Energy Efficiency and Management Systems

White Paper

Dr. Cem Onus, Managing Director, DEKRA Audit North America

Energy efficiency, especially when reinforced with strategic management, organizational learning, systems thinking, and an energy management system, is the most effective approach for dealing with climate change.

Business managers in the U.S. automotive manufacturing industry may have an opportunity to increase their companies' performance by evaluating the decision-making process for their company's energy-efficiency (EE) projects in their facilities. Major studies have revealed that EE projects have about a 50% implementation rate in the U.S. industrial sector.

The financial cost of purchased fuels and electricity in the U.S. motor vehicle industry totals about $2.7 billion annually (U.S. Census Bureau, 2015). This cost is not significant when juxtaposed to the $695 billion dollars in value of shipments for this industry during the same year; however, there is potential room for energy performance improvement (U.S. Census Bureau, 2015). Automotive companies have an opportunity not only to cut energy costs but also to reduce harmful emissions (Galitsky & Worrell, 2008; Moynihan & Triantafillu, 2012).

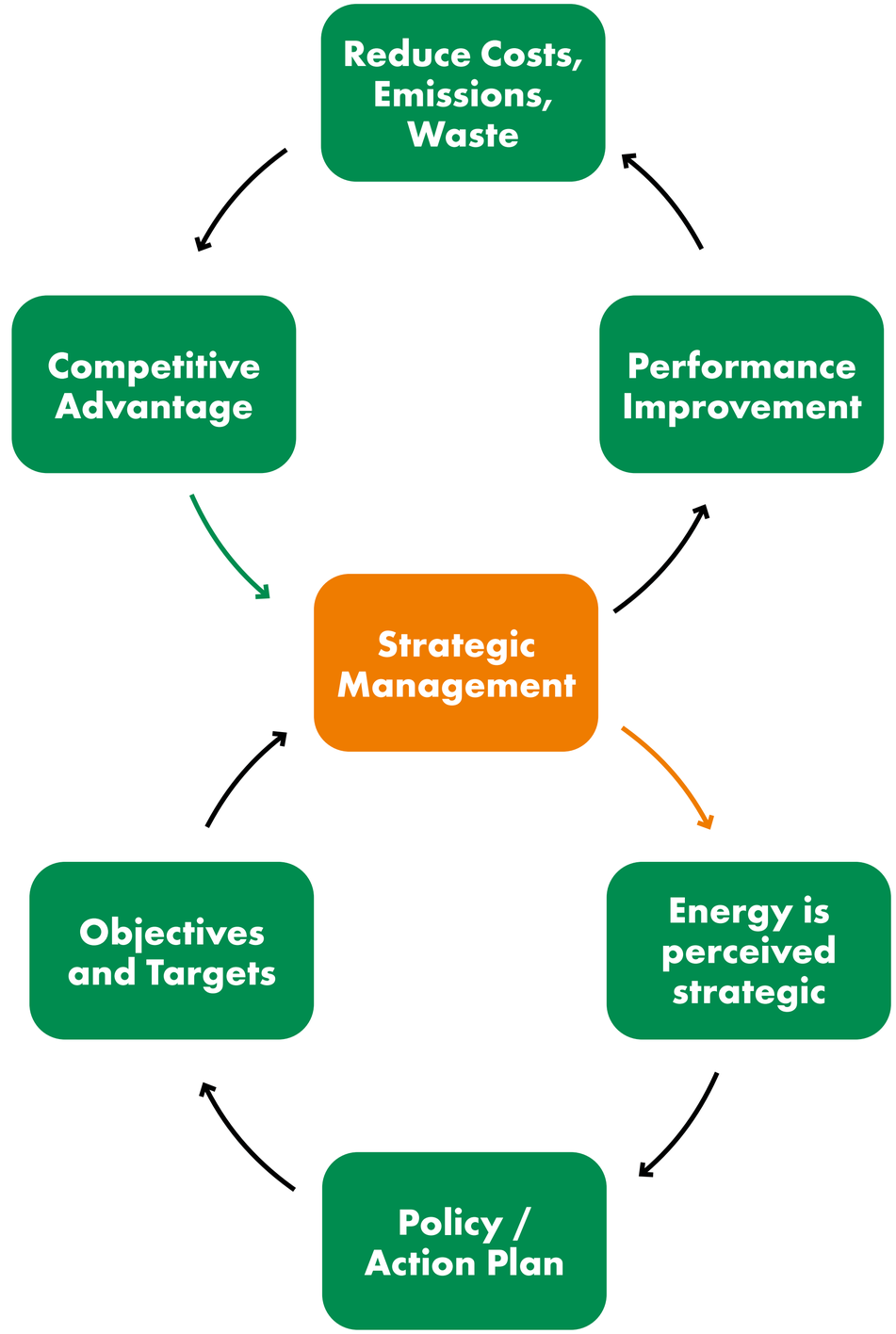
Strategic Management

The emergency of energy performance in production as a strategy

Efficiencies of energy use in the production processes of the U.S. automotive manufacturing industry have the potential to lower costs and, more importantly, anthropogenic emissions. According to research, the automotive manufacturing industry is responsible for 15% of global carbon emissions. Energy efficiency is the most cost-effective and efficient way to deal with the global financial and environmental problems caused by increasing energy demand. The automotive industry has the potential to decrease its energy usage with minimal or no capital expenditure by implementing behavioral changes.

Energy efficiency is the ratio between output of performance, service, or goods, and input of energy. Despite the fact that energy efficiency of a system or a process is essential to the control of energy consumption and energy costs, many industrial companies lack appropriate methods to effectively address energy efficiency in a comprehensive manner.

According to Kiron, Kruschwitz, Haanaes, and Von (2012), most managers believe sustainability strategy is a competitive necessity. Strategic management of energy



efficiency will require that top-level management commit to energy performance improvement. In terms of systems thinking, The diagram below illustrates the causal loop diagram for continual energy management dynamics under the scope of strategic management.

Our research shows that strategic management plays a significant role in energy efficiency projects; however, financial decision-making criteria for EE projects need alignment with strategic objectives.

Leaders in the automotive industry should evaluate how strategic management systems can help align top-level corporate objectives and day-to-day decision-making processes.

Organizational Learning

Organizational learning may be the only competitive advantage for firms. Adaptation to an environment requires individuals and organizations to learn, and organizational learning is an essential source of sustainable competitive advantage. According to research, an organizational manager's style of leadership plays a critical role in developing organizational learning.

Top managers are starting to think about how their responses to social and environmental issues affect their bottom line (Pagell & Gobeli, 2009). In response to this shift in managerial thinking, academics posit that organizational learning is a viable strategy for the automotive industry in order to manage the continually changing environment (Omar, Mears, Kurfess, & Kiggans, 2011).

Omar et al. (2011) posited that organizational learning in the automotive industry is a strategy for providing the OEMs with sustainable resources for innovation and responding to the changes in the operating environment. Continual learning is a strategic choice for OEMs to gain and maintain a competitive advantage (Omar et al., 2011).

According to Marksberry et al. (2011), Toyota's problem-solving methodology is successful because it utilizes the Plan-Do-Check-Act (PDCA) cycle and continuously improves the processes by repeating the learning cycle.

OICA (2012) stated, climate change due to human activity is probably the greatest challenge facing society in the 21st century. Public acknowledgment of the role of human-caused climate change by international organizations, such as the OICA, is a great start; however, as pointed out by Ijose (2010), companies should look to change their culture in order to learn and take action toward solving problems. Collective action by organizations and companies must start now to tackle the universal waste of natural resources during production processes.

Lozano (2012) studied a major automotive manufacturer and concluded that orchestrated organizational systems changes, for sustainability initiatives, that are planned and labeled offer the most proactive options for companies to initiate sustainability options. Wells and Nieuwenhuis (2012) argued that such transformation of organizations' structures, economic relationships, social and cultural attitudes is fundamental to create new sustainable mobility.

Systems Thinking

As a management concept, systems dynamics is an approach to studying complex systems, such as an organization. According to Senge (2006), systems dynamics deals with how organizations change through time. The U.S. automotive manufacturing industry is constantly changing, and organizations that make up the industry are in a constant state of flux; therefore, this concept is particularly important to the automotive industry. Senge (2006) expanded on the idea of systems dynamics under the label of systems thinking. Senge described systems thinking as a discipline for managers for visualizing organizations as a whole. Systems thinking is made up of four components: holistic thinking, operational thinking, interactive design, and self-organization.

- **Holistic thinking:** Holistic thinking involves process orientation, where managers focus on the whole system instead of the components. Seeing the whole requires managers to understand the structure, function, process, and context.
- **Operational thinking:** Operational thinking (or dynamic thinking) refers to the principals of systems dynamics, such as multiloop feedback systems, identification of the delay effect, and barriers to growth. Analytical thinking helps organizations to be good at the particulars, whereas systems thinking helps organizations to be good overall. Through dynamic thinking, managers gain the perspective of internal and external organizational barriers. Real advantage for management in situations is to understand dynamic complexity, not detail complexity.
- **Interactive design:** Interactive design is both the art of finding differences among similar things and the science of finding similarities among different things. Interactivity is the design of the desired future and a search of implementation techniques. Interactivity is a step process of defining a problem, gathering information to solve the problem, formulating a hypothesis, checking correctness of findings, and constructing a solution.
- **Self-organization:** The foundation of new business architecture is the ability of the managers to match the internal competencies with the external market opportunities. Organizations, similar to organisms, must learn to adapt to their environment and continually react with offensive or defensive mechanisms in order to sustain. Self-organization is a movement toward a predefined order.

Systems thinking among departments varies considerably. The concept of systems thinking is very challenging to most managers that are not familiar with the practice. According to systems thinking discipline, managers should be able to see things, such as organizations, as a whole. In the realm of energy management, energy efficiency systems are thought to be related to equipment, or network of equipment, such as an HVAC system. Our research responses suggest that the concept has limited reach in the automotive industry.

Mass production emerged out of the automotive manufacturing industry in the beginning of the 20th century. Systems thinking simplifies decisions by allowing managers to see the deeper patterns lying behind the events and the details. According to Palaima and Sakriauskine (2010), systems thinking by managers is especially important in manufacturing organizations that must react to global pressures. Palaima and Sakriauskine argued that modern conceptions in

manufacturing organizations stress the importance of a new perspective, which is different from mass production. They stated that this new perspective requires flexible reaction of management to changes and orientation toward integrated solutions is very important.

Energy Management

Industrial manufacturers in the U.S. are facing volatile energy markets, stiff competition, and potential regulation of greenhouse gases, so they are considering energy management as a way to gain competitive advantage and risk management. Despite the fact that energy efficiency of a system or a process is essential to the control of energy consumption and energy costs, many industrial companies lack appropriate methods to effectively address energy efficiency in a comprehensive manner. Plants with energy management programs can still save 10% to 15% more energy by using best practices to increase their energy efficiency. Many organizations implement problem-solving techniques to increase performance based on best practices, the idea that whatever works for a particular company must be the best approach. Information can give companies a competitive advantage, and information about energy management may provide competitive advantages to companies.

Industrial energy use accounts for about one third of global energy demand; therefore, optimizing Energy Efficiency (EE) is essential to industrial competitiveness and an important element in mitigating climate change. EE is cost effective, clean, and creates numerous jobs. Conserving energy was widely regarded as an untapped energy resource. Companies in all industries agree that sustainability through operational change was essential to remain competitive. In order to improve energy performance, companies need data to analyze usage trends to establish baselines and establish objectives and targets leading up to an action plan. One component metric is EE, the ratio of a unit of energy input per product. In other words, it is the amount of energy used for the production of a product. Systematic energy management is as one of the most effective methods for improving EE in industry.

For manufacturing companies, global warming, rising energy prices, and the increasing ecological awareness of customers have raised energy efficiency to the top of the agenda. Based on a survey of 2,100 mechanical engineers with 20 or more years of experience, we found that 62% of survey respondents said their organizations were interested in designs that use less energy. The current body of knowledge points to significant benefits of EE; however, there are still many barriers for EE improvement. When discussing the barriers to EE investing in the U.S., researchers identified insufficient information, the principal-agent problem, difficulties in gaining access to capital, and the difference in private and social discount rates as the primary hurdles. Imperfect information was the most important form of investment inefficiency that could cause the EE gap.

Citations

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Connect with us:

Email us: sales.us@dekra.com

Call us: +1 215-997-4519

Website: www.dekra.us/audit

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