Greenhouse gas emissions per unit of value a corporate guide to voluntary climate action

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Greenhouse gas emissions per unit of value added ("GEVA") — A corporate guide to voluntary climate action

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ABSTRACT

How much must I reduce my greenhouse gas (GHG) emissions if I want to do my fair share to contribute towards the global effort to keep global warming below a 2 °C rise in average temperature over preindustrial times? This paper suggests an answer for nations and corporations that want to move ahead of legislation on a voluntary basis.

If all nations reduce their "GHG emissions per unit of GDP" by 5% per year, global GHG emissions will be 50% lower in 2050 than in 2010 as long as the global economy continues to grow at its historical rate of 3.5% per year. The suggested 5% per year decline can be translated into a corporate resolution to reduce corporate "GHG emissions per unit of value added" (GEVA) by 5% per year.

If all corporations cut their GEVA by 5% per year, the same global result will be achieved. The suggested 5% per year decline can be used as a guideline for responsible action on a voluntary basis. The guideline is unlikely to be made mandatory soon, but compulsory publication of the necessary emissions and productivity data by nations and corporations could help civil society highlight top performers.

1. The research question

1.1. Fair share in voluntary climate action

This paper suggests an answer to the question: how much must I reduce my greenhouse gas (GHG) emissions if I am to do my fair share to contribute towards the global effort to keep global warming below a 2 °C rise in average temperature over preindustrial times. The answer is provided both for nations and for corporations that want to move ahead of international agreements and national legislation on a voluntary basis.

The first part of the paper presents the logic behind the suggested answer, which is to cut "GHG emissions per unit of GDP" at the national level and "GHG emissions per unit of value added" at the corporate level, both by 5% per year. The second part of the paper discusses the concepts involved and provides some illustrative data for national and corporate performance. The third and final part of the paper discusses issues related to practical use of the two indicators.

1.2. Global goals for climate stabilisation and poverty alleviation

The world has been debating the challenge of sustainable development since the term was coined by the Brundtland Commission in 1987. The exact content of the challenge has remained unclear, but there is emerging international consensus that the global endeavour for a more sustainable world includes two main ambitions: the desire to alleviate world poverty; and the desire to avoid dangerous climate change. The world increasingly agrees on its main tool in the endeavour to fight poverty — namely continued economic growth. Similarly, the chosen tool in the effort to avoid dangerous climate change is general reduction in global emissions of GHG.

The world has furthermore agreed on quantitative goals for this dual effort. These goals are summarised in the United Nations (UN) Millennium Development Goals, which seeks poverty alleviation (UN, 2012a), and the UN Framework Convention for Climate Change, which seeks to keep man-made global warming below a danger threshold. Fig. 1 presents the dual challenge in a 40-year historical perspective.

The UN Millennium goals cover a spectrum of global ambitions related to development: ranging from higher income, via better health, nourishment, living conditions, and education to improved physical safety and human rights. The tool intended to deliver these goals is economic growth, particularly in the developing and emerging world. The implicit quantitative goal is to continue to expand world GDP at the historical rate of 3.5% per year in real terms.

On the climate side, the Kyoto Protocol in 1997 represented the first step on the way toward reduced GHG emissions. The Kyoto Protocol outlined common, yet differentiated responsibilities for the world's nations to cut GHG emissions by 5% from

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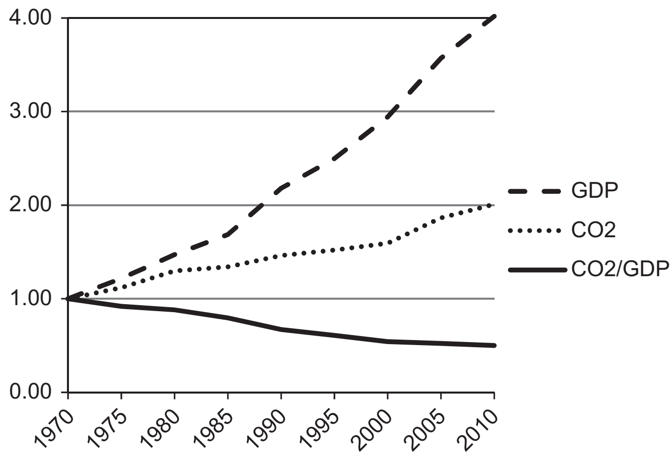

Fig. 1. Gross domestic product (GDP), emissions of CO_2, and the ratio CO_2 emissions per unit GDP (Index values, 1970=1), World 1970–2010 (Based on data from Penn World Tables and BP Statistical Review of World Energy).

1990 to 2008–2012. Later, in 2009, the danger threshold was agreed to be 2 °C above average global temperatures in preindustrial times. The UN Intergovernmental Panel on Climate Change has also concluded that keeping below plus 2 °C will require a reduction in global GHG emissions of 50–80% by 2050. I choose the lower number in this range, accepting that this increases the risk of not staying below plus 2 °C. As a rough summary, the world ambition is to cut GHG emissions by 50% by 2050, while maintaining economic growth at historical rates of 3.5% per year.

1.3. Global tools for climate stabilisation and poverty alleviation

Economic growth is pursued in various ways, based on theoretical considerations and experience from the last century of active effort to increase global growth rates. The establishment of a stable institutional framework has played an important role, as has liberalisation and trade. One major recent success is the economic expansion of China, and there are signs of acceleration in a number of emerging economies. Long-term growth rates in the rich industrialised countries have been below the world average, around 2.5% per year since 1970. Corporations – private or public – play an important role as the central vehicle of growth in all economies.

Reduction of GHG emissions are achieved in various ways. Some cuts have occurred simply because they were profitable at current prices. After the year 2000, more reductions have become profitable as a result of higher prices for fossil energy (coal, oil and gas — the main sources of man-made CO_2 emissions). Higher prices have made it commercially attractive to cut the use of fossil energy, and thereby GHG emissions, throughout the economy.

Additional efforts have been made to accelerate the reduction of GHG emissions. Three important tools are (a) pricing of GHG emissions; (b) new legislation to reduce emissions: and (c) voluntary activities to limit emissions from corporations, organisations, or local communities.

Pricing has attracted the most interest. After an initial focus on carbon taxes on coal, oil and gas – levied at the mine face or at different places in the economy – recent efforts have sought to establish effective cap and trade systems for corporate emission rights. The European Union's Emission Trading System (ETS) is the most advanced system, but even this ETS has not been able to establish a stable, high and motivating quota price. Concerning legislation, examples include emission standards, mandatory requirements for the use of renewable electricity and heat, and reduced deforestation. An uncommon example of broader legislation is the United Kingdom Climate Act[1] which commits the country to reducing its national emissions at a predetermined rate up to a total cut of 80% by 2050. In addition to pricing and legislation, there are, of course, voluntary cuts beyond what is profitable and compulsory. These can be substantial and often constitute an element in corporate social responsibility (CSR) strategies or in citizen's initiatives at the city, local or even household level.

This far, neither pricing, nor legislation, nor voluntary action has been put in place at a rate which is sufficient to mitigate the impacts of climate change. Calculations show that the sum of national commitments as of 2011 will lead to a temperature increase of plus 2.5 °C by 2050, and much higher in the second part of the century (Climate Interactive, 2011). Much deeper cuts need to be agreed to, and this is the ambition of the ongoing climate negotiations.

Thus the question remains how the world could cut GHG emissions by 50% by 2050, while maintaining economic growth at historical rates of 3.5% per year.

1.4. Three strategies for cutting GHG emissions

There are three ways of splitting the task of cutting GHG emissions among the world's emitters.

1.4.1. Proportional cuts through legislation

The simplest way to cut emissions is to ask "everyone" to cut 50% by 2050, which amounts to a reduction of 1.7% per year. If all nations, cities, corporations, and households cut at this rate, global warming would be kept below 2 °C. Each emitter could use their current emissions as the basis for calculating their proportional part of the total effort. If everyone cut their emissions by 1.7% per year, irrespective of how fast they grew economically, this reduction would solve the global problem.. This strategy could be translated into milestones on a suitable time horizon, like "minus 20% by 2020." I call this strategy "proportional cuts."

The main argument against proportional cuts is that it is neither cost efficient nor fair. It is much simpler and cheaper to cut GHG emissions in some places than others. For example it is much cheaper (in euros per ton of CO_2 avoided) to reduce emissions by stopping the harvest of northern forests than by introducing electric cars. But, the simple proportional cut strategy is also seen as blatantly unfair by the less industrialised countries. Most of the current man-made CO_2 in the atmosphere has been emitted by the rich industrialised countries since preindustrial times. It is therefore argued that the poorer nations should be allowed to emit more GHG during their endeavour to overcome poverty.

1.4.2. Pricing of emissions through quota trading

In order to make the cut strategy more cost effective it is commonly proposed to base the cuts on a system of "quota trading." This strategy involves establishing a cap and trade system, which automatically picks the cheapest reduction projects and ensures that capital flows to these projects from the participants in the system. The cap equals the total number of emission rights allowed by the system at the beginning of each year. Trade occurs when each participant in the system is obliged to hand in enough emission rights every year to cover their emissions.

[1] The UK Climate Change Act 2008 is available at 〈http://www.legislation.gov.uk/ukpga/2008/27/contents〉.

The issue of fairness – the historical equity problem – can be solved by allowing some nations to operate outside the trading system (i.e., without the obligation to buy emission rights to cover their emissions). For example, one could agree that developing countries should not be required to participate before their per capita emissions have reached the same level as per capita emissions in the rich world.

But it has proved difficult to establish effective quota trading. The main problem has been political opposition – both from industry and labour – against making the cap sufficiently tight, for fear that this would threaten economic growth, employment, and poverty alleviation. The result has been so generous caps (i.e., so high ceilings) that the price of an emission right (i.e., the quota price) has remained too low to make important climate projects profitable. As an example, the quota price in the EU Emissions Trading System is expected to deliver a quota price around 20€/tCO_2e in 2020 (KLIF, 2010). This amount is below what is necessary to make wind power, electric cars, and carbon capture and storage economically competitive.

1.4.3. Voluntary reductions

The third possible strategy to cut GHG emissions is through voluntary action. This is what responsible and conscientious global players (nations, cities, corporations, and households) might choose to do even though it is neither profitable nor mandatory.

There are many reasons why emitters would take on such commitments despite the cost and the hassle. First, they may believe that proactive reductions will improve their position in the long run. Corporations may draw competitive advantage from practical experience with new technologies, and nations may reduce future costs by subsidising early shifts to green technologies. Second, emitters may think that voluntary action will improve their general reputation, and specifically help them retain attractive staff or citizens. Third emitters may cut simply because they believe this is the right thing to do.

But how far should they go? How much should they cut? This is a relevant question if the emitter is willing to move ahead of established policy. It is also the central question asked in this paper. How much must a corporation cut if it *voluntarily* wants to do its fair share of the global effort to keep global warming below 2 °C? Similarly, at the national level: How much must a nation cut if the nation wants to do its fair share of the global effort — even if there is no international agreement that divides the task among the nations?

1.5. How much is enough at the national level?

As mentioned above, the dual global ambition is to halve global GHG emissions over the next forty years, while maintaining the same growth rate in world GDP as during the last forty years.

In quantitative terms this means reducing GHG emissions by 50% from 2010 to 2050 (which is equivalent to a decline of 1.7% per year), while keeping the world economy growing at 3.5% per year in real terms. In sum, this implies a reduction of "GHG emissions per unit of GDP" by 5% per year.

This quantitative result is obtained as follows: If global GHG emissions in 2010 is defined as 1, and global GDP in 2010 is also defined as 1, the dual ambition is that GHG emissions in 2050 shall be 0.5 and that GDP in 2050 shall be 4.0 (the result of growing at the historical rate of 3.5% per year for forty years). The ratio "GHG per unit of GDP" must thereby decline from $1/1=1$ in 2010 to $0.5/4=0.125$ in 2050. The latter is equivalent to an annual decline of 5% per year for forty years.

Thus, it is simple to tell what is "enough" at the national level. If all nations pursue economic growth as they have done historically, with the same success rate, and at the same time reduce their GHG emissions per unit of GDP by 5% per year, then GHG emissions in 2050 will be 50% below current levels and the world economy 400% of current levels (four times as big as today). This could be enough to eliminate poverty and avoid dangerous global warming.

In summary, the world would make a major step towards climate stabilisation and poverty alleviation if all nations voluntarily committed to reducing their GHG emissions per unit of GDP by 5% per year, while keeping economic growth at traditional rates. Therefore cutting by 5% per year would constitute a reasonable ambition if the nation's goal was to do its fair share of the global effort.

But, although the suggested decline rate of 5% per year would suffice, there are many reasons why nations would insist on differentiated responsibilities, as I will discuss in a later section.

1.6. How much Is enough at the corporate level?

The national ambition to cut 5% per year can be translated into a resolution at the corporate level, since the nation's GDP is the sum of the value added of all of its corporations.

The corporate contribution to GDP is technically named the corporate "value added," and is defined as "total revenues less all purchases of goods and services from external suppliers." Thus the nation's GDP will grow by 3.5% per year if all of its corporations increase their value added by 3.5% per year. Similarly, a nation's GHG emission is the sum of the emissions of all of its corporations. Thus the nation's emissions would decline by 1.7% per year if all its corporations – and all its households – cut their emissions by 1.7% per year.

Notice that, for the sake of brevity, I use the word "corporation" to denote any entity (private or public, for profit or not) involved in economic activity. Thus the word "corporation" includes not only businesses, but also hospitals and universities, NGOs, and governmental agencies. Notice also that I need to include explicitly the emissions from "households" (the nation's final consumers), since they do not add to the GDP or to corporate value added, according to standard definitions.

In summary, the nation would succeed in reducing its GHG emissions per unit of GDP by 5% per year, if all its corporations reduced their GEVA by 5% per year (and all households reduced their emissions by 1.7% per year). Therefore cutting GEVA by 5% per year would constitute a reasonable ambition if the corporation's goal is to do its fair share of the global effort.

But although the suggested decline of 5% per year would suffice, there are many reasons why corporations could argue for differentiated responsibilities, as I will discuss in a later section.

2. Concepts, measurement and data

2.1. At the national level — the GHG/GDP ratio

The concept of GHG emissions and GDP are well defined and commonly used at the national level. Most nations provide annual data on their GDP according to procedures developed since World War II. Many nations measure the annual GHG emissions from their territory, using procedures developed and negotiated by the UNFCCC (UNFCCC, 2012). By dividing the two numbers, one obtains GHG emissions per unit of GDP. By following the GHG/

GDP ratio over time, one can judge whether it declines at the suggested decline rate of 5% per year.

2.1.1. Longitudinal data

Fig. 2 shows how the ratio has developed over the last forty years for five regions of the world, plus for the world total. Notice that the figure is limited to one greenhouse gas, namely CO_2, because data is lacking on most of the other 5 Kyoto-gases. But CO_2 is a reasonably good measure, since it represents some 80% of total man-made GHG emissions.

The numbers underlying Fig. 2 are highlighted in the table below, which shows that the GHG emissions per unit of GDP for the world as a total declined at 1.7% per year. Table 1

The regions varied in their performance. The industrial world reduced its GHG/GDP ratio by some 2% per year. China and BRISE (Brazil, Russia, India, South Africa and the ten biggest Emerging economies) made the fastest cuts, at around 2.8% per year. But all were far below the suggested decline rate of 5% per year.

2.1.2. A real challenge

Although it is simple to calculate the path of the GHG/GDP ratio at the national level, no region has been able to make it decline by 5% per year over the last forty years. But the goal may still be attainable. For example, the EU has committed to cut its GHG emissions by 20% from 2010 to 2020. During these ten years the EU economy would grow by 25% if past growth rates were continued. Thus, if the EU reached both goals, its GHG/GDP ratio would fall from 1/1=1 in 2010 to 0.8/1.25=0.62 in 2020. This amounts to an annual decline of 4.4% per year, and is not far from what would be the EU's "fair share" of a global effort.

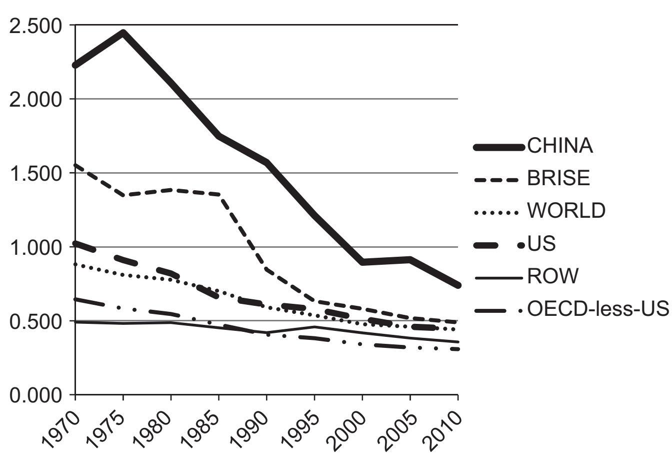

Fig. 2. GHG emissions per unit of GDP (in $kgCO_2$ per 2010-USD), five regions and the world total, 1970–2010 (Based on data from Penn World Tables and BP Statistical Review of World Energy).

Table 1
GHG per GDP in 2010, and rate of decline in GHG per GDP from 1970–2010.

Region	GHG per GDP in 2010 in $kgCO_2$ per 2010-USD	Rate of decline in GHG per GDP from 1970 to 2010 in % per year
U.S.	0.45	−2.1
OECD (less U.S.)	0.31	−1.8
China	0.74	−2.7
Brise	0.49	−2.8
Rest of world	0.36	−0.8
Sum world	**0.44**	**−1.7**

2.1.3. Common boundaries

It is important to use the same boundary for the calculation of GHG emissions and GDP. The emissions data should cover the emissions from all production involved in the gross domestic product. Emissions from tourism abroad should not be included, while emissions from visiting tourists should be. Emissions from the production of an imported car should not be included, but emissions from domestic car productions should, even if the car is exported. Absorption through photosynthesis in domestic forests should be credited to the nation. The emissions from use of the wood is (slightly illogical, but by convention) debited to the country that cut the tree.

2.1.4. Stable growth rate at global level

The global ambition of a 50% cut in GHG emissions will be achieved if all nations cut their GHG/GDP ratio by 5% per year, as long as the world economy grows at 3.5% per year. Notice the presumption that the growth rates of the individual nations will add up to a stable long-term growth rate of the world economy of 3.5% per year — in the future as in the past. Some nations will indeed grow faster, but others will grow slower than desired and planned. In the past this mixture of success led to an expansion of the world economy at 3.5% per year. If we assume the same degree of average success during the next forty years, the world economy will continue to expand at 3.5% per year. In that case, if all nations reduce their GHG/GDP ratio by 5% per year over these forty years, total GHG emissions will be 50% lower in 2050.

2.1.5. Robust decline rate

The number 5% per year is relatively robust against variations in the assumptions made. If the GDP growth rate is varied within the range from 2.5 to 4.5% per year, and the GHG reduction varied within the range from 0.2 to 0.8, the suggested decline rate in the GHG/GDP ratio varies within the range from 3.0 to 8.5% per year. Thus 5% might serve as a reasonable average guideline for voluntary action.

2.1.6. The distributional issue

Finally, there is the question of whether it makes sense to ask all nations to cut their GHG/GDP ratio at the same rate. The answer is obviously no. Most of the GHG in the current atmosphere was put there by the current rich industrialised countries, and many argue that these countries should take the lead in the effort to reduce man-made GHG emissions. The industrialised countries could do so by requiring their GHG/GDP ratio to drop faster than 5% per year. They could achieve this goal either by deeper cuts in domestic emissions or by paying for cuts abroad and including these reductions in the numerator of the GHG/GDP ratio.

There are many ways to differentiate the responsibilities among nations. For example, it has been suggested that the industrialised countries should cut their emissions by 80% by 2050, not by the 50% which I have assumed this far. In the 80% scenario, the industrialised countries would have to reduce their GHG/GDP ratio to (1–0.8)/4=0.05 by 2050, if we continue to assume an economic growth rate of 3.5% per year. This would require a decline rate of 7% per year. Thus, one solution to the distributional issue would be for the industrialised countries to cut by 7% per year and the other nations by 3% per year so that the average remains at the suggested decline rate of 5% per year. In order to manage long-term changes in wealth, one could agree to shift countries from the poor to the rich category when their GDP per person exceeds a certain threshold (for example the expected GDP per person in China in 2020).

Before concluding on what is fundamentally a political question of equity, it is important to be aware of the distributional effect of using the 5% per year decline rate for all countries. This effect is easily seen if starting from the observation that emerging economies tend to grow faster than the industrialised countries. The difference is significant. In the long run the GDP expands by around 7% per year in emerging economies and around 2% per year in the industrialised world. If both regions reduce their GHG/GDP ratio by the same 5% per year, the result is a *decline* in absolute emissions by 3% per year in the industrial world versus an *increase* in emissions by 2% per year in the emerging world. One could argue that this automatic shift in the global distribution of the emission of GHG is sufficient to counter the historical inequity.

Obviously, the discussion about how much the rich should cut is a controversial question. But there is useful guidance in the fact that if all nations cut their GHG/GDP ratio by 5% per year, global CO_2 emissions in 2050 would be 50% lower, assuming continuation of the historical GDP growth.

A totally different approach to differentiated responsibilities is based on GHG emissions *per person*, rather than per unit of GDP. This line of thought starts from the presumption that each person has the same right to emit greenhouse gases. Thus the long-term target should be equal per capita emissions in all nations. To get there, the ‘‘leading’’ nations with the highest per capita emissions would start the effort by cutting their emissions. Over the years they would gradually lower their per capita emissions, towards the level of the (still rising) per capita emissions in the rest of the world. The only obligation of those other countries would be to start cutting once their per capita emissions starts to exceed the (now falling) per capita emissions in the leading nations (Holtsmark and Randers, 2008).

2.2. At the corporate level — GEVA

It is harder to find data for GHG emissions per unit of value added at the corporate level.

2.2.1. Corporate greenhouse gas emissions

GHG emissions (in tons of CO_2 equivalents per year) are published by the Carbon Disclosure Project (CDP) for a large number of corporations (CDP, 2010). But CDP only provides data for a few recent years, so it is near impossible to find the long time series illustrated in Figs. 1 and 2 at the national level. CDP provides emissions from within three sets of corporate boundaries. ‘‘Scope 1’’ emissions are direct emissions from operations controlled by the corporation. ‘‘Scope 2’’ emissions are mainly the emissions from the electricity purchased by the corporation from external suppliers. Finally, ‘‘Scope 3’’ emissions are all upstream and downstream emissions not included in Scopes 1 and 2.[2] Ideally the data should cover all 6 Kyoto-gases, but are often limited to CO_2.

So, when calculating the GEVA for a corporation, one should only include its Scope 1 emissions, since these are the emissions that emanate from the creation of value in the corporation.

2.2.2. Corporate value added

The corporate contribution to the nation's GDP is not commonly calculated or made available, although it can be derived from the annual financial statements. The challenge is that the corporate accounts do not traditionally focus on value added, but on other measures of profitability. Economic value added is defined as the difference in economic value between the outputs and the inputs of the corporation. In accounting terms ‘‘value added’’ equals ‘‘sales revenue less the cost of goods and services purchased from external suppliers.’’ This concept is approximated by the term ‘‘Gross Profit’’ in US accounting, which is often directly available in the annual financial statement. In European accounting, value added can be calculated from basic data in the financial statements. Economic value added is approximately equal to ‘‘operating profit, i.e., earnings before interest and depreciation (EBITDA)’’ plus all ‘‘personnel costs.’’ Personnel costs should include payment to management and board members. The approximation is good as long as there are no payments to external suppliers included in the final estimate of value added.

The value added of corporations that do not sell their output (for example public hospitals or NGOs) is normally measured as the sum of all costs, less payments to external suppliers. As an example, the value added in an elderly persons' nursing home is dominated by labour and lodging costs, and typically shows little change from year to year beyond the real rise in wage costs. The direct GHG emissions are dominated by heating, cooling and transport emissions.

Long time series for the economic value added in corporations are also uncommon, but can be obtained from historical accounts, although there are problems arising from changes in the reporting boundary, which should be the same for measurement of both GHG emissions and value added.

Using value added as the denominator in GEVA (rather than for example sales) allocates responsibility for climate cuts in an unambiguous manner among corporations and organisations and avoids the problem of double counting.

2.2.3. GEVA

In those cases where data for GHG emissions (in tons of CO_2e per year) and for value added (in USD million per year) are available, it is possible to calculate GEVA — the GHG emissions per unit of value added (in kg of CO_2e per USD).

Fig. 3 shows GEVA for a number of US corporations in 2008, but once more limited to CO_2 emissions. The numbers vary greatly between industries, as would be expected, and within industries. The utilities sector produce little economic value per ton of CO_2, and have high GEVAs. The reason is that the large emissions from the production of electricity from coal and gas are counted, correctly, as Scope 1 emissions from this sector. At the other end of the spectrum, telecommunications, financial institutions, and IT have low emissions, arising largely from office operations and travel in company cars (and jets). They create much economic value per ton of Scope 1 GHG emissions. They are more carbon efficient — with smaller GEVAs.

It is very difficult to find longitudinal data on GEVA for time periods that are long enough to establish a trend. I have only succeeded in obtaining indicative data from a random sample of progressive firms. Fig. 4 shows the GEVA of BT – the British telecommunications giant – from 1997 to 2008. BT is widely seen as a leader in the sustainability field and did reduce its GEVA by 28% over these 11 years. This is equivalent to a decline of 2.9% per year, which is short of BT's ‘‘fair share’’ and which would have required a decline of 5% per year.

Fig. 5 shows the GEVA for SABMiller – the multinational brewery – from 2005–201010. SABMiller appears to have done its ‘‘fair share,’’ albeit over a shorter time period, and perhaps from a advantageous starting point.

When calculating the trend in GEVA, it is important to use numbers corrected for inflation.

Otherwise, corporate performance will look better than reality because the growth in value added is higher when measured in

[2] These concepts are defined in the Greenhouse Gas Protocol available at www.ghgprotocol.org/files/ghg-protocol-revised.pdf

Company Name	CDP Sector	CO2 emissions		Gross Profit	GEVA = Scope 1 Emissions over Gross Profit	
		(tons CO2 per year)		(million $ per year)	(kg CO2 per $)	
		Scope 1	Scope 2		Company	Sector average
American Tower	Telecommunications	431	193 465	1 204	0,000	
Qwest Communications Intl	Telecommunications	168 467	1 204 160	8 890	0,019	
Sprint Nextel	Telecommunications	68 057	2 015 217	18 889	0,004	
AT&T	Telecommunications	129 985	450 770	74 133	0,002	
Verizon Communications	Telecommunications	527 802	5 742 912	58 347	0,009	0,007
Simon Property Group	Financials	26 068	689 914	3 327	0,008	0,008
Cisco Systems	Information Technology	51 620	546 762	25 484	0,002	
Hewlett-Packard	Information Technology	303 844	2 145 534	28 443	0,011	
Advanced Micro Devices	Information Technology	84 719	354 784	2 320	0,037	
EMC	Information Technology	35 850	335 770	8 222	0,004	
Intel	Information Technology	1 000 000	2 500 000	20 844	0,048	0,020
Allergan	Health Care	45 643	58 567	3 642	0,013	
Schering-Plough	Health Care	446 987	557 157	11 195	0,040	
Biogen Idec	Health Care	49 459	47 438	3 696	0,013	
Johnson & Johnson	Health Care	356 729	970 543	45 236	0,008	
Bristol-Myers Squibb	Health Care	377 825	454 310	14 201	0,027	
Pfizer	Health Care	1 017 810	1 000 959	40 184	0,025	0,021
Wal-Mart Stores	Consumer Staples	5 566 006	15 500 950	99 449	0,056	
Dean Foods	Consumer Staples	884 448	765 605	2 945	0,300	
Colgate-Palmolive	Consumer Staples	271 599	429 992	8 626	0,031	
H.J. Heinz	Consumer Staples	524 606	338 526	3 681	0,143	
Estee Lauder	Consumer Staples	36 600	91 400	5 914	0,006	
Molson Coors Brewing	Consumer Staples	680 831	437 805	1 934	0,352	0,148
Boeing*	Industrials	575 000	1 104 000	12 985	0,044	
Burlington Northern Santa Fe	Industrials	14 889 927	323 267	11 242	1,324	
Eaton	Industrials	122 000	726 000	4 185	0,029	
United Parcel Service	Industrials	12 148 866	1 105 134	39 608	0,307	
United Technologies Corp	Industrials	968 080	1 113 827	16 120	0,060	0,353
Chevron	Energy	62 978 970	5 216 351	80 813	0,779	
Spectra Energy	Energy	9 614 164	1 421 690	3 488	2,756	
Hess	Energy	10 714 780	574 092	9 698	1,105	
Anadarko Petroleum	Energy	8 284 413	641 458	13 266	0,624	
Transocean	Energy	2 148 208	4 762	7 319	0,294	0,353
Carnival	Consumer Discretionary	10 247 517	50 748	5 607	1,828	
News Corporation	Consumer Discretionary	108 931	527 343	5 381	0,020	
Stanley Works	Consumer Discretionary	50 746	162 190	1 671	0,030	
Limited Brands	Consumer Discretionary	31 631	353 377	3 542	0,009	
Darden Restaurants	Consumer Discretionary	324 835	750 388	1 488	0,218	
Johnson Controls	Consumer Discretionary	458 324	1 256 307	5 526	0,083	0,365
Praxair	Materials	3 695 830	9 732 516	4 301	0,859	
PPG Industries	Materials	4 442 743	1 805 521	5 694	0,780	
E.I. du Pont de Nemours	Materials	9 336 753	4 002 807	7 753	1,204	
Air Products & Chemicals	Materials	12 300 000	8 900 000	2 721	4,520	
Newmont Mining	Materials	4 138 189	1 187 354	3 055	1,355	1,744
PG&E	Utilities	1 903 901	1 535 505	8 113	0,235	
Public Service Enterprise Group	Utilities	24 287 856	1 851 103	6 027	4,030	
Pepco Holdings	Utilities	2 959 112	79 756	2 411	1,227	
Xcel Energy	Utilities	62 650 466	59 397	4 401	14,234	
DTE Energy	Utilities	41 800 000	445 000	5 023	8,322	5,610
					Overall average	0,968

Fig. 3. Greenhouse gas emissions per unit of value added (in kg CO_2 per USD), US Corporations 2008 (Thanks to Rich Baltimore of ClearCarbon Consulting Inc for having provided this data).

nominal money. The spurious improvement can be significant relative to the target of minus 5% per year.

A third estimate of past corporate GEVA performance is more indirect. The Carbon Disclosure Project has done various surveys of corporate climate policy. In one survey they investigated the use of intensity indicators among the world's 100 largest companies (CDP, 2009). CDP found that one third of the companies in the survey had established GHG emissions targets on an intensity basis - typically per unit of revenue, per ton of production, or per employee — instead of in absolute terms. These companies were expecting to reduce their GHG emissions per unit of sales by 3.3% per year on average — impressive, but still short

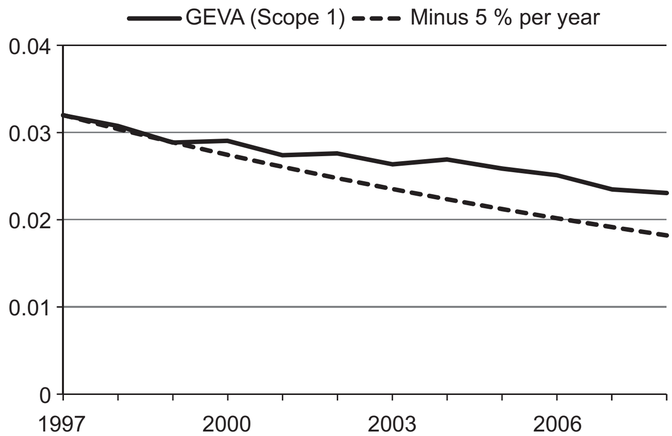

Fig. 4. Greenhouse gas emissions per unit of value added (in $kgCO_2e$ per 2010-£), British Telecom, Scope 1, 1997–2008 (Thanks to Chris Tuppen of Advancing Sustainability LLP who undertook the big effort of collecting the data in Figs. 4, 6 and 7 in 2008 while Chief Sustainability Officer of BT).

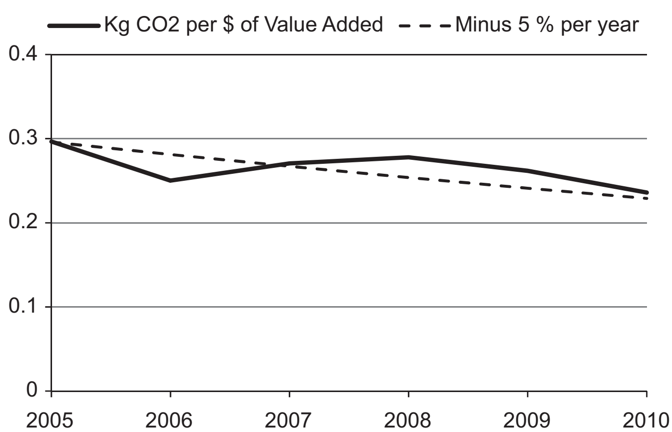

Fig. 5. CO_2 emissions per unit of value added (in $kgCO_2$ per 2010-USD), SABMiller, Scope 1, 2005–2010 (Thanks to Peter Koegler of SABMiller for obtaining the data in Fig. 5).

of the target of minus 5% per year. They planned to achieve their 3.3% per year through future growth rates (in sales) of 2.6% per year and absolute reductions of 0.7% per year.

3. Discussion

GEVA is well defined and can be measured at the corporate level, but this in not yet commonly done. Below we discuss a number of issues related to the use of GEVA as a corporate guide to voluntary climate action.

3.1. Scope 1 avoids double counting

The main reason to focus solely on Scope 1 emissions when calculating GEVA is that Scope 1 emissions of all corporations add up to national emissions. One avoids double counting — for example of the double counting of the emissions from the energy sector if the users of the energy also include their Scope 2 emissions in their report. It is important to notice, again, that one must include separately the GHG emissions from final consumers — those that do not create value, but still burns fossil fuels or emit GHG in other ways.

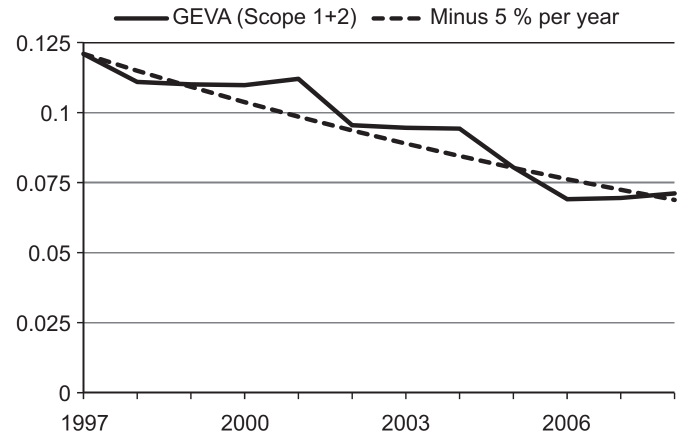

Fig. 6. Greenhouse gas emissions per unit of value added (in kg CO_2e per 2010-£), British Telecom, Scope 1+2, 1997–2008.

If Scope 2 emissions were included in GEVA, the emissions from the nation's utilities would be counted twice. This problem could be avoided by excluding all utilities from the GEVA reporting requirement, and ask all other corporations to report on the sum of Scope 1 and Scope 2 emissions. But then it would become unclear what denominator to use when establishing the national target for the GHG/GDP ratio. The recommended decline rate would depend on whether one used "GDP" or "GDP less GDP of utility sector" in the denominator.

So, focusing on "Scope 1 emissions" is intellectually rigorous and avoids double counting, but has another drawback. Using GEVA based on Scope 1 would most likely reduce the corporate incentive to cut Scope 2 emissions. A "political" compromise might be to ask everyone to report on Scope 1+2 emissions per unit of value added and keep the desired decline rate of 5% per year. This would be slightly illogical, but still provide a corporate guide for voluntary climate action.

Fig. 6 shows a modified GEVA based on Scope 1+2 for BT from 1997 to 2008. The modified GEVA declines faster than GEVA based on Scope 1 in Fig. 4. The reason is BT's huge shift towards low-carbon energy during the measurement period. As a consequence BT did succeed in cutting the modified GEVA by the desired decline rate of 5% per year.

3.2. Value added is rarely used

This paper focuses on value added because the nation's GDP is the sum of the value added of all its corporations. Although value added is the central concept in GDP, value added is surprisingly unknown in the corporate world and among business economists. Few seem to be aware that "gross profit" in US accounts is the same as value added. It will take time to make value added as familiar as other denominators like "per sales," "per ton of production," or "per USD of operating profit." A slightly illogical compromise would be to use data for "emissions per unit of revenue" or "emissions per unit of operating profit."

3.3. Long time series are required

Value added is always less than revenue (by the amount paid for goods and services purchased from external suppliers). Value added can be seen as a fraction of revenue, and may fluctuate from year to year. Emissions, on the other hand, are rooted in the corporate technology and proportional to slowly changing production rates.

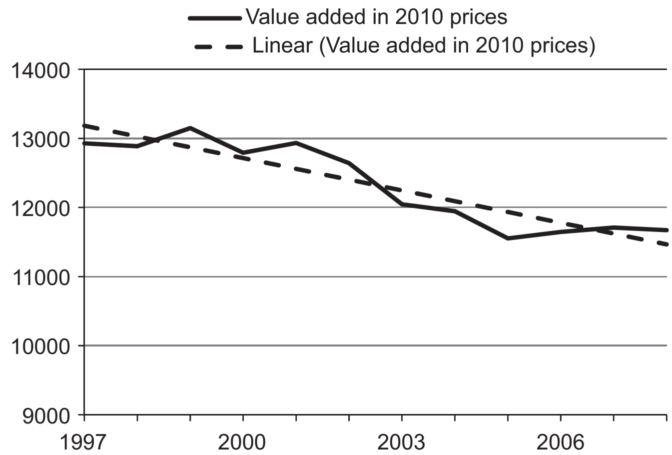

Fig. 7. Economic value added (in 2010-£ per year), British Telecom, 1997–2008.

As a consequence, GEVA may show spurious variation from year to year. Data from several years may be necessary to establish a clear trend. Fig. 7 illustrates this phenomenon for BT. There is a clear trend,[3] but the annual values of GEVA deviate from the trend. The fluctuation is not excessive, but still the annual variation might make GEVA unsuitable as a basis for management compensation. Compensation might better be based on the long-term trend.

3.4. *Suggests a definition of fair share*

Any corporation that cut its GEVA by 5% per year can argue it is doing its "fair share" of the global effort to stabilise the climate and help solve world poverty.

Still, the critic will make the point that absolute emissions from a corporation will increase if it grows by more than 3.5% per year. If the company succeeds in reducing its GEVA by 5% per year, but grows at 7% per year in the process, its GHG emissions will increase by 2% per year.

This does not invalidate the conclusion of this paper, because corporations *on average* will only grow at 3.5% per year. It is true that some corporations will grow faster then 3.5% per year and increase their absolute emissions. But others will grow less fast, or even decline, and reduce their absolute emissions. The total value added of all corporations will, per my central assumption, increase by 3.5% per year.

3.5. *Gives room for corporate growth*

It is simpler for a corporation to commit to reduction of an intensity measure like GEVA, than to commit to absolute emission cuts. This is because the intensity measure gives the corporation room for future growth, be it endogenously or through mergers and acquisitions. When a company grows, its emissions normally grow. And since most corporations seek to expand, most corporations are worried about committing to constant emissions and – even worse – to declining emissions. It is much simpler to commit to declining intensities, like for example a decline in GEVA. The corporation can commit to the suggested decline rate of 5% per year in GEVA, argue it is doing its fair share, and proceed to grow as fast as desirable.

This flexibility increases the likelihood that corporations will commit to measure GEVA, seek to reduce its value by minus 5% per year, and report on performance. This conclusion is supported by the fact that numerous firms already report on corporate intensity performance – albeit with sales in the denominator – in CDP's Global 500 Carbon Disclosure Leadership Index (CDP, 2010).

3.6. *No need to adjust the target*

A consequence of the preceding point is that the corporation does not need to adjust its target for GHG reduction even if it happens to grow faster than anticipated. The target to achieve a certain decline rate in GEVA – for example 5% per year – can be maintained. This makes it simpler for corporations to commit to reducing GEVA than to promise absolute cuts in GHG emissions. GEVA is an intensity indicator that does not need to be revised even if the company grows.

If the company prefers to decide on and communicate an absolute emission cut, this absolute goal can easily be translated into a commitment to reduce its GEVA. For example, if the company wants to cut emissions by 20% from 2010 to 2020 (i.e., by minus 2% per year), and expects to double its value added in the same period (i.e., by plus 7% per year), it implicitly commits to a decline rate in GEVA of 9% per year.

3.7. *Guides investors toward low-carbon corporations*

GEVA tells how much economic value the corporation creates for every ton of GHG emitted.

Thus GEVA is a useful indicator in a carbon-constrained world, where it will be important to create as much value as possible for each ton of GHG emitted.

A corporation which creates more value per ton of GHG can be argued to be more sustainable, in the sense that it utilises a limited resource in a more efficient way. Thus a corporation with a low GEVA – both absolute and relative to competitors – is likely to be more sustainable (or at least less unsustainable). Thus GEVA numbers may be a useful guide for long-term investors seeking both more climate friendly and more sustainable operations.[4]

For the investor it is furthermore helpful to use value added as the denominator in an indicator, rather than using the more common denominator of sales. Using value added as the denominator helps allocate the responsibility for climate cuts (or other impacts) to its proper place in the value chain. Using value added as the foundation leads to an unambiguous distribution of "guilt" among the corporations and organisations, and avoids the problem of double counting. The principle is the same as when computing the value added tax.

Corporations could further guide investors toward sustainability by publishing other impacts (water use, oil consumption, mercury emissions, etc) per unit of value added, as illustrated by Tomra of Norway (Tomra, 2010).

3.8. *Not cost efficient*

Notice that GEVA does not provide a guide toward cost efficient climate action. GEVA indicates where one is getting most economic value created for each ton of GHG emitted. It does not point towards the cheapest projects if the goal is to reduce emissions in a cost efficient manner. For this latter purpose, one needs to know the cost of reducing emissions in various ways. Many such lists exist — expressing the reduction cost in USD per ton of CO_2e. McKinsey and Co., 2010 is a good example.

[3] It is interesting that the value added of BT declined over this decade, but not surprising given the huge divestitures during the period.

[4] Others have suggested other indicators to guide investors toward higher societal value, see for instance Simon Thomas et al., "Integrated environmental and financial performance indicators", Corporate Governance, Vol 3 No 15, page 421, 2009.

3.9. Potential for differentiation

Finally, there is the question of whether to use the same suggested decline rate for all the world's corporations. The answer is deeply political and the logic as in the discussion of national differentiation earlier in the paper.

It is of course possible to argue in favour of stricter requirements for particular corporations. For example for the big, or for the multinationals, or for those owned by rich country investors, or for those headquartered in rich countries, and so on. But any such differentiation is difficult, because it invites evasion.

Before deciding on differentiation it is important to consider the automatic effect on distribution effect of applying the same 5% per year decline rate in GEVA to all corporations. The (intended) effect is to allow fast growing firms to increase their absolute emissions, while requiring slow growing firms to reduce theirs. This amounts, in turn, to enabling a shift from dying to growing industries — even when total emissions decline. It also amounts to shifting GHG emissions to regions with many fast growing firms — exemplified by the emerging regions discussed earlier in the paper.

In summary it appears difficult to differentiate and GEVA may well be best suited as a guide to voluntary action in progressive firms who want to do more than required by legislation.

4. Implementation

4.1. Voluntary action

The original intention of the work reported in this paper was to develop a corporate indicator that could be used as a guide by progressive firms that wanted to decide on the appropriate target for their voluntary climate policy. The intention was to assist corporations who wanted to move ahead of a potential binding international climate framework and potential national legislation. Such progressive firms often asked: What is a reasonable target? What would be our fair share of the global effort? How much do we need to burden ourselves in order to be able to say we have done our bit?

The suggested answer, namely to reduce the corporate GEVA by 5% per year, was discussed in the preceding pages. The corporate answer was supplemented by a guideline for voluntary action at the national level, namely a suggested decline in the GHG/GDP ratio of 5% per year.

The presumption was that the use of GEVA and the GHG/GDP ratio would take the form of voluntary measurement and public reporting. At the end of each year, progressive corporations would measure their Scope 1 emissions and their value added during the year. They would calculate their GEVA for the year and add it to the history of earlier GEVA values in their non-financial reports. Once the time series was sufficiently long to define a trend in GEVA, they would calculate its slope and compare the decline rate with the corporate target, for example minus 5% per year, and report on the result. Similarly the national statistical office each year would collect data for national GHG emissions and national GDP during the last year, divide the two, add it to earlier values of the GHG/GDP ratio, establish a trend and report on the decline rate of this trend in the statistical yearbook.

There does not exist much incentive to do all this work, beyond the rare corporate and national desire to be progressive and forward looking for one reason or the other, as detailed earlier in this paper. As a consequence, such reporting is not yet common practice. At the national level, the underlying data sometimes exist, but is not yet routinely combined into time series of the GHG/GDP ratio.

4.2. Current examples

At the corporate level, the numbers are harder to obtain, and very few corporations have chosen to report on its impacts (including GHG emissions) per unit of value added. This is in spite of the intellectual rigour involved in such reporting, the unambiguous distribution of blame along the value chain, and the flexibility it provides for the growth oriented manager.

There seem to be a few exceptions. UK's BT plc, which publishes its "climate stabilisation index," defined as Scope $1+2+3$ emissions divided by its economic value added defined as EBITDA plus salary costs. BT furthermore has established goals for this index (BT, 2010). Tomra of Norway has presented its environmental impacts (including Scope $1+2$ emissions) per unit of value added for a number of years (Tomra, 2010). Autodesk Inc in California compares its annual Scope $1+2+3$ emissions per unit of value added with the decline rate necessary to reach its corporate climate goal for 2050. This decline rate proves to be minus 9% per year. This high target is partly explained by the fact that Autodesk does not correct its sales for inflation (Stewart and Deodhar, 2010).

4.3. Engaging civil society

If the necessary data were publicly available, civil society and others could use the data to highlight whether a nation or corporation is doing its fair share.

One way to increase the corporate and national incentive to measure and report GEVA and GHG/GDP ratio would be to copy the success of the Carbon Disclosure Project in coercing well-known corporations to measure and report on their climate gas emissions. CDP simply asks the largest corporations in the world to provide their emission numbers, and then proceeds to publish the response. If a corporation does not respond, this is conspicuously highlighted in the CDP annual report. As a consequence of this public blaming tactics, it did not take many years before most respectable corporations did indeed measure and report their climate gas emissions. This action, in turn, made it possible for CDP to up the pressure by highlighting corporations with growing emissions.

One expansion on this technique might be to have the CDP publish GEVA numbers along with the emission numbers. And after some years, calculate the trend, compare it to the suggested decline rate of 5% per year, and publicise the result. This would only require one more box in the CDP questionnaire, asking for the corporation's economic value added in the reporting year. CDP has hesitated for fear that the extra burden would stop corporations from supplying the emissions data. But CDP or other civil society activists could dramatically increase the motivation of corporations to measure and report their GEVA. A third party beneficiary would be the investor community who could use the GEVA listings to pick companies that produce much economic value per ton of GHG emissions.

A similar tactic would be to try to include GEVA in the Global Reporting Initiative's core set of indicators. This is, however, a much longer uphill struggle, because of the consensus nature of GRI decision making. Or one could try to make GEVA reporting part of the charter of the UN Global Compact, but again this is probably impossible because it breaks with the general nature of the charter.

4.4. Passing legislation

The most direct route would be to establish new legislation which made it mandatory to report on GEVA as part of mandatory non-financial reporting — and obligatory to publish the GHG/GDP ratio routinely in national statistics. But since there are few short term advantages for anyone in this amount of "increased bureaucracy," I believe such initiatives would fail. This is even more so for legislation that would require corporations to reduce their GEVA by 5% per year, and with penalties if they do not.

5. Conclusion

It is unlikely that legislation for mandatory measurement and reporting of corporate GEVA and the national GHG/GDP ratio will come forth over the next decade.

The practical utility of GEVA is therefore likely to remain as a corporate guide to calibrate voluntary action in progressive firms that want to move ahead of current legislation. In such cases GEVA can act as a rational basis for the corporation's climate policy. The absolute value of the corporation's GEVA and its development over time will also help guide investors to identify corporations that are likely to do well in a carbon-constrained future.

The suggestion to cut the national GHG/GDP ratio by 5% per year can similarly be used to calibrate national climate policy. But since it is unlikely that international agreement will be reached to this end anytime soon, the GHG/GDP ratio is likely to remain as a guide to the voluntary climate policy of progressive nations that want to move ahead of international agreements.

It certainly would accelerate implementation if civil society chose GEVA and the GHG/GDP ratio as their standard metric to evaluate the climate policy of corporations and nations, respectively, gradually making them known in the public and gradually making it less acceptable for emitters to escape routine reporting of these performance indicators.

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