Counting to Zero

Accounting for a Green Building

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Counting to Zero: Accounting for a Green Building

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Counting to zero: accounting for a green building

Abstract

Purpose: This paper examines how a particular form of environmental accounting, energy accounting, is negotiated in practice and how energy accounting may act as a productive organizing device in organizational contexts. Energy accounting is considered as performative in organizational practices rather than as a representation of resource use.

Design/methodology/approach: This paper is based on a longitudinal case study of the design phase in a construction project. Data collection entailed observational and document studies as well as interviews with those involved in the design processes. This paper draws on actor-network theory, notably the notions of framing and overflowing, in analyzing the role of energy accounting in design processes and in affecting organizational practice.

Findings: The paper provides several insights regarding energy accounting in the making, energy accounting's performative role in enacting possible futures, the narrative importance of numbers, and the entangled nature of designing, accounting and organizing practices. Our findings demonstrate the strong links between accounting and organizing.

Originality/value: This paper adds to the extant literature on environmental accounting by directing attention to how such accounting practices contribute to forming rather than just informing management decisions. By focusing on how the calculative practices of making such accounts mediate ideas and help assemble new entities, this paper provides useful insights into the performative role of environmental accounting.

Keywords: Environmental accounting, framing and overflowing, performativity, calculative devices, organization, design processes

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1. Introduction

There is a longstanding interest in the environment within the accounting community (Lehman, 2001; Gray, 2010), and it is widely agreed that environmental accounting is likely to continue to play a central role in addressing the serious problems related to human-made climate change (Hopwood, 2009). Environmental accounting is a multifarious phenomenon that takes many different forms. This is exemplified by the variety of distinctions made both in practice and in academia between e.g. green accounting, energy accounting, carbon accounting and resource use accounting, all of which are sub-categories of environmental accounting. Although much of the research within this field focuses on environmental disclosures as an externally-directed activity (Qian et al., 2011: 94), there is a growing interest in environmental management accounting practices, i.e. on the collection and use of environmental information to improve managerial decision-making (Ferreira et al., 2010; Burritt et al., 2011; Burritt et al. 2002).

Relatively little attention has, however, been given to the question of how environmental accounting frameworks are developed and negotiated in practice, and to how such accounts may become productive, organizing devices in organizations. In this paper we examine this issue through a longitudinal case study of the design phase in a "green" building project, where "green" was in the course of the design process further qualified as a "zero-energy building". This design ambition put calculation and energy accounting right at the center of the project, as project success became hinged upon the future energy account showing – at least – a "zero".

In analyzing this, we draw on insights from actor-network theory (ANT), and in particular Callon's (1998a; 1998b) notions of framing and overflowing. Although ANT is not a unified perspective, its proponents share a number of basic ontological assumptions and a methodological approach that emphasizes studying things in "action" (Latour, 1987). In ANT, no actors are privileged in advance and nonhumans are considered potential actors as well. According to Latour (2005, p. 71), an actor can be anything that modifies a state of affairs by making a difference, but, equally important, no actor acts alone. All actors are associated in networks that define actions in a specific ways that can only be accounted for empirically. Analytically, this means that "attachments are first, actors are second" (Latour, 2005, p. 217). In that sense, ANT is fundamentally anti-essentialist. Things are made rather than given. As a consequence, ANT-inspired analyses pay close attention to how associations are made and the effects this has in specific empirical situations. Building on this general ANT approach, Callon (1998a; 1998b) introduced the notions of framing and overflowing to describe these networks of interaction.

We pursue this line of thinking in a detailed empirical study of environmental accounting in the making; paying particular attention to the role of accounting methods and technical metrics – nonhuman actors – in constituting the entities to which they refer. We address the question of how environmental accounting was framed and, in turn, helped assemble the design of a new "green, zero-energy" building. Our study illustrates that this required many negotiations, and that it was a precarious and contestable process leading to numerous overflows. Both the accounting framework and the design of the building were subject to substantial debate because project participants had to agree on how to define and demarcate the zero-energy building, how to account for it and how to strike a balance between energy concerns and other concerns.

Whilst much of the existing literature on environmental accounting focuses on either critiquing environmental accounting as more or less truthful narratives of corporate environmental behavior or on improving environmental management accounting, this paper contributes to the literature on a number of different, but interrelated, counts. First, our paper supplements the literature emphasizing the use of environmental accounting internally in organizations (Henri and Journeault, 2010; Burritt et al., 2002; Burritt and Schaltegger, 2010; Ferreira et al., 2010). In our study environmental accounting was used internally as an organizing tool in a design process. However, we also argue that boundaries between the internal and external use of environmental accounting are contingent, contestable and fluid, and our analysis illustrates how these boundaries can be blurred and transversed.

Second, our study shows how environmental accounting may enact the future, and offers an alternative perspective on environmental accounting as representations of past environmental performance. Instead, our study illustrates how environmental accounting can be future-orientated. When the future is invoked in the environmental accounting literature, it is often related to a normative, programmatic discussion of how environmental accounting may advance sustainability (Gray, 2010), or to providing management with information to make future-directed decisions as in environmental management accounting (Burritt et al., 2002). As noted by Henri and Journeault (2010: 64), the concept "eco-control" can provide "financial and ecological information to maintain or alter patterns in environmental activity." Eco-control is future-directed in the sense that it can be applied with the purpose of changing organizational behavior. However, each of these future oriented perspectives is hinged on a representational argument. We extend this research by demonstrating *how* environmental accounting and the future may become connected at the concrete, empirical level of organizational practice. Emphasis is given to energy accounting, in action. We consider energy accounts as inscriptions (Latour, 1987; Robson, 1992) that are performative in the sense that they produce new insights, visions and constellations of possible building designs (Justesen and Mouritsen, 2009). Instead of asking what energy accounting represents, we ask how it was constructed in practice and how it helped to assemble the design of a zero-energy building.

Third, our study highlights the role of numbers and calculative practices (Miller, 2001) in environmental accounting. While it has been argued that environmental disclosures tend to be qualitative rather than quantitative (Hrasky, 2012: 181), numbers and calculations were fundamental to environmental accounting in our case study. The number zero was particularly important for qualifying the design ambition. As it turned out, defining units, input, output in the calculations that were to result in "zero" demanded considerable effort and negotiation.

The remainder of the paper is structured as follows. First, we discuss how environmental accounting can be considered as performative rather than representative. Then we present Callon's conceptualization of framing and overflowing, which, we argue, is useful to our study. This is followed by a description of the research context and our methodology. Based on our case study, we then present an analysis of how environmental accounting was constructed in practice and how it became intertwined with and affected the organizational process of defining the design parameters for a new office building, where minimizing energy consumption had to be balanced with other concerns such as work climate, aesthetics and costs. Our findings lead to a theoretical discussion of the connections between organizing, accounting and the assembling of a building design. This is followed by our conclusions.

2. Environmental accounting as framing

Much of the environmental accounting literature appears to assume that there is a gap between organizations' actual environmental performance and what they report. This is the background for queries such as "Is accounting for sustainability *actually* accounting for sustainability… and how would we know?" (emphasis added) that appeared in the title of an article by Gray (2010). Such questions are asked even though few, if anybody, would claim that a complete representation of environmental performance is possible. Yet, despite such epistemological skepticism captured e.g. by the question "… and how would we know?", the underlying dualism is maintained in such arguments. "Real" sustainability or environmental performances appear to belong to a, perhaps partly inaccessible, ontological domain.

According to Latour (1999), this dualism between reality and representation tends to lead to epistemological discussions regarding possible ways of bridging this gap. In the environmental accounting literature this bridging concern is often cast as a matter of improving reporting practices so as to provide more truthful representations. According to this view, a good account, "should reflect corporate ethical, social and environmental performance" (Adams, 2004: 732), and, "[p]erhaps the most serious problem with current reporting […] is its lack of completeness" (ibid.). Premised on the gap between reality and representation, the key issue, then, becomes how to ensure better representations, i.e. ones that mirror real performance more accurately.

Based on similar assumptions, several researchers have argued that information provided through corporate environmental accounting is often used with the aim of "managing impressions" and ensuring corporate legitimacy (Neu et al., 1998; Cho and Patten, 2007; Aerts and Comier, 2009; Cho et al., 2010). Environmental accounting is viewed as window-dressing or green-washing. The relationship between representations of environmental performance (e.g. in environmental or annual reports) and "real" environmental performance is questioned as these two activities are described as being more or less decoupled (Meyer and Rowan, 1977; Neu et al., 1998). Environmental accounting has also been described as a management fashion with little substance, likely to be replaced by new, but equally shallow accounting practices (Burritt and Schaltegger, 2010). While such analyses clearly add to our understanding of the externally orientated, strategic purposes of environmental accounting, they tell us little about how environmental accounting may be related to, and even be intertwined with, calculative practices and organizational processes. It could be argued that much of this literature black-boxes (Latour, 1987) the connections between accounting, calculations and organizations.

Inspired by ANT, we attempt to sidestep the dualisms of reality-representation, past-future and internal-external (Latour, 1999) found in much environmental accounting literature and offer a different approach that emphasizes what energy accounting *does* rather than what it might represent. Environmental accounting involves a number of calculative, visual and narrative devices that provide visibility and measurability to environmental performance, and as these tools become entangled in organizational practices, they play a central role in bringing about representations that have performative effects. To quote a set of metaphors proposed by MacKenzie (2006), accounting representations work as engines rather than cameras[1]. In this sense, accounting is seen as a

[1] Originally coined by the language philosopher John Austin (1962) in his book "How to do things with words", the concept performativity has been revived and reinterpreted in different traditions, such as feminist studies (Butler, 1990),

performative practice that helps enact reality (Boedker, 2010; Skærbæk and Tryggestad, 2010; Tryggestad et al., 2010). According to Callon (1998a: 23): "The most interesting element is to be found in the relationship between what is to be measured and the tools used to measure it. The latter does not merely record a reality independent of themselves; they contribute powerfully to shaping, simply by measuring it, the reality that they measure".

Callon links his performativity approach to the concepts framing and overflowing. Drawing on Goffman's theater metaphor, he compares framing to a stage (Callon, 1998b: 249). Like a stage, a frame is a clearly bounded space that allows interactions, calculations and decisions to take place in a relatively unproblematic manner precisely because the actors agree on the frame in advance. The frame establishes a set of shared assumptions and defines boundaries that make it possible to decide what to take into account and what to leave out. Framing is tied to the equipment, objects and specialists involved and, therefore, situated. Lohmann (2009: 503) suggests that the metaphor of framing invites novel ways of exploring environmental accounting because "[i]nstead of focusing on imagined pre-existing or intrinsic properties of environmental objects and agents, it focuses on what produces and sustains the objects and agents […]. [T]he framing metaphor sees objects constantly being made and remade, and boundaries as fluid or poorly defined". Following from this, even though prescriptions for what environmental accounting should entail appear to be fairly well defined, when it comes to specifying them in practice this may prove more controversial. The issue of making energy performance calculable calls for negotiations on what include and how to measure it, Hence, framing is always fragile and likely to be subject to contestation. This produces overflows (Callon, 1998b: 251); concerns that cannot be contained within the existing frame. Attempts to contain overflows require identifying and measuring them so as to be able to re-frame and reestablish "spaces of calculability" (Callon, 1998b: 256).

Our study examines how our case company tried to establish an agreed-upon frame for energy accounting as a means for designing a "green" building. Numbers and calculations played a crucial role, and the raison d'être of the design project was even based on the numerical metaphor of constructing "a zero-energy building". However, in order to calculate how "zero" could be achieved they had to establish a certain space of calculability – a frame they could agree on and that

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actor-network theory (e.g. Law, 1999) and the sociology of finance (e.g. MacKenzie, 2006; 2009; Callon, 2007). The concept has particularly been discussed in the latter field, e.g. MacKenzie (2009) distinguishes between different versions and effects of performativity. For a review of this discussion, see Pollock and Williams (2010). Although these distinctions are important conceptualizations, they are less relevant for our analysis. We use the term performativity in the more general sense reflected in actor-network theory (e.g. Law, 1999), which challenges the idea that accounting merely represents reality. Instead our case study shows how accounting helps enact reality in the sense that it helps actors sort between ideas and thereby create a building that can be defined as a zero-energy building.

would allow them to determine *how* to calculate, *what* to calculate and *what to leave out* of the calculations. The project unfolded in a situation that can be described as experimental and "hot", i.e. a situation in which the frame is highly contested (Callon, 1998b). Both the environmental accounting frame and the design of the building were unsettled and subject to substantial debates amongst project participants. The situation was also highly experimental, because the participants had no blueprint for how to proceed.

3. Research context and methodology

We conducted our study in Gamma (a pseudonym), a large Northern European energy company that provides energy related services. Part of an environmentally sensitive industry, Gamma has an explicit strategic commitment to reduce its CO_2 emissions. Our case study focuses on Gamma's efforts in the initial design phase in building their new corporate headquarters. This allowed us to study environmental accounting in the making, and at a time when the frailty and contestability of the accounting framework and multiple overflows were particularly visible. Another reason for choosing Gamma was the company's experimental approach to this design task. It was based on extensive employee involvement. Thus, Gamma can be considered an extreme rather than a representative case; i.e. it is one that is "richer in information" because it "activate[s] more actors and more basic mechanisms in the situation studied" (Flyvbjerg, 2006: 229). Extreme cases are useful when studying little explored phenomena, such as environmental accounting in the making.

The empirical material was collected through fieldwork observations, interviews and document analysis. Our fieldwork began in January 2010, a little over four months after Gamma had begun their deliberations regarding the building's design. Gamma had established a cross-departmental "innovation group", dedicated to this task, and we were permitted to sit in on all 10 of their meetings, each lasting 4-6 hours. We corroborated our observation notes and used them as a supplement to the minutes Gamma made of the meetings. We conducted, recorded and transcribed semi-structured interviews lasting one to three hours with each of the seven members of the innovation group. In addition, we were given access to the project database, which provided us with all project documents as they were uploaded during the project (which ended late 2010). The database included various kinds of background material, such as sketches and drawings, technical reports and the energy calculations, as well as minutes from all meetings.

The analysis of the empirical material involved reading and ordering our field notes, the interview transcripts and various documents by focusing on four themes: 1) How was the building design discussed and defined in the project, i.e. how was it delineated and concretized? 2) How were different notions of environmental accounting, such as energy and carbon accounting, mobilized in the project, when and by whom? 3) What role did calculations and other inscriptions play in the process? 4) What other matters of concern became central in the discussions and how were these concerns related to the company's concerns regarding the building's energy performance? These questions stem not only from our fieldwork, but also from our theoretical interests and approach.

From the empirical material, it was clear that the definitions of how and what to count and account for in assessing the building's future environmental performance were unsettled and contentious. Settling these issues was the innovation group's core task. This was, however, not straightforward, because developing the design was entangled with questions regarding the building's boundaries as well as with a host of organizational considerations that called for balancing the building's environmental performance with other concerns. We noted that the project participants used strong metaphors to convey their ideas, particularly in "hot" situations where there was little or no agreement as to what a "green" or "zero energy" building should entail in practice. As a result of this observation, our analysis also examines the use of metaphors closely.

4. Assembling and accounting for a "zero energy" design

Gamma had long been planning to replace their existing headquarters, an older building from the 1970s, with a new one to be located at the same site. Three years prior to the process we followed, Gamma's proposed architectural design met extensive citizen protest, mainly because the proposed building was found to be too visually obtrusive. As a result, Gamma abandoned their initial design proposal. When they (three years later) decided to develop a less controversial design, they had in the interim been branding themselves as environmentally conscious, and it seemed only logical that their new headquarters should be a "green" building. They had, however, no idea of what this would entail in practice or how it could be accounted for.

Gamma initiated the design process by establishing a project organization consisting of a project management team (a project coordinator and the project manager) and five so-called "innovation teams", consisting of company employees but also the lead architect, his assistant and two engineers from a large engineering consultancy. The innovation teams (each consisting of 4-6 people) were responsible for finding innovative green solutions for five main sets of issues: functionality and work environment, electrical installations, building envelope and construction techniques, energy supply, and water and sanitation. Each team was headed by a Gamma employee, all of whom were members of a cross-team "innovation group". Although the innovation teams were encouraged to "think out of the box" when developing their suggestions, some design parameters had been settled by project management in advance: The building had to unobtrusively fit in the landscape to avoid community protest, and it had to symbolize Gamma's corporate identity. At a kick-off workshop in September 2009, sustainability was introduced as the guiding concept for the design process, but this was subsequently narrowed down to minimizing energy use. However, determined to go beyond compliance with existing energy performance requirements, Gamma decided to design a "zero-energy building".

4.1The making of an accounting framework

Once they had agreed upon this idea, project management faced the issue of how to account for the building's energy performance. The notion of zero was central, but they were not sure of what to *count* and how to *account* for these things. A shared space of calculability (Callon, 1998b) had to be established. One initial concern was whether the primary physical unit to account for was to be carbon or energy. As a consultant explained:

> You can consider energy used, but you might also choose to look at carbon. And many people think that CO_2 is the real currency that ought to be considered, if you want look at how you behave in relation to the climate.

Even though CO_2 might be considered the "real currency" for measuring energy performance, project management argued that *energy* accounting was a better framework for this particular project, for pragmatic, technical reasons. The project manager and the engineering consultants agreed that defining and specifying inputs and outputs in a CO_2 account is technically much more difficult than completing an energy account. According to the consultant:

> In a CO_2 account, you have to define the boundaries of the CO_2 account. And the client [Gamma's project manager] felt that this kind of definition and

> delimitation would be difficult to make in a sensible way. Also – and he's probably right in this regard – it's incredibly difficult to get the necessary data. If you really want a complete CO_2 account for a building, then it's extremely hard to get information about the input needed for the account.

Gamma had, however, another reason for choosing energy accounting. This would allow them to illustrate that Gamma is an *energy* company. Carbon accounting could, according to the project manager, be risky, because Gamma produces considerable amounts of CO_2, despite their strategy to reduce emissions. Using carbon accounting to help brand their new headquarters could, therefore, easily backfire, if the media or environmentalists started comparing the building's CO_2 account with Gamma's overall CO_2 emissions. As the project manager explained:

> We're an energy company. So, early on it was clear to me that we shouldn't do anything that focused on CO_2 […]. We're one of the most CO_2 polluting companies in the country and we can't just change that overnight. […]. And I don't see how we can make a good story based on the fact that we might save a little CO_2 on the coffee makers, or whatever. It's just not coherent. Any journalist or Greenpeace activist could say 'yeah, right, it's good that you do all this, but look at your green accounts. They tell us that you emit thousands of tons CO_2 every year. And now you save 400 tons here'. That doesn't make sense.

Hence, CO_2 was excluded from the calculations and the accounting framework, and attention centered on energy instead.

In developing their energy account, Gamma built upon a readily available tool – an energy account algorithm, developed by a government agency. This tool allows contractors to document a building's expected energy performance and compliance with the building code. It is based on calculations of the energy needed to operate a building and projections of energy demand for room heating, cooling, ventilation, water heating and lighting, but it does not include user-related energy demand or on-site energy production. By adding these two dimensions to the tool, Gamma developed their own accounting framework that they used to assess whether they, indeed, had succeed in developing a "zero energy" design. Calculations of user-related energy demand were based on the consultancy's experience in assessing best practices within facilities management, whilst the energy production calculations were based on results from Gamma's research and development activities. Table 1 illustrates the structure, content and types of calculations called for in Gamma's accounting framework.

- Insert Table 1 here -

This framework established the necessary space of calculability for guiding Gamma's discussions about the building's design. As can be seen from table 1, changes in key parameters such as area, choice of building envelope materials and energy technologies all effect the energy consumption and production calculations.

4.2 Drawing boundaries

Defining the building as a zero-energy building meant that energy calculations and accounting were fundamental to the project throughout the design process. The success of the building design would depend on the account showing a (positive) balance between energy production and consumption. Given that the building's design was unresolved, this further accentuated questions of *what* to include in the energy account and *how* to count.

Although the definition of a zero-energy building seems to be straightforward, translating this overarching idea into a design program for a specific building raised a number of non-trivial questions regarding the activities to be included in the account, the building's spatial form and the temporal dimensions of the account. First, what were the relevant activities to be included? Was it only the operations taking place inside the new office building that were to be taken into account? Or should energy consumption during the construction process be included as well? What about the energy consumption associated with the employees' daily commute to and from work? Second, how were the physical boundaries of the building to be drawn relative to the adjacent buildings? Third, at what point in time would it be legitimate to call it a zero-energy building, i.e. what should the time frame for the account be? For example, given that achieving an energy surplus is easier in the summer than in the winter, should the account show a surplus on an annual or a monthly basis? Or at any point measured, no matter how short the time period? There were, in other words, a number of boundaries that had to be settled so as to frame the design project before Gamma's energy accounting framework could be used to calculate the building's future energy performance and assess this against the benchmark "zero".

Project management excluded energy consumption during construction and the employees' commute in their framing of the project, because of the difficulties in (respectively) achieving a positive energy balance in the short-term and registering employee transport behavior. Gamma chose, instead, to focus on the operational aspects of the building in a relatively narrow sense, i.e. solely on the energy used for operating the building. However, in order to do so, they had to specify the building's spatial dimensions. The second key boundary issue was, therefore, defining the physical building to be accounted for. The plan was to locate the new building adjacent to an older office building and link the two via an atrium. It was not until the innovation group began calculating the projected energy use and production that they began to consider how the abstract space of a future building could be made physically calculable. Up until that point, they had treated all three entities – the new building, the older one and the atrium – as one building. However, attempts to balance the energy account showed that the older building's energy performance was so poor that it would have to be modernized drastically, at an unwelcomed cost. As a result, they decided that *the* building to be accounted for would only be the new building and the atrium. This would make it easier to balance the energy account. The decision to exclude the existing building meant drawing a spatial boundary in relation to the energy account. Even though the old and the new building would be physically connected, the two buildings were disconnected in the energy accounting framework. This was controversial and a concern for some in the innovation group. As one participant explained: "It's very difficult, because once construction [of the new building] has been completed, it will look like one building. You enter the reception area […] and when you look to the left you see the walls over there, and then you look to the right and say 'that doesn't count'."

The project manager, however, insisted on establishing this boundary, because it would enable Gamma to fulfill the zero-energy ambition at a reasonable cost and still be consistent with the story Gamma wanted to tell:

> …We changed the story to say that the zero-energy account would be about the new building. And then we would try to make another energy account for the old part of the building that would hopefully show that we have, at least, fulfilled the building regulation requirements.

The economic implications of having to re-vamp an old office building so as to balance the energy account were not initially a concern, nor part of the initial framing of the project. However, the account's rendering of the building's energy performance strongly informed – if not forced – the project management to re-frame the building's spatial boundary, because they felt it would increase the likelihood of top management's accept of the team's design idea.

Some participants argued that imposing such a strict spatial boundary could potentially have negative effects on the energy account, because it affected another vital concern – the possibilities for producing energy. If the spatial bounds of the new building symbolized an absolute boundary, then this would also mean that energy production would be limited to this site, i.e. have to be supplied by technologies physically located on the building. This lead to much debate, as some group members thought that this would result in a visually disturbing design that could provoke renewed community protest. It was repeatedly argued that easing up on the spatial boundary would allow for using a nearby parking lot for solar panels, a small wind mill and perhaps batteries for storing energy. These technologies would be less visible and, therefore, less likely to interfere with the aesthetics of the building. However, others in the innovation group considered this as inconsistent with the spatial boundary and tantamount to "cheating". This issue remained controversial throughout the design process.

The third type of boundary that needed to be set was a temporal one, i.e. determining the time frame in which the energy account was supposed to be in balance. Was it to be on an annual basis or should consumption and production balance at all times? As one of the proponents of the former framing explained:

> But what is a zero-energy building? You know, one of the things we discussed is whether producing the same amount of energy as you consume on an annual basis is sufficient. Because then you can just put up some solar cells to solve the problem. But then you produce all your energy in the summer and put it on the grid, which acts as a battery. So when the sun doesn't shine much during the winter, you can withdraw the energy saved on your account.

If the building were linked to the grid, it would, according to him, be much easier to balance the account. Project management wanted, however, to treat the building as if it were "an isolated island" – completely self-sufficient in terms of energy at any given time; as if the building would not be connected to the grid. This metaphor was, however, quite controversial. Some team members felt that treating the building as if it were an "island" would lead to "a second-best solution," because it would not be possible to utilize the grid's capacity, and Gamma would, thus, undermine efficiency of the existing energy system. This concern continued to surface in the innovation group's deliberations.

Establishing the design project's spatial and temporal boundaries further specified the calculative space constructed in Gamma's accounting framework and enabled the project team to re-frame the design task. However, accounting for the future, imagined energy use in Gamma's new building invoked a number of considerations regarding the building's material design.

4.3 Different concerns

The design challenge facing the project team was multifaceted: they wanted to design a building that would provide the desired office space, signal Gamma's corporate identity, and simultaneously live up to the ambition of "producing as much energy on site as would be consumed". With the area and, thereby, the number of workspaces, meeting and kitchen facilities (temporarily) settled, calculations of the user-related energy demand could be stabilized, whilst calculations of the building's energy performance and on-site energy production remained much more fluid, hinged on choice of materials and technologies, and the implications that these choices were thought to have for the local community's acceptance of the building and the future users' presumed requirements regarding the building's functional qualities. Hence, balancing the account involved iterative explorations of design options rather than simple trade-offs amongst known options. Many of these design iterations were subject to contestation.

The aesthetics of the building was a great concern because of Gamma's experience with their previous design proposal. Several team members had experienced the public protests against Gamma's initial building project first-hand and were, therefore, keen on ensuring local community support for the new project. They introduced the metaphors "Moon-base Alpha" and "an amusement park" to convey what they considered to be undesirable designs. These characterizations of the imagined building were prompted by visualizations of the building depicting energy-producing devices such as micro-turbines, horizontal turbines on the roof, and solar cells attached to the building edifice. Even though these technologies would enable Gamma to balance their energy account, the design was not considered aesthetically viable, because the building would look too "unruly". Both metaphors were frequently invoked in the design process whenever concerns about the building design's aesthetical appearance surfaced.

Had these aesthetic concerns not stood in the way, it would have been relatively easy to balance energy use and supply. As one participant noted: “The initial design ideas, visualized in the drawing, were really just based on counting backwards”. Based on estimates of the amount of energy needed to operate the building and the office facilities, they could then relatively easy determine the amount of energy that had to be produced on site using various energy sources and technologies. However, the aesthetic concerns arising from the anticipation of citizen protest precluded them from taking this approach. The team had to find other ways of “counting to zero”, i.e. by placing more emphasis on reducing energy consumption.

This, however, led to different concerns regarding the functionality of the building, which were not easily aligned with the zero-energy goal. Ventilation, temperature and indoor climate were considered of paramount importance not only for employee comfort, but also for their acceptance of the design and, hence, the building’s energy performance. For instance, if employees could accept seasonal variations in room temperature, then this could have a positive impact on the energy account. However, these energy-saving considerations had to be balanced with imagined user perceptions of an acceptable indoor work climate. Clearly, a room temperature of say 10 degrees centigrade would be unacceptable, but would a span ranging from 19-28 degrees be reasonable? Would employees accept this? Or could they perhaps *learn* to accept these parameters, if they were brought to understand that this would contributed positively to the energy account and, hence, to the global climate? These questions were discussed at great lengths, because the building’s energy performance was seen as contingent on employee behavior. Future employees were often invoked at the innovation group meetings and imagined as individuals open to changing their behavior (reducing energy consumption) so as to balance the energy account.

The question of employee behavior prompted discussions of how particular design elements could induce the desired energy-saving employee behavior, for example by physically locating the elevators in such a way to encourage employees to take the stairs, and using displays to make employee energy-consumption visible. As one participant explained:

> Visualizations affect people’s behavior. […] If you have big screens showing consumption and balance, then you’ll notice if it’s red and blinking. You know, some kind of simple system that’ll make our colleagues say, ‘hey, did you notice that we spent way too much energy yesterday?’, ‘Well, that’s because …’, ‘Okay, today we need to spend less because the sun is shining and then we don’t

> have to …'. You, know some kind of motivating factor. That means a lot. Because there are some serious problems, like people don't care whether or not they turn off the coffee maker or dishwasher after it's finished. That's something we really have to work with.

However, each of these 'solutions' introduced new concerns, e.g. making the elevator less easily accessible might make the employees take the stairs, but it could also be seen as discriminating against disabled users; visualizations of daily energy consumption may affect the behavior of some employees, but not for others; and what happens when the novelty wears out?

Moreover, the building's long-term energy performance was also a concern. The design had to be flexible enough to accommodate changes in technologies, user needs and the ways work would be organized in the future. The metaphor "plug and play" was often invoked to capture this design challenge – the building design had to be sufficiently flexible so that new technologies could easily be plugged in and made to play. Flexibility was considered as an important way of not only ensuring but possibly also improving the zero-energy account, because the participants believed that future innovations would make it possible to save even more energy. Flexibility was also considered as an important aspect in relation to the future work environment and, hence, sustained user satisfaction.

These aesthetic, functional and behavioral concerns were unresolved when the design process was abruptly brought to an end, because of changes in Gamma's economic priorities. After more than a year's work, Gamma abandoned the idea of rebuilding their corporate headquarter.

5. Discussion

Counting to zero may sound like a simple task, but our study highlights how calculations presuppose contingent processes of boundary drawing, classification, simplification, and commensuration (Miller, 2001; Lohmann, 2009; MacKenzie, 2009). Our study has focused energy accounting *in the making*, and contributes to the environmental accounting literature by illustrating the messiness of energy accounting in action at a detailed, empirical level. As with accounting in general, a central aspect of energy accounting is about "turning qualities into quantities" (Espeland and Stevens 2008: 412). In our case study, the general idea of designing a green building was translated into the quantifiable idea of designing a zero-energy building. Once the building was defined as such, they extended an existing energy accounting algorithm to create a number of measures that could be used in the design process. Calculations became key to developing the design. Even though this accounting framework was not subject to much debate, using it to design and account for a specific zero-energy building was far from a straightforward endeavor. It involved intensive work in the project teams, numerous discussions, negotiations and calculations to establish frames for both the account and the building design.

The framings remained contestable and subject to overflows created by other concerns. Aesthetic, technical and functional concerns became entangled with one another in the design process, and this generated a succession of what Callon (1998b) would consider "hot situations", i.e. situations in which the proposed designs were subject to contestation and, in some instances, re-framed. Thus, while calculations were central and the zero was a fundamental measure, this measure never stood alone. Other concerns and evaluative criteria also had to be taken into consideration, thus, intertwining accounting, designing and organizing in complex ways. The specific accounting framework in our case emerged as previous events (citizen protests over a previous design), interests in communicating corporate identity, and existing calculative tools (an energy performance algorithm, best practices in facilities management, existing research results) became entangled with one another.

This accounting framework provided a temporary space of calculability within which the project team could assess whether or not the various design proposals lived up to the ambition of balancing future energy consumption and production; of the account showing at least zero. This balancing act enabled evaluations of suggested design elements and guided the design choices. In this fashion, energy accounting had an adjudicating role (Miller and Power, 2013). Energy accounting was used to document – through a variety of calculations – the energy performance of each design proposal which, in turn, allowed project members to assess which of the proposals would best enable them to meet their design ambition of constructing a zero energy building. Thus, the number zero established the yardstick that made it possible to distinguish between success and failure.

Our analysis shows how energy accounting inscriptions were mobilized at different points in time in the design process and how they, in turn, mobilized different design ideas that either had not been considered previously or had already been rejected. In this context, accounting was not just mobilized, but also mobilizing (Mouritsen et al., 2009: 738). Following from this, the energy account can be seen an important device in the process, an "object with agency" (Muniesa et al., 2007: 2) that intervened in the design process and made it possible for the participants to assemble a building design that could be labeled a zero-energy building. Hence, Gamma's energy account helped to bring into existence the concrete spaces in which it would be used. It helped define the accounting entity. This became apparent when project management and the innovation group were 'forced' to determine what should be accounted for, i.e. to physically delineate the not yet existing building as the relevant object to be accounted for. Drawing the boundaries was, however, subject to much negotiation and dispute. Hence, the physical building, as a specific accounting entity, was a contingent construction. The boundaries of which could have been drawn differently (Kurunmaki, 1999; Arnold and Oakes, 1995).

Not only were the energy accounting framework and the preliminary building design constructed in the process. Gamma's project team members also invoked *imaginary* users of the energy account. Amongst the more important were the employees working in the future building. All project members agreed that the employees' behavior would affect the energy account significantly and that realizing the goal of a zero-energy building would depend on their behavior. Energy accounting was seen as one of several means for providing future employees with the necessary information to motivate them to behave in an energy-conscious fashion that would enable Gamma to fulfill their zero-energy goal. However, the team members continued in their discussions of the various designs to invoke their future neighbors; imagining how these neighbors and the local press would react to their various design proposals, and reflecting upon these conjurings in further developing the building design. In a sense, the case is not only about making an accounting framework and an accounting energy, but is also about the making of the future energy accounting users (Young, 2006).

Our study illustrates how calculations, visualizations and narratives are intertwined in accountability processes. Accounting for the zero-energy building implied numerous calculations, but they were constantly being supplemented, and sometimes contested, by visualizations and different stories about the building and the future user of both the building and the accounts. Throughout the entire project, the project team kept coming back to the question of "what story do we want the building to tell" and "how do we design the building in a way that will actually tell this story". The team used a variety of metaphors – island, Moonbase Alpha, an amusement park – to indicate what story they would like/not like to tell. Initially their goal was to design a building that would be recognizable as a Gamma building, but as they worked to develop their ideas of what the building might look like and might contain, they became more ambitious because they wanted the building to represent their corporate identity as an environmentally friendly energy company. In this way, the design project was about accountability in more than one sense. Gamma wanted to account for their corporate identity through energy accounts that would demonstrate energy-consciousness, as materialized in their new headquarters. The building would show, they hoped, that Gamma is an accountable and responsible firm.

This shows that the distinction between environmental accounting as either externally or internally directed activity might be less clear than often assumed in the literature. Concerns regarding external stakeholders' reception of Gamma's energy account and the associated reputational effects had a strong influence Gamma's choice of accounting framework. Although this may be deemed as symbolic action, this framing of the energy account had, nevertheless, substantive implications internally, i.e. for the development and assessment of the project team's design decisions. Concerns for both external and internal stakeholders were recursively interwoven into Gamma's design process. The framing of what to count and account for also suggests that the distinction between internal and external environmental accounting was not so sharp. On the one hand, energy accounting was clearly seen as an internal tool that Gamma could use to inform their design ideas. On the other hand, in debating what to account for – energy or carbon – the former was chosen not only for simplicity's sake, but also because of the reputational risks associated with carbon accounting. Project management anticipated that attempts to frame accounting solely as an internal activity would prompt critique if people outside the company read the accounts; a critique – overflow – that would be difficult to accommodate, thus, calling for a re-framing of the account.

6. Conclusion

This paper has examined how a particular form of environmental accounting, energy accounting, was established and used in defining the design parameters for a new office building, where minimizing energy consumption had to be balanced with other concerns such as work climate, aesthetics and costs. Our findings offer several insights regarding energy accounting in the making that supplements the extant literature.

First, in keeping with insights from the literature on environmental management accounting, energy accounting provides information that can inform management's decisions, but our findings also suggest that energy accounting contributes to *forming* rather than just informing management decisions. Second, energy accounting is also performative in the sense that is helps frame the accounting entities and enactment of possible futures rather than just describing and monitoring past performance. However, our study has shown that this is far from a straightforward process when the object to be accounted for is not a 'given' but something that has to be framed in order to establish the necessary "spaces of calculability" (Callon, 1998a: 256). Our analysis shows that this practice is subject to contestation and overflows as new concerns surface to challenge existing (temporally stabilized) frames and provoke a reframing of that which is to be accounted for.

Third, our study highlights just how important numbers are in allowing the participants to, on the one hand, make sense of their design ideas, and to tell stories on the other hand. Energy accounting is as a practice entangled with numerous other concerns that have to be settled. In our case these concerns emerged in the organizational process of defining the design of Gamma's new headquarters. These observations suggest the need to closely examine the processes whereby the objects of accounting are framed and re-framed.

Although ANT is increasingly used within the general accounting literature (Justesen and Mouritsen, 2011), we have sought to extend this perspective to the realm of environmental accounting as a way of theorizing the role of environmental accounting by directing attention to the performative role that environmental accounting can play. Rather than considering these forms of accounting solely as representations, they can be considered as interventions that can be useful in shaping future organizational performance. In this sense, environmental accounting can be considered as a design tool. However, as our case shows, the making of such accounts is subject to numerous overflows that have to be negotiated and reframed. We suggest that this offers a broader view of the organizational and managerial complexities involved in environmental accounting that are often not explicitly considered in the literature.

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Table 1. Gamma's energy account: estimations of energy consumption and production

Energy consumption

1. Operating the building (according to the building code):
   - Building envelope – calculations of heat transmission loss for each element:
     - Outer walls, roof, ceilings, floors, other plane areas
     - Foundation, window joints: including calculations for cold bridges
     - Windows, outer doors: including calculations for solar heat transmission, solar screening
     - Unheated areas

     Based on data for transmission area, transmission coefficients, temperature gradients
   - Ventilation: calculation of energy use for different ventilation systems (mechanical ventilation, natural ventilation and mechanical suction, all operating at average capacity), and considering infiltration and seasonal variations
   - Internal heat sources: calculation of heat contribution from the number of people (each person producing a number of watts) and heat emitted from office equipment
   - Lighting: calculations based on the usage, effect and regulation of lighting systems, adjusted according to a daylight factor (dependent on the orientation of the building). Also included are calculations of stand-by effects of all lighting systems
   - Other forms of electricity use (including standby use): outdoor lighting and special equipment, e.g. elevators, computer servers, window automation, etc.
   - Heat distribution systems: calculations of heat loss in the boiler/pipes and pumps in the boiler and/or ventilation system
   - Water heating: calculations based on water consumption, temperature and heat loss in the water system; electricity used for circulation pumps
   - Energy supply: calculations of effect, efficiency, etc. for boiler and each type of energy source:
     - Combined heat (CHP)
     - Solar cells/PV-system
     - Heat pumps

     Energy provided by different sources is weighted by different factors in the calculations.

2. Operating the offices – based on estimations of number of employees, workspaces, number of meeting rooms, canteen facilities, and of office equipment energy efficiency
   - Electricity use associated with each workspace: for PCs, screens, motorized desks, table lamps, charging telephones
   - Electricity use for alarm system and other technical installations (operations and standby)
   - Electricity use for special lighting
   - Electricity use for printers, coffee machines and other appliances
   - Electricity use associated with meeting rooms: for PC, AV-equipment, screens
   - Electricity used in operating the canteen kitchen: for stoves/ovns, fridges/freezers and other electric kitchen appliances

Energy production

1. Electricity: based on estimations of number of units their effect (kWh/yr/m^2 or kWh/yr/unit)
   – Solar cells on roof
   – Solar cells on atrium roof
   – Solar cells on façade
   – Solar cells on roof of parking lot
   – Mini wind mills
   – Mini combustion plant
2. Heat
   – Mini combustion plant
3. Cooling