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Decarbonizing the boardroom? Aligning Electric Utility Executive Compensation with Climate Change Incentives.

Abstract

Despite the drastic reversal of decarbonization effort by the Trump administration, the majority of U.S. states continue policies aimed at reducing greenhouse gas (GHG) emissions and increasing renewable energy technology (RET) deployment. Although electrical power utilities are required and/or encouraged to comply with these policies, their executives lack direct incentives to do so. In this study, a novel incentive mechanism is evaluated for aligning utility executive compensation with such policies. First, an overview is provided on chief executive officer (CEO) pay and the GHG emissions. The relationship between GHG emissions, renewable energy diversification, and CEO pay is examined using the case study of three of the largest electric utilities in Michigan. The results show that the regulated utility market is not consistently rewarding CEOs with higher compensation for decreasing GHG emissions and that both an approach incentivizing RETs adoption and an approach encouraging GHG emissions have deficiencies. A combined approach is then analyzed that results in a compensation equation allowing for utility executives to receive incentive pay for reducing overall emissions and increasing renewable generation. The results indicate that by careful calibration of the proposed incentive equations the harmful effects of emissions can be prevented through CEO incentive pay.

Keywords: CEO Compensation; Electric Utility; Emissions; Executive Compensation;

1. Introduction

The infancy of the current U.S. Presidential administration has been marked by stark reversal of several federal decarbonization initiatives (Kormann, 2017; The White House, 2017). However, as energy policy expert Kathryn Hamilton observed, the Trump administration's actions "can't change the facts of climate change. It is happening whether or not they say it's happening." (GTM Squared, 2017). Both greenhouse gas (GHG) emissions (Pizer, 2002; Garnett, 2009; Tilman, et al., 2011) and carbon dioxide (CO₂) levels are increasing rapidly on a global scale (Boden, et al., 1994; Riebesell, et al., 2000; Peters & Hertwich, 2008). This has led to climate change with significant, well established negative effects on natural and socio-economic systems (Stern, 2006; Moss, et al., 2010). These negative effects¹ are due to human activity, primarily through the combustion of fossil fuels, which have been increasing global temperatures from 1951 through 2010, and have been proven with a confidence of 95% (IPCC, 2013; UN, 2014).

The United States Environmental Protection Agency (EPA) has determined that electric utilities are the main source of GHG and CO₂ emissions in the United States (Soytas, et al., 2007; EPA, 2016). In the U.S., electricity generation accounts for 31% of GHG emissions; globally, it accounts for 25% of emissions (EPA, 2016). Numerous studies indicate that these GHG emissions may be a source of economic liability for electric utilities, which has the potential to significantly impact their financial viability and returns for shareholders (Allen, 2003; Kunreuther & Michel-Kerjan, 2007; Faure, & Nollkaemper, 2007; Heidari & Pearce, 2016). Addressing this issue through reductions of emissions and increases in renewable energy technologies (RET) will help reduce the issue of climate change directly (Tsoutsos, et al., 2008) and limit the potential liability for utilities (Heidari & Pearce, 2016).

The radical departure of the current presidential administration from past environmentally-centric federal energy policies is unlikely to reverse the global trend of decarbonization in the electrical power sector and therefore absolve GHG emitters of the aforementioned liability. Due to significant gains in efficiency and cost competitiveness, RETs are gaining grid parity (achieving similar or lower prices than conventional generation) throughout the United States (U.S. EIA, 2017). For example, 2016 saw solar photovoltaic (PV) system costs drop by 20%, which contributed to solar technology becoming the leading source of new electric power generating capacity in the United States (Obama, 2017; GTM, 2016). Another reason for the irreversible momentum is state policies aimed at combating climate change. Renewable Portfolio Standards (RPS) that require utilities to supply a set percentage of electricity from renewable sources have been an important policy tool of the decarbonization effort by individual states (National Conference of State Legislators, 2016). Currently 29 states, Washington,

¹ These effects include: higher temperatures with heat waves resulting in death by hyperthermia (Dhainaut, et al., 2004; Poumadre, 2005; Fouillet, et al., 2006), crop failure and global hunger (Parry, et al., 2004; Parry, et al., 2005; Schmidhuber & Tubiello, 2007; D'Amato & Cecchi, 2008; Gislason & Gorsky, 2010), power outages (Klinenberg, 2008; Vine, 2012), sea level rise (Moorhead & Brinson, 1995; Frihy, 2003), erosion (Moorhead & Brinson, 1995; Frihy, 2003), higher risk of flooding and saltwater intrusion (Nicholls, et al., 1999; Bobba, 2002; Frihy, 2003), strong, damaging storms (Dale, et al., 2001; Desantis, et al., 2007; Allen, et al., 2010; Carnicer, et al., 2011), drought (Dai, 2016), and fire (Amiro, et al., 2001; Dale, et al., 2001; Flannigan, et al., 2009).

D.C., and three territories have adopted an RPS (National Conference of State Legislators, 2016). The reversal of the federal decarbonization policies is yet to have a significant effect on states' renewable energy policies, including RPSs. Moreover, several states are in the process or have raised their RPS goals since November 8, 2016. Among these states is Michigan that elevated its RPS goals from 10% in 2015 to 15% by 2021 (Act. No. 342, 2016; MPSC, 2017). In addition, the implementing legislation, titled the "Clean, Renewable and Efficient Energy Act" (Act 342) set an ambitious albeit non-binding goal of not less than 35% of the "state's electric needs to be met through a combination of energy waste reduction and renewable energy by 2025".

In Michigan, Act 342 creates a path for electric utilities towards renewable low-carbon energy sources and away from fossil fuels. Whether Michigan electric utilities will succeed at adopting this path will in large part depend on the efforts of their top executives--directors and officers--including chief executive officers (CEOs). Traditionally, CEO compensation has included a fair number of performance incentives. Yet rarely have these incentives emanated from public environmental goals (Jin, 2002). Generally, companies that are subject to government rate setting, such as electric utilities, have lower CEO pay (Palia, 2000). Restricting the scope of a CEO incentives package can have unintended negative consequences (Dittmann, et al., 2011). Because CEOs are driven largely by personal financial gain, they are likely to focus on maximizing sales (Boyes & Schlagenhauf, 1979; Hirschey & Pappas, 1981; Tosi, et al., 2000). Therefore, in a U.S. state where utility profits are not meaningfully decoupled from volumetric sales of energy, a utility CEO is likely prioritize increasing such volumetric sales of energy the vast majority of which comes from fossil fuel-powered generation sources (IEA, 2015). In the case of Michigan, this effectively creates a conflict between the binding and non-binding goals set by the state for electric utilities and the personal goals pursued by their CEOs.

Appropriate executive incentives designed to encourage transitioning to a lower carbon energy mix are likely to play a significant role in diverting electric utilities from the current fossil-fuel path. In this study, we propose a novel mechanism that aligns electric utility executive compensation with the state regulatory decarbonization requirements akin to those of Act 342, as well as global climate change mitigation goals. First, we provide a rationale for the proposed mechanism. In particular, we outline the environmental and socio-economic benefits of incorporating renewable energy into an electric utility's generation mix and employ the agency conflict and path dependence theories to lay out our theoretical foundation. Second, we provide an overview of our case study and then outline and analyze the aforementioned mechanism using RET and GHG emissions goals for determining CEO pay in order to see if current compensation is in line with RPS requirements and global climate change mitigation goals. We conclude with observations on the potential effectiveness of these novel compensation systems.

2. Background and Conceptual Framework

2.1. Comprehensive Benefits of Renewable Energy Technologies

Historically, environmental benefits, including climate change mitigation, have served as primary

reasons for RETs adoption (El-Fadel, et al., 2003; Sims, 2004; Granovskii, et al., 2007; Longo, et al., 2008; Tsoutsos, et al., 2008). RETs environmental benefits extend well beyond climate change mitigation and include improving public health (Rabl & Spadaro, 2000; Martinot & Chaurey, 2002; Haines, et al., 2006; Prehoda & Pearce, 2017) and overall environmental sustainability (Demirbas, 2005; Kishore, et al., 2006; Babypriya, et al., 2009, US EPA Renewable, 2016). Accordingly, Davis, et al. (2010) estimates that 30 TW of renewable generation will be needed by 2050 to curtail all GHG emissions in the electric power sector. Thus, the generation from these technologies is predicted to increase heavily in the near and long-term future (Davis, et al., 2010; Nehrir, et al., 2011; Aslani & Wong, 2014).²

Until recently, the economic case for RETs had been built on less direct grounds, such as mitigation of substantial long-term costs on society (Stern, 2006; Mendelsohn, 2007). Yet the drop in the cost of RET generation in the last decade has moved the technologies into competitive economic range of fossil fuels in many regions (Branker, et al., 2011; RFE, 2016; IRENA, 2016; Sandu, et al., 2010). As noted above, solar PV as one of the most technologically promising technologies (Pearce, 2002), has also demonstrated great economic promise due to rapid cost decline along with rapid expansion (Obama, 2017; GTM, 2016; Movellan, 2016). Other commercialized RETs have shown similar promise (Branker, et al., 2011; RFE, 2016; Sandu, et al., 2010). The U.S. Energy Information Administration (EIA), lists pre-tax credit levelized cost of electricity (LCOE) for new geothermal generation entering service in 2022 at 46.5 \$/MWh (EIA, 2017). In comparison, the EIA (2017) lists the costs of natural gas-fired conventional combined cycle at 57.3 \$/MWh, natural gas-fired advanced combined cycle at 56.5 \$/MWh, and advanced nuclear at 99.1 \$/MWh. Remarkably, EIA's 2017 outlook does not contain any data on coal-fired power plants without carbon capture and sequestration (CSS), indicating that the agency does not see any of them entering service by 2022. The LCOE numbers on coal-fired generation with CSS are not promising either as they are roughly triple those of geothermal (EIA, 2017).

The environmental and societal case, including higher than fossil fuel jobs per-unit of energy ratio (Martinot & Chaurey, 2002; Geller, et al., 2004; Haines, et al., 2009; Wei, et al., 2010), has been strengthened by the business case for RETs. RETs are becoming less expensive whereas fossil fuels are moving in the opposite direction (Sovacool et al., 2014).³ As noted above, the majority of the U.S. states require utilities to have a certain percentage of renewable power in their generation portfolios. Therefore, in these states, reorienting a utility away from fossil fuels and towards RETs has become a matter of both sustaining a company's economic performance and legal compliance.

² RETs adoption is not the only way to decrease GHGs in the electricity sector. Energy efficiency, for example, represents a potent and cost-competitive tool to lower electricity sector's carbon footprint (EPA, 2009). However, in this study we focus only on one technological solution to decarbonization – RETs.

³ This is not say that RETs integration into the electric grid is only a matter of the increasingly favorable LCOE. Presently, if not coupled with storage, most commercially scalable RETs are considered non-dispatchable technologies (EIA, 2017). Because the existing electric grid was designed to accommodate dispatchable, centralized, and largely fossil fuel and nuclear generation, RETs proliferation in the existing grid is hampered by several technological and economic barriers. However, because of the largely distributed RETs application, these technologies show favorable levelized avoided costs of electricity (LACE), a measure that shows generation technology's value to the grid (EIA, 2017).

2.2. Utility Executives, Agency Conflict Theory, and Path Dependence

Utilities that continue on the fossil fuel-heavy path risk engulfing themselves in the phenomenon known as path dependence. Also known as inertia, stickiness, and lock-in, path dependence in the simplest terms means that the ‘past determines the future’ (Mahoney, 2000, p. 507). Puffert (2015) defines path dependence as follows:

Path dependence is the dependence of economic outcomes on the path of previous outcomes, rather than simply on current conditions. In a path dependent process, "history matters" – it has an enduring influence. Choices made on the basis of transitory conditions can persist long after those conditions change. Thus, explanations of the outcomes of path-dependent processes require looking at history, rather than simply at current conditions of technology, preferences, and other factors that determine outcomes.

Perhaps the most recognizable form of path dependence in the energy sector (the most “uninteresting” to Puffert) is known as sunk costs. This form is based on the longevity of capital-intensive infrastructure and equipment. Thus, according to Puffert (2015), “[o]bsolete, inferior equipment may remain in use because its fixed cost is already ‘sunk’ or paid for, while its variable costs are lower than the total costs of replacing it with a new generation of equipment.” The energy sector is prone to a sunk cost and path dependence problem as exemplified by nuclear power plants with massive cost overruns (Grimston, 2005) or oil and gas projects that take nearly a quarter of a century to develop (Sidortsov, 2012). The lengthy commission timelines, financing arrangements, and power purchase agreements, as well as legal and policy changes often make centralized, capital-intensive energy infrastructure obsolete before the end of its useful life.

Path dependence comes in more than one flavor. One of its most famous examples, the continuing use of the QWERTY computer keyboard layout, reveals a subtler pathway to inertia. Created for nineteenth century typewriters based on advice from telegraph operators, the layout carried over to modern day computers, tablets, and smart phones despite being inferior to several alternatives. What is distinct about the keyboard example is that it crosses into the territory of personal path dependence, with billions of typists “wired” to the QWERTY layout (Mahoney, 2000). A similar type of dependence affects the people responsible for operating centralized, fossil fuel-based and nuclear-based energy infrastructure, including the people perched at the top of the command chain. In this sense, their behavior is “wired” to such infrastructure as they are contractually obligated and financially incentivized to ensure its continuous profitable operation.

It would be a gross overstatement to say that all electric utilities and executives that run them are averse to decarbonizing their generation fleets. There are plenty of electric utility CEOs who have acknowledged the inevitable energy transformation and have taken steps towards it. For example, Tom Fanning, the CEO of Southern Company, the second-largest utility in the United States stated that his company favors a balanced generation portfolio that includes RETs (Lacey, 2017). Even stronger support comes from the Edison Electric Institute (EEI), a trade association representing investor-owned electric utilities that provide service to 220 million customers in all 50 U.S. states and the District of Columbia

(EEI, 2017). David Owens, an Executive Vice President at the EEI pointed out the 25 percent reduction in GHG emissions from the member utilities since 2005 through their commitment to RET proliferation and grid enhancement (Lacey, 2017). However, technological, economic, and personal path dependence premised on hundreds of GW of centralized fossil fuel-based and nuclear-based generation capacity may prove to be impossible to overcome even with the best intentions in mind. Therefore, finding ways of breaching this formidable barrier remains highly important.

Pursuant to the agency conflict theory, personal incentives might serve as a powerful tool for overcoming or minimizing path dependence, including sunk costs. Agency conflict is the theory of how an agent, (in the legal sense of this word), a CEO, for example, will manage a firm for which he or she works, but does not own (Jensen & Meckling, 1976; Miller, et al., 2002). The theory states that executives of large, publically traded firms may not always act in furtherance of their companies' best interests if they do not directly benefit from the results (Jensen & Meckling, 1976; Miller, et al., 2002). In addition, because executive compensation responds asymmetrically to good and bad news, there are incentives against disrupting the status quo, which may not be in the best interests of investors let alone other stakeholders (Taylor, 2013). Poorly designed incentives can encourage counterproductive, unethical, and potentially unlawful executive behavior (Biggerstaff, et al., 2014), which may have been directly influenced by what Mayer refers to as 'dark money' to reduce government oversight of corporations (Mayer, 2016). Current compensation packages are intended to eliminate these conflicts by promoting the growth of shareholders' wealth (Lewellen & Huntsman, 1970; Jensen & Murphy, 1990; Bizjak, et al., 1993). Simply exposing compensation values appears to have an effect. However, the enactment of federal legislation limiting the deductibility of non-performance related compensation and the adoption of mandatory enhanced disclosure of executive compensation by the United States Securities and Exchange Commission (SEC) had measurable effect on executive compensation (Perry & Zenner, 2001).

Historically, executive compensation packages have been developed with the idea of minimizing the agency conflict (Bebchuk & Fried, 2003; 2005; Bebchuk, et al. 2011) and aligning corporate leadership goals with those of stockholders (Agrawal, et al., 1991; Lanen & Larcker, 1992). In addition, there have been proposals to align executive compensation with public health goals (Pearce and Denkenberger, 2015). It is reasonable to expect company executives to align their personal compensation requirements with their company's short-term performance without making fundamental changes in the compensation package (Agrawal, et al., 1991; Lanen & Larcker, 1992). However, combating path dependence—avoiding or minimizing the sunk cost problem while ultimately increasing RETs proliferation and reducing carbon emissions—requires fundamental changes in the ways utility executive compensation is structured. Below, we propose two such ways.

3. Data and Methods

3.1. The Case Study of Three Michigan Utilities

Michigan is the tenth most populous U.S. state. The state is a major electricity producer and consumer placing 12th nationally in both categories (EIA, 2017a; EIA, 2014). Michigan is currently transitioning

from a coal-heavy generation mix towards larger shares of natural gas and non-hydro RETs. For example, in 2014, coal-fired power plants provided half of electricity in the state. In 2016, this share dropped to 36% (EIA, 2017a). Michigan is among 14 so-called restructured states (and the District of Columbia) where some types of customers have the ability to purchase electricity directly from retail electricity providers (RAP, 2011).

The energy landscapes of U.S. states are unique in terms of the regulatory approaches, fuel mixes, commitments to decarbonization, and other factors. Michigan, for example, finds itself among the minority of the states that opted for a market-based approach to electricity pricing for certain consumers (RAP, 2011). However, because of Michigan's diversity of geography, economy, population, generation mix, end uses, and regulatory approaches, the state is confronted with many energy policy issues of nationwide relevance. For example, the aforementioned shift from coal-fired generation to natural gas and renewables is in line with the trend observed in many U.S. states (Houser, et al., 2017). Therefore, due to such representative characteristics, Michigan and its utilities provide an excellent opportunity for a case study.

We selected Michigan's three of the largest utilities, DTE Electric, a subsidiary of DTE Energy (DTE), Consumers (CMS) Energy (CMS), and Indiana Michigan Power, a subsidiary of American Electric Power (AEP). DTE and CMS historically have been Michigan's largest electric utilities (Howell, 2011) whereas AEP historically has been one of the largest electric utilities in the United States (AEP, 2017a). Therefore, because of these companies' long-standing prominence in the state's and national energy landscapes, DTE, CMS, and AEP have enduring corporate culture while displaying high potential potential for carbon sunk cost. DTE Electric serves 2.2 million customers and has the generating capacity of 11,084 MW (DTE, 2017a). CMS has 5,885 MW of generating capacity and serves 6.7 Michiganders (CMS Energy, 2017). Indiana Michigan Power's market share of 128,426 customers in Michigan is significantly lower than those of DTE Electric's and CMS's. Yet the AEP's nation-wide generating capacity of 26,000 MW supersedes the DTE Electric and CMS's generating capacities by a wide margin (Indiana Michigan Power, 2017).

Because the overarching goal of our analysis was the level of personal path dependence and agency conflict at the top of the corporate command chain, we chose to evaluate parent company CEOs compensation packages along with the GHG emissions that these companies produce. Unfortunately, one or both types of data is not available for every Michigan utility. For that reason, we opted to focus on the firms with significant carbon footprints that are required to disclose the GHG and executive compensation data under environmental and securities laws.

We obtained emissions data, measured in metric tons, from the EPA's Greenhouse Gas Emissions from Large Facilities database (EPA, 2016). The CEO compensation data came from the SEC; more specifically, from the so-called "Schedule 14A" forms, which are annual proxy statements filed pursuant to Section 14 (a) of the Securities and Exchange Act of 1934 (SEC, 2016). In addition, we used fuel source data reported by each utility itself (AEP, 2016; CMS, 2016; DTE, 2016).

3.2. Methods

Two approaches were developed in order to provide incentives for utility CEOs to decrease GHG emissions directly or to increase RET deployment by altering their overall compensation with relation to both GHG emissions and renewable fuel used. The effect of compensation based on emissions data, where C_{GHG} is the total compensation after incentives in U.S. dollars, and is given by:

$$C_{GHG}(t) = S_{Base}(t) \exp \left[\frac{E_0 - E(t)}{M_1(t)} \right] \quad C_{GHG}(t) = S_{Base}(t) \exp \left[\frac{E_0 - E(t)}{M_1(t)} \right] \quad (1)$$

where S_{Base} is base salary before incentives, E_0 is initial emissions in kg/MWh and $E(t)$ is final emissions in kg/MWh. $M_1(t)$ is a constant that can be changed to scale the effect of emissions on the incentive pay. Both S_{Base} and $M_1(t)$ can be modified to account for inflation among other factors unique to a specific utility's business environment.

In the second approach CEO pay is related to the percent renewable fuel used and thus C_{RET} is the compensation after incentives:

$$C_{RET} = S_{Base} \exp \left[\frac{R}{M_2(t)} \right] \quad C_{RET} = S_{Base} \exp \left[\frac{R}{M_2(t)} \right] \quad (2)$$

where $M_2(t)$ is a constant that can be changed to account for sensitivity or inflation, R is the amount of RETs used in the generation of electricity per utility in percent. Again, S_{Base} can be scaled to account for inflation. For both methods, S_{Base} should be set at a value that allows CEOs a comfortable, but not excessive lifestyle (Palia, 2000; Hadlock, et al., 2002). It should be pointed out that future work is needed to determine what those values should be and if appropriate to adjust to meet other goals such as those of 'just sustainabilities' (Agyeman, et al., 2003).

These approaches can both be used to provide a higher overall CEO compensation for firms that are more environmentally conscious. In order to determine the impact of both methods with each chosen company, the data for all variables is examined for effects on overall compensation following equation 1 and 2.

For equation 1, the first method, E_0 and $E(t)$ and filled by using the emission data across one year periods, 2012-2013 and 2013-2014, with E_0 being the first of the two emission points. S_{Base} is set at the starting salary of the CEO for the given period. C_{GHG} is then set at the current CEOs salary for the examined calendar year, t . By doing this, M_1 values can be determined for any firm and here it is done for the three case study firms.

For the second method, the R percentage is set using data for the specific year in question, t . S_{Base} is the same as it was for equation 1. C_{RET} reflects the CEOs salary for year t . The constant M_2 is calculated in a similar manner as the calculation of M_1 .

A sensitivity study is then used to probe the two methods, GHG emissions or renewable energy percentage, to determine which is more effective at reaching the goal, increased pay for CEOs of environmentally conscious firms, over a range of constants. This is done by varying the constants over static historical data, found from the proxy statements, the emissions data, and the RET data from the published fuel mix of the utilities.

4. Results and Discussion

According to DTE's 2016 Schedule 14A, executive compensation consists of the following four components: base salary, annual and long-term incentives, pension and deferred compensation, and post-termination agreements such as severance and change-in-control compensation. The annual and long-term incentives are particularly important for DTE executives. For example, they comprised on average 75% of DTE CEO's total compensation in the fiscal years 2014, 2015, and 2016 (DTE p. 53, 2017). These incentives are "designed to tie compensation to performance and encourage executives to align their interests with those of the shareholders and customers of the [c]ompany (DTE p. 41, 2017). The amount of compensation is determined by two incentive plans, one that is focused on the company's performance and another that tracks the performance of eligible executives. The former is calculated pursuant to a rather complex formula in which the company's financial performance accounts for 50%, customer satisfaction for 16%, employee engagement for 8%, employee safety for 8%, and generation, distribution, and system reliability for 18%. (*Ibid.* p. 44). The basic principle behind DTE's long-term compensation is to postpone its full vesting for three years. The long-term incentives comprise performance shares and restricted stock, which reflect various aspects of DTE's financial performance.

CMS' 2016 Schedule 14A puts alignment of executive compensation with increasing shareholder value as the top principle of its executive compensation program (CMS, p. 25 2017). To achieve that, the company employs compensation packages consisting of a base salary, annual, and long-term incentives. Similarly to DTE, performance-based incentives comprise approximately 75% of CMS executives compensation packages (CMS, 2017). Although CMS' 2016 Schedule 14A boasts company's safety, reliability, and consumer cost achievements, both annual and long-term incentives are based on CMS' financial performance as measured by earnings per share, operating cash flow and total shareholder return. Also similarly to DTE, "long-term" means that the compensation, in the CMS' case performance- and tenure-based restricted stock, fully vests three years after the award date (*Ibid.*).

AEP's use of incentives in executive compensation is even higher than that of DTE's and CMS'. For example, incentives comprised on average 85% of AEP CEO's total compensation in the fiscal years 2014, 2015, and 2016 (AEP p. 48, 2017). Pursuant to AEP's 2016 Schedule 14A, the company sees both annual and long-term incentives as the main vehicle for aligning executives' interests and efforts with the AEP's objectives. The long-term incentives are structurally similar to those offered by DTE and CMS. The performance-based stock comprises 75% and tenure-based stock 25% of the long-term incentive package. The incentives fully vest within 3 years of the initial award (AEP, 2017).

What sets AEP apart from DTE and CMS is the structure of the company's annual incentives, namely,

the inclusion of RETs adoption as a factor affecting executive compensation. The Schedule 14A lists this measure under the Strategic Initiatives component of the annual incentive compensation. The measure is based on the “volume of new projects captured by AEP OnSite Partners and AEP Renewables,” the two AEP subsidiaries tasked with developing renewable energy projects (AEP, p. 36, 2017).

However, this RETs adoption incentive appears to have very limited significance vis-à-vis the rest of the incentive package. First, the annual incentive package is less than a half of the long-term incentive one (AEP p. 48, 2017). Second, the RETs adoption incentive accounts only for 2% of the annual incentive performance score. In comparison, operating earnings per share accounts for 75%, safety for 10% and the rest of the Strategic Initiatives for 13% (AEP p. 36, 2017). Third, the performance minimum, target, and maximum goals are set at \$0, \$20, and \$50 million in renewable start up projects respectively. This is inexplicably low as AEP OnSite Partners and AEP Renewables delivered \$299 million such projects in 2016 (*Ibid.*)

Whilst we can mark the AEP’s initiative as a start (albeit a timid one), the omission of renewable energy or carbon emissions in relation to CMS and DTE executive performance is troubling. Not only does the omission contradict the aforementioned generation mix trend, it does not reflect the requirement set forth by Michigan’s RPS. In addition, three years might be long-term in CEO years but certainly not in capital-intensive energy infrastructure. Therefore, all three utilities can benefit from reevaluating their executive compensation packages in light of inevitable energy transformation.

Data gathered on AEP, CMS Energy, and DTE Energy is presented in Figures 1-3, which show the percentage of RET, GHG emissions, and total CEO compensation, respectively. These values were used along with the equations 1 and 2 to calculate M values for each approach from each firm. By calculating the M values, it can be determined how closely each firm currently follows the given equations.

The first method determines M_1 values from equation 1. A lower M_1 leads to higher compensation increases for reductions in emissions. If the value is zero or negative, the variables have no effect on CEO pay. By setting an M_1 value that will give CEOs proportionally increased benefits with a significant decrease in emissions, equation 1 can be used to determine the future CEO compensation contracts that will benefit the general public by reducing GHG emissions.

The second method, which uses equation 2, determines the CEO compensation as a function of percent of electricity generated using RETs. The higher the percent of renewable technology used, the higher the overall pay will be. The closer a positive M_2 value is to zero, the more of an effect RET incentives have on CEO pay.

By optimizing the M values for both equation 1 and equation 2, compensation contracts can be developed that encompass the need for RETs. The calculated M values are seen in Table 1 and 2. It was found that AEPs CEO was not compensated with relation to the emissions. In fact, the CEO was actually compensated more when the emissions increased. CMS Energy's CEO compensation was strongly related to emissions and DTE's compensation was related moderately to a decrease in

emissions. RET use is not given over a time period in equation 2, so it does not show correlations to any firm.

In order to determine which approach fits best for each firm, a sensitivity study was performed. The results of this sensitivity analysis can be seen in Figures 4-6 for the GHG emissions approach and Figures 7-9 for the RET approach. These show the total increases in compensation for both equations over the lifetime of the goal. That is, for equation 1, the total increase in compensation if the firm reduces their total GHG emissions to zero. For equation 2, the total increase in compensation if the firm uses 100% RETs is shown. These increases are given for various M values to help determine the best fit for each firm.

For the first approach, a decrease in M_1 corresponds to an increase in compensation. It can be seen in Figures 4-6 that an M_1 of approximately 5000 will give a 100% increase in compensation for the various firms for a total elimination of emissions. These values can be used to help set a reasonable M_1 value to utilize equation 1 for individual firms.

Figures 7-9 show how, like the previous approach, decreases in the M value will correspond to increases in CEO pay. Unlike approach one, a value for M_2 that gives a 100% increase in compensation for complete adoption of RETs is about 1.2. Figures 4-9 help to visually show what effects various constants will have on the pay of an electric utility CEO in Michigan.

Qualitative analysis of both equations can also help to determine the best fit. Method 1, emissions, may give strong incentives for the CEO to quickly reduce emissions on all current generating plants. This will help to promote a reduction in emissions on all non-renewable power sources. Method 2, RET, will help promote long term renewable energy technology increases. CEOs operating under the RET method will reduce their dependency on non-renewable generation. Over time, the effect will be to reduce both emissions and operating costs.

Both equation 1 and 2 can work interchangeably. This is shown in Figure 10, where both GHG emissions and RET percentage are compared to CEO compensation. For this comparison, a base salary of \$10,000,000, starting emissions of 5,000 kg/MWh, and a starting RET percentage of 0% were used. As a result of compensation for both GHG and RET being equal, an equation that encompasses both previous approaches can be developed. This is done by scaling equation 1 and 2 to appropriate percentages, P_1 and P_2 , of the desired influence, and adding them together. The resulting compensation equation allows for CEOs to receive incentive pay for both reducing their overall emissions and increasing their renewable generation.

$$C = P_1 \left[S_{Base}(t) \exp \left[\frac{E_0 - E(t)}{M_1(t)} \right] \right] + P_2 \left[S_{Base} \exp \left[\frac{R}{M_2(t)} \right] \right]$$

$$C = P_1 \left[S_{Base}(t) \exp \left[\frac{E_0 - E(t)}{M_1(t)} \right] \right] + P_2 \left[S_{Base} \exp \left[\frac{R}{M_2(t)} \right] \right] \quad (3)$$

Equation 3 has some key advantages over the previous two methods, which develop from allowing the

total compensation to be reliant on both emissions and renewable energy technologies in variable amounts. If a firm feels that from year to year their scope has changed, the board can easily modify the percentages of each component that affect CEO pay. This allows for an obvious focus, reduction in emissions or increase in renewable energy technologies, that the CEO must move towards in order to achieve their highest possible pay. Equation 3 helps to encompass the entire goal of moving towards cleaner energy into one simple equation.

One possible consequences of combining the first two approaches into a final, singular equation is a confusion of constants. If the M_1 and M_2 values are not correctly chosen in equation 3, the equation can modify the significance of one approach versus the other more than intended. While this is easily solved, it can cause complications with the use of equation 3.

The limits in the scope of this study are that only three electric utility firms in a single U.S. state were examined. While the case study possesses representative characteristics and it reached the goal of developing useful approaches for providing utility executives with incentives that befit their companies and general public, the study could be further verified if a broader range of data was collected. The only sources of error found in this study were from the company data itself. That is, most companies report their emissions data over different time periods (i.e. fiscal vs. normal year) or in different units. While these were all correctly standardized, there is no confirmation from each company on the accuracy of the data. Future policy work would benefit from a standardized method of emissions reporting.

Future work can focus on examining many electric utility firms to determine optimal constant values for implementation of these approaches. This approach could also be focused on examining other industries (e.g. manufacturing, agriculture, mining, etc.) and determining if these sustainability based executive compensation incentives can also work for using executive pay to improve environmental performance in those sectors. If the approach quantified by equation 3 was deployed into use, it could help align executive personal financial goals with environment objectives in a number of industries with environmental challenges. For deployment to be possible, the stability of this equation over changing economic environments within the United States and the global economies must also be examined in addition to the optimal constant evaluation and differentiated industry evaluation mentioned above. This method can be implemented either voluntarily or it can be used as an incentive by regulators during permitting and/or rate proceedings.

5. Conclusions

The need to better align executive compensation with global environmental objectives arises from both internal and external reasons. Not only it is an environmentally-responsible thing to do considering grave risks posed by climate change, it is a commercially-prudent thing to do in light of existential risks to electric power utilities posed by the path dependence problem. At present, two out of the three largest Michigan utilities, DTE and CMX do not factor RETs adoption in structuring their executive compensation despite the RETs adoption requirement under state law. AEP's executive compensation

package includes a RET-driven incentive but this incentive appears lack significance in comparison to the remainder of the executive compensation package. While the AEP's RET-driven incentive represents a welcoming start, it must be scaled up to become a sufficient inducement for AEP executives to start rerouting the company on to a path to meaningful decarbonization. We see no apparent reason why this type of incentives cannot be adopted by DTE and CMX as part of executive compensation packages, provided these incentives are appropriately scaled.

However, we caution against blindly copying incentive packages from one company to another. An executive compensation package that works for a state or regional electric utility might not work for a company operating nationally and vice versa. In fact a utility with presence in several states might have a greater flexibility in where and when to phase out fossil fuel generation assets and roll out RET facilities. Therefore, we see studies of successful and unsuccessful executive compensation packages featuring incentives for meeting environmental and social objectives as particularly fruitful avenues for future work. Such studies have the potential to contextualize the GHG and RET approach, or any combination thereof, proposed in this study to develop executive compensation packages. The approaches can be customized by modifying the constants in the combined equation to meet any requirements of an individual firm. In order to help prevent the harmful effects of GHG emissions, executives of firms with significant emissions can be provided with incentives for a direct benefit to implementing RETs, and policy. Additional future work is needed to investigate how this can be effectively accomplished through CEO incentive pay in industries beyond electric utilities.

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Figure Captions

Figure 1. Percentage of fuel used in the generation of electricity from RETs for each firm.

Figure 2. GHG emissions for each examined firm from 2012 to 2014.

Figure 3. Total CEO compensation per year for each examined firm from 2012 to 2014.

Figure 4. Change CEO pay per year for DTE Energy as a function of emissions for various M_1 values.

Figure 5. Change CEO pay per year for CMS Energy as a function of emissions for various M_1 values.

Figure 6. Change CEO pay per year for AEP as a function of emissions for various M_1 values.

Figure 7. Change CEO pay per year for DTE Energy as a function of RETs used in fuel generation for various M_2 values.

Figure 8. Change CEO pay per year for CMS Energy as a function of RETs used in fuel generation for various M_2 values.

Figure 9. Change CEO pay per year for AEP as a function of RETs used in fuel generation for various M_2 values.

Figure 10. A comparison of both methods, assuming \$10,000,000 base salary and 0% base emissions. It shows that both methods are interchangeable.