



TÜV Rheinland White Paper on Status and Development of Energy Management Systems



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01

Preface



Ever since the industrial revolution, production activities undertaken by mankind have pushed the concentration of greenhouse gases to new heights. As a result, a collection of severe weather issues has arisen, directly threatening our future. Emissions from energy production and utilization account for two thirds of the total greenhouse gases in the world, in view of which, countries start contemplating how to effectively minimize global warming and resolve a shortage of energy. In addition to the introduction of carbon emissions reduction and emissions trading, another perspective starts with the energy management system. Formulation and implementation of an energy management system within an energy-consuming enterprise, as well as gradual reduction of energy consumption or enhanced utilization rate of energy, will simultaneously achieve the goal of emissions reduction. As the largest producer and consumer of energy in the world, China experiences a significant contradiction in energy demand and consumption.

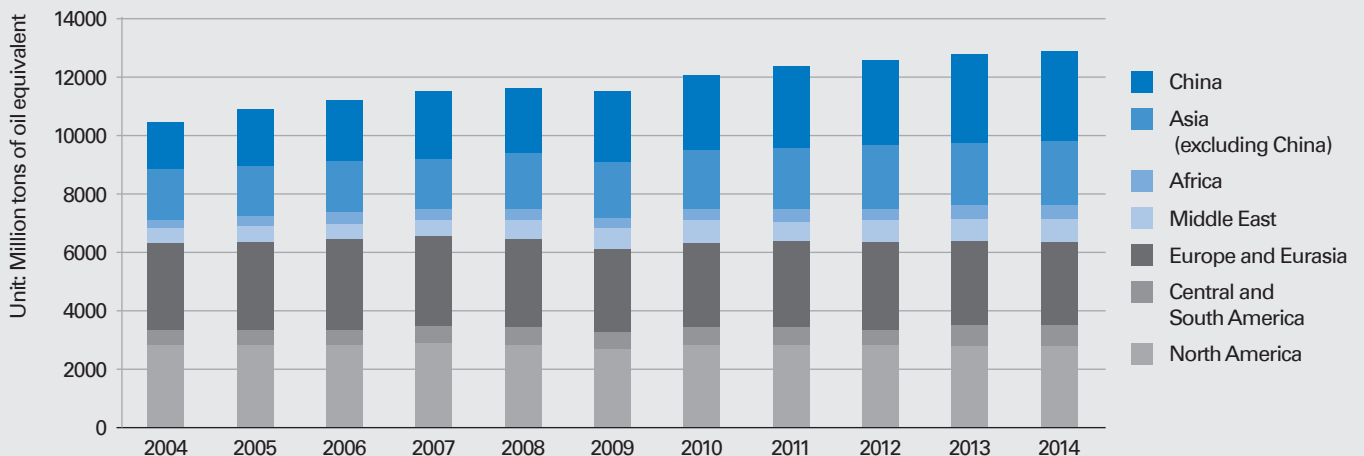
TÜV Rheinland published the 2016 White Paper on Status and Development of Energy Management Systems, which summarizes the practical experiences in energy management on a global scale. According to this publication, many recommendations with respect to these following areas are provided: current status of global energy, Chinese issues on energy consumption, policy-specific directions, and issues and lessons learnt from the development of energy management systems. For business sectors engaged in high energy consumption or low-ratio energy utilization, these will help them understand energy management systems and seize opportunities for energy conservation and emissions reduction. In addition, they will make correct business decisions and identify the direction of corporate development.

02 Global Landscape of Carbon Emissions and Energy Consumption

Energy consumption always goes hand in hand with economic development. Over the past two years, a global economic depression has lowered energy consumption to a certain extent. In 2015, the global primary energy consumption only increased by 10%, which was lower than the growth rate of 1.1% in 2014 and even lower than the average growth rate of 1.9% over the last decade. Excluding the global economic recession in 2009, 2015 reported the lowest global economic growth following 1998. It is noteworthy that China is the country with the largest total carbon emissions of 10.4 billion tons, accounting for 29%. The United States comes in second with 5.2 billion tons, accounting for 15%, and Europe reports 3.4 billion tons, accounting for 10%. Meanwhile, India accounts for 7.1%. Growth in carbon emissions correlates with global economic recovery and growth in carbon intensity, which is significantly noticeable in developing countries.



Percentage of Global Primary Energy Consumption in 2014



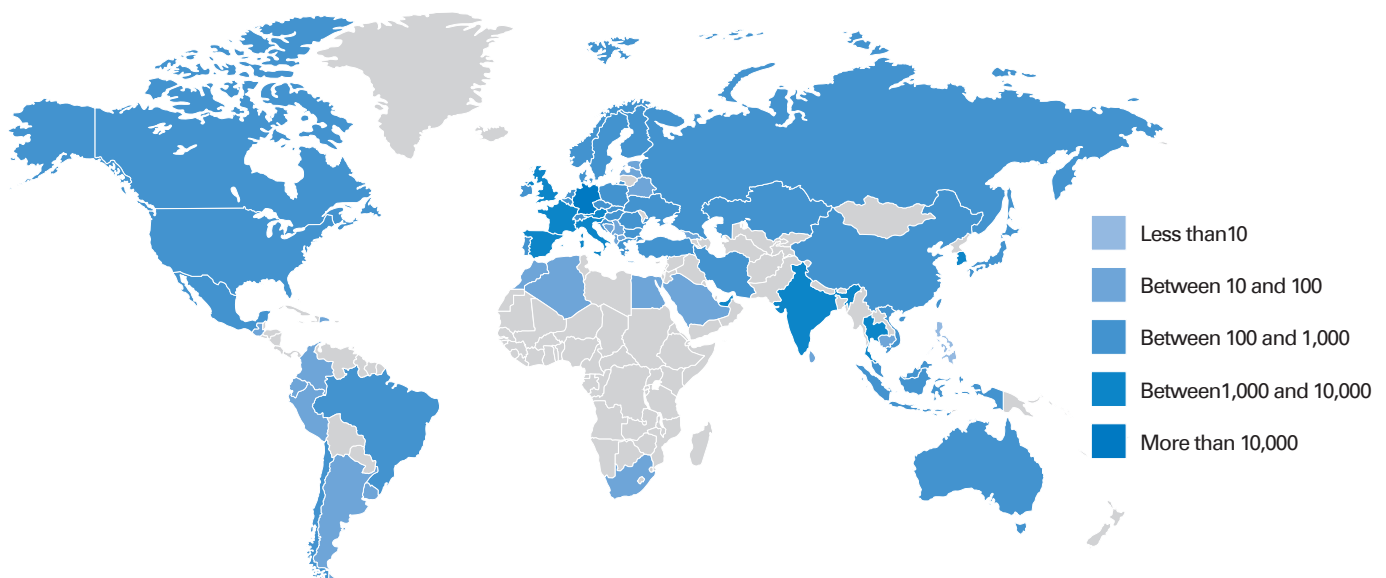
Source: BP Statistical Review of World Energy 2016

03 Standardization Process of Energy Management Systems

To address the prevalent standards governing energy management in different countries, the United Nations Industrial Development Organization (UNIDO) in 2007 proposed a concept with respect to collaboration on formulating energy management standards. Following multiple rounds of discussions and modifications, the ISO officially promulgated the ISO 50001 Energy Management Systems - Requirements with guidance for use, EnMS.

According to annual statistics published by the ISO, the ISO 50001 Energy Management Systems witnessed a super high growth rate in 2012, and even a compound growth rate of 74% in 2013 and 2014. What lies beneath such data is a significantly noticeable sign of energy shortage along with the institution of energy management in countries. Currently, the major market for energy management systems concentrates in Europe, where Germany enjoys the highest market share (with an issuance of 3,402 certificates in 2014). Such high market share is closely relevant to the laws and regulations governing the energy implemented in Germany.

World Distribution of ISO 50001

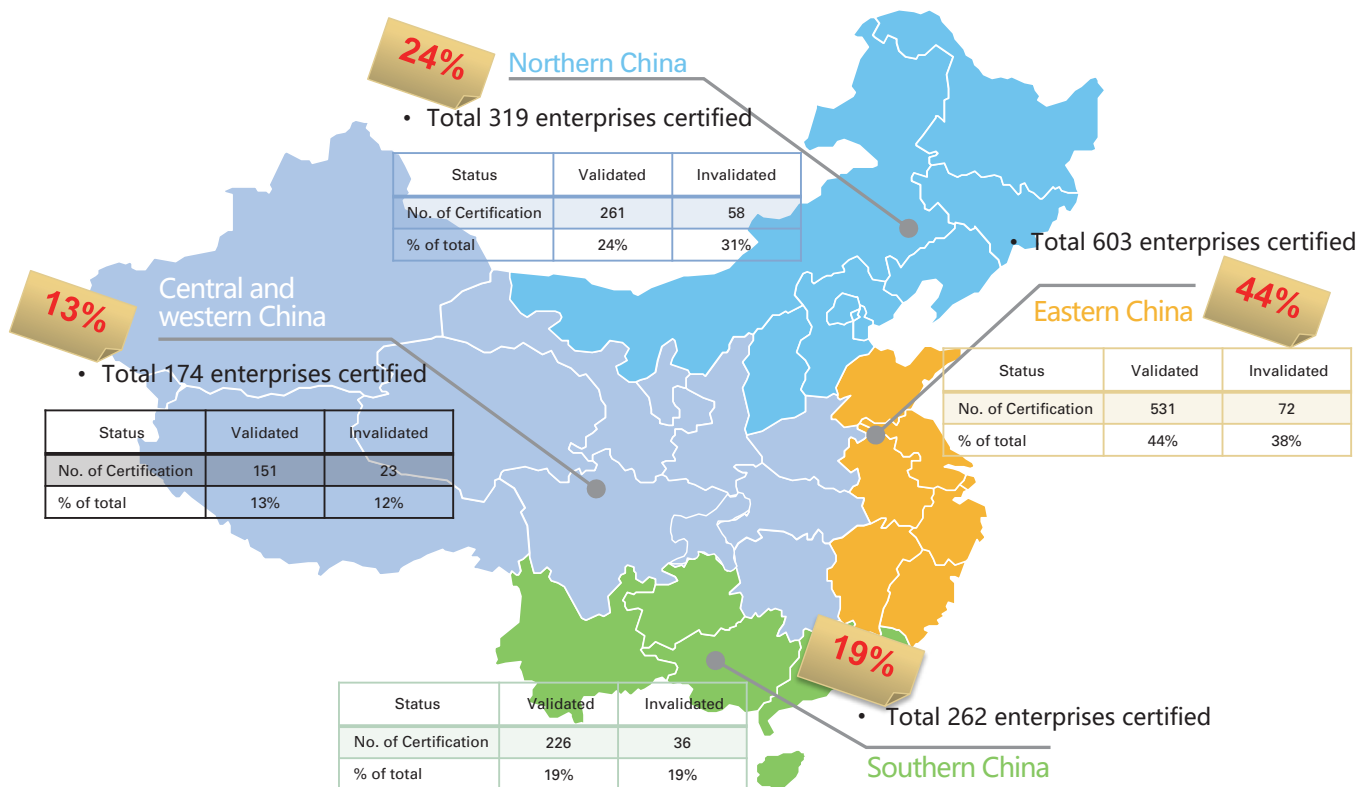


Source: The ISO Survey of Management System Standard Certifications –2014

On December 31, 2012, China promulgated the Energy Management System Requirements GB/T 23331-2012 (idt ISO 50001:2011), which became effective on October 1, 2013. According to statistics available at CNCA, by June 2015, the current effective certificates of energy management systems amounted to a total of 1,169. As comparatively developed areas, the coastal regions report a constantly high level of energy consumption, resulting in the most robust demand for energy management. In the East China region, 531 enterprises are currently in possession of the certified energy management systems, accounting for 44% of the entire market.



China's Distribution of Energy Management Standard Certification



Source: Certification and Accreditation Administration of the People's Republic of China, Analysis of TÜV Rheinland Greater China Marketing

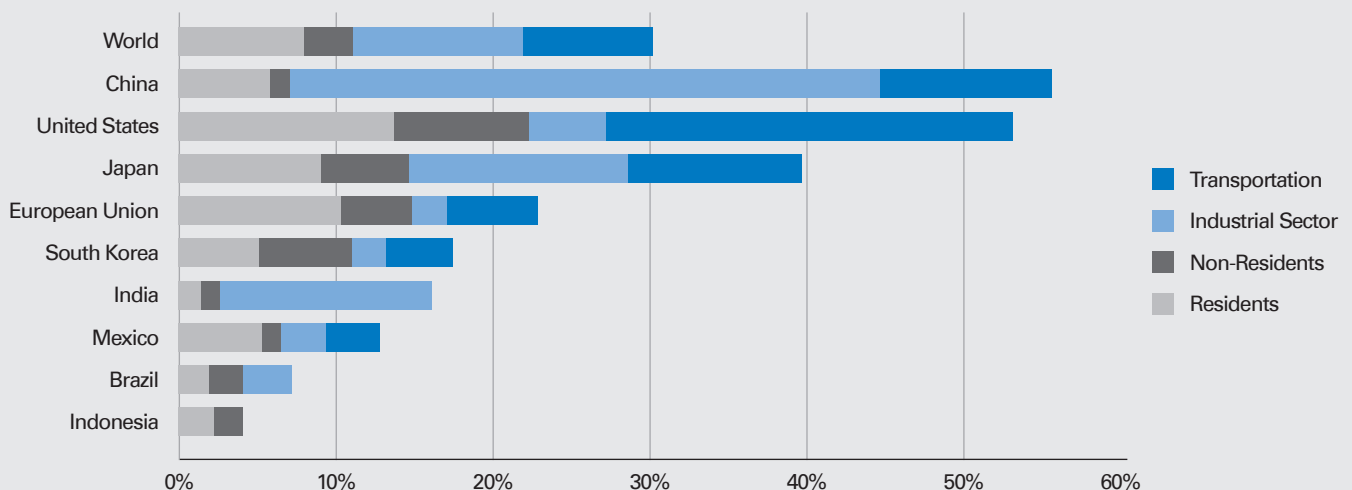
04 Market Growth of Energy Efficiency due to Chinese Policies

As a country mostly committed to implementing the most thorough policies and action plans on energy efficiency in the world, China always implements policies and action plans that play critical roles in catalyzing investment and improvement in energy efficiency.

Over the past decade, China's policies on energy conservation have witnessed a significantly increasing percentage to cover energy consumption. Prior to 2005, few mandatory standards or laws and regulations were implemented that required compliance from the industrial sector. However, the implementation of an energy conservation policy framework is currently underway to cover all business sectors, which is consistent with the growth rate of 59% in energy consumed by the industrial sector from 2005 to 2013. The terminal energy consumption of the industrial sector in China accounts for the largest percentage, while that of the industrial sector in the United States and the European Union accounts for a smaller percentage than other business sectors.



Terminal Energy Consumption Volume of Business Sectors Covered under Mandatory Policies on Energy Efficiency

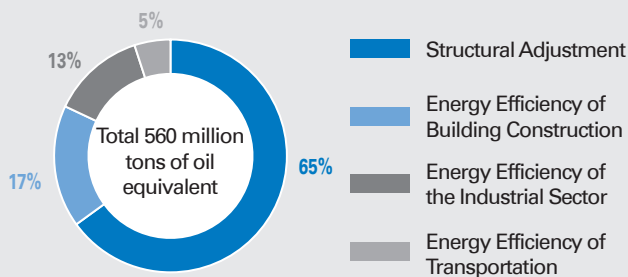


Source: Energy Efficiency Market Report 2016

According to the “13th Five-Year Plan”, China caps energy consumption for the first time up to 3.5 billion tons of oil equivalent. In addition to this cap, China wishes to reduce energy intensity by 44% from 2005 to 2020. In other words, 15% must be reduced from 2015 to 2020. In compliance with the “13th Five-Year Plan” already in circulation, the Energy Development Strategy Action Plan (2014 to 2020), and other documents for the energy development strategy, energy development planning under the “13th Five-Year Plan” will focus on the following two aspects:

- Primary Mission: To control consumption of coal and charcoal and optimize the energy structure
- Core Contents: Energy security and utilization rate

Percentage of Different Initiatives for Energy Conservation under the “13th Five-Year Plan”



Source: Energy Efficiency Market Report 2016



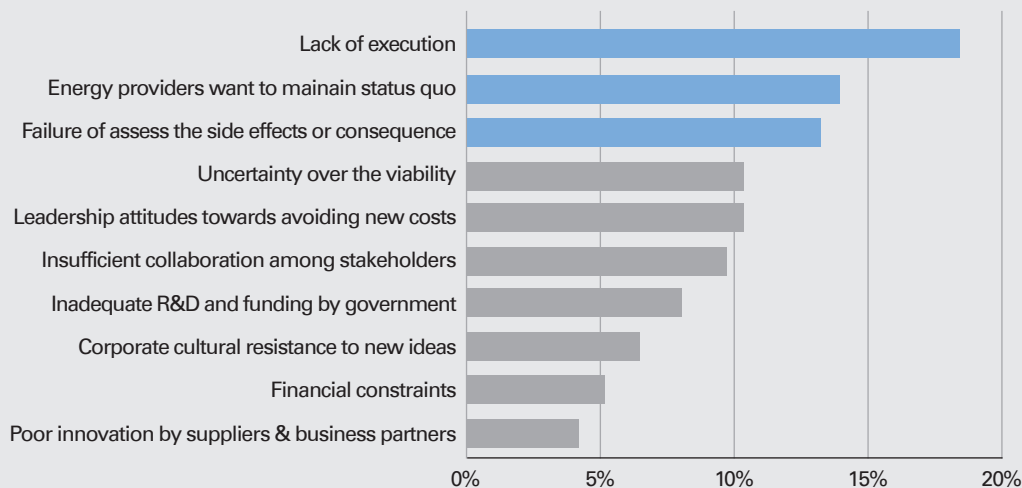
05 Barriers for Successful Development of Energy Management Systems

Lack of Execution as the Primary Factor

China increasingly stresses importance to the potential of energy conservation in various business sectors. Numerous mainstay businesses with high energy consumption, including steel and cement businesses, apply a series of technologies and management measures to minimize energy consumption. Currently, however, these technologies and management measures fail to operate in full swing due to enterprises' insufficiency in management philosophies, techniques, and capacities for energy efficiency, which in return hinders constant improvement in energy efficiency. Based on the experience and analysis of TÜV Rheinland, major barriers to the successful development of energy management are not technological limitations, but rather the lack of execution power and evaluation failures. In addition, energy providers want to maintain the status quo.



Major Barriers to the Development of Energy Management Systems



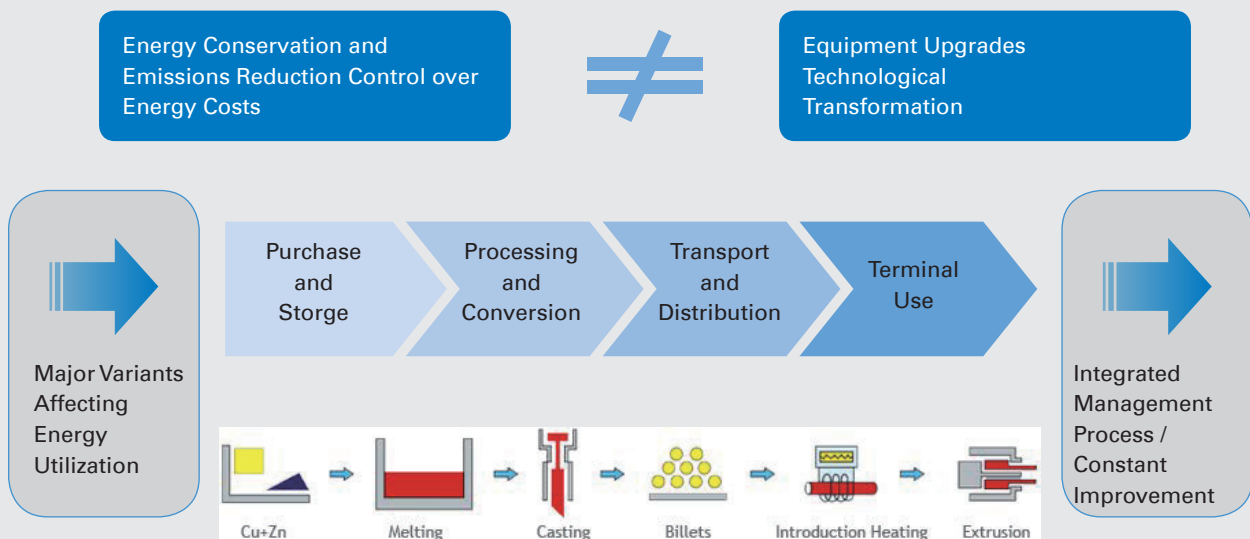
Source: The Future of Energy. A Harvard Business Review Analytic Services Report

Energy Conservation and Emission Reduction are more than Technological Upgrades and Installation of Energy-Saving Equipment

When considering energy conservation, emissions reduction, and control over energy costs, enterprises easily equate these to technological upgrades or installation of energy-saving equipment. Despite instant and direct results in short cycles at moderate costs, the following three noticeable issues continue to exist:

- **Funding limitations:** Due to a prolonged cycle for project investments and approval regarding energy conservation and technological transformation, as well as budget limitations, it is generally believed that energy conservation activities will not proceed without sufficient funding.
- **Disconnection from improvement in daily and basic management:** The misplacement of daily utilization and management disables the constant and effective improvement of energy efficiency by new technologies and equipment.
- **Lack of systematic and thorough manners:** Although certain enterprises resolve the funding issue by contracting energy management solutions, dependence on technical means only provides partial improvement, which is not developed in a systematic manner.

Energy Management and Industrial Process



Source: TÜV Rheinland Systems



Pain-points in Implementation of Energy Management Systems

Energy has already become a critical indicator for numerous enterprises, amid which energy conservation means to save operating costs. By optimizing energy consumption, energy consumption giants will see a significant improvement in the efficiency of energy utilization, thus alleviating the amounting pressure from competition and costs. According to the discoveries by TÜV Rheinland through constant practice, enterprises may easily encounter the following conditions when establishing and implementing energy management systems:

- Technological transformation is completed with no further improvement required for energy efficiency, thus facing a bottleneck.
- Identify room for improvement in energy efficiency, but misunderstand energy conservation requires further enormous investments.
- Do not know where to start energy conservation due to lack of systematic monitoring, measurement, and analysis relating to energy efficiency.
- Completely fail to identify any opportunity to achieve energy conservation, as they believe their equipment and facilities are well developed and production is stable.
- Subjectively believe energy costs can be ignored, as enterprises account for a small percentage of total costs. However, energy costs usually are equivalent or higher than labor costs, even when purchasing raw materials for production, which is accounted as fixed costs, is excluded.
- Fail to consider emissions reduction from the perspective of energy conservation, which enable them to sell the quota balance and capture market opportunities. Instead, they may ignore limitations on carbon emissions and purchase the emissions quota when carbon emissions exceed the limit.

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