



Creative accounting: A critical perspective on the market-based method for reporting purchased electricity (scope 2) emissions

Matthew Brander^{a,*}, Michael Gillenwater^b, Francisco Ascuí^a

^a Centre for Business and Climate Change, University of Edinburgh Business School, UK

^b GHG Management Institute, USA

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ABSTRACT

Electricity generation accounts for approximately 25% of global greenhouse gas (GHG) emissions, with more than two-thirds of this electricity consumed by commercial or industrial users. To reduce electricity consumption-related emissions effectively at the level of individual firms, it is essential that they are measured accurately and that decision-relevant information is provided to managers, consumers, regulators and investors. However, an emergent GHG accounting method for corporate electricity consumption (the 'market-based' method) fails to meet these criteria and therefore is likely to lead to a misallocation of climate change mitigation efforts. We identify two interrelated problems with the market-based method: 1. purchasing contractual emission factors is very unlikely to increase the amount of renewable electricity generation; and 2. the method fails to provide accurate or relevant information in GHG reports. We also identify reasons why the method has nonetheless been accepted by many stakeholders, and provide recommendations for the revision of international standards for GHG accounting. The case is important given the magnitude of emissions attributable to commercial/industrial electricity consumption, and it also provides broader lessons for other forms of GHG accounting.

1. Introduction

Electricity generation currently produces around 25% of global greenhouse gas (GHG) emissions (Victor et al., 2014), or about 12.4 GtCO₂e/year. More than two-thirds of the electricity generated is consumed by commercial and industrial users (IEA, 2016a). To reduce electricity consumption-related emissions effectively at the level of individual firms, it is essential that they are measured accurately and that decision-relevant information is provided to managers, consumers, regulators and investors. The compilation and public reporting of corporate GHG inventories, ostensibly for this purpose, is becoming mainstream business practice (CDP, 2016b). However, an emergent 'market-based' method for quantifying emissions associated with electricity consumption, which allows reporting entities to purchase and claim the GHG attributes associated with renewable generation, is not aligned with reducing emissions or providing accurate or relevant GHG information. This issue is highly topical as recently published reporting guidance from the GHG Protocol (WRI, 2015) has endorsed the market-based approach, while the forthcoming update of ISO 14064-1 for corporate GHG inventories provides an opportunity to establish a more robust approach.

This perspective article aims to inform the development of GHG

accounting practice and international standards by providing a synthesis of existing studies, with additional analysis on the implications for GHG accounting. Following a brief introduction to corporate GHG accounting practice and the quantification methods for purchased electricity, we set out two interrelated problems with the market-based method, and then explore why, despite these problems, the market-based approach has been accepted by many stakeholders. We conclude with recommendations for a more robust accounting method, and briefly reflect on the applicability of the lessons learned for GHG accounting more broadly.

2. Corporate GHG accounting and the market-based method

The first internationally recognised guidance for corporate GHG inventory reporting was published by the GHG Protocol in 2001 (WBCSD/WRI, 2004), with a corresponding ISO standard published in 2006 (ISO, 2006a). The GHG Protocol has since published revisions and other standards, including guidance for emissions associated with purchased electricity, termed 'scope 2' emissions (WRI, 2015). 'Scope 2' denotes the point-of-generation emissions from purchased grid electricity (or other forms of purchased energy, such as district heating and cooling), while 'scope 1' covers direct emissions from facilities and

* Correspondence to: University of Edinburgh Business School, 29 Buccleuch Place, Edinburgh EH8 9JS, UK.
E-mail address: Matthew.Brande@ed.ac.uk (M. Brander).

machinery owned by a reporting company, and ‘scope 3’ includes any other indirect emissions associated with a reporting company’s broader value chain, such as business travel or the disposal of waste (WBCSD/WRI, 2004).

Standard practice is to estimate emissions using activity data for each source and GHG. For example, if a small diesel car is used for business travel, then the CO₂ emissions associated with the car should be calculated using data on its actual fuel consumption or distance travelled, multiplied by a technology-specific emission factor, such as 0.1448 kgCO₂/km travelled in a small diesel car (Defra/DECC, 2016). If the specific source is not known then an average emission factor may be used instead, e.g. the emission factor for an average car, 0.1856 kgCO₂/km travelled (Defra/DECC, 2016).

One feature of purchased electricity from a public distribution grid, which makes it difficult from an accounting perspective, is that it is not possible to trace the electricity consumed by an entity back to any particular grid-connected power plant (Raadal, 2013). To address this physical reality, it has been standard practice to use a grid average emission factor to estimate scope 2 emissions (e.g. those provided by Defra/DECC (2016) or eGRID (2017)), which is derived by dividing the total emissions from all the generation sources supplying a defined transmission and distribution grid area by the total amount of electricity supplied over a given period (Harmsen and Graus, 2013). This approach is termed the ‘locational’ or ‘grid average’ method, as it reflects the average emissions for the location in which the consumption occurs (WRI, 2015).

An alternative accounting method is the ‘market-based’ or ‘contractual’ approach, which permits a reporting company to apply an emission factor associated with electricity from a specific generation facility, such as a wind farm, with which the reporting company has a contractual agreement to claim the associated emissions attributes. In the case of most renewable technologies, the point-of-generation emissions are zero, and so the reporting company will claim a zero emission factor for its purchased electricity. Contractual arrangements can take place through various instruments, such as Renewable Energy Certificates (RECs), Guarantees of Origin (GOs), utility green tariffs, or power purchase agreements (PPAs). It is worth emphasizing that these contractual arrangements do not entail any changes to how electricity from a renewable facility is physically delivered or consumed. The only thing transacted is a claimed right to use the emission factor associated with a certain amount of generation from a particular renewable energy facility.

The GHG Protocol’s *Scope 2 Guidance*, published in 2015, requires that companies use both the locational grid average method and the market-based method to report scope 2 emissions (i.e. dual reporting). However, the guidance also allows companies to choose a single method for meeting their reduction targets and for reporting their supply chain emissions (WRI, 2015). The same guidance has been adopted by CDP, formerly the Carbon Disclosure Project (CDP, 2016a).

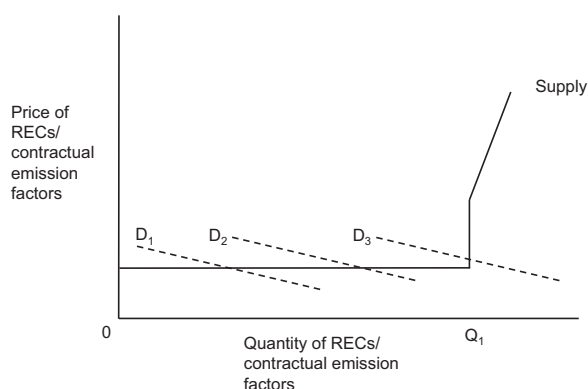


Fig. 1. Demand and supply of contractual emission factors.

In its current form, the guidance does not require the electricity associated with any purchased emission factor to be additional: in other words, it could be from a long-established facility, or one which receives government or other subsidies sufficient to justify its operation already, in the absence of the contractual arrangement.

3. Problems with the market-based method

This section sets out two interrelated problems with contractual emission factors and the market-based accounting method: purchasing contractual emission factors does not influence or affect the amount of renewable electricity generated (except under very specific additionality conditions, which are generally not fulfilled); and the market-based accounting method fails to provide accurate or relevant information in GHG reports.

Problem 1.: Lack of additional renewable energy generation

There are structural reasons for expecting that markets for contractual emission factors will fail to influence renewable energy supply. In many countries there are now large amounts of renewable generation available, because of government subsidies, legacy investments or because renewables are already economically viable (IEA, 2016b). The attributes associated with some of this electricity are available for allocation via contractual arrangements, without causing any increase in the amount of renewable electricity generated. In some jurisdictions, e.g. the U.S., renewable attributes used for compliance with regulatory mandates are not also available for sale in the voluntary market, whereas in other jurisdictions, e.g. many EU countries, renewable generation can be used for compliance with regulatory targets and the attributes from the same renewable generation can also be sold in the voluntary market.

This situation, i.e. large amounts of renewable attributes available, is illustrated in Fig. 1, adapted from Gillenwater (2008). Between 0–Q₁ changes in demand for renewable attributes (e.g., shift from D₁ to D₂) only involves the allocation of existing (non-additional) renewable energy output, and the price reflects only the associated transaction costs. A market equilibrium to the right of Q₁ would drive additional renewable generation. However, the higher costs of genuinely additional supply, and the elasticity of demand to higher prices, suggests that the market for contractual emission factors is highly unlikely to cause additional renewable capacity investments.¹ Moreover, in many countries the amount of renewable generation is increasing due to the other drivers, such as government subsidies (IEA, 2016b), and therefore the point at which additionality might be achieved (i.e. beyond Q₁) is continually advancing further beyond the reach of voluntary market demand for contractual emission factors.

As an approximate indication of the demand increase needed before there is an effect on supply, ET Index Research data, which includes 2000 of the world’s largest listed companies, shows 97 companies using the market-based accounting method to report lower emissions, equating to 22.2 million tCO₂e/yr.² This approximates to ~ 1% of globally available renewable electricity generation in 2015,³ and therefore demand for contractual emission factors would need to increase a hundred-fold to reach the existing supply threshold for renewable attributes (which is continually increasing anyway), and only once above that threshold would demand cause a fractional increase in

¹ It is possible that there will be an additionality ‘window’ if the net cost of additional generation does not exceed the market’s willingness to pay for renewable attributes, which increasingly may be the case as the cost of new renewable capacity decreases (i.e. the supply curve beyond Q₁ will be less inelastic). However, as noted above, this situation would only be expected to arise after the baseline supply threshold has been reached.

² Chief Technical Officer, ET Index Research, 2016, personal communication, 24 October.

³ This indicative estimate is based on 5.530 TWh of renewable electricity generation (derived from U.S. EIA (2016)) and an assumed average grid emission factor of 0.4 tCO₂e/MWh (which approximates to the grid averages for the UK and the US).

renewable generation.

There is also empirical evidence from the voluntary REC market in the U.S., and GO market in Europe, which shows that purchasing contractual emission factors does not significantly influence generation from renewable technologies. The amount of renewable electricity generated is the same in the absence of this market for generator-specific emission factors. Specifically, Gillenwater (2013) and Gillenwater et al. (2014) find that the amount of revenue from voluntary RECs in the United States is too low and too uncertain to alter renewable capacity investment decisions. Voluntary REC prices instead largely reflect marketing and transaction costs (Gillenwater, 2008). An empirical study for the Netherlands shows similar results (Mulder and Zomer, 2016), and concludes that the voluntary market for GOs is unlikely to increase renewable generation.

It should be emphasized that the current discussion relates specifically to the influence of the *voluntary* market for contractual emission factors, and not to the wholly distinct *compliance* market for RECs within renewable portfolio standards, which have been successful in driving additional renewable generation (Carley et al., 2016). The conflation of these two markets is discussed further in Section 4 below as one possible explanation for the perceived legitimacy of the voluntary market.

Problem 2.: Impact on the accuracy and relevance of GHG inventories

A further, and interrelated, problem with contractual emission factors is the impact they have on the decision-usefulness of the information in GHG accounts. The illustrative example below demonstrates this problem using the core accounting principles of *accuracy* and *relevance* (WBCSD/WRI, 2004) as criteria for decision-usefulness.

Following the WRI (2015) guidance, Company A purchases contractual emission factors for all of its consumed grid electricity, and reports a scope 2 value of zero (0) tCO₂e in its supply chain reporting, and also a 30% reduction in its overall corporate emissions, as a result of this newly claimed zero rating of its scope 2 emissions. By contrast, the otherwise identical Company B does not purchase contractual emission factors, instead using the equivalent money to implement an energy efficiency programme that reduces its electricity consumption and scope 2 emissions by 10%. Climate-friendly consumers and investors use the GHG reports from the two companies to inform their purchasing and investment decisions, and favour Company A as it appears to exhibit superior environmental performance. However, Company A's consumption of grid electricity is unchanged, its purchase of contractual emission factors has not increased the amount of renewable generation, and therefore its actions have not reduced emissions to the atmosphere. In contrast, Company B has reduced its demand for grid electricity, some of which is supplied by fossil fuel power stations, and therefore has credibly reduced emissions to the atmosphere. Company A's GHG reporting does not appear to be an accurate reflection of the emissions caused by its electricity consumption, and neither is the information relevant (i.e. useful) for informed decision-making. Moreover, the purchase of contractual emission factors is not a benign activity, as the opportunity cost is to forgo genuine mitigation activities that could otherwise have been funded.

Further, for Company A's use of contractual emission factors not to lead to double-counting of the claimed renewable attributes, the method requires all other reporting entities to also apply a 'residual grid mix' emission factor. As this emission factor would be higher than the grid average, due to removing some renewable generation from the calculation, Company B's performance is again made to look worse, although its actual contribution to reducing emissions is greater than Company A's.

There are numerous real-world examples of companies that use contractual emission factors to meet their reduction targets (e.g. Unilever (2017), Marks and Spencer (2015), Nestlé (2014) and Philips (2014)). Although the 22.2 million tCO₂e/yr figure from ET Index Research is a small quantity in terms of existing renewable supply, it is

nevertheless a large amount of emissions to misrepresent within corporate GHG inventories.

One of the noteworthy aspects of the market-based method is that many interested parties, including standard setters (e.g. WRI (2015)), continue to endorse the method, despite the two problems described above. The following section provides an initial exploration of why this may have come about.

4. Explanations for the promotion of the market-based method

There appear to be a variety of reasons that explain why the market-based method has been adopted by many reporting companies and standard setters. Not all of these explanatory factors may apply to any single stakeholder, but the combination of reasons may explain the promotion and widespread, though not universal (e.g. see Defra/DECC (2012)), acceptance of the market-based approach. The list of explanations below provides an initial survey of explanatory factors, which may serve as an agenda for further research.

- a. **Commercial interests.** There are strong commercial drivers for the use of contractual emission factors, on the part of both buyers and sellers. They represent a windfall revenue stream, albeit small, for those marketing these contractual instruments, as the claimed attributes are derived from renewable electricity that is being generated anyway. Further, contractual factors provide a low cost means of appearing to achieve emission reduction targets, and so are popular with reporting companies. Corporations that engage in corporate social responsibility primarily for public relations reasons may also have less motivation for ensuring the actual environmental integrity of their actions (Schaltegger and Burritt, 2015).
- b. **The ideology of the market.** Contractual emission factors are often presented as a market-based solution to climate change (e.g. The International REC Standard, 2017), and advocates of non-regulatory approaches may therefore view contractual emission factors favourably. However, in reality, contractual emission factors represent a market failure, because the implied goal (actual reduction of emissions to the atmosphere) is in fact not delivered by contractual emission factors (as discussed in Section 2), and therefore the approach has only the appearance, and not the substance, of a market-based solution. In addition to the label 'market-based method' itself, other market or business related terms are used in the GHG Protocol's Scope 2 Guidance, such as 'risks and opportunities' (2015, p. 15), 'consumer choice' (2015, p. 26), and 'market signals' (2015, p. 27). However, the 'risks and opportunities' indicated by market-based results are only those created by the method itself, such as the risk of government regulation that is based on contractual arrangements, or legal risks from misreporting contractual arrangements. 'Consumer choice' is suggestive of additionality, in that consumer choice is generally assumed to influence supply, whereas this is not the case with contractual factors (as discussed in Section 2). 'Market signals' also implies a positive action, however, the implied 'signal' does not achieve a change in renewable energy investment, and thereby, generation capacity.
- c. **Implied legitimacy from compliance markets.** RECs were initially developed as compliance instruments within renewable portfolio standards, with utility companies retiring RECs to demonstrate achievement of a mandated level of renewable supply (Menanteau et al., 2003; Gillenwater, 2008). This regulatory background allows consumers to conflate RECs used for regulatory purposes with those sold to contractually claim renewable energy emission factors, and thereby lends an appearance of legitimacy or credibility to the subsequent practice of electricity consumers using RECs to contractually claim renewable energy emission factors.
- d. **Regulatory capture.** Some regulators and environmental NGOs, including the U.S. Environmental Protection Agency and World Wildlife Fund (WWF), who might otherwise be relied upon to

scrutinise the environmental integrity of GHG accounting practices, have introduced their own renewable electricity attribute trading programmes (US EPA, 2016; WindMade, 2016), and therefore have an interest in downplaying or ignoring the problems with the market-based method. There appears to be a reluctance on the part of environmental watchdogs to criticize the practices of companies and environmental organizations that have the appearance of striving to support renewable energy. Furthermore, the GHG Protocol, as a voluntary, non-governmental standard-setting organisation, depends, in part, for its funding on the very companies that have a commercial interest in buying and selling contractual emission factors. All standard setters are vulnerable to the asymmetry of power within their stakeholder engagement processes (Boström and Hallström, 2010), and the *Scope 2 Guidance* appears to be the first standard produced by the GHG Protocol which has had significant financial implications for certain stakeholder groups. Although the GHG Protocol working group for the *Scope 2 Guidance* was open to all interested parties, it is likely that those organizations with the greatest commercial interest would also spend the most time and resources promoting their desired outcomes.

- e. **Lack of awareness.** Consumers and policy-makers are generally unaware of the problems associated with the market-based method. There is an everyday presumption that consumer choice ultimately drives supply. However, as discussed in Section 2, numerous other factors drive renewable energy supply, such as government policies and commercial viability, and evidence shows that consumer demand for renewable attributes (versus physical electricity demand) does not play a significant role (and would be more expensive at the point where it might begin to influence renewable energy investment). The lack of awareness of the problem of additionality is also to be expected given the marketing messages used to sell contractual factors, which are often opaque or misleading on the point of additionality. For example, Natural Capital Partners, a retailer of contractual emission factors, state: ‘Clients are able to immediately and effectively meet their global renewable energy targets, support the generation of renewable energy in the locations of interest to them, and address their Scope 2 impacts, through our customised, global portfolios of renewable energy instruments. Our renewable energy solutions meet all Greenhouse Gas (GHG) Protocol requirements and CDP quality criteria, providing greater recognition to businesses buying renewable energy certificates’ (Natural Capital Partners, 2017).
- f. **Conceptual confusion.** The distinction between attributional and consequential GHG accounting is well understood in some fields, such as life cycle assessment (LCA), but much less so in the area of corporate GHG accounting, which has traditionally used attributional accounting (Brander et al., 2015). This has led to conceptual confusion in some of the justifications for the market-based method. For example, the *Scope 2 Guidance* suggests that additionality is only relevant to consequential forms of GHG accounting, such as project-level accounting, as it is only these methods that measure changes in emissions relative to what would have occurred in the absence of an intervention (WRI, 2015, p. 90). In contrast, attributional inventories of emissions, such as corporate GHG inventories, only need to allocate total emissions between reporting entities without double-counting. However, to be accurate and relevant, GHG inventories must reflect the emissions caused by the reporting entity. The fundamental issue with the contractual method is that it does not represent any causal relationship between the reporting entity and the emissions reported. Another example of conceptual confusion is the argument, again present in the *Scope 2 Guidance* (WRI, 2015, p.90), that the market-based method reflects choices companies make about their electricity products. However, the choice in question relates only to the purchase of contractual emission factors and is not about the physical delivery or generation of electricity, so the argument is equivalent to claiming that contractual emission

factors are justified because they reflect the decision to purchase contractual emission factors. The resulting accounts only reflect the accounting arrangements themselves, and do not provide any decision-relevant information about actual emissions. To be useful, environmental accounts must represent something other than their own accounting rules.

The above list of explanatory factors demonstrates the range and interaction of issues at play in obscuring the two problems with the market-based method, and indicates a considerable opportunity for further social, political, critical and normative research. Further empirical analysis of the effects of voluntary contractual arrangements with respect to causing increased renewable electricity generation in specific markets, and whether these markets could be improved (for example by more accurate GHG accounting rules), would also be useful. Focusing for now on the practical implications, the following section provides a number of recommendations for the treatment of purchased electricity within GHG inventories.

5. Recommendations

ISO 14064-1 for organisational GHG inventories (ISO, 2006a) is currently under revision, with the updated standard expected to be published in 2018. We strongly recommend that this ISO standard, and also a revised version of the current GHG Protocol *Scope 2 Guidance*, should adopt the following approach:

- a. **The locational grid average method should be the only method used to calculate and report scope 2 emissions.** This is not to suggest that the locational method is perfect, nor that locational emission factors cannot be improved. For instance, ideally grid average emission factors should be specific to the time at which consumption takes place (Spork et al., 2015), e.g. using smart meters, but currently such high temporal resolution emission factors are not commonly available. In addition, the boundary for calculating the grid average should be based on the grid balancing area in which electricity supply is balanced with demand, whereas at present many grid average factors are often based on more arbitrary national or regional jurisdictional boundaries (Colett et al., 2015). Notwithstanding these issues, the locational grid average is the best available method for reflecting the emissions caused by companies’ contribution to aggregate demand on the grid.
- b. **Actions that genuinely result in additional grid-connected renewable energy generation should be quantified using a consequential accounting method, and reported separately to the corporate GHG inventory.** For example, if a company enters into a long-term power purchase agreement that enables investment in new renewable energy generation capacity that would not otherwise have been viable, the emission reductions caused by that action could be quantified using methods such as ISO 14064-2 (2006b) or the GHG Protocol’s Guidelines for Quantifying Reductions from Grid-Connected Electricity Projects (WBCSD/WRI, 2007), and reported as additional information to the corporate GHG inventory.

In addition to the standards for corporate GHG accounting, the draft text (as of June 2017) for ISO 14067 for *product* carbon footprinting also endorses the use of contractual emission factors for grid electricity. Exactly the same problems arise with contractual emission factors at the product-level (i.e. no increase in the amount of renewable generation, and inaccurate and irrelevant information in the reported footprint), and the same recommended approach, above, should therefore be applied within ISO 14067.

6. Conclusions

In summary, how companies measure and report the GHG emissions

arising from their consumption of electricity is important not only for those companies, but also for consumers, regulators, investors, and society as a whole. The generation of electricity for commercial and industrial consumption makes a significant contribution to global GHG emissions, in the order of 8 GtCO₂e/year (Victor et al., 2014). Misrepresenting responsibility for these emissions through using the market-based method therefore has the potential to significantly undermine global climate change mitigation efforts.

As a guiding principle, we recommend that all environmental inventories must reflect the impacts *caused* by the reporting entity, otherwise they are simply not useful for managing environmental impacts. This applies to corporate-level inventories, but also any other types of inventory, such as product-level (ISO, 2013), city-level (Gudipudi et al., 2016), or building-level inventories (Lai, 2014). We also hope that the case of contractual emission factors will provide governments, UNFCCC negotiators, and corporate managers with a useful cautionary tale against similar creative accounting methods that distort rather than measure reality.

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