NC STATE UNIVERSITY

Department of Accounting

Poole College of Management
Campus Box 8113
Raleigh, NC 27695-8113
poole.ncsu.edu/accounting
919.515.4430 (phone)
919.515.4446 (fax)

January 11, 2018

Director of Research
2017 Public Comment Period
Sustainability Accounting Standards Board
1045 Sansome St., Suite 450
San Francisco, CA 94111

Dear Sir/Madam:

We are responding to your invitation to provide feedback on the exposure drafts of Proposed Changes to the Provisional Standards. The following comments apply to all metrics for sustainability aspects for which the proposed standards require or recommend the disclosure of absolute quantities that registrants also are likely to normalize for variations in activity level. As a result**, these comments are relevant to the Exposure Drafts of substantially in all industries across all industry sectors**. To illustrate the problem with current disclosure practices that can be corrected by additions to the Provisional Standards, we will refer to the exposure drafts of the **Non-Alcoholic Beverages Industry (SICS #FB0201)** and the **Alcoholic Beverages (SICS #FB0202) Industry in the Food & Beverages Sector**.

For Non-Alcoholic Beverages, the specific standards and metrics addressed are:

- FB0201-01 Energy & Fleet Fuel Management – Operational energy consumed in gigajoules
- FB0201-03 Water Management – (1) Total water withdrawn and (2) Total water consumed in cubic meters
    - FB0201-04.24 requires the disclosure of any water management targets and an analysis of performance against those targets (note that many companies set targets for company-wide average normalized metrics)
    - FB0201-04.25 requires the disclosure of percentage reduction from the base year of water management targets
- FB0201-11 Packaging Lifecycle Management – Total weight of packaging purchased in metric tons
    - FB0201-11.60 recommends the disclosure of any packaging-related targets and performance against those targets (note that many companies set targets for company-wide average normalized metrics)

For Alcoholic Beverages, the specific standards and metrics addressed are:

- FB0202-01 Energy Management – Total energy consumed in gigajoules
- FB0202-02 Water Management – (1) Total water withdrawn and (2) Total water consumed in cubic meters
    - FB0202-03.17 requires the disclosure of any water management targets and an analysis of performance against those targets (note that many companies set targets for company-wide average normalized metrics)

    - FB0202-03.18 requires the disclosure of percentage reduction from the base year of water management targets
- FB0202-08 Packaging Lifecycle Management – Total weight of packaging purchased in metric tons
    - FB0201-09.48 recommends the disclosure of any packaging-related targets and performance against those targets (note that many companies set targets for company-wide average normalized metrics)

Who we are and the background for our recommendations

The signers of this comment letter are a group of accounting faculty at North Carolina State University and a sustainability manager formerly employed by Bacardi Limited. Our comments are based on five years of research directed to improving the measurement and interpretation of average "efficiency" and "intensity" metrics for sustainability aspects (company-wide average measures). This research was conducted with financial support from the Institute of Management Accountants (IMA) and the cooperation of Bacardi Limited, a leading international alcoholic beverage company. See attachment for brief bios of each coauthor.

Our research results were published in 2015 by the IMA Research Foundation (Institute of Management Accountants) in a report titled "Flexible Budgeting Applied to Sustainability Measurements." In addition, our findings and recommendations for practice have been published widely in environmental, accounting, and management journals including a current series of online publications by the American Institute of Certified Public Accountants. The references at the end of this comment letter provide many examples of the flexible budgeting methodology applied to a range of simple and complex reporting situations.

Overview of the issue

The primary focus of this comment letter is on an existing practice error that many, if not most, reporting companies make in their disclosures of "intensity" and "efficiency improvement" metrics for sustainability aspects. Specifically, many companies are erroneously describing and interpreting changes in normalized intensity measures (e.g., average cubic meters of water consumed per unit of output) as measures of efficiency improvement. Sustainability reports commonly compare average intensity measures in the current year to the prior year or to a base year. Companies frequently present the relevant data in charts and tables that display annual intensity measurements for sustainability aspects.

The Proposed Standards for the beverage industries require the disclosure of absolute measures of three sustainability aspects: metric tons of CO_2 emissions, gigajoules of energy consumed, and cubic meters of water consumed and withdrawn. In addition, the Proposed Standards advocate disclosure of (1) normalized measures in addition to absolute measures and (2) activity metrics that support stakeholder calculation of normalized measures. For the beverage industries, FB0201-03 and FB0202-2 require the disclosure of these data where targets have been established. We will address three limitations of the Proposed Standards regarding these metrics.

First, absolute metrics and intensity metrics for sustainability aspects are not required to be accompanied by disclosures that are adequate for useful interpretation of changes in those measures over time. Second, the Proposed Standards recommend, but do not require, that companies present intensity measurements. This is a serious limitation of the usefulness of

disclosures because comparisons among industry peers are almost meaningless without normalization for size differences. Further, many, if not most, disclosures that companies voluntarily make of intensity metrics misinterpret the percentage changes in intensity as measures of "efficiency" improvement. Changes in the efficiency of managing resource consumption and emissions are essential measures of a company's sustainability performance. To provide more useful measures of performance and assure the correct measurement of efficiency improvement, the Proposed Standards should require and specify the correct calculation of changes in sustainability efficiency.

Improvement in efficiency for key sustainability aspects is a critical measure for evaluation of a company's sustainability performance. To be clear, "efficiency" is a measure of the effectiveness of a company's utilization of resources and avoidance of the generation of waste and emissions. Improvement in efficiency is the result of a company making physical or procedural improvements in its processes, eliminating waste and more effectively using its facilities and resources to produce goods and services.

This comment letter will describe how changes in average intensity are driven by several confounding factors in addition to efficiency. As a result, it is erroneous to describe an improvement in a company's average intensity for a sustainability aspect as an improvement in efficiency. The deficiency in interpreting changes in average intensity as a measure of efficiency improvement is that changes in intensity are the product of several confounding factors. For example, a change in energy intensity measured as average gigajoules energy consumed per unit of production could be the result of changes in the actual efficiency of a company's operating processes, and any of the following:

- Changes in product demand that cause shifts in production among products with differing energy intensities (product mix changes)
- Changes in factory utilization (caused by changes in production volume) when some portion of energy consumption is fixed during the relevant time frame (note that like fixed costs, there are fixed components of many sustainability aspects)
- Outsourcing and insourcing elements of the production process
- Acquisitions and divestitures of product lines.

We emphasize that although intensity measurements are useful, changes in intensity are rarely accurate measures of efficiency improvement. In this comment letter, we illustrate how proven flexible-budgeting calculations can be applied to intensity metrics to derive accurate measures of efficiency improvement for sustainability aspects. In addition, we show why additional disclosures are necessary to allow meaningful interpretation of changes in a company's absolute measures of sustainability aspects, e.g., total gigajoules of energy consumed.

An Illustration of the difference between intensity and efficiency improvement

We use a simple case drawn from our "Flexible Budgeting Applied to Sustainability Measurements" report to the IMA to demonstrate that annual changes in average (aggregate) absolute and normalized measures of a sustainability aspect do not measure the change in its average efficiency. Consider a company's measurement of a single sustainability aspect (energy consumption) for two products, A and B. For simplicity, total production of A and B remains constant at 200 units while the efficiency of energy consumption improves for both A and B from the Base Year to Year S.

Base Year Information:
Product A: 1 unit of energy is required to produce 1 unit of Product A
Product B: 2 units of energy are required to produce 1 unit of Product B
Actual production: 100 units of Product A and 100 units of Product B

Assume that between the Base Year and Year S, the product mix shifts from the more energy intensive product B to the less energy intensive A. In addition, energy efficiency improves 20% for product A and 10% for B. The following data summarize these measurements:

	Base Year			Year S		
Product	Production	Energy Used	Intensity	Production	Energy Used	Intensity
Product A	100	100	1.0	150	120	0.8
Product B	100	200	2.0	50	90	1.8
Total	200	300	1.5	200	210	1.05
Change in Absolute Total Energy Used					-90	
% Change in Absolute Total Energy Used					-30%	= (210 - 300) / 300
Change in Intensity						-30%
						= (1.05 - 1.5) / 1.5

Both the total energy used, and the intensity of energy usage decrease 30% by the end of Year S. However, it is apparent that these percentage changes do not measure the average change in energy efficiency. For the individual products, there is an efficiency improvement of 20% for product A (intensity reduced from 1.0 to 0.8) and 10% for B (intensity reduced from 2.0 to 1.8). Therefore, one expects the average efficiency improvement to be between 10% and 20%. Clearly, neither the change in absolute energy or in energy intensity provides useful guidance regarding the actual change in aggregate efficiency. The 30% decreases in both measures fall outside the expected range of 10-20% efficiency improvement.

It is important to emphasize that we are not saying the changes in the absolute quantities and average intensity of sustainability aspects are not relevant to stakeholders. Rather, the distortion is that these metrics often fail to accurately measure the improvement in a company's efficiency in managing sustainability aspects. In our example, the reduction in average intensity is a good outcome, but it should not be interpreted as a measure of the company's successful efforts to improve energy efficiency.

The Greenhouse Gas Protocol recognizes the problem of confounding factors on intensity metrics, but it does not provide guidance on the correct calculation of efficiency improvement. Most companies are voluntarily providing intensity metrics typically reporting the intensity measure in a base year and all subsequent years. Many set single and multiple-year performance goals and track the changes in intensity as they make progress toward the goals. This is an excellent practice except that companies also describe the percentage change in intensity as an improvement or reduction in efficiency. With rare exceptions, very few companies recognize the problem by explaining that the change in an absolute or an average intensity measure was influenced by confounding factors such as changes in the relative volume of activity among business units and product lines, changes in facility utilization, acquisitions, divestitures, insourcing and outsourcing.

Even companies with sustainability performance measurements and disclosures that are recognized as outstanding mistakenly equate a change in sustainability aspect intensity as a measure of the change in the efficiency of their operations. For example, Coca-Cola Company reports that it has used water more efficiently in its global operations, showing a 27% improvement of water intensity (liters of water used to make 1 liter of a product) since 2004 (p.13, 2016 Sustainability Report, Coca-Cola Company). Coca-Cola unknowingly misinterprets its water intensity change as an accurate measure of efficiency improvement. It is likely that over the previous 12 years, Coca-Cola experienced some significant changes in product demand, production processes, or factory utilization that distort average intensity improvement as a measure of efficiency. Coca-Cola's summary table of its performance for water intensity is attached at the end of these comments (see Appendix 1).

Limitations of the Proposed Standards and Recommendations for Improvement

Normalized performance data is essential to the ability of financial statement users to make comparisons of performance across companies and industries. When companies disclose only absolute sustainability measures (e.g., gigajoules, cubic meters, metric tons), meaningful time-series and cross-sectional comparisons are very difficult because of differences in size/volume of activities among companies. The reporting guidelines of most international sustainability organizations recommend the disclosure of both absolute quantity and intensity metrics for material sustainability aspects. The importance of improvement in efficiency as a measure of sustainability performance is demonstrated by the frequency of voluntary disclosures of "efficiency" that companies currently make in their sustainability reports.

The SASB's Proposed Standards "recognize(s) that normalizing accounting metrics is important for analysis of SASB disclosures," and recommend that beverage companies make a minimum disclosure of the volume of products sold, the number of production facilities, and the total fleet road miles driven. However, the recommended disclosures in the Proposed Standards will not be adequate for stakeholders to make correct normalization calculations. Further, additional confounding factors potentially are introduced by suggesting that activity metrics from Form 10-K such as revenue and EBITDA useful to normalize sustainability aspects. Unfortunately, providing aggregate activity measures without product and service line data will not enable stakeholders to accurately calculate the efficiency measure. Further, validating the use of revenue and EBITDA ignores the additional influence of changes in prices, currency translation rates[1] and operating expenses.

A related problem is that the Proposed Standards require companies to present absolute measures of sustainability aspects without also disclosing the quantitative or directional impacts of the confounding factors we have identified. This leaves stakeholders uncertain about the success of a company's sustainability efforts. For example, does a decrease in absolute energy consumption and average intensity result from a successful program for improving energy efficiency or from some other factor such as outsourcing the most energy intensity part of the company's production process to a supplier that may be even less efficient?

[1] This distortion was highlighted in "Proposing Constant Currency as a Revenue-Based Denominator to Measure Greenhouse Gas Intensity: A Case Study from the Industrial Gasses Sector" published in *The Journal of Environmental Investing,* September 2017.

Research we have conducted demonstrates how concepts routinely applied to product costs in managerial accounting can be applied easily to physical sustainability metrics to control for external factors that confound intensity measures. Bacardi Limited was the first company we are aware of applying the flexible budgeting methodology in external sustainability reports, and our research team worked closely with the company in refining and validating the methodology. Fortunately, the managerial accounting staff in every company should be familiar with flexible budgeting and the necessary calculations. In addition, the application of flexible budgeting will almost always eliminate the need to use revenue or EBITDA as the common activity metric for multiple product lines.

This comment letter strongly supports additional SASB standards (for all industries) requiring, or at a minimum recommending that:

- In addition to the current requirements for disclosing absolute sustainability measures, companies also disclose normalized intensity measures, the method used to normalize, and the annual efficiency improvement achieved for each.
- In the absence of a requirement to disclose efficiency improvement measures, require disclosures indicating that changes in the absolute amounts and in average intensity metrics cannot be interpreted as measures of efficiency improvement.
- The standards eliminate the existing confusion about the correct calculation of efficiency improvement by including specific computational guidance.
- In the absence of the operating data necessary to calculate normalized intensity measures, companies should disclose any material changes in operations that have influenced their absolute measures (e.g., the increase in absolute energy consumption is partially the result of a shift in demand to a more energy intensive product).
- The use of revenues and EBDITA as measures of activity should be discouraged because they introduce additional confounding variation from changes in pricing, foreign exchange rates, and cost structure (in the case of EBDITA). Although these metrics have the benefit of providing a single activity measure for all business units, the efficiency metric we are recommending provides the same benefits of aggregation without the accompanying distortions.

Background of the development of flexible budgeting for the measurement of efficiency improvement for sustainability aspects and a complex example

Bacardi Limited first recognized the failure of changes in absolute and average intensity measures to accurately measure changes in its operational efficiency when the bottling operations of a major beverage product line was moved to a contract manufacturer. The product bottling business unit had a lower average water intensity than distilling. The computational impact on average water intensity was a much larger reduction in the denominator (units of bottled product) than in the numerator (resource consumed) causing average water intensity to increase. Bacardi's sustainability staff recognized that this was not an accurate measurement of its sustainability efforts because the water intensity of the production processes for both product lines had been reduced.

Working with accounting faculty at North Carolina State University, Bacardi Limited solved its measurement problem by applying the flexible budgeting methodology to the measurement of average efficiency improvements for sustainability aspects. This is the same methodology that has long been applied in managerial accounting to accurately measure cost efficiency in

production processes. The current practice problem with the calculation and interpretation of company-wide average intensity metrics may be the result of a lack of engagement by managerial accounting professionals in the development of sustainability metrics. Sustainability aspect measurements and reporting are normally made by sustainability professionals who are less familiar with some the complex interpretation issues that aggregated measurements often present. Fortunately, managerial accountants have addressed the same issues in the context of average cost calculations, and the flexible budgeting methodology they developed is a proven and widely-accepted solution.

Most large companies are diverse and dynamic entities with many activities that contribute toward resource consumption and waste creation. Over time, these companies typically experience material changes in the scale of their operations as well as the mix of products and services offered. Outsourcing, in-sourcing and change in facility utilization routinely accompany these changes. As a result, most registrants face the same measurement problems as Bacardi Limited in reporting average improvements in sustainability efficiency.

Flexible budgeting effectively eliminates all the distortional effects previously discussed, providing an accurate measurement of a company's overall performance for each sustainability aspect. For example, to measure overall water use efficiency, a company needs to measure the water use for each activity (or product) in a base year (or simply the prior year). If a significant portion of water consumption is fixed relative to volume, the fixed and variable factors should be measured separately. In any subsequent year, the total water used by each activity is compiled and compared to the flexible-budget quantity of water. The flexible-budget quantity is calculated by applying the base-year fixed amount and the base-year variable factors to the current-year activity level. In effect, the "flexible budget" *is the quantity of water that would be used in the current-year, assuming there is no change in efficiency.* The actual water usage in the current-year is compared to the budgeted quantity revealing the actual improvement or decrease in efficiency. For convenience, water usage in both the base year and the current year are converted to an index for disclosure.

To demonstrate the flexible budgeting methodology, we use a more complex example that is drawn from our 2017 article in the *Journal of Applied Corporate Finance*. A company has three divisions that produce Devices A & B, Widgets, and Wonder Dust; and it reports total water use and the average intensity of water use for the whole company. The divisions have differing physical measures of output activity. Because the company does not use flexible budgeting, average intensity is calculated using dollars of revenue as the common activity measurement for normalization. In all years analyzed, Widgets and both Devices sell for $20 each while Wonder Dust sells for $100 per ton.

Small improvements in water use efficiency were achieved for all product lines since the base year. Widget water efficiency improved by 3%, Wonder Dust water efficiency improved by 2%, and Device water efficiency improved by 1%. Because all product lines improved by at least 1%, but no more than 3%, we know that overall corporate efficiency improvement must fall within this range. Further, because the production of Device A requires the largest use of water and that activity achieved 1% improvement, our overall corporate improvement is expected to be near the low end of the range, i.e., slightly higher than 1%.

Examining the data in the following table, you will see that average intensity shows a 26.8% "improvement." Let's explore how such a number gets reported.

The flexible budget method versus average intensity

The example includes two confounding factors in the measurement of water efficiency: changes in product mix and a change in facility utilization (the volume of production) for Wonder Dust which has a large fixed component that is not subject to reduction in its water use. The operating data for all products in the Base Year are displayed in the following table. Average intensity is calculated based on total revenues and, as shown below, is 81.3 Liters per $1,000. The water use rate factors are determined for each product line and listed in the two columns at the far right of the table.

BASE YEAR

Product	Step	Output Units	Output	Price $/Unit	Rev ($000)	Water, L	Fixed Water, L	Variable W Rate, L/Unit
Widgets	1	Units	1,000,000			600,000	0	0.6
	2	Units	1,000,000			300,000	0	0.3
	3	Units	1,000,000			100,000	0	0.1
	Total	Units	1,000,000	$20	$20,000	1,000,000	0	1.0
Wonder Dust		Tons	1,000,000	$100	$100,000	1,000,000	400,000	0.6
Device A		Units	1,000,000	$20	$20,000	10,000,000	0	10.0
Device B		Units	1,000,000	$20	$20,000	1,000,000	0	1.0
TOTAL					$160,000	13,000,000		
Average Intensity						**81.3**	**L/($000)**	

The operating data for the Current Year appear below. The improved efficiency levels (1% to 3%) can be seen for each product line. Actual water consumption is shown in the column labeled 'Water, L" and the "Flexible Budget" values appear in the adjacent column. Recall that the "flexible budget value is the quantity of water that would have been consumed if no change in efficiency occurred. The Index value is simply the ratio of actual water use to flexible budget water use, multiplied by 100. The individual Index values for the product lines reflect the 3%, 2% and 1% improvements, respectfully, that these product lines achieved since the Base Year.

CURRENT YEAR

Product	Step	Output Units	Output	Price $/Unit	Rev ($000)	Water, L	Flexible Budget, L	Index (100)
Widgets	1	Units	0				0	
	2	Units	1,000,000			291,000	300,000	
	3	Units	1,000,000			97,000	100,000	
	Total	Units	1,000,000	$20	$20,000	388,000	400,000	97.0
Wonder Dust		Tons	1,250,000	$100	$125,000	1,127,000	1,150,000	98.0
Device A		Units	800,000	$20	$16,000	7,920,000	8,000,000	99.0
Device B		Units	1,200,000	$20	$24,000	1,188,000	1,200,000	99.0
TOTAL					$185,000	11,011,000	11,150,000	**98.8**
Average Intensity						**59.5**	**L/($000)**	

As demonstrated in the above table, the average intensity for the Current Year is calculated to be 59.5 L per $1,000 in revenue. This is a 26.8% improvement since the Base Year. However, most of the reduction in average intensity results from the two confounding factors, not improved operational efficiency. Clearly, this is an overstatement of the change in efficiency. The distortion would be even greater if there were changes in the pricing of any of the four products.

In contrast, the flexible budget index for the whole company has been reduced from 100 in the Base Year to 98.8 in the Current Year. This reduction represents a 1.2% (100 / [100 - 98.8]) improvement in water efficiency. This example illustrates how average intensity is a poor proxy for efficiency while the flexible budget method provides an accurate measure of a company's sustainability performance. In addition, it avoids the potentially large distortions that will be caused by price changes when revenue is used to measure activity in the normalization calculation.

Stakeholders who rely on average intensity as a proxy for efficiency can be misled about a company's overall performance. In contrast, the flexible budget method provides stakeholders with an accurate measurement of the corporation's overall change in efficiency. The correct calculation of efficiency has important advantages for managers as well. Flexible budgeting allows managers to easily analyze the performance of the individual divisions and activities that contributed to overall corporate performance. As a result, managers can be evaluated on the changes in operational efficiency that they control rather than the arbitrary distortional effects that influence average intensity. By focusing on actual drivers of efficiency and holding managers accountable for controllable sustainability factors, the flexible budget method increases the likelihood that companies will achieve efficiency improvements. Without the flexible budget method, companies and their stakeholders are effectively "flying blind" in their sustainability improvement programs.

Conclusion

We believe that material errors and distortions will continue to occur in the reporting of efficiency improvements for sustainability aspects absent an explicit requirement for the disclosure of normalized sustainability measures supported by explicit guidance for the accurate calculation of efficiency. Without additional guidance, many companies will not make the disclosures necessary for cross-sectional comparisons, and more seriously, companies will unknowingly continue to provide erroneous measures of efficiency improvement.

Changes in absolute quantities, intensity, and efficiency are important to stakeholders in evaluating sustainability performance, and although the metrics are closely related, they are distinctly different in most decision-making contexts. As a result, it is essential for the SASB to require companies to disclose all three metrics. Given the importance of efficiency and the common confusion about the correct calculation of efficiency metrics, it is necessary to provide guidance regarding its calculation in all SASB industry-based standards. In finalizing the Provisional Standards, the SASB has an opportunity to highlight this distortion and to provide guidance for its solution, thus improving the quality of sustainability information provided to stakeholders.

The references we provide contain many examples that apply flexible budgeting to measure efficiency improvement in the presence of a variety of confounding factors. In addition, practicing

sustainability professionals and stakeholders can find detailed discussion and guidelines for flexible budgeting in all managerial accounting texts.

We support the efforts of the SASB to develop industry-specific sustainability metrics and disclosure guidelines. Our research team is willing to work with the SASB Board and staff to address the identified sustainability reporting issues noted above – both for the Proposed Standards and any further standard setting efforts. Feel free to contact us for additional discussion.

Respectfully submitted,

Jon Bartley
Y.S. Al Chen
Stephen K Harvey
D. Scott Showalter
Gilroy Zuckerman

References

Jon Bartley, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, Levi Stewart, and Gilroy Zuckerman, "Investor's Guide to Understanding Company Sustainability Performance Metrics: Beware of Flawed Metrics," *Journal of Environmental Investing* (Volume 8, No. 1, 2017, pp.194-205).
http://www.thejei.com/wp-content/uploads/2017/11/Journal-of-Environmental-Investing-8-No.-1.rev_-1.pdf

Jon Bartley, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, Levi Stewart, and Gilroy Zuckerman, "Lies, Damn Lies and Statistics: Why the Most Widely Used Sustainability Metrics Fail to Measure Actual Achievement and How a New, More Advanced Methodology Solves This Dilemma," *Journal of Applied Corporate Finance* (Volume 29, Number 2, Spring 2017, pp.109-114).
http://onlinelibrary.wiley.com/doi/10.1111/jacf.12238/epdf

Jon Bartley, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, "Using Flexible Budgeting to Improve Sustainability Measures, Part III," AICPA.org, (November 15, 2017).
https://www.aicpa.org/interestareas/businessindustryandgovernment/resources/sustainability/improvesustainabilitymeasures3.html

Jon Bartley, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, "Using Flexible Budgeting to Improve Sustainability Measures, Part II," AICPA.org, (April 17, 2017).
https://www.aicpa.org/InterestAreas/BusinessIndustryAndGovernment/Resources/Sustainability/Pages/ImproveSustainabilityMeasures2.aspx

Jon Bartley, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, "Using Flexible Budgeting to Improve Sustainability Measures," AICPA.org, (January 26, 2017).
http://www.aicpa.org/InterestAreas/BusinessIndustryAndGovernment/Resources/Sustainability/Pages/ImproveSustainabilityMeasures.aspx#

Jon Bartley, Frank Buckless, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, Why Sustainability Metrics Fail to Measure Achievement, and How to Fix Them, *GreenBiz*, (September 21, 2016).
https://www.greenbiz.com/article/why-sustainability-metrics-fail-measure-achievement-and-how-fix-them

Jon Bartley, Frank Buckless, Y.S. Al Chen, D. Scott Showalter, and Gilroy Zuckerman, "Flexible Budgeting Applied to Sustainability Measurements," *IMA Research Foundation C-Suite Report*. NJ: Institute of Management Accountants (August 2015).
https://www.imanet.org/insights-and-trends/external-reporting-and-disclosure-management/flexible-budgeting?ssopc=1

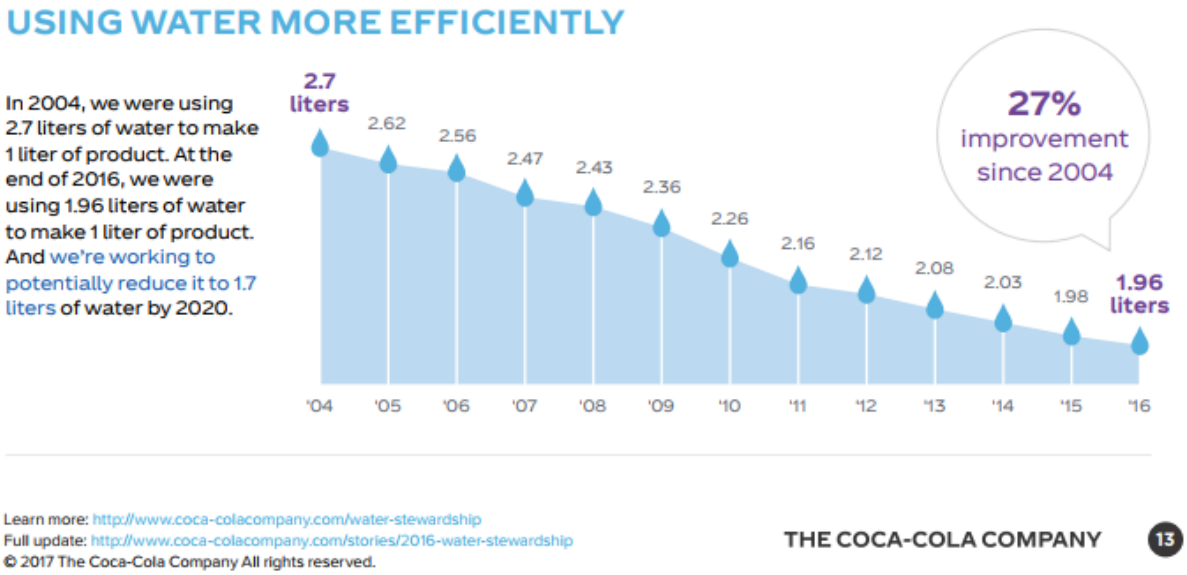
Jon Bartley, Frank Buckless, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, "How Widely Used Sustainability Metrics Distort Actual Performance-And a Solution to this All-Too-Common Problem," *Environmental Quality Management* (Volume 24, Number 4, Summer 2015, pp.1-9).
http://onlinelibrary.wiley.com/doi/10.1002/tqem.2015.24.issue-4/issuetoc

Jon Bartley, Frank Buckless, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, “Strategic Sustainability Performance Metric: How Bacardi Limited Drives Sustainability Improvement,” *Academy of Business Research Journal*, (Volume 1, 2014, pp.9-17). https://www.aobronline.com/abrj

Jon Bartley, Frank Buckless, Y.S. Al Chen, Stephen K. Harvey, D. Scott Showalter, and Gilroy Zuckerman, “Flexible Budgeting Meets Sustainability at Bacardi Limited.” *Strategic Finance*, (December 2012, pp. 29-34). http://sfmagazine.com/wp-content/uploads/sfarchive/2012/12/Flexible-Budgeting-Meets-Sustainability-at-Bacardi-Limited.pdf

Riva Krut, Juan Pelaez, and Arthur Qi, “Proposing Constant Currency as a Revenue-Based Denominator to Measure Greenhouse Gas Intensity: A Case Study from the Industrial Gases Sector.” *Journal of Environmental Investing* (Volume 8, No. 1, 2017, pp.182-193). http://www.thejei.com/wp-content/uploads/2017/11/Journal-of-Environmental-Investing-8-No.-1.rev_-1.pdf

Appendix 1: Example of typical disclosure practice



Authors

Jon Bartley, MBA, Ph.D., is Professor Emeritus of Accounting and former Dean of the Poole College of Management, North Carolina State University in Raleigh, NC. Jon's research has focused on the information usefulness of financial accounting. He is a member of the American Institute of Certified Public Accountants. You can reach Jon at jon_bartley@ncsu.edu

Y.S. Al Chen, Ph.D., CPA, CITP, CGMA, CMA, CFM, is Professor of Accounting at the Poole College of Management, North Carolina State University in Raleigh, NC. His research and teaching interests include sustainability performance measurement, environment cost management, combined assurance, and XBRL. He has published in *Journal of Environmental Investing, Journal of Applied Corporate Finance, Environmental Quality Management, Journal of Accountancy*, *Internal Auditor, Strategic Finance*, *Accounting Horizons, Engineering Economist* and other professional and academic journals. You can reach Al at alchen@ncsu.edu

Stephen K. Harvey, M.S., M.B.A., P.E., is former Global Director of Environment, Health and Safety for Bacardi Limited and is currently Industry Fellow in Corporate Responsibility at the Poole College of Management, North Carolina State University. One of the original architects of the method to apply flexible budgeting to sustainable metrics, Steve was the first to apply it to real world applications. At Bacardi Limited, he implemented the method in 2009, and the company has continued to use flexible budgeting as its primary method to track and annually report on its sustainability performance. You can reach Steve at sharvey2@ncsu.edu

D. Scott Showalter, CPA, is a Professor of Practice in the Department of Accounting, Poole College of Management at North Carolina State University. Previously a partner with KPMG LLP, he joined the faculty at NC State after a 33 year-year career. During his time with KPMG, he led the development of KPMG's sustainability services. His current teaching and research efforts focus on sustainability reporting and his research has been published in numerous academic and industry publications. He is a member of the American Institute of CPA's ASEC Sustainability Assurance and Advisory Task Force that recently released the Sustainability Attestation Guide. He graduated summa cum laude from the University of Richmond Robins School of Business. You can reach Scott at dsshowal@ncsu.edu

Gilroy Zuckerman, Ph.D., is Associate Professor of Accounting and former Associate Dean of Academic Affairs of the Poole College of Management, North Carolina State University. Gil has mentored many student teams focusing attention on sustainability. One undergraduate team presented its research at the annual meeting of the IMA in 2014.You can reach Gil at zuckerma@ncsu.edu