

Understanding the Role of Government and Buyers in Supplier Energy Efficiency Initiatives

The Faculty of Oregon State University has made this article openly available.
Please share how this access benefits you. Your story matters.

Citation	Wu, Z., Ellram, L. M. and Schuchard, R. (2014), Understanding the Role of Government and Buyers in Supplier Energy Efficiency Initiatives. <i>Journal of Supply Chain Management</i> , 50: 84–105. doi:10.1111/jscm.12044
DOI	10.1111/jscm.12044
Publisher	John Wiley & Sons Ltd.
Version	Accepted Manuscript
Terms of Use	http://cdss.library.oregonstate.edu/sa-termsfuse

Understanding the Role of Government and Buyers in Supplier Energy Efficiency Initiatives

Zhaohui Wu, Lisa M. Ellram, and Ryan Schuchard

Article information:

Zhaohui Wu, Lisa M. Ellram, and Ryan Schuchard (2014), "Understanding the Role of Government and Buyers in Supplier Energy Efficiency Initiatives," *Journal of Supply Chain Management*, Vol. 50 No. 2.

Abstract

In environmental management, companies must respond to myriad needs and pressures from stakeholders such as buyers, regulators, communities and NGOs. While researchers recognize that these stakeholder entities have different saliency and influences over a focal firm, the influences from multiple stakeholders are often aggregated as a single factor, overlooking differences among them. Stakeholders may have competing demands: A buyer may consider only potential environment-cost trade-offs while the government balances the environment, increased cost-competitive manufacturing and job creation. Such demands compete for the same resources within the supplier's organization, forcing suppliers to satisfy and compromise. This paper qualitatively examines Chinese suppliers' responses to requests to adopt energy efficiency initiatives in their production plants by two of their most critical stakeholders: buyers and the government. We identify three categories of energy efficiency (EE) initiatives implemented by the suppliers and find that their implementations are contingent on their ownership characteristics and value alignment with these two stakeholders. Further, we find that suppliers interpret buyers' motives regarding EE in the context of buyer-supplier relationships and environmental positioning of the buyers' products. These findings are articulated in a set of propositions that are introduced based on our analysis of these case study data.

Keywords: *stakeholder theory; energy efficiency; buyer-supplier relationship; government influence; environmental decision-making; sustainability, case study; supply management; China*

Acknowledgements: We thank the firms and numerous managers who generously devoted their time to participate in this study. We also acknowledge and thank Sherry Ma, Fengyuan Wang and many of their colleagues at BSR for introducing the buyers and suppliers and coordinating our field visits in China.

INTRODUCTION

Over the past three decades, rapid economic development in China has created a strong export-oriented manufacturing sector, the so-called world factory (Zhao, Flynn, & Roth, 2007), supplying consumer goods to western buying firms (buyers henceforth). This world factory comprises both state-owned enterprises, and private and publicly-traded companies founded by entrepreneurs from the mainland, Taiwan and Hong Kong. As the Chinese economy is transitioning from a planned economy to what is termed state capitalism, the division of power (legislature, executive and judiciary) is primitive and evolving (Luo, 2007). In environmental management, the central government establishes policies and enforces them with varying rigor.

When it comes to managing energy efficiency (EE henceforth), suppliers face a unique challenge involving two issues. The first is that energy waste is different from other waste, such as toxins released from a factory. While most energy production creates greenhouse gases, the *use* of energy is not treated like a direct form of pollution with clear regulation and compliance mandates. Chinese manufacturers focus primarily on Scope 1 emissions, and do not view energy usage as a form of pollution (Zhang, 2013).¹ Likewise, buyers classify their suppliers' EE as a Scope 3 carbon emission and thus a greenhouse challenge in their extended supply chain, where carbon counting is still a new agenda even for proactive buyers.

The second issue is the competing motives of their critical stakeholders, the buyers and the government, when they demand EE. On the one hand EE can reduce cost and greenhouse gases. On the other hand, it may require resources and investment that have no immediate financial benefits and stymie regional economic development by raising production costs.

1. Scope 1 emissions are direct pollutants emitted by an owned manufacturing process; Scope 2 emissions are emissions from owned transportation and employee commuting; while Scope 3 emissions are everything else, including emissions from purchased electricity, purchased materials and components and product usage (Ellram and Tate 2013).

Thus, suppliers have to interpret what the government and buyers want and how to incorporate these demands into business decisions. Stakeholder theory researchers differentiate and categorize stakeholders based on power, legitimacy and urgency (Mitchell, Agle, & Wood, 1997). While stakeholder analysis recognizes differences among stakeholders, there is limited investigation as to how these differences affect an organization's environmental actions. For instance, in empirical studies, researchers often aggregate stakeholder influences and treat the combined impact as a single indicator (e.g. Agle, Mitchell, & Sonnenfeld, 1999; Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010). They typically consider stakeholders as having a coherent and unified agenda, simplifying the reality that a focal firm must deal with competing demands. Even though awareness of and ability to strategically manage the demands of multiple stakeholders is important to organizational success, existing studies overlook how focal firms' environmental actions vary as they interpret stakeholder demands.

In this study, we examine the EE initiatives of Chinese suppliers. This setting offers an opportunity to explore a more nuanced understanding of stakeholder influence and ensuing environmental actions of the focal firms. It also has practical implications due to the severity of carbon emission in China and other emerging economies that compete with China as manufacturers of the world. Our objective is to expand the application of stakeholder theory by exploring the complexity of buyers' and the government's multi-dimensional demands, and in doing so, identify factors affecting suppliers' implementation of EE initiatives, thus providing buyers with practical guidance to understand suppliers' motives in tackling Scope 3 environmental challenges.

We take a qualitative approach to explore how suppliers in China adopt EE initiatives in their manufacturing operations. More specifically, we examine:

1. What motivates suppliers to pursue EE objectives?
2. What affects the influence, if any, of the government and western buyers in suppliers' pursuit of EE initiatives?
3. What types of actions do suppliers take in pursuing EE, and why?

LITERATURE REVIEW

Energy Efficiency Management and Chinese Policy

For purposes of this research, EE initiatives are efforts to conserve energy used in production and improve the productivity of energy as an input. Amory Lovins (1976) pointed out that increasing EE is one of the most effective ways to solve resource shortages and environmental challenges, because most of the energy produced is wasted in generation, transmission and distribution. In recent years, supply chain programs such as the Carbon Disclosure Project are demanding that suppliers report and reduce greenhouse gases (Plambeck & Denend, 2011). For many western buyers with heavy reliance on Chinese manufacturing operations, managing Chinese suppliers' EE is becoming a crucial element of their supply chain environmental sustainability initiatives.

Furthermore, governments and companies view EE as a measure of a country's productivity and competitiveness and a strategic resource management issue (Bell, Autry, Mollenkopf, & Thornton, 2012; Krautkraemer, 1998). China is the world's largest carbon emitter and also has lower EE performance than all major developed countries (Hayes, Young, & Sciortino, 2012). Since coal supplies 70 percent of China's total energy consumption (EIA, 2012) and manufacturing is a primary energy consumer, EE is considered an important economic, social and environmental development initiative by the Chinese central government. From an economic standpoint, energy shortages in the summer months slow or stop production, hindering

regional output. As a social and environmental issue, increasing pollution and fatal accidents in coal mines have created a public health crisis and social unrest as citizens protest the lack of transparency in government reporting of both air quality and the loose control of coal mine operations (Economist, 2012).

China uses industrial policy to mandate EE targets for the overall economy (Sabrie, 2012). While the efficacy of industrial policy is elusive, it directs significant resources to industry sectors and affects the competitive industrial landscape (Fallows, 2012). EE was a critical component of the Chinese government's 11th Five-Year Plan (2006-2010), mandating a goal of 20% energy consumption reduction per unit of GDP. The current 12th Five-Year Plan continues to advocate those objectives with a strong emphasis on investment in environmental protection industries and technologies (Stanley & Xu, 2012).

EE and Environmental Management

Businesses frequently overlook EE in environmental management. The operations literature considers Scope 1 environmental issues related to internal manufacturing (Kitazawa & Sarkis, 2000; Klassen & Vachon, 2003; Klassen & Whybark, 1999; Pagell, Wu, & Murthy, 2007; Zhu & Sarkis, 2004). Energy consumption does not directly generate pollution (Scope 1) because energy production takes place outside the production plant (Scope 3) and even beyond the supply chain. The lack of managerial attention to EE is also due to the reality that energy is artificially “cheap” and as a result, energy consumption is not generally budgeted to specific activities. Lack of expensing energy directly to products, as one does raw materials, reduces the incentive to save energy, compared to efforts to conserve materials (Hicks, Dietmar, & Eugster, 2005).

A motivation for this study is that as companies tackle supply chain greenhouse gas emissions and discover that energy usage is the greatest Scope 3 (indirect) form of carbon in

much of the world, EE will likely become a prominent environmental management focus. Suppliers often lag behind their buyers in EE performance (Carbon Disclosure Project, 2012). One of the objectives of this study is to better understand how the ideals of western buyers and the Chinese government influence the EE behaviors of Chinese suppliers to mitigate the large impact of coal-based energy on carbon emissions.

Interpretation of Stakeholder Demands

Companies engage in environmental actions in response to pressure from the stakeholders on whom they depend for survival and vital resources (Agle, et al., 1999; Crilly, Zollo & Hansen, 2012; Freeman, 1984). They pay attention to how stakeholders construe their actions as appropriate behavior (Campbell, 2007; Friedman & Miles, 2006; LaPlume, Sonpar, & Litz, 2008). The relative saliency of the stakeholder is determined by its perceived legitimacy, power and the urgency of its demands (LaPlume et al., 2008; Mitchell et al., 1997; Parmigiani, Klassen, & Russo, 2011).

For export-oriented companies in China, the two most salient stakeholders are the government and western buyers. The government is an important stakeholder in the command-and-control economy. The government is not one monolithic entity. It includes agencies at central (e.g., industry ministries, regulatory bodies) and regional levels (e.g., provincial and municipal governments). Tension exists among government agencies with competing goals. Chan and colleagues (1995) found that environmental regulators working in different regional agencies operate in a pro-growth social environment where regional governments often ignore mandates from the central government.

With their purchasing leverage, western buyers represent another critical stakeholder. Scholars usually consider suppliers' Scope 1 environmental management as a compliance issue

(Bansal & Roth, 2000; Montabon, Melnyk, Sroufe, & Calantone, 2006; Vachon & Klassen, 2008). However, when it comes to Scope 3 environmental management such as suppliers' EE, where carbon emission is not formally regulated, the buyers and suppliers confront the cost vs. environment trade-offs as they decide what voluntary actions can bring tangible and intangible benefits. Furthermore, buyers may have different sustainability objectives and strategies, leading to varying demands on suppliers to reduce greenhouse gases.

Thus, buyers and government are complex stakeholders for a given supplier. Both have dualistic objectives when it comes to companies they regulate or from whom they purchase: they face a similar dilemma of balancing the long-term environmental sustainability and short-term competitiveness of the suppliers. As the first step of stakeholder analysis, a supplier needs to know whether the buyer is leaning toward cost reduction or drastic environment performance improvement when it talks about sustainability. This supplier also needs to understand which government entities matter the most given its business environment – environmental regulators, pro-growth local government or both.

METHOD

EE management is not a clearly-defined supply chain issue. While it has gained urgency, little research has yet been conducted regarding supply chain EE implementation, to the best of our knowledge. We thus conducted an exploratory case study, which is appropriate in developing a preliminary understanding of a research question and making conceptual clarifications to assess existing literature (Glaser & Strauss, 1967; Strauss & Corbin, 1990; Yin, 1994). More specifically, we follow the principles and best practices of case study methods in business research to further our understanding of stakeholder management (Barratt, Choi, & Li, 2011; Eisenhardt, 1989; McCutcheon & Meredith, 1993; Miles & Huberman, 1994). The unit of

analysis is the suppliers' EE initiatives at the plant level. The unit of reference is the buyer-supplier dyad. That is, a supplier's EE decisions and initiatives are examined in the context of its relationship with the buyer.

Sample

Prior to sampling, we explored multiple export-oriented industries in China to determine the appropriate sample choice for this study. The apparel and kitchenware production industries were chosen for a number of reasons. First, the production process of these products is traditionally labor-intensive, so workers' behavior can have a strong influence on how resources are used. Additionally, plant managers have had the option of using more automated equipment in recent years. Thus a company has the ability to leverage both people and equipment to improve EE.

Through Business for Social Responsibility (BSR.org), the researchers contacted six western buying firms in these two industries. BSR provides supplier training programs such as safety and environmental health, EE and ecosystem services on their behalf. The six buying organizations are all multinational firms including four apparel brands in the US and Europe and two global retailers. The buying firms were asked to identify suppliers that have implemented EE initiatives at their behest in the past two years. They provided us a list of their top-performing suppliers based on traditional operations measures. These suppliers have all participated in basic EE training organized by BSR.

Selection of suppliers was based on two criteria. First, participants had to be first-tier suppliers that (a) have direct interactions with the buying firm, and (b) have a significant portion of their sales going to the buyers. This ensures that the buyers can directly influence suppliers' behavior. Second, suppliers were selected to represent a range of different types of ownership

(state-owned, non-state-owned), origin (mainland Chinese, Taiwan-based, Hong Kong-based) and size (medium and large). We anticipated that suppliers with different origins and ownership characteristics would perceive varying levels of power, legitimacy and urgency attributes associated with the buyers and governments (Mitchell et al., 1997).

Initially, twelve suppliers agreed to participate in the study. However, five suppliers dropped out because of (1) unavailability at the time of data collection or (2) reluctance to disclose information we desired that they deemed confidential. Ultimately data were collected systematically in seven supplier companies including three companies from Hong Kong (HK), one from Taiwan and three from mainland China. Two kitchenware suppliers serve one buyer. We kept both of them in the data set as they represent different regions: one is from HK and one from Taiwan, which allows us to explore differences between companies of these two origins. Table 1 illustrates the matched profiles of buyers and suppliers in our samples and numbers of interviews.

(Table 1 about here)

Data Collection

Data collection took place between March and September, 2011. Interview data were collected from both buyers and suppliers. As shown in Table 1, ten interviews were conducted with the sustainability managers in the six buying firms, six by phone and four in face-to-face interviews. These managers were directly in charge of their companies' EE initiatives, giving them a clear understanding of their suppliers' EE initiatives and progress made. Two different managers were interviewed at Buyers 1 and 4. A single manager was interviewed twice at both Buyers 2 and 3.

Among the seven suppliers, six are located in South China (Guangzhou and Fujian provinces) and one in Southeast China (Jiangsu province). A total of eighteen supplier interviews were conducted. Face-to-face interviews were conducted during site visits of three supplier companies, whereas interviews with the other four supplier companies were conducted by telephone. Supplier interviews lasted from 50 minutes to three hours. Different managers were interviewed at Jean Supplier, Towel Supplier, and Kitchenware Supplier. One manager was interviewed multiple times in each of the other four supplier companies. Follow-up interviews were conducted by phone and email.

The supplier visits included factory tours to gain an intimate understanding of production processes and EE activities. Supplier questions probed suppliers' EE initiatives, motives, buyer-supplier interactions and perceived influence from buyers and the government. We asked the interviewees to identify the government entities that have the strongest influence on their EE initiatives and discuss how these entities affect them. Appendix A summarizes the buyer and supplier interview questions.

Following the recommended approach for collecting multiple sources of data (Eisenhardt, 1989; Yin, 1994), archival data regarding the buyers and suppliers were collected from sources including news reports, company websites and documents obtained from the suppliers (McCutcheon & Meredith, 1993). This information shed light on their business backgrounds, sustainability initiatives and production processes.

Another important source of data is the detailed report of suppliers' EE initiatives and open-ended questionnaire on their EE management systems and strategies. These data were collected in survey form by BSR. BSR collected EE progress reports from each supplier between 2009 and 2011 and in turn provided technical assistance and audits on behalf of the buyers.

These reports document suppliers' EE initiatives, organizational structure and support, and the challenges they faced. The reports allowed us to evaluate the overall breadth and depth of EE initiatives taken by each supplier in the context of its manufacturing environment. Appendix B provides a sample of the open-ended survey questions.

Interviews with the buyers were conducted in English and all but one interview with the suppliers were conducted in Chinese. One of the researchers speaks Chinese fluently and conducted the supplier interviews together with a Chinese MBA student. All interviews except one were taped; that interviewee did not agree to taping, but copious notes were taken. The recorded interviews were transcribed. The Chinese interviews were subsequently translated into English.

We followed standard procedures for establishing reliability and validity in the data and analysis, as illustrated in Table 2.

(Table 2 about here)

Coding and Analysis

Coding was carried out to identify and classify the motives behind EE initiatives, exploring the nature of EE initiatives carried out in each organization and how managers perceive stakeholders and stakeholder influence on EE. Iterative coding followed the procedures recommended by Miles and Huberman (1994). Each researcher individually coded the data.

Each researcher separately created a synopsis of every case, highlighting the key facts and motives behind EE initiatives at each company and more importantly, each researcher's assessment of the role of EE in the context of the company's business and environmental strategy and institutional environment. We then discussed the synopses to identify themes and emerging constructs. Disagreements on the coding were resolved to attain a 100% inter-rater agreement.

This typically involves revisiting the original transcripts, clarifying technical information and reconciling interpretations of the data (Miles & Huberman, 1994).

Within-Case Analysis

The within-case analysis involved data reduction and analysis (Yin, 1994). It had four components. First, we delineated various EE initiatives carried out by each company in different production and operations areas. We consolidated, categorized and analyzed objective survey data from BSR and our interview data to understand suppliers' EE activities in the context of their manufacturing processes and business environments. The critical task was to understand to what extent these initiatives are implemented as "cost-saving" and "business strategy" opportunities as opposed to direct stakeholder considerations. We used capital investment justification, investment payback and action plan information from each company to validate interview transcripts.

Second, we tried to gain an understanding of how EE initiatives fit into the overall business strategies and sustainability goals of each supplier company. The goal was to understand how EE initiatives are anchored in different triple-bottom line based sustainability frameworks in each company and how EE affects their actions given their institutional environments.

Third, we tried to gauge how EE management is similar to or different from Scope-1 environmental management practices in existing studies. Such comparisons highlight what is unique about EE practices (Scope 3) and offer insights into our research questions. Lastly, we assessed the efficacy of EE implementation to understand how EE initiatives affect each supplier's business and social performance.

Cross-Case Analysis

Cross-case analysis allowed us to identify common themes concerning managerial practices in EE adoption and suppliers' motives and responses to stakeholder demands. A variety of analytical tools were used to reduce, organize and present data in a meaningful fashion (Miles & Huberman, 1994). Two examples highlight the processes we employed and issues we faced in the cross-case analysis.

The first example involves the coding of factors influencing companies' EE initiatives. Initial within-case coding and analysis suggest that a supplier's size and resources are linked with the breadth and depth of proactive EE initiatives. As we looked deeper into the cases, we found that this supposition only reflects the companies' capital investment decisions. Company size and resources do not explain the varied organizational commitment regarding the effort to educate and engage employees in behavioral changes. An iterative process of reviewing data, comparison and discussion led us to the construct "ownership" as a more accurate predictor of different levels of EE initiatives; it also allows us to explain different motives and EE strategies. Then, using "ownership" as anchor point, we proceeded to explore how suppliers' EE initiatives vary within the same type of ownership. This led us to the firm-specific factors including labor relationships and learning ability as differentiators.

The second example concerns comparison and ranking of companies' EE actions. Because the companies make three different types of products, they use different equipment and processes. Our cross-case comparison had to consider these differences when we evaluated the relative levels of EE initiatives. In other words, our ranking of EE had to control for company-specific factors. For instance, lighting management is a more prevalent practice in apparel manufacturing than it is in the kitchenware plant because lighting accounts for a significant amount of energy consumption in apparel production. In this case, we are aware of the fact that a

lighting equipment overhaul represents a different level of commitment and has different costs and benefits to these two types of companies. As a result, we looked carefully into our interview transcript and suppliers' answers in the open-ended questionnaires to understand the challenges and efforts of a given initiative. We also sought out expert opinions from two EE engineers in China to explain the energy management challenges and validate our ranking of each company's commitment. The research team members discussed individual ranking rationale until a consensus was reached. Through this iterative process, a coherent understanding of EE initiatives implementation and suppliers' decision logic emerged.

FINDINGS

A common sentiment among managers in all seven supplier companies is that managing EE is different from managing material waste in production and inventory.

EE as a Unique Operations Challenge

We found that organizations use different criteria for implementing EE initiatives and the consequent performance implications of these decisions.

Hidden Waste. EE management is unique because energy waste is not as visible as waste associated with inventory surplus, defects or scrap. In other words, it is not the typical waste management focus targeted by a lean method. As one manager at the Towel Supplier remarked, "...electricity or gas comes into a pipe or through a hole in the wall and you just plug in and then you use it. And it's very difficult to see what (forms of) the energy is used, where the energy is used, and how much you are using [*sic*]."

Further, energy is ubiquitous; it is used in various forms (electricity, steam, hot water) and in production facilities, offices and workers' dormitories. EE requires behavioral changes from employees, which can get personal. At Kitchenware Supplier A, one production manager

always had to remind the workers to turn off the lamp inside the lathe machine while they were away from the work area. The lamp is intended for machine repair and maintenance. The manager often half-jokingly pointed out that it only needs to be on to see inside the machine. As a habit, some workers would still turn on the lamp automatically at the beginning of their shift.

Lack of Accountability/Priority. EE is often given low priority by production departments. For production managers, energy management typically means having a sufficient and steady supply, but pre-ordering is not possible, therefore it lies beyond their purview. Also, energy generally accounts for a small portion of total product cost in comparison to materials and labor. It is often allocated to product cost based on a “standard” estimate, rather than actual usage. As a result, there is little if any penalty for energy waste or reward for energy reduction in manufacturing. The owner of Apparel Supplier B pointed out that electricity is expensive from a facility cost standpoint, but is less than 5% of the product cost. On two different occasions, managers at Jean Supplier and Apparel Supplier B pointed out that apparel suppliers usually do not worry about energy consumption in lighting and running machinery if the facility is less than 100,000 sq. feet. Instead, they look for greater savings in sourcing direct materials.

Organizational Design and Responsibility. The lack of accountability for EE is reflected in a company’s organizational design. In six supplier companies (excepting Towel Supplier), energy management responsibility belonged to facility services, a support department in charge of equipment maintenance and indirect (MRO) materials. While the facility services department participates in equipment procurement decisions, the suppliers indicated that EE is generally given little weight in equipment selection. One manager at the Towel Supplier told us that production capacity is the default criterion used to select and evaluate equipment. Thus, the equipment is set to its maximum capacity. Neither the company selling the equipment nor its

users adjust the equipment to match the actual production rate, often resulting in overcapacity and excessive energy use in such forms as heating and cooling.

Lack of Accurate Measurement. Finally, the reports collected through BSR and case data suggest that suppliers are just beginning to collect detailed measures of EE. Without such data, managers cannot easily assess waste or opportunities for improvement. For example, energy usage is generally not tied to products and production processes when multiple products are made in one facility. One challenge of measuring EE, as one manager pointed out, is that energy needs vary and are contingent on many real-time factors such as equipment utilization, variety of batches, materials and even the weather. The production manager of Apparel Supplier A commented that water absorption rates of cotton purchased from Pakistan and the US are different. Thus energy consumption for different batches of cotton and production orders varies accordingly. It has been difficult to link EE performance with the performance of production processes. As they take steps to improve EE, the first thing managers realize is that existing energy metrics do not consider such factors; energy usage is metered only by shifts and days. There is no clear feedback loop between EE and corresponding machines or people.

Three Categories of EE Initiatives

The BSR survey asks the suppliers about EE activities in two categories: management actions and technical actions. Questions on management actions explore each supplier's energy management systems implementation and managerial actions in training and education. The technical action questions ask about suppliers' EE initiatives in seven energy systems: facility (lighting and building insulation), energy generation (boiler/steam) and distribution (transformer, metering), motor/driver systems, HVAC systems (air conditioner/chiller/heat pump), ventilation

and compressed air systems and lastly, stand-alone production equipment such as plastic injection molding equipment.

When we coded the survey information from each company to quantify the EE initiatives and compare them across the sample, we recognized that the people-versus-equipment categorization of EE initiatives used by BSR does not fully explain the EE initiatives implemented by each company. More specifically, the survey data does not capture process changes that we discovered from the interviews. Process changes might be reported as equipment upgrades and employee participation in the survey. However, as illustrated in the example from the Towel Supplier below, certain changes in these companies entail rearrangement of work flows that may or may not include significant equipment upgrades but clearly involved in-depth analysis and modification of internal production process—sometimes radical. They are different from stand-alone equipment upgrades and are not captured by the survey. Thus, we combined the survey and interview data to code suppliers' EE initiatives and specified a taxonomy of three categories of EE initiatives (Bailey, 1994; Boyer, Bozarth, & McDermott, 2000): *management-, equipment- and process-oriented* EE initiatives. These three categories of initiatives encompass management systems, hardware and operating procedures. They corroborate Shrivastava's (1995) "environmental technologies" and Klassen and Whybark's (1999) "environmental technology portfolio," which supports the taxonomy's external validity. Table 3 describes these three categories with illustrative quotes from managers.

(Table 3 about here)

EE through management focuses on establishing work routines, training programs, task teams and reward systems and nurturing environmental awareness to influence employees' behavior. The direct objective is to reduce energy consumption and waste in existing production

processes and work and life routines of factory workers. The specifics of training at the three apparel supply companies, for example, are typically simple and intuitive, focusing on common sense practices such as stopping leaks or drips and reducing non-productive use of electricity, water and steam.

The low-hanging fruit of EE through management is to reduce energy usage through personal behavioral change. During visits to three factories and administrative offices of some of the largest producers of certain apparel categories in China (e.g., Jean Supplier), we noticed that lighting in office building hallways and non-production areas of the factories was dimmed, or turned off. We saw signage mandating that employees can use an elevator only when a minimum of three riders are present. Managers in these companies said that EE training is held during new employee orientation, which is a continuous endeavor because the average annual turnover is around 20% in the apparel industry in Southern China.

There is shared awareness among the managers and workers that China has limited natural resources. Employee education promotes the notion of frugality and waste reduction, which aligns with the traditional virtues of Chinese culture and is easily understood by migrant workers. In the Jean Supplier, for instance, management indoctrinates frugality using the Chinese proverb “everyone is responsible for the financial wellbeing of the family.” Motivational posters and performance charts are displayed in the plants and hallways of migrant workers' living quarters, reminding workers of the guidelines.

Labor relations are an important factor for effective education and EE initiative implementation. Managers are very cautious that an aggressive mandate could be interpreted as an infringement on the welfare of the workers. Managers from three companies (Apparel

Supplier B, Kitchenware Supplier A, and Jean Supplier) told us that they would never resort to punitive measures on EE issues given recent labor-related scandals reported in the media.

Managers from the two Kitchenware Suppliers offered contrasting examples of how employees respond to different EE approaches. When a mid-level manager from Kitchenware Supplier A bluntly told a worker to shut off a water faucet completely as he walked away for a lunch break, the worker obliged. Later the manager overheard this worker complain to other workers: *“I am spending the money of the boss (factory owners) and not his money.”* The manager later reasoned that the labor relationship is lukewarm at best in his company. Migrant workers typically believe that they belong to one “family” while the managers from overseas, in this case Hong Kong, belong to another.

In contrast, workers of Kitchenware Supplier B seemed to embrace EE initiatives when the company’s overseas managers unexpectedly demonstrated their environmental concerns. During a company-sponsored outing, several Taiwanese managers collected garbage along the hiking trail. While this is common in Taiwan, such actions surprised the mainland workers. In the end, the workers volunteered to organize similar monthly events involving litter collection in the city parks. The Taiwanese managers pointed to this event as a defining moment. Since then, there is little effort needed to indoctrinate the value of EE.

EE through equipment consists of a company’s activities related to upgrading equipment (e.g., adding inverters to existing machinery or replacing boilers burning heavy oil with more efficient electrical boilers) and purchasing more energy efficient equipment. One “low-hanging fruit” area for all sampled companies includes replacing light bulbs and retrofitting machines with inverters. For instance, one manager at Kitchenware B pointed out that motors often run

continuously at maximum speed, which is rarely needed. Adding variable-speed drives has saved up to 60-70%. Installing such drives is an easy win and widely adopted best practice.

Our analysis suggests that equipment investment decisions are based on a combination of factors including financial considerations (ROI), long-term production projections and the strategic factors of competitiveness and institutional pressures. As the next section explains, state-owned companies' investment decisions tend to be driven and supported by government policies whereas the non-state-owned companies are more cost-driven. Apparel Supplier A identified rising labor costs as one reason for investing in automated equipment, where EE is actually a side benefit. Thus, EE is often used as one of several justifications in the capital equipment purchasing decisions.

On the surface, *EE through process orientation* appears to be similar to equipment upgrades, or involve the tactical adjustment and retrofit of existing equipment. However, it differs from equipment-focused EE initiatives in two important ways. First, equipment-focused EE targets the energy savings potential of stand-alone equipment, whereas process-oriented EE initiatives focus on opportunities in existing or new production processes. The chief energy engineer of Towel Supplier pointed out that he conceived the production process as a process of energy consumption such that his task is to identify and eliminate excess electricity, lighting, and heating/chilling throughout the plant.

Second, in process-oriented EE, one process improvement activity can trigger a cascade of changes when production processes are coupled. Again, at Towel Supplier, when the engineering team made process changes to recover heat lost in the factory's dyeing process, the chimney temperature was also reduced. This allowed the company to use more efficient heat exchangers. Then engineers realized that heat exchanger technology resides in the boiler industry

and no one in the company knew the field. The engineers subsequently visited various boiler manufactures to evaluate options and implement decisions.

The examples above offer a basic understanding of the nature of EE initiatives and a grounding to discuss why companies adopt different EE initiatives. We now examine the focal question of the study: what motivates suppliers to pursue EE initiatives and what determines the influence of the government and western buyers in such pursuits?

Stakeholder Influence: Government versus Buyers

The seven suppliers all have strong operations performance records. The sustainability directors of Buyer 1 and Buyer 4 remarked that they sponsor their most capable suppliers to initiate EE so as to understand the challenges in EE implementation. When we asked, "What if a supplier decides not to participate?", the director commented that it would raise the question about a supplier's capability to learn and grow with the buyer. We heard similar comments from other buyers that failure to comply with requests to pursue EE would be viewed unfavorably in supplier evaluation.

The seven suppliers included here were all receptive toward the buyers' push for EE. With the rising costs in production material and labor and electricity shortages in the summer months, the suppliers acknowledge the buyers' legitimate concerns. Suppliers are also aware of the government policy on EE. In this sense, the two stakeholders' direct objectives overlap to a great extent: energy conservation. At the same time, we found that the suppliers experienced different levels of influence from the government. They also have rarified interpretations of the buyers' motives. The differences in suppliers' perception and their interpretation of stakeholders are demarcated by their ownership types.

We compared and contrasted the influence of government versus buyers for each company. Table 4 provides quotes from the suppliers' managers to illustrate their interpretation of the demands from two stakeholders. Table 5 delineates our analysis on how suppliers synthesize their motives and stakeholder demands. We begin our analysis with a brief explanation of the two types of ownership to help understand the institutional environment in which the sampled companies operate.

(Tables 4 & 5 about here)

State-Owned Supplier Companies. The two state-owned companies (Jean Supplier and Towel Supplier) have direct administrative affiliation with government ministries. While both of these companies have become more market-oriented with China's economic reform, they still have a significant responsibility for providing social services and welfare to current, retired and even laid-off workers, including pension, basic healthcare and housing. The appointment of senior managers is determined by the affiliated ministries. For instance, the CEO of Jean Supplier's parent company is considered a deputy-minister level official. With such administrative ties, the senior executives have the dual roles of running a company and executing government economic policies. Because of this, the government policy has a strong influence on the company's business decisions and the careers of managers. In return for fulfilling the government goals, the state-owned companies benefit from preferential industrial policies in the form of cheaper loans, subsidies and tax incentives.

Non-State-Owned Supplier Companies. The remaining five suppliers operate as private enterprises. Four are privately-owned and one is a publicly-traded company. One manager in Apparel Company A (mainland, private) explained its relationship with the government using a Chinese proverb "the mountain is high and the emperor is far away." There is no direct

administrative connection between these companies and the government. Influence from the government comes in the form of quotas for electricity consumption and rules and timetables to phase out energy-intensive equipment such as boilers burning heavy oil. The industries in our sample are not among the heaviest emitters such as cement producers or thermo power plants, where the government enforces clear timetables and laws on technology and equipment upgrades.

Ownership and Influence of the Government. Our interview suggests that two types of government entities exert strong influence on the suppliers. One government entity is the regional Power Companies that are affiliated with the State Grid and responsible for power distribution. Both state and non-state-owned suppliers see direct interference from the government in the form of electricity curtailment by the Power Companies that give households priority during summer months. The regional power companies are not directly involved in suppliers' EE initiatives; yet they do offer training and rebates on lighting upgrades.

The other type of government entity is either the industry ministries or the municipal government. The ministries directly influence state-owned suppliers, sharing responsibility for economic development and energy objectives. For the non-state-owned suppliers, municipal governments exert influence similar to the ministries over the state-owned companies.

We found the nature of company ownership predicates the influence of these two government entities. Managers of the two state-owned companies consider fulfilling the government's policy articulated in the 11th 5-Year Plan on EE as an integral part of their business objectives. One manager of Towel Supplier remarked: "we reduce the burden for the government; the government clearly is treating us preferably." In other words, they expect the government to reciprocate their effort. Although the two state-owned companies are attentive to

the buyers' EE improvement requests, it was handled as a typical business request. Towel Supplier was concerned about the buyer's intent to share the savings from EE in the future. Jean Supplier contemplated how its EE initiatives could enhance its bargaining power. Hence it appears that the state-owned suppliers consider the government's influence as a long-term strategic issue whereas the buyers' demand is considered a tactical operations task.

Considering EE as a strategic issue also means that both state-owned suppliers link EE with opportunities to improve their competitiveness and "elevate management and technological capability." One manager at the Jean Supplier remarked: "It does not matter what the client asks, it matters what we demand of ourselves" (See Table 4). The chief engineer at Towel Supplier framed EE as a learning and development agenda. Thus, with support from the government, a sense of sovereignty underlies the state-owned suppliers' decision logic—fulfilling the goal of the government should in turn enhance competitiveness. The buyers are just viewed as clients for whom they fulfill a business contract.

For the five non-state-owned companies, incentives and subsidies from the municipal government are miniscule compared with the largess from the ministries to the state-owned suppliers. Only one municipal government in collaboration with the regional Power Company offered rebates on efficient lighting in the city where Apparel Supplier C is located.

The non-state-owned suppliers believe that the Power Companies have a strong influence on their decisions regarding EE compared with the municipal government. The Power Companies hand down electricity consumption quotas and penalties (see comments from Apparel Supplier B and C in Table 4). Among them, three suppliers (Kitchenware Supplier A and B and Apparel Supplier B) mentioned that they strongly support the national policy considering EE as their social responsibility just like the two state-owned suppliers. One manager at

Kitchenware Supplier B also pointed out that EE is about “survival and competition.” The other two suppliers considered EE initiatives as a necessity due to energy shortages: they recognize that they *need* to adapt to the EE goals of the government as the business environment changes.

The non-state-owned suppliers are more attentive to the demands of the buyer. One interesting observation is that they always discussed the buyers’ intent with a business relationship undertone (see Table 4). A common sentiment was that suppliers expect their EE efforts will improve their relationships even though they know that, whether the buyers’ intent is perceived as cost or sustainability, the buyers will not financially invest in suppliers’ EE efforts.

Varied Interpretation of the Buyer’s Intent. We observed that while all managers of the western buyers discussed EE as a sustainability issue, Towel Supplier and Apparel Suppliers A and B largely consider that their buyers’ EE objective has a cost reduction focus. Further, when we asked if the buyer was willing to share the suppliers’ investment in EE, Apparel Supplier A made it clear that its buyer (Buyer 4) would not “sacrifice their own” business interests to do that. Rather, Buyer 4 required a 10% energy reduction goal and expected the supplier to share the savings.

While it is possible that the buyers’ managers we interviewed communicated an environmental agenda because they knew the intent of this study, interviews with the suppliers also suggest two alternative explanations regarding why suppliers interpret EE mandates as cost reduction. The first is the competing demands of cost reduction and environmental sustainability and how EE initiatives are managed by the buyers. Specifically, buyers of Apparel Supplier A and B manage EE as a sustainability issue from corporate headquarters, which is comparatively independent from its regional supply chain functions. Even though the buyers’ sustainability managers regularly visit suppliers’ facilities in China, the suppliers interact more frequently with

the buyers' regional sourcing and merchandising managers who also evaluate suppliers' business performance. In such cases, achievement of the EE objective has a weak or indirect bearing on suppliers' performance evaluation. As one manager of Apparel Supplier A remarked "[Buyer 4's] CSR is global, merchandising is local." In other words, profits have a stronger influence on behavior than CSR. Correspondingly, improved EE performance, according to Buyer 4's sourcing managers, should be reflected in the overall cost-competitiveness of the supplier. Hence, the buyer's EE requirement is interpreted as a way to reduce costs instead of a way to reduce carbon emission.

The second plausible explanation is cross-cultural communication difficulties. When we asked suppliers about what sustainability means to them and their initiatives, Apparel Supplier A and B often refer to their efforts in labor management (e.g., work conditions, wages). Environmental issues are generally confined to traditional Scope 1 pollution management. The Scope 3 EE is considered government policy issues, which they support but see as beyond their control. Even though the sustainability managers from the buyers' headquarters may have communicated their broad triple-bottom line sustainability goals related to EE, it is possible that the EE message from the buyers could just be "lost in translation."

In contrast, interviews show that managers of Jean Supplier, Kitchenware Suppliers A and B and Apparel Supplier C are keenly aware that environmental attributes are an important value proposition conveyed through their buyers' products in the consumer market. Our interviews suggest that middle-level managers at these suppliers discussed EE in the same triple-bottom-line framework as that of the sustainability managers at the buyers. Interestingly, two of these four suppliers have overseas offices and more direct interactions with personnel in the buyers' headquarters collaborating on product design and merchandising management. Such

direct interactions suggest a higher level of supply chain integration and information sharing between buyers and suppliers.

Relationships among the Three Categories of EE Initiatives

Examining the implementation of the three EE initiatives, we ranked suppliers' adoption of three categories of EE initiatives into three levels. The ranking reveals patterns in the execution of these initiatives.

Ranking was an iterative process. We used the definition of each initiative category to identify and sort all the activities in each company reported in the BSR survey. Then we consolidated activities from all seven companies in one table for comparison. These activities were then evaluated to understand the relative effort by each supplier, with the objective of comparing the *extent of efforts* across the seven companies. For instance, on *equipment-oriented EE initiatives*, the ranking was not a simple count of investment dollars or equipment. Instead, we considered (1) how the equipment investment spread across different energy systems that are relevant to the production process of the company; and (2) the financial “burden” a supplier had with different investment decisions. Information from our interviews and consultation with two energy engineers provided contextual understanding of the supplier’s effort. Similarly, in *management-oriented EE initiatives*, it was important to assess how management effort affected the workforce—the efficacy of employee training. This required multiple rounds of coding and discussion to clarify which “effects” matter and how to measure them based on available data. Eventually, a consensus was reached—training could be captured by their persistence and extent of management’s effort and the “effect” was demonstrated by reported employee awareness of those efforts. Finally, to rank the *process-oriented EE initiatives*, the critical issue was to differentiate ad hoc and independent process changes (e.g., adjustment of production area layout)

from systematic changes (e.g., multiple interdependent changes in production process). Table 6 highlights the suppliers' EE initiatives with representative facts from the survey data and our ranking of these initiatives.

(Table 6 about here)

Basic *EE through management* was implemented by all suppliers in our sample, which is not surprising given that these companies are exemplars. All but one supplier (Apparel Supplier B) had at least a medium level of EE initiatives through management. Given the cost pressure and financial constraints of non-state owned companies, most suppliers avoided spending on equipment, preferring savings through behavioral change.

Beyond adopting the basic EE management tasks, each company's environment shapes its unique path. EE activities diverge as opportunities are situation-specific and require custom solutions. The nature of business ownership is an important factor differentiating these companies' EE initiatives. The two state-owned companies invested heavily in equipment to improve EE. We posit that such aggressive investment is a response to administrative mandates. Purchasing new equipment is a measurable way to demonstrate a company's commitment. It matches the pattern of the Chinese government: aggressive investment in infrastructure. They also have more financial and technical resources at their disposal than non-state owned companies.

The five non-state owned companies are less aggressive in capital equipment investment. Only Kitchenware Supplier A and Apparel Supplier C have a medium level of equipment-based EE initiatives. Apparel Supplier C made a series of equipment investments including an expensive bio-fuel boiler. The company struggled with this decision, but they saw the provincial government tightening up pollution control standards in the coastal cities and knew they would

be affected soon. The other four companies took a measured approach to phase out older equipment and upgrade existing equipment. A one-and-a-half year ROI is the norm in such decisions.

One refrain from the managers is that acquiring advanced equipment does not always equal a mastery of its energy-saving potential. The operations director of Kitchenware Supplier A remarked – “You can install a new injection molding system that should use half the energy, but if you’re not using equipment in the right way, you will not save any money.” On two different occasions, managers in Apparel Supplier A and B pointed out that, in drive technology, operations account for 97% of the life cycle costs of a motor. Effective use of equipment requires operators to have an innate understanding of the real-time production process. This is where they see process-oriented improvement making more sense.

Towel Supplier stood out as the only company with a high level of process-oriented EE initiatives. Kitchenware Supplier A and Apparel Supplier C attained a medium level of process innovation. These three companies also have at least a medium level of management EE initiatives. Apparel Supplier B has a low ranking on both management and process-oriented initiatives. No company has a process ranking higher than its management ranking. This observation, together with the data from the interviews, suggests that management-oriented initiatives are a prerequisite for companies to exploit process-oriented EE opportunities. More specifically, managers and employees will be more likely to search for meaningful process-based opportunities only when they have a conservation mindset, training, and understanding of the production process.

DISCUSSION AND PROPOSITIONS

In this study, we set out to explore what motivates suppliers to improve EE and what determines the influence that buyers and the government exert on suppliers in such pursuit. Our analysis suggests suppliers perceive the influence of buyers and the government differently, depending on company ownership. Sustainability focus and strategy alignment between suppliers and these two stakeholders affect the suppliers' response. These observations highlight the factors that may constrain buyers' influence on suppliers' behavior.

Supply management studies point out that a buyer often has a strong influence over suppliers' operations. However, when a buyer asks for EE improvement from suppliers without binding contracts, its influence is contingent on the interplay of factors including the suppliers' development needs, ownership characteristics and goal alignment among stakeholders. In this sense, our study offers a contingency perspective on the role of the buyers. When we consider the buyer and suppliers in a broad stakeholder setting, suppliers' EE initiatives arise from both technical and social decisions based on the influence of multiple stakeholders. For a decision on equipment investment, return on investment is seldom a straightforward financial calculation. Whereas state-owned suppliers rationalized investment decisions in the context of attaining government policy goals, non-state owned suppliers tended to consider how EE decisions would affect their business relationship with the buyers. For non-state owned suppliers, government influence is not as salient as that of their buyers, even though they heed the government's appeal for energy conservation.

Proposition 1: Buyers and governments exert differential influence on suppliers, moderated by suppliers' ownership characteristics. Supplier response to stakeholder influence leads to varied implementation of EE initiatives and performance efficacy.

Proposition 1a: State-owned supplier companies who receive direct government support will focus specifically on meeting policy objectives, pursuing EE through aggressive investment in equipment-oriented EE initiatives in exchange for government resources.

Proposition 1b: Non-state owned suppliers are influenced by primarily their key western buyers and are thus more prudent in equipment-oriented EE initiatives due to lack of external support.

Suppliers, especially the non-state owned ones, are aware that despite their preferred supplier status, buyers offer minimal financial support for their EE-related investment and initiatives. In the high-volume, low-margin manufacturing sectors in China, suppliers understand the high-pressure, short-term commitment from buyers and the power and leverage that the buyers hold over them. Suppliers leverage their EE initiatives to influence their relationships with the buyers. Kitchenware Supplier B believed that its buyer sells a “green product” at a price premium and it is helping the buyer to enhance its brand value (see Table 4). Even Apparel Supplier B, whose EE efforts are the lowest among all seven companies, thinks it needs to let the buyer know “we care.” The intent is to signal a desire to maintain a good relationship with this essential stakeholder.

Proposition 2: Suppliers leverage EE initiatives as a means to enhance their standing with their buyers through signaling efforts and compliance.

As the suppliers consider the relational implications of EE, they also gauge buyers’ objectives concerning EE – whether it is reducing costs or supply chain carbon emissions. They do so by examining buyers’ brand positioning and through interactions with buyers’ product design and corporate and local CSR management. The frequency and intensity of interactions between various organizational functions of the buyers and the suppliers affect how buyers’ EE objectives are communicated and interpreted. As presented in the findings, local supply management agents of the buyer tend to focus on price and availability (e.g., Apparel Supplier A and B), whereas corporate-level functions such as product design and CSR invariably focus on sustainability issues (e.g., Jean Supplier, Kitchenware Suppliers A and B and Apparel Supplier C).

Proposition 3: Suppliers who interact more frequently with their western buyer's local sourcing representatives tend to treat EE as an economic/operations initiative, because their primary contacts tend to have a strong cost-price priority in their interactions with the suppliers.

Proposition 4: Suppliers who have extensive interactions with their western buyer's corporate-level personnel in design and sustainability tend to treat EE as an environmental initiative, because their primary contacts emphasize the environmental issues in EE.

There is a pattern of implementing the three categories of EE initiatives. In six out of the seven companies, the level of management-oriented EE initiative implementation is higher or at least equal to equipment-oriented EE initiatives. The level of management-oriented EE initiatives in each company is also equal to or higher than process-oriented EE initiatives. This observation suggests that companies generally start with training and education to reduce energy usage and waste before they implement equipment-oriented EE or identify process-oriented EE opportunities. This pattern highlights employee behavior. As shown above, employee education focuses on conservation values and citizenship instead of mandates and penalties. Behavioral change is a gradual process. Policy mandates on habit and behavior only work when behavior is monitored, and would send a more coercive message. Further, when a manager can associate employees' personal behavior with virtues, it creates job enrichment and good labor relations that facilitate continuous employee learning because it dispels mistrust and facilitates communication (Towel Supplier; Kitchenware Supplier B).

Proposition 5: Employee education and training in EE are most effective in changing behaviors when such training focuses on the virtues of conservation and frugality.

Proposition 5a: A strong labor relationship positively moderates the relationship between management-oriented EE initiatives and the employee behavioral change.

CONTRIBUTIONS, LIMITATIONS AND FUTURE RESEARCH

Improving EE is an operations challenge and strategic opportunity for suppliers. This study takes a first step in examining the role of buyers in influencing suppliers' decisions on

implementing EE initiatives as they wrestle with balancing cost pressures with the emerging energy conservation demands from the government and buyers. To the best of our knowledge, this is one of the first exploratory studies that examine the suppliers' challenges in implementing EE initiatives to support their buyers' carbon reduction goals. Existing studies on stakeholder analysis often examine firms' external stakeholders. The influence of the focal firms' buyers in such analysis is largely overlooked—buyer influence is often considered “given” and attributed to the buyers' purchasing leverage. In this exploratory case study, data from both buyers and suppliers tells a more nuanced story. Insights about buyer influence emerge when we consider the influence from the buyer and government together in this unique research setting.

The study makes two theoretical contributions. First, this study examines an under-explored environmental management issue. Unless a company generates its own power supply, EE is a Scope 3 concern—the environmental impact is consequential yet the regulatory framework is tenuous. This study reveals how managing suppliers' energy usage is different from managing their direct pollution. In the case of EE initiatives, employee behavior, intentional and unintentional, directly affects a supply chain's carbon footprint. Recent studies call for attention to training and organizational support to engage employees in environmental activities (Cantor, Morrow, & Montabon, 2012; Sarkis et al., 2010). This study found that clear alignment of sustainability values between buyers and suppliers coupled with indoctrination of frugality and conservation as virtues will motivate employees to change behavior. Our study accentuates a people-centric perspective to reduce the carbon footprint of the supply chain.

Second, this study addresses an important yet overlooked question in stakeholder theory. Following Mitchell and colleagues' (1997) argument that stakeholder groups are different from each other, we delve into the differences between two critical stakeholder groups, buyers and the

government. One salient issue is that these stakeholders have dualistic and potentially competing demands on suppliers. Our study identified important contingency factors such as suppliers' ownership types, sustainability strategies and value alignment to explain their decision logic and the efficacy of stakeholder influence. These contingency factors enrich our understanding of stakeholder analysis. More importantly, they supplement such moderating factors as firm size, industry and region identified in Golicic and Smith's (2013) meta-analysis of the relationship between environmental supply chain practices and firm performance.

This study also has two practical implications. First, we find that beyond regulatory compliance, buyer influence is limited; buyers represent only one of many stakeholders that impact suppliers' environmental actions. Suppliers interpret sustainability issues in the specific stakeholder environment in which they operate. Our study highlights this overlooked yet increasingly important challenge concerning supply chain carbon footprint management. Our study suggests that the western buyers need to empathize to better understand suppliers' motives and priorities when they communicate corporate environmental strategies.

Second, western buyers should consider the identified contingency factors when they engage suppliers on Scope 3 environmental tasks in a transitional economy exemplified by China. Buyers need to make sure their sustainability strategy and messages mesh with the suppliers' priorities and motives, and that communications from headquarters and local buyer representatives to the supplier are consistent. They also need to consider how their supply chain sustainability strategy is managed such that suppliers' sustainability accomplishments are evaluated and rewarded not only based on cost reduction but also on long-term supplier capability enhancement.

This study is exploratory in nature. There are inherent limitations in this method. Despite our effort to gain access to suppliers in China, we only had one Taiwanese supplier in our sample. We observed differences in EE initiatives between this Taiwanese-owned supplier and the company from Hong Kong supplying the same buyer, but we cannot draw definitive conclusions from one comparison. Ideally we would have had a more balanced ownership sample from these two regions to compare differences in their responses to various stakeholders and how their practices differ from companies with origins in mainland China.

Additionally, as a first step in understanding suppliers' EE practices, we focused on two stakeholders and first tier suppliers in the light industry sectors (apparel and household retail products). The EE challenge would be different and perhaps more daunting for suppliers in sub-tier supply chains. Several managers mentioned that the sheer number of small sub-tier suppliers creates serious carbon emission challenges. They commented that energy, water and chemical usage in the fabric dyeing process have their own set of energy challenges. Future research should include sub-tier suppliers and consider the interaction of a broader spectrum of environmental issues including energy, pollution and natural resource management. Furthermore, suppliers are invariably affected by other stakeholders besides the buyers and government. Historically, environmental NGOs in China have had little influence on companies. In recent years, citizens are forming watchdog groups that are more assertive, demanding higher environmental standards. Future research needs to consider the influence of such emerging stakeholders on suppliers' environmental behavior and sustainability strategies.

These limitations also point to important questions that warrant future research. First, the findings of the case studies can only be interpreted in the context of the sample selected for this study. Findings from this case analysis are biased towards larger and more EE-proactive

companies; they need to be empirically validated using large cross-industry samples. Researchers should also consider longitudinal data to better understand the relationship among people, processes and equipment. Given the early stage of implementing EE initiatives, process-oriented EE initiatives in particular are still new and less understood. Longitudinal analyses of the interactive relationship among management, equipment and processes are necessary to have a more systematic understanding of suppliers' learning process and supply chain integration.

Our study reveals that buyer-supplier relationship dynamics may affect how the buyer's sustainability strategy is integrated into the suppliers' EE initiatives. As we discussed, buyers' functional managers send mixed signals to suppliers regarding operations and sustainability. This may result in skewed interpretation by the supplier of the buyer's intent, especially if the sustainability demands require additional resources and expense. This tension among the three dimensions of the triple-bottom line raises the question of goal alignment between buyers and suppliers. One question is the degree to which a buyer is willing to integrate suppliers into their sustainability mission in an outsourcing strategy where the upstream supply chain is more fluid. For instance, cost pressure may force the buyers to maintain a distance from the suppliers which allows the buyers to seek out other suppliers in lower-cost regions. If so, a lack of long-term commitment would hamper supplier innovation. Future research should explore the alignment of environmental values and business motives between buyers and suppliers and the effect of that interplay on the overall sustainability of supply chain operations.

Lastly, EE deals with a unique form of waste. EE management requires gradual changes of personal behavior and motivation beyond immediate economic payoffs. EE appeals to a deeper concern for people and their connections to the environment and community as illustrated in the motivated workforce of Kitchenware Supplier B and persistent pursuit of EE by the

engineers at Towel Suppliers. Future research needs to investigate how national culture influences employees' perceptions of natural resources and conservation that ultimately induce environmental behaviors. Such understanding will help managers design management practices that nurture environmental values and bring rich meaning to employees' work.

REFERENCES

- Agle, B. R., Mitchell, R. K., & Sonnenfeld, J. A. (1999). Who matters to CEOs? An investigation of stakeholder attributes and salience, corporate performance, and CEO values. *Academy of Management Journal*, 42 (5), 507-525.
- Bailey, K. D. (1994). *Typologies and taxonomies: An introduction to classification techniques*. Thousand Oaks, CA: Sage Publications, Inc.
- Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of Management Journal*, 43 (4), 717-736.
- Barratt, M., Choi, T. Y., & Li, M. (2011). Qualitative case studies in operations management: Trends, research outcomes, and future research implications. *Journal of Operations Management*, 29 (4), 329–342.
- Bell, J. E., Autry, C. W., Mollenkopf, D., & Thornton, L. M. (2012). A natural resource scarcity typology: Theoretical foundations and strategic implications for supply chain management. *Journal of Business Logistics*, 33 (2), 158–166.
- Boyer, K., Bozarth, C., & McDermott, C. (2000). Configurations in operations: An emerging area of study. *Journal of Operations Management*, 18 (6), 601–604.
- Campbell, J. L. (2007). Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility. *Academy of Management Review*, 32 (3), 946–967.
- Cantor, D. E., Morrow, P. C., & Montabon, F. (2012). Engagement in environmental behaviors among supply chain management employees: An organizational support theoretical perspective. *Journal of Supply Chain Management*, 48 (3), 33–51.
- Carbon Disclosure Project, CDP supply chain report 2012: A new era: Supplier management in the low-carbon economy, www.cdproject.net/CDPResults/CDP-Supply-Chain-Report-2012.pdf, Accessed December 13, 2012.
- Chan, H. S., Wong, K. K., Cheung, K. C., & Lo, J. M. (1995). The implementation gap in environmental management in China: The case of Guangzhou, Zhengzhou, and Nanjing. *Public Administration Review*, 55 (4), 333-340.
- Crilly, D., Zollo, M., & Hansen, M. T. (2012). Faking it or muddling through? Understanding decoupling in response to stakeholder pressures. *Academy of Management Journal*. 55 (6), 1429-1448.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20 (1), 65–91.

- Driscoll, C., & Starik, M. (2004). The primordial stakeholder: Advancing the conceptual consideration of stakeholder status for the natural environment. *Journal of Business Ethics*, 49 (1), 55-73.
- Economist. (2012, February 11). Pollution in China: Clearing the Air, www.economist.com/node/21547215, Accessed December 20, 2012.
- EIA. China: Background, www.eia.gov/countries/cab.cfm?fips=CH, Accessed October 15, 2012.
- Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, 14 (4), 532-550.
- Ellram, L. M., & Tate, W. L. (2013). *Sourcing to support the green initiative*. New York, NY: Business Expert Press.
- Fallows, J. (2012). *China airborne*. New York, NY: Pantheon Books.
- Freeman, R. E. (1984). *Strategic Management: A stakeholder approach*. Marshfield, MA: Pitman.
- Friedman, A. L., & Miles, S. (2006). *Stakeholders: Theory and practice*. Oxford: Oxford University Press.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.
- Golicic, S. L., & Smith, C. D. (2013). A meta-analysis of environmentally sustainable supply chain management practices and firm performance. *Journal of Supply Chain Management*, 49 (2), 78-95.
- Hayes, S., Young, R., & Sciortino, M. (2012). *The ACEEE 2012 international energy efficiency scorecard*, Report number E12A, American Council for An Energy Efficient Economy, aceee.org, Accessed December 13, 2012.
- Hicks, C., Dietmar, R., & Eugster, M. (2005). The recycling and disposal of electrical and electronic waste in China—Legislative and market responses. *Environmental Impact Assessment Review*, 25 (5), 459-471.
- Kitazawa, S., & Sarkis, J. (2000). The relationship between ISO 14001 and continuous source reduction programs. *International Journal of Operations and Production Management*, 20 (2), 225–248.
- Klassen, R. D., & Whybark, D. C. (1999). The impact of environmental technologies on manufacturing performance. *Academy of Management Journal*, 42 (6), 599-615.

- Klassen, R. D., & Vachon, S. (2003). Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment. *Production & Operations Management*, 12 (3), 336-352.
- Krautkraemer, J. A. (1998). Nonrenewable resource scarcity. *Journal of Economic Literature*, 36 (4), 2065–2107.
- LaPlume, A. O., Sonpar, K. & Litz, R. A. (2008). Stakeholder theory: Reviewing a theory that moves us. *Journal of Management*, 34 (6), 1152-1189.
- Lovins, A. B. (1976). Energy strategy: The road not taken? *Foreign Affairs*, 91 (5), 65-96.
- Luo, Y. (2007). From foreign investors to strategic insiders: Shifting parameters, prescriptions and paradigms for MNCs in China. *Journal of World Business*, 42 (1), 14-34.
- McCutcheon, D., & Meredith, J. (1993). Conducting case study research in operations management. *Journal of Operations Management*, 11 (3), 239–256.
- Montabon, F., Melnyk, S. A., Sroufe, R., & Calantone, R. J. (2000). ISO 14000: Assessing its perceived impact on corporate performance. *Journal of Supply Chain Management*, 36 (1), 4-16.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: Grounded theory procedures and techniques*. London: Sage Publications.
- Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22 (4), 853–886.
- Pagell, M., Wu, Z., & Murthy, N. (2007). The supply chain implications of recycling. *Business Horizons*, 50 (2), 133-143.
- Parmigiani, A., Klassen, R. D., & Russo, M. V. (2011). Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. *Journal of Operations Management*, 29 (3), 212–223.
- Plambeck, E., & Denend, L. (2007). The greening of Wal-mart's supply chain. *Supply Chain Management Review*, 11 (5), 16-23.
- Sabrie, G. (2012, November 12). With China and India ravenous for energy, coal's future seems assured, *The New York Times*, p. B6.
- Sarkis, J. P., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28 (2), 163-176.

- Shrivastava, P. (1995). Environmental technologies and competitive advantage. *Strategic Management Journal*, 16 (SI), 183-200.
- Stanley, T., & Xu, V. (2012). China's 12th five-year plan: An overview. KPMG Insights Series, kpmg.com/cn/en/issuesandinsights, Accessed December 19, 2012.
- Strauss A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. London: Sage Publications.
- Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations and Production Management*, 26 (7), 795-821.
- Yin, R. K. (1994). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.
- Zhang, S., (2013, August 6). Chinese factories embrace environmentalism—to a point, <http://www.theatlantic.com/china/archive/2013/08/chinese-factories-embrace-environmentalism-to-a-point/278419/>, Accessed August 14, 2013.
- Zhao, X., Flynn, B. B., & Roth, A. V. (2007). Decision sciences research in China: Current status, opportunities and propositions for researching supply chain management, logistics and quality management. *Decision Sciences Journal*, 38 (1), 39-80.
- Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, 22 (3), 265–89.

APPENDIX A

Buyer and Supplier Interview Protocol

Introduce this project.

Scope out a company's EE initiatives, environmental and carbon emission reduction programs.

Motivation and Strategy. Ask supplier to:

Explain the background of EE initiatives, objectives.

Explain how EE initiatives are related to pollution control/prevention and environmental management.

Explain the relationship between EE initiatives and supplier's core business and overall sustainability strategy.

Buyer-Supplier Interactions and EE Implementation. Ask buyer and supplier to:

Explain buyer influence on supplier's EE initiatives.

Explain supplier's interpretation and response to the buyer's demand on EE.

Explain the specific action taken in various areas of operations (i.e. sourcing, logistics, manufacturing, plant management, quality management, capital investment)

Explain how suppliers' EE initiative is related to carbon/energy initiatives and Health, Safety requirement of the buyers.

Government. Ask supplier to:

Identify major stakeholders on EE and environmental issues besides the buyer. Be specific about the government stakeholders (names of the government entities).

Suppliers' perception of government entities' influence on EE-related decisions and initiatives.

Explain the interactions between the supplier and the government entities.

Performance and challenges. Ask buyer and supplier to:

Explain how EE performance is measured.

Explain whether and how EE initiatives affect the supplier's business performance.

Explain how the supplier's EE initiatives affect buyer-supplier relationship.

Explain the challenges in energy, resource and overall environmental management.

Note: Interview protocol is customized for each company.

APPENDIX B
Questionnaire on Supplier's EE Initiatives

1. Does your factory use the following technologies and equipment? (Boilers, Motors/ Drives, Air Conditioner/ Chiller/ Heat Pumps, Transformers, Ventilation Systems, Air Compressors, Plastic Injection, Others). Please specify the number and highest design capacity (e.g., in kilowatts).
2. If there is a budget to support EE improvement related activities?
3. In the last 2 years, has your factory management set any goals or targets around energy efficiency or waste reduction?
4. Does your factory have an energy manager or a team responsible for increasing factory energy efficiency? Specify the staff members' experience, relevant certifications or qualifications.
5. Does your factory have incentives for the person responsible for meeting a specific EE goal?
6. Do you have an energy management system/action plan?
7. Has the factory received or does the factory plan to receive an external energy audit?
8. Has the factory provided or will the factory provide the specific energy saving related training to employees?
9. Does your factory currently use any energy metering technology?
10. Has your factory received any government awards or financial support for effective energy efficiency improvement efforts since 2007?
11. Does your factory have criteria for approving a capital investment in EE initiatives? Are there internal/external communications of the EE initiatives? If yes, please explain
12. In the last 2 years, has your factory undertaken any steps to increase energy efficiency or purchased energy efficient technology?

Note: The survey was conducted by BSR. Suppliers were asked to provide detailed facts to support their answers.

TABLE 1
Supplier Profiles and Corresponding Buyers

Supplier Names	Origin, Size* & Ownership	Number of Supplier Interviews**	Buyer Names	Number of Buyer Interviews***
Jean Supplier	Mainland, large, state-owned enterprise	2	Buyer 1	2
Towel Supplier	Mainland, large, state-owned enterprise	4	Buyer 2	2
Kitchenware Supplier A	HK, medium private	2	Buyer 3	2
Kitchenware Supplier B	Taiwan, medium size, private	3		
Apparel Supplier A	Mainland, medium size, private	3	Buyer 4	2
Apparel Supplier B	HK, medium private	2	Buyer 5	1
Apparel Supplier C	HK, large, publicly-traded	2	Buyer 6	1

* Large companies are those with more than 1,000 workers in the plant.

** Different managers were interviewed at Jean Supplier, Towel Supplier, and Kitchenware Supplier. One manager was interviewed multiple times in each of the other four supplier companies

*** Two different managers were interviewed at Buyers 1 and 4. A single manager was interviewed twice at both Buyers 2 and 3.

TABLE 2
Reliability and Validity Procedures Employed in Data Analysis

Criteria	Application in This Study
External validity	<ul style="list-style-type: none"> - Use of multiple informants - Buyer- supplier dyadic data - Verification of classification of efforts with engineers - Thick descriptive data - Site visits to three of the seven suppliers
Reliability	<ul style="list-style-type: none"> - Use of common questions/research protocol - Development of case study database including transcripts, reports from BSR, company provided data and external data - Site visits to three of the seven suppliers - Iterative discussion and coding to reach consensus, 100% inter-rater reliability
Construct validity	<ul style="list-style-type: none"> - Multiple sources of evidence- multiple informants, public and internal documents - Review of findings by uninvolved practitioners and academics
Internal validity	<ul style="list-style-type: none"> - Structured data coding and analysis following well established procedures - Development of propositions based on a chain of evidence

TABLE 3
Three Categories of EE Initiatives

EE Initiatives	Explanation	Quotes from Supplier Interviews
...through management	Establishing work routines, training programs, work teams and award systems to influence employees' behavior and nurture environmental awareness.	<p>We have made environmental protection a part of people's daily work routine. ... The training is quite lively and informal. It is not about saving money. They would not listen if it is always about money (because) it is the boss' money.</p> <p>We would never penalize workers. We only reward them for EE achievement. We take a soft approach, education, share best practice in the industry and ultimately benefit everybody. The culture here, you cannot ignore the culture in China.</p> <p>We have monthly EE meeting. Some called it "brainwash". The new workers are trained when they begin work, cultivating a good habit.</p> <p>The concept of energy saving, everyone can understand it, it is saving. But not everyone understands emission reduction. It is about social responsibility.</p>
...through equipment	Investment in newer and more energy efficient production equipment or upgrading existing equipment.	<p>Especially for those factories that might be up to 100,000 sq. feet, the lighting cost will contribute to about 14% to 20% of energy cost. ..this type of factory is more willing to invest in lighting.</p> <p>The large EE project is always combined with EE investment, it is changing constantly, the heat recycling equipment, we bought 3 in 3 years, the newer one is always better than the old one.</p> <p>We learned from hospital and installed automatic water faucet... but the water pressure is low and you cannot wash your hands clean, so someone suggests we block the water pipe to increase water pressure. This is the low cost approach.</p>
... through process innovation	Significant and even drastic changes of existing production processes and energy systems.	<p>We adopted an integrated method. In the past, de-sizing, scouring, bleaching and dyeing were done in three different vats. Now we combine it in one process; water saving is more than 40%.</p> <p>Hot water recycling..., the temperature is about 80°C, I want to recycle the heat before the waste water is discharged. But this will affect the waste water treatment. If the temperature is above 30°C, the bacteria cannot live, so there is need for electricity to cool/chill the hot waste temperature....we used heat exchange, cold and hot water are exchanged and we continuously use the water.</p> <p>Process-related EE effort is hard to imitate and it is kept as (company) secret. And what we did here cannot be used in factories in Shanghai. The acidity level of water is different. It has to be applied to specific situation.</p>

TABLE 4
Suppliers' Interpretation of Buyer and Governments' Intent and Influence on Their EE Initiatives

Suppliers	Buyer's Influence	<i>Quotes from Interviews of Suppliers</i>	Government's Influence
Jean Supplier	<p>We see (buyer's) intent is to have low carbon product.</p> <p>(Buyer) will not invest in energy efficiency on us, they wants lower price. If I can reach a certain standard, that will improve my bargaining leverage, because I have helped (buyer)'s brand value.</p>	<p>Since we are affiliated with the ministry, there is a piece of social responsibility as our goal. It is connected to both cost saving and social responsibility. In the 11th 5-year Plan, 8 items out of 10 are associated with social well-being, so our company mandates this; it proves the issue is going to be important in the future.</p>	
Towel Supplier	<p>When (buyer) requirement came down, since it is one of our biggest clients, we put great emphasis and do our best.</p> <p>(Buyer) has not used our saving to pressure for cost reduction. But we do have such a concern.</p>	<p>There is a responsibility agreement between the head of the local government and us on EE between 2006 and 2011. It is also a requirement of the country, the 11th5-year Plan. Domestic enterprises like us are all influenced by the state policy. As a large enterprise, we reduce the burden for the government; the government clearly is treating us preferably.</p>	
Kitchenware Supplier A	<p>(Buyer) has never talked with us on price cutting because we implement EE. Doing business, it needs to be mutual beneficial. (Buyer) sells a green product at a price premium because customers demand it.</p>	<p>The government talked about 20% energy saving, reduction of emission. We know the natural resources are shrinking. You cannot waste resources, .. it is a resource for the world.</p>	
Kitchenware Supplier B	<p>We noticed that our customer indeed cares about the concept "Earth as Our Village".</p> <p>(Buyer)'s supplier evaluation criterion is on the product, there is no such long-term contract between us. If the market is bad, they will not buy from us.</p>	<p>We received funding from the Taiwan Chamber of Commerce and XYZ City in our initiatives of hiring consultative services on EE management. They provide positive influence instead of just throwing regulations at us.</p>	
Apparel Supplier A	<p>(Buyer) requires us 10% reduction a year. They consider their own profit maximization, it is not possible for an enterprise to take care of your interests and sacrifice their own.</p> <p>For (buyer), CSR is global, merchandising is local. We negotiate and take the order and deal with the independent office of (buyer) in HK, who is commission-based and responsible for its own loss and profit.</p>	<p>We consider the country's policy on energy efficiency. We need to adapt to the needs.</p> <p>The local government does not have specific policy.</p>	
Apparel Supplier B	<p>(Buyer) does not provide specific standards or goals, it is in the early stage of promoting the idea. Although we do not use EE as leverage and bargain with (buyer), we let the (buyer) know we care and do a lot of EE projects.</p>	<p>If we look at the trend, the local government, country and individuals have requirements, we feel this is something we need to do, and it is not a harm to us.</p>	
Apparel Supplier C	<p>(The buyer) provided us with suggestion, invited us to participate Hong Kong Productivity Council meeting to see if we can get subsidy and provided the opportunity to us as they work on environmental protection, as a social responsibility action.</p>	<p>Two days a week the black rollout forces us to generate our own electricity.</p>	

TABLE 5
Analysis of Stakeholder Influence on Suppliers' EE Initiatives

Suppliers	Analytical Comments from Researchers
Jean Supplier	Goal alignment with the government and the buyer. EE is an opportunity to increase competitiveness and business with the buyer.
Towel Supplier	Goal alignment with the government. EE is an opportunity to enhance competitiveness but a concern that buyer may ask for price cut.
Kitchenware Supplier A	Conservation value matches the government policy. Shared value with the buyer.
Kitchenware Supplier B	Positive support from the government. Shared value with the buyer. EE is part of company vision for long-term development.
Apparel Supplier A	Receptive of government policy. Shared goal with the buyer on cost reduction.
Apparel Supplier B	Receptive of government policy. EE is considered means to reduce cost.
Apparel Supplier C	Positive support from the buyer on sustainability initiatives. Regulatory pressure from the government.

TABLE 6
Example Implementations of Three Categories of EE Initiatives

Suppliers	through Equipment	through Management	through Process Innovation
Jean Supplier	<i>High</i> Heavy investment in equipment upgrades (e.g. lighting, sewing equipment, boiler, heaters) with 2-5 year-long ROI.	<i>Medium</i> Energy-saving committee provides regular employee training focusing on behavioral change; Energy use monitoring at shop-floor and workers' living space.	<i>Low</i> Change production area layout to reduce production space requirement, hence lighting and HVAC use.
Towel Supplier	<i>High</i> Boiler upgrades; thermo-coating of dyeing machine cylinder, installation of inverter on various equipment (e.g. HVAC, dryer).	<i>High</i> Dedicated and independent energy efficiency team made up of professionals and engineers within the company	<i>High</i> Systematic process changes to recover heat, high-temperature water from dyeing process; Reducing air pressure in the spray pump; Radical design innovation of dyeing process.
Kitchenware Supplier A	<i>Medium</i> Various upgrades including, heater, air compressor, boiler, company fleet; addition of inverter on production equipment; Gradual phase out of old light bulbs because of the environmental impact of throwing away usable bulbs.	<i>Medium</i> Regulation to change employees' behavior; Raise temperature/humidity level for AC operations; Require employees use tricycle instead of electricity or fuel-based transport.	<i>Medium</i> Monitoring and adjustment of electricity and steam pressure based on real-time production needs; Routine monitoring and prevention of water, electricity leaks.
Kitchenware Supplier B	<i>Low</i> Very limited small financial investment; Addition of energy-saving devices on existing equipment including plastic injection molding machines, digitally-controlled motors; Lighting upgrade and replacing old equipment such air compressors and less fuel efficient vehicles.	<i>High</i> Regular employee training focusing on equipment handling; Cross-functional team formed to conduct in-depth analysis of the production processes; Inducing behavioral changes including use tricycle in the factory, mandate a minimum of 3 riders in an elevator.	<i>Low</i> Recycling cooling water in drawing machines.
Apparel Supplier A	<i>Low</i> Gradual phase out of old light tubes instead of a complete overhaul because the electricity usage for lighting is low.	<i>Medium</i> Establishing procedures to nudge behavioral change; Monitoring and control electricity and water consumption in production, office and workers' living space.	<i>Low</i> Reducing steam pressure in certain areas of production processes.
Apparel Supplier B	<i>Low</i> Install efficient lighting, energy-saving accessories for water tank, spin dryers; Install smaller electronic boiler.	<i>low</i> Basic employee education on energy saving; Adopting resource conservation measures including recycling, lighting control, e-document	<i>Low</i> Recycle heat exhaust from boilers; Use electrical boilers when production volume is low. Reducing lighting intensity in production areas
Apparel Supplier C	<i>Medium</i> Lighting upgrades; Replacing heavy-oil boiler with bio-fuel boiler to eliminate SO2 and improve EE. Upfront investment is	<i>Medium</i> Basic training of workers; Cross-functional team analyzing technology/equipment options and investment and implication to production process.	<i>Medium</i> Adjustment of water pressures; Process change and process analysis to determine how temperature change from the boiler can meet production

costly.

needs for apparel ironing and washing processes.
