

Energy Management in Public Higher Education Institutions in Ghana

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Abstract

This paper investigates the implementation of energy management key practices in six public higher education institutions in Ghana in order to identify the existence of potential to save energy. Data for this research was obtained through questionnaire based on an energy management assessment measurement tool involving heads of estates/property and maintenance departments of the studied institutions. Total of 45 key practices adapted from previous studies has been used to assess the implementation of energy management in the respective institutions in Ghana. The study revealed that implementation of energy management key practices was generally low across all the phases. Six key practices - informing of the reasons/need for energy management, motivation, conducting economic analyses, tracking and targeting energy usage and key energy use groups, and reviewing building drawings and equipment specification - were not implementad by any institution. The key practices that were implemented quite well in the planning, implementation and monitoring phase respectively were: 'gaining top management commitment' and 'providing sufficient tools'; improving sufficiency of electrical appliances'; and 'advising on energy matters'. The findings from the study has shown that energy management is an untapped potential to reduce electricity cost in higher education institutions (HEIs) in Ghana.

Keywords: Energy, energy management; energy management key practices; higher education institutions, Ghana

1. Introduction

In recent times, global interest in energy matters has arisen sharply. The driving forces of this upsurge have been oil price volatility, environmental and climate change challenges, and social impact of energy from extraction through processing and distribution to consumption (World Energy Council, 2015), and increasing demand for energy (Pe ŕez-Lombard, *et al.*, 2008). However, energy plays significant role in the development and growth of every organization, business and nations (Commission on Environment and Energy, 2007; Choong *et al.*, 2012; Ki-Moon, 2012; Carbon Trust. 2013; Frei, C. 2013). Therefore, reducing energy consumption is a pleasant thing to do. It saves costs and improves corporate image in addition to supporting the fight against climate change (Carbon Trust. 2013).

Over the past two-and-half decades, Ghana has been hit by four power crises. The first three occurring in 1998, 2002 and 2007 (Brew-Hammond & Kemausuor, 2007) mainly as a result of poor rainfall with its effect on power supply generated from hydro. The current power crisis, the fourth in the series, commenced in 2012. Several reasons have been ascribed to it, prominent amongst them are unreliable rainfall to supply water to the country's hydro generation plants (Akosombo, Kpong and Bui dams) and financial challenges of the country leading to the government's inability to procure natural resources such as oil and natural gas to power her thermal plants to generate enough power to meet the increasing demand (Adam, 2015). The seriousness of this crisis have resulted in daily discussion of energy matters in the newspapers, on television and radio programmes in the country and beyond.

In addition, there have been persistent astronomical increase in electricity and water tariffs over last couple of years. For instance, electricity tariff was increased by 76% (average) and 78.9% respectively for residential and non-residential sectors in 2013 (PURC, 2013). Similarly, 2014 saw tariff increases between 6% and 12% while in 2015, with the exception of the first quarter (no increase), there was consistent increase in electricity tariffs, beginning with 2.63% to 59.2% by the end of the year (PURC, 2014a-d, 2015a-d). These have increased the financial burden of individuals, businesses and government, who from time immemorial, has been responsible for electricity used by public institutions – ministries, departments and agencies (MDAs) – including higher education institutions (HEIs). Consequently, government directed all public institutions to commence payment for electricity consumption from their own budget, effective January 2014 (Myjoyonline.com, 2014). In addition, most HEIs have resorted to local (on-site)

power generation using generators, burning fossil fuel at high cost. At the same time, the power supplied from these generators are not sufficient to power the entire campuses anytime there is curtailment of power supplied from the national grid. Due to the huge amount involved in the electricity bills, the administrators of these institutions are seeking to transfer the electricity cost to students while students have also been resisting the imposition of electricity cost on them (Hawkson, 2015; Jafaru & Appiah, 2015). One Rector asserted "We tried to arrange with students to at least pay something, but it seems they are still adamant in doing so, they will not barge" (Ultimate1069.com, 2015). This left the Government in a fix and has thus rescinded her earlier decision through the Ministry of Education (Larnyoh, 2015). As Turner *et al.*(2007) argued, when businesses, industries and government organizations are faced with economic challenges such as burdened with high electricity cost, competition and meeting environmental standards, which forms major part of operational cost, and have to meet their critical objectives, energy management is seen as an important instrument to mitigate them.

Energy is one of the critical resources required by every organization for effective functioning and achievement of its goals. It is referred to as "the golden thread that connects economic growth, social equity, and environmental sustainability" (Ki-Moon, 2012; Frei, 2013). Thus, lack of energy will tremendously hamper the growth and development of the social life of the individuals, business organisations, nations and the world economy at large. It must therefore be managed in the same way as the organisation's other resources – human, capital and movable and immovable assets.

According to Turner *et al.* (2007), implementing effective energy management makes economic sense and that it is cost effective. Similarly, the International Chamber of Commerce acknowledge that energy efficiency is good for business and enhances competitiveness (Commission on Environment and Energy, 2007) which is certainly achieved through effective energy management. Every organisation operates on the basis of budgetary allocation and/or the necessity of profit. Therefore, the acceptance of any new project is based on its cost reduction or profit gain potential. Cost savings accrued from energy management is estimated to be within 5-15% of energy bill with little or no expenses just after commencing implementation (Keeffe, & Grimshaw, 1994; Turner *et al.*, 2007) with continual savings increasing up to 70% of energy bill as more aggressive energy management programmes are implemented with appropriate investments (Turner *et al.*, 2007).

Previous studies have indicated that buildings consume significant amount of energy and emit huge amount of greenhouse gases (GHG) (Sapri & Muhammad, 2010; Dimoudia & Tompab, 2008) with some variations across the regional blocks. For instance, it is estimated that buildings consume 25%-50% of all energy used in OECD countries while emitting about 25-40% related GHG emissions with 40-95% of it resulting from operational energy use (Wilde & Coley, 2012). Similarly, buildings in the UK are estimated to consume up to 45% of generated energy in their operations (Elmualim *et al.*, 2010) and responsible for 38% of the total GHG emissions in 2009 (Coleman *et al.*, 2013). In the US buildings account for about 39% of the total energy annually and 48% of GHG emissions (Janda, 2012) whereas in China, buildings account 44.2% of total energy consumption in the country of which over 60 % is supplied directly from fossil fuel combustion, and being responsible for 17 per cent of China's total CO_2 emissions (Qian & Chan, 2010; Tang, 2001).

Generally, HEIs possess large amount and variety of building facilities utilised for various purposes such as classrooms, laboratories, sporting facilities, libraries, administrative buildings and offices, hospitals as well as students residential accommodation (Choong *et al.*, 2012; Sapri & Muhammad, 2010). In addition, there is large number of facilities users of HEIs' facilities with the number of students increasing every year. With its large users, HEIs' facilities are bound to consume high amount of energy culminating in high utility cost and greenhouse gas emissions. Thus, the level of energy consumption and its consequences – environmental and economic cannot be overstated. Hence, energy management is an invaluable tool needed to address these challenges.

2. Energy Management Key Practices

Energy management is defined as "the efficient and effective use of energy to maximize profits (minimize costs) and enhance competitive positions" (Capehart *et al.*, 2008a: 1). Also, Thumann (1998) refers to energy management as "the judicious and effective use of energy to maximise profits and to enhance competitive positions through organisational measures and optimisation of energy efficiency in the process" (p.946). Advocates of energy management state as their justification: financial rewards; environmental, climate and resource protection; social benefit and corporate image, etc. (Kannan & Boie, 2003; Commission on Environment and Energy, 2007; Mashburn, 2007; Turner *et al.*, 2007; Turner & Doty, 2007; Choong *et al.*, 2012). Harris (2012) summarized the primary aim and objectives for energy management as "minimizing energy consumption, optimizing size of plant, maximizing energy efficiency, minimizing energy waste, reducing carbon emissions and reducing costs."

Researchers, international organisations, and practitioners have identified various strategies of energy management with subtle differences in the processes involved in managing organisation's energy (Keeffe, G. & B. Grimshaw, 1994; Gorp, 2004; Mashburn, 2007; Capehart *et al.*, 2008b; ISO, 2011; FMA, 2012; USEPA; Carbon Trust, 2013). The key elements fundamental to energy management includes securing top management's commitment; developing energy policy; energy audit, planning or developing energy strategy which comprises action plan, organisation of energy management, regulatory compliance and incentives, investments, procurement, metering, monitoring, targeting, identifying energy saving opportunities, organisational culture and communications; and management review for continuous improvement. Almost all energy management models follow Plan-Do-Act-Check model emphasizing the continuous nature of energy management.

However, Choong *et al.* (2012) proposed an energy management measurement tool consisting of a comprehensive list of 47 key energy management practices spanning across three phases of energy management implementation – planning, implementation and monitoring & evaluation phases based on Malaysian Universities. The tool is used to assess the level of implementation of the key energy management practices in an organisation. It enables one to identify areas of potential energy savings. The original tool comprises 16 key practices at the planning phase, 17 at implementation phase and 14 at the monitoring and evaluation phase. This was modified to suite the Ghanaian environment. In essence, present study adapted the key practices framework proposed by Low (2008) and Choong *et al.* (2012). The list of key practices adapted for present context is shown in Table 1.

Table 1: Energy management key practices (Adapted Low, 2008; Choong *et al.*, 2012)

Energy Management Phase	Energy Management Key Practices
Planning	Gaining top management commitment; Establishing goals and objectives, Budget allocation; Establishing procedures for implementing energy management programmes; Developing a master plan for overall energy use – present and future; Establishing database; Developing energy policy; Developing strategy plan; Providing sufficient tools; Providing guidelines; Determining capital investment and priority; Visibility start-up; Forming energy management committee; Appointing energy manager and Developing educational plan
Implementation	Conducting energy audits; Communicating energy matters to students; Communicating energy matters to employees; Promoting awareness; Improving energy efficiency of electrical appliance systems, Identifying energy saving opportunities; Employee involvement; Students' involvement; Educating and training of staff and students; Establishing uniform record-keeping system; Conducting energy walk-through surveys; Motivation; Conducting periodic meetings between the energy management committee and the manager; Establishing a reporting system; Informing top management/users of the need or reason; Charging students for electricity consuming appliances used; Registering and conducting follow-up inspection of electricity consuming appliances; and Conducting a programme to stimulate and sustain interest.
Monitoring and Evaluation	Conducting energy usage and performance analysis; Measuring and verifying energy savings; Periodic review and evaluation of overall programme; Ensuring rules are always met; Conducting economic analysis; Demanding control, Paying attention to the details of use and costs; Performing follow-up task; Conducting energy forecasting; Tracking and targeting; Review of drawing, data sheet, and equipment specification; and Advising on energy matters.

3. Methods

The aim of the study was to examine the level of implementation of energy management in the institutions to determine any areas that could be improved. It was therefore appropriate to involve people who have responsibility towards the management of energy resources in the institutions. The study involved 6 participants drawn from 6 public higher education institutions, mainly heads of the estate/property and/maintenance management departments of the respective institutions. The departments were responsible for the management and maintenance of the institutions' facilities, including electricity. Purposive sampling technique was used in selecting respondents for the study. The respondents assessed the level of implementation of the energy management key practices from a questionnaire based on an energy management measurement tool developed by (Choong *et al.*, 2012). Total of 45 key practices of energy management has been included in the questionnaire. The institution was ranked from 0 – 3 based on its level of implementation (0 being the lowest mark) and the data was analysed using descriptive statistics (percentages) and tables. The result of the analysis are presented in the next section.

4. Results and Discussion

Generally, the findings indicate that implementation of energy management key practices were very low compared to the findings in (Choong *et al.*, 2012). Table 2 presents the level of implementation of energy management practices at the planning phase. The results clearly shows that implementation of energy management practices at the planning phase was generally low across all the case study institutions. Only three of the 15 practices were reported being implemented at level 3 by 16.7% of the respondents. These were gaining top management commitment, i.e., 'top management provide sufficient resources to implement energy management programmes and actively participate and provide support and opinion throughout energy management programmes'; and establishing energy database, i.e., 'establish a comprehensive, accurate and complete database, and periodically update database immidaitely there is new information'. The third practice is developing an educational plan – 'develop a detailed education plan that consists of education methods, procedures, budget estimate, human resource required, objectives, expected results and frequency to conduct such training'. Also, it is interesting to note that 10 key practices were implemented at Level 0 by at least 50% of the institutions, i.e., the institutions do not implement these practices as shown in Table 2. The energy management practice that was implemented quite well at Level 2 was, 'providing sufficient tools', i.e. providing limited energy conservation tools, by 66.7% . This was followed by gaining top management commitment with 33.3%.

Similarly, another key practices that are seen as important, once the decision towards energy management has been made is to provide for responsibility, that is, appointing energy manager and forming energy management committee (Mashburn, 2007; Capehart *et al.*, 2008). The findings revealed that 50% of the institutions have not assigned the responsibility of managing energy to any person with 33% having volunteer energy managers without any knowledge in energy management. Also, 83.3% of the respondents reported not having energy management committee while 16.7% reported of the existence of adhoc energy management committee, limited to a small group of members.

Table 2: Implementation of energy management practices at the planning phase

Energy management practices	Level 0	Level 1	Level 2	Level 3
Top management commitment	16.7	33.3	33.3	16.7
Energy goals and objectives	66.7	0.0	33.3	0.0
Budget allocation	16.7	50.0	33.3	0.0
Establishing procedures	66.7	33.3	0.0	0.0
Master plan	50.0	50.0	0.0	0.0
Energy database	83.3	0.0	0.0	16.7
Development of Energy policy	33.3	50.0	16.7	0.0
A strategy plan	83.3	16.7	0.0	0.0
Sufficient tools	16.7	16.7	66.7	0.0
Guidelines	0.0	83.3	16.7	0.0
Capital investment and priorities	100.0	0.0	0.0	0.0
Visibility start-up	66.7	33.3	0.0	0.0
Energy management committee	83.3	16.7	0.0	0.0
Energy manager	50.0	33.0	16.7	0.0
Educational plan	66.7	16.7	0.0	16.7

Gaining top management commitment has been held as a critical requirement for successful implmentation of energy management (Kannan & Boie, 2003; Mashburn, 2007; Capehart *et al.*, 2008; Harris, 2012). Without commitment from top manangement, energy management is bound to fail. Thus, the lack of commitment on the part of top management towards energy management in most of the institutions serves as a barrier to implementating effcetive energy management. In addition, the absence of an energy manager or a person formally assigned this respondility and energy management team in most of the institutions, is an indication of the low level of commitment shown by top management, and in itself a strong barrier to successful energy management. Energy management committee usually consists of representatives from all identifiable groups (e.g. departments/units/students, etc.) within the institution, especially, those who show interest in energy matters. The committee could garner support for energy management within their constituencies, generate more ideas, appraise proposals, set gools and implement most auspicious ideas. With the energy manager as a cordinator the team oversees the development and implementation of energy management programs carrying along, all stakeholders within the organisation.

Another key practice at the planning phase that is central to effective energy management is to develop a formal energy policy (usually a single page), signed by top management to signify their commitment. The results indicate that 83.3% of the institutions either did not have energy policy or had an informal one.

Furthermore, among the least implemented key practices, beside determining capital investment and priorities which was not implemented by any institution, establishing energy database, and developing a strategy plan were implemented at Level 0 by 83.3% of the institutions. In other words, no database has been established and no energy strategy has been developed by these institutions. Table 2 also revealed that with the exception of providing guidelines, all the key practices were implement at Level 0 by between 16.7% and 100% of the institutions. This is an indication that planning for energy management within the HEIs might not be a priority to the top management of the institutions. Energy management therefore presents a potential to save energy within the HEIs in Ghana.

Table 3 presents the level of implementation of energy management practices at the implementation phase. Similar to the planning phase, general level of implementation of energy management practices was low. Most of the key practices were implemented at Level 0 and Level 1. At least, 50% of the respondents reported implementing 13 out of the 18 energy management key practices at Level 0. Moreover, two key practices were not implemented at all (i.e., 100% at Level 0) whilst 6 practices were implemented at Level 1 by at least 50% of the institutions. On the other hand, 2 key practices were implemented at Level 3 by 16.7% and 2 other practices

by 33.3% of the institutions. Also, between 16.7% and 33.3% respondents reported implementing some practices at Level 2 and/or Level 3. Communicating energy matters to employees was implemented at levels 1 and 2, whiles energy efficiency of electrical appliances was at levels 1, 2 and 3 (Table 3).

The practices that were implemented at Level 0 included motivation, i.e., 'do not give recognition and prizes to award energy conservation effort'; and informing both top management and other users of the reasons or need for energy management, i.e., 'employees/top management/students were only informed that energy management is needed but no further justification or effort made'. In addition, the key practices, promoting awareness, involving students in energy management and conducting energy management meeting were implemented at Level 0 by 83.3%. Furthermore, identifying energy conservation opportunities, education and training of staff and students, establishing uniform record-keeping system, charging students for electrical appliances in their residential facilities and organising programmes to stimulate and sustain interest all scored low values with 66.7% respondents reporting not implementing any of them.

Moreover, among the key practices implemented at Level 1 was communicating to students, that is, energy messages are delivered during orientation for newly admitted students. This was reported by 83.3% of respondents. Similarly, 66.7% of the respondents reported that energy messages were communicated to employees through informal communication. The next set of practices implemented at Level 1 reported by 50% of respondents included improving efficiency of electrical appliance systems, i.e., 'have intention to improve energy efficiency of electrical systems, but no further action is taken'; involving employees, i.e., 'only some divisions/departments/levels are involved'; conducting walk-through survey, which is 'done only upon complaint'; and establishing a reporting system, where 'reports are only generated for internal use and submitted to management for review but not publicised'.

Table 3: Implementation of energy management practice at the implementation phase

Energy management practices	Level 0	Level 1	Level 2	Level 3
Energy audits	50.0	16.7	33.3	0.0
Communicating to employees	0.0	66.7	33.3	0.0
Communicating to students	16.7	83.3	0.0	0.0
Promoting awareness	83.3	0.0	0.0	16.7
Efficiency of electrical appliances	0.0	50.0	16.7	33.3
Energy conservation opportunities	66.7	33.3	0.0	0.0
Employee involvement	16.7	50.0	33.3	0.0
Students involvement	83.3	0.0	16.7	0.0
Education and training of staff	66.7	16.7	0.0	16.7
Record-keeping system	66.7	16.7	16.7	0.0
Walk-through surveys	33.3	50.0	16.7	0.0
Motivation	100.0	0.0	0.0	0.0
Energy committee meetings	83.3	0.0	16.7	0.0
Reporting system	50.0	50.0	0.0	0.0
Informing of the reasons/need	100.0	0.0	0.0	0.0
Payment for using Students electrical appliances used	66.7	16.7	16.7	0.0
Registration and inspection of electrical appliances	50.0	16.7	0.0	33.3
Programme to stimulate and sustain interest	66.7	16.7	16.7	0.0

Furthermore, the key practices implemented at the level 3 were promoting awareness through 'distribution of information like summary statistics about energy, sources of energy, energy use of equipment with awareness campaign properly planned'; and education and training of staff and students, i.e., 'periodically educate and train all staff and students on various energy issues, matters, technology, and opportunities through training, seminars, workshops, campaigns, etc. with follow-up appraisal conducted to ensure that staff and students are

really getting knowledge, implemented' was reported by only 16.7%. Also, improving efficiency of electrical appliances and registering and inspecting students' electrical appliances were implemented at Level 3 by 33.3%.

Most of the practices at implementation phase relate directly to improving facilities users energy awareness and participation in energy management programme. For instance, communicating energy message or information, promoting awareness, involving employees and students at all levels, motivation, conducting a programme to stimulate and sustain interest, and informing of the reasons/need for energy management all aim directly at getteing the support of the users. Effective energy management thrives on the commitment and participation of all within the institution. It is never a one-man business. Implementing the user-related practices such as promoting awareness is an important element to secure such commitment (Turner *et al.*, 2007; Harris, 2012). Without basic information on energy issues and appropriate energy behaviour, the users would not operate in an energy-efficient manner (Kollmuss & Agyeman, 2002; Abrahamse *et al.*, 2007; Steg, 2008; Kaplowitz *et al.*, 2012). Energy-aware facility users are less likely to operate facility or behave in a manner that is energy wasteful, are well positioned to notice energy waste around them, know what to do whenever waste is noticed and are able to make meaningful contributions towards improving energy efficiency and curtailing loss.

It has also been noted that energy awareness campaign yields quick energy savings with little or no disruption whilst impacting positively on organisational image and saving money (Choong *et al.*, 2012). However, one-off information delievered to students mostly during their first few months of entry into the institutions or to employees on informal way may not yield remarkable result on energy savings. By not communicating appropriately and continually to users of the need to and how to save energy as indicated by the results create a serious barrier to save energy (Yik & Lee, 2002; Yik *et al.*, 2002; Choong *et al.*, 2009). Thus, with energy awareness not promoted within the institutions, training and education not being organised for users and users not being informed of the need to save electricity, energy management presents a potential to reduce energy consumption and costs to public HEIs in Ghana.

Related to communication is motivation. Individuals (students and employees, including management) and departments would not engaging in energy saving if they do not envisage any personal benefit (Harris, 2012). Providing incentives or recognition to individuals/departmnts who make effort to save energy would motivate them to engage in more energy saving activities while influencing others too to engage in similar activities and behaviours. However, this practice was not implemented in any of the institutions, creating huge potential for energy management.

Another important element for a successful energy management is conducting energy audit. Energy audit concerns investigation and a comprehensive analysis of energy inflow and outflow of the facility. It is conducted with the aim of understanding energy usage in a facility of an organsation and identifying opportunities for improvement, energy savings and costs (Capehart *et al.*, 2008b; Hasanbeigi & Price, 2010; Harris, 2012). It also seeks to improve enevironmental conditions for facility users, reduce carbon emissions, develop a system for recording energy use and monitoring and targeting schemes. Energy audit is fundamental to effective energy management. The collection and appropriate analysis of data forms the basis of appropriate enery saving decision and measures. Several studies have shown how significant energy audit is to energy management (Capehart *et al.*, 2007; Jamaludin *et al.*, 2013), yet it is minimally implemented within the case study institutions.

Table 4 presents the level of implementation of energy management key practices at the monitoring and evaluation phase. Generally, energy management key practices were least well implemented as compared to the levels at the planning and implementation phases with most of the practices implemented at Level 0. Indeed, as shown in Table 4, three key practices were reported to be implemented at Level 0 by all respondents at this phase. These were conducting economic analyses, i.e., 'no economic analysis is conducted'; tracking and targeting, i.e., 'no tracking or targeting procedure is done'; and review of drawings, data sheet and equipment specification, i.e., 'no review of drawing, data sheet, and equipment specification'. Likewise, 3 other key practices and 4 others were reported to be implemented at Level 0 by 83.3% and 66.7% of the institutions respectively (Table 4). The practices that were implemented at Level 0 by 83.3% were periodic review and evaluation of overall programme, paying attention to details of use and costs and performing follow-up on task. On the other hand, the practices that were implemented by 66.7% at Level 0 included conducting energy use and performance analysis, measuring and verifying total energy savings, ensuring regulations are always met and conducting energy forecasting. Whilst the same key practices and demanding control were implemented by 33.3% and 83.3% of the institutions respectively at Level 1, performing follow-up task was implemented at level 2 by 16.7% of the respondents.

With the exception of the practice, performing follow-up task, which was implemented at Level 2, i.e., 'ensures that proposed strategy/project is initiated properly', all other practices that were implemented were at Level 1. Also, one key practice, advising on energy matters was implemented at Level 1, i.e., 'only provide oral or informal advice', by all institutions whereas the practice, demanding control, was also reported to be

implemented at Level 1, i.e., 'occasionally provide oral advice to employees and students to switch off plants/equipment whenever appropriate' by 83.3%.

However, for successful implementation of energy management programme, it is critical that energy usage is monitored, measured and evaluated. Whereas monitoring energy ensures that usage are kept in check, evaluation helps to determine the success or failure of the programme over a period of time. But with the results showing clearly that the key practices implemented at the monitoring and evaluation phase were limited to only oral advice in terms of demanding control or advising on energy matters with all others mostly not implemented make it difficult to determine real savings which is the primary aim of any energy management programme.

Table 4. Implementation of energy management practice at the monitoring and evaluation phase

Energy management practices	Level 0	Level 1	Level 2	Level 3
Usage and performance analysis	66.7	33.3	0.0	0.0
Measuring and verifying	66.7	33.3	0.0	0.0
Periodic programme review	83.3	16.7	0.0	0.0
Compliance with regulations	66.7	33.3	0.0	0.0
Economic analyses	100.0	0.0	0.0	0.0
Demanding control	16.7	83.3	0.0	0.0
Attention to details of use and costs	83.3	16.7	0.0	0.0
Follow-up task	83.3	0.0	16.7	0.0
Energy forecasting	66.7	33.3	0.0	0.0
Tracking and targeting	100.0	0.0	0.0	0.0
Review of specifications	100.0	0.0	0.0	0.0
Advising on energy matters	0.0	100.0	0.0	0.0

From the foregoing discussion, the gloomy picture of energy management is obvious and it could be argued that energy management is a peripheral activity in the institutions. However, the brighter side of it is that it indicates the existence of vast potential within the institutions, and the necessity for effective energy management to reduce electricity consumption and cost, and carbon emissions and their environmental consequences, to enhance energy supply security confronting the country and the world at large. At least, to begin with, it is necessargy for a senior member of the administrators of the HEIs to sign and promote a single page energy policy, appoint energy managers (assign persons with some level of expertise to the task) and form energy management committee to kick start energy management in their institutions.

5. Conclusion

The paper explored the potential of energy management to ameriolate high electricity cost challenges of public HEIs in Ghana through the assessment of the level of implementation of energy management key practices. The results indicate there is great potential for enegy management to help reduce electricity cost to the HEIs. The findings reveal that implementation of energy management key practices are generally low in all the institutions across the three phases of energy management. Six key practices namely informing users of the importance/need for energy management, motivation through recognition and reward, conducting economic analyses of energy management options, tracking and targeting major energy usage groups to determine their current and future energy needs, determining capital investment and priorities, and reviewing building drawings and equipment specification in relation to energy saving are implemented at Level 0 by all studied institutions. Several other practices were implemented only at Level 1.

Two key energy management practices that were implemented quite well at the planning phase by most repondents were 'gaining top management commitment' and 'providing sufficient tools'. Similarly, the key practice improving sufficiency of electrical appliances' was implemented fairly well at the implementation phase whilst at the monitoring and evaluation phase, the key practice that was implemented a little bit well was advising on energy matters, mainly through oral/informal advice. Like in every research there exist limitation,

this study is no exception. In spite of the clear high potential for energy management in HEIs in Ghana, as shown by the results from the studied institutions, generalization of this findings should be done with caution because of the small number of institutions consdidered.

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