APPLICATION NOTE
ASSET AND ENERGY MANAGEMENT

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SUMMARY

In January 2014 the *ISO55000*, *55001* and *55002* standards for asset management were released. This series specifies how organizations should manage their assets to achieve their strategic goals and balance the associated performance, risks and costs.

Numerous industries have already developed many standards for related topics. An example of such a standard is *ISO 50001:2011, Energy management systems—Requirements with guidance for use*.

Many organizations are working on improving their energy management and are considering implementing *ISO 50001*. But there are many more aspects to consider, such as safety, quality and finance. *ISO55001*, the standard for asset management, takes all these aspects into account.

Now the question arises whether if it is really necessary to implement more than one standard within an organization? Is it not enough to implement for example only *ISO55000*? This application note compares the *ISO55001* to *ISO50001* and gives a view on the questions above.

Although the standards have different purposes, many elements are the same. An organization that has already implemented one of these standards can benefit greatly during the implementation of the other standards. However, the structure and detailed demands of each standard are different. Even the standards of a single organization, such as ISO, have had different structures in the past. This forced organizations to implement somewhat different administrative systems for separate ISO standards. In 2012, ISO released its new high level structure, which is the structure now incorporated into all of its management systems. In this way, ISO has made a plug-in model for all of its standards such as the *ISO55001* and *ISO9001*. The *ISO55001* that was published in 2014 was developed according to this high level structure. Other standards will follow suit.

The figure below shows a model of asset management, including some of the aspects that can be managed by *ISO55001*.
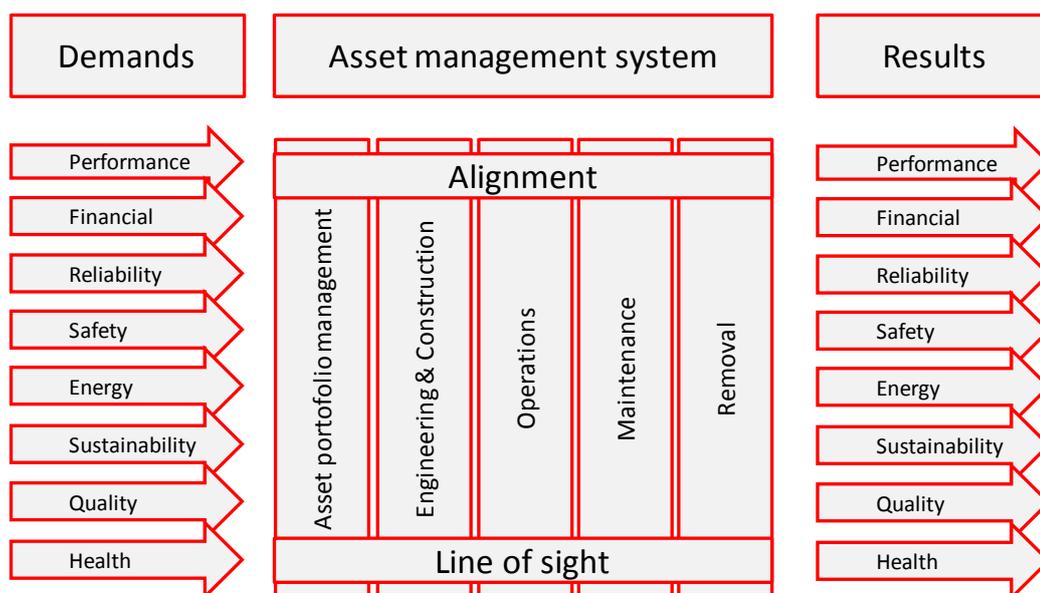

Figure 1 – An asset management model

TERMS AND DEFINITIONS

Asset

Item, thing or entity that has value to the organization. This can range from a road or a building to a production machine, a vehicle or a computer.

Asset Management

Coordinated activity of an organization to realize value from assets.

Asset portfolio

The assets within the scope of the asset management system

Dependability

Collective term use to describe the availability performance and its influencing factors for a product: reliability performance, maintainability performance and maintenance support performance

Energy

Electricity, fuels, steam, heat, compressed air, and other like media.

Energy baseline

Quantitative reference(s) providing a basis for comparison of energy performance

Energy consumption

Quantity of energy applied.

Energy use

Manner or kind of application of energy.

FMEA

Failure mode and effect analysis. A method to establish the risks of a product or process.

Kaizen

Method in which teams of employees implement improvements in their own work place. The Japanese word Kai means change and the word Zen = good.

LCC

Life Cycle Costing. Methodology to establish the lowest integral costs over the total life cycle of the asset.

Management system

Set of interrelated or interacting elements of an organization to establish policies and objectives and processes to achieve those objectives

Organization

This includes any type of organization, ranging from a single person to a multinational corporation or a government institution. In this application note we use the term organization for the organization that wishes to implement the standards.

Product

Result of a process. *IEC60300* distinguishes four types of products:

- Services
- Software
- Hardware
- Processed materials

Performance

Measurable result

Top management

Person or group of people who directs and controls an organization at the highest level

INTRODUCTION

The *ISO55000, 55001* and *55002* standards for asset management were released in January 2014. This series specifies how organizations must manage their assets to achieve their strategic goals and balance the associated performance, risks and costs. These performances, risks and costs include items such as reliability, availability, safety, dependability, energy performance, environmental safety as well as many other aspects. There are already existing standards for many of these topics. These standards range from general management standards to very detailed specifications on how to apply a methodology. There are a vast number of standards including military, aviation, railway, ISO, IEC, and national standards among many more.

This leads us to the question of which of these standards are applicable for a given organization. Does *ISO55000* replace all others? To answer these questions, this application note compares the *ISO55000* standards to another, already existing standards: *ISO 50001:2011, Energy management systems—Requirements with guidance for use*. We selected this standard because it is relevant to organizations interested in the Leonardo Energy Initiative.

The following paragraphs each describe one of the standards. The paragraphs that follow then compare the standards and outline their similarities and differences. Finally, the question is discussed regarding what the practical implications are of implementing one or more standards.

ISO55000: ASSET MANAGEMENT

INTRODUCTION

Asset management has a long history. Although the standards for asset management are new, organizations have been managing assets at some level since the Stone Age. During the last half century, many countries have developed integrated systems for managing their assets and realizing maximum value from them.

Worth mentioning is the *Local Government Act of New Zealand (1974).* This eventually led to the development of the *New Zealand Infrastructure Management Manual (1996).* By 2000 this was further developed to the *International Infrastructure Management Manual*. The focus in these documents was on infrastructure assets, such as roads, waterways and power systems. In 2004 the *Publically Available Specification 55 (PAS55)* was published by the British Standards Institution (BSI). It had the simple title of *Asset Management*. The standard was used by the British government to ensure that assets of public interest, such as energy supply systems and railroads, were well managed. PAS 55 was subsequently widely adopted by organizations around the world. It initially was limited to infrastructure organizations, but later, production companies also started to use the specification.

The International Organization for Standardization (ISO), released the *ISO55000* series of standards for asset management in January 2014. They have been accepted by 32 countries. The *ISO55001* standard specifies the demands for certification of an asset management system. It does not specify how these demands should be met. Each organization is free to fulfill the demands in any way it finds appropriate.

WHAT IS ASSET MANAGEMENT?

There are many definitions of asset management. *ISO55000* defines asset management as: "Coordinated activity of an organization to realize value from assets." This is a very broad definition. The *Publicly Available Specification (PAS)55* was one of the important predecessors of *ISO5500*. It uses a definition for asset management that gives a good insight in the elements of asset management. According to *PAS55*, asset management is:

- *"Systematic and coordinated activities and practices*
- *through which an organization optimally and sustainably manages its assets and asset systems,*
- *their associated performance, risks and expenditures*
- *over their life cycles*
- *for the purpose of achieving its organizational strategic plan."*

There are a number of important elements in this definition. First of all, the activities in asset management should be "*systematic and coordinated*". Just having a set of procedures for each separate department is neither systematic nor coordinated. This demand requires that all departments know what the others are doing and that they cooperate.

Secondly, the system should be aimed at "*optimally and sustainably managing the assets and asset systems for the purpose of achieving its organizational strategic plan*." This means that every decision in asset management should be based on this organizational strategic plan. Investments should be made, based on the long-term requirements of the organization, not on the lowest investment required. Maintenance plans should be based on the impact of equipment failure for the strategic plan, not purely on the technical specification of individual components.

The third asset management concern aims at optimizing performance, risk and expenditures. Therefore it must be clear what level of performance is required by the organization, what the costs will be if the level is not achieved and what level of risk is the organization is willing to accept.

Fourth asset management concern includes all activities over the entire life cycle of the assets. It is not just about maintenance or engineering. It includes among others:

1. Investment decisions: which assets do we need to fulfill the strategic plan?
2. Engineering: how should these assets be designed?
3. Utilization: how to operate the assets?
4. Maintenance: what maintenance activities are needed?
5. Removal, demolishing or recycling of the assets.

This definition gives us a good starting point of how to implement asset management
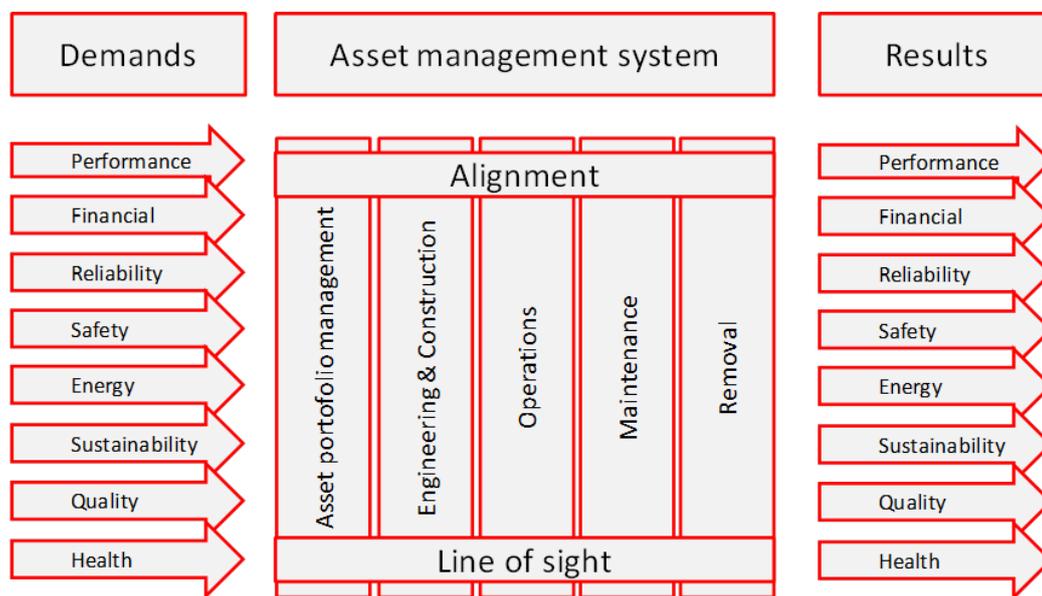
Figure 2 – An asset management model (repetition of figure 1)

MAIN ELEMENTS OF ISO55000

The standard consists of three parts:

ISO55000:   *Overview, principles and terminology*
ISO55001:   *Management systems—Requirements*
ISO55002:   *Management systems—Guidelines for the application of ISO55001*

The requirements in the *ISO55000* series consist of seven elements:

1. General
2. Context of the organization
3. Leadership
4. Planning
5. Support
6. Operation

7. Performance evaluation
8. Improvement

GENERAL

All asset management activities must be aimed at fulfilling the organizations strategic plan. Therefore the company must have an asset management policy describing the goals and conditions for the management of physical assets. This includes all activities, ranging from portfolio management (which assets do we need), through the design, building, operation and maintenance phases to demolishing the assets and asset systems.

Asset management impacts all aspects and every department of an organization. It connects many activities and functions that would otherwise remain isolated.

CONTEXT OF THE ORGANIZATION

When setting up an asset management system, the organization should take into account all internal and external contexts such as cultural, social, economic and physical environments as well as inputs from all stakeholders.

This paragraph in the standard contains the elements:

- Understanding the organization and its context
- Understanding the needs and expectations of stakeholders
- Determining the scope of the asset management system
- Asset management system

LEADERSHIP

Top management must develop an asset management policy and make sure it is aligned with the objectives of the organization. Management at all levels must be involved. Roles and responsibilities must be clear.

This paragraph in the standard contains the elements:

- Leadership and commitment
- Policy
- Organizational roles, responsibilities and authorities

PLANNING

The organization must develop an organizational plan that specifies how the organizational objectives will be met.

This paragraph in the standard contains the elements:

- Actions to address risks and opportunities for the asset management system
- Asset management objectives and planning to achieve them

SUPPORT

The resources needed for the asset management system should be coordinated, and often shared. Asset management objectives must be clear for the entire organization. Data systems must be in place and effective. It must be clear what competency employees should have.

This paragraph in the standard contains the elements:

- Resources
- Competence

- Awareness
- Communication
- Information requirements
- Documented information

OPERATION

The asset management system enables the control of the organization's asset management activities. This includes functional policies, technical standards, processes and procedures. Outsourced activities also must be under control.

This paragraph in the standard contains the elements:

- Operational planning and control
- Management of change
- Outsourcing

PERFORMANCE EVALUATION

The organization must measure and evaluate if its asset management objectives are achieved.

This paragraph in the standard contains the elements:

- Monitoring, measurement, analysis and evaluation
- Internal audit
- Management review

IMPROVEMENT

Organizations, environments and demands are constantly changing. Continual improvement is applied to the assets, asset systems and the asset management system.

This paragraph in the standard contains the following elements:

- Nonconformity and corrective action
- Preventive action
- Continual improvement

ISO50001: Energy management

In standards that cover entire assets or products, such as the *ISO55000* series, there is not a special chapter about energy management. It is considered to be a demand, such as reliability or environmental safety.

Carbon-based energy reserves are running out and CO_2 emissions are causing dramatic climate change. So there are good reasons to pay special attention to energy consumption. Still many companies neglect it however, because energy consumption inefficiency is not noticed in daily practices, unlike quality problems or breakdowns.

Governments in many countries have set standards in recent decades for reducing energy consumption and carbon dioxide emissions from their citizens and companies. In 2009 the European Committee for Standardization (CEN) published *EN 16001:2009 Energy management systems*.

The United Nations Industrial Development Organization (UNIDO) also started working on standards to reduce climate change, recognizing that industry around the world needed to mount an effective response to climate change. In 2007, it asked the ISO to develop a standard for energy management. A team from ISO consisting of members from 44 countries together with observers from 14 additional countries, developed a standard, , UNIDO and the World Energy Council. In 2011 ISO published *ISO 50001:2011 Energy management systems— Requirements with guidance for use*. Because of the release of *ISO50001,* the CEN withdrew the *EN16001* standard.

Main elements of ISO50001

The goal of an energy management system is to deliver a systematic approach for continuously improving energy efficiency and energy consumption. *ISO50001* contains requirements on measurement, documentation and reporting, design and procurement practices for assets, processes and personnel related to energy performance.

The standard does not set specific targets. It does however demand continual improvement of energy performance. The standard applies to any type of organization. It contains the following elements:

General
This paragraph specifies that the organization must have a system with clear boundaries that specifies how to improve energy performance.

Management responsibility
The most important aspect of this element is that top management should appoint an energy management representative and a team that are responsible for setting up and implementing the system. Top management must facilitate the team and ensure compliance with the system.

Energy policy
The energy policy must contain a commitment to continual improvement, set the targets, make the means available and be clear to everyone.

Energy planning
This is one of the most important elements of the standard. The organization must have a clear plan on how to improve all aspects of energy performance. This includes identifying legal requirements, reviewing all energy sources and all energy consumption within the organization and establishing an energy baseline. This baseline is a measurement of all energy consumption over a certain period of time, based on valid data. The organization must also define and measure energy performance indicators and finally set objectives, targets and plans for improvement.

IMPLEMENTATION AND OPERATION

This element is about how to realize the plans. It contains demands on:

- Competence
- Training
- Awareness
- Communication
- Documentation requirements
- Control of documents
- Operational control
- Design
- Procurement of energy services, products, equipment and energy

CHECKING

This element covers the aspect of checking that the system is being implemented according to plan. It deals with subjects such as:

- Monitoring, measurement and analysis
- Evaluation of compliance with legal and other requirements
- Internal audit of the energy management system, nonconformities, correction and corrective action and preventive action
- Control of records

MANAGEMENT REVIEW

This paragraph describes how top management must review the suitability, adequacy and effectiveness of the system.

COMPARISON OF THE STANDARDS

In the previous paragraphs we described two standards. This paragraph describes the similarities and differences between the two standards.

WHAT DO THEY SPECIFY?

- *ISO55001* specifies the demands for managing assets to maximize the value for the organization
- *ISO50001* specifies the demands for an energy management system

WHO ARE THEY INTENDED FOR?

ISO55000 and *ISO50001* are suitable for any organization that has assets or uses energy. In practice this means they can be used by any organization. They both originated from government initiatives.

HOW PRACTICAL ARE THEY?

ISO55000 describes only what organizations must arrange, such as having competent people, preventive maintenance or good documentation. It is up to the organization that implements the standard to decide how it will comply with the demands.

ISO50001 is somewhat more concrete. It specifies that an organization must have a measuring system for energy, clear targets for improvement and other demands, but still leaves a lot of freedom regarding how the organization will comply with these demands.

	ISO55000	ISO50001
Subject	Management of physical assets	Energy management systems
Intended for	Any organization	Any organization
Concreteness	Specifies "what", not "how"	Specifies "what", not "how"
Developed by	ISO	ISO
Background	Infrastructure	United Nations
Year of release	2014	2011

WHAT IF YOU WANT TO IMPLEMENT BOTH ENERGY MANAGEMENT AND ASSET MANAGEMENT?

Many organizations strive for world class asset management, energy management and product dependability. What should they do?

There are many common elements in the two standards. In short, they all specify that an organization must:

1. Set clear goals and define risk acceptance levels
2. Assets
   a. Have a clear view of its assets and their related functions or energy use
   b. Know which assets are critical in relation to the goals and risks
3. Make a plan to achieve the goals, such as product dependability or energy performance
   a. Perform the necessary actions to achieve the goals, such as deciding on which assets should be in the portfolio to design, build, operate and maintain them
4. Manage the proper resources, such as people, competency, information and documentation, tools and parts
5. Continuously check, audit and improve
6. Document everything for auditing

The above mentioned similarities lead to the conclusion that organizations that have already implemented one of the two standards, and thus have already completed a lot of the work needed for other standards. The following paragraphs describe a few of the demands in greater detail. Some issues are selected here that usually require a change in culture or consume the most resources in implementation.

CLEAR GOALS AND RISKS

Maybe the most important step in each one of the standards is that top management must clearly define its demands for the performance, risks and energy performance of its assets. These demands are the targets that the entire project of implementing the standards should achieve. Neither of the two standards describes in a quantitative way what these demands are. It is up to top management to decide concrete targets. If they set the demands too high, the costs will rise. If they set them too low, products and assets will be of inferior quality and performance and risks will be below standard.

ALIGNMENT

Both subjects in the standards require close alignment between the different functions within an organization. Functions (departments) such as Marketing & Sales, Engineering & Construction, Operations and Maintenance must cooperate and communicate closely. In the design stage of an asset, aspects such as the dependability, energy costs, life cycle costs and maintainability must all be taken into account. The organization must have clearly defined roles, responsibilities and authority.

MEASURING PERFORMANCE

The organization needs to measure the current performances of the asset or product. *ISO50001* specifies a system to measure the baseline of energy performance and *ISO55001* describes more in general the measurement of performance, costs and risks.

In practice, the unambiguous definition and measurement of key performance indicators is a complex subject. One of the reasons for this is Goodhart's Law. This states that once an organization uses a performance indicator as a target, it becomes unreliable, because people will try to manipulate the measurement.

Continuous improvement

Organizations must keep track of all failures, breakdowns, incidents and other non-conformities and act upon them to continuously improve the performance.

Preventive maintenance

The organization must develop and execute a preventive maintenance plan to assure that the asset keeps complying with all demands. This means preventive maintenance should not just be set up based on the types of components installed, but based instead upon the impact of failure of these components on the demands of the organization. By maintenance we also mean cleaning, calibration, inspection and other activities to keep the assets or products in good working order.

Organization and resources

Organizations must among other things:

- Assess what competency every employee needs and assure that this competency is also in place for external employees. This competency must clearly be described, tested and trained
- Have clear, complete and up to date drawings, documentation and other information on their assets, their operation and configuration
- Have the proper spare parts and tools
- Have an information system registering the relevant data of the assets, the work that is being done on them and their failures

It is clear that although the standards differ, many topics are similar in the current standards.

An organization that wants to manage its assets professionally could use *ISO55000* as a guideline. *ISO55001* requires the development of an asset management policy that describes the required performance, risk and cost levels for the asset systems of the organization. Once the organization has determined what types of performance and risks are relevant to its asset systems, it can select a more detailed standard to achieve the goals for this type of performance and risks. If an organization determines for example that energy performance is important to the organization, it can use *ISO50001* to set up an energy management system in greater detail.

An organization that wants to set up preventive maintenance schedules that reduce the risks associated with the use of its asset systems could use *IEC60300-3-11 Reliability Centered Maintenance*. There are many conditions that are similar in all standards. They all require a clear insight in and control over information, resources and competency.

Although there already was a major overlap in the approach of all standards, until 2012 each standard had a different structure. In 2012, ISO published its new *High Level Structure (HLS) for all standards for management systems*; this includes standards, such as *ISO55001 for asset management* and *ISO9001 for quality management systems*.

This HLS assures identical structure, definitions and text for all ISO management systems. The high level structure of all standards will be:

Clause 1—Scope
Clause 2—Normative references
Clause 3—Terms and definitions
Clause 4—Context of the organization

Clause 5—Leadership
Clause 6—Planning
Clause 7—Support
Clause 8—Operation
Clause 9—Performance evaluation
Clause 10—Improvement
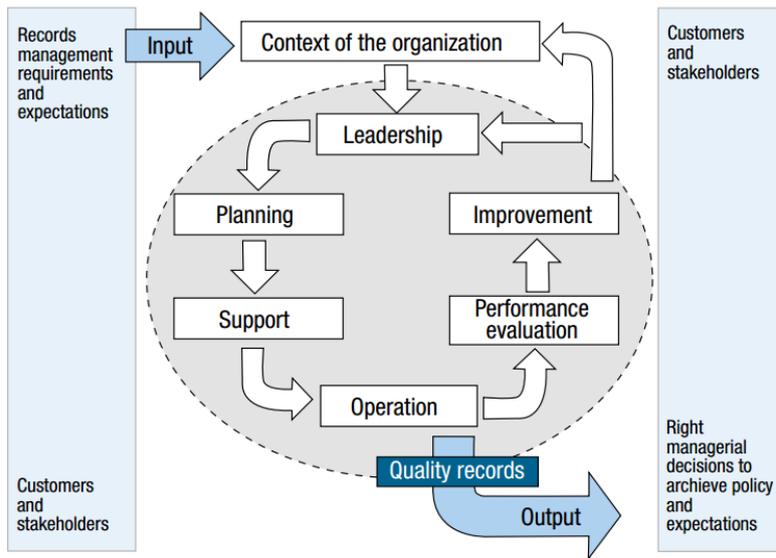
Figure 3 – From input to output.

Terms like: organization, interested party, policy, objective, competency or conformity will have the same definition in every ISO management system. Some phrases such as *"Top management shall ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization"* will also be identical.

The new HLS forms a plug-in model. Once an organization has implemented one standard, it only has to plug - in the extra demands that are needed to comply with another standard. If an organization has already implemented *ISO55001*, it can keep its main structure, when implementing *ISO14001* or *ISO9001*.

Examples of other ISO standards that will be structured according to the HLS include:

ISO45001 Occupational Health and Safety Management Standard, planned to replace *OHSAS 18001* in 2016
ISO19011 Auditing of management systems
ISO31000 Risk Management
*ISO26000 Guidance on social responsibility*
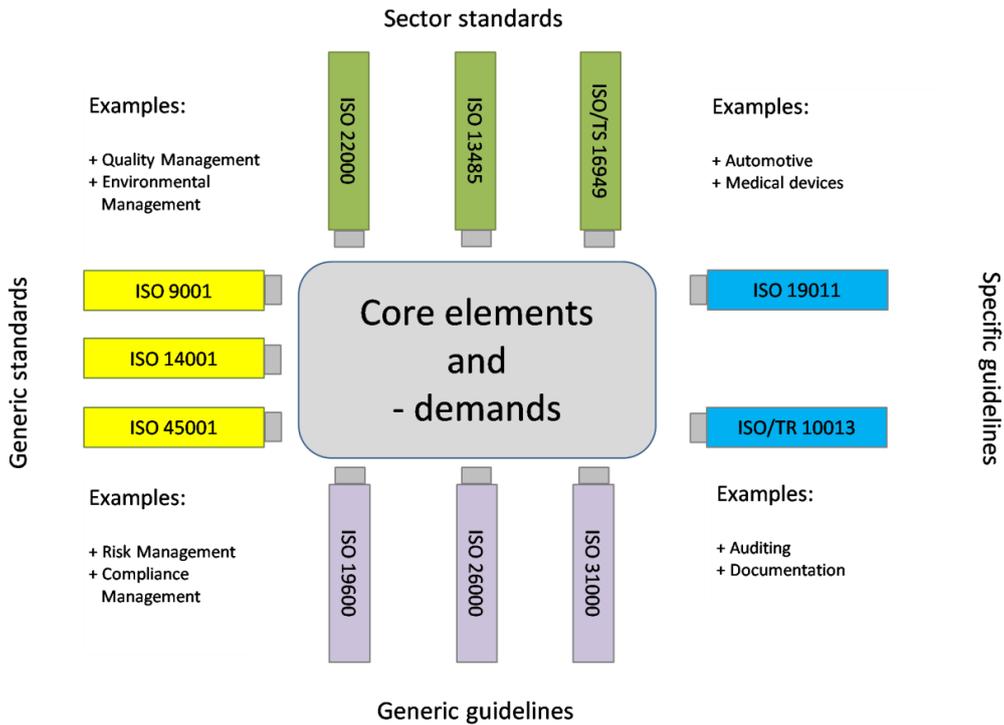
Figure 4 – How the various ISO standards connect.

At present (2014), some standards have already been published according to the new *High Level Structure*. Examples are the *ISO55001*, the *ISO27001* (Information security) and *ISO22301* (Business continuity management systems). The new *ISO9001* and *14001* (Environmental management systems) that are to be published in 2015 are also developed according to the new structure.

ENSURING THAT MANAGEMENT SYSTEMS ARE EXECUTED ON THE WORK FLOOR

Implementing standards within organizations requires a good plan. In many cases implementations fail because organizations have not prepared the implementation thoroughly. Sometimes they succeed in setting up a system for energy management, dependability or asset management, but create unnecessary bureaucracy. This is, of course, not the purpose of the standards. This paragraph describes some points of attention for successful implementation.

MANAGEMENT COMMITMENT

Top management must actively support the implementation of the standards. It must clearly define goals, allocate resources and keep track of the progress of implementation. This is something that is specified in all standards. *ISO50001* specifies that top management must assign a management representative for the implementation of the standards. After the standards are implemented management must periodically review the status of the system.

A CLEAR PLAN OR STRATEGY

Both standards specify that the organization must have a clear plan regarding how it will implement the standard. This plan needs to pay attention to the human aspects that implementation will have on changes within the organization. This includes involvement of stakeholders, communication and training.

COMMUNICATION TO WORK FLOOR

The organization must communicate to all stakeholders that implementation of the standard is a priority. It is important to train people and show them all aspects of the implementation. If employees only see separate loose elements, they will feel there is a "program of the month" culture in their organization, even if this is not the case.

INVOLVEMENT OF STAKEHOLDERS

A successful implementation of change in any organization requires involvement and buy-in of all stakeholders. The two basic steps in getting buy-in is to first clearly specify the goals of the change and then involve the stakeholders in working out the details for how these goals can be met. If a change must take place for instance in a production department, it is necessary to involve the production operators or their representatives in discussing how the changes can take place. The people that actually do the work are in the best position to know what can be improved and how to go about it. It is important to be aware that people are often averse to change. Changes imposed from above often meet with a lot of resistance.

CONCLUSION

In the Introduction of this application note, two questions were raised.

The first one was whether *ISO55000* makes all other standards that cover the management of assets superfluous. Would implementing just this one standard cover all aspects that are included in other standards?

The second question was what an organization wants to implement more standards, such as both *ISO55001* and *ISO50001*, should do.

ISO55001 is a standard for asset management that covers:

- The entire life cycle of an asset (entity or thing that an organization uses to create value)
- Includes all types of performance, risk and costs (including availability, reliability, energy, safety and all other relevant aspects)
- All types of organizations

Because *ISO55001* covers such a broad range of topics, it is written in very general terms. It prescribes that an organization must write an asset management policy that translates the organizational strategy into demands for the assets. Next it must write a strategy and a plan to achieve the management policy. *ISO55001* states in very general terms how an organization should professionally manage the necessary resources to achieve all of this.

An organization that wants to manage its assets professionally could use *ISO5500*. Once the organization has determined what types of performance and risks are relevant to its asset systems, it can select a more detailed standard to achieve the goals for this type of performance and risks. *ISO55001* covers all aspects of the entire lifecycle of its assets, but it will need tools and methodologies to do so. *ISO50001* is more specific and describes what an organization should do to implement an energy management system. But it does not describe which concrete tools or methodologies to use.

Once an organization has implemented one standard, it will require less effort to implement the next. There are many conditions that are similar in all standards. They all require:

1. Clear demands and conditions of the organization
2. Information on the assets and products, their functioning and configuration
3. Insight into and control over information, resources and competency
4. Design, building, maintenance and operations that ensures that all demands and conditions are met
5. Management review and auditing
6. Records of the above

The new high level structure of ISO will streamline the process of implementing more standards, by creating a plug-in model. Implementing standards does not require high tech systems, but it does require clear processes and procedures and the discipline to follow them.