

# Global Warming, Energy Conservation, Competence based Training and Competency Certification of Energy Auditor

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Abstract: Global warming is a form of imbalance of the ecosystem on Earth due to the onset of the process of increasing the average temperature of the atmosphere, oceans, and landmasses on Earth. Increasing the average temperature of the Earth's surface that occurs is due to increasing emissions of greenhouse gases, such as; carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), dinitro oxide (NO<sub>2</sub>), hydrofluorocarbons (HFCS), perfluorocarbon (PFCS), and sulfur hexafluoride (SF<sub>6</sub>) in the atmosphere. These emissions are primarily generated from the combustion of fossil fuels (oil and coal) as well as due to the deforestation and the burning of forests. Sector energy users is the sector that most of its contribution to greenhouse gas emissions. The use of renewable energy and conservation mitigation is to reduce greenhouse gas emissions. Energy conservation is one of the efforts the planned, systematic, and integrated in order to preserve domestic energy resources as well as increase the efficiency of its utilization. Energy savings can lead to reduced costs, as well as increasing the value of the environment, state security, personal security, as well as comfort. Efficiency of energy is implemented through the energy audit. Cement industry as energy users more than 6000 TOE (ton oil equivalent) appropriate to Government Regulation Permen ESDM No. 14/2012 about applying compulsory energy management system by appointing managers, carry out energy audits energy at regular intervals, implement the recommendations of the audit results, and reporting the implementation of the energy conservation of energy every year. This audit should be done by a certified auditor. Energy Auditors for certification in the cement industry is a competency-based training refers to the standard National Indonesia Work Competence (SKKNI) and is certified by independent agencies, institutions of professional certification (LSP) under the National Board certification of Professions (BNSP)

## 1 INTRODUCTION

Global warming is a form of imbalance of the ecosystem on Earth due to the onset of the process of increasing the average temperature of the atmosphere, oceans, and landmasses on Earth. Increasing the average temperature of the Earth's surface that occurs is due to increasing emissions of greenhouse gases, such as; carbon dioxide, methane, hydrofluorocarbons, dinitro oxide, perfluorocarbon, and sulfur hexafluoride in the atmosphere. These emissions are primarily generated from the

combustion of fossil fuels (oil and coal) as well as due to the deforestation and the burning of forests.

The gas that is categorized as greenhouse gases (GRK) are gases that effect directly or indirectly against the greenhouse effect that is causing climate change. In the UN Convention on climate change (United Nations Framework Convention on Climate Change-UNFCCC), there are six types of which are classed as GRK namely carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) gas, dinitrogen oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), perfluorocarbon (PFCS) and hydrofluorocarbons (HFCS). In addition there are several gases which are also included in GRK i.e.

carbonmonoxy (CO), nitrogen oxides (NOX), chlorofluorocarbons (CFCS), and organic gases in nonvolatile metal.



Figure 1: mechanism of efek greenhouse gases (modified from <http://i.livescience.com>)

Greenhouse gases are expressed most contribute to the symptoms of global warming are CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>x</sub>, CO, PFC and SF<sub>6</sub>. However, for Indonesia two gas called the last emissions are still very small, so it is not taken into account. Of the six greenhouse gases, carbon dioxide (CO<sub>2</sub>) is the largest contributing towards global warming followed by methane gas (CH<sub>4</sub>). More than 75% of the composition of the atmosphere is CO<sub>2</sub> in GRK so if CO<sub>2</sub> contribution from various activities can be reduced significantly then there are chances that the impact of global warming on climate change will be reduced. Total emissions in Indonesia GRK from all sectors in the year 2000 amounted to 1,377,982 Gg CO<sub>2</sub>e and industrial sector contributed amounted to 3.12%. To reduce the negative effects of the phenomenon of climate change, need to be calculated the amount of emissions from industrial activity greenhouse gases. Therefore, compiled technical guide to assist stakeholders in the calculation of the emission of greenhouse gases.

All sectors of the industry contributes to the emission of GRK, but the biggest contributor is the cement industry, steel industry, pulp paper, textile industries & petrochemical industry, fertilizer industry, ceramic industry, food and beverage industry. Based on the presidential Regulation No. 61 year 2011 National action plan of Decreasing Greenhouse Gas emissions (RAN-GRK) target a decrease in emissions from industrial sectors was of 0.001 Gton CO<sub>2</sub>e scenario (26%) and of 0.00510 Gton CO<sub>2</sub>e scenario (41%) in the year 2020. The results of the inventory of GRK conducted in 2010 shows that emissions GRK in 8 (eight) subsector of the industry heartily energy is as described in table 1.

Table 1. The contribution of Emissions from the industrial sector GRK

No	Subsektor Industri	Emisi GRK (MTon CO <sub>2</sub> e) Inventory tahun 2010	Prosentase (%)	Target penurunan emisi GRK pada 2020 (skenario 26%) Mton CO <sub>2</sub> e	Target penurunan emisi GRK pada 2020 (skenario 41%) Mton CO <sub>2</sub> e
1	Semen	32	27,97	0.280	1.398
2	Baja	8.34	7,29	0.073	0.364
3	Pulp & Kertas	31.02	27,11	0.271	1.356
4	Tekstil	11.09	9,69	0.097	0.485
5	Petrokimia	11.46	10,02	0.100	0.501
6	Keramik	1.36	1,19	0.012	0.059
7	Pupuk	11.23	9,82	0.098	0.491
8	Makanan & Minuman	7.91	6,91	0.069	0.346
	<b>Total</b>	<b>114,41</b>	<b>100</b>	<b>1</b>	<b>5</b>

Source: Study of the development of policies and Strategies of energy conservation, BAPPENAS 2010

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## 2 RESEARCH METHODS

This research aims to develop Technical Guidance Instructional model of energy Audit to get a Certification of competence of the profession in the cement industry is expected to increase the effectiveness of learning. Instructional model that will be developed in this research is the ability to solve problems in the workplace especially in the aspect of knowledge in the implementation of the activities of the energy audit. Research and development (R&D) is a research method that is used to produce a particular product, and test the effectiveness of these products. As expressed by Gall, Gall & Borg in his book "An Introduction Educational Research 4th Edition, (2003)". that research and development in education is an industry-based model of development where research findings

used to design new products and procedures, which are then systematically tested in field, evaluated, and enhanced to meet certain criteria, namely effectiveness and quality. According to Borg and Gall., "educational research and development approaches is used to develop and validate educational product", or it can mean that the research is the development of education is a process used to develop and validate product education. The result of the research of the development of not only the development of an existing products but also to find the answers to the knowledge or practical problems. Based on the above definition, it is understood that development research is a move to develop a new product or refining existing products and effectiveness test, as well as the longitudinal nature of the gradual or can multi-years.

Furthermore, the Borg and Gall. Describes four main characteristics in research and development, namely: 1) Wadi research findings pertinent to the product to be develop, which means, doing the initial research study or to find research findings related to the product will be developed. 2) Developing the product base on these findings, that is to say, developing products based on the findings of such research. 3.) Field testing it in the setting where it will eventually be used to mean, he did field test in the setting or actual situation where the products were later used, 4.) Revising it to correct the deficiencies found in the field-testing stage, that is to say, did the revision to correct the weaknesses found in the stages of field test. Of the four main characteristics of the R&D, giving an overview of the key features that R&D is the initial research steps related to the products that will be developed. Based on the results of research education and training products are designed and developed to test and then repaired/revised.

In the early research, researchers tried to find out whether there is any energy conservation is concerned with competency-based training (CBT) in the cement industry for the energy auditor must be developed. Technical Guidance Training on energy Auditor in the cement industry is necessary in order to certify the energy auditor competencies to meet the mandate of Government Regulation and applicable legislation

### 3 THEORETICAL STUDIES

The notion of global warming is the process of increasing the average temperature of the Earth, be it on a layer of the atmosphere, land, and sea. Global warming is closely associated with the air pollution

around the world. The increasing amount of carbon dioxide, the greenhouse effect, gas resulting from combustion of fossil fuels, and other human activities, is the main source of the onset of global warming for years. Based on the results of research experts mentioned that the Earth's temperature has increased drastically during the last century, that is, achieving 0.6 ° c. It might look small, but the impact of global warming is so great for life on Earth. (<https://www.maxmanroe.com/vid/umum/pengertian-pemanasan-global.html>).

Furthermore, <https://helpsavenature.com/what-causes-global-warming> says: "Global warming is basically a change in the climatic conditions of the Earth, brought about by a considerable rise in the near-surface temperature of the planet....Global warming, and the resulting climate change, can be caused by natural as well as man-made factors (anthropogenic factors, to be precise). The natural factors causing this are sudden warming of the planet include the greenhouse effect, solar activity, volcanic emissions, orbital forcing (slow tilting of the Earth's axis), etc. The anthropogenic causes, on the other hand, include various human activities - right from breathing (respiration), to the use of vehicles and various industrial processes, which add to the greenhouse effect and cause the Earth to become warm."

In order to better understand what is global warming, then we can refer to the opinion of some experts, as follows: 1. According to The United States Environmental Protection Agency (USEPA) United States Environmental Protection Agency, the notion of global warming is the increase in the average temperature at the Earth's surface, either elapsed or is going on at the moment. The greenhouse effect is the cause of global warming that is causing most of the necessary changes in climate. 2. New According to the New Mexico solar energy Association, United States the notion of global warming is the increase in the temperature or the temperature average in the Earth's surface as the impact of the greenhouse effect. The greenhouse effect is a heat trapped events on earth because it is hindered by such emissions carbon dioxide gas (smoke motor vehicles, factories or industries, forest fires) in the atmosphere. 3. According to Natural Resources Defence Council (NRDC), global warming is the process of increasing air temperature due to heat trapped in the atmosphere by carbon dioxide gas which could threaten the climate changes and it may cause a disaster on the surface of the Earth. The NRDC said the global warming is the biggest humanitarian and environmental crisis that is happening at the moment.



reducing the impact of global warming is through energy saving. In the cement industry, energy saving can be done through diversification of energy and conservation of energy. Both, good diversification of energy and conservation of energy can be done through energy management. One of the important parts in the management of energy is an energy audit. This energy audit was carried out in order to make use of its energy efficiency can be achieved.

Cement industry as energy users more than 6000 TOE (ton oil equivalent) appropriate to Government Regulation PerMen ESDM No. 14/2012 about applying compulsory energy management energy management system by appointing managers, carry out energy audits energy at regular intervals, implement the recommendations of the audit results, and reporting the implementation of the energy conservation of energy every year. This audit should be done by a certified auditor. Energy Auditors for certification in the cement industry is a competency-based training refers to the standard National Indonesia Work Competence (SKKNI) and is certified by independent agencies, institutions of professional certification (LSP) under the National Board Certification of Professions (BNSP)

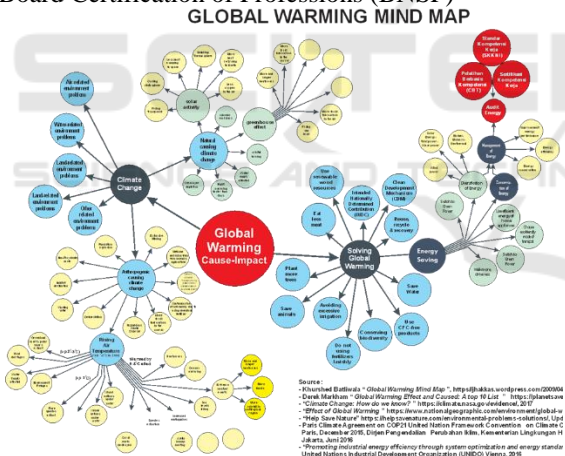


Figure 4: Mind map of the effects of global warming (global warming cause-impact) and attempt to solve it (the global solving energy) modification of Dr. Jane Genovese "Global Warming Mindmap", <https://www.learningfundamentals.com/>

#### 4 RESULT AND DISCUSSION

Activity in producing a product in the cement industry cannot be detached from the enormity of the use of electrical energy and heat energy. The increase in the price of energy is derived from fossil that continue to occur will have a direct impact on the

soaring cost of production, especially the production of cement requires high energy costs, which typically reach 30-40% of the cost of production, excluding the cost of the investment. Often found some cases that the intensity of use of electrical energy and heat energy is high, then it can add to the amount of emissions from the production process. This of course being the spotlight with increasingly tight and high pressure for industry to increasingly care about environmental sustainability. In order to this, Al Gore in his book "Our choice, a Plan to Solve the Climate Crisis" (2009) environmental sustainability. former 45<sup>th</sup> Vice President of the United States mentions: "Global population is still growing, but expected to plateau at slightly more than nine billion people halfway through the 21st century. However, even as human population stabilizes, greenhouse gas emission rates are increasing. Annual carbon emissions have quadrupled since 1950, and their rate of growth sharply increased between 2000 and 2008. Many scientists say that CO2 concentrations must be stabilized at 350 parts per million in the atmosphere, which would require a real reduction from the present concentration", reaffirms how serious a problem global warming if not handled properly

With the issue of energy costs and the impact on global warming due to industrial exhaust gas produced, then it is important to implement energy management system. With the implementation of the energy management system, the energy efficiency efforts can be optimal to fruition. In applying this system must be supported by all elements of the Organization, from each of these elements should be concerned and contributing as well as in achieving the success of an energy management.

Energy management is an integrated program that is planned and carried out systematically to utilize energy resources and energy effectively and efficiently by conducting planning, record keeping, monitoring and continuous evaluation without reducing the quality of the production/service. Pencakup energy management planning and operation of unit consumption and production related to energy. Energy management objectives, namely the conservation of resources, climate protection, and cost savings. Next to running an energy management the needed preliminary data from all the instruments involved in the use of energy. To get the data then required the existence of an energy Audit.

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reducing the quality of the production/service. Energy management encompasses the planning and operation of unit consumption and production related to energy. Energy management objectives, namely the conservation of resources, climate protection, and cost savings. Next to running an energy management the needed preliminary data from all the instruments involved in the use of energy. To get the data then required the existence of an energy audit.

In addition, the Government Regulation through PerMen ESDM No. 14/2012 about energy management that set the industry with energy use more than 6000 TOE (ton oil equivalent) is required to apply energy management systems and industrial energy use is less than 6000 TOE (ton oil equivalent) in order to implement energy management systems or energy savings. The setting of limits on numbers 6,000 (six thousand) was done based on the consideration that the user with the consumption of energy is greater than or equal to 6,000 (six thousand) tons of oil equivalent per year is not too much, but the total energy consumption reached about 60% of the national energy usage.

Energy conservation measures undertaken with energy management, namely with: a) appoints Manager of energy; b) devised a program of energy conservation; c) implementing energy audits at regular intervals; d) implement the recommendations of the energy audit results; and e) report on the implementation of the energy conservation each year to the Minister, Governors, or Bupati/Walikota in accordance with its respective

An energy audit is a process evaluation of the users of energy and energy saving opportunities identification as well as recommendations for increased efficiency in a company. While the meaning of the word Audit itself in broader sense meaningful evaluation of an organization, system, process, or product. The audit was carried out by a competent, objective, and impartial, which is called an auditor. The goal is to verify that the subject of the audit have been resolved or walking in accordance with standards, regulations, and practices that have been approved and received.

Energy-saving or energy conservation is the Act of reducing the amount of energy use. Energy savings can be achieved by efficient energy use where similar benefits are obtained by using less energy, or by reducing consumption and activities that use energy. Energy savings can lead to reduced costs, as well as increasing the value of the environment, State security, personal security, as well as comfort

Based on the source of the Head of the Center for the Assessment of Green Industry and the

Environment of the Ministry of Industry. Opportunities and Challenges of Energy Conservation in the Cement Industry Sector are Opportunities for Energy Conservation in the Industrial Sector; The industrial potential that has to do energy efficiency is quite high with the potential for considerable savings because 1) Generally companies need assistance for implementing energy conservation, 2) The industry already knows the government is promoting the development of green industry, 3) Availability of energy efficiency and business actors the existence of free energy audits from the government, 4) Increased banking knowledge and attention to the implementation of energy efficiency businesses.

Challenges of Energy Conservation in the Industrial Sector: 1) Not yet optimal implementation of energy management, 2) Not enough number of competent industrial human resources to carry out systematic energy management, 3) Lack of willingness; industry knowledge and capabilities change business as usual, 4) lack of knowledge and ability of service providers in carrying out energy efficiency business from technical and financial aspects, 4) lack of incentive mechanisms that directly benefit energy efficiency actors, 5) lack of understanding of the relationship between energy efficiency efforts with reduced emissions in terms of easy access to banking

While the barriers to the implementation of energy conservation in the Industrial Sector are as follows: 1) In general, the industry still does not care about energy conservation, they are still reluctant to conduct energy audits, unless the audit is free. Besides the audited industry, if you have to replace equipment, they are still reluctant to do it, because they have to spend high investment costs. 2) The industry is still not cultured to report its energy use to the government and generally still considers all data to be confidential; 3) Large industries, especially those with export orientation, have competent experts so that they are often unsure of the ability of local auditors. 4) Integrity of local auditors is often not proven by their competence, especially in the ability to manage confidentiality data. 5) Inability of industrial HR to distinguish confidential data / not confidential, so it is considered all the secrets, 6) The energy management capability in the industry is very low, the number of new energy managers is around 25% -30% of what is needed; 7) Lack of industry appreciation for implementing energy management. Only 40% of companies in the cement sector carry out energy conservation; 8) Plan-Do-Check-Action in Industry according to the Energy Management

System Standard ISO 50001: 2011 has not been running optimally; 9) The main orientation of the industry is still productivity and quality; 10) The price of technology is still expensive, there has been no significant government assistance; 11) The implementation of a monitoring system in the framework of energy audits has not been optimal.

The scheme of global warming and energy conservation in the industry and its relation to the 3 (three) pillars of professional competency certification in the chart below (figure 3) refer to mind map Dr. Jane Genovese "Global Warming Mind map", shows how the effects of global warming occur and how the cement industry tries to overcome them with energy conservation efforts where an energy audit is needed. For energy audits, auditors are required to be certified. This Energy Auditor Certification is related to 3 pillars of HR development, SKKNI / KKNi, Competency-Based Training, and Competency Certification from the Government cq the Ministry of Manpower and Transmigration of the Republic of Indonesia.

The scheme of global warming and energy conservation in the industry shows that global warming is characterized by, among other things, the depletion of the ozone layer, and the greenhouse effect. Global warming has triggered a number of adverse consequences for both the environment and every aspect of human life. Some of them are as follows: 1. Melting of the ice sheet at the North and South Poles. 2. Increased intensity of extreme weather phenomena. 3. Extinction of various types of fauna. 4. Animal habitat changes due to changes in temperature, humidity and primary productivity factors 5. Increased sea level, tide and erratic rainy season causes increased frequency and intensity of flooding. 6. The height of high mountains decreases due to melting ice at its peak. 7. Changes in air pressure, temperature, wind speed and direction cause changes in ocean currents. This can have an effect on fish migration, so that it has an impact on capture fisheries. 8. Changing habitat 9. Threatening damage to coral reefs in the coral triangle area in six countries, namely Indonesia, Malaysia, Salomon Islands, Papua New Guinea, Timor Leste, and the Philippines.

Minimizing the Impact of Global Warming, among others by 1) environmental conservation, 2) using energy sourced from alternative energy to reduce energy use of fossil fuels (petroleum and coal), recycling and energy efficiency.

The scheme of global warming and energy conservation in the industry shows that Energy Audit including the certification of professional competence is an important part of the

implementation of Indonesia's energy conservation, especially in the cement industry, where energy use is more than 6000 TOE (ton oil equivalent).

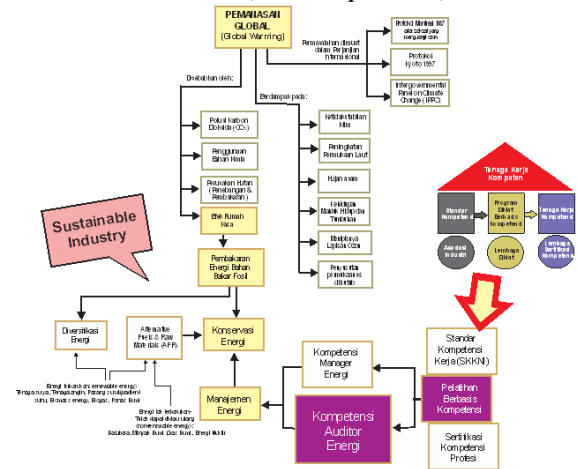


Figure 5. The concept of energy conservation in industry and three pillars of competence Certification

The cement industry as an energy user is more than 6000 TOE (ton oil equivalent) according to the Minister of Energy and Mineral Resources, NO. 14/2012 concerning energy management must implement an energy management system by appointing energy managers, carrying out periodic energy audits, implementing recommendations from energy audits, and reporting on the implementation of energy conservation every year. This audit must be carried out by a certified auditor.

For the certification of energy auditors in the cement industry, it is needed competency-based training that refers to the Indonesian National Work Competency Standards (SKKNI) with a curriculum that emphasizes what should be done by energy auditors in the world of work after following the technical guidance of the Energy Auditor (outcome) and as representation is a shift from an emphasis on entering the process into technical guidance (input).

Referring to the triangle of human resource development with various competencies (Fig. 6), the implementation of Competency Based Training (PBK) for Technical Guidance for Energy Auditors in Industry must meet the PBK component, namely: Indonesian National Work Competency Standards (SKKNI) and Indonesian National Work Qualifications (KKNi)

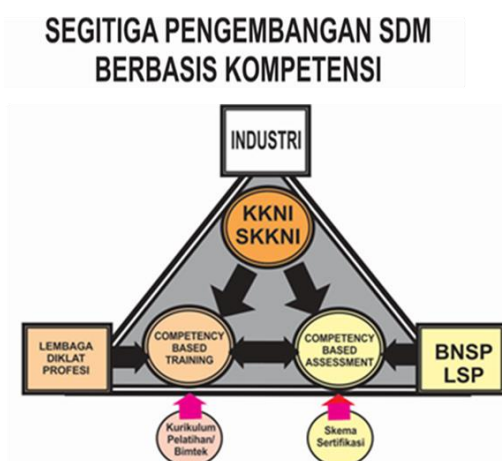


Figure 6. Integration of Human Resource Development Triangle competency-based

## 5 CONCLUSIONS

Global warming is a form of ecosystem imbalance on earth due to the process of increasing the average temperature of the atmosphere, sea, and land on earth. The increase in the average temperature of the earth's surface that occurs is due to increased greenhouse gas emissions, such as; carbon dioxide, methane, dinitro oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride in the atmosphere. These emissions are mainly generated from the process of burning fossil fuels (petroleum and coal) as well as due to deforestation and burning of forests. The energy user sector is the sector with the largest contribution to greenhouse gas emissions.

The use of renewable energy and conservation is mitigation to reduce greenhouse gas emissions. Energy conservation is one of the systematic, planned and integrated efforts to conserve domestic energy resources and improve the efficiency of their use. Energy saving or energy conservation is an action to reduce the amount of energy use. Energy savings can be achieved by using energy efficiently where the same benefits are obtained by using less energy, or by reducing consumption and activities that use energy.

Energy savings can lead to reduced costs, as well as increased environmental value, state security, personal security, and comfort. This energy efficiency is carried out through an energy audit. The cement industry as an energy user is more than 6000 TOE (ton oil equivalent) according to the Minister of Energy and Mineral Resources, No. 14/2012 concerning energy management must implement an energy management system by appointing energy

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