

Building a School Energy Policy – A Review Paper

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Doi:10.5901/jesr.2016.v6n2p183

Abstract

Human has always searched for higher living standards and greater power. Higher energy consumption, conversion, quality and efficiency have greatly served for the purpose with some consequences. Yet, the energy crisis in 1970s forced countries to take more imposing and complicated measures for energy saving and efficiency. For instance, the European Union set forward the 2010 Energy Performance of Buildings Directive legislation to lessen building energy consumption. The International Energy Agency (IEA) proposed its '25 Energy Efficiency Policy Recommendations' in 2008 to save energy and to reduce annual CO₂ emissions. Education and energy are two key concepts in people's life. As schools play a significant role in education, they can play a similar role in energy consumption and education. Millions of students are enrolled in pre-primary, primary and secondary education around the world every year and countries spend significant amount of their GDP on education. It provides great opportunities to governments and schools to reduce energy consumption, save environment, and teach future generations the importance of building/following policies and standards through education as energy policy and education in schools have become an applying issue in today's world and for the future. The aim of this article is to emphasize the importance of energy users' behavior, school energy education and policies as building and implementing a school energy policy with the help of energy education and (inter)national standards can pay off not only within school areas but also nationwide in the long run. Additionally, this article provides step-by-step energy policy guidance with a sample primary school energy policy for schools from the beginning and recommendations to raise school members' energy awareness.

Keywords: School, energy users' behavior, school energy education, school energy policy

1. Significance of School Energy Policy

Energy policy is a means of determining how energy will be produced, contributed and consumed. It is derived from energy conservation guidelines, public concerns, state legislation, taxation, international agreements, environmental issues and investment encouragement. U.S. Department of Energy defines energy policy as "An energy policy establishes and validates top management's commitment to energy performance improvement. It must be defined by top management, as well as documented and understood by employees and anyone working on behalf of the organization" (U.S. Department of Energy, 2015).

Although The European Union's interest in energy efficiency and policy started with energy crisis due to dramatically increased oil prices in the 70s with some poorly implemented energy directives, in 1989 the first uses of The TERMIE program that provided energy technologies was a milestone and the original SAVE program was approved in 1991 (Allard & Seppanen, 2009). The 1998's action plan recommended the Union Members 1% additional energy efficiency improvement higher than expectations. The European Union announced its first mandatory energy policy in 2005 followed by "Energy for a Changing World" policy in January 2007 and EU obligatory 20/20/20 energy policy objectives in March 2007 (Obrecht et al., 2013). The leaders of the Union agreed in March 2007 to reduce the EU's projected energy consumption by 20 % by 2020. That is the equivalent of closing 400 power stations. In 2011, the Union proposed an energy efficiency plan up to the year 2050 and in 2012, an energy efficiency directive for indicative energy efficiency targets (EUR-Lex, 2015). In October 2014, the Union leaders agreed on a higher energy savings target of 27 %, or greater, by 2030.

On a national scale -depending on the country in accordance with the constitution, relevant directives and international treaties- a national energy policy basically aims at:

- Increasing energy efficiency, energy reliability and job opportunities

- Reducing pollution, energy prices and energy import.

American Council for an Energy-Efficient Economy (ACEEE) explain that "The opportunities for realizing these energy efficiency savings are distributed throughout many end-uses, from manufacturing systems to transportation choices to home appliances. Federal policies that promote efficient investment in each sector and end-use are critical to tackling climate change, economic development, and job creation" (American Council for an Energy-Efficient Economy, 2015). Variant energy agencies help to develop energy policy and efficiency throughout the world. Energy Star in U.S., European Environment Agency (EEA) in The European Union and International Energy Agency (IEA) in 28 OECD countries support their members in this meaning by making recommendations and building standards. For instance, IEA 25 Energy Policy Recommendations booklet (International Energy Agency, 2011) summarizes a set of 25 energy efficiency policy recommendations developed in 2008 for seven priority areas. It was calculated that if the proposal was implemented globally without delay, it would save countries 1 trillion USD in energy and reduce annual CO₂ emissions by the equivalent of about 1.5 times recent annual emissions in the United States from the energy sector (Pasquier, 2013). According to Energy Policy Review of Indonesia (International Energy Agency, 2008), two of IEA's International Energy Programme's targets are "to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organizations" and "to assist in the integration of environmental and energy policies".

Schools are one of the most commonly used buildings all over the world and almost everybody spends a great amount of their life time at schools. About 1398 million students were enrolled in pre-primary, primary and secondary education around the world in 2010 (The World Bank, 2016) and the number is equal to the population of China in 2013. With the number of their participants and purpose, schools play a significant role in bringing up children and shaping their characters and habits. Schools also play an important role on energy consumption with their increasing energy costs as the world population and use of energy consuming appliances keep growing. According to the World Bank, on the global scale, countries spend 4.77 % of their GDP only on primary education on average (The World Bank, 2016). The European Union 'allocates 6.4 % of their total public expenditure to direct public-sector support for pupils and students in all education levels' (European Commission, 2012). Additionally, annual energy expenditure of primary and secondary school in U.S. is higher than 6 billion dollars (Orth, 2009).

Huge energy consumption and costs along with environmental consequences make school energy management an alarmingly important issue. Thus, the issue naturally attracts scientific attention. Starting from Stanley (Stanley, 1957) up to now researchers emphasized the importance, effectiveness, implementations of school policies, staff's and communities' involvement, effects of policy outcomes, interrelation between environmental issues and school energy policies, policy enactment and implementation and the role of policy actors in policy (Lane et al., 2014). Stanley (Stanley, 1957) advocated the importance of involving different school and community members in policy progress. Bandura (Bandura, 1986) investigated energy saving behaviors while Bontrager and Hubbard (1977) highlighted the significance of school energy policies from the point of energy crisis as schools consume great amount of energy. Hines et al. (1987) along with DeWaters and Powers (2011) focused on environmental behaviors. Braun et al. (2010) carried out a study on school policy performance and Ball et al. (2011) researched policy actors' roles. Although there are many other researches in the field, there is a lot of space for scientific studies on school energy policy.

The U.S. Environmental Protection Agency (EPA) (U.S. Environmental Protection Agency, 2005) states that organizations with energy management policies show better performance than the ones without policies. U.S. Department of Energy - by the applications of Energy Smart Schools Program - concludes that schools can save energy up to 25% through efficient management and school energy policies supported by distribution of information and guidelines (U.S. Department of Energy, 2009). It is clear that school energy policies make difference and show better energy performance. The U.S. Department of Energy counts the benefits of high performance schools in its Guide to Operating and Maintaining EnergySmart Schools (U.S. Department of Energy, 2009) as:

- Value to the Community: Quality schools attract businesses
- Educational Value: High-performing schools are educational tools to teach significance of energy efficiency to future generations
- Student/Teacher Health and Satisfaction: Indoor air quality, lighting and thermal comfort increases students' outcome and attendance
- Operational/Financial: EnergySmart Schools reduce energy cost and they are more systematic to run.

Environmental benefits due to less carbon footprints and depletion of natural resources should also be added to the above-mentioned list.

Ministries related to energy and education, and schools are to find means of increasing energy

efficiency/performance and reducing energy use and costs. Successfully implemented school energy policies supported with energy education can serve for the purpose. Rickert (Rickert, 2011) proposes that administrators, energy resource managers and teachers should be involved in both strategies. Lane et al. (2014) recommend a school energy policy and energy education as two basic precautions for energy efficiency in schools. To harvest the best results, these two precautions should be combined by making energy education a significant partition in school energy policy. Many energy management and efficiency projects may fail in practice even though they seem effective in theory. One of the reasons behind those failures is unforeseen energy users' behavior and lack of energy education as it is people who use energy in real life not the policy makers or managers.

2. Impact of Energy Users' Behavior

Users' behavior affects energy efficiency (Salleh et al., 2014) and energy consumption patterns (Heiskanen, 2013) in buildings. Energy consumption analysis without taking energy users' behavior will not be realistic as Masoso and Grobler's study (2010) evidenced that energy is wasted in buildings even they are not occupied. McKinsey (2009) found cost effective energy users' behavior may reduce energy consumption by 22% and low-cost and no-cost energy consumption/efficiency measurements by 57%. The same research found out that people adapt to energy efficient technology fast if monetary savings are obvious in particular. It applies to school buildings as well since users' behavior can influence energy conservation up to 15% in schools (Ismail, 2009) indicating the importance of users' behavior on energy conservation alone in school buildings. For instance, up to 900 million dollars can be saved through proper energy user behavior only in primary and secondary schools in U.S. as they spend 6 billion dollars yearly on energy bills (Orth, 2009).

Salleh et al. (2014) draw attention to questionnaire surveys on "building users as respondents with the aim of investigating the relationship between user behaviors with building design in evaluating school building design" and observatory method on "user perception assessment in the building can provide information on the user performance and satisfaction level". European Union's goal to base energy consumption on users' needs makes energy users' behavior a more central issue. The challenge is that although energy efficiency is considered as the key indicator for energy consumption, it is not the same as for the users. Except for simply saving energy in some ways, energy users should be able to understand and deal with the issue more conscientiously which requires knowledge of energy users' behavior. After this initial step, the case should be dealt from the point of improving energy users' behavior and building designs accordingly. An optimum/effective method should be practiced that matches energy efficiency – including users' comfort and environmental issues -, users' behavior and building design. Energy efficiency specialists should first understand users' behavior (Parnell & Popovics-Larsen, 2005) as often building energy efficiency practices do not answer users' demands and they should take realities into account which limit the success of efficiency measures (Heiskanen & Lovio, 2010). Firstly, it is to be stated that energy use is the result of other purposes rather than simply the act of energy use. Thus, those concerns should be dealt with the help of various insiders and more measurable and automatic systems. A good example of taking users' perception into account is Low Carbon Communities Challenge's implementation in United Kingdom that observes energy users' reaction to new energy conservation measurements (Department of Energy and Climate Change, 2010).

Naturally students' behavior involvement in energy consumption in schools is limited in comparison with their behavioral impacts at homes. Yet, energy consumption/efficiency education at schools will help to develop better understanding of energy use and efficiency in every field during the course individual's life.

3. Need for Energy Education in Schools

As everything stands on knowledge and turns around energy, they play a crucial role for human race. Thus, energy education is a significant component for the future and school energy education is an important part of school energy policy. However, energy education in schools should not be proposed or taken as a pure school subject or an issue mentioned only by science teachers. Rather, it should be considered as a tool to enhance life standards of individuals and societies. It will be more fruitful if the concept is practiced within and outside schools. Student-centered energy education that is based on practice rather than theory is more likely to attract students' attention.

A step-by-step energy education can be implemented starting from motivational presentations by students and some experts of the field according to students' levels. School science fairs concerning energy, energy use and saving, energy and environment, etc. can attract students' and staff's attention to take part in energy savings and efficiency and

prompt them to take more actions specifically if they are rewarded with success and participation certificates. Lectures and regular competitions such as an informative poster competition can refresh students' attention in the matter. Furthermore, building a school energy policy team with administrators, teachers, parents, some experts of the field, school workers and students is a good start to take some measures. In-service training by using school facilities as an on-the-walk school energy survey/audit with students and staff can be both practical and informative. School newsletters, website announcements, progress reports in different places of the school and consultative and informative meetings can gain school-wide support. It is understandable that school energy policy teams and schools themselves will need some in-hand educational material for guidance. Alliance to Save Energy's Green Schools Program and the National Energy Education Development Project (National Energy Education Development, 2012) provide free resources to build a plan not only for energy education in schools but also for energy efficiency measures. The measures can vary from turning off lights in unoccupied rooms to upgrading energy consuming systems as schools can adapt their own energy efficiency and policy plans. Moreover, Lane et al. (2014) state that the Wisconsin K-12 Energy Education Program (KEEP), "a statewide energy education program in Wisconsin to promote the development of energy policy and education plans in the state's schools", can be used as a guideline. The program does not only build a plan for the school district but also provides a school energy program framework to be applied.

4. Building a School Energy Policy

According to a report from the International Energy Agency that confirms the position of energy efficiency as the world's "first fuel", the total global energy efficiency market is worth at least 310 billion USD a year and growing (International Energy Agency, 2014). Wiel et al. (1998) state that "building energy efficiency policies have played important roles in reducing energy demand and improving energy use in building sector in the Organization for Economic Cooperation (OECD) countries". They also argue that these policies require voluntary agreements and energy efficiency standards. Thus, following (inter)nationally accepted standards, guidelines and successful policy applications can help schools to build their own school energy policies. For instance, U.S. Department of Energy (U.S. Department of Energy, 2015) states that the policy must state management's commitments to:

- Achieving continual improvement in energy performance
- Ensuring availability of information and resources to meet energy objectives
- Complying with legal energy requirements subscribed to by the organization
- Supporting to purchase energy efficient products and services
- Supporting to design energy performance improvement

According to the department, "the policy provides the framework for setting the company's energy objectives and targets and is consistent with the strategic plan" (U.S. Department of Energy, 2015). Thus, energy policy defines the priorities of energy use in an organization combining with the other current policies of the organization.

Additionally, Department for Education and Skills (Department for Education and Skills, 2002) delivers a guide to manage school energy and water. The guide summarizes energy management action plan in several steps as follow:

- Identify of current school energy management through a matrix
- Display the current energy cost
- Assess what and how to improve
- Compare through benchmarking
- Set realistic energy saving/efficiency objectives with low cost or no-cost implementation
- Streamline school accommodation for the best efficiency
- Sustain school energy and energy linked systems
- Compute the economic energy costs
- Instruct and train school members

It is clear that identifying a school energy management plan along with a statement of commitment is the first step for a school energy policy. In this manner, EnergyStar of the U.S. Environmental Protection Agency Program (EnergyStar, 2013) provides a simplified energy management guideline as given below in Figure 1:



Figure 1. A Simplified Energy Management Guideline by EnergyStar of the U.S. Environmental Protection Agency Program

As mentioned before, inspecting successful samples and a detailed school energy policy matrix is a good start to build a school energy policy. For instance, The Wisconsin K-12 Energy Education Program (KEEP) can be very useful at least to have a practical guideline for a start. As an energy management matrix, the matrix by Energy Management Guide (Building Research Energy Conservation Support Unit, 1993) has been used directly or with some variations by numerous organizations, such as National College for Teaching and Leadership (2015) and by Carbon Trust funded by the UK Department of Energy and Climate Change in the guideline called "A Whole School Approach". It is a five-level matrix with Energy Policy, Organizing, Motivation, Information Systems, Marketing and Investment as evaluating and development variables. Some organizations such as Wiltshire Council (2013) use "Training, Performance Measurement and communicating as variation. The lowest level in the matrix is considered as "no explicit (energy) policy" and the highest one as "energy policy action plan and regular review have active commitment of top management as part of a corporate strategy". An energy and water management matrix for schools recommended by National College for Teaching and Leadership (2015) is given below in Table 1.

Table 1: Energy and water management matrix for schools

	Energy and water policy	Organising for energy and water efficiency	Education	Information collection and analysis	Communication	Investing in energy and water efficiency
4	All members of senior management committed to an energy and water policy and action plan; regular reviews as part of the school's SD strategy	Energy and water management fully integrated into management structure; clear delegation of responsibility for management of energy and water consumption	Full involvement of learners in the management of energy and water in the school, at a level appropriate to their age	Comprehensive system: setting targets, monitoring consumption, identifying faults, quantifying savings and providing budget tracking	Formal and informal channels of communication regularly explored by energy and water coordinator, learners and school management team	Positive discrimination in favour of green schemes with investment appraisal of all new build and refurbishment opportunities
3	Formal energy and water policy, but with only a low level of commitment from senior management	Energy and water coordinator accountable to senior management and governors	Co-ordinated approach to energy and water education, linked to school policy	Monitoring and targeting reports for premises and major users where possible; savings not reported effectively to users	Programme of energy and water awareness, including regular publicity campaigns aimed at all building users	Same payback criteria employed as for all other investment
2	Unadopted energy and water policy set by senior management	Energy and water coordinator in post but line management and authority unclear	Some identification of opportunities for using the school buildings and systems to teach about energy and water efficiency	Monitoring and targeting reports based on actual meter readings; analysis of trends, and input into budget setting	Some ad hoc awareness training for all building users	Investment using short-term payback criteria only

	Energy and water policy	Organising for energy and water efficiency	Education	Information collection and analysis	Communication	Investing in energy and water efficiency
1	Unwritten guidelines	Energy and water management responsibilities identified but not co-ordinated	Uncoordinated delivery of energy and water education in the school	Annual cost reporting based only on bill data with some analysis of annual trends	Informal contacts used to communicate school energy and water performance and plans for improvement	Only low-cost measures taken
0	No explicit policy	No energy or water management, nor formal delegation of responsibility for consumption	No known teaching of energy efficiency or water conservation	Meter readings not recorded, bills not analysed	No communication of school energy and water performance	No investment in increasing energy and water efficiency in the school

Source: National College for Teaching and Leadership, 2015. CSBM Managing the school environment, Section 04: Unit 3: Energy and water management, Utilities management. [Online] Available: <https://www.nationalcollege.org.uk/transfer/open/csbn-managing-the-school-environment/csbn8env-s4/csbn8env-s4t2.html>

However, the biggest barrier in front of building a school energy policy and its application is not building an energy management plan but people that find changes difficult to adapt as they feel comfortable in their current state. Moreover, changes usually demand additional effort. Thus, motivation is the key word. Selecting at least two enthusiastic and co-operative members from each diversion of the school such as administrators, custodial workers, teachers, parents and students along with a specialist in the field can make a positive start. Employing an expert/advisor will pay off in the long run although it may be considered as an extra cost at the beginning. Building your own policy with the help of some guidelines, instead of following a totally ready one, can seem difficult at the beginning but the members of the school energy policy team can feel that it is their own work and can more readily stand behind it while they can still make use of some good samples. A set of simplified policy building steps compiled from the relevant literature as given below can be useful as a draft.

- Form a co-operative and enthusiastic school energy policy team including one or two members from each group (administrators, teachers, students, etc.) in addition to a specialist and set regular meetings. Promote team members.
- Apply a school energy audit with the team to evaluate the current state and carry out a SWOT (strengths, weaknesses, opportunities and threats) analysis. Pay attention to energy efficiency.
- Allocate explicit tasks to team members
- Apply an school energy consumption and students' comfort questionnaire at school
- Compile a list of recommendations and feedback from advisors/experts and school members other than the team
- Outline a policy and education plan taking environmental concern into consideration and set targets. Review them at the end of each academic year
- Build a data base
- Arrange in-service training for the team and other school members and encourage them to have relevant certificates such as building or energy management certificates if available
- Follow (inter)national building energy standards and aim at receiving an (inter)nationally accepted building energy certificate
- Publicize outcomes and advocate/lobby school energy policy when you have desirable outcomes

It is also worth mentioning that administrative and financial support is crucial to build and apply a school energy policy. Especially, it will be easier to take and implement decisions if an administrator is a member of the team. Furthermore, by doing so, team members will feel the support of the administration. They will be encouraged and will take the matter more seriously. A sample primary school energy policy (Court Farm Primary School, 2015) approved by a governing body is given below.

Court Farm Primary School Energy Policy

Commitment

Court Farm Primary School is committed to sustainable development and reducing our impacts on the environment. The Governors recognise that energy consumption relating to heating and electricity use within our school releases significant CO emissions to the environment and we wish to support the targets of the Climate Change Act 2008 by reducing our energy consumption and carbon footprint by 34% by 2020. The school is committed to delivering energy and environmental education and will utilize energy management to provide practical learning opportunities across the curriculum and actively involve the whole school community.

Approach

To support Court Form Primary School commitment to Energy/Carbon reduction we will advance the following:

- Publish a School Energy Policy adopted by the Governors and communicated on our website.
- Assess historic energy consumption records and Display Energy Certificates to produce a baseline annual energy consumption for each fuel and carbon foot print for our school.
- Monitor our energy consumption from meter readings on a monthly basis. Produce graphical displays of consumption year on year to monitor and demonstrate savings.
- Communicate energy monitoring and improvements as part of a school sustainability display board. Produce energy performance reports once per term for presentation to the Governing Body.
- The Governors will set targets for every consumption reduction each year that will be maintained in line with government targets.
- The school will establish an energy team that will include stakeholders across the whole school including pupils, lead teacher, Building Service Manager and School Business Manager.

The team will work to:

- ❖ Identify Saving Opportunities
- ❖ Monitor consumption and produce annual reports.
- ❖ Assess the use of energy management initiatives to provide practical learning and education to pupils.
- ❖ Communicate the opportunities and involve all school stakeholders.
 - The energy team will produce an action plan identifying the opportunities, defining specific actions to deliver savings, nominating a lead for each opportunity and timescales for implementation. Each opportunity will be assessed for its practical use in educating and involving pupils across the school.
 - The energy team will update progress and add further actions to the plan each term. Introducing new opportunities and re-invigorating the initiatives.
 - The resulting financial savings from energy management will be established and communicated to the school each term. The Governors will direct a proportion of the savings 10 % to provide a sustainability fund managed by the energy team to fund sustainable resources, activities and prizes.
 - This policy will be reviewed and updated annually by the Governors.

Date of Last Review:

Date of Current Review:

Date of Next Review:

Signed by Chair of Governors:

Date:

Approved By Governing Body:

Date:

5. Conclusion

Energy efficiency is huge and growing market and is presented as the world's first fuel (International Energy Agency, 2014). National and international agencies have put great effort in the matter and have introduced several legislations. However, the issue is so significant that it should be dealt in the bud. Therefore, energy consumption and education should be considered as highly relevant issues not only from the point of reducing energy consumption in schools but also from the point of educating people at the beginning about how to use energy efficiently. Building a school energy policy with the help of energy education at schools can greatly serve for the purpose. Energy education in schools can be more attractive and fruitful if all stakeholders along with students take part in it applying more practical methods, such as school energy audits, surveys on students' energy use behavior, competitions or energy science fairs. Having gained school members attention and built awareness, the next step should be building a school energy policy with the help of a

school energy policy team and feedback from other school members. A simple but successfully applied policy sample can serve as a starting point and national/international standards/legislations can be taken into consideration in further levels. Signing a contract with an expert or energy company should pay off in the long run.

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