ISO 14001 for the Geothermal World

Melinda M. Camu
29055 Pointe O’Woods Place #206, Southfield, MI, 48034 U.S.A.
melcamu@yahoo.com

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ABSTRACT

It was reported that if all geothermal power projects become operational by their target completion dates, the world may attain a geothermal capacity of 13,402 MW by 2017.

As the excitement grows for developing and utilizing this renewable energy resource across countries, this also gives rise to a global concern for environmental protection and preservation. Although the perceived impact of geothermal energy development and utilization is considered low compared to the impact caused by other energy sources (e.g., thermal power plant emissions and nuclear plant facility waste), still, as with other business and energy industry operations, a simple oversight, an unrecognized gap, or prolonged unresolved concerns can bring about serious consequences, project delays, major financial loss, or even lead to the mothballing of the project.

The ISO 14001:2004 is a voluntary international Environmental Management System standard developed by the International Organization for Standardization to promote environmental protection. Accordingly, the number of companies that acquired ISO 14001 certification increased to 285,844 at the end of 2012 across 167 countries - a considerable increase of 9% compared to the previous year 2011. In spite of such numbers, not all of the installed geothermal facilities or ongoing development projects are ISO 14001 certified. Hence, this paper will present the rationale for establishing the ISO 14001 environmental management system in the geothermal industry, considering that the geothermal energy development is a timely response to the global challenges for sustainable development.

By using several energy companies as role models, this paper aims to amplify that the ISO 14001 international standard for environmental management system is beneficial and integral to the geothermal operations, worldwide.

1. INTRODUCTION

The Geothermal Energy Association cited that if all geothermal power projects become operational by their target completion dates, the geothermal industry could deliver to the world as much as 13,402 MW by year 2017. Thus, geothermal power generation would help serve the energy needs of the rising population.

According to the United States Census Bureau, the world population has already reached 7 billion in 2013. It is projected to rise further to almost 8 billion by 2025. The upsurge in population will result to an escalation in the demand for resources, and consequently, an increase in ecosystem disturbance. Hence, even with the great advancement in technology, everyone’s quality of life is threatened unless the global call to action is supported by all nations.

In response, global summits were held to convene and commit government leaders and international organizations towards a common agenda: to achieve sustainable development through the balanced integration of economic development, social development and environmental protection. During the 1992 (Earth Summit) United Nations Conference on Environment and Development held at Rio de Janeiro, Brazil, representatives and participants from 178 countries agreed on developing international environmental management programs. The outcome was the ISO 14000 series of environmental management system established by the International Organization for Standardization (ISO). Among these series, only one has a corresponding certification - the ISO 14001 which establishes the framework and the requirements of the environmental management system. The ISO 14001 that was developed in 1996 was revised in 2004. Furthermore, revision to ISO 14001:2012 is underway to help industries respond to bigger, global challenges.

In direct relation with the increase in population, the world energy consumption is also projected to increase. The U.S. Energy Information Administration (EIA) reported a rise from 524 quadrillion Btu (British thermal units) in year 2010 to an estimated 820 quadrillion Btu in year 2040 (International Energy Outlook 2013). The International Energy Agency (IEA) likewise reported that the world is not on track with meeting the governments’ target of 2°C limit in the average increase of global temperature. Accordingly, this is mainly attributed to the energy sector contributing about two-thirds of the greenhouse gas emissions, more than 80% of which comes from fossil fuels. The development of renewable energy resources to replace fossil fuel consumption is therefore considered a top global priority, and this is where the geothermal world and the ISO 14001 can enter into a highly valuable partnership.

2. THE GLOBAL CHALLENGES

2.1 The Group of 20 (G20) and Economic Development

To promote the world’s economic development, the G20 was formed in 1999. The G20 is composed of finance ministers and central bank governors from countries with large economies: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom, United States.
and the European Union. Accordingly, they represent about two-thirds of the world’s population, supply 85% of the world’s gross domestic product and dominate 75% of global trade.

The 2014 G20 Summit is scheduled on November 15 – 16, 2014 in Brisbane, Queensland. The summit’s agenda are: Anti-corruption, Development, Employment, Energy, Financial Regulation, Fiscal and Monetary Policy, Investment and Infrastructure, Reforming Global Institutions, Tax and Trade.

2.2 The Millennium Development Goals (MDGs) and Social Development

The United Nations established eight Millennium Development Goals following its 2000 summit. The 189 member countries (now increased to 193) and 23 international organizations made commitments to help achieve these goals by 2015.

These MDGs are: 1) To eradicate extreme poverty and hunger; 2) To achieve universal primary education; 3) To promote gender equality and empowering women; 4) To reduce child mortality rates; 5) To improve maternal health; 6) To combat HIV/AIDS, malaria and other diseases; 7) To ensure environmental sustainability; 8) To develop a global partnership for development.

2.3 The Rio+20 and Environmental Protection

The Rio+20 refers to the United Nations Conference on Sustainable Development that took place in Rio de Janeiro, Brazil, on June 20-22, 2012. The seven priority areas discussed in this conference were: Jobs, Energy, Sustainable cities, Food Security and Sustainable Agriculture, Water, Oceans and Disaster Readiness.

Although some positive results were attained arising from the 1992 Earth Summit, the Rio+20 fact sheet issued by the United Nations Conference on Sustainable Development (2012) cited the following remaining concerns.

- Over a billion people still live in poverty, with large areas in the sub-Saharan Africa and south Asia unlikely to meet the MDGs
- Biodiversity declined by 12%, and 20 – 30% of species at risk of extinction, impacted by climate change
- Rising congestion of cities, with one-third of urban population in slum dwelling conditions
- 783 million people without safe drinking water; around 2 million people per year die from diseases attributed to poor sanitation and hygiene
- 925 million people are hungry
- 1.4 billion people without electricity, alternatively using wood, coal, charcoal or animal waste for heating/cooking which further contribute to greenhouse gas emissions (GHG). 60% of total global GHGs are from energy sources, but renewable energy is only 13% of the global energy supply.
  - Alarming climate change: carbon dioxide emissions increased by 38% since 1990, 10 hottest years occurred since 1998.
  - 25% of carbon dioxide emissions absorbed into seas and oceans, threat to coral reefs and marine life.
  - 80% of the world’s forests are publicly owned, but primary forest area decreased by 300 million hectares since 1990. More than 1.6 billion people depend on forests for livelihood.
- Depletion of natural resources, global use rose over 40% from 1992 to 2005
- Land degradation, more than 12 million hectares diversification per year; reduced global food production causing possible 30% increase in worldwide food prices over the next 25 years.

3. GEOThERMAL ENERGY AND ISO 14001 FOR SUSTAINABLE DEVELOPMENT

The strategies and objectives of the G20, the MDG, and Rio+20 are interlinked, reinforcing each other and strengthening the foundation for the three pillars of sustainable development - the economy, the society and the environment.

Economists agree that energy is the prime mover of every economy - local, national, and global. Energy serves as a foundation for sustainability. Electricity is a vital utility to every home, to every facility, to every industry, and largely contributes to the quality of life in every society. On the other hand, energy development and utilization has likewise created an impact to the environment, of which the main global focus right now is the greenhouse gas emissions. Therefore, development of renewable energy resource with maximum consideration for environmental protection is a worldwide goal.

Geothermal is a renewable energy resource available in 90 countries across the globe. Of these countries, 79 have direct use of the geothermal resource, and 24 use the resource for electricity generation. In addition to being a renewable energy resource with lower greenhouse gas emissions, geothermal energy is a reliable and worthy investment based on the reasons presented herein.

3.1 Response to the Group of 20 Agenda:

The Geothermal World has a ready response to the global growth challenge and to six of the G20’s working agenda:...
• Available and increased financing for geothermal development projects in countries with geothermal resource will encourage an investment climate for developing economies (empower development, energy, fiscal and monetary policy, investment and infrastructure).

• Geothermal development projects and operations will create jobs (employment).

• Geothermal development will facilitate the transfer of technology, products, equipment and will enhance business and growth across the developed and developing countries (trade, investment and infrastructure).

• Geothermal energy is a renewable resource that will provide a reliable, locally available (to cushion the impact of oil import shortage and international disruptions), and poses lower risks compared to other energy sources.

• Geothermal energy has the highest capacity factor (72%) compared to bioenergy (55%), hydropower (44 %) wind energy (23 %) and solar energy (13 percent). The geothermal generator produces the highest amount of electricity if operated the entire year at full capacity, compared to the other renewable energy resource generators.

• Geothermal energy is reliable for both peak load (maximum demand) and base load (minimum demand) operations. Its cost for base load operations is most economical compared to energy resource.

3.2 Response to the Millennium Development Goals (MDGs)

Geothermal energy development will facilitate the realization of the MDGs to alleviate poverty.

One such example is the social development in the Philippines’ first geothermal project. Tiwi showcases the transition of a small town from a class 1 to a class 4 municipality. Community benefits brought about by geothermal operations included job and livelihood opportunities, electrification projects, road constructions, college and high school scholarship programs, medical assistance, community training and skills development program, emergency and disaster preparedness plans, and Mothers’ Class to promote family awareness on health and nutrition. The benefits also provided the host community and the local government with monetary share in national wealth and power generation among other benefits.

The Wayang Windu geothermal power plants, operated by Star Energy Geothermal Limited, is another example of a geothermal project that largely contributes to the realization of the MDGs. Star Energy was awarded the Platinum Award for the prevention and management of HIV/AIDS in the work place by Indonesia Ministry of Labor and Transmigration. Star Energy also demonstrated its social responsibility by supporting community livelihood projects (coffee, silk worms, milking cows), providing medical and educational assistance, initiating infrastructure, environment and reforestation projects, including economic empowerment projects like the micro finance program.

Geothermal energy development and operations will significantly help realize goals 1 – 6 on poverty, education, equality and empowerment, protection of life and health. The ISO 14001 international standard will help the geothermal sector realize goals 7 - 8 on environmental sustainability and global partnership for development.

3.3 Response to the Rio+20

Geothermal energy development will address the Rio+20 sustainable development challenge.

• As presented in the response to the G20 and MDG concerns, geothermal development will create jobs, provide electricity to locals, and move the hub of industrial and economic activities outside of the congested cities while still contributing to their commercial growth.

• Having the highest capacity factor and base load reliability among renewable energy sources, geothermal energy will replace fossil fuel to address greenhouse gas emissions in countries with geothermal resource. Other renewable energy resource, like solar and wind energy, are not economical to operate for base loads.

• The life cycle assessment (LCA) for geothermal power plants resulted to greenhouse gas emissions of less than 50 g CO2 eq/kwh for flash steam, and less than 80 g CO2 eq/kwh for enhanced geothermal system (EGS) plants. Comparatively, it is much lower than the LCA for coal which is 675 to 2,689 g CO2 eq/kwh.

• Geothermal energy has established reliability under extreme weather condition. Geothermal power plants efficiently generate electricity in the typhoon besieged countries of Asia, in the hot arid regions of Africa, and in the ice cold countries of Europe and North America. Other renewable energy resource may not serve as a robust and reliable source of power during extreme climate conditions.

• On disaster preparedness concerns, various energy sectors have incurred the following critical incidents and/or major disasters:
  o nuclear power accidents (e.g., 1986 Chernobyl disaster, 1979 Three Mile Island accident,);
  o reservoir dam failures (e.g., 1975 Banquiao Reservoir Dam and Shimantan Reservoir Dam, 1963 Vajont Dam landslide and flood);
  o oil tanker accidents and oil spills (e.g., the 2010 Deep Water Horizon oil spill, the 1989 Exxon Valdez oil spill);
  o oil pipeline accidents (e.g., 1998 Jesse, Nigeria pipeline explosion);
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- oil platform disaster (e.g., 1988 Piper Alpha oil platform disaster);
- refinery disasters (e.g., 2005 Texas City refinery disaster);
- coal mine accidents (e.g., 1972 Buffalo Creek dam failure, 1942 Benxihu Colliery accident, 1906 Courrières coal mine disaster);
- gas processing plant accidents (e.g., 2004 Skikda LNG explosion);
- natural gas pipeline accidents (e.g., 1989 Ufa train disaster);
- power plant accidents (e.g., Kingston fossil plant);
- pollution incidents (e.g., 1952 London smog disaster)

Above incidents magnifies the need for all energy sectors to respond to the Rio + 20 call for disaster preparedness, risk reduction and control, and proactive management. For geothermal, disaster preparedness may involve preventive management and strong safety measures against potential incidents like steam pipeline rupture, landslide and erosion, well drilling incidents, high level hydrogen sulfide exposure, geothermal eruption, climate-triggered flooding or intentional sabotage.

Majority of potential energy concerns are occupational and/or environmental related. Disaster preparedness involves implementing adequate control measures to avert potential threats, and having a ready response to minimize any potential impact caused by possible incidents. Adopting ISO 14001 environmental management system will significantly help streamline support for disaster preparedness in the geothermal industry.

Furthermore, the integration of ISO 14001 environmental management system in geothermal development and project operations will help deliver the Rio+20 green jobs - the synergy of employment, energy and environment.

4. THE VALUE OF ISO 14001 IN THE GEOTHERMAL WORLD

In 2012, the number of companies that acquired ISO 14001 certification from 167 countries increased to 285,844, showing an increase of 9% compared to the previous year 2011.

The top five industrial sectors that obtained ISO 14001 certificates in 2012 were Construction (22,414), Basic Metal and Fabricated Metal Products (17,171), Electrical and Optical Equipment (15,039), Wholesale and Retail, Repair of Motor Vehicles (10,091), and Rubber and Plastic Products (8,966).

If these top five industrial sectors are willing to commit to environmental protection through an environmental management system that conforms to the requirements of ISO 14001 international standard, will the energy industry and the geothermal world do less?

Every energy development has its challenge. Geothermal development, though considered a clean energy source, is not free of concerns. It entails a high investment, but earns magnanimous returns due to its low operating cost and high reliability. It may have social impact, hence affected community residents may petition for the institution of appropriate government policies and company social responsibility programs. However, the silent stakeholder - the environment, from which the renewable energy resource comes from, mainly relies on humanity for its preservation and protection.

Land use impact, air quality and emission, water quality and effluent, waste management and disposal are among the concerns that could be managed effectively and are dependent on the level of commitment of the human stakeholders – the investor, the industry management and personnel, the government leaders, the regulatory officials and the community residents.

The ISO 14001 environmental management system is a voluntary international standard, not a legal compliance requirement. However, the following explanations and scenario justify the need for the ISO 14001’s integration into every geothermal development project and power plant operations:

- Every business and industry needs a system.
- A system needs a standard for reliability, dependability and continual improvement.
- A standard against which performance is periodically reviewed will reduce or eliminate the vulnerability of the system caused by changes in contractor, personnel, management, or company ownership.
- The ISO 14001 standard will sustain the environmental management system of the facility amid variations in stages of operations, changes in technology, operational equipment issues, and changes in management programs and priorities.
- An internationally recognized standard is the best decision, to complement the interplay of global technology, materials, equipment and market across countries and diverse cultures.
- The ISO 14001 is an international standard that will provide the environmental management system framework that will guide the facility towards the realization of its environmental objectives, as well as the company’s mission and vision.
- The ISO 14001 standard will provide the robust anchor for the facility’s environmental management system.
A geothermal facility / project may have an environmental system. However, if it is not ISO 14001 certified, it opens the facility or project to the following risks and vulnerabilities:

- Discontinuity of environmental management programs/projects arising from situations like the retirement or resignation of project leader, change in management priorities, change in contractors, change in ownership and lack of budget allocations.
- Incur environmental risks and incidents arising from major changes in its operation.
- Existence of unrecognized gaps and unidentified risks, thereby compromising safety, health, environmental compliance, and operations’ efficiency.
- Lack of consistent direction. Environmental programs could be bumped anytime.
- Absence of continual improvement efforts, thereby missing on opportunities that may mutually contribute to both environmental management system and operational productivity.
- Lack of environmental performance tracking, causing omissions that could result to regulatory violations and/or incidents.
- Lack of measurement system to determine the adequacy of the current environmental management system.
- Existence of an environmental management system that fails to respond to prevailing environmental concerns.
- Existence of an environmental management system that fails to support regulatory compliance.
- Existence of an environmental management system that is inadequate to sustain geothermal operations.

The ISO 14001 environmental management system has the following requirements: environmental policy, planning, implementation and operation, checking, and management review, all linked together in the framework cycle of continual improvement. If said elements and framework are not applied, the facility’s environmental management system may be reactive to compliance issues but neglects other potential risks and fails to resolve recurring problems. The facility’s environmental funds and activities may also be mostly focused on monitoring, thereby overlooking needed allocation for control and mitigation.

The ISO 14001 environmental management system helps to identify and assess such gaps and oversights.

5. ISO 14001 CERTIFIED ENERGY FACILITIES AND COMPANIES
The ISO organization’s call for action is briefly summarized in its short statement, “Environmental problems like pollution and climate change do not stop at borders. So tools for tackling them need to be effective on a global scale.”

Recognizing the value of ISO 14001 in their operation, several energy companies responsibly acted, among which are:

5.1 Iberdrola
Iberdrola is a global energy company operating in about 40 countries. Their products and services include: 1) electricity generation and distribution; 2) renewable energy projects; 3) natural gas production, sale and distribution; 4) telecommunications. Iberdrola is based in Bilbao, Spain, owning a generation mix of nuclear plants, thermal plants, combined cycle plants, hydroelectric plants and wind farms.

Iberdrola is acclaimed as Spain’s number one energy group and the world’s leader in wind power, positioning itself highly among electric utilities. Iberdrola upholds the business management concept that environmental protection is a worthy investment.

Iberdrola acquired ISO 14001:2004 environmental management system certifications for its different facilities all over the world. Thus, the ISO 14001 delivered to Iberdrola the following benefits:

- Minimized environmental risks, thereby responding to the global commitment for environmental protection;
- Enhanced synergies between businesses, thereby improving internal tools and simplifying procedures;
- Improved training and enhanced environmental awareness of employees and suppliers;
- Strengthened the company image, with public demonstration that Iberdrola is a socially responsible company;
- Earned the business respect of investment analysts and investors;
- Improved resource management, thereby optimizing investments and costs.

5.2 Enel Green Power
Enel Green Power S.p.A. (EGP) is an Italian multinational renewable energy corporation with headquarters in Rome. It has 750 power plants in 16 countries, carrying a total installed capacity of 8,913 MW. EGP has a generation mix of wind, solar, hydro,
geothermal, and biomass. EGP claims to apply the strategy of integrating the best practices in its business operations and value chain, as manifested by incorporating the environmental management system international standard among others.

EGP incorporate the ISO 14001 environmental management system into various phases of its energy development and operation - from construction phase to the management of the power plant facilities.

By acquiring ISO 14001:2004 certifications in all its sites, EGP obtained the following benefits:

- The ISO 14001 environmental management system provided the framework to prevent, monitor and reduce potential environmental impact;
- The ISO 14001 environmental management system provided support to realize the effective and efficient management of renewable resources;
- Overall, the ISO 14001 environmental management system helped improve the competitiveness of the production system and maintaining secure energy supplies.

5.3 Kamojang Geothermal Field
The Kamojang geothermal field, located in West Java, supplies steam to Indonesia’s first geothermal power plant that has a total combined capacity of 140 MWe for its three generation units. PT Pertamina (now PT Pertamina Geothermal Energy) established an environmental management system for the Kamojang geothermal field in accordance with the ISO 14001 standard. The certification was acquired in December 2002. The ISO 14001 environmental management system is audited annually and the certificate renewed accordingly. This approach helps ensure that all potential hazards and environmental issues from the operation are identified, managed and documented. Accordingly, the ISO 14001 proved to be a useful tool in improving resource management at the Kamojang geothermal field.

In recognition of the company’s environmental commitment, Pertamina Geothermal Energy (PGE) received the following:

- Golden Padma Award – awarded by Indonesia’s Department of Energy and Mineral Resources
- PKBL Award – the North Sulawesi Province Award, as best in implementing partnership and environmental development programs
- Environmental Management Award – as main winner for geothermal mining activity in the Kamojang and Lahendong areas.

5.4 Wayang Windu Geothermal Power Generation
Wayang Windu Power Generation located in West Java, Indonesia is operated by Star Energy Geothermal Limited, under a joint operation contract with Pertamina and sales agreement contract with PLN to develop up to 400 MWe. The generating units include: Unit 1 (110 MWe, 1999), Unit 2 (127 MWe, 2009), Unit 3 (127 MWe, 2014), to be followed by Unit 4.

Star Energy is certified to both ISO 14001 and OHSAS 18001, manifesting the company’s commitment towards environmental protection and safety. The ISO 14001 certification was acquired in 2007.

The key values and goals of Star Energy and Wayang Windu Geothermal are environmental excellence, zero harm and optimum performance.

With the help of ISO 14001, Star Energy achieved its goal for environmental excellence and was recognized as top ranking in the national environmental and corporate social responsibility audit in 2008.

5.5 Landsvirkjun
Landsvirkjun manages and operates 16 power plants in Iceland, a generation mix of hydropower and geothermal energy. All of the company’s operations are certified to the ISO14001 international standard. Along with its environmental policy, the company embraces a culture of transparency and open discussions on issues related to potential environmental impact of its activities.

Landsvirkjun has worked on binding carbon by planting vegetation and maintaining the forests to reduce greenhouse gas emissions. Landsvirkjun’s declared policy is to become a carbon neutral company.

Additionally, Landsvirkjun allocates funds for environmental and energy research, awarding them as grants to students and institutions.

5.6 Other Geothermal Companies / Contractors
Mannvit is an international consultancy company based in Reykjavik, Iceland, and offers services ranging from environmental to project management inclusive of engineering, procurement and construction management. The company’s market coverage includes geothermal energy, hydroelectric power, energy transmission and distribution. The company has acquired certifications for ISO 14001:2004 and ISO 9001:2008 to sustain its consultancy and contract operations.

Reykjavik Geothermal Limited is a geothermal development company based in Reykjavik, Iceland. It has managed development projects in more than 30 countries, and is the owner and developer of the geothermal power plants in Hellisheidi, Iceland. Reykjavik Geothermal has acquired ISO 14001 certification on environmental management, and related certifications like OHSAS 18001 for occupational health and safety and ISO 9001 on quality management.
6. CONCLUSION

The international global agenda highlighted the following:

1. The economy cannot move forward without energy development, and energy shortage will directly impact the people’s quality of life;
2. The environment cannot be further compromised, and its neglect or abuse will eventually impact the life and survival in this planet.

Hence, everyone has a role to play towards defining the global future – a choice between environmental protection, or this planet’s degradation.

How about the geothermal sector’s role?

Geothermal energy development and operation is a reliable source of energy to replace fossil fuels and address greenhouse gas emissions. However, it is not totally free of challenges and concerns. Geothermal development can support the global concerns raised during the summits of the G20, United Nations’ MDG and the Rio +20, but it needs the ISO 14001 international standard to provide a stable framework and robust anchor of every development project or power plant’s environmental management system.

The ISO 14001 certification offers the following benefits to the geothermal industry stakeholders:

- To the investor - security of investment and assurance that the project will proactively address potential environmental issues.
- To the geothermal industry management and personnel - clarity in environmental management system and direction, and efficiency in project implementation.
- To the community - assurance that the environment is protected and maintained, thereby providing them with healthy and safe living conditions.
- To the government, country and locality – delivery of a reliable, renewable energy resource to support the country’s economy, respond to society’s needs, and protect the environment.

Therefore, a strong partnership between the Geothermal World and the ISO 14001 international standard will deliver the global goal of sustainable development.

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