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Context-Based Sustainability and Corporate CO2 Reduction Targets: Are Companies Moving Fast Enough?

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Abstract: Corporate accounting and finance sustainability activities are often ad hoc; that is, the extent to which a company moves toward being more sustainable is based on organizational feasibility or economic acceptance rather than true sustainability criteria. This paper examines corporate climate and carbon policy through the lens of context-based sustainability (CBS). CBS argues that true sustainable efforts must consider the ecological capacity of the environment and the fair allocation of this capacity. Only by doing so will the result be an outcome of a livable and sustainable world. The paper combines aspects of physical science (atmospheric CO2 carrying capacity) and philosophy (inter-generational equity and resource allocation) with corporate policy. When applied to climate change this implies examining corporate efforts relative to climate stabilization paths and further examining what a fair allocation of future emissions would be. We look at the documented carbon reductions for a sample of large US corporations including EPA Climate Leadership Award Winners in 2012 and a larger sample of companies from the same industries and compare their carbon reductions to several allocations of the global carbon budget required to limit climate change to just 1℃ or 2℃. We find that the emissions path of these US corporations only satisfies the most generous, business-as-usual allocation of carbon emissions.

JEL Codes: Q50, M14; G30

Keywords: Environmental Economics, Social Responsibility, Sustainability Accounting

1. Introduction

Accounting for carbon emissions has become more of an integrated part of the operations of many large corporations. The Sustainability Accounting Standards Board (www.sasb.org), a non-profit organization has issued sustainability accounting standards to use by publicly-listed corporations in the U.S. for different industry groups. Similarly, the Carbon Disclosure Project (CDP) has for over a decade provided a forum for reporting for companies to reduce carbon emissions and the return on investments of reducing emissions, with 190 corporate carbon action signatories. For 2013, the CDP reported for US corporations, 1,050 projects to reduce emissions, and 169 million metric tonnes CO2 emissions reduced, with the net present value of these carbon reductions of USD 15.1 billion, providing an average internal rate of return of 33.6 percent (Carbon Disclosure Project 2014). Similarly, the Environmental Protection Agency (EPA) has promoted carbon reductions with its Climate Leadership Awards recognizing exemplary corporate, organizational and individual leadership in response to climate change, including companies with excellence in greenhouse gas management (goal achievement award) (www.epa.gov), along with a center for corporate climate leadership with tools for GHG measurement and management for companies. Despite great progress in reducing CO2 emissions by a larger number of companies, the question arises whether emission reductions are sufficient, given warnings by scientists that warming effects may have dire consequences if emissions go beyond a critical tipping point (McKie, 2013).

This paper examines how ad-hoc CO2 emissions targets adopted by corporations compare with the emissions necessary to achieve climate stabilization within acceptable bounds. We use the WRE 350 climate stabilization pathway (Wrigley, Richels, and Edmonds, 1996) as the template for progress to a stable climate with a high probability of less than 2℃ of warming. Using a sample of companies, some of which should be among the most progressive in terms of addressing climate change issues, we compare their targets (and achievements) to the WRE 350 pathway. We then compare their actual emissions and proposed targets to an allocation of the WRE 350 pathway emissions modified to reflect several different sharing patterns of future emissions. More specifically, we allocate the total annual WRE 350 emissions in various ways to reflect equity, population growth and the need for economic development. The following section discusses the current ad-hoc approaches for company sustainability efforts.

2. Ad-hoc Approaches for Company Sustainability Efforts and Climate Change

Companies engage in a range of sustainability efforts. Price Waterhouse Coopers (PWC) reports that in 2010 almost 80 percent of US companies that it surveyed had sustainability or CSR information on their websites and 40 percent published CSR or sustainability reports. Of reporting companies, 80 percent listed CO2 emissions reduction targets and almost 90 percent discussed measures they were taking to reduce emissions (PWC, CSR Trends 2010). Both the GRI reporting guidelines and the Carbon Disclosure Project ask companies to report carbon emissions initiatives or whether they have reduction targets. Since an increasing number of companies are following the GRI protocol or reporting to the CDP we expect more adoption and discussion of emission reduction activities over time.

In 2009 most companies set carbon emission reduction targets of between 1-1.5 percent (Dickinson, 2009). This corresponds fairly closely to the national CO2 reduction target announced in 2009 by President Obama of 17 percent by 2020, or a 1.05% per year reduction when measured against a 2005 baseline. Some companies, about 9% of CDP respondents, reported emissions reductions of 5%, but only 38% of these reporters had absolute reductions in emissions, reporting instead carbon intensity reductions (carbon emissions divided by total assets, revenue, or number of employees). By using and reporting carbon intensity targets, companies that are growing appear to be more efficient in terms of their emissions relative to larger total assets, but absolute emissions often rise with this growth, so from the perspective of climate change intensity reduction targets may not be effective at reducing atmospheric carbon.

The "low-hanging fruit" argument suggests that early in the process companies will more easily identify and reduce emissions. If emissions reductions follow standard cost patterns the marginal cost of reduction will rise as improvements are made. However, technological improvements (i.e., new developments in clean energy or energy efficiency) could cause this assumption to be incorrect. Therefore, reductions today may or may not be indicative of the ability of companies to make further reductions.

For companies, stating a reduction target is just the first step. They must meet the target. In the UK, FTSE 100 companies had average annual reduction targets of 2.5%, but achieved only a 1.2% reduction or less than 50% of the goal (CDP, 2010b). In the US the sectors that contribute about 90% of total emissions (Utilities, Energy, Materials and Industrials) had mixed results, with a slight net increase in emissions from 2007 to 2009 (CDP, 2010a). CDP (2010a) also reported that if this trend continues there will be "a 3.66% absolute increase in emissions by 2020, relative to 2009 levels." Moreover, the time period examined included the global economic recession during which business activity, and thereby emissions, declined. As the global economy recovers a byproduct of increased economic activity will be increased carbon emissions. So the data in these two reports by the Carbon Disclosure Project may be biased down rather than representative of the near future.

While companies are increasingly aware of and reporting their carbon emissions, the targets that they are aiming for, if in fact they are aiming for anything, are not necessarily linked to the atmospheric carbon budget estimated by climate scientists. In the next section we introduce such carbon budgets and their role in context-based sustainability.

3. Context-based Sustainability

Context-based sustainability is an important development in sustainability thinking. Developed by McElroy and van Engelen (2012), context-based sustainability adds two considerations to the standard dialogue about environmental stewardship: ecological limits and fairness. In terms of climate change, context-based sustainability would consider the absorptive capacity of the atmosphere relative to an acceptable range of temperature increase. For example, climate scientists (Meinshausen, 2009) estimate that limiting total CO2 emissions over the 2000-2050 to approximately 1000 gigatons (Gt) would result in a 25% chance of temperatures rising over 2 degrees Celsius relative to pre-industrial levels. Scientists use the 2℃ target as one that avoids the most serious risks of climate change. This implies that the global carbon emission budget for a 75% probability of no more than 2℃ of warming is 1,000 Gt CO2. If emissions rise beyond 1,000 Gt the likelihood of warming greater than 2℃ increases. To put this into perspective, in 2011 annual global CO2 emissions were 31.3 gigatons of CO2 (IEA, 2013), and the cumulated emissions from 2000 through 2011 are about 330 gigatons, leaving only 670 gigatons for the next 40 years (WRI CAIT, 2014).

Given a global carbon budget of 1,000 Gt the next step is allocating it fairly. Here context-based sustainability moves into the ethical realm so often ignored in sustainability discussions, but so necessary. Recall the most prominent definition of sustainable development:

Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their needs." (WCED 1987)

Implicit in this definition is that resources are available so everyone's basic needs are met today and indefinitely into the future. That is, if some people lack these resources there will be a re-distribution or sharing so the minimum need-threshold is reached. In philosophy the issue is often termed intergenerational equity, and has been studied for centuries.

Ringius (2001) lists five types of sharing rules. His table is reproduced here. From this perspective the economic burden of reducing or paying for carbon is allocated according to different types of burden sharing rules that range from egalitarian, where every individual has the right to pollute or be protected from pollution, sovereignty, where current levels of pollution constitute a status quo right, horizontal where countries with similar economic circumstances have similar emission rights and burdens to vertical where countries with the greater ability to pay bear a greater economic burden, and polluter pays where the economic burden is on the greatest polluters based on historical emissions.

Table 1. Selected equity principles & related burden sharing rules (from Ringius 2001)

Equity principle	Interpretation	Example of implied burden sharing rule
Egalitarian	Every individual has an equal right to pollute or to be protected from pollution	Allow or reduce emissions in proportion to population
Sovereignty	All nations have an equal right to pollute or to be protected from pollution; current level of emissions constitutes a status quo right	Allow or reduce emissions proportionally across all countries to maintain relative emission levels between them
Horizontal	Countries with similar economic circumstances have similar emission rights and burden sharing responsibilities	Equalize net welfare change across countries (net cost of abatement as a proportion of GDP is equal for each country)
Vertical	The greater the ability to pay, the greater the economic burden	Net cost of abatement is directly correlated with per capita GDP
Polluter pays	The economic burden is proportional to emissions (eventually including historical emissions)	Share abatement costs across countries in proportion to emission levels

To this list we can add the result if John Rawls (1971) “veil of ignorance” were applied to the allocation of a carbon budget. It would almost certainly result in an equal sharing of the carbon budget close to the egalitarian result (Kriss et al, 2011). The range of possible allocation methods of carbon emissions is broad so we cannot test every one of them, but we can test several representative methods.

4. Climate Stabilization Paths: WRE 350 PPM path and others

Many climate scientists state that to avoid potentially catastrophic warming atmospheric concentrations of CO2 should be stabilized at 350 ppm (Hansen, 2008). Current atmospheric CO2 levels are about 395 ppm (retrieved 7/16/2012: http://co2now.org/) so absolute reductions on CO2 are required. Since CO2 stays in the atmosphere from 20 to 200 years before a significant majority dissolves into the oceans, it is imperative that new emissions be reduced quickly so the current stock of atmospheric CO2 can begin to decrease. A well-recognized climate stabilization pathway is the WRE350 path developed by Wrigley, Richels and Edmonds (1996).

Figure 1 shows the WRE 350 path with CO2 measured in billons of tons of CO2. To give the WRE 350 path some context, notice that the actual global CO2 emissions for 2011 were 31.6 billion tons.

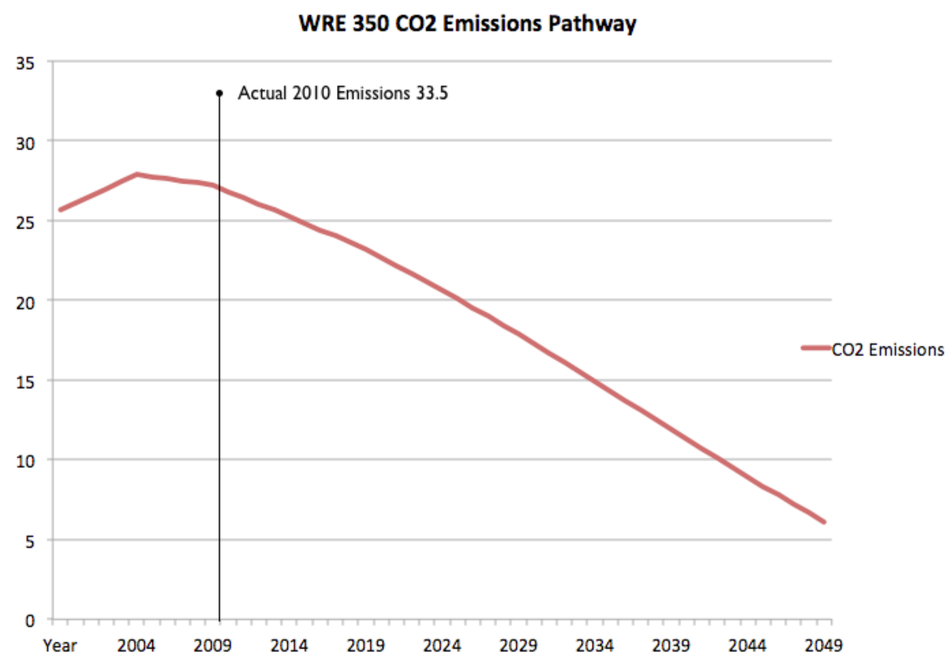

Figure 1. A 350 ppm climate stabilization path based on Wigley et al (1996)

Other pathways exist. Hansen's (2008) pathway requires deeper emissions reductions than the WRE 350 pathway. There are also pathways to 450 ppm and 550 ppm. Another approach is to set a temperature target then determine the CO2 concentration that corresponds to that temperature. Using this approach, 450 ppm of atmospheric CO2 concentration gives a 50% probability of temperature changes of above or below 2℃. To reduce the likelihood of temperature changes greater than 2℃ the CO2 target must stabilize at less than 450 ppm.

We will use the WRE 350 stabilization path since it is often used in the literature about climate change mitigation and would result in a climate regime with fewer serious impacts than other targets, such as 450 ppm or 550 ppm.

5. Comparing Corporate Responses to 350 path and the sample

We compare stated corporate CO2 emissions targets to the reductions implied by the WRE 350 stabilization path. We use reduction targets from two groups of companies: EPA Climate Leadership Award winners (See Appendix A for company list). These companies should comprise a sub-group that has set and achieved the most stringent CO2 reduction targets, so should be close to or exceed the reduction requirements of the WRE 350 target pathway. The second sample is a randomly selected group of companies from the same industries from the same industries as the Climate Leadership Award winners.

Table 2 shows the distribution of firms by industry, which includes firms from more higher emission industries (energy, industrials, telecommunications) as well as retail (consumer discretionary and staples), health care, information technology, materials and packaging, and the financial industry. The total sample is 164 firms in a broad range of industries.

Table 2. The industry Distribution of Sample Firms

Consumer Discretionary	22
Consumer Staples	24
Energy	12
Financials	20
Health Care	18
Industrials	19
Information Technology	30
Materials & Packaging	16
Telecommunications	3
TOTAL	164

6. The Status Quo or Sovereignty Allocation

Under the Status Quo allocation companies can continue to emit carbon according to the proportion they have previously emitted. The allocation could be in absolute terms, i.e., a company that has been emitting 1 million metric tons continues to have the right to emit 1 million tons, or on a proportional basis, i.e., a company that has historically emitted 0.005% of total global emissions can continue to emit that proportion. The second approach would allow for a cap-and-trade scheme, since the cap can be lowered over time and companies would respond by reducing their emissions until they were once again at their allocated proportion.

We use data from the US EIA (US Energy Information Agency) for total US emissions and collect company emissions from company sources, such as corporate websites and sustainability or CSR reports. For the years 2008-2011 we compute each company's share of total US CO2 emissions. We compute the year-to-year change in this share figure and compare it to the year-to-year change stipulated in the WRE 350 stabilization path. Table 3 shows these results as well as the average absolute emissions for the US and the sample. The maximum annual emissions for all four years is for

ExxonMobil. For the three years for which change data can be calculated the year-to-year change varies from a 4.86% increase (2008 to 2009) to a 1.27% decrease (2009 to 2010). The decrease probably is the result of the economic recession. In two of the three years the change in the sample average exceeds the WRE 350 emissions path. Therefore, even under the most generous allocation method we find that US corporations cannot consistently meet the required emissions reductions called for to achieve a future climate regime of a 75% probability of no more than 2℃ of warming by 2050.

Examining year-to-year changes in individual companies we find year-to-year increases as high as 418% and as low as -86%. Such changes can be due to companies selling subsidiaries or changing the way they report emissions. These data are not presented for the sake of brevity. The large range shows diversity over the sample.

Table 3. Results of the Status Quo Allocation Analysis for 164 US corporations compared to the WRE 350 Climate Stabilization Path.

	2008	2009	2010	2011
Sample Average Share of US Emissions	0.0693%	0.0727%	0.0718%	0.0738%
Actual year-to-year change in average share		4.86%	-1.28%	2.85%
EIA Total US MtCO2	5,841,354,000	5,424,673,000	5,606,905,000	5,485,623,000
WRE Trajectory	5,582,378,070	5,431,205,834	5,263,932,662	5,090,847,169
Sample Average in MtCO2	4,050,211	2,694,031	2,752,018	2,761,315
Sample Maximum MtCO2	145,000,000	143,000,000	147,000,000	150,000,000
WRE 350 PPM Year-to-year change		-.49%	-0.50%	-1.45%
Compare actual to WRE		Over	Under	Over

7. Comparing corporate responses to the 350 path with population growth and sharing (emerging economies growing)

While percentage reductions that are in line with those prescribed by the WRE 350 climate stabilization path satisfy one of the context-based sustainability criterion (that reduction recognize ecological limits or the atmosphere's absorptive capacity), they may not satisfy the distribution criterion. In this section we compare the CO2 reduction targets of our sample companies to several different allocation or sharing plans. The total global emissions dictated by the WRE 350 pathway are allocated according to the World population considering population growth from 2010 to 2030.

7.1 Transition to per capita emissions

In Table 4 we estimate allowable US CO2 emissions if total global emissions are reduced according to the WRE 3500 trajectory, and there is a 20-year transition from today's pattern of emissions (US currently emits about 19.5% of the world's total) to an allocation based on population. The US emissions must change much faster than the WRE 350 path because of two additional factors. One, there is a shift to a per capita allocation so the US is losing some of its allocation each year. Two, over the 20-year period world population is growing, but largely in developing countries. Among industrialized countries the US is unusual as its population is projected to grow by about 17% from 2010 to 2030. Global population growth, however, is forecast to be over 20%. So proportionately, the US will see a further reduction in allowable emissions because of relatively slower population growth. We model the transition as a linear reduction from United States' 19.5% share of world emissions in 2008 to 4.4% in 2028. The 4.37% target is the US share of total world population as of 2030 according to the UN population database (UN 2010).

As Table 4 shows while the WRE path calls for reductions of 0.49%, 0.50% and 1.45% for the years 2009 through 2011, the US will need to reduce its total emissions by 4.4% to 5.6% from 2009 to 2011 to satisfy both the WRE reductions and the shift to an allocation based on global per capita emissions. In the rightmost column we show the actual reductions by our sample of 164 US corporations.

It is clear that current corporate action regarding carbon dioxide emissions is far from the path needed to satisfy both the WRE climate stabilization path and a shift to a more equitable allocation of emissions. The change in required reductions continues to increase through 2028 when it reaches 17%. So if companies cannot achieve early reduction goals they will have a much greater challenge as the goals increase.

Table 4. A transition from the current world emissions pattern to a global per capita allocation over 20 years with WRE 350 reductions.

Year	WRE 350 Change	Total World CO2 Emissions	US Portion of Global Total	United States Absolute Emissions	Change in US Total Emissions	Change in Sample Firm Emissions
2008		29,888,121	19.5%	5,841,014		
2009	-0.49%	29,740,634	18.8%	5,586,557	-4.4%	4.9%
2010	-0.50%	29,593,146	18.0%	5,334,337	-4.5%	-1.3%
2011	-1.45%	29,162,642	17.3%	5,035,487	-5.6%	2.9%
2012	-1.47%	28,735,328	16.5%	4,743,696	-5.8%	
2013	-1.49%	28,306,418	15.7%	4,458,138	-6.0%	

7.2 Types of Sustainability Goals by Sample Firms

Corporations have a choice of using absolute greenhouse emission reduction goals, and/or CO2 emissions intensity (CO2 relative to assets, sales, or # of employee) goals. At times companies report absolute emission goals and use intensity ratios internally.

In sustainability reports, firms may report absolute reductions, along with intensity reduction targets. Since intensity goals are a percentage of assets, sales, or number of employees, if a firm grows, its intensity goal may be lower, but absolute emissions may actually increase over time. For our sample of firm's although sometimes target goals were difficult to interpret, the majority of firms appeared to have primarily carbon intensity goals or goals for particular operations versus the firm as a whole or vague goals to reduce emissions generally, but with no clear goal. From this perspective, goal setting for absolute emission changes would be more effective in making progress towards actual carbon emission reduction. Given the challenge that corporations need to make in the future to carbon dioxide emissions in the future, less ad hoc approaches need to be developed and transparent accounting standards need to be developed with uniform reporting and targets based on absolute emissions to be able to significantly reduce carbon emissions to avoid dire consequences with climate change.

8. Summary and Conclusion

Context-based sustainability is an important development in sustainability thinking including considerations of ecological limits and fairness. In terms of climate change, context-based sustainability should consider the absorptive capacity of the atmosphere relative to an acceptable range of temperature increase. We use the WRE 350 stabilization path since often used in the literature about climate change mitigation which would result in a climate regime with fewer serious impacts than other targets, such as 450 ppm or 550 ppm. We compare stated corporate CO2 emissions targets for a sample of large corporations in different industries to the reductions implied by the WRE 350 stabilization path. We use data from the US EIA (US Energy Information Agency) for total US emissions and collect company emissions from company sources, such as corporate websites and sustainability or CSR reports. For the years 2008-2011 we compute each company's share of total US CO2 emissions. We compute the year-to-year change in this share figure and compare it to the year-to-year change stipulated in the WRE 350 stabilization path.

For the three years for which change data can be calculated the year-to-year change varies from a 4.86% increase (2008 to 2009) to a 1.27% decrease (2009 to 2010). The decrease probably is the result of the economic recession. In two of the three years the change in the sample average exceeds the WRE 350 emissions path. Therefore, even under the most generous allocation method we find that US corporations cannot consistently meet the required emissions reductions called for to achieve a future climate regime of a 75% probability of no more than 2℃ of warming by 2050.

We also compare the CO2 reduction targets of our sample companies to several different allocation or sharing plans. The total global emissions dictated by the WRE 350 pathway are allocated according to the World population considering population growth from 2010 to 2030. While the WRE path calls for reductions of 0.49%, 0.50% and 1.45% for the years 2009 through 2011, the US will need to reduce its total emissions by 4.4% to 5.6% from 2009 to 2011 to satisfy both the WRE reductions and the shift to an allocation based on global per capita emission.

The results suggest that US corporations need to reassess carbon reduction goals. A persistent practice in sustainability reports is to report no precise goals or carbon intensity goals (with carbon emissions as a percentage of sales, assets, or number of employees) whereby a carbon intensity goal may go down, but total absolute carbon emissions go up over time. More transparent requirements for accounting including the inclusion of absolute changes in emissions in reporting would be one step that could at least allow stakeholders in US companies to be aware of the actual progress of corporations towards carbon emission reductions.

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Appendix A

2012 EPA Climate Leadership Award Winners

(retrieved on July 16, 2012 at: http://epa.gov/climateleadership/awards/2012winners.html)

Avaya

Bentley Prince Street

Campbell Soup Company

Casella Waste Systems

Cummins Inc.

Fairchild Semiconductor

Ford Motor Company

Gap Inc.

Genzyme

Hasbro

IBM

Ingersoll Rand

Intel Corporation

International Paper

San Diego Gas & Electric

SAP

SC Johnson

UPS