A Review of Energy Management in the World

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Abstract*— *In this paper, the literature reviews of energy management publications are summarized in three categories which are the energy policy, the renewable energy and the environmental impact. The energy management standard (EMS) in many countries is overviewed. For the energy policy, the sustainable energy policy of developed countries is analyzed to indicate the significant solutions. In addition, the energy policy indicators and energy service companies (ESCO) are concluded. The interested renewable energy publications are discussed by various types. Furthermore, the studies of environmental impact in term of greenhouse gas (GHG), Kyoto Protocol and effective analytical methods are conducted to indicate the optimal criteria for GHG reduction. Finally, the energy management in the Greater Mekong Sub-regions (GMS) countries is presented and the regulation of the energy management system in Thailand is discussed according to The Energy Conservation Promotion Act (No.2) B.E.2550.

***Keywords*— Energy Management, The Energy Conservation Promotion Act (No.2) B.E.2550, Energy Management Standard.**

1. INTRODUCTION

According to the rapid growth of energy consumption in the world, the fossil fuel still is the highest portion with more than 86.16% of the commercial energy usages [1]. However, the limitation of reproduction cycle for fossil fuel has been difficult to resolve based on the present technology. Fig. 1 shows the continuous growth rate of the world primary energy consumption. Although in year 2008, the world faced economic crisis consequence of decreased total energy consumptions. Nevertheless, a rapid technology development and high standard living let the increasing of world energy consumption; in reality the concept of decreased energy consumption is still difficult. To maintain the energy consumption or de-accelerate of energy usage, the concept of energy management is the practical measures for the residential, commercial and industrial sectors. Many research groups contribute the significant solutions for the energy crisis which can be classified in the energy policy, renewable energy and environmental impact. In this paper, the review of the selected publications of energy management system (EMS) is summarized by previous categories. First of all, the development of EMS for many countries is shown in Table 1. Secondly, the significant solutions of energy management are collected from the most popular databases as illustrated in Fig. 2. Furthermore, the energy management of the Greater Mekong Sub-region (GMS) countries is also reviewed. Lastly, the regulation of the energy management system in Thailand will be discussed according to The Energy Conservation Promotion Act (No.2) B.E.2550.

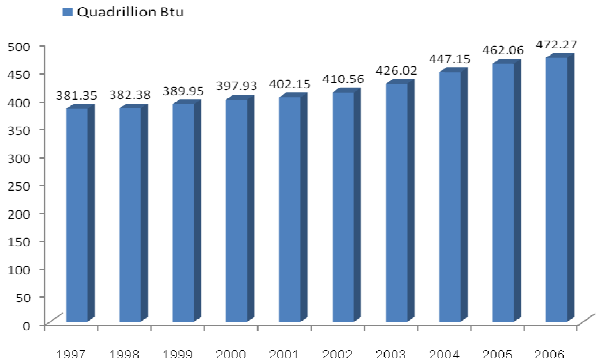

Fig. 1. World primary energy consumption

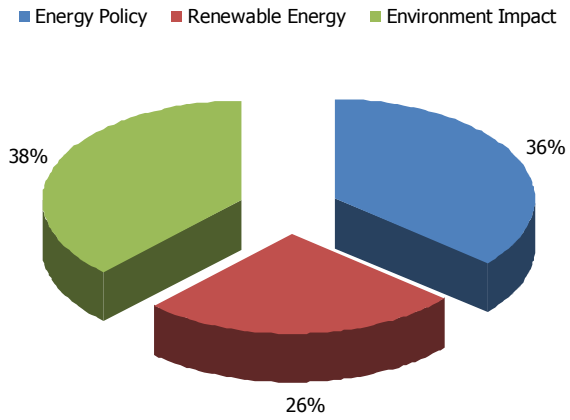

Fig. 2. The classification of selected publications by energy management categories

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2. ENERGY MANAGEMENT STANDARD

Table 1. Energy management standard in many countries

Country	Energy Management Standard
International	ISO 14001:2004
Europe	European Union Standard, CEN CENELEC
USA	U.S. Standard, ANSI/MSE
UK	United Kingdom Standard, PAS 99:2006
Denmark	Danish Standard, DS 2403:E2001
Netherlands	Dutch Standard, SenterNovem 2004
Germany	German Standard, VDI 4602/1 and VD 4602
Sweden	Swedish Standard, SS 627750:2003
Ireland	Irish Standard, I.S. 393:2005
China	Chinese Standard, GB/T23331-2009 Energy Management System
Korea	Korean Standard, KS A4000:2007
Japan	Japan Government, Fundamental Law on Energy

ISO 14001: Implementing an Environmental Management System is a systematic way to discover and control the effects organization on the environment [2]. Cost savings can be made through improved performance and productivity. These are achieved by detecting ways to minimize waste and dispose of it more effectiveness and learning how to use energy more effectively. It verifies compliance with current legislation and makes insurance cover more accessibility.

CEN CENELEC: The CENELEC is the energy management standard that defined by European Standardization Committee [3]. The main result of CEN CENELEC is an overview of "priorities" in standardization for energy efficiency. Each priority level has been defined as Level A: for immediate action, Level B: needs further investigation or research before standardization and Level C: needs to be discussed in the context of a strategic and holistic view, such as policy questions.

ANSI/MSE: As a management standard, ANSI/MSE 2000:2005 contains requirements for the workable system incorporating both the technical and management aspects of energy cost and consumption control [4].

PAS 99:2006: Specification of common management system requirements as a framework for integration PAS 99 is a Publicly Available Standard for the integration of BS EN ISO 9001:2008, BS EN ISO 14001:2004 and BS OHSAS 18001 [5].

DS 2403:E2001: The guidelines are also applicable to focus on energy management and improve the energy performance without specifically aiming at certification [6].

SenterNovem 2004: The standard, regulation and laws of energy efficiency in Netherland are not implementing yet, but they apply EMS in term of Long Term Agreement (LTA) [7]. The LTA phase 2's experience is brought into CEN/CENELEC TF 189 for developing a European Energy Management Standard.

VDI 4602/1 and VD 4602: In Germany, the energy utilization technical committee of the VDI society for energy technology, specialists from science, industry and administration are working voluntarily and at their own responsibility on the preparation of VDI guidelines for rational energy utilization in industrial enterprises [8]. One particular focus of this work is energy management.

SS 627750:2003: This Swedish Standard (SS) details the requirements for an EMS that enables an organization to formulate an energy policy and energy objectives [9]. The standard demands continual improvement through means, such as improved energy efficiency, increased use of renewable energy, and increased energy exchange with the rest of society.

I.S. 393:2005: This standard is structured and based on existing management standards such as ISO 9001 and ISO 14001 [10]. It also includes guidance and possible methodologies. It provides a range of possible methodologies and approaches which could be used in both satisfying the standard and ensuring the development and operation of an effective and documented EMS.

GB/T23331-2009: The element of energy management system in China was developed based on ISO 14001 [11] and released to industries on November 2009. The management commitment, develop energy management plan, establish energy use base line, identify energy coordinator, establish cross divisional implementation team, emphasis on continuous improvement, document energy saving, establish performance indicator and energy saving target, document and train employee on procedural and operational changes are also included in developed standard. But specific interval for re-evaluating performance targets is set by own industry.

KSA 4000:2007: This standard was established on June 8, 2007, notified on December 28, 2007 by Korean Agency for Technology and Standards. Ministry of Knowledge Economy purposes all members of organization that participate energy management system to create the profit by reducing energy consumption and greenhouse gas emission [12].

Fundamental Law on Energy of Japan: Japan submits the energy laws as following:

- Fundamental Law on Energy. November 8, 2001, the bill of Fundamental Law on Energy was introduced to the Diet. The aims of this law are to indicate the basic Japanese energy directions; (1) basic policy on energy demand and supply; (2) responsibility of public sector and private sector; (3) endeavor of the people; (4) report to the diet; (5) settle on the basic energy plan for energy demand and supply; (6) promotion for international cooperation and (7) diffusion of the knowledge on energy [13].
- Amendment of the law concerns the rational use of energy with the objective of increasing dependency on oil supplies from Middle East. Based on these situation, the amended law will obligate to introduce a new system for large scale building (include existing and new constructing) that should be applied EMS and established the new system so that government could grasp the energy supply and consumption situation.

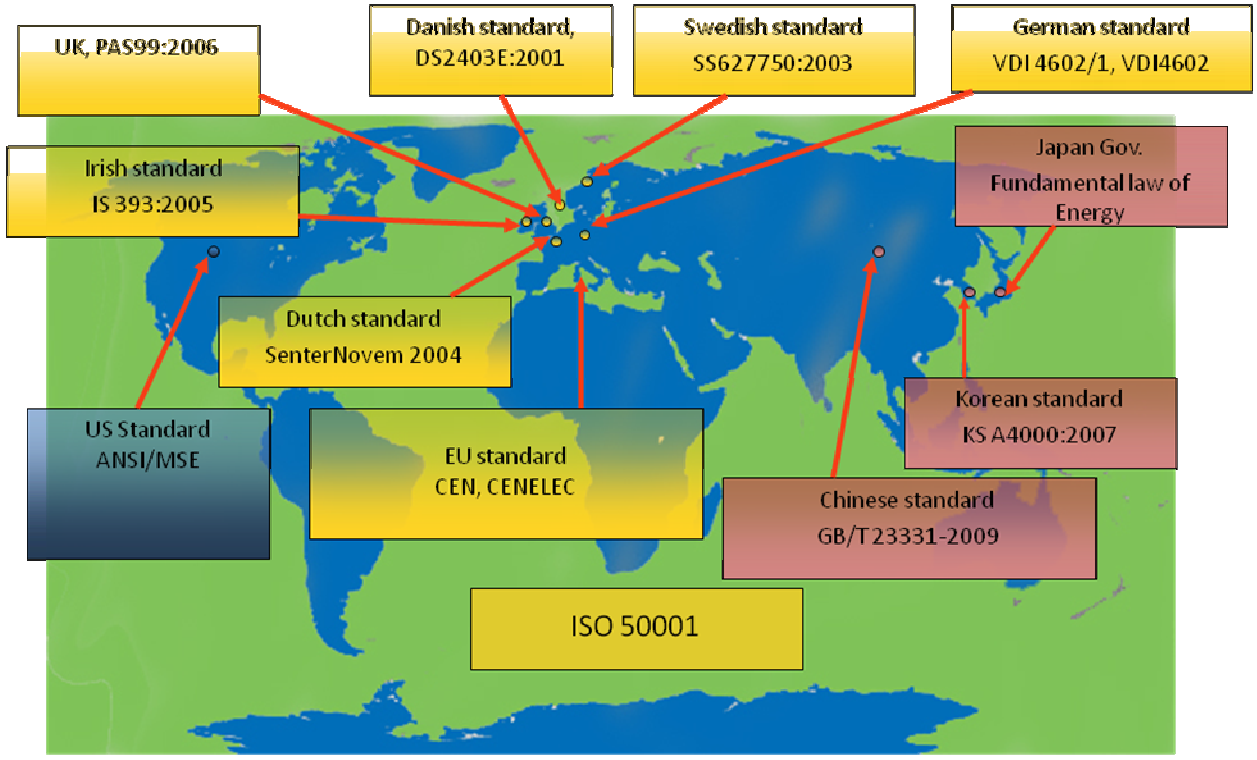

Fig. 3. Energy Management Standard in the world

The energy management standard in the world is summarized by locations as shown in Fig. 3. Finally, the new energy management standard is proposed in the name of ISO 50001.

3. ENERGY LITERATURE REVIEWS

Energy Policy

Nowadays, the sustainable energy policy making is directed by the objectives and priorities taking into consideration the impact of the specified characteristics in each country [14]. Even if each state or geopolitical region has various energy policy objectives, depending on the level of economical growth as well as its status (importer, producer and exporter of energy), that are described in term of security of supply, competitiveness of energy market and environmental protection [15-17]. The energy policy making could be based on the following indicators to enhance the performance of energy policy as shown in Table 2.

Most of developed countries, the energy policy is integrated in the national policy to enhance the goal. Moreover, in the European Union (EU) which consists of 27 countries propose the unique energy policy called The European energy policy context [18]. It is driven by restructuring and liberalization of energy markets, and measures to combat climate change. According to the Kyoto protocol, EU has an agreement on the reduction of 8% greenhouse gas (GHG) emissions between 2008 and 2012 relative to 1990 as based levels. In addition, the three efficient methods are proposed to fulfill the emission reductions target of Annex I countries that are joint implementation (JI), emission trading (ET) and clean development mechanism (CDM). Furthermore, several important legislations and policy documents are adopted in EU aiming to increase energy efficiency by using the various effective tools, such as the EU Green paper and energy service companies (ESCO) [19,20].

Table 2. Indicators of energy policy objective

Energy policy objective	Detail of indicators
Security of supply	The securing of energy supply does not aim to maximize the independence on energy or to minimize the dependence of a country, but to minimize the dangers involved in, depending on external supply.
Competitive energy market	This objective reflects the capacity for the provision of energy products and services that can compete with the international standards.
Environmental protection	The third objective of energy policy refers to the protection from all external parameters that are influenced by production of energy.

Energy Service Companies

A recent survey of interested case studies for ESCO businesses in many countries is investigated. In some countries a large number of ESCOs have been successfully operating for a number of years, such as Germany, Austria, UK, Spain, and Hungary while in other countries only a few ESCOs have recently started to operate. The majority of ESCO projects have been in

co-generation (CHP), public lighting, heating ventilating and air conditioning (HVAC) and energy conservation. The ESCOs are examples of companies whose combine business model to energy conservation and energy management, based on guaranteeing energy savings to their clients. ESCOs are a diverse group, with some core characteristics as follow:

(1) The ESCO's revenue is linked to delivering energy savings,

(2) The energy savings are verified through monitoring and maintenance services,

(3) The ESCO provides or facilitates the financing for the energy efficiency investment.

The investigation can be summarized as follow [21]:

Italy: Italian market is still dominated. The major target sectors include cogeneration in the local health board sector, heating for public buildings, cogeneration and heat generation in the industrial sectors, and lighting for all sectors but Italian banks are still reluctant to provide financing for ESCO projects [22, 23].

France: the ESCOs in France consists of the aggregation of financing and guarantee of savings, or aggregation between the operator, the guarantee and the financier. French market is moderately well developed and very special and largely dominated by a few very large ESCOs [24, 25].

Spain: ESCOs are rapidly developing both in private and public sectors. The private ESCOs are especially active in financing wind farms, while public ESCOs are fostered new markets, such as cogeneration with biomass, biomass technologies for different uses and solar thermal and photovoltaic applications. The regional and national energy agencies are very active in project involvement and the financial support [26].

Germany: ESCO's leaders are very well developed. The accomplishment of the German ESCO market has been driven by the financial and technical support for energy efficiency projects which are provided by the governmental action and non-governmental programs [27,28].

Finland: ESCOs in Finland are very activeness. The main customer is the process industry (80%) with the refurbishment of HVAC systems. Finland has been a few attempts to get financial institutions as long as the market is not large enough [29].

Austria: the market is increased based on know-how: energy agencies at the national, regional and local level have acted as know-how carriers and through action in public buildings drew the attention of businesses to the end-use energy efficiency market [30, 31].

United Kingdom: ESCOs provide a totality of services and risk sharing. The banks and credit institutions are very active in financing ESCO projects. The high experience in project financing, the inventive strength of enterprises and the encouraging market structure, have developed a successful ESCO industry, which could further develop as a result of the UK carbon tax [32].

In addition, the summary of ESCO activity indicators by various countries is shown in Table 3. Finally, a recommended ESCO's strategies for sustainable development are as below:

- Increase dissemination of ESCO services and Projects,
- Launch an accreditation system for ESCOs (to provide a qualified and reliable service),
- Develop financing sources,
- Standardize contracts, measures and verification,
- Ensure that governments take the lead with measures in public buildings.

Table 3. ESCO activity indicators by various countries

Country	Date of first ESCO	Number of ESCOs	Total value ($x10^6$ $)
Argentina	1990s	5	< 4
Australia	1990	8	25
Austria	1951	25	7
Belgium	1990	4	na
Brazil	1992	60	100
Bulgaria	1995	12	na
Canada	1982	5	100
Chile	1996	0–3	0.2
China	1995	23	49.7
Columbia	1997	1–3	0.2
Cote d'Ivoire	2000	4	0.25
Czech Republic	1993	3	2
Egypt	1996	14	na
Estonia	1986	20	3
Finland	2000	4	1
Germany	1995	1000	150
Ghana	1996	1–3	<0.1
Hungary	1990	10–20	na
India	1994	4–8	1
Italy	1980	20	na
Japan	1997	21	61.7
Jordan	1994	1	2
Kenya	1997	2	<0.01
Korea	1992	158	20
Lithuania	1998	3	na
Mexico	1998	7	na
Morocco	1990	1	0.5
Nepal	2002	2	0.25
Philippines	1990	5	< 0.2
Poland	1995	8	30
Slovak Republic	1995	10	1.7
South Africa	1998	3–5	10
Sweden	1978	6–12	30
Switzerland	1995	50	13.5
Thailand	2000	6	5
Tunisia	2000	1	0.5
Ukraine	1996	5	2.5
United Kingdom	1980	20	na

Remark: na is not avialable

Table 4. Examples of renewable energy publications

Type of renewable energy	Example publications
Biomass, Biogas and Bio fuel	Finland uses residual forest as renewable energy resources with combined heat and power (CHP) technology support [33]. Wood waste, firewood, straw and biofuel are used as traditional resources in Lithuania [34]. According to the economic constriants, biomass is a lower potential renewable energy sources in Turkey [35]. The multiple sources of biomass-biogas energy were powerful renewable energy used in China including biological chemical transition (marsh gas and fuel alcohol), the biomass gasification (power generation or thermal power coproduction), biomass liquefaction (bio-diesel) and direct burning (boiler burning, dense burning and garbage burning) [36].
Solar	Photovoltaic array is one of many potentials that can be compromised with microgrids in UK [37]. Solar energy can be used for preparing hot water, passive solar heating through the windows and solar drying for agriculture production in Lithuania [34]. Solar power is a potential renewable energy resources in Turkey but solar power had less effectiveness to used [35]. In UK, solar energy has the possibility to employ in the building to collect and deliver heating lighting and ventilation [38]. Solar power was used as alternative source to produce hot water for building in UK [39] The studies based on buildings renewable energy systems in Hong Kong have provided prototypes for successful use of solar-based energy systems in buildings to enhance energy efficiency and sustainability [40]. China has abundant solar resource, the solar energy is mainly intended for urban and rural domestic energy use and the power supply for remote areas [36].
Fuel Cell	The hybrid microgrids system based on fuel cell is studied the potential to increase the energy efficiency in UK [37].
Municipal Solid Waste	The municipal solid waste utilization of Lithuanian cities are interested in combustion of garbage in boilers [34].
Geotherm al	The geothermal areas cover 80% of country's territory. There is certainly space for an accelerated use of geothermal in Lithuania [34]. Geothermal welded energy is an environmental friendly and potential renewable energy in Turkey [35]. There are several studies of geothermal energy in Hong Kong that provide a basis for further studies whether the use of ground source heat pump is appropriate in the local climate condition [41]. More than 1300 spots of 3200 geothermal resource spots in China have been exploited and used, still geothermal power generations are now inadequate [36].
Wind	Lithuania has not very good conditions for wind energy because there is no free land with good wind conditions for wind turbine and some zones are in recreation areas which are protected [34]. Turkey has wind power as an important renewable energy resource and continue increasing in usage [35]. Up to the year of 2005, a total of 61 wind power plants have been impremented. According to China support programs, in the years of 2010 and 2020, the wind power installed capacity of state grid would reach 5.0 $x10^6$ kW and 3.0 x 10^7 kW, respectively [36].
Hydro	Hydro power takes the highest ratio among other renewable energy resources in Lithuania [34]. Up to the year of 2004, the installed capacity in the exploited small hydropower plants had reached 3.45x 10^7 kW, accounting for 27% of the total exploitable resources. The potential of the exploited small hydropower plants accounts for 35% of the total capacity in China [36].
Ocean	Abundant ocean energy resources are contained in China's ocean, including tidal energy, wave energy, oceanic flow energy, temperature difference energy, salt difference energy. But only tidal energy was utilized from the ocean renewable energy in China [36].
Others renewable energy	Renewable energy is limited in generation capacities and cannot be expected to substitute the current fossil fuel consumption level [42]. Community energy plan (CEP) in Canada has variety of initiatives recommendation to suit their own need [43]. Among various state programs available to support renewable energy, three stand out, which include the state renewable portfolio standard (RPS), the system benefit charge (SBC) assigned to all generators and used to support energy efficiency and renewable generation, where consumers have the option of securing a portion for their electricity from renewable resources, often at a premium rate [44].

Renewable energy

Renewable energy is the energy generated from natural resources that are biomass, biogas, bio fuel, solar, fuel cell, municipal solid waste, geothermal, wind, hydro, ocean, and others renewable energy. Fig. 4 shows the portion of renewable energy in the world [1]. According to the reduction of fossil resources, renewable energy is the sustained mechanism to utilize the resources management. The reviews of selected publications related to the energy management are summarized in Table 4. The perspective of renewable energy in GMS countries for next two decades is illustrated in Table 5. Cambodia is used the renewable energy more than 80% of the total energy consumption. However, the portion of renewable energy usages will be reduced down to less than 70% in 2030. At the same time, the trend of renewable energy usage in Loas is same as Cambodia. On the other hand, the renewable energy need to be promoted more and more in Thailand and Vietnam because the portion of renewable energy in Thailand and Vietnam is less than 25%.

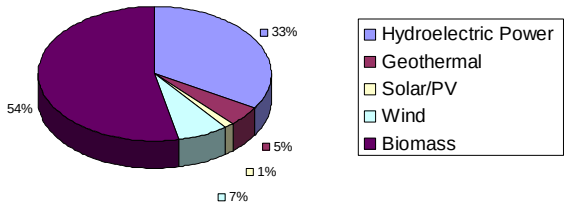

Fig. 4. Renewable energy consumption by sources

Table 5. The perspective of renewable energy usages in GMS countries

Year	Vietnam	Cambodia	Laos	Thailand
2010	19.59	87.68	40.25	18.39
2020	20.10	81.65	21.23	18.22
2030	15.89	69.47	20.00	10.15

Environmental impact versus energy management

GHG has been the hot issue in the world forum in a few decades. More than 60% of GHG has been generated from energy usages [45], which can imply that the energy management is the successfully key to sustainable reduce the GHG. Most of results in the energy management field proposed the effectiveness methods to manage the GHG problems. The selected publications are summarized. The emission generation was studied in ASEAN countries; the analytical results show that Vietnam can improve the emission factor of selected stoves with highest efficiency in ASEAN countries. In addition, the incremental of CO_2 emission from fuel combustion in Myanmar is twice time in eight years [46]. On the other hand, Singapore can handle the CO_2 emission with effective criteria, because the incremental of CO_2 from fuel combustion is lowest in ASEAN countries [47]. According to the ADB study, Thailand has trend to generate the highest CO_2 emissions from fossil fuel in ASEAN countries [48]. Furthermore, the trend of the equivalent CO_2 emission of GMS countries is presented in Table 6.

The effective analytical methods are proposed to maintain the GHG. The multi scenario method is used to develop the effective policy planning in Vietnam to minimize the emission generation [49]. The combined social and environmental energy goal of sustainable development could thus be defined as increasing the service per energy unit to ensure access to the greatest number, while continuously decreasing the energy consumption and emissions of the most wealthy, in order to reach a global level of energy consumption within environmental limits. [50] In addition, the decision-making of nuclear energy policy is developed to environmental friendly of nuclear plant than traditional fossil plant [51] and sensitivity analysis is selected to solve the GHG problem in building and transportation sectors [52].

Table 6. The perspective of equivalent CO2 emission (x103 tons)

Year	Vietnam	Cambodia	Laos	Thailand	Myanmar
2010	79,981	3,803	7,828	277,211	11,683
2020	167,667	7,074	26,300	470,840	12,795
2030	359,193	14,449	30,890	898,805	18,461

Under the Kyoto Protocol, a scheme for GHG allowance trading within the Community to reduce GHG emissions was introduced. In principle, this scheme offers the possibility to implement the most cost-effective measures for reducing GHG emission while still achieving the derived outcome. There are several market-based mechanisms aiming to achieve environmental management or having impact on achievement of the aim:

- A Tradable White Certificate (TWC) scheme would aim to encourage energy-saving measures for delivering end-use energy saving and reducing energy consumption and CO_2 emission [53].
- The European Union Emission Trading Scheme (EU ETS) aims to promote reduction of GHG in a cost effective and economically efficient manner [54].
- Flexible Kyoto mechanisms (JI and CDM) have the same as EU ETS just on the broader area outside the border of EU [55, 56].

4. THE REGULATION AND LAW OF ENERGY MANAGEMENT IN THAILAND

In Thailand, the energy policy had started since 1973 during the third National Economic and Social Development plan (3rd plan: 1973-1976) to prevent oil shortage and saving of oil and electricity. The energy policy was continuous improvement and development in the fourth plan (1977-1982) and the fifth plan (1982-

1986) of National Economic and Social Development. At primary, the Department of Alternative Energy Development and Efficiency (DEDE) has been assigned to implement the energy efficiency and promotion measure and saving in industrial sector, and expanded to commercial and residential sectors. The first of Energy Conservation Promotion (ECP) Act had passed consideration and effective in April 1992. Currently, the second of ECP has been revised and effective implementation on 1st June 2008 that still emphasis in designated factories, designated buildings and Manufacturers or suppliers of high efficient machinery and equipment and of materials using for conserving energy. The ECP Act is emphasis on factories and buildings consuming a large amount of energy and having potentials to implement the energy conservation in compliance with ECP Act and shall submit the annual report data on energy production, consumption and conservation to DEDE. The new revised ECP Act had emphasis all designated factories and designated buildings to had third party audit the energy management activities and report. The third party auditor must be certified by DEDE. The activities to be counted as energy conservation in factory in compliance with ECP Act are to operate any one of such the following implementations:

1. Improvement of Fuel combustion efficiency,
2. Energy loss prevention,
3. Energy recovery,
4. Change to use another energy type,
5. Improvement of electricity use by improving the power factor, reducing the peak demand in peak period, using the electrical appliances to properly meet their load requirements and other improvement methods,
6. Using the high efficient machinery or equipment, the operational control system and other materials resulted in energy conservation,
7. Conserving an energy by any other methods required by the ministerial regulation.

The revised ECP Act (No.2) B.E.2550 has increase participle from the owner of designated factories and designated building to public their energy conservation plan and report to officer every year. The effectiveness implementation of energy conservation is improved by using third party organization or ESCO to sustain energy conservative activities by system audit to those companies.

5. CONCLUSIONS

The energy management is the effective management tools to maintain energy consumption and greenhouse gas emission by considering energy policy, renewable energy and environmental impact. The importance key points are concluded as follows:

- The significant solutions of energy management are the sustainable energy policy, the performance energy policy indicators and the mechanism of energy service companies.
- The performance-based energy economy (PBEE) applies the combined concepts of the performance economy, energy policy and energy service company to be a successful solution to the energy management and energy conservation in many countries.
- The renewable energy is the efficient sources for the modern energy management system in term of the global resouces management, the environmental management scheme and the utilization of energy usages. But the renewable energy sources are limited in their generation capacity and cannot be expected to substitute the current fossil fuel consumption levels.
- The Kyoto mechanisms in term of joint implementation, emission trading and clean development mechanism are the valuable tools to enhance the greenhouse gas reduction target.

The development of energy management in the Greater Mekong Sub-regions is rapidly concentrated by the Government especially in Thailand. The Energy Conservation Promotion Act (No.2) B.E.2550 was regulated to designated buildings and factories**.**

REFERENCES

[1] Energy Information Administration (EIA). 2008. Annual Energy Review.
[2] ISO 14000. 2004. International Organization for Standardization (ISO).
[3] CEN CENELEC. European Union Standard, 2008.
[4] ANSI/MSE. 2005. American National Standards Institute.
[5] PAS99: 2009. Publicly Available Standard, United Kingdom.
[6] DS2403:E2001. 2001. Danish Standard Energy Management.
[7] Senter Novem. 2004. The Agency of the Dutch Ministry of Economic Affairs.
[8] VDI 4602/1 and VD 4602. Handbuch Energietechnik Germany Standard.
[9] **SS** 627750**:**2003. 2003. Swedish Standards Institute.
[10] I.S. 393:2005. Irish Standard.
[11] GB/T xxx-200x. China Government (Under Developing).
[12] KSA 4000:2007. Korean Standard Association.
[13] Fundamental law on Energy. Japan Government.
[14] Patlitzianas, K.D., Doukas, H., Kagiannas, A. G., and Psarras, J. 2006. Sustainable energy policy indicators: Review and recommendation. *Renewable Energy* 33:966-973.
[15] Patlitzianas, K.D. and Psarras, J. 2006. Formulating a modern energy companies' environment in the EU accession member states through a decision support methodology. *Energy Policy* 35(4):2231-8.
[16] Kagiannas A., Flamos A., Askounis D., and Psarras J. 2002. Energy policy indicators for the assessment of the Euro Mediterranean energy cooperation. *International Journal of Energy Technology and Policy* 2(4):301-22.

[17] Neij L. and Astrand K. 2006. Outcome indicators for the evaluation of energy policy instruments and technical change. *Energy Policy* 34(17):2662-76.

[18] Bertoldi, P., Rezessy, S., Paternost, A., and Edward, V. 2005. Energy service companies in European countries: Current status and a strategy to foster their development. *Energy Policy* 34:1818-1832.

[19] Streimikiene, D., Ciegis, R., and Grundey, D. 2006. Promotion of energy efficiency in Lithuania. *Renewable & Sustainable energy reviews* 12:772-789.

[20] Streimikiene, D. 2004. Implementation of EU environmental directives and Kyoto protocol requirements in Lithuanian power and district heating sectors. *Power Engineering* 3:30-9.

[21] Bertoldi, P., Rezessy, S., Paternost, A., and Edward, V. 2005. Energy service companies in European countries: Current status and a strategy to foster their development. *Energy Policy* 34:1818-1832.

[22] Capozza, A. 2003. Country Report Italy. Prepared for the IEA DSM Task X Performance Contracting.

[23] Pela, A., 2003. Development of the ESCO in Italy: state of the art. In *Bertoldi, P. (Ed.), Proceedings of the First Pan-European Conference on Energy Service Companies*.

[24] Dupont, M., and Adnot, J. 2004. Investigation of actual energy efficiency content of energy services in France. In *Proceedings of the ARTICLE IN PRESS International Conference on Improving Electricity Efficiency in Commercial Buildings*, Frankfurt, April 2004.

[25] Jamet, B. and Adnot, J. 2003. Country report France. Prepared for the IEA DSM Task X Performance Contracting.

[26] Blanco, I. 2003. Personal Communication. IDAE, Spain February 24.

[27] Seefeldt, F. 2003. Energy performance contracting success in Austria and Germany dead end for Europe? In *Proceedings of the European Council for Energy Efficient Economy 2003 Summer Study*, European Council for an Energy-Efficient Economy, Stockholm.

[28] Brand, M. and Geissler, M. 2003. Innovations in CHP and lighting: best practice in the public & building sector. In *Bertoldi, P. (Ed.), Proceedings of the First Pan-European Conference on Energy Service Companies*, Milan May 2003.

[29] Vaisanen, H. 2003. Personal Communication. Ministry of Trade and Industry, Finland January 15.

[30] Vine, E. 2005. An international survey of the energy service company (ESCO) industry. *Energy Policy* 33 (5): 691-704.

[31] Leutgob, K. 2003. The role of energy agencies in developing the 'classical' EPC-market in Austria. In *Bertoldi, P. (Ed.), Proceedings of the First Pan-European Conference on Energy Service Companies*.

[32] Iqbal, A. 2003. Opportunities for ESCO development in accession countries-Lithuania as an example. In *Bertoldi, P. (Ed.), Proceedings of the First Pan-European Conference on Energy Service Companies*.

[33] Hakkila, P. 2003. Factors driving the development of forest energy in Finland. *Biomass & Bioenergy* 30:281-288.

[34] Katinas, V., and Markevicius, A. 2004. Promotional policy of usage renewable energy in Lithuania. *Energy Policy* 34:771-780.

[35] Soyhan, H.S. 2008. Sustainable energy production and consumption in Turkey: *A Review. Renewable & Sustainable energy reviews* 13:1350-1360.

[36] Peidong, Z., Yanli, Y., Jin, S., Yonghong, Z., Lisheng, W., and Xinrong, L. 2007. Opportunities and challenges for renewable energy policy in China. *Renewable & Sustainable Energy Reviews* 13:439-449.

[37] Abu-Sharkh, S., Arnold, R.J., Kohler, J., Li, R., Markvart, T., Ross, J.N., Street, K., Wilson, P., and Yao, R. 2004. Can microgrids make a major contribution to UK energy supply? *Renewable & Sustainable energy reviews* 10: 78-127

[38] Hinnells, M. (2008). Combined heat and power in industry and buildings. *Energy Policy* 36:4522-4526.

[39] Roberts, S. 2008. Altering existing building in the UK. *Energy Policy* 36:4482-4486

[40] Ma, Z., and Wang, S. 2009. Building energy research in Hong Kong: A review. *Renewable and Sustainable Energy Reviews* 13:1870-1883.

[41] Kanoglu, M., Dincer, I., and Rosen, M. A. 2006. Understanding energy and exergy efficiencies for improved energy management in power plants. *Energy Policy* 35:3967-3978

[42] Steinberger, J. K,, Niel, J. V., and Bourg, D. 2008. Profiting from megawatts: Reducing absolute consumption and emissions through a performance-based energy economy. *Energy Policy* 37:361-370.

[43] Genevieve St. Denis, Paul Parker. 2009. Community energy planning in Canada: The role of renewable energy. *Renewable and Sustainable Energy Reviews* 13:2088-2095.

[44] Heiman, M.K. 2006. Expectations for renewable energy under market restructuring: the U.S. experience. *Energy* 31:1052-1066

[45] Baumert. 2005. Navigating the Numbers: Greenhouse Gas Data and International Climate Policy. World Resources Institute.

[46] International Energy Agency (IEA). 2000. Energy Balances of Non-OECD Countries 1996-1997. IEA, Paris.

[47] Bhattacharya, S.C., Albina, D.O., and Abdul S. 2002. Emission factors of charcoal-fired cookstoves. *Biomass and Bioenergy* 23:453-469.

[48] Asian Development Bank (ADB), 1995. Subregional Energy Sector Study for the Greater Mekong Subregion. Final Report, ADB, Manila.

[49] Nguyen, N.T., and Ha-Duong, M. 2008. Economic potential of renewable energy in Vietnam's power sector. *Energy Policy* 37:1601-1613.

[50] Julia K. Steinberger, Johan van Niel, Dominique Bourg. 2009. Profiting from megawatts: Reducing absolute consumption and emissions through a

performance-based energy economy. *Energy Policy* 37: 361-370

[51] Lee, Y. E., and Koh, K. 2002. Decision-making of nuclear energy policy: application of environmental management tool to nuclear fuel cycle. *Energy Policy* 30:1151-1161.

[52] Farreny, R., Gabarrell, X., and Rieradevall, J. 2007. Energy intensity and greenhouse gas emission of a purchase in the retail park service sector: An integrative approach. *Energy Policy* 36:1957-1968.

[53] Malaman, R., and Pavan, M. 2002. Market-based policy approaches for end-use energy efficiency promotion. In *Proceedings of the IEECB'02 conference*, Nice: ADEME.

[54] Streimikiene, D. 2004. Implementation of EU environmental directives and Kyoto protocol requirements in Lithuanian power and district heating sectors. *Power Engineering* 3:30-39.

[55] Streimikiene D., and Mikalauskiene, A. 2004. Perspectives of joint implementation projects in Lithuania. *Manage Organization System* 29:201-213.

[56] Streimikiene, D., and Mikalauskiene, A. 2004. Implementation of Kyoto flexible mechanisms in Lithuania. *Nuclear Radiation Technology* 2:35-39.