulations could have a significant impact on investor sentiment with regards to renewable energy investments. Furthermore, Shah, Hiles and Morley's (2018) identified a link between lower levels of support for renewable energy on a policy level and investments being more dependent on oil prices. As the level of substitution between renewable energy and fossil fuels becomes more intense, this dependence has also been found to become more severe. It can therefore be considered whether renewable energy policies and oil prices might also influence acquirer abnormal announcement returns. In particular, cumulative abnormal returns might be less positive in countries with less supportive sustainable energy policies when oil prices are low. Therefore, the second hypothesis is as follows:

Hypothesis 2: Announcement returns for acquirers in countries with less supportive sustainable energy policies are less positive when oil prices are low.

Another major impact factor behind M&A announcement returns is the possibility of obtaining financial and/or operational synergies through a merger or acquisition. Literature on diversification suggests a diversifying merger or acquisition could deteriorate firm performance and therefore decrease shareholder value. Deregulation, such as in the power sector, often leads to an increase in diversifying mergers. In addition to potential value destruction through diversification, conglomerates have also been found to be riskier and their performance in terms of return on assets and return on equity is statistically worse (Mason & Goudzwaard, 1976). Homogeneous M&A activity in general and in the renewable energy industry in particular has been found to result in higher returns and improved post-merger performance (Palmquist & Bask, 2016; Yoo, Lee and Heo 2013). The third hypothesis is formulated to be:

Hypothesis 3: Homogeneous acquisitions of clean energy assets have more positive acquirer returns than heterogeneous acquisitions.

Within the heterogeneous activity, a split can be made between oil acquirers and utilities acquirers. Acquirer returns for M&A activity in the oil industry in general have been identified as negative. Additionally, historical performance suggests acquirers in the oil and gas industry will face more complex integration and a larger mismatch with their traditional business models when acquiring a clean energy target (Pinkse & Van den Buuse, 2012). The scale of clean energy targets is often small in comparison to the mega-corporations in the oil industry, therefore earning less attention from stakeholders and resulting in little to no share price reaction. Furthermore, managers will be less focused on spending resources on successful integration. Any positive returns related to such small-scale renewable energy acquisitions may be linked to the green premium and the CSR value-creation to the acquirer. In contrast, renewable electricity generation, although using different generation methods, has a closer fit with utilities' business models. The fourth hypothesis is as follows:

Hypothesis 4: Oil acquirers of clean energy assets have less positive announcement returns.

There are large differences between Europe and North America when it comes to the treatment of climate change and the effort made to speed up the energy transition. Especially United States politics has shown little interest in battling climate change by, for example, withdrawing from the Paris Agreement. In terms of political incentives in the form of policies like subsidies and feed-in-tariffs, a growing number of European countries has been taking considerable action. This in contrast to the United States, with KMPG (2018) documenting that senior-level investors in renewable energy find the US to have the least favourable policies for promoting investments in renewables among advanced economies. Additionally, European investors are becoming more and more aware of the importance of sustainability and the need for financing of the energy transition. It has been found that European investors in general 'care more' about the level of sustainability of their investments than American investors. This is also emphasised by the very low expected increase in M&A deal activity in renewable energy in the United States for 2019. This region is expected to see an increase of 5% compared to 47% for the EMA region (KMPG, 2018). The last hypothesis is therefore:

Hypothesis 5: Announcement returns of clean energy acquisitions are more positive in Europe than in North America.

6 Methodology

The efficient market hypothesis states that a company's share price represents the current value of its expected future cash flows. Stock price changes following an event therefore reflect changes in these expectations and can be used to measure the effect of an event on the company. An event study analysis is performed to assess the abnormal returns of 263 deals with clean energy targets in the years 1990-2018. The event study analysis is performed by calculating abnormal returns using two different methodologies to improve reliability: the market model and a market model corrected for generalised autoregressive conditional heteroskedasticity. Although the market model is widely used by researchers for event studies, the method has been found to have some limitations, such as the reliance on the assumption of constant variance in pre- and post-event windows. Using the market model while the assumption of constant variance is violated, will lead to rejection of the null hypothesis in cases where it is in fact true. The GARCH-adjusted market model method allows for time-varying volatility while modelling the level of returns, thus resulting in more reliable results (Boehmer, Musumeci, & Poulsen, 1991). In addition to measuring any abnormal returns in the period surrounding the acquisition announcement, an attempt will be made to identify any variables that might explain the abnormal returns using pooled ordinary least squares regressions.

6.1 Modelling cumulative abnormal returns

To assess the extent to which returns are abnormal, an estimation window is used of 120 days as per MacKinlay (1997). The estimation window starts 140 days before the announcement date of the merger or acquisition and ends 20 days before. Market index returns are used as a proxy for 'normal' returns during the estimation period. The event window consists of 1 day before and 1 days after the event, making the event window 3 days long, with the event defined as the announcement of clean energy M&A. Such a short event window is used because the database consists of acquirers listed in Europe and North America. Markets in these developed regions are often considered to be highly efficient, therefore incorporating any information in stock prices relatively quickly. As a robustness check, however, event windows of 2 days before and 2 days after the event and of 5 days before and 5 days after the event are used to capture information leakage and any information that is processed late by the market. The total timeline has been made as long as possible to accommodate for the assumption of normality.

Calculation of cumulative abnormal returns is done following MacKinlay's (1997) paper. Acquiring firms and their stock returns during the timeline period have been obtained with returns defined as daily stock returns:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

where R_t is firm i's rate of return at day t. P_t is day t's closing price and P_{t-1} is the prior day's closing price. Returns are corrected for stock splits during the estimation or event windows. Subsequently, abnormal returns are defined as the differene between actual stock returns and normal returns and are calculated as follows:

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_{\tau})$$

where $AR_{i\tau}$, $R_{i\tau}$, and $E(R_{i\tau}|X_{\tau})$ represent the abnormal, actual and normal returns respectively for the period τ. X_{τ} is defined as the conditioning information for the normal return model.

Normal returns are modelled using two different methods:

A. Normal returns are modelled using the market model with parameters estimated by OLS, whereby X_{τ} is the market return proxied by the market index return. MacKinlay (1997) defines the market model for any security i as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

$$E(\varepsilon_{it} = 0)$$

$$var(\varepsilon_{it}) = \sigma_{\varepsilon}^2$$

where R_{it} and R_{mt} are the returns on security i and the market portfolio at time t and ε_{it} is the zero mean disturbance term. α_i, β_i and σ^2_{ε} are market model parameters.

B. Normal returns are modelled using a market model adjusted for GARCH following Yoo, Lee and Heo (2013). The model corrected for GARCH(p,q) is defined as done by Corhay and Tourani Rad (1996):

$$\varepsilon_{it}|\psi_{it-1} \sim D(0, h_{it}, d)$$

$$\varepsilon_{it} = R_{it} - \alpha_i\beta_i R_{mt}$$

$$h_{it} = \alpha_{i0} + \sum_{k=1}^{p} \alpha_{ik}\varepsilon^2_{it\text{-}k} + \sum_{j=1}^{q} b_{it}h_{it\text{-}j}$$

where ψ_{it} represents the information set of all information through time t on firm i, h_{it} is the conditional variance of firm i, and D is a student-l distribution with d degrees of freedom and with $p > 0$; $\alpha_{ik} \geq 0$, $i = 0, ..., p$; $q > 0$; $b_{ij} \geq 0$, $j = 0, \ldots, q$. In line with previous studies, a simple GARCH(1, 1) model is used (Yoo, Lee, & Heo, 2013; Lamoureux & Lastrapes, 1993).

All models are estimated using the user-written module *Eventstudy2* in Stata (Kaspereit, 2018).

In order to be able to draw conclusions about the impact of an event on the company, abnormal returns have to be aggregated to cumulative abnormal returns. Aggregated abnormal returns for security i through time are defined as:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau}$$

with $CAR_i(\tau_1,\tau_2)$ defined as the cumulative abnormal return for time period τ_1 to τ_2, and being the sum of included abnormal returns.

6.2 Testing the significance of cumulative abnormal returns

To answer the first hypothesis, the significance of the aggregated abnormal returns is tested at the 1, 5 and 10 percent levels using a number of tests. Firstly, a *t*-test assuming cross-sectional independence according to Serra (2002) is used. Additionally, a standardised cross-sectional residual test is used, in line with previous research (Eisenbach, Ettenhuber, Schiereck, Flotow, & Paschen, 2011; Basse-Mama, Koch, Bassen, & Bank, 2013; Palmquist & Bask, 2016). This test, as described by Boehmer, Musumeci and Poulsen (1991) and hereafter referred to as the BMP-test, allows for heteroskedasticity as there is reason to believe that the event periods are subject to event-induced variance. Event-induced volatility is common for event-studies in which events are clustered, as is often the case in M&A event studies. The adjusted BMP-test as proposed by Kolari and Pynnonen (2010) is used to deal with cross-correlation of returns due to event-date clustering. Lastly, to account for nonnormality of returns and identify small levels of abnormal returns, a non-parametric test, the generalised sign test, is used.

6.3 Regressions

To answer hypotheses 2, 3, 4 and 5 and identify any drivers for CAR, several models are regressed using a cross-sectional OLS regression adding a different explanatory variable in addition to the control variables in each model. Control variables used are acquirer Tobin's Q (*TobinsQ)*, acquirer firm size (*FirmSize)*, acquirer free cash flow (*FCF*), and acquirer leverage (*Leverage*). All regressions will be run using two-way clustered standard errors to control for autocorrelation and heteroscedasticity. As a robustness check, all regressions are ran using the 5-day and 11-day CARs as well. The second hypothesis examines the impact of an interaction between the acquirer nation's Regulatory Indicators for Sustainable Energy scores and oil prices (*InteractionTerm)* on their announcement returns. The regression equation for model 1 is as follows:

<u>Model 1:</u>

$$CAR = \alpha + \beta_1 InteractionTerm + \beta_2 TobinsQ + \beta_3 FirmSize + \beta_4 FCF + \beta_5 Leverage + error$$

The third hypothesis examines whether there is a difference between homogeneous and heterogeneous deals, and includes a dummy variable that takes the value 1 for homogeneous deals (*Homogeneous*):

<u>Model 2:</u>

$$CAR = \alpha + \beta_1 Homogeneous + \beta_2 TobinsQ + \beta_3 FirmSize + \beta_4 FCF + \beta_5 Leverage + error$$

For the fourth hypothesis, a dummy variable taking the value of 1 for oil acquirers (*Oil*) is added to identify whether there is a difference between oil acquirers and other power sector players:

Model 3:

$$CAR = \alpha + \beta_1 Oil + \beta_2 TobinsQ + \beta_3 FirmSize + \beta_4 FCF + \beta_5 Leverage + error$$

The last hypothesis will be tested using model 4 with a dummy variable that equals 1 for deals with a European acquirer (*Europe*):

Model 4:

$$CAR = \alpha + \beta_1 Europe + \beta_2 TobinsQ + \beta_3 FirmSize + \beta_4 FCF + \beta_5 Leverage + error$$

Lastly, a full model will be regressed including all independent variables and all control variables:

Full model:

$$CAR = \alpha + \beta_1 InteractiontTerm + \beta_2 Homogeneous + \beta_3 Oil + \beta_4 Europe + \beta_5 TobinsQ + \beta_6 FirmSize + \beta_7 FCF + \beta_8 Leverage + error$$

In addition to robustness checks using different event windows, additional models will be regressed to control for omitted variable bias and year-fixed effects. Control variables *Cash*, a dummy with value 1 for cash-paid acquisitions, and *DealValue,* a variable containing deal values, are added, as these are usually included in M&A literature. The variables are not included in the main regressions due to a lack of information for the full database, decreasing the number of observations significantly.

Full model:

$$CAR = \alpha + \beta_1 InteractiontTerm + \beta_2 Homogeneous + \beta_3 Oil + \beta_4 Europe + \beta_5 TobinsQ + \beta_6 FirmSize + \beta_7 FCF + \beta_8 Leverage + \beta_9 Cash + \beta_{10} DealValue + \beta_{11} YearEffect + error$$

6.4 Control variables

In line with financial economics literature, a number of control variables are used to avoid omitted variable bias. All variables using accounting data are calculated as measured per the last fiscal year end preceding the announcement. To control for outliers, all accounting variables are winsorised at 5%. All values are denoted in US Dollars.

Acquirer's Tobin's Q

Several authors have identified a positive relationship between an acquirer's Tobin's Q and its abnormal announcement returns (Lang, Stulz, & Walkling, 1989; Servaes, 1991). Tobin's Q is computed by dividing acquirer market capitalisation by the book value of its assets.

Acquirer's leverage

Jensen's (1986) free cash flow hypothesis states that leverage limits free cash flow through interest payments. Furthermore, leverage limits the power of managers, both through reduced free cash flow, as well as through reduced investment opportunities. This disciplining function of leverage limits managers' ability to engage in empire building. Leverage is calculated by dividing book value of long- and short-term debt by the market capitalisation.

Acquirer's free cash flow

In line with the rationale for including leverage as a control variable, free cash flow is also added. It has been found that acquirers with high free cash flow earn lower abnormal returns (Jensen, 1986). Free cash flow is computed by substracting interest expense, income taxes and capital expenditures from operating income before depreciation and amortisation, scaled by the lagged value of total assets.

Acquirer's firm size

Research has found that the firm size of an acquirer influences its announcement returns (Moeller, Schlingemann, & Stulz, 2005). It is shown that announcement returns for large acquirers are significantly lower than announcement returns for small acquirers. Firm size is calculated by taking the natural logarithm of acquirer's total book value of assets.

Payment method

Previous literature such as Franks, Harris and Titman (1991) has identified a relationship between payment method and abnormal returns, coinciding with the pecking order theory of Myers and Majluf (1984). To accommodate for this, a dummy variable with value 1 for all-cash deals is included. The dummy variable has value 0 for deals involving stock payments and for payments consisting of a mixture of stocks and cash.

Deal value

Target size has been found to have a considerable influence on deal success, premia paid and investor reactions (Alexandridis, Fuller, Terhaar, & Travlos, 2013). For example, it has been found that acquirers tend to pay less for large firms and overpayment potential is less. To proxy for target size, the natural logarithm of the acquisition's deal value is used.

Year-fixed effects

Year-fixed effects control for the year in which the acquisition is made, which could be especially relevant in this case due to the skewness over time of the dataset. Over the years the attention on sustainability and the need for renewable energy has grown considerably, resulting in a strong increase in deal activity. Furthermore, the cost of generating renewable energy has decreased significantly, which has had a substantial impact on the industry.

7 Results

7.1 Correlation matrix

Table 8 in Appendix B presents the Pearson correlation matrix, showing correlation coefficients for the dependent, independent and control variables and their significance. This matrix essentially displays the strength and direction of linear relationships between the dependent, independent and control variables used in this study. The coefficients and their significance are used to check for multicollinearity between variables. All coefficients are relatively low, with all but the correlation coefficients for deal value and acquirer firm size being below 0.5. This implies multicollinearity is likely not an issue in the dataset. Interestingly, the coefficient for the homogeneity dummy and the cash dummy and the two CAR variables differ in sign, with market model CAR having a negative linear relationship and GARCH-adjusted market model CAR having a positive linear relationship with the homogeneity dummy, while market model CAR has a positive linear relationship and GARCH-adjusted market model CAR has a negative linear relationship with the cash dummy. These coefficients, however, are both highly insignificant.

7.2 Significance of cumulative abnormal returns

In Table 3, the results of several tests to determine the significance of the market model cumulative abnormal returns can be found. Market model CARs have been calculated using a market model in Stata with market index returns for the respective acquirer countries used as proxies for the market return. Subsequently, the significance of the obtained CARs is tested. 3-day, 5-day and 11-day market model CARs are significant at the 1, 5 and 10% level respectively according to the *t*-test. However, as there is reason to believe the data suffers from event-induced volatility, this could mean the null hypothesis is rejected wrongfully. Both the BMP-test correcting for event-induced changes in volatility and the adjusted BMP-test also adjusting for cross-correlation produce a significant 3-day CAR at the 1 and 5% respectively. 5-day and 11-day CARs, however, are not significant. Lastly, the generalised sign test is performed and finds the 3-day and 5-day CARs to be significant at the 5 and 10% levels respectively. 11-day CAR is again insignificant.

Table 4 displays the results of several tests to determine the significance of the GARCH-adjusted market model cumulative abnormal returns. GARCH-adjusted market model CARs have been calculated using a market model adjusted for GARCH in Stata with market index returns for the respective acquirer countries used as proxies for the market return. Subsequently, the significance of the obtained CARs is tested. Again, 3-day, 5-day and 11-day GARCH-adjusted market model CARs are significant at the 1, 5 and 10% level respectively according to the *t*-test. Although calculating cumulative abnormal returns following a GARCH-adjusted method should correct for event-induced volatility, the BMP- and adjusted BMP-tests are still performed. The BMP-test finds the 3-day CAR to be significant at the 1% level and the adjusted BMP-test produces a 5% level significant result. Both 5-day and 11-day CARs are not significant. According to the generalised sign test, 3-day GARCH-adjusted market model CAR is significant at the 1% level, but 5-day and 11-day GARCH-adjusted market model CARs are not statistically significant.

Based on the *t*-tests, all types of CAR included in this study are found to be statistically significant, either at the 1, 5 or at the 10% level. However, based on the other significance tests performed, only the 3-day CARs are statistically significant. Because it is likely the data suffers from event-induced volatility, the BMP- and adjusted BMP-tests are considered more robust. Therefore, in conclusion, hypothesis 1 is not rejected based on a 3-day event window and acquirer shareholders on average earn significantly positive announcement returns for acquisitions of clean energy assets.

Table 3: Significance of market model cumulative abnormal returns

Results for 3-day, 5-day and 11-day CARs modelled following the market model (MacKinlay, 1997) using the user written *Eventstudy2* module in Stata, as well as a *t*-test assuming cross-sectional independence according to Serra (2002), the BMP-test of standardised residuals corrected for event-induced changes in volatility (Boehmer et al., 1991), the adjusted BMP-test of standardised residuals corrected for event-induced changes in volatility and cross-correlation (Kolari & Pynnonen, 2010) and a generalised sign test (Cowan, 1992), ultimately testing the hypothesis H_0: $CAR = 0$. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

		T-test	BMP-test	Adjusted BMP-test	Gen. sign test
Variable	Coefficient	*t*-value (*p*-value)	*z*-value (*p*-value)	*z*-value (*p*-value)	*z*-value (*p*-value)
CAR(-1,1)	0.018	3.267*** (0.001)	2.668*** (0.009)	2.152** (0.033)	2.110** (0.035)
CAR(-2,2)	0.017	2.386** (0.019)	1.395 (0.166)	1.126 (0.263)	1.682* (0.092)
CAR(-5,5)	0.018	1.675* (0.097)	0.424 (0.672)	0.342 (0.733)	1.121 (0.262)

Table 4: Significance of GARCH-adjusted market model cumulative abnormal returns

Results for 3-day, 5-day and 11-day CARs modelled following the GARCH-adjusted market model (Corhay & Tourani Rad, 1996) using the user written *Eventstudy2* module in Stata, as well as a *t*-test assuming cross-sectional independence according to Serra (2002), the BMP-test of standardised residuals corrected for event-induced changes in volatility (Boehmer et al., 1991), the adjusted BMP-test of standardised residuals corrected for event-induced changes in volatility and cross-correlation (Kolari & Pynnonen, 2010) and a generalised sign test (Cowan, 1992), ultimately testing the hypothesis H_0: $CAR = 0$. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

		T-test	BMP-test	Adjusted BMP-test	Gen. sign test
Variable	Coefficient	*t*-value (*p*-value)	*z*-value (*p*-value)	*z*-value (*p*-value)	*z*-value (*p*-value)
CAR(-1,1)	0.018	3.437*** (0.001)	2.843*** (0.005)	2.232** (0.028)	3.038*** (0.002)
CAR(-2,2)	0.017	2.523** (0.013)	1.498 (0.137)	1.176 (0.242)	1.368 (0.171)
CAR(-5,5)	0.019	1.778* (0.078)	0.482 (0.631)	0.378 (0.706)	0.681 (0.496)

7.3 Regression results

After testing for the significance of the cumulative abnormal returns, the remaining hypotheses are tested using several regression models. All models include acquirers' Tobin's Q, firm size, free cash flow and leverage as control variables. Table 5 presents the results for the regressions using market model and GARCH-adjusted market model 3-day cumulative abnormal returns as the dependent variable. CARs over a 3-day event window have been identified as most significant and are therefore used as the default dependent variable. The CARs over longer event windows are used as robustness tests. For model 1, testing hypothesis 2, the results for the CARs are similar. The interaction terms between oil prices and RISE scores are both economically and statistically not significant, with a very small coefficient and high *p*-value. In these models, none of the variables are found to be statistically significant. In model 2, testing hypothesis 3, only firm size and the constant are found to be significant at the 5% level in both cases, however, due to the size of the firm size coefficient (-0.008) the variable is not economically significant. The independent variables in this model, the dummies for homogeneous deals, have a negative coefficient, implying homogeneous deals earn lower acquirer CARs, but these results are not significant. The third model, testing hypothesis 4, again has a statistically significant but economically insignificant firm size. The constant term in these model is statistically significant at the 5% level. The dummies for oil acquirers indicate a positive relationship between the fact that an acquirers is active in the oil industry and its cumulative abnormal announcement returns, which is contrary to expectations. The oil dummy is statistically significant at the 10% level for the model using market model CAR as the dependent variable. The fifth hypothesis is tested by model 4. The coefficients for the European acquirer dummies imply a negative relationship between an acquirer in Europe and its announcement CAR, also contrary to expectations. These results, however, are neither economically nor statistically significant. Again, firm size and constant variables are significant at the 5% level for market model and GARCH-adjusted market model CARs. Lastly, the full model is tested, including all independent variables. In both of these models, none of the variables are statistically significant.

Table 9 in Appendix B presents the results for the robustness check repeating the regressions using 5-day cumulative abnormal returns as the dependent variable to accommodate for any potential delays in information processing. None of the models produce any statistically significant coefficients. Only the constant is statistically significant in the full models at the 10% level.

This robustness check is repeated using 11-day cumulative abnormal returns, for which results are presented in Table 10 in Appendix B. In model 1 and the full model using market model CARs, the interaction variable between oil prices and RISE scores are statistically significant at the 10% level. The coefficient in both models, however, is -0.000, meaning the coefficients are not economically significant. Model 1 and the full model also both produce a significant constant, at the 5% level. Results for GARCH-adjusted market model CARs are similar, with the major distinction being that no significance is found for the interaction term in model 1.

Using longer event windows has not improved the results of the regressions in comparison to the 3-day event window in terms of significance. In model 4, the sign of the independent variable coefficient (European dummy) for both market model and GARCH-adjusted market model CARs, however, has shifted from negative to positive when using 11-day CARs. This relationship is more in line with expectations as laid out in hypothesis 5 and based on literature.

Table 11 in Appendix B presents results for an additional robustness check incorporating two extra control variables to the models in Table 5 to correct for omitted variable bias. Neither market model CAR models nor GARCH-adjusted market model CAR models report any significant independent variables. Lastly, year-fixed effects are added to the models as a robustness check to accommodate for differences between the years in the dataset. These regressions are presented in Table 12 in Appendix B. Again, neither market model CAR models nor GARCH-adjusted market model CAR models produce any significant independent variables. The additional variables did, however, cause some of the coefficients to switch sign. The oil acquirer dummy in model 4 is negative for both CARs, which is more in line with expectations, while the homogeneity dummy in model 2 using GARCH-adjusted market model CARs is positive which is also in line with expectations. Additionally, the adjusted R^2 increases quite substantially after adding more control variables, suggesting the models improve in explanatory power through the inclusion of the additional explanatory variables.

In conclusion, hypotheses 2, 3, 4 and 5 are rejected because OLS regressions did not produce significant results for the independent variables using CAR(-1,1). In the robustness check using CAR(-5,5), the interaction term was found to be statistically significant, however due to the size of the coefficient the term is not economically significant. Contrary to expectations, there is no significant relationship between oil prices, RISE scores and acquirer returns. Homogeneous deals also did not earn more positive acquirer returns than heterogeneous deals and oil acquirers produced a positive but insignificant relationship. This positive relationship is, however, contradictory to expectations, as hypothesis 4 states oil acquirers of clean energy assets have less positive announcement returns. Lastly, there was no significant difference between acquirers' announcement returns in Europe compared to North America.

Table 5: Regression results – CAR(-1,1)

Results for an ordinary least squares regression of the acquirers' cumulative abnormal announcement returns over a 3-day event window. The dependent variable is the acquiring firms' CAR calculated using the market model (MacKinlay, 1997) and using a GARCH-adjusted market model (Corhay & Tourani Rad, 1996) with a window of -1 and +1 days around the announcement date. The main independent variable in model 1 is an interaction term between the oil price and acquirer nation's RISE score. In model 2 the independent variable is a dummy with value 1 for homogeneous deals and 0 for heterogeneous deals. In model 3 a dummy with value 1 for oil acquirers is used and in model 4, a dummy with value 1 for European deals is incorporated. Lastly, a model using all independent variables is regressed. All models include the following control variables: acquirers' Tobin's Q, acquirers' firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets and acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation. All models control for autocorrelation and heteroscedasticity by using the two way clustered standard errors, clustered by year and company ID. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

	Dependent variable: market model CAR(-1,1)					**Dependent variable: GARCH-adjusted market model CAR(-1,1)**				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Full model*	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Full model*
Oil price * RISE score	-0.000				-0.000	-0.000				-0.000
	(0.243)				(0.226)	(0.224)				(0.182)
Homogeneity dummy		-0.013			-0.003		-0.014			-0.005
		(0.251)			(0.798)		(0.282)			(0.715)
Oil dummy			0.025*		0.010			0.025		0.005
			(0.075)		(0.408)			(0.102)		(0.675)
European dummy				-0.016	-0.025				-0.018	-0.026
				(0.224)	(0.268)				(0.166)	(0.219)
Tobin's Q	-0.004	-0.001	-0.001	-0.001	0.005	0.004	-0.002	-0.001	-0.001	-0.005
	(0.473)	(0.702)	(0.760)	(0.755)	(0.459)	(0.486)	(0.619)	(0.668)	(0.676)	(0.465)
Firm size	-0.004	-0.008**	-0.007**	-0.006**	-0.005	-0.004	-0.008**	-0.007**	-0.007**	-0.005
	(0.359)	(0.049)	(0.040)	(0.049)	(0.280)	(0.319)	(0.050)	(0.037)	(0.041)	(0.259)
Free cash flow	0.023	0.015	0.014	0.020	0.036	0.031	0.010	0.010	0.016	0.044
	(0.437)	(0.418)	(0.428)	(0.282)	(0.194)	(0.313)	(0.628)	(0.646)	(0.450)	(0.138)
Leverage	-0.004	-0.003	-0.001	-0.007	-0.007	-0.006	-0.004	-0.002	-0.008	-0.009
	(0.637)	(0.609)	(0.838)	(0.360)	(0.552)	(0.533)	(0.564)	(0.758)	(0.323)	(0.437)
c	-0.086	0.083**	0.066**	0.080**	-0.130	-0.070	0.086**	0.068**	0.084**	-0.113
	(0.246)	(0.025)	(0.027)	(0.031)	(0.174)	(0.334)	(0.028)	(0.025)	(0.027)	(0.212)
N	137	205	205	205	137	137	205	205	205	137
Adj. R-squared	0.062	0.049	0.055	0.053	0.081	0.061	0.051	0.057	0.057	0.081

8 Conclusion

In response to the strongly increasing awareness of the need for an efficient and quick energy transition, this study analyses mergers and acquisitions activity involving public and private clean energy targets. M&A activity has increased a lot in recent years, which has resulted in a small body of literature on abnormal returns. However, as these developments are fairly recent the amount of research on the topic is limited. This study therefore attempts to add to the already existing literature by both building upon it and analysing new, unexplored issues. A new database is used and a number of variables are investigated to identify drivers for abnormal returns. This thesis ultimately attempts to answer the following research question:

Do shareholders of acquirers of public and private clean energy targets earn a positive cumulative abnormal return upon announcement of the acquisition?

To analyse cumulative abnormal returns earned by acquirers of clean energy targets, a dataset was compiled of 263 deals involving an acquirer active in the power sector in Europe or North America, and a public or private target involved in the generation of clean energy, development of clean energy technology, or a natural gas asset. The latter is included as natural gas is expected to be crucial in facilitating the energy transition until renewable energy generation is advanced enough to provide a stable and sufficient supply of electricity. The 3-day cumulative abnormal returns have been calculated using a market model, as well as a market model adjusted for GARCH to accommodate for fluctuations in volatility. Cumulative abnormal returns for longer event windows have also been obtained as robustness checks to catch any delays in information processing. A number of significance tests have been used to determine the significance of the calculated CARs, and it was found that 3-day CARs are highly significant. Acquirers of clean energy targets earn, on average, a 1.7-1.8% abnormal return depending on the method of calculation, and the first hypothesis stating: *Acquirer shareholders on average earn positive announcement returns for acquisitions of clean energy assets*, is accepted.

Based on Shah, Hiles and Morley (2018) it was expected that acquirers in countries with low-support policies for renewable energy would earn less positive abnormal returns during periods of low oil prices, however, no significant relationship was found in this regard. Hypothesis 2, which states: *Announcement returns for acquirers in countries with less supportive sustainable energy policies are less positive when oil prices are low*, is therefore rejected. In line with Palmquist and Bask (2016) and Yoo, Lee and Heo (2013), differences between homogeneous and heterogeneous deals were analysed, with the expectation that homogeneous earn more positive acquirer returns, as follows from the third hypothesis: *Homogeneous acquisitions of clean energy targets have more positive acquirer returns than heterogeneous acquisitions.* This relationship too was not confirmed and the third hypothesis is therefore rejected. Based on theories of integration and historical performance of oil companies who acquired a renewable energy target (Pinkse & Van den Buuse, 2012), hypothesis 4 was formulated as follows: *Oil acquirers of clean energy assets have less positive announcement returns*. No supportive evidence for this was found, however, and this hypothesis is also rejected. Lastly, the difference between returns earned by European acquirers and North American acquirers was analysed. Issues of climate change and sustainability, and the energy transition in particular, are topics that get a lot more attention in Europe. Especially when comparing the political climate and political policies in place to incentivise businesses to invest in more sustainable solutions, it is clear that the circumstances for the successful development and roll-out of the energy transition are a lot more favourable in Europe. It would therefore be expected that acquirer returns for acquisitions of clean energy targets are more positive in Europe than in North America, resulting in hypothesis 5: *Announcement returns of clean energy acquisitions are more positive in Europe than in North America.* No evidence for this was found and the hypothesis is rejected.

8.1 Limitations and recommendations for further research

There are a number of limitations that can be attributed to this study. Most of these limitations originate in the dataset used, as due to the relatively immature nature of the renewable energy sector, the data available is limited. This translates into both the size of the database, as well as the availability of information necessary to compute all variables and the characteristics of the targets in the database used. The dataset in this thesis has been set up in such a way to ensure maximum number of observations (for example by not using a minimum size requirement for targets or acquirers), however, this has resulted in incomplete information for a number of control variables. Because of this some variables have been included as a robustness check only. Other control variables that are found in standard M&A literature, especially those concerning target information, have not been included due to the lack of information. It should be noted, however, that a control variable concerning the nature of the acquisition (e.g. friendly, hostile) was left out because only 3 deals were classified as hostile in the dataset. Inclusion of pending deals and announcements of acquisitions of less than 100% of the shares (but more than 50%), could negatively impact the robustness of the analyses, as the market might react differently to such announcements. Additionally, some of the targets in the dataset involved small clean energy generation assets such as wind parks or solar parks as no minimum size requirements were used for neither targets nor acquirers. It can be argued these assets are too small to have any significant effect on the performance of acquirers. The fact that nearly all targets are private might also have impacted the results due to the illiquidity discount often found for acquisitions of private targets.

The potentially missing control variables can cause an endogeneity problem. An endogeneity problem might also be the root cause for the lack of significance found in the explanatory variables used in this thesis. There are potentially other explanatory variables that are the driving factors for the cumulative abnormal return that have been found. For example, explanatory variables linked to the technology nature of renewable energy firms that was identified in a number of studies might be lacking.

Causes for concern can be found in the way some data “problems” were treated. Control variables for example, were winsorised at the 5% level to accommodate for some (very) extreme outliers. Although winsorising is a fairly standard and common way to deal with outliers, it could still have influenced the results of the study, especially considering winsorising at the 5% level is quite a rigorous measure. Furthermore, the fact that announcements for multiple acquisitions on the same day by the same acquirer were merged means the multiplying factor for these serial acquisition announcements might have been lost.

The inclusion of natural gas fired generation targets in the dataset can also be considered a flaw. Although it can be argued these assets are crucial in the transition from fossil fuel-fired energy generation to renewable energy, an analysis without these target gives a cleaner view on the value creation through clean energy acquisitions. This is something that will need to be investigated in a later stage of the energy transition, when more data on clean energy targets becomes available.

Although cumulative abnormal returns were identified and found to be significant, this study was unable to determine the driving forces behind these returns. This is likely a result of the mentioned limited amount of data, which was also a limiting factor in earlier studies. As we are just at the beginning of the transition of the power sector, the future will likely bring further increases in deal activity in the sector. As a first suggestion for further research, it can therefore be advised to repeat this study a few years from now, when more data is available. With a larger amount of data it is interesting to zoom in further to identify differences between the several different methods of renewable energy generation (e.g. wind, solar, hydro, etc.). With the current data this is difficult because the number of pure-pay wind, solar or hydro targets is limited. In-depth case studies of the successes and failures of oil and gas companies and utilities trying to integrate renewable power generation in their business model could shed light on crucial factors involved in the process. Shifting the focus from power sector acquirers to financial sponsor activity in the renewable energy sector can help to identify how renewable energy companies’ business models can be turned into a robust revenue generator. Financial sponsors have been showing increasing amounts of interest in the renewable energy sector and are starting to get more and more involved. This also means they are competing with the power sector players that were investigated in this thesis.

With the availability of more data also comes the possibility to include more variables. For example, the impact of CSR scores on the level of abnormal returns and the effect of the discrepancy between investment timing and revenue generation could be investigated. An area that requires more attention is also the long-term performance of acquirers post-acquisition. It has already been acknowledged that oil companies have had difficulties in the past to integrate renewable energy generating assets into their business models due to large discrepancies. As more data becomes available, this would be useful to analyse, foremost to identify where the opportunities lie for effective and efficient wide-spread roll-out of renewable energy. This study has linked the renewable energy sector to oil prices based on Shah, Hiles and Morley (2018), however, there is also a body of literature that has found the renewable energy sector to be closely linked to the technology sector. This might provide a fresh angle for further research. Other factors that can provide insights are the effect of electricity prices (or predicitions thereof) and whether acquirer nations are net oil importers or exporters. Lastly, a different way of computing control variables such as Tobin's Q might provide more robust results. In this study, the decision was made to use a fairly simple method for calculating Tobin's Q, as this offered the most available data. It can be argued, however, that the method put forward by Chung and Pruitt (1994) is more accurate and therefore preferred.

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APPENDIX A - Descriptive statistics

Table 6: Geographical distribution

Overview of the geographical distribution of the acquirers in the dataset with equity indices used per country to compute abnormal returns.

Acquirer nation	Number of deals	Equity index
Europe	**154**	
Austria	3	Austrian Traded Index
Belgium	6	BEL 20
Denmark	8	OMX Copenhagen 20
Finland	3	OMX Helsinki 25
France	23	CAC 40
Germany	22	DAX 30
Greece	1	FTSE/Athens Large Cap (Athex 20)
Ireland	6	Irish Stock Exchange Overall Index
Italy	25	FTSE Milano Italia Borsa
Luxembourg	2	Luxembourg Stock Exchange LuxX Index
Norway	2	OSLO SE OBX
Poland	3	Warsaw General Index 20
Portugal	1	PSI20
Romania	1	BET-10
Spain	21	IBEX 35
Sweden	4	OMX Stockholm PI
Switzerland	7	Swiss Market Index (SMI)
United Kingdom	16	FTSE 100 Index
North America	**109**	
Canada	50	Canada S&P/TSX 60
United States	59	S&P 500
Total	263	

Table 7: Temporal distribution

Overview of the temporal distribution of all deals in the dataset including a percentage split over the years and as well as the temporal distribution for subsamples of European and North American deals.

	All deals		**European deals**		**North American deals**	
Year	Number of deals	Percentage	Number of deals	Percentage	Number of deals	Percentage
2018	17	6.46%	15	9.74%	2	1.83%
2017	13	4.94%	9	5.84%	4	3.67%
2016	20	7.60%	18	11.69%	2	1.83%
2015	26	9.89%	14	9.09%	12	11.01%
2014	26	9.89%	10	6.49%	16	14.68%
2013	18	6.84%	8	5.19%	10	9.17%
2012	13	4.94%	8	5.19%	5	4.59%
2011	23	8.75%	13	8.44%	10	9.17%
2010	15	5.70%	9	5.84%	6	5.50%
2009	13	4.94%	7	4.55%	6	5.50%
2008	18	6.84%	14	9.09%	4	3.67%
2007	19	7.22%	11	7.14%	8	7.34%
2006	10	3.80%	6	3.90%	4	3.67%
2005	4	1.52%	3	1.95%	1	0.92%
2004	2	0.76%	1	0.65%	1	0.92%
2003	1	0.38%	1	0.65%	0	0.00%
2002	1	0.38%	1	0.65%	0	0.00%
2001	7	2.66%	1	0.65%	6	5.50%
2000	6	2.28%	3	1.95%	3	2.75%
1999	4	1.52%	1	0.65%	3	2.75%
1998	3	1.14%	0	0.00%	3	2.75%
1997	2	0.76%	1	0.00%	1	0.92%
1996	1	0.38%	0	0.00%	1	0.92%
1995	0	0.00%	0	0.00%	0	0.00%
1994	0	0.00%	0	0.00%	0	0.00%
1993	0	0.00%	0	0.00%	0	0.00%
1992	0	0.00%	0	0.00%	0	0.00%
1991	1	0.38%	0	0.00%	1	0.92%
1990	0	0.00%	0	0.00%	0	0.00%

Figure 1:
Graphical overview of the temporal distribution

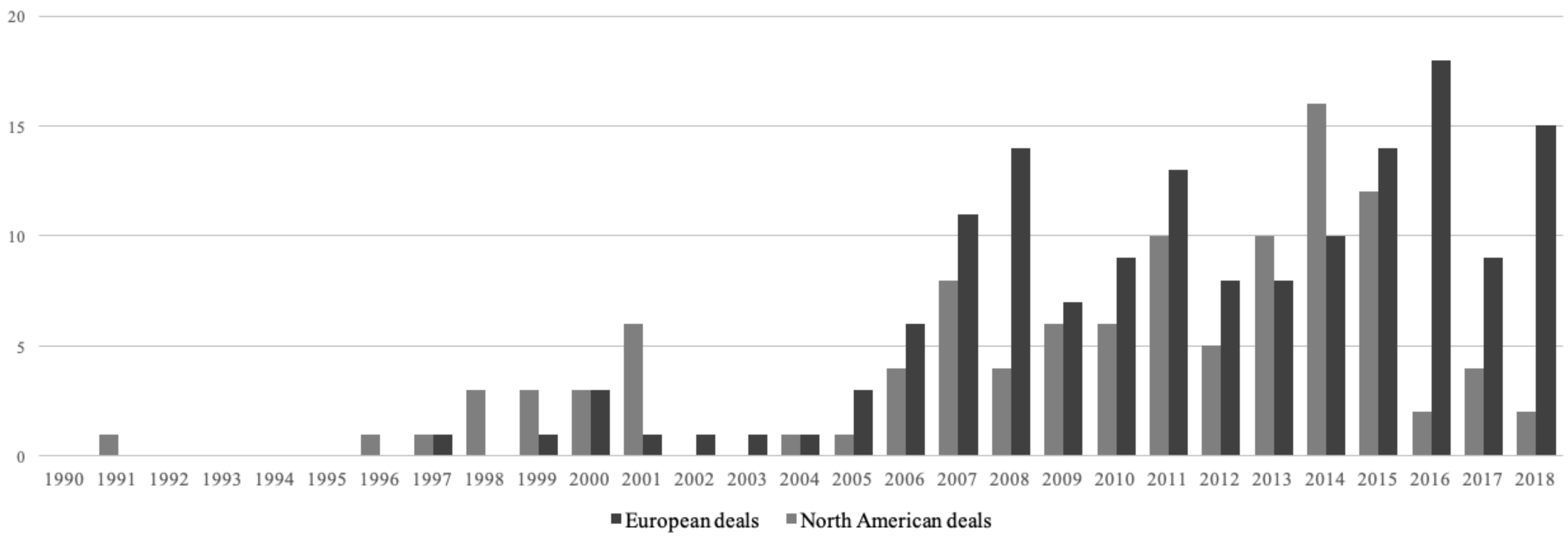


Figure 2:
Market model abnormal returns over an 11-day event window for all deals

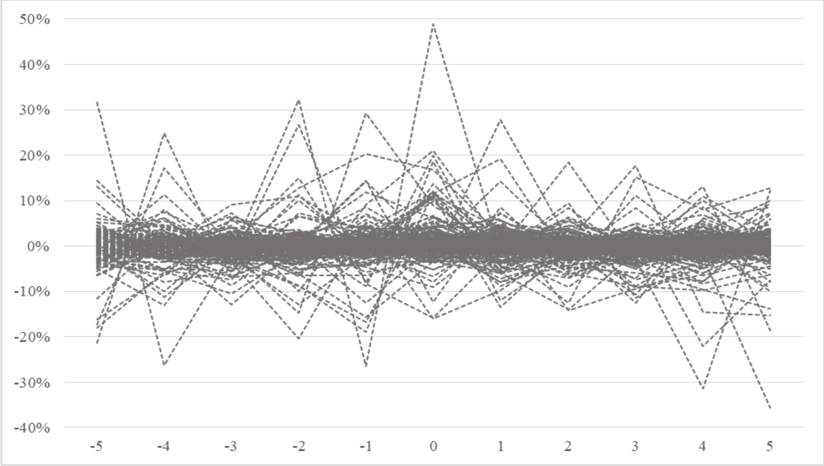


Figure 3:
Market model abnormal returns over an 11-day event window for heterogeneous deals

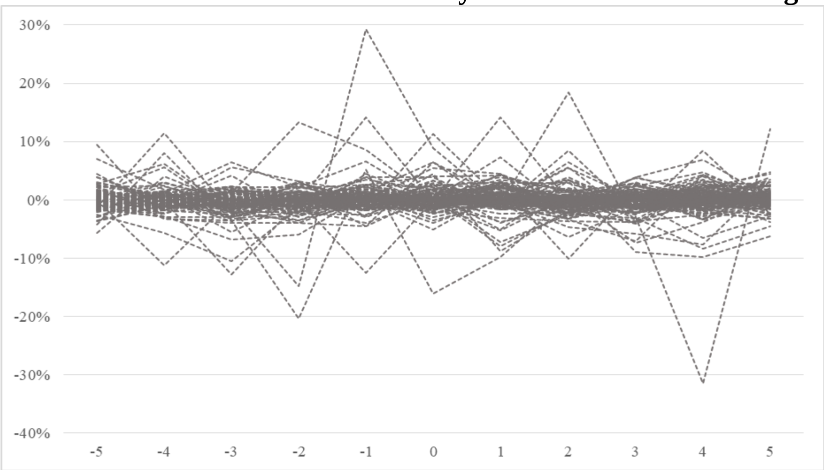
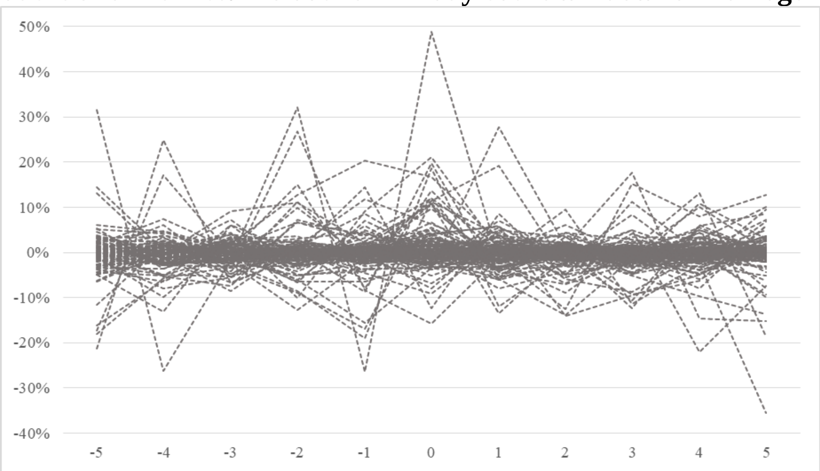


Figure 4:
Market model abnormal returns over an 11-day event window for homogeneous deals



APPENDIX B - Results

Table 8: Correlation matrix

Pearson's correlation matrix showing correlations between the acquirers' market model ("MM") and GARCH-adjusted market model ("GMM") 3-day cumulative abnormal returns and all other variables. Oil price is the WTI daily spot price (North American deals) or the Brent North Sea Crude daily spot price (European deals) in US Dollars, RISE score denotes the acquirers' nation World Bank Regulatory Indicators for Sustainable Energy score, the heterogeneity dummy has value 1 for homogeneous deals and 0 for heterogeneous deals, the oil dummy has value 1 for oil acquirers, the European dummy has value 1 for European acquirers, Tobin's Q is calculated by dividing acquirer market capitalisation by the book value of its assets, firm size is calculated as the natural logarithm of acquirers' total assets, free cash flow is acquirers' free cash flow as a percentage of lagged total assets, leverage is acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation, the cash dummy has value 1 for deals with all cash payments, and deal value is the natural logarithm of the deal value. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. CAR(-1,1) MM	1.000												
2. CAR(-1,1) GMM	0.984***	1.000											
	(0.000)												
3. Oil price	-0.069	-0.062	1.000										
	(0.265)	(0.318)											
4. RISE score	0.078	0.072	-0.402***	1.000									
	(0.311)	(0.351)	(0.000)										
5. Homogeneity dummy	-0.001	0.010	0.190***	0.165**	1.000								
	(0.984)	(0.876)	(0.002)	(0.032)									
6. Oil dummy	0.113**	0.129**	-0.005	-0.017	-0.325***	1.000							
	(0.031)	(0.037)	(0.954)	(0.830)	(0.000)								
7. European dummy	-0.074	-0.092	0.074	0.301***	0.055	-0.067	1.000						
	(0.232)	(0.138)	(0.235)	(0.000)	(0.378)	(0.280)							
8. Tobin's Q	0.048	0.085	0.034	0.085	0.207***	-0.065	0.025	1.000					
	(0.460)	(0.191)	(0.602)	(0.291)	(0.001)	(0.322)	(0.706)						
9. Firm size	-0.236***	-0.256***	-0.010	-0.244***	-0.483***	0.157**	0.017	-0.350***	1.000				
	(0.000)	(0.000)	(0.877)	(0.002)	(0.000)	(0.016)	(0.793)	(0.000)					
10. Free cash flow	-0.004	-0.025	-0.040	0.136*	-0.187***	0.028	0.106	-0.261***	0.383***	1.000			
	(0.951)	(0.708)	(0.545)	(0.091)	(0.004)	(0.676)	(0.107)	(0.000)	(0.000)				
11. Leverage	-0.032	-0.042	-0.108*	0.042	-0.0411	-0.157**	-0.070	-0.397***	0.264***	0.229***	1.000		
	(0.614)	(0.509)	(0.090)	(0.593)	(0.518)	(0.013)	(0.270)	(0.000)	(0.000)	(0.001)			
12. Cash dummy	0.018	-0.003	-0.187***	0.180**	0.077	-0.004	-0.037	-0.041	-0.047	0.054	-0.032	1.000	
	(0.801)	(0.964)	(0.009)	(0.037)	(0.285)	(0.951)	(0.611)	(0.599)	(0.538)	(0.480)	(0.670)		
13. Deal value	-0.188**	-0.185**	-0.047	-0.315***	-0.311***	-0.043	-0.077	-0.384***	0.635***	0.194**	0.175*	0.336***	1.000
	(0.036)	(0.040)	(0.602)	(0.007)	(0.000)	(0.635)	(0.397)	(0.000)	(0.000)	(0.041)	(0.055)	(0.008)	

Table 9: Robustness check – CAR(-2,2)

Results for an ordinary least squares regression of the acquirers' cumulative abnormal announcement returns over a 5-day event window. The dependent variable is the acquiring firms' CAR calculated using the market model (MacKinlay, 1997) and using a GARCH-adjusted market model (Corhay & Tourani Rad, 1996) with a window of -2 and +2 days around the announcement date. The main independent variable in model 1 is an interaction term between the oil price and acquirer nation's RISE score. In model 2 the independent variable is a dummy with value 1 for homogeneous deals and 0 for heterogeneous deals. In model 3 a dummy with value 1 for oil acquirers is used and in model 4, a dummy with value 1 for European deals is incorporated. Lastly, a model using all independent variables is regressed. All models include the following control variables: acquirers' Tobin's Q, acquirers' firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets and acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation. All models control for autocorrelation and heteroscedasticity by using the two way clustered standard errors, clustered by year and company ID. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

	Dependent variable: market model CAR(-2,2)					**Dependent variable: GARCH-adjusted market model CAR(-2,2)**				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Full model*	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Full model*
Oil price * RISE score	-0.000				-0.000	-0.000				-0.000
	(0.430)				(0.284)	(0.403)				(0.260)
Homogeneity dummy		-0.015			-0.003		-0.012			-0.002
		(0.336)			(0.872)		(0.468)			(0.907)
Oil dummy			0.026		0.016			0.025		0.008
			(0.118)		(0.253)			(0.169)		(0.549)
European dummy				-0.014	-0.028				-0.013	-0.029
				(0.310)	(0.228)				(0.337)	(0.176)
Tobin's Q	0.007	0.001	0.001	0.001	0.007	0.007	0.001	-0.001	-0.001	0.001
	(0.329)	(0.733)	(0.675)	(0.721)	(0.321)	(0.334)	(0.878)	(0.813)	(0.854)	(0.323)
Firm size	-0.001	-0.006	-0.005	-0.005	-0.003	-0.001	-0.006	-0.005	-0.005	-0.002
	(0.812)	(0.162)	(0.145)	(0.172)	(0.621)	(0.773)	(0.201)	(0.152)	(0.171)	(0.655)
Free cash flow	0.008	0.020	0.020	0.025	0.023	0.022	0.012	0.012	0.017	0.037
	(0.864)	(0.454)	(0.459)	(0.356)	(0.617)	(0.667)	(0.686)	(0.700)	(0.586)	(0.461)
Leverage	-0.003	-0.001	0.001	-0.004	-0.005	-0.004	-0.002	-0.000	-0.005	-0.007
	(0.822)	(0.877)	(0.933)	(0.642)	(0.732)	(0.736)	(0.826)	(0.991)	(0.631)	(0.616)
c	-0.139	0.064	0.046	0.059	-0.190*	-0.117	0.062	0.046	0.058	-0.169*
	(0.116)	(0.119)	(0.148)	(0.142)	(0.077)	(0.180)	(0.160)	(0.141)	(0.146)	(0.100)
N	137	205	205	205	137	137	205	205	205	137
Adj. R-squared	0.057	0.025	0.030	0.026	0.077	0.052	0.023	0.028	0.025	0.070

Table 10: Robustness check – CAR(-5,5)

Results for an ordinary least squares regression of the acquirers' cumulative abnormal announcement returns over a 11-day event window. The dependent variable is the acquiring firms' CAR calculated using the market model (MacKinlay, 1997) and using a GARCH-adjusted market model (Corhay & Tourani Rad, 1996) with a window of -5 and +5 days around the announcement date. The main independent variable in model 1 is an interaction term between the oil price and acquirer nation's RISE score. In model 2 the independent variable is a dummy with value 1 for homogeneous deals and 0 for heterogeneous deals. In model 3 a dummy with value 1 for oil acquirers is used and in model 4, a dummy with value 1 for European deals is incorporated. Lastly, a model using all independent variables is regressed. All models include the following control variables: acquirers' Tobin's Q, acquirers' firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets and acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation. All models control for autocorrelation and heteroscedasticity by using the two way clustered standard errors, clustered by year and company ID. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

	Dependent variable: market model CAR(-5,5)					**Dependent variable: GARCH-adjusted market model CAR(-5,5)**				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Full model*	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Full model*
Oil price * RISE score	-0.000*				-0.000**	-0.000				-0.000*
	(0.059)				(0.050)	(0.120)				(0.089)
Homogeneity dummy		-0.007			-0.005		-0.005			-0.008
		(0.643)			(0.806)		(0.786)			(0.706)
Oil dummy			0.015		0.024			0.013		0.008
			(0.384)		(0.246)			(0.461)		(0.721)
European dummy				0.009	-0.015				0.012	-0.015
				(0.492)	(0.246)				(0.384)	(0.380)
Tobin's Q	0.000	-0.001	-0.001	-0.002	0.000	0.001	-0.003	-0.002	-0.003	0.001
	(0.957)	(0.628)	(0.663)	(0.573)	(0.969)	(0.898)	(0.385)	(0.400)	(0.346)	(0.879)
Firm size	-0.001	-0.003	-0.003	-0.003	-0.003	-0.001	-0.004	-0.004	-0.003	-0.003
	(0.842)	(0.358)	(0.325)	(0.378)	(0.599)	(0.739)	(0.347)	(0.251)	(0.286)	(0.608)
Free cash flow	0.006	0.005	0.004	0.002	0.014	0.037	-0.004	-0.004	-0.007	0.044
	(0.928)	(0.896)	(0.907)	(0.957)	(0.806)	(0.526)	(0.930)	(0.922)	(0.857)	(0.441)
Leverage	-0.001	-0.003	-0.001	-0.002	-0.001	-0.002	-0.003	-0.002	-0.002	-0.003
	(0.927)	(0.777)	(0.882)	(0.855)	(0.956)	(0.897)	(0.775)	(0.854)	(0.881)	(0.855)
c	-0.233**	0.039	0.030	0.024	-0.258**	-0.164	0.041	0.034	0.026	-0.183
	(0.017)	(0.278)	(0.281)	(0.482)	(0.019)	(0.128)	(0.315)	(0.232)	(0.458)	(0.104)
N	137	205	205	205	137	137	205	205	205	137
Adj. R-squared	0.042	0.008	0.010	0.009	0.057	0.029	0.011	0.012	0.014	0.037

Table 11: Robustness check – CAR(-1,1) with additional control variables

Results for an ordinary least squares regression of the acquirers' cumulative abnormal announcement returns over a 3-day event window incorporating additional control variables. The dependent variable is the acquiring firms' CAR calculated using the market model (MacKinlay, 1997) and using a GARCH-adjusted market model (Corhay & Tourani Rad, 1996) with a window of -1 and +1 days around the announcement date. The main independent variable in model 1 is an interaction term between the oil price and acquirer nation's RISE score. In model 2 the independent variable is a dummy with value 1 for homogeneous deals and 0 for heterogeneous deals. In model 3 a dummy with value 1 for oil acquirers is used and in model 4, a dummy with value 1 for European deals is incorporated. Lastly, a model using all independent variables is regressed. All models include the following control variables: acquirers' Tobin's Q, acquirers' firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets, acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation, a dummy with value 1 for deals with all cash payments and deal value calculated as the natural logarithm of the deal value. All models control for autocorrelation and heteroscedasticity by using the two way clustered standard errors, clustered by year and company ID. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

	Dependent variable: market mode CAR(-1,1)					**Dependent variable: GARCH-adjusted market model CAR(-1,1)**				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Full model*	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Full model*
Oil price * RISE score	-0.000				-0.000	-0.000				-0.000
	(0.695)				(0.462)	(0.703)				(0.477)
Homogeneity dummy		0.011			0.019		0.020			0.022
		(0.789)			(0.763)		(0.666)			(0.721)
Oil dummy			0.002		-0.064			0.004		-0.073
			(0.968)		(0.390)			(0.946)		(0.331)
European dummy				-0.069	-0.159				-0.069	-0.162
				(0.221)	(0.174)				(0.231)	(0.167)
Tobin's Q	0.001	-0.002	-0.001	0.001	0.000	0.002	-0.002	-0.001	0.001	0.001
	(0.873)	(0.797)	(0.811)	(0.919)	(0.962)	(0.820)	(0.752)	(0.796)	(0.943)	(0.889)
Firm size	-0.023	-0.019	-0.020	-0.020	-0.023	-0.022	-0.020	-0.021	-0.021	-0.022
	(0.314)	(0.181)	(0.183)	(0.160)	(0.213)	(0.345)	(0.192)	(0.180)	(0.158)	(0.250)
Free cash flow	-0.131	-0.139	-0.128	-0.086	0.017	-0.129	-0.170	-0.149	-0.108	0.018
	(0.401)	(0.301)	(0.293)	(0.408)	(0.914)	(0.417)	(0.258)	(0.268)	(0.364)	(0.909)
Leverage	-0.010	0.009	0.010	0.004	-0.047	-0.013	0.006	0.008	0.002	-0.051
	(0.811)	(0.659)	(0.615)	(0.802)	(0.401)	(0.762)	(0.783)	(0.706)	(0.909)	(0.371)
Cash dummy	0.061	0.039	0.037	0.047	0.066	0.059	0.033	0.031	0.040	0.068
	(0.228)	(0.607)	(0.603)	(0.521)	(0.174)	(0.240)	(0.666)	(0.676)	(0.586)	(0.155)
Deal value	0.005	-0.007	-0.006	-0.015	-0.014	0.005	-0.002	-0.001	-0.008	-0.015
	(0.696)	(0.448)	(0.523)	(0.282)	(0.386)	(0.695)	(0.846)	(0.898)	(0.543)	(0.365)
c	-0.136	0.121	0.132*	0.190*	-0.290	-0.135	0.106	0.126	0.185*	-0.295
	(0.715)	(0.142)	(0.098)	(0.061)	(0.536)	(0.715)	(0.273)	(0.133)	(0.090)	(0.530)
N	37	51	51	51	37	37	51	51	51	37
Adj. R-squared	0.281	0.221	0.220	0.276	0.459	0.266	0.213	0.210	0.262	0.453

Table 12: Robustness check – CAR(-1,1) with year-fixed effects

Results for an ordinary least squares regression of the acquirers' cumulative abnormal announcement returns over a 3-day event window incorporating additional control variables and year-fixed effects. The dependent variable is the acquiring firms' CAR calculated using the market model (MacKinlay, 1997) and using a GARCH-adjusted market model (Corhay & Tourani Rad, 1996) with a window of -1 and +1 days around the announcement date. The main independent variable in model 1 is an interaction term between the oil price and acquirer nation's RISE score. In model 2 the independent variable is a dummy with value 1 for homogeneous deals and 0 for heterogeneous deals. In model 3 a dummy with value 1 for oil acquirers is used and in model 4, a dummy with value 1 for European deals is incorporated. Lastly, a model using all independent variables is regressed. All models include the following control variables: acquirers' Tobin's Q, acquirers' firm size calculated as the natural logarithm of acquirers' total assets, acquirers' free cash flow as a percentage of lagged total assets, acquirers' total leverage (short-term and long-term debt) as a percentage of market capitalisation, a dummy with value 1 for deals with all cash payments, deal value calculated as the natural logarithm of the deal value and year-fixed effects. All models control for autocorrelation and heteroscedasticity by using the two way clustered standard errors, clustered by year and company ID. The *p*-values are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively.

	Dependent variable: market model CAR(-1,1)					**Dependent variable: GARCH-adjusted market model CAR(-1,1)**				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Full model*	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Full model*
Oil price * RISE score	-0.000				-0.000	-0.000				-0.000
	(0.984)				(0.412)	(0.976)				(0.399)
Homogeneity dummy		-0.005			0.037		0.005			0.045
		(0.882)			(0.677)		(0.879)			(0.609)
Oil dummy			0.044		-0.055			0.050		-0.067
			(0.220)		(0.651)			(0.205)		(0.584)
European dummy				-0.115	-0.167				-0.114	-0.172
				(0.206)	(0.198)				(0.218)	(0.186)
Tobin's Q	-0.012	-0.012	-0.012	-0.013	-0.012	-0.012	-0.012	-0.012	-0.014	-0.011
	(0.467)	(0.417)	(0.423)	(0.317)	(0.446)	(0.475)	(0.405)	(0.394)	(0.293)	(0.476)
Firm size	-0.024	-0.019	-0.020	-0.019	-0.023	-0.023	-0.018	-0.019	-0.019	-0.021
	(0.407)	(0.389)	(0.380)	(0.289)	(0.357)	(0.436)	(0.431)	(0.394)	(0.313)	(0.400)
Free cash flow	-0.066	-0.080	-0.076	0.003	0.184	-0.068	-0.082	-0.063	0.013	0.184
	(0.760)	(0.452)	(0.397)	(0.976)	(0.506)	(0.757)	(0.440)	(0.484)	(0.904)	(0.504)
Leverage	-0.058	-0.027	-0.027	-0.048	-0.089	-0.064	-0.033	-0.035	-0.055	-0.095
	(0.760)	(0.556)	(0.547)	(0.363)	(0.261)	(0.363)	(0.479)	(0.453)	(0.305)	(0.230)
Cash dummy	0.080	0.047	0.041	0.021	0.087	0.079	0.048	0.037	0.019	0.094
	(0.182)	(0.370)	(0.386)	(0.635)	(0.381)	(0.192)	(0.351)	(0.426)	(0.658)	(0.347)
Deal value	-0.004	-0.003	-0.002	-0.017	-0.025	-0.003	-0.001	-0.000	-0.015	-0.024
	(0.858)	(0.873)	(0.913)	(0.408)	(0.440)	(0.903)	(0.938)	(0.978)	(0.475)	(0.474)
c	0.444	0.391***	0.349***	0.438***	-0.195	0.386	0.426***	0.384***	0.478***	-0.278
	(0.468)	(0.000)	(0.000)	(0.000)	(0.823)	(0.528)	(0.000)	(0.000)	(0.000)	(0.750)
N	37	51	51	51	37	37	51	51	51	37
Adj. R-squared	0.426	0.487	0.492	0.587	0.580	0.417	0.520	0.526	0.608	0.580