5-20-2020

Making Energy Metrics Relevant to Service Firms: From Energy Conservation to Energy Productivity

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Recommended Citation

Randle D. Raggio, Peter Ekman, Steven M. Thompson, Making energy metrics relevant to service firms: from energy conservation to energy productivity, *Journal of Cleaner Production*, Volume 256, 2020. DOI: https://doi.org/10.1016/j.jclepro.2020.120493.

This is the authors' accepted version of Raggio, Randle D., Peter Ekman, and Steven M. Thompson. "Making Energy Metrics Relevant to Service Firms: From Energy Conservation to Energy Productivity." *Journal of Cleaner Production* 256 (May 20, 2020): 120493. https://doi.org/10.1016/j.jclepro.2020.120493.

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Highlights

- Describes how energy use can become an integrated part in the management of service firms.
- Measures energy utilization per square meter of space and per employee, do not reliably capture changes in sustainable efforts.
- Energy consumption relative to value creation is a better measure for stimulating energy efficiency within service firms.
- Energy productivity metric for service firms relates energy usage to organizational and national sustainability goals.

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Abstract

Although energy conservation and reduction in environmental impact are on the international and most national agendas, service firms rarely include energy consumption metrics in their strategic decision-making. One reason for the omission is that for service industries, firm level energy utilization is most commonly measured in kilowatt hours per square meter of office space where changes often related to the space rather than the firm performance. The measure also presents several problems for firms in service industries. First, energy conservation and reduction may be counterproductive for service firms that are growing and require energy to sustain that growth. Second, it may not relate to national and international goals which are often focused on the amount of carbon dioxide produced generating energy than the total amount of energy consumed. Third, it treats energy as a utility rather than a resource in firms' value creation. Results from a field study focused on service firms in Sweden suggests that focusing on energy productivity overcomes the limitations of existing measures and produces positive results. By conceptualizing energy productivity as output per unit of energy, we create a conservation metric that enables service firms to measure their contributions to energy consumption relative to national economic growth. As a result, energy productivity aligns the interests of service organizations with those of policy makers and conservationists.

Keywords: Energy productivity, energy conservation, service organizations, corporate social responsibility, abductive research

1. INTRODUCTION

Energy policy has emerged as a significant social and governmental concern shared by local, national and international organizations (Press & Arnould, 2009). In industrial sectors where firms use significant amounts of energy, well-developed systems and key performance indicators (KPIs) for firms to measure and report their energy efficiency have been developed and adopted (Bajpai, Fernandes & Tiwari, 2018; Blomberg, Henriksson & Lundmark, 2012; Bunse *et al.*, 2011). However, in most developed countries the *service sector* is the dominant form of business and the single largest component of the national economy (Furrer & Sollberger, 2007). In contrast to industrial firms, most service firms do not have manufacturing or production processes that require large amounts of energy. Instead these firms utilize factors of production such as office space, retail areas or restaurant areas, employees, and information and communication technologies. Other than the generic goal of "energy conservation" and highly aggregated estimates of energy use, service firms do not have effective energy consumption measures that reflect organizational priorities and national policy objectives.

Service industries are having a growing impact on economies, but they are seldom the focus of environmental impact studies (Wang, He & Zhao, 2020; Ma *et al.*, 2019; Shrake, Bilec & Landis, 2013). While it may be expected that corporations would focus on profits while governmental or non-governmental organizations (NGO) will focus on energy conservation, we find that corporate sustainability managers tend to focus exclusively on energy conservation, conceived and measured narrowly as synonymous with gross energy *reduction*. That is, we find a conflict even *within* organizations: i.e., sustainability managers vs. other executives. Unfortunately, existing measures available to service firms such as kilowatt-hours per-square

meter (kWh/m^2) or kilowatt-hours per-employee (kWh/employee), although easy to obtain, can be detrimental to the bottom line *and* encourage environmentally damaging practices.

Based on a field study that built on a close researcher-practitioner collaboration with service firm representatives (those using the energy for value creation) and commercial real estate firms' representatives (those offering the offices, retail and warehouse areas with related infrastructure) this article introduces a new energy consumption measure. Instead of accepting the idea that there is an intractable tension between profitability and sustainability, we introduce the concept of *energy productivity* (conceptualized as output per unit of energy) to reveal a nexus of aligned interests that can overcome entrenched positions and bring service firms, government, NGOs and society to the same side of the table. By focusing on energy productivity, service firms can align their resource allocations (Andersson & Mattsson, 2010) with their financial and environmental goals as well as national policy objectives on energy usage. Like existing productivity measures with which managers are familiar, such as revenue-per-employee (or miles-per-gallon), we suggest that energy productivity is a concept that is both intuitive and attractive to those who wish to increase profits. Additionally, the concept improves the piecemeal and often counterproductive approach of current attempts to measure service firms' sustainability efforts. The good news is that, although energy productivity has been developed with service firms in mind, this metric is relevant and applicable to all firms and organizations.

This article is written for researchers interested in energy-related managerial studies as well as governmental and NGO, public and private organizations that wish for a true partnership to bridge the extremes of governmental mandates and greenwashing. In this article we make three important contributions: (1) the application of the concept of energy productivity to service firms, (2) a simple operationalization focused on managerial action, (3) an empirical investigation from

a country with progressive energy goals. We suggest that a clear demonstration of the possibilities for service firms, NGOs and government will provide a path forward for future policies, procedures and protocols where international, national, sector and firm goals can be aligned.

2. STUDY DESIGN

This article reports the results of a multi-year longitudinal field study of service firms in Stockholm, Sweden. The research design was inspired by engaged scholarship where researchers and practitioners collaborate to develop both academic advances and enlightened practice (Van de Ven, 2007). The study had three stages starting with an explorative stage 1, followed by a clarifying stage 2, to a confirmatory stage 3 (see Figure 1). Practitioners at various managerial levels were involved throughout to ensure a complete understanding of motivations and attitudes, and we analyzed detailed operational data to evaluate the proposed solution.

[Insert Figure 1 about here]

Figure 1. Study Design

Sweden is considered a progressive country when it comes to sustainability and quality of life (Strand, Freeman & Hockerts, 2015), and Swedish corporate communications frequently focus on ecological, environmental, or sustainable activities. Sweden has well-developed regulations on energy use and has gone as far as specifying regulatory guidelines for buildings (see Appendix A). Thus, we suggest that insights developed in this setting can lead to generalizable recommendations based on the following factors: (1) the commercial real estate sector is subject to specific regulations on energy use that significantly impact current and future corporate behavior; (2) most

commercial real estate tenants are small and midsize enterprises (SMEs) active in the service sector; (3) Stockholm is a major city in the country and region; (4) Sweden has a long and important history dealing with energy issues through governmental and market-based regulation; and (5) Sweden is subject to Directives and Regulations that apply equally to all European Union (EU) member countries; and (6) in 2017, Sweden set even higher environmental goals than the EU, such as to be fossil-free by 2040.

2.1. An Abductive Approach

The study followed an abductive approach (Dubois & Gadde, 2002; 2014) that allows for an interplay between the data and theory (Paloviita *et al.*, 2016) where the "goal of the research was to match theory and reality in a nonlinear, path-dependent process of systematically combining empirical observations and insights from a continuous exposure to literature." (Storbacka, 2011, p. 700). Thus, literature review, data collection and analysis were not performed in a sequential, stepwise process. The abductive approach allows all stages of the research process to be conducted simultaneously through the process of systemic combining (Dubois & Gadde, 2002). Thus, the research findings are the result of an analytical approach that Nenonen *et al.*, (2017, p. 1137) describe as following an abduction method when (a) it requires collaborating with managers and (b) where "the theorizing process does not include steps that require *separate* information gathering or analysis, and the potentially resulting new knowledge is generated during the practitioner–academic interactions." Thus, it was a highly interactive process that included highly engaged practitioners (Holstein & Gubrium, 1997). The study's three main stages, which are outlined in Figure 1, allow for a refinement of the results. Throughout all three stages, the abductive approach was upheld by constantly going 'back and forth' from one type of research

activity to another and between empirical observations and theory (Tavory & Timmermans, 2014; Dubois & Gadde, 2002) which allowed for a simultaneous understanding of both theory and the observed phenomena.

2.2. Data Collection

Data collection included more than 40 structured and 20 unstructured interviews (Hannabuss, 1996), eight focus groups (Morgan, 1997), and repeated participation in seminars and fairs. The structured interviews probed the respondents understanding of the energy use of his or her organization, the extent to which they regularly followed up on energy use, and the types of information they gathered related to their resource use. The unstructured interviews allowed for complementary insights and for the development of contextual understanding. Finally, the focus groups were an efficient way for gathering insights related to group consensus on energy conservation efforts as well for obtaining confirmation of nascent empirical findings as they emerged.

In addition to workshops and interviews, we had access to energy usage data that was collected by one of the real estate firm's software applications. Tenants could use the software to monitor actual energy consumption. We also had access to other energy-related communications from IT firm that developed the software application. Combined with field notes, the interviews and focus groups generated 1,000+ single-line pages that were stored in a database so that all participating researchers could access all data. Since the study setting is characterized by extensive government regulation and is infused with numerous regulations, certifications, and standards, we also applied triangulation by using secondary data such as government and NGO documents, webpages, and news reports.

2.3. Three Stages of Inquiry and Analysis

The first organization we contacted for our field study was a large commercial real estate firm with more than 500 commercial tenants active in the service sector. Access to this large organization provided deep insights into the significant issues facing the service sector and their landlords, along with the broader global social and policy implications of energy use. During Stage 1, we followed this firm and its tenants (i.e., service firms) by (1) monitoring their daily use of a newly developed software application, or "app" for ease of exposition, that offered real time energy use, (2) tracking their attendance at interest groups and meetings with NGOs. The purpose of gathering this data was to better understand the role of energy – and their adoption of CSR activities – in their everyday operations. Our goal for Stage 1 was to develop an understanding of the energy-related problems and issues faced by real estate and service-sector firms, capturing the different viewpoints and norms related to energy use, and to develop a structure for representing the problem. The first stage allowed for developing initial rough propositions about current concerns and possibilities.

In stage 2, we expanded the study to include additional real estate firms, their commercial tenants, and NGOs. During this phase we developed a set of possible explanations for why service firms are dissatisfied with current energy conservation metrics. Our goal for Stage 2 was to have practitioners review the set of possible explanations and refine them with addition detail. Two independent researchers reviewed the material added by the managers for inconsistencies and contradictions between how we structured the problem and the managers' interpretation and elaboration of the problem (Silverman, 2001). This was followed by workshops with the participants for further member checking and clarifications (Marshall & Rossman, 2011). During

the workshops, the managers assumed the role of reflective practitioners (Schön, 1983) by again elaborating our findings to validate or refine them. Based on this feedback, we revised the proposed explanations and developed a solution, energy productivity.

Finally, in Stage 3, we carried out a final workshop where participating firms gave input on their view of our proposed solution. This stage included further clarifying interviews and focus groups that were recorded and transcribed (initial focus groups were also filmed). Initial findings have been presented to the participating practitioners and to other researchers at scientific conferences and seminar for refinement and clarity. The results were then described as a narrative with illustrative quotes representing respondent thoughts and concerns. Given this process, the outcome has not been quantified (e.g., the is probably variance in the six concerns depending on industry and context) but the concerns can be expected be present in a larger population as well as the applicability (cf. theory in use) of the remedy (energy productivity).

3. LITERATURE REVIEW AND PROBLEM IDENTIFICATION [STAGE 1]

Individuals, organizations and governments are increasingly sensitive to actions that impact the environment. Such action can be described as environmentally significant behavior (Stern, 2000, p. 408) and it has two dimensions: (1) "the extent to which [behavior] changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself" and (2) "from the actor's standpoint as behavior that is undertaken with the intention to change (normally, to benefit) the environment". In this study, we focus on the second dimension, specifically "people's beliefs, motives, and so forth in order to understand and change the target behaviors" (Ibid., p. 408). Thus, environmentally significant behaviors have the potential

to increase or decrease measures of energy use, energy conservation, energy efficiency, energy productivity, energy intensity, sustainability, etc.

Although "corporate sensitivity to the environment is on the rise" (Ramirez, Gonzalez & Moreira 2014, p. 16), most energy-behavior studies are conducted on consumer (B2C) markets rather than business (B2B) markets. Examples in B2B settings include Ramirez *et al.* (2014) that consider factors that inhibit the purchase of environmentally sustainable offerings for use in business operations, and Tjärnemo and Södahl (2015) that evaluate Swedish food retailers' attitudes toward promoting "climate smarter food choices." A few energy related B2B articles were published in the 1970s (BenDaniel *et al.*, 1977; Estrup, 1974; Brookes, 1971), but these had more of an econometrics approach than a managerial orientation. Across decades, most published work in management addressing energy use has focused on how consumers react to messages or programs encouraging environmentally significant behaviors (e.g., Goldstein, Cialdini & Griskevicius 2008; Harries *et al.*, 2013; Schwartz *et al.*, 2015; Allen, Calantone & Schewe 1982; Ritchie & McDougall 1985), or what keeps consumers from adopting such behaviors (Press & Arnould, 2009). A review of literature in other fields, such as economics, law and energy policy, shows that those researchers have adopted a similar focus on consumers (Wilson 2014; Faruqui, Sergici & Sharif, 2010; Costa & Kahn, 2013a; Ayres, Raseman & Shih, 2012; Allcott 2011; Harding & Hsiaw, 2014; Allcott & Rogers, 2014). Thus, we extrapolate from previous studies in order to frame the research context of service firms. Fortunately, several areas of research are shared among the different disciplines, and are relevant to the present study.

Based on a content analysis of relevant literature and supported by conversations with experts in the field, we discuss the general theoretical frameworks for investigating *environmentally significant behaviors* that are also applicable to service firms. The relevant

theories are: (1) Social Norms Feedback, (2) Goal Setting, (3) Short-Term and Long-Term Effects, and (4) Cost Considerations.

3.1. *Social Norms Feedback*

A common research frame that is important to consider is the effect on environmentally significant behaviors of providing information related to social norms (i.e., what is "normal"). In behavioral economics, such information is commonly referred to as a "nudge" (Thaler & Sunstein, 2008). Several studies evaluate how providing information about others' energy use in addition to one's own impacts residential energy consumption (e.g., Harries *et al.*, 2013; Allcott 2011; Allcott & Rogers, 2014; Costa & Kahn, 2013a; Ayres *et al.*, 2012). Similarly, Goldstein *et al.* (2008) evaluate the impact of information about others' behavior in messages designed to encourage hotel guests to reuse their towels.

A consistent and significant finding from this research is that the choice of comparison is critical. Goldstein *et al.* (2008) find that presenting what they refer to as "provincial norms," or information about behavior that has occurred in the setting that most closely matched individuals' most immediate circumstances (e.g., "the majority of guests in this room [#xxx] reuse their towels"), was more effective than a standard environmental message (e.g., "Help save the environment"), or descriptive norms conveying the behaviors of potentially relevant identity groups: "X% of [identity group] participated in this program" ("fellow guests"; "fellow citizens"; "men and Y% of women"), despite the fact that hotel guests found "guest of a particular room" to be the least important of the social identities presented. They suggest that an "important factor [in determining individuals' adherence to social norms] is the degree of match among one's setting, situation, and circumstances and those in which the norms were found" (Goldstein *et al.*,

2008, p. 479). This observation may explain some of the results that find social norms messages to be generally ineffective (Harries *et al.*, 2013); ineffective with specific groups such as political conservatives vs. liberals (Costa & Kahn, 2013b); or rarely utilized (Harding & Hsiaw, 2014). For example, Harries *et al.* (2013) found no incremental effect of providing feedback on one's own energy consumption along with that of others in their locality over feedback that provided information about their consumption alone. However, participants in the social norms condition were provided information about others' *total* Kilowatt Hours (kWh), with no control for size of house, or age or number of occupants. Based on Goldstein *et al.*'s (2008) caution, it is plausible to attribute the negative results of social norms information on participants' discounting of the information because they were not confident that the reference group was relevant. At least, participants could justify their own performance in light of possible differences between their own and unknown "others'" situations. Whatever metric used, it needs to be related to a specific firm instead of to a highly aggregated population in order to allow for benchmarking (Hsu, 2014), thus inducing normative pressure (Stephenson *et al.*, 2010; Goldstein *et al.*, 2008).

3.2. Goal Setting

For competitive firms, *goal setting* is central (Fang, Palmatier & Evans, 2004) and this is also reflected in earlier energy user research. Loock, Staake and Thiesse (2013) find that feedback systems that incorporate specific goals can affect individual behavior more than feedback without the context of goals. Harding and Hsiaw (2014) find that users who set realistic goals for energy conservation actually save more than those who set very low or "unrealistically high" goals. Researchers from New Zealand have developed and applied the energy cultures framework in various settings spanning households, firms, and industries, and

considers the interests of all actors in an energy system. (Stephenson *et al.*, 2010; 2015). The framework includes three main concepts: material culture, external influences, and energy practices. The lesson from this research is that while positive energy *behavior* may be the goal, aspirations that become embedded in the actors' norms may be a springboard for change (Stephenson *et al.*, 2015). Organizations regularly set goals for cost, output or performance, and many organizations already have goals related to sustainability efforts, so we note the importance of setting specific and realistic goals.

3.3. *Short-Term and Long-Term Effects*

Because an enduring concern for the environment drives sustainability efforts, researchers have been interested in identifying both short-term or transient and long-term or sustained effects. For example, Allcott and Rogers (2014) assess the long-term and short-term effects of Opower's home energy reports, which are sent to 6.2 million households receiving power from 85 utilities across the United States, and feature "personalized energy use feedback, social comparisons, and energy conservation information" (Ibid., p. 3004). The Opower reports offer comparisons to 100 neighbors "with similar house characteristics." Generally, they find significant long-term effects of the reports, despite the fact that positive results "reach their peak about 10 days after report arrival, and consumers backslide after that point" (Ibid., p. 3015). Although they find such "action and backsliding" throughout their five-year data horizon, treatment effects decay more slowly after two years than between initial reports. They attribute this to an accumulation of "capital stock" that generates persistent changes in outcomes. Such stock can be physical (energy efficient light bulbs, appliances, etc.) or habits of energy use. Importantly, they find that "treatment effects in the third through fifth years are 50 to 60 percent

stronger if the intervention is continued instead of discontinued" (Allcott & Rogers, 2014, p. 3005). However, Hargreaves, Nye and Burgess (2010) find in a consumer context that the novelty effects of continuous feedback quickly wear off. We note that in commercial settings, managers often set monthly goals and develop monthly reports, which suggests that monthly feedback on energy usage may be optimal, as long as its timing coincides with the existing managerial reporting cycle.

3.4. *Cost Considerations*.

As mentioned in the introduction, cost considerations are a significant factor in firms' sustainability efforts. The same is true for consumers. In their summary of consumer research between 1973 and 1983, Richie and McDougall (1985, p. 16), state, "Existing research strongly indicates that individuals take actions to save energy for one primary reason: to save money." That attitude is still prevalent among many managers (e.g., Husted, 2003; Cronin *et al.*, 2011; Ramirez, 2013; Tjärnemo & Södahl, 2015). Ramirez *et al.* (2014) cite numerous studies that indicate the positive financial effects that accrue to firms that adopt environmentally sustainable offerings in their operations. Some of the positive financial performance is related to the fact that "firms incorporating an environmentally-sustainable approach tend to monitor material inputs and production processes in an effort to minimize wasteful practices, resulting in cost savings" (Ibid., p. 17). Although energy is an "abstract, invisible, intangible, and only consumed indirectly and as a by-product of other practices" (Harries *et al.*, 2013, p. 1459), it is a significant resource that should be incorporated into the managerial decision making as any other resource, even amongst service firms.

4. PROBLEM IDENTIFICATION: SIX CONCERNS [STAGE 2A]

Landlords and service firm tenants, along with government leaders, had common concerns about the current approach for evaluating and discussing energy issues and for how service firms incorporate energy-related issues into decision-making. Six concerns with the existing structure of sustainability certifications and measures of energy efficiency were identified and elaborated with both service firm managers and landlords.

4.1. Greenwashing

A substantial and growing literature on "greenwashing" (e.g., Chen & Chang, 2013; Kim & Lyon, 2015; Lyon & Montgomery, 2015; Polonsky, Grau & Garma, 2010) suggests that some firms are less than sincere in their sustainability efforts. An Operations Manager of Premises in a Stockholm suburb noted, "some firms are only interested in sustainability for branding purposes." One landlord explained that it is rather easy getting a green certificate for a building with very few occupants, but this is a sub-optimization given that the construction produces a significant environmental footprint. Because of the proliferation of environmental certifications and the public's general unfamiliarity with assessment criteria, it is possible to promote certifications without context as evidence of overall corporate practice, when the certification may apply only to a small portion of a building and not the firm's operations, which leads us to the next criticism.

4.2. Piecemeal

As discussed previously, many certifications apply to the building only and not its operations. Requirements for new construction, such as the Swedish building regulations (BBR), relate only to estimates of energy use by the building *before* occupancy, and even then, only

apply to the basic construction (walls, roof, windows, and doors). This means that a large part of the energy consumption used for the actual operation of the facility may be missed. As described by a real estate manager, "a new building such as an indoor swimming pool, measures can relate to as little as 10% of the property's total energy use." This means that the certified energy use has no relation to the energy consumed by its operation (e.g., heating and cleaning the swimming pool, whirlpools, etc.). That is, BBR and similar certifications are focused on the property's shell but not its purpose (i.e., its processes or operations). During a workshop, one of the landlord's energy engineers reflected: "what is needed is a good key performance indicator that compares facilities from a user perspective, without needing to collect too much information."

4.3. Monolithic

Despite the fact that buildings are designed for different specific purposes, regulations and certifications impose monolithic standards across all building types and uses. For example, requirements that property energy not exceed, e.g., 50 kWh/m^2 will apply to all new structures in Stockholm in 2020, regardless of the building type or planned use. Such simple specifications make sense from an administrative and communications perspective, but their use leads to the piecemeal approach mentioned previously. That is, in order to accommodate different operational profiles, the regulations apply only to the space occupied by people who may not be engaged in the primary operation of the organization. Further, because initial certification applies to the building, once met it maintains its certification through subsequent tenants despite how their operations differ from those of the original design. Consider a law firm and an IT services firm that maintain computing resources such as servers on-site. The former will likely

be more dependent on human labor with nearly 100% of the space evaluated for certification occupied by employees, while the latter may be equipment-intense with only a small portion of the space occupied by people. Both buildings would retain their certification after the firms switched offices, despite the fact that the new tenants' operations do not align with the use for which the properties were certified. As a result, these certifications encourage overbuilding, or 'dilution' behavior, where it is easier to reach environmental certification limits when you build, e.g., a 4,000 m^2 office for only two people, than when you build the same size structure as a dormitory for 12 students, with showers, clothes washers, televisions, etc.

Additionally, a more nuanced perspective on the definition of "green" is emerging where notions of ecological embeddedness (Landrum & Ohsowski, 2018) are becoming evident. A conversation with a governmental sustainability manager in Stockholm is illustrative of the trend. With respect to electric vehicles, she suggested that not all electric vehicle use is green. "Electric vehicles in Sweden are green" [where most energy comes from renewable sources], but not in India" [where most energy is produced by burning fossil fuels]. Building codes do not yet reflect such nuance with respect to either the amount or source of energy consumed.

4.4. Perverse Incentives

Another problem with monolithic criteria is that they may create perverse incentives for organizations, such as encouraging new building instead of greater utilization of existing space. Consider an office building that seeks to maintain a certain level of operational energy use, measured in kWh/m^2. If space were available, the more efficient action would be to add equipment to an existing building rather than to add new space. As two real estate managers commented, independent of each other; "The best square meter is the one that is never built."

However, to maintain a low measure of operational energy, the "green" thing to do would be to consume physical and financial resources to build (or acquire) new physical space.

For example, if one of the commercial tenants (i.e., a Swedish service firm) expands operations into the U.S. (six to nine hours behind Swedish time), it could add a night shift of workers in its existing headquarters without having to build new facilities. But such nontraditional use could increase operational energy use beyond 40 kWh/m^2, risking the tenant's Miljöbyggnad Guld (gold) certification. The same concern is expressed by governmental building managers who want to create multipurpose spaces, such as libraries that serve both schools and the community, or schools that host community events in the evenings or weekends. Maximizing utilization of an existing structure is a much more efficient use of space, but risks certain certifications, which creates the perverse incentive to create unnecessary space.

4.5. Irrelevant Reference Groups

Based on the literature mentioned previously related to social norms feedback, we expected that relative rankings of firms using apps or web-interfaces that reported energy use and allowed for comparison would help tenants maintain motivation for sustainability efforts. the lead landlord's app offered tenants both real-time and periodical energy-use reports. However, most tenants disregarded the information, as they easily could argue that the comparison firms were not an appropriate reference group. The sheer number of tenants using the app were irrelevant, as tenants were distributed among a wide variety of industries and occupied many different types of buildings. As long as tenants could claim to be "different," based on their own subjective criteria (e.g., the law firm and IT firm mentioned previously), then they were happy to ignore the relative rankings. Similarly, some firms fortuitously happened to easily meet the

criteria (based on building or operational characteristics), while others did not. As mentioned by an operations manager at a tenant firm: "We have a large data warehouse – that is why we consume the most energy!" Possibly influenced by the potential branding benefits, firms in the low energy use group praised the standards, while firms with energy intensive business models criticized them. As long as measures do not accommodate varying types of properties and activities, then firms will continue to ignore or discount them.

4.6. Organizational Growth

Finally, the most important issue communicated relates to organizational growth. As a growing population requires increased GDP to meet stable per-capita demand, and organizations generally desire growth, reductions in gross energy consumption at an organizational level can be counterproductive. A growing organization likely will need *more* energy to produce additional output or serve additional customers or clients. As elaborated by one tenant that was in a phase of strong growth: "We need some room to breathe. We got four new office spaces, but now that is not enough." One of the landlords described that a solution to the challenges of organizational growth is co-working. When it comes to co-working, "you are also looking into the use of meeting spaces. If you can measure carbon dioxide and so forth – so you can optimize the use of resources. Co-working does often give a much better use of space – but this does reasonably also require more energy."

In contrast, a large reduction in energy consumption could be a sign that an organization is *failing*. This is true for a manufacturer, hospital, government agency or library. But fixed standards do not account for organizational growth.

Next, we propose a measure that can overcome these six limitations and is amenable to analysis via the four frames identified in the literature.

5. ENERGY PRODUCTIVITY AS A SOLUTION [STAGE 2B]

After evaluating the existing literature on sustainability, facility management, services marketing, and operations, Swedish energy regulation, and extensive conversations with managers from a real estate firm and more than 20 of its tenants, as described in the previous section, we elaborated our findings with additional managers to obtain their feedback. The meetings with reflective practitioners helped us refine our understanding of the problem and led to the development of *energy productivity* for service firms as a proposed solution. In total for this stage, we talked with practitioners from NGOs (N=3), real estate firms (N=20), and their tenants (N=12).

Our follow up meetings in this stage clarified that the most important issue for firms is growth. Although an organization may use more energy as it grows, conservation and efficiency efforts should result in more output per unit of energy consumed. Thus, our research led us to develop a measure of *energy productivity* (EP) which for time period *t* is defined as:

$$EP_{(t)} = O_{(t)} / E_{(t)} \quad (1)$$

where *O* is total output and *E* is total units of energy consumed. For a generic operationalization, we suggest *EP* = Revenue/kWh. If service firms were to measure and report on their energy-related sustainability efforts via the energy productivity metric, then the problem of greenwashing would be reduced. Energy productivity is also easy to understand and communicate, which is an attractive feature for a common standard relating energy use to value

creation. Finally, the measure is holistic (as opposed to piecemeal), capturing the effects of changes in output across both property and operational energy.

Although the metric may be seen as monolithic, it can be specified according to service sector or firm context. For example, a hotel may calculate energy productivity based on guest-nights/kWh. A library may focus on readers served, or books loaned/kWh. It can also be modified to focus on any component of the organization and its facilities. Consider the swimming pool mentioned previously. The metric may be modified further to consider both a sector-specific standard and only operational areas in combination: e.g., swimmers/kWh, where 'swimmers' could be total visitors to the pool and kWh is operational energy to run and maintain the pool. Such modification addresses the issues of being monolithic and the lack of relevant reference groups. Further, a higher-level measure focused on changes in energy productivity (ΔEP) could be calculated for comparisons across time, sector or facility type, e.g.:

$$\Delta EP = (EP_{(t-1)} - EP_{(t)}) / EP_{(t-1)} \quad (2)$$

The concept of energy productivity is not novel. However, existing use typically focuses on energy productivity (or its inverse, energy intensity) at a country level (e.g., McKinsey 2008, b; U.S. Energy Information Administration, 2013; The World Bank, 2015). Country-level figures may be interesting to macroeconomists, but they do not provide operational guidance for any specific firm or economic sector, as "The production of a huge number of goods, the mixing of the transport of freight and people, and the variety of housing and climates makes an aggregate energy intensity number based on Gross Domestic Product (GDP) a number that disguises rather than illuminates (U.S. Department of Energy 2012).

6. CONFIRMING THE APPLICABILITY OF ENERGY PRODUCTIVITY [STAGE 3]

To begin Stage 3, and to control for the energy productivity applicability for service firms, we calculated energy productivity as revenue per Kilowatt hour (SEK/kWh) for seven commercial tenants of a real estate firm that were in similar buildings and comparable businesses. We had access to this data for each service firm for three years. Although aggregate energy consumption increased for all firms, from about 202,000 kWh in Year 1 to about 224,000 in Year 3, the firms were growing, with aggregate revenues climbing from about 1.97 million SEK in Year 1 to about 2.39 SEK in Year 3. The real estate firm was actively engaged in efforts to promote energy efficiency among its tenants through its new app. Accordingly, even during growth, the firms increased their energy productivity (thousands of SEK/kWh) from 9.8 in Year 1 to 10.6 in Year 3. These results should encourage both environmentalists and CFOs.

After these results were developed, we reconvened real estate managers (N=4) and NGO reps (N=2) to have them evaluate the usefulness of our measure. Managers reported that energy productivity helps to operationalize the goal of energy conservation with a measure that does not harm growth. While energy productivity encourages growth, it removes the perverse incentives associated with meeting criteria that are not associated with organizational productivity and replaces them with positive incentives to achieve more with less (scaled for output). Thus, our results suggest that management research, along with government, NGOs, and the service sector, could effectively adopt energy productivity as a useful metric.

7. CONCLUSIONS

In this article, we have addressed the current logical gap between service firms' focus on energy conservation, which has been narrowly conceived of as synonymous with 'reduction,' and their corporate goals for growth. Energy productivity emphasizes energy as a resource that is necessary in all settings, not just industrial manufacturing. Because energy is a necessary resource for value creation, it must be managed for efficiency, not simply reduced regardless of the economic or environmental impact.

The results are relevant not only to service firms, but also to other organizations residing in commercial buildings. Our results also suggest that while energy is used, monitored, and managed at the building level, the goal of having relevant comparison suggests that comparisons among service firms – preferably in the same sector – are more beneficial. Just as industry analysts and corporate executives may use measures of average revenue/employee as a relevant metric, average energy productivity for a specific service sector could help individual firms and their associated groups manage and promote their efforts. In a service context, different measures of output besides revenue may be more appropriate to support comparisons and benchmarks. For example, guest-nights/kWh may be more appropriate for hotels. It is also more likely that some service sectors could more effectively segment their different member firms according to relevant characteristics, providing an even greater relevance to comparative metrics. Thus, while it is commendable that this effort has been spearheaded by commercial real estate firms housing these service firms, further refinement and use of sector/organization norms may require other organizations, such as trade associations, to now assume the lead.

The results have clear policy implications given that sector-level measures of energy productivity perform well when assessed via the four frames identified in the extant research:

(1) by treating energy as a controllable factor of production (i.e., value creation), it instills a cost focus on managers; (2) by providing a relevant metric across comparable firms, it provides relevant social norms, while (3) absolute and average sector values and period-to-period changes provide a benchmark against which all firms can compare themselves, providing a clear framework for goal-setting; and finally (4) measures of energy productivity can be reported on a monthly or quarterly basis aligned with other typical managerial reporting and do not suffer the same floor effects found with existing measures, both of which should help them retain long-term impact, as over time firms will acquire additional capital stock that can help them continue to improve into the future.

Although energy productivity is a robust single metric that is easily understood and communicated and provides a direct measure of energy use that is relevant to both CFOs and environmentalists, it may still overlook certain factors of sustainability such as the source of energy (i.e., energy mix), see Claudy *et al.* (2013). Thus, more research is needed. While it may be desirable from a societal or country level to have a higher percentage of renewable energy, this goal may not scale or translate directly to the organizational level, as a specific organization may have no choice over the method of energy generation. Further work is needed to integrate the concept of energy productivity with measures that account for energy as part of the service firm's value-generation. Hydropower vs. coal-fired power can be assessed by translating energy consumption into tons of carbon dioxide emitted but is insufficient to identify essential differences between, e.g., large-scale and small-scale hydroelectric power generation.

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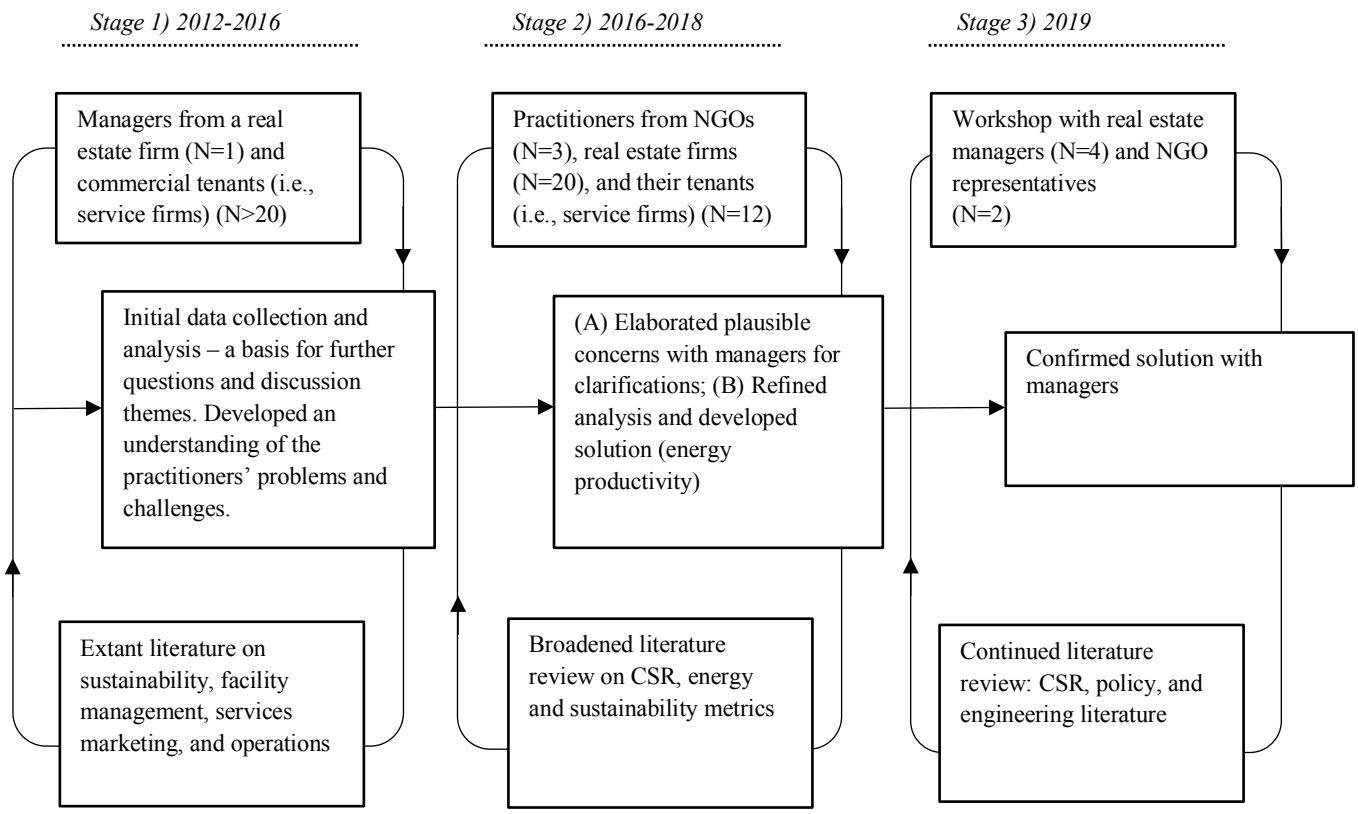

N=number of participating organizations

Figure 1. Study Design

Appendix A: Swedish Building and Energy Regulations

Boverket, the Swedish National Board of Housing, Building and Planning, is the agency authorized to interpret EU Regulations and Directives and their impact on country policy related to energy consumption and use in commercial and residential buildings. Boverket then issues mandatory provisions and general recommendations, commonly referred to as the BBR (Boverket Building Regulations). As it relates to building design, construction and use, "The European construction standards (Eurocodes), together with the national choices in the Boverket Series of Provision on the Application of European Construction Standards (EKS) constitute the only system for the design of structures in Sweden" (Boverket's web, 2015). "Boverket's overarching obligation is to promote sustainable development in its environmental, economic, cultural and social aspects…aiming towards technical, environmental and economic sustainability" (Boverket's web, 2015).

The EU has issued a Directive of Energy Performance of Buildings, and the Swedish Parliament has set Environmental Objectives related to "A Good Built Environment." All of which are reflected in the BBR. Chapter 9 summarizes the policy on Energy Management: "Buildings shall be designed in such a way that energy use is limited by low heat losses, low cooling demands, efficient use of heat and cooling and efficient use of electricity" (BBR 19 BFS, 2011:26, Chapter 9: Energy Management).

Sweden has also signed on to the EU's 2020 Climate and Energy Package (or 20-20-20 plan), calling for (1) a 20% reduction in EU greenhouse gas emissions from 1990 levels; (2) raising the share of EU energy consumption produced from renewable resources to 20%; (3) a 20% improvement in the EU's energy efficiency. Sweden also is part of the EU's 2030 "framework" (40% reductions by 2030; European Commission, 2013), and 2050 "roadmap"

(80% reductions by 2050; European Commission, 2011). As part of the "efficiency" goal (i.e., number 3 in 20-20-20 plan described above), effective December 5, 2015, and every four years thereafter, all companies with 250 or more employees and annual turnover more than €50 million must report energy use and plans for future increased energy efficiency, along with expected costs and benefits of those future plans. All companies must also indicate who will collect the data. Unfortunately, no standard framework for understanding "efficiency" (beyond reduction) has been universally adopted.

The BBR applies to new construction as well as alterations to existing structures greater in size than 50 square meters (m^2). It is beyond the scope of this paper to describe the entire BBR; however, to illustrate regulations that are relevant for the present study, the BBR specifies maximum kilowatt-hours-per-m^2 (kWh/m^2) and average thermal transmittance (watts per thousand m^2) for all buildings (commercial and residential) and also the installed power rating (kW) for electric heating (heat pumps, where used), all of which vary according to the climate zone in which a property is located.

The BBR distinguishes between a building's "property energy," that which is required to use the building, such as heating, cooling, and lighting of common spaces (excluding garage and any areas not kept above 10 degrees Celsius), and its "operational energy," that which is used for purposes other than dwelling, such as computers, copiers, machinery, and lighting of individuals' desks. Property energy is subject to BBR, while operational energy, as it does not apply to the building itself, is not. Tenants pay monthly for operational energy directly to the power company and thus manage these costs themselves.