Energy & Environment

Environmental & Energy Management Systems

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- Management Systems
- International Environmental Management Systems
  - ISO 14001
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  - Comparison
- Energy Management Systems
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Environmental protection

- Practice of protecting the natural environment on individual, organizational or governmental levels
- Benefit for humans and the natural environment
- Waste production, air pollution, loss of biodiversity
- Often focuses on the role of government, legislation and law enforcement
- Broad stakeholder involvement
- National and international environmental protection organizations (e.g. GLOBAL 2000, United Nations Environment Programme)

Environmental protection

To date:

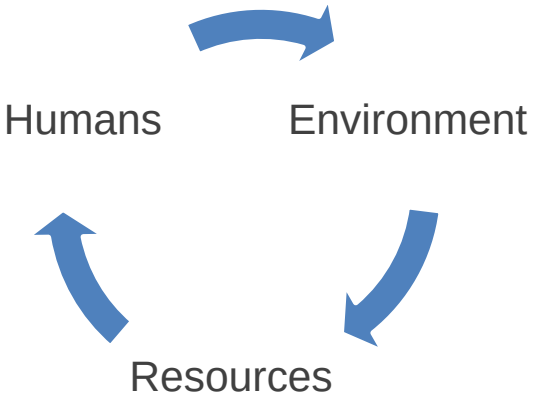
- Ensuring compliance with law and regulations
- Filters (e.g. flue gas cleaning, wastewater treatment)
- Operational level
- End-of-pipe technology (additive environmental protection)

Tomorrow:

- Holistic, proactive, dynamic
- Integration of the whole value chain
- Closed-loop economy
- Strategic level
- Front-of-pipe technology (integrated environmental protection)
- Environmental management

Environmental awareness

- Environmental awareness is changing
  - Environmental damage affect air, water, soil **and the own health**
  - Finite resources



- Environmental protection demands:
  - Responsible behaviour of each individual
  - Common approach on an international level

Eco-efficiency

Tool to promote a transformation to sustainable development

$$\text{Eco-efficiency} = \frac{\text{Economic performance}}{\text{Ecological performance}}$$

- Create „added value“
- Use less resources
- Reduce environmental pollution
- Avoid accidents

Management Systems

Management Systems

- Ensure that an organization can fulfill all tasks required to achieve its objectives
- Can be assessed at every phase
- Improvement of the operational and organisational structure of the company
- Basis
  - Establishing responsibilities
  - Determine accountability in action plans
  - Assessing the system objectively
- First standards in the 1970s for Quality Management

Management systems

Management system means what the organization does to manage its processes, or activities in order that

- its products or services meet **the organization's objectives**, such as
- satisfying the **customer's quality requirements**,
- complying to **regulations**, or
- meeting **environmental objectives.**

- Elements
  - Vision and policy
  - Goals
  - Implementation
  - Validation and Verification

Management systems

- To be really efficient and effective, the organization can manage its way of doing things by **systemizing** it.
- **Clear responsibilities** (what, when, how, why and where)
- Management system standards provide the organization with an international, state-of-the-art **model** to follow
- Integrated management systems
- Necessary for large companies

Management Systems

Top-Down-Principle: From rough to detail

1) Define the observed system
2) Restrict the system to the most important details

- Demonstrate the management systems on various levels
  - ➔ Each employee knows how he can/should contribute and what he/she has to do
- The obtained findings need to be incorporated in the management system “bottom up”

Principles for designing management systems

- Holistic nature
- Modularity and openness for other systems
- Simplicity and intelligibility
- Neutrality regarding functional orientation
- Flexibility and adaptability to environmental conditions
- Feedback loops
- Innovation support and dynamic

Environmental Management Systems

Environmental management systems

- Help organizations to implement environmental management
  - Identify and control environmental impact
  - Improve environmental performance
- EMAS
- ISO 14001

Costs and benefits

Costs

- Information procurement
- Internal time expenditures
- Consulting
- Internal environmental audit (staff and equipment)
- Externally approved environmental auditors
- Certification fee
- Public relations

Costs and benefits

Benefits

- Reduction of
  - Environmental risks
  - Fines due to non-conformance to laws and regulations
- Improvement of
  - Employee's health
  - Responsibility and commitment of employees
  - Credibility against public
- Recognition of
  - Cost reduction potentials
  - Necessary training of employees
  - Non-conformance to existing environmental laws and regulations

Costs and benefits

- Estimations are difficult
  - Size of the company
  - Environmental relevant activities (cabinet-maker's ≠ chemical industry)
  - (Local) Funding for SMEs
- Internal costs
  - Commitment of employees
  - Training of employees
- External costs
  - Fees for consulting
  - Fees for certification
  - Fees for registration
  - Expenditures for public relations

Environmental Management System

ISO 14001

ISO 14001

Voluntary international standard published by the International Organization for Standardization (ISO)

- Specifies requirements of an environmental management system (EMS)
- Not for single products or services
- Generic standard, can be applied to
  - **any organization**, large or small, whatever its product or service,
  - in **any sector** of activity,
  - whether it is a business enterprise, a public administration, or a government department, and
  - no matter what the organization's scope of activity is.

Environmental management

ISO 14001 is for **environmental management**.

What the organization does to:

- **minimize harmful effects** on the environment caused by its activities,
- to conform to applicable **regulatory requirements**, and to
- achieve **continual improvement** of its **environmental performance**.

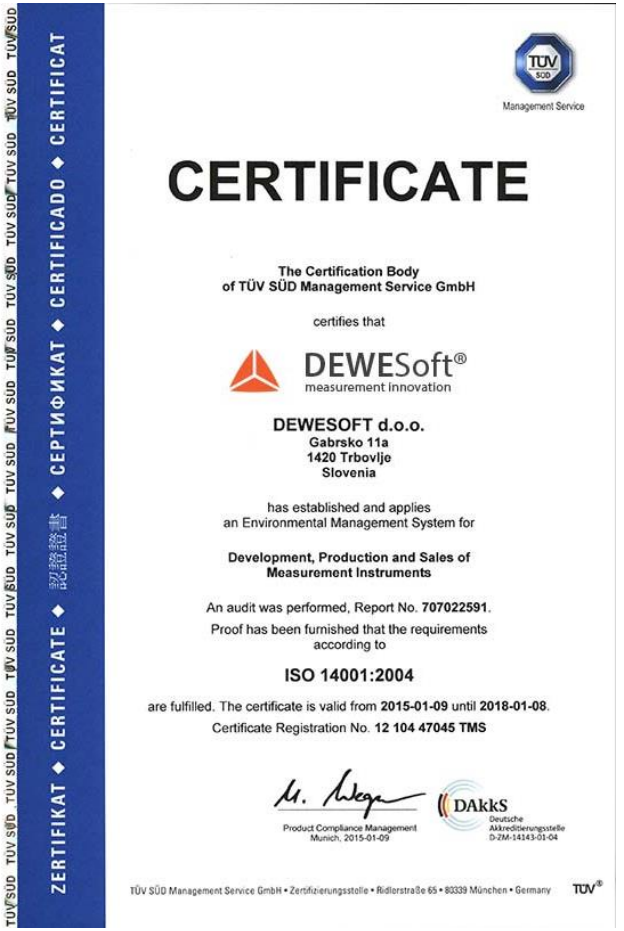
Processes, not products

- ISO 14001 concerns **the way an organization goes about its work**.
- Not for products or services → **Process** standards
- Can be used by **product manufacturers and service providers**.
- Processes affect final products or services.
- **ISO 14001** gives the requirements for what the organization must do to manage **processes affecting the impact of its activities on the environment**.

→ **Say what you do!**

Certification

- **Independent, external body** audits an organization's EMS and verifies that it conforms to the requirements specified in the standard
- **ISO does not carry out certification** and does not issue or approve certificates
- ISO does not accredit, approve or control certification bodies
- ISO develops **standards and guides to encourage good practice** in accreditation and certification



Accreditation

- Like certification of the certification body
- Formal approval by a specialized body (accreditation body) that a certification body is competent to carry out certification in specified business sectors.
- **Accredited certificates** issued by accredited certification bodies may be perceived on the market as having increased credibility

Certification is a business decision

Certification not a requirement

- Organization can implement and benefit from an ISO 9001 or ISO 14001 system without having it certified.
- **But:** Advertisement only allowed with certification!

Certification is **a decision to be taken for business reasons**

- If it is a contractual, regulatory, or market requirement
- If it meets customer preferences
- It is part of a risk management program
- If it will motivate staff by setting a clear goal

The ISO 14000 family

Includes **21 standards** that can help an organization specific aspects such as auditing, environmental labelling, life cycle analysis…

DIN EN ISO 14001

Environmental Management System
Specification and requirements with guidance for use

Latest version:
ISO 14001:2015

Only standard within the family that can be used for certification!

DIN EN ISO 14004

Environmental Management System
General guideline about basics, systems and support instruments

DIN EN ISO 14010

Guideline for environmental audits
General principles

DIN EN ISO 14011

Guideline for environmental audits
Audit process, environmental audits

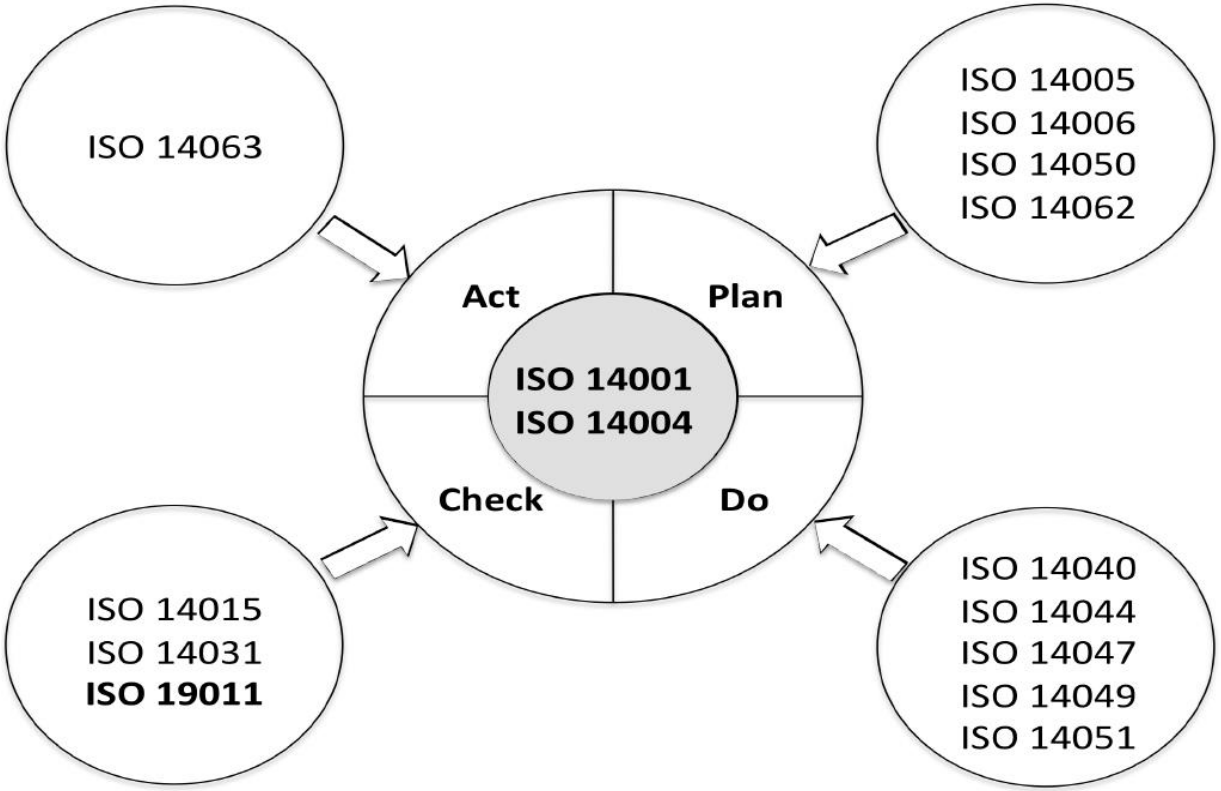
DIN EN ISO 14012

Guideline for environmental audits
Qualification criteria for environmental auditors

The ISO 14000 family

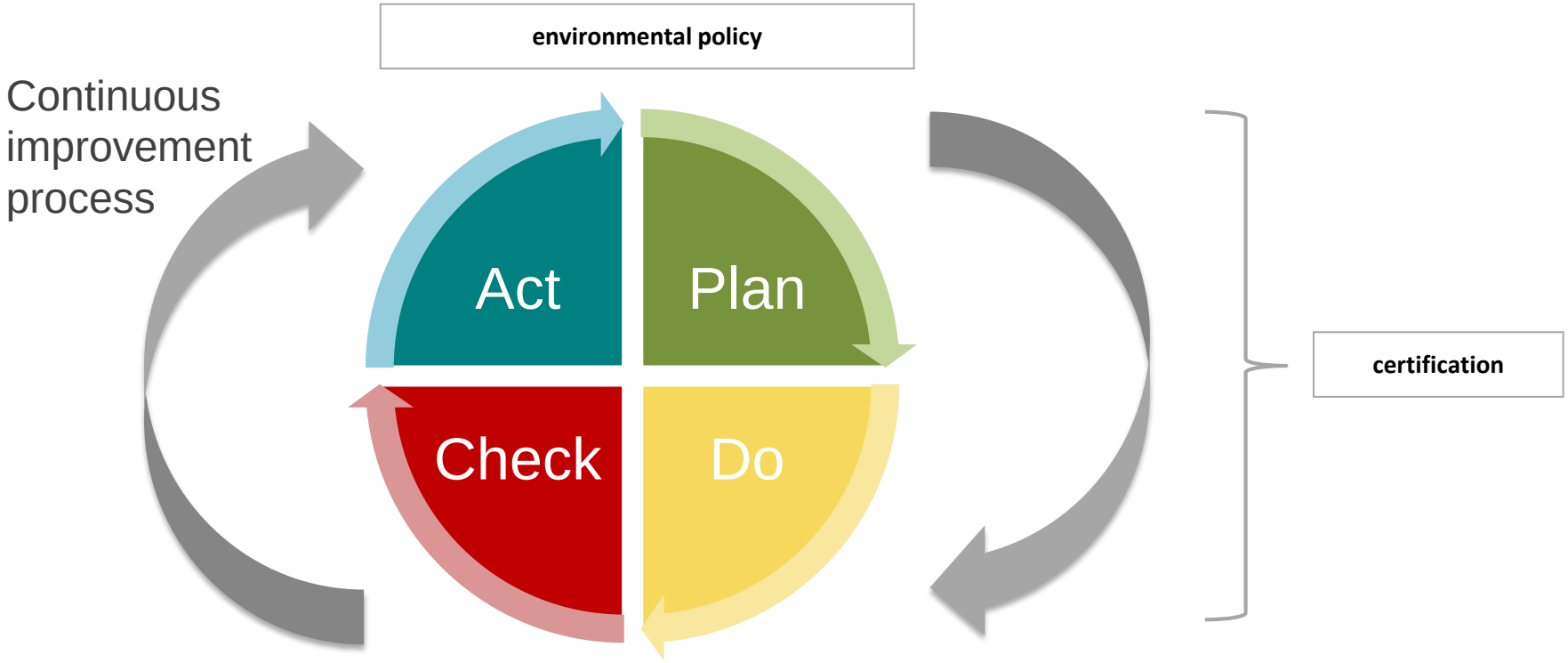
ISO 14001	**Environmental management systems—Requirements with guidance for use**
ISO 14004	Environmental management systems—General guidelines on principles, systems and support techniques
ISO 14006	Environmental management systems—Guidelines for incorporating ecodesign
ISO 14015	Environmental assessment of sites and organizations
ISO 14020	Series (14020 to 14025) Environmental labels and declarations
ISO 14030	Discusses post-production environmental assessment
ISO 14031	Environmental performance evaluation—Guidelines
ISO 14040	Series (14040 to 14049), Life Cycle Assessment, LCA, discusses pre-production planning and environment goal setting.
ISO 14046	Environmental Management- Water Footprint- Principles, Requirements, and Guidelines Sets guidelines and requirements for water footprint assessments of products, processes, organizations. Includes only air and soil emissions that impact water quality.
ISO 14050	Terms and definitions
ISO 14062	Discusses making improvements to environmental impact goals
ISO 14063	Environmental communication guidelines and examples
ISO 14064	Measuring, quantifying, and reducing greenhouse gas emissions
ISO 19011	Specifies one audit protocol for both 14000 and 9000 series standards together

Structure of the ISO series

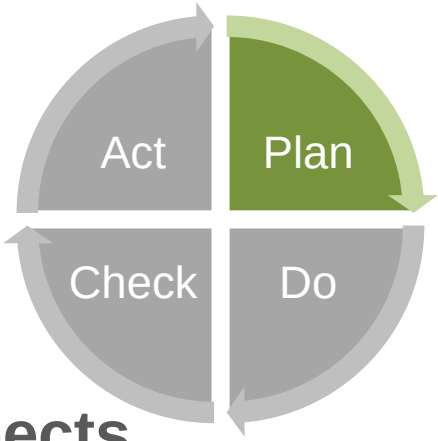


Continuous improvement process

ISO 14001 is based on the Plan-Do-Check-Act-Cycle



Plan

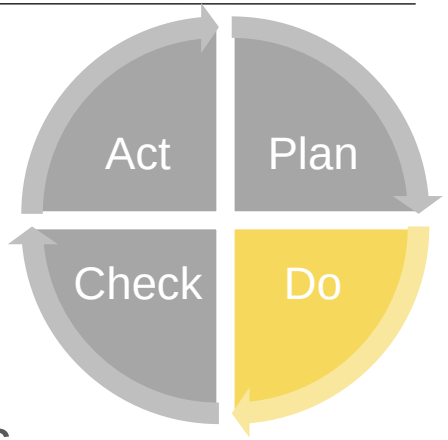


Establish required objectives and processes

- Initial review to identify **environmental aspects**
  - Current and future operations that may interact with the environment
  - Direct: use during manufacturing
  - Indirect: consumer's behaviour

- Establish **measurable** environmental **objectives, goals and targets**

Do

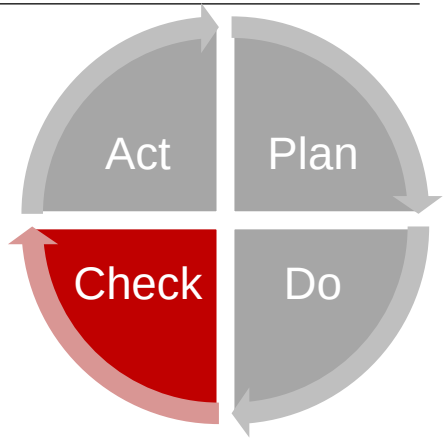


Implement the processes

Identify required resources and responsibilities

- Establish procedures and processes
- Documentation control
  - Emergency preparedness
  - Emergency response
  - Education of employees
- Communication and participation across **all levels** of the organization

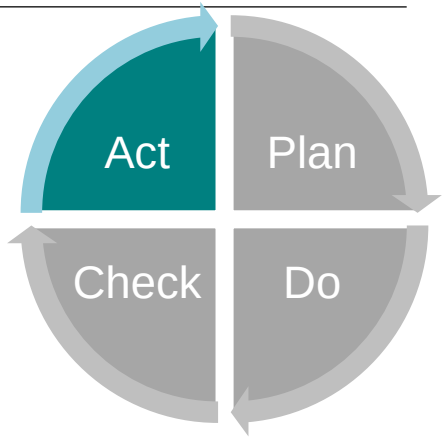
Check



Measure and monitor performance and report results

- Ensures that environmental targets and objectives are being met
- Internal audits
- Are the processes and procedures maintained and monitored adequately?

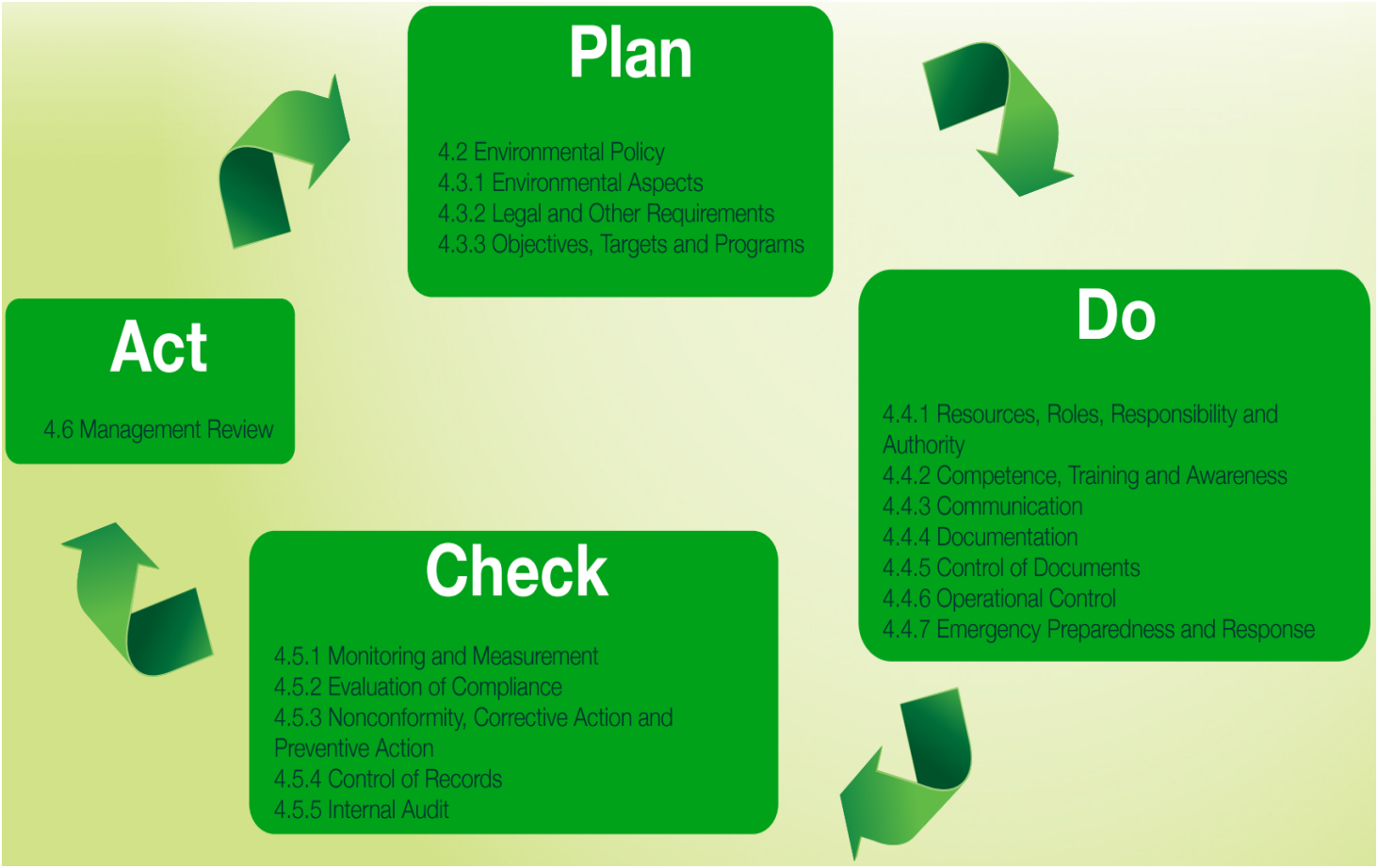
Act



Take action to improve performance based on results

- Management reviews
  - To ensure that objectives are being met
  - To evaluate to which extend they are met
  - To ensure appropriate communications
  - To evaluate changing circumstances (legal requirements)
- Make recommendations for further improvement

PDCA-Cycle

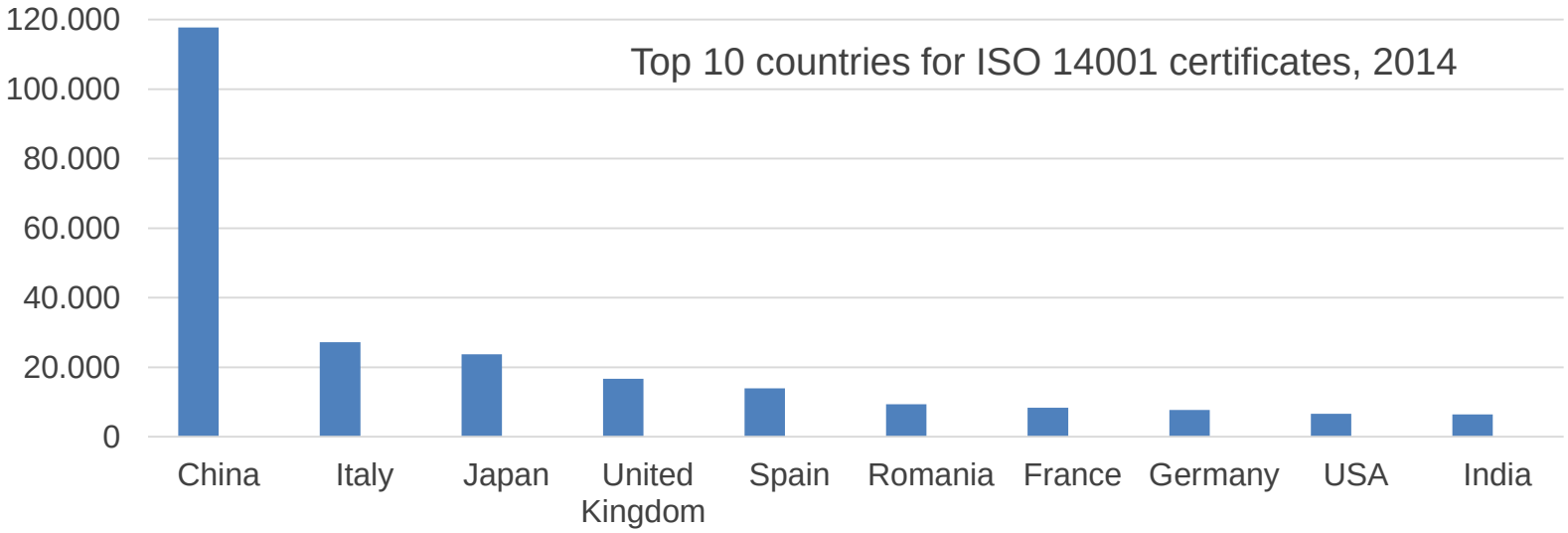

Plan
4.2 Environmental Policy
4.3.1 Environmental Aspects
4.3.2 Legal and Other Requirements
4.3.3 Objectives, Targets and Programs
Do
4.4.1 Resources, Roles, Responsibility and Authority
4.4.2 Competence, Training and Awareness
4.4.3 Communication
4.4.4 Documentation
4.4.5 Control of Documents
4.4.6 Operational Control
4.4.7 Emergency Preparedness and Response
Check
4.5.1 Monitoring and Measurement
4.5.2 Evaluation of Compliance
4.5.3 Nonconformity, Corrective Action and Preventive Action
4.5.4 Control of Records
4.5.5 Internal Audit
Act
4.6 Management Review

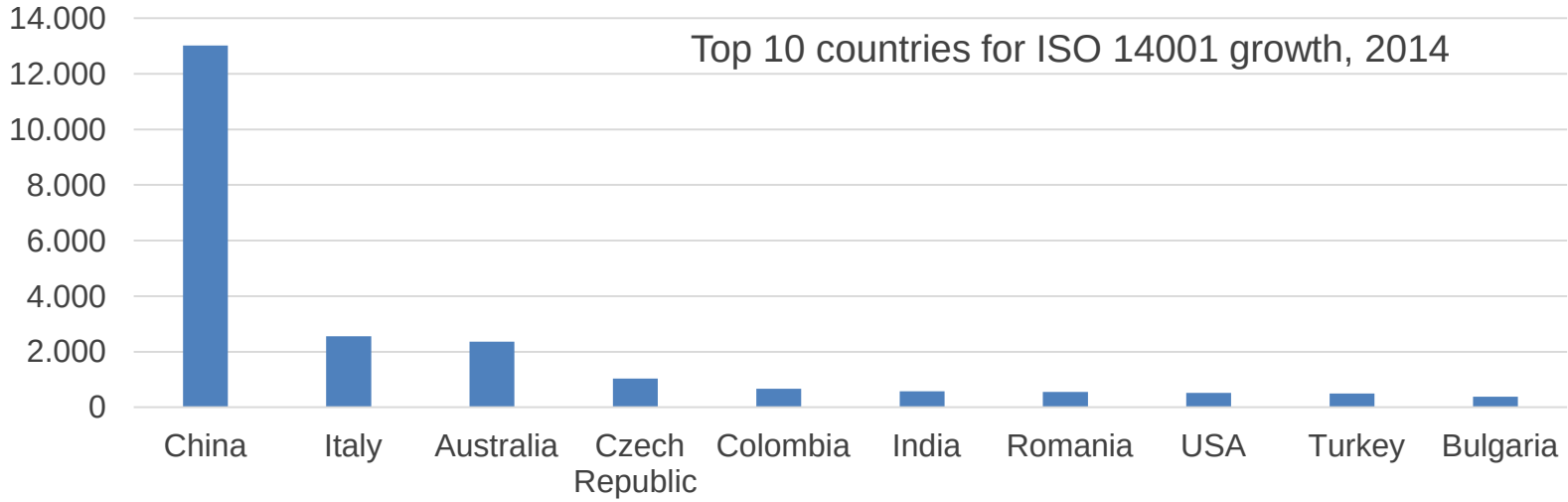
The ISO Survey

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TOTAL	49.440	64.996	90.554	111.163	128.211	154.572	188.574	222.974	251.548	261.926	284.654	301.622	324.148
Africa	418	626	817	1.130	1.079	1.096	1.518	1.531	1.675	1.740	2.084	2.519	2.565
Central/ South America	1.418	1.691	2.955	3.411	4.355	4.260	4.413	3.748	6.999	7.074	8.202	9.890	10.143
North America	4.053	5.233	6.743	7.119	7.673	7.267	7.194	7.316	6.302	7.450	8.573	8.917	10.139
Europe	23.305	30.918	39.805	47.837	55.919	65.097	78.118	89.237	103.126	101.177	111.910	119.082	123.849
East Asia & Pacific	19.307	25.151	38.050	48.800	55.428	72.350	91.156	113.850	126.551	137.335	146.069	151.203	166.441
Central & South Asia	636	927	1.322	1.829	2.201	2.926	3.770	4.517	4.380	4.725	4.969	6.577	7.192
Middle East	303	450	862	1.037	1.556	1.576	2.405	2.775	2.515	2.425	2.847	3.434	3.819

Source: http://www.iso.org/iso/iso-survey

The ISO Survey



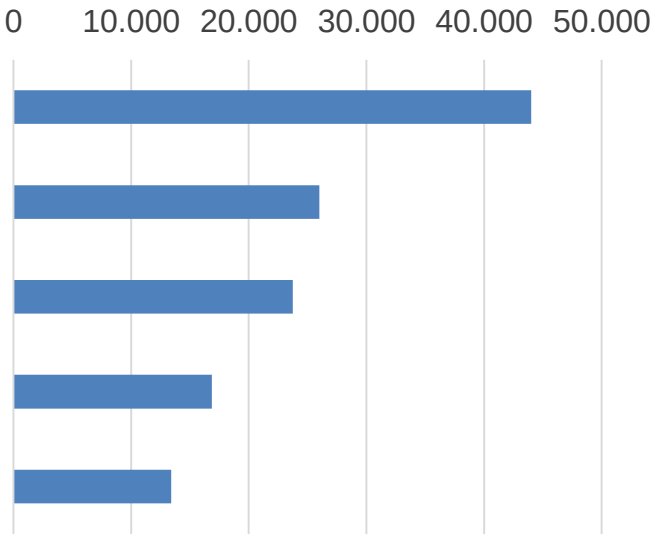


Source: http://www.iso.org/iso/iso-survey

The ISO Survey

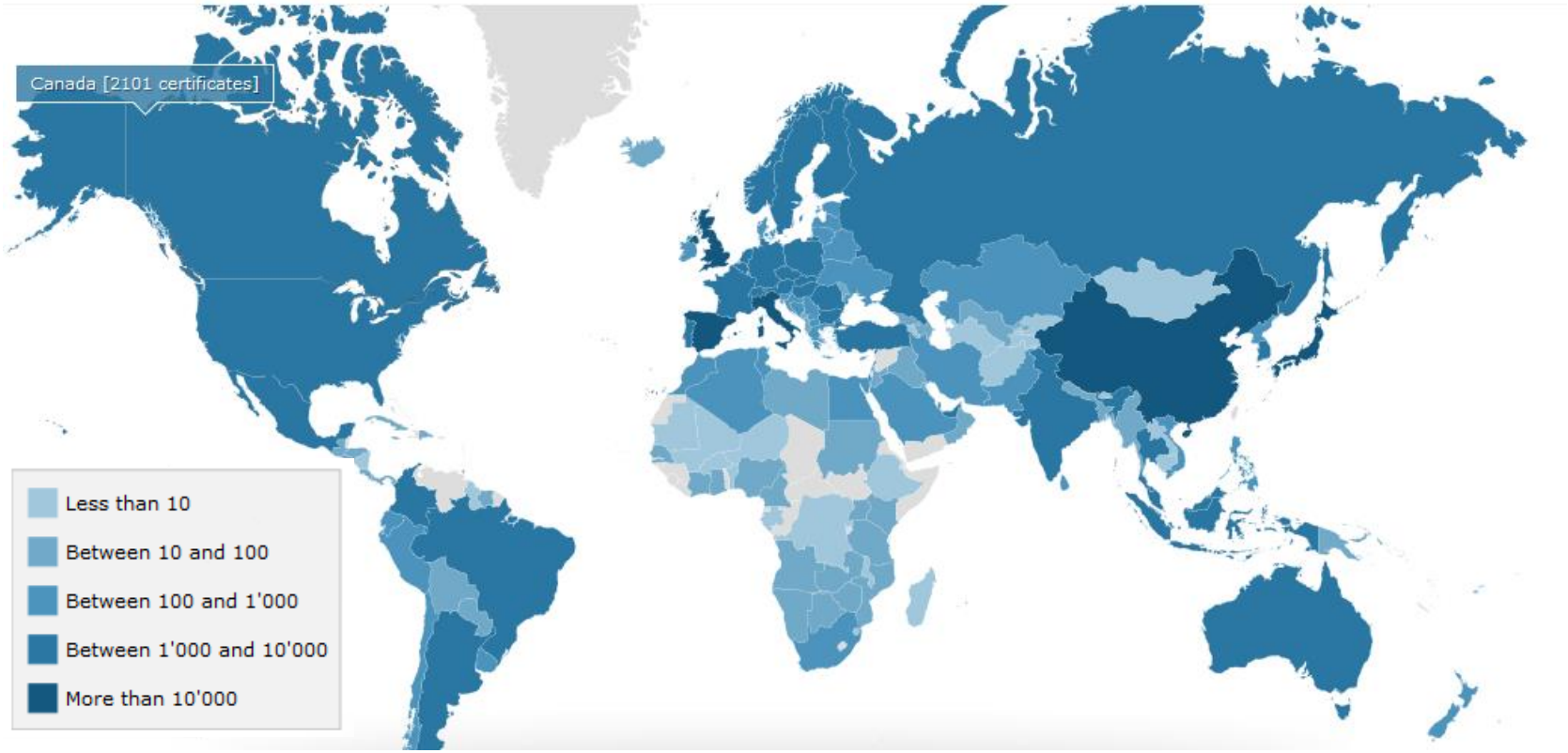
Top 5 industrial sectors for ISO 14001 certificates, 2014

Construction	43.995
Basic metal & fabricated metal products	26.006
Electrical and optical equipment	23.741
Wholesale & retail trade, repairs of motor vehicles	16.872
Rubber and plastic products	13.394



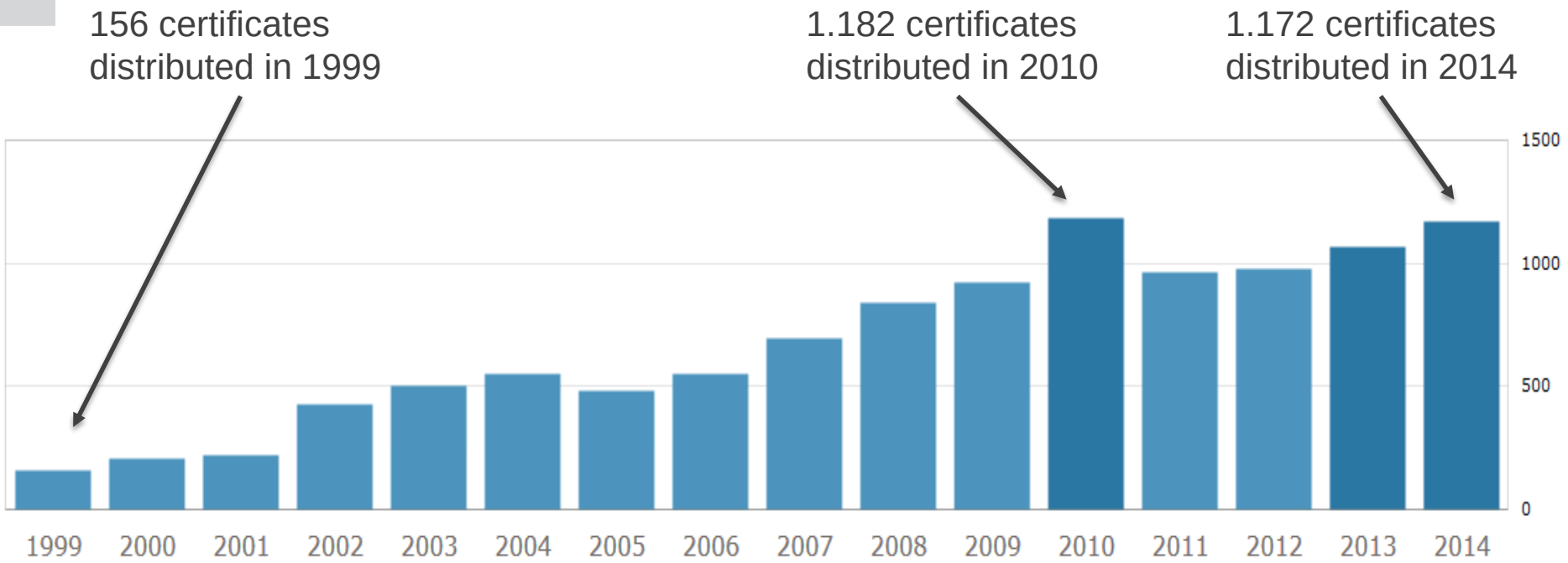
Source: http://www.iso.org/iso/iso-survey

World distribution



Source: http://www.iso.org/iso/iso-survey

Evolution in Austria



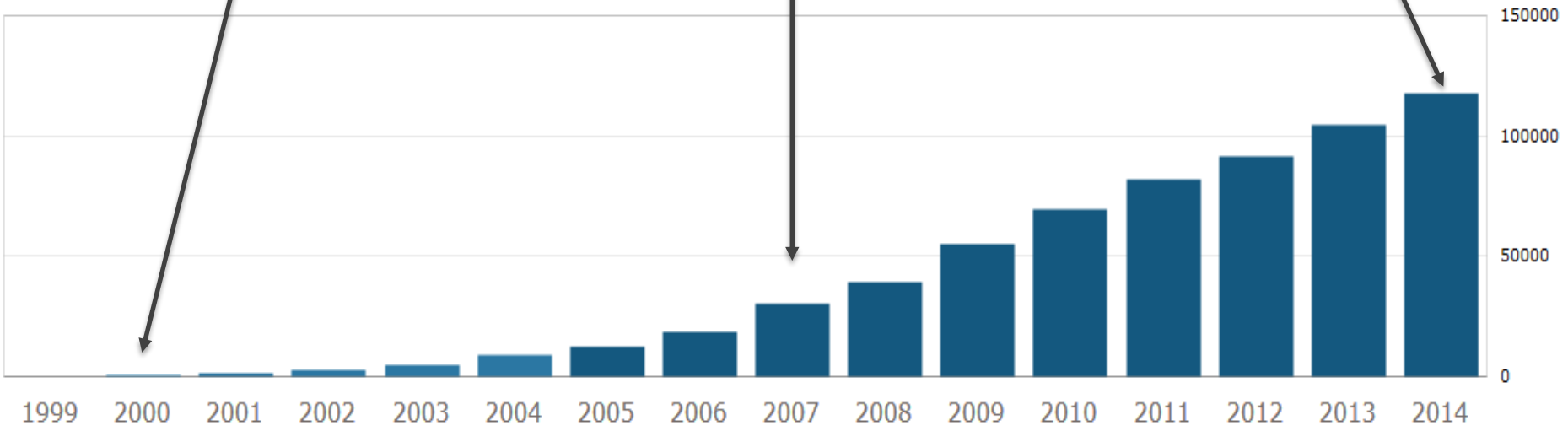
Source: http://www.iso.org/iso/iso-survey

Evolution in China

510 certificates distributed in 2000

30.489 certificates distributed in 2007

117.758 certificates distributed in 2014



Average annual growth rate: 52%

Source: http://www.iso.org/iso/iso-survey

Benefits

- International, expert consensus on state-of-the-art practices for environmental management
- Common language for dealing with customers and suppliers worldwide in B2B
- Improved communication
- Goes beyond compliance and legislation
  - Address environmental concerns of customers and public, and comply with government regulations
  - Qualify suppliers for global supply chains
  - Transfer of good practice to developing countries
- Model for continual improvement

Benefits

- Model for satisfying customers and other stakeholders
- Build quality into products and services from design onwards
- Integrate with global economy, regional integration
- Sustainable business
- Reduced costs
  - Increase efficiency and effectiveness
  - Reduce waste
  - Reduce energy use
  - Reduce resource use

Potential limitations

- Implementation can be time consuming
- Expensive
  - Start-up implementation
  - Running costs
  - Certification
- Continuous process – continuous work
- Resources
  - Leadership: Full commitment also of top management
  - Proficiencies or skills: Training in understanding the standard
  - Staff time: Estimation: 6-18 months to implement EMS

Port of Virginia EMS

Source: https://www.youtube.com/watch?v=l1Wvp1Y_S4E

Environmental Management and Audit Scheme

EMAS

EMAS

- Developed by the European Commission in 1993
- Assess, manage and continuously **improve environmental performance**
- Commitment to evaluate and reduce negative environmental impacts
- **Aim:** recognise and reward organisations that go beyond minimum legal compliance and improve environmental performance
- Voluntary, globally applicable
- For all types of organizations (private and public)
  - 4.600 organizations, 7.900 sites

Development

EMAS I

- Adopted in 1993
- Entered into force in 1995
- Restricted to companies in industrial sectors

EMAS II

- Open to companies from all economic sectors including public and private services
- Integration of ISO 14001 requirements

Development

EMAS III

- Entered into force in 2011
- Changes
  - Globally applicable, no longer limited to EU Member States
  - Obligatory Key Performance Indicators (KPI) to harmonize reporting on environmental performance
  - Validation cycle for SMEs increased from 3 to 4 years
  - Environmental statement has to be updated every 2 years
  - Single corporate registration for organizations with several sites

EMAS

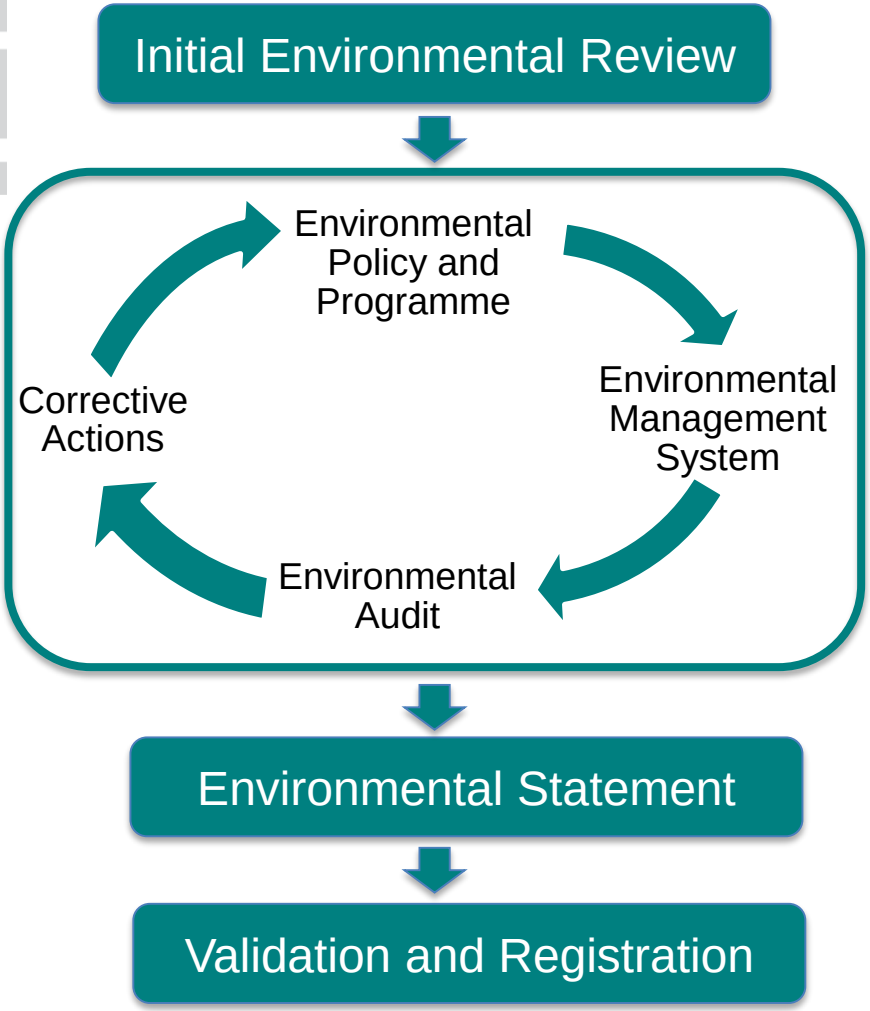
- ISO 14001 as an integral part
- EMAS goes beyond the scope of ISO 14001
- Stakeholder engagement
  - Involve employees and others to benefit from their commitment, ideas, skills, experiences, etc.
- Environmental verifier validates
  - Report of an organization’s environmental performance (KPI)
  - Continuous improvement process

Process

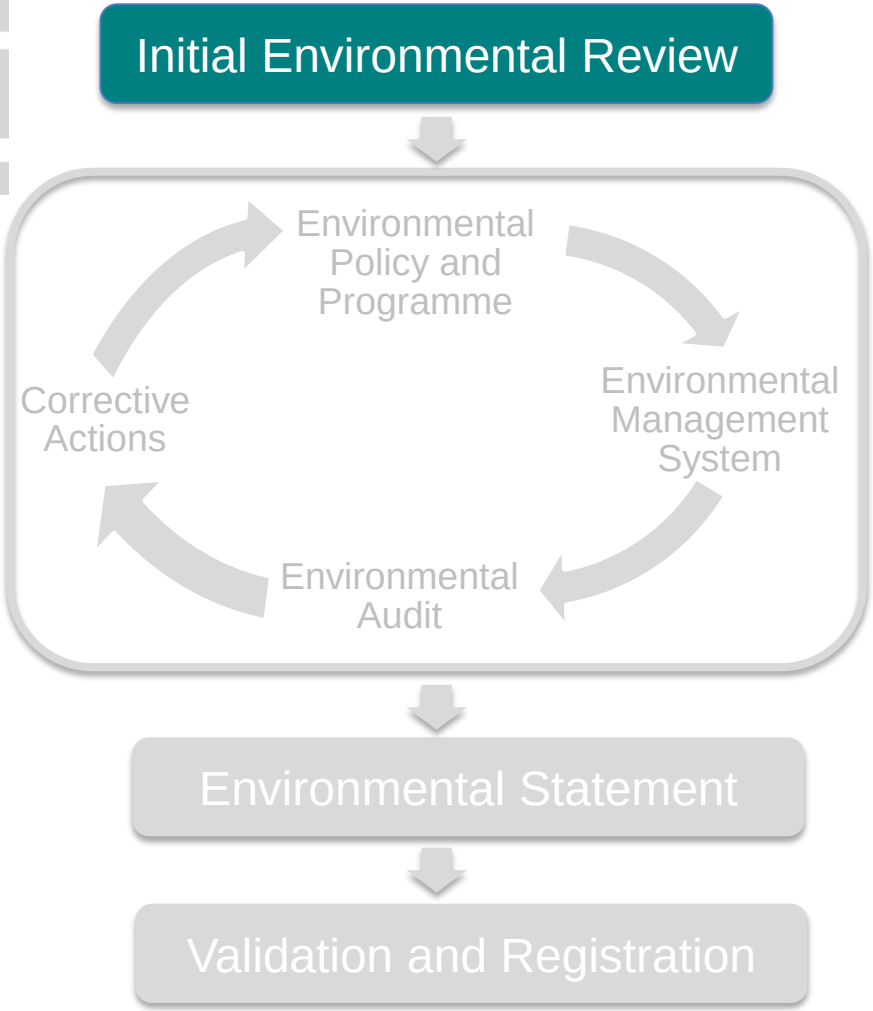
Four main stages to achieve EMAS registration:

1. Conduct an **environmental review** of all activities and assess them against existing environmental laws.
2. Establish an **environmental management system** setting out the environment objectives and the means to achieve these objectives.
3. Carry out an internal **environmental audit** assessing the management system in place and compliance with relevant environmental regulatory requirements.
4. Provide a **statement** outlining the environmental policy, programme and management system, and summarising the environmental performance with the results achieved and the steps necessary for future improvements.

EMAS continuous improvement process



EMAS continuous improvement process

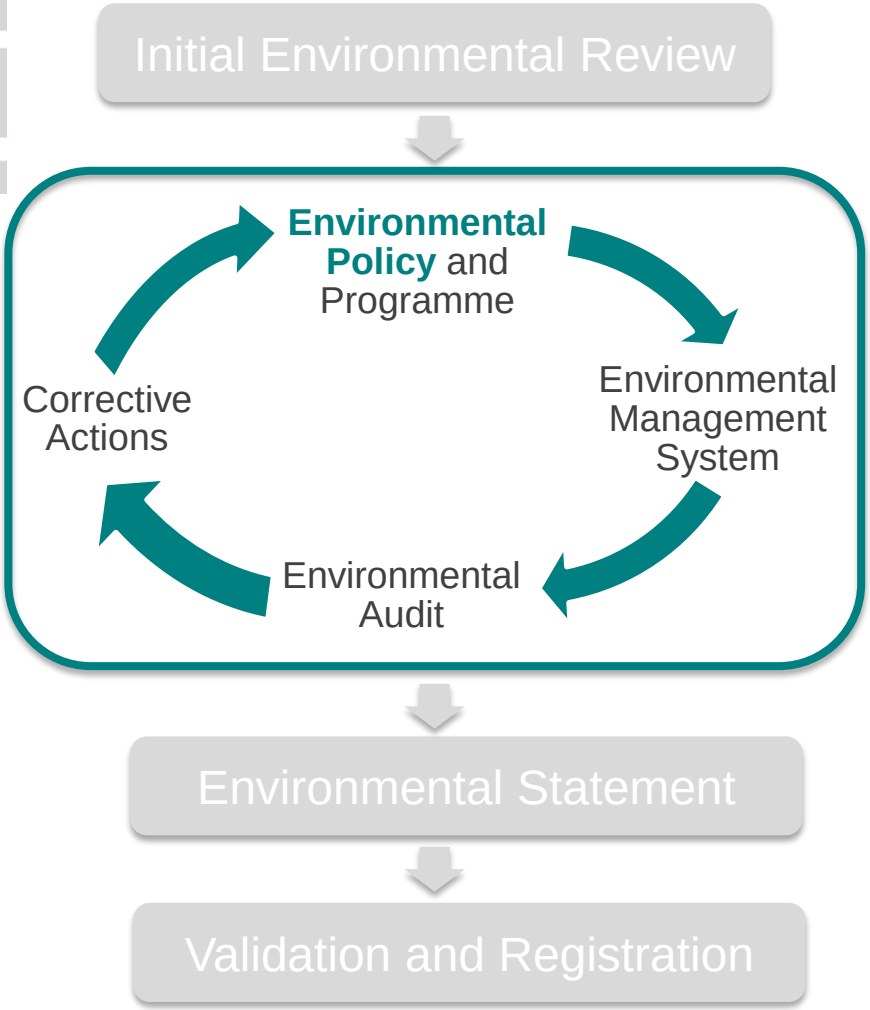


➔ Comprehensive analysis of the environmental problems caused by an organisation‘s activities.

Purpose: identify most significant environmental impacts, identify possible priorities, benchmark to measure future success

Data about
- Consumption of raw materials
- Production of waste
- Emissions
- Indirect environmental impacts

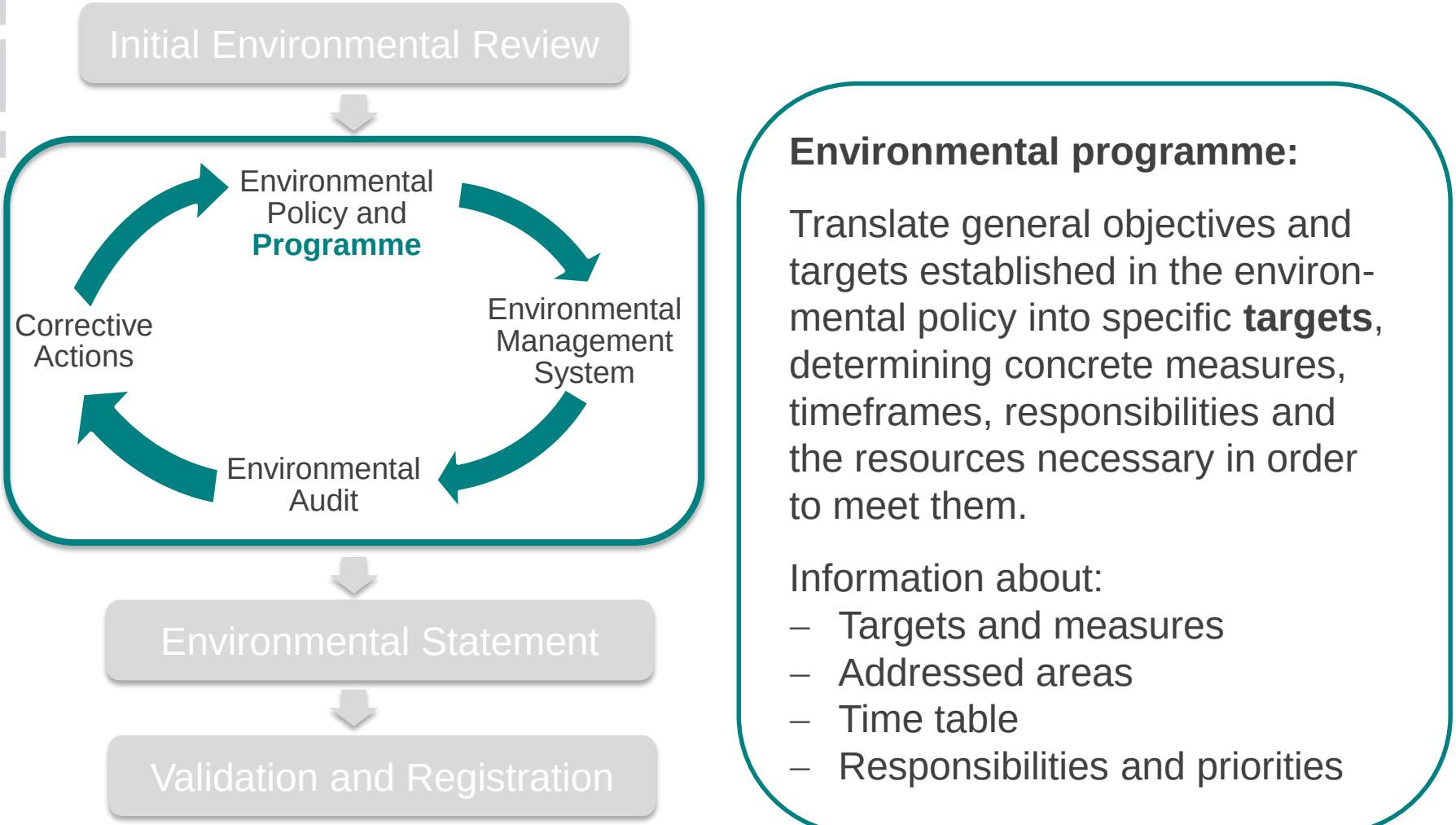
EMAS continuous improvement process



Environmental policy:

- Describe the organization's overall aims and principles of action with respect to the environment
- To be revised periodically
- Two central elements:
  - Compliance with relevant environmental regulations
  - Commitment to continuous improvement
- For employees and the public

EMAS continuous improvement process



Environmental programme:

Translate general objectives and targets established in the environmental policy into specific **targets**, determining concrete measures, timeframes, responsibilities and the resources necessary in order to meet them.

Information about:

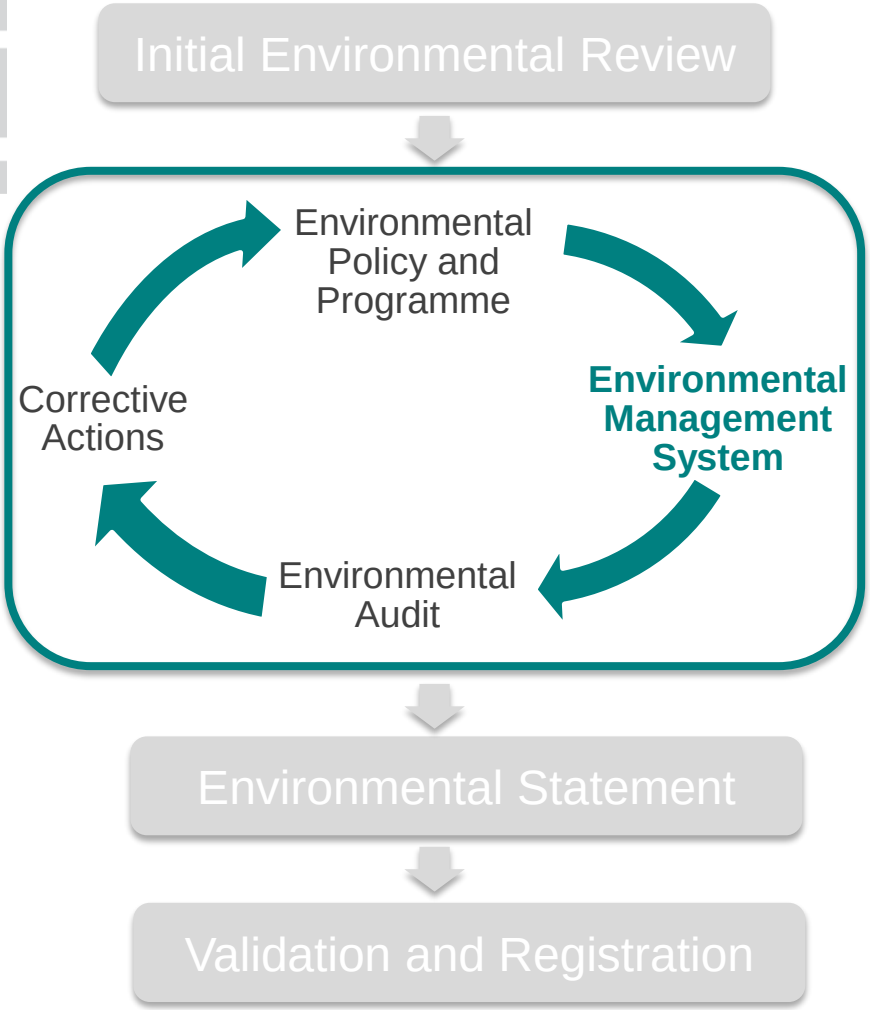
- Targets and measures
- Addressed areas
- Time table
- Responsibilities and priorities

Environmental programme: Example

Environmental programme for the year 20XX

Area	Concrete target	Time	Measures	Responsible	Priority	Resources
Energy	Decrease of total energy demand by 5%	End of 20XX	Detailed analysis of consumption data, installation of smart meters	Ms. Taylor	A	€ 10.000,-- 10 work days
Resources	Increase recycling by 10%	Beginning of 20XX	Workshop for analysing possibilities	Mr. Miller	C	5 work days
Waste	Decrease waste by 10%	End of 20XX	Analysis of waste, separation of waste	Ms. Smith	B	€ 2.000,--

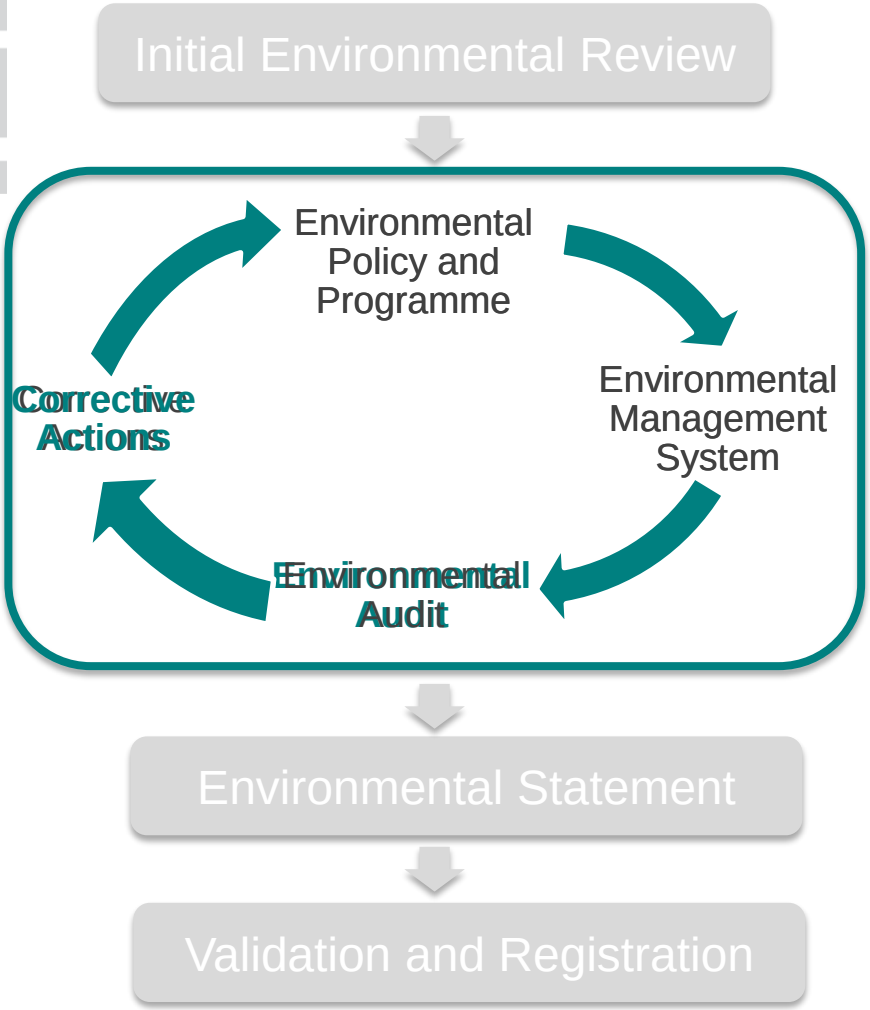
EMAS continuous improvement process



Environmental Management System:

- For successful implementation of the environmental programme
- Operating procedures and controls
- Include direct and indirect environmental impacts

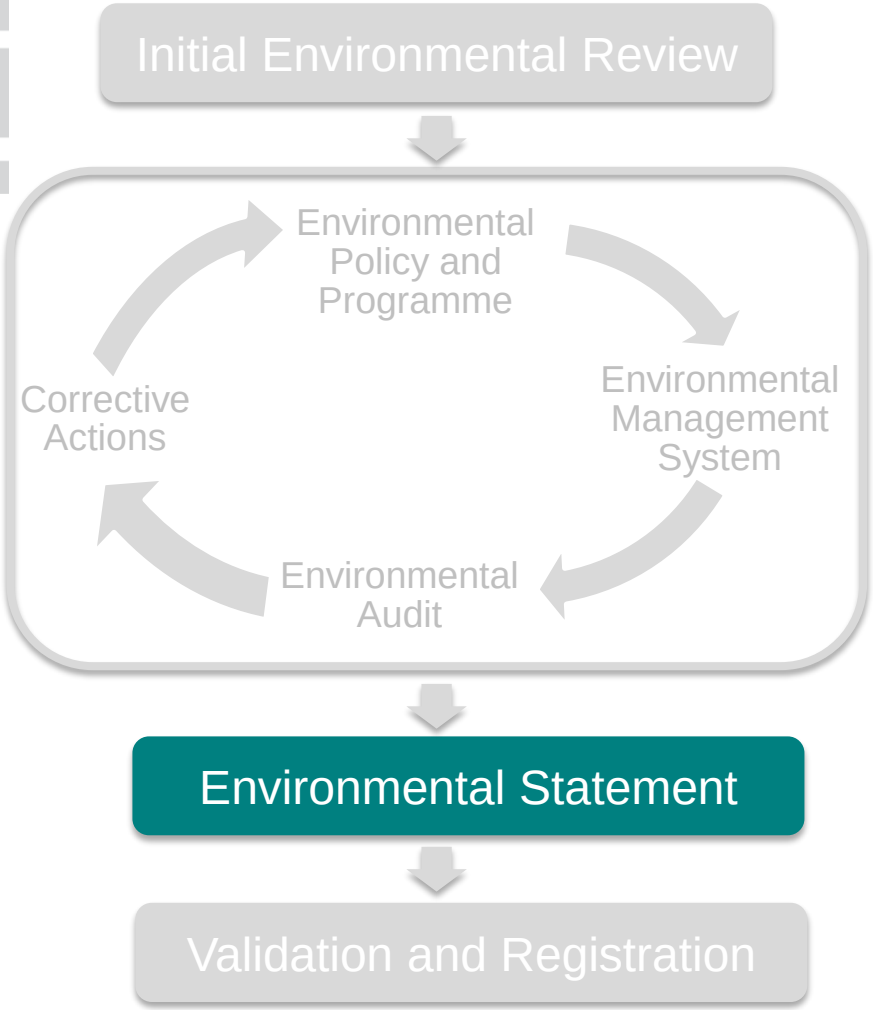
EMAS continuous improvement process



Environmental Audit:
- To asses the management system in place
- Output is described in the environmental statement

Corrective Actions:
- Compare the results obtained with those expected
- Analyse the causes of divergences

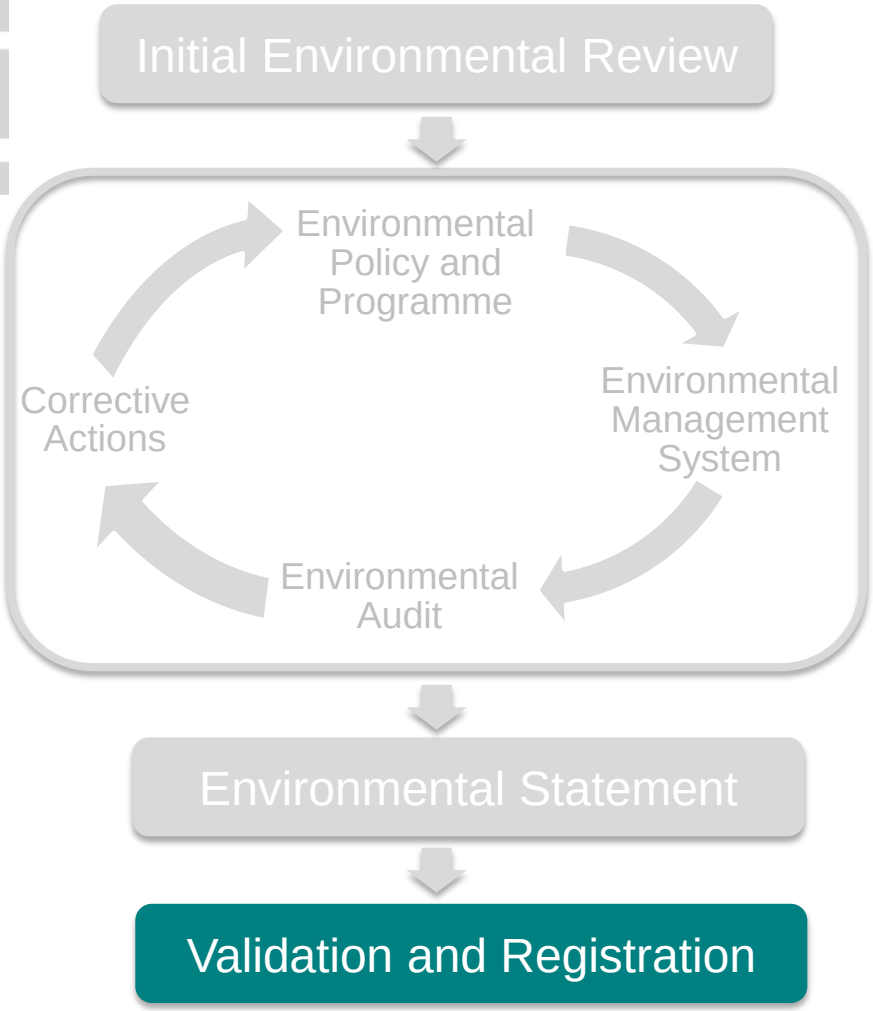
EMAS continuous improvement process



Environmental Statement:

- Description of the organization, activities, products/services
- Assessment of all direct and indirect environmental impacts
- Yearly summary on pollution emissions, waste generation, raw material consumption, energy, water and noise
- Presentation of the environmental policy, programmes and management system
- Deadline for the next statement
- Information about the verifier

EMAS continuous improvement process



➔ Environmental management system and environmental statement have to be validated by an independent accredited verifier

Verifier: independent external party who examines the organisation's environmental policy, management system, audit procedures and environmental statement

After validation ➔ registration
- Listed in EMAS register
- Right to use EMAS logo
- Annual update of env. statement

Benefits

- Use EMAS logo to **promote** an organisation's active **involvement** in environmental issues to potential customers or service users.
- **Environmental benefits**: reduce waste, energy use and resources → reduce costs
- **Communicate** environmental accountability to stakeholders through environmental statements that have been externally validated by an independent verifier
- **Continuous improvement**
- **Involve employees** – motivating action towards environmental improvement

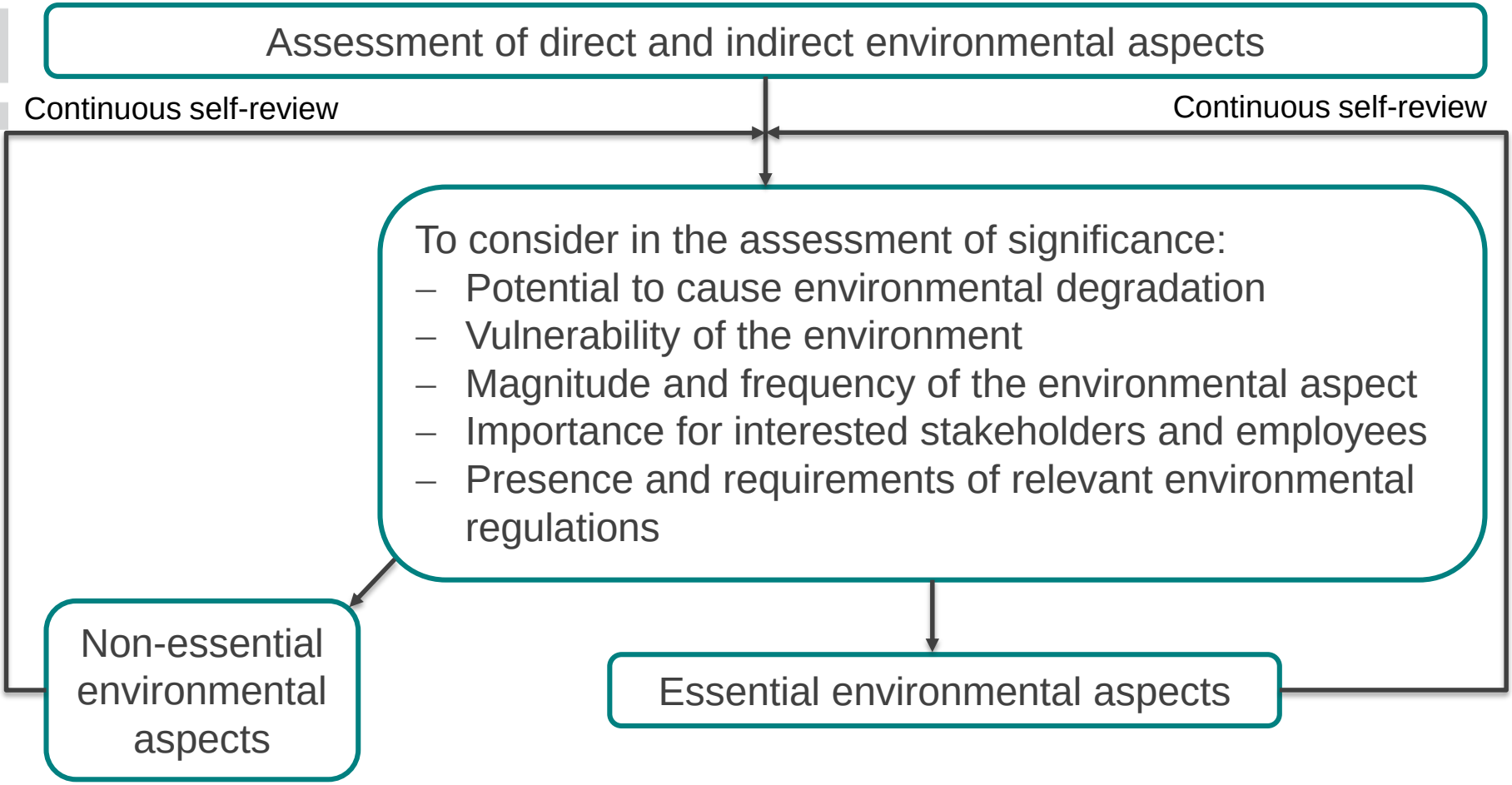
Limitations

- **Expensive**
  - Cost of verification, training of employees, registration
  - Estimation:
    - €10,000 for very small companies (< 10 employees)
    - €20,000 for small companies (< 50 employees)
    - €35,000 for medium companies (50 < 250 employees)
    - €50,000 for large companies (> 250 employees)
- Complicated or labour intensive for SMEs
- Focus: environmental impact
  - No social or economic impacts

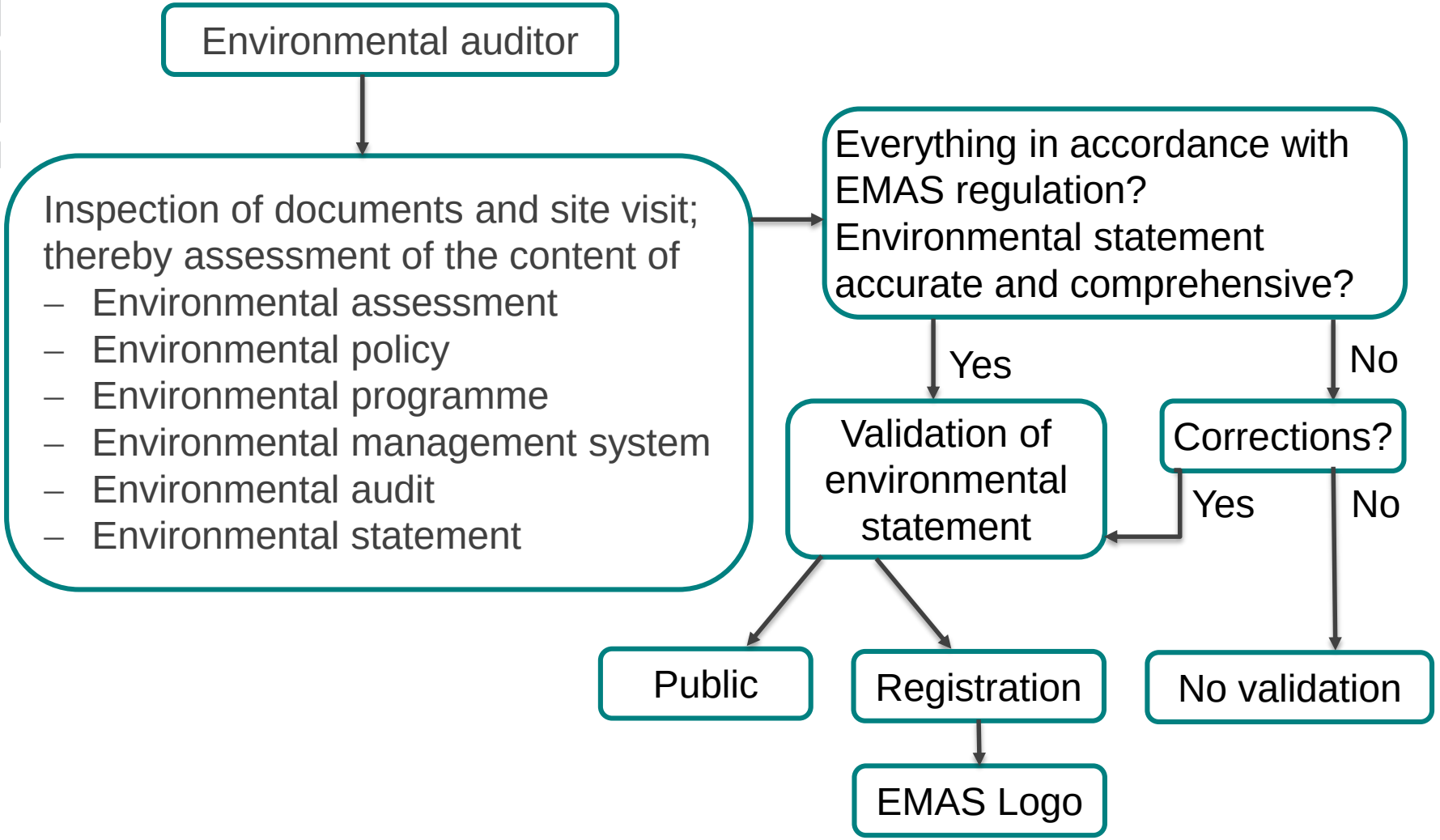
Resources

- Leadership
  - Involvement of all management levels
- Proficiencies or skills
  - Time, knowledge, human resources, external advice
- Time span to implement EMAS
  - A few month in a small organisation with few sites
  - Several years in very large organisations with many sites
  - One day per week required to keep EMAS effective

Determination of environmental aspects



Verification of the EMS



Environmental auditor

- Auditor gets admission at notified body
  - In AT: The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management
  - Prove expert knowledge and education (technical aspects, environmental laws and standards, environmental audits,…)
  - Independence
  - At least 3 years of work experience
- Ongoing supervision through notified body
- Notified body has register of approved auditors

Approved auditor (AT)

ETA Umweltmanagement & Technologiebewertung GmbH

TÜV Süd Landesgesellschaft Österreich GmbH

Quality Austria Trainings-, Zertifizierungs- und Begutachtungs GmbH

DVN GL Business Assurance GmbH

TÜV AUSTRIA CERT GMBH

Dipl.-Ing. Dr. Rudolf Kanzian

LRQA, Lloyd‘s Register EMEA Niederlassung Wien

SGS Austria Controll-Co.Ges.m.b.H.

Mag. Walter Beyer

Ernst & Young, Wirtschaftsprüfungsgesellschaft m.b.H.

TÜV Nord Austria Gm.b.H.

Examples

Austria Card GmbH, CEO:

„A lot of national and international invitations to tender already include ecological requirements and require a certification of the company according to well known environmental standards. With EMAS such a requirement can easily be fulfilled and proved.“

EGGER Spanplattenwerk, factory manager technic/production:

The environmental certificate according to EMAS and ISO 14001 are a milestone in our environmental and sustainability strategy. The EMS offers us an additional instrument to develop, foster and improve environmental and climate protection.

Differences EMAS – ISO 14001

Main differences

ISO 14001 as “subset” of EMAS

EMAS goes beyond the scope of ISO 14001

- Demonstrate legal compliance as minimum requirement.
- Commit to continual improvement of environmental performance.
- Demonstrate an open dialogue with all stakeholders.
- Extend employee involvement to the process of continually improving the organisation‘s environmental performance.

Differences EMAS – ISO (I)

	EMAS	ISO 14001
Status	Under legal bases (EU Member States and EEA countries). Regulation of the European Parliament and the Council under public law.	Under no legal bases. World wide ISO standard under private law.
Organisation	The entity to be registered shall not exceed the boundaries of the Member State, and it is intended to go towards **entities and sites**.	Does **not go towards entities or sites**.
Environmental policy	**Included commitment to continual improvement of environmental performance** of the organisation.	Does not include a commitment to the **continual improvement** of environmental performance but **of the performance of the system**.
Initial environmental review	Obligatory preliminary review, when is the first time that the organisation sets its environmental status.	Initial review is recommended, but not required.

Differences EMAS – ISO (II)

	EMAS	ISO 14001
Environmental aspects	**Identification and evaluation of the environmental aspects** (direct and indirect). Establishment of criteria for assessing the significance of the environmental aspects.	Required only a procedure able to **identify environmental aspects**.
Legal compliance	Obligatory to demonstrate it. Required full legal compliance. There is a **compliance-audit**.	Only commitment to comply with applicable legal requirements. There is **no compliance-audit**.
External communication	**Open dialogue** with the public. **Public Environmental Statement** (validate for verifiers).	**No open dialogue** with the public. Only is required to respond to relevant communication from external interested parts. Control by public is not possible.
Continual improvement	Required **annual improvement**.	Required a **periodically improvement** without a defined frequency.

Differences EMAS – ISO (III)

	EMAS	ISO 14001
Management review	Is wider and requires an evaluation of the environmental performance of the organization, based in a **performance-audit**.	Required an environmental performance in the management, but **not through a performance audit**.
Contractors and suppliers	Obligatory to demonstrate it. Required full legal compliance. There is a **compliance-audit**.	Only commitment to comply with applicable legal requirements. There is **no compliance-audit**.
Employees involvement	**Active involvement** of employees and their representatives.	**No.**
Internal environmental auditing	Includes: system-audit, performance-audit (evaluation of environmental performance), environmental compliance-audit (determination of legal compliance).	Includes only system audit against the requirements of the standard.
Auditor	**Required** the **independence** of the auditor.	**Advised** the **independence** of the auditor.

Differences EMAS – ISO (IV)

	EMAS	ISO 14001
Audits	Check for improvement of environmental performance. **Frequency required**: 3 year cycle during which all areas are verified at least once.	Check environmental system performance. **No frequency required.**
External verification	Accredited environmental verifiers.	**No.**
Verification/ Certification scope	Verifiers accredited according to NACE codes.	Certifiers accredited according to EAC code.
Authorities are informed	Obligation by validation of Environmental Statement.	No obligation.
Logo	**Yes.**	**No.**

Energy Management System

ISO 50001

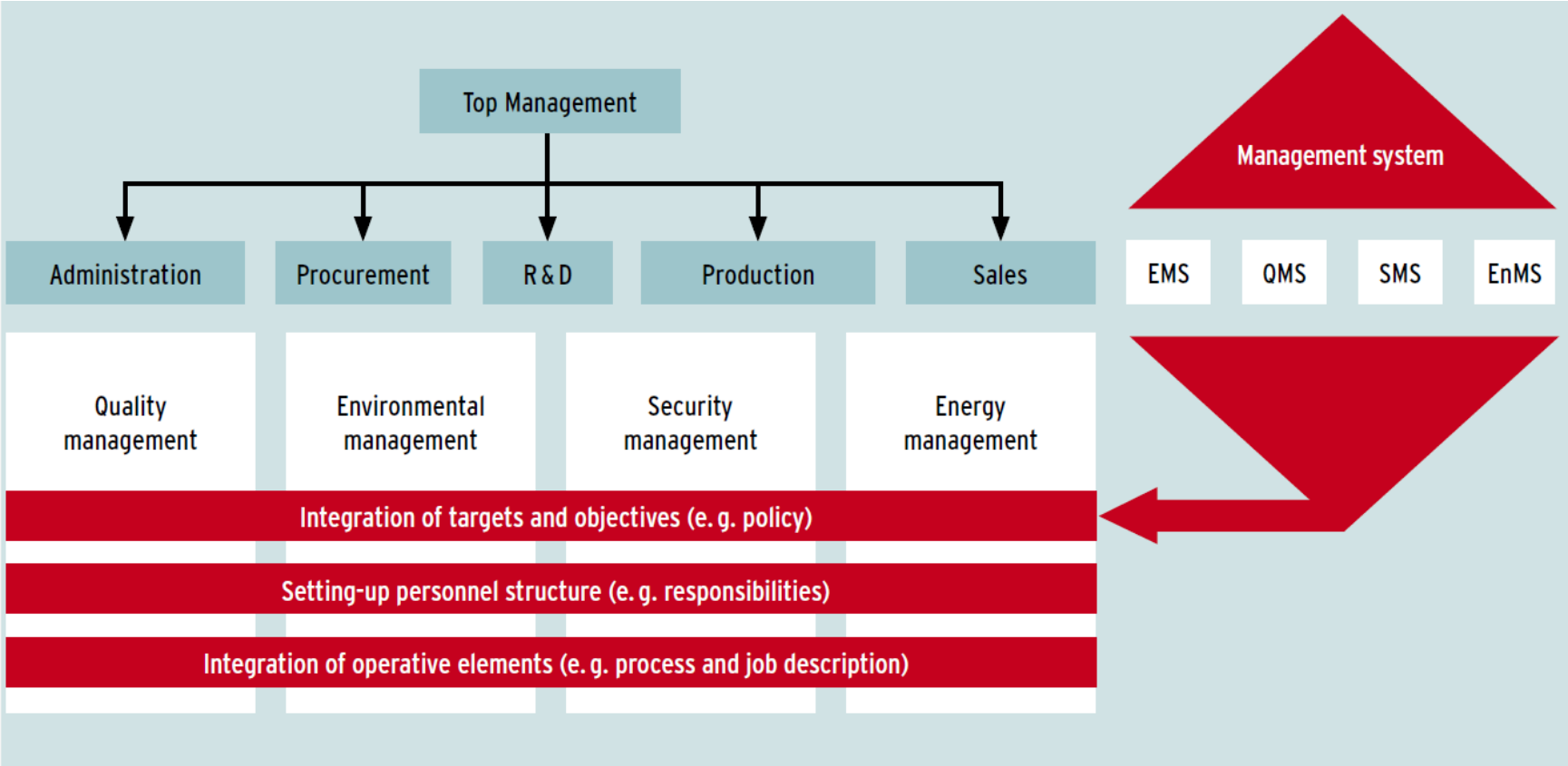
ISO 50001

- Released by ISO in June 2011
- Requirements for establishing, implementing maintaining and improving an energy management system
- Purpose: systematic approach in achieving continual improvement of energy performance
  - Energy efficiency
  - Energy security
  - Energy use and consumption
- Organizations
  - Reduce energy use
  - Reduce energy costs
  - Reduce GHG emissions

ISO 50001

- Generic standard, can be applied to:
  - Any organization, large or small
  - In any sector of activity
  - Any geographical location
- Following ISO 9001 and ISO 14001
- Improve the EnMS and the resulting energy performance (ISO 50001) **vs.** improvement to the effectiveness of the Management System (ISO 9001, ISO 14001)
  - New: Requirement for an organization to demonstrate that they have improved their energy performance
  - No quantitative targets specified, an organization chooses its own and then creates an action plan to reach the targets

Integration of EnMS



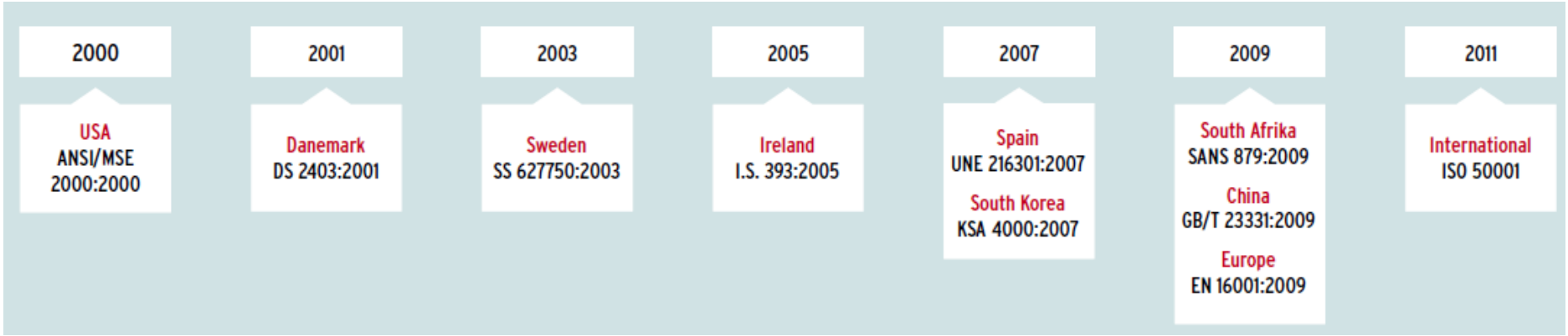
Source: BMU (2012): Energy Management Systems in Practice

ISO 50001

- Background: reduce the amount of energy consumed
- Particularly important for energy-intensive companies
- Drivers
  - Reduce costs
  - Reduce the impact of rising costs
  - Increase competitiveness
  - Meet legislative or self-imposed carbon targets (climate policies)
  - Reduce reliance on fossil fuels
  - Enhance the organization’s reputation as a socially responsible organization
  - Improvement of public image
  - Environmental protection
  - Sustainable management

Development

- United Nations Industrial Development Organization (UNIDO) industry around the world needed to mount an effective response to climate change
  - ➔ Various national energy management standards to support energy efficiency
  - ➔ ISO developed an international energy management standard



Source: BMU (2012): Energy Management Systems in Practice

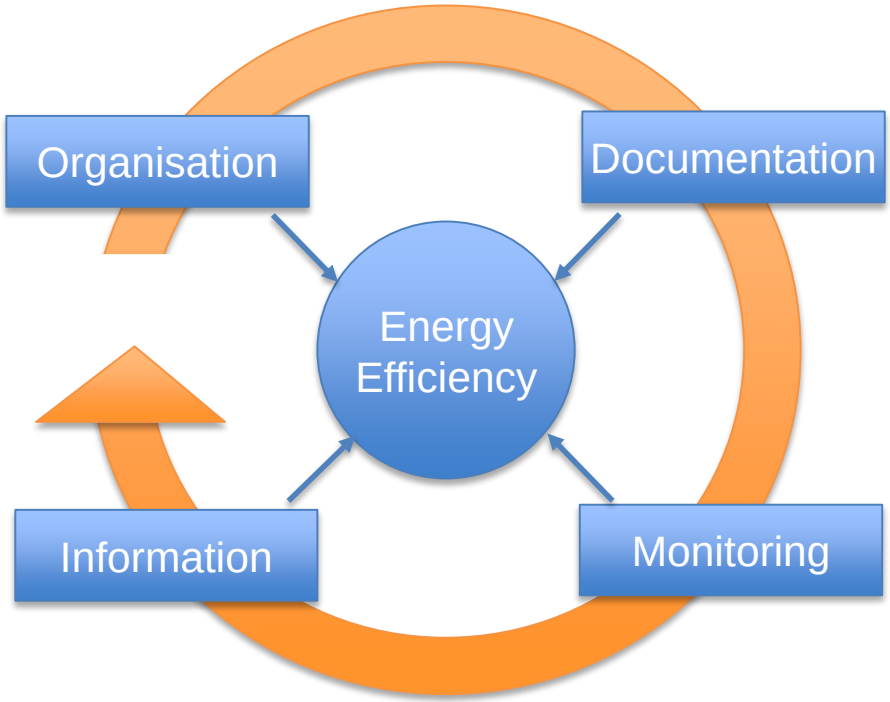
Structure

7 major components

1) General requirements
2) Management responsibility
3) Energy policy
4) Energy action plan
5) Implementation and operation
6) Performance audits
7) Management review

Energy Management System

- Records the energy flux
- Basis for investments in improving energy efficiency
- Ensure that company comply with commitments made in its energy policy
- Continuously and systematically improve energy performance



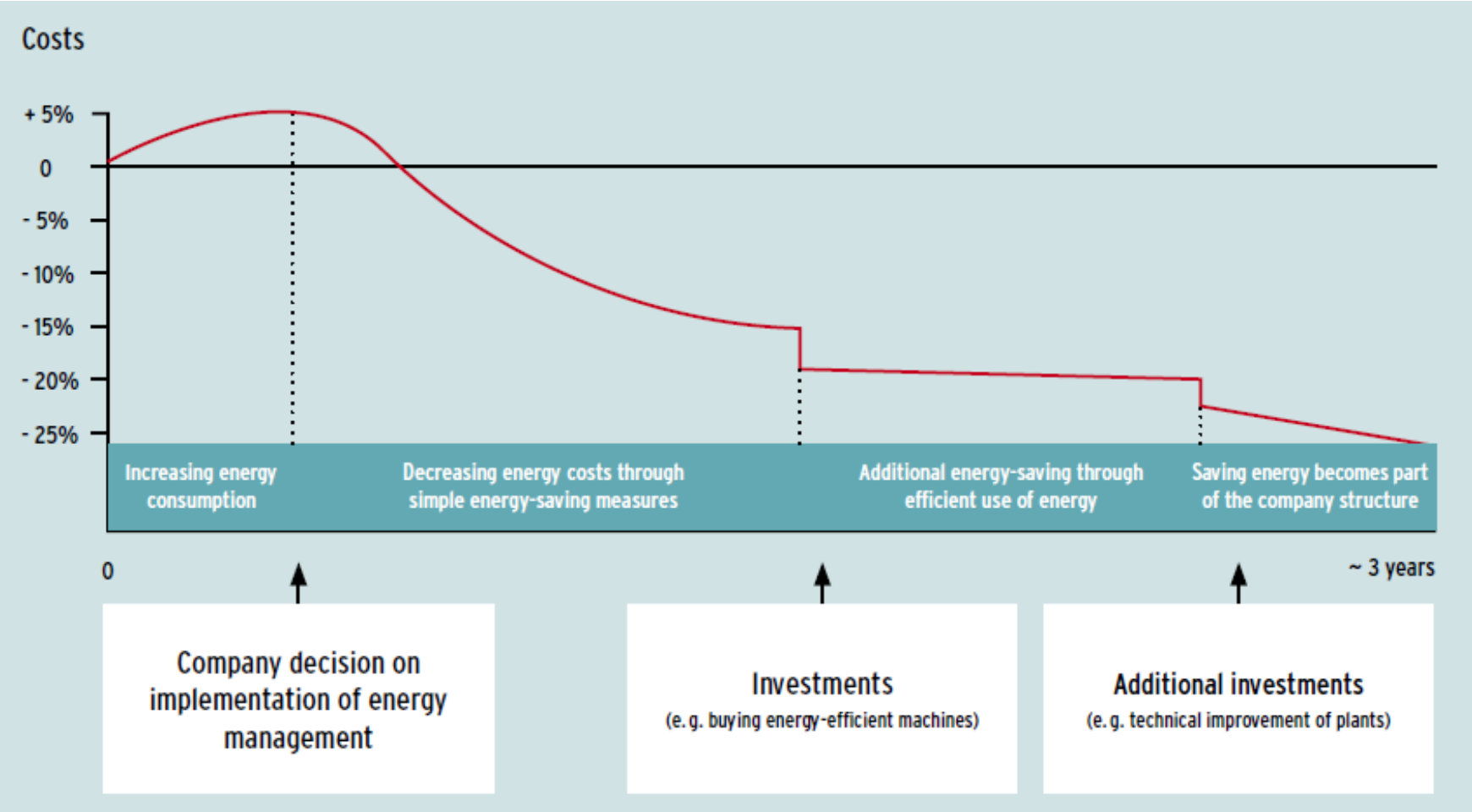
Source: BMU (2012): Energy Management Systems in Practice

Examples on energy conservation

Measures	Sectors	Investment in Euro	Cost reduction in Euro per year	Payback time (statistic)	Savings in Mwh and tons of CO_2
Installation of heat exchanging device at different locations	Construction material industry / Brick production (Schlagmann)	925.000	around 450.000	around 2 years	3.225 t CO_2
Checking the lighting situation in the furniture hall buildings	Mail order selling (Baur)	0	5.500	0	48 MWh and 30 t CO_2
New circulation pumps in swimming pools	Hospitality industry (Hotel St. Georg, Bad Aibling)	4.000	3.200	1,25 years	20 MWh and 11 t CO_2
Developing a new energy-saving synthetic paint finishing system	Car component industry (sector classification code)	133.000 (additional expenditure)	255.000	0,52 years	219 MWh electrical 4080 MWh thermal 120 t CO_2 + 1.224 t CO_2
Optimising compressed air systems	Food industry (Brauerei Haus Cramer KG)	62.500	55.000	1,1 years	775 MWh 300 t CO_2

Source: BMU (2012): Energy Management Systems in Practice

Continuous cost reduction



Source: BMU (2012): Energy Management Systems in Practice

Top management

- Motivation and commitment for EnMS of employees and the top management for long-term success
- Responsibilities of top management
  - Define and continually maintain an energy policy
  - Ensure the availability of required resources for introducing, attaining, maintaining, and improving the EnMS
  - Appoint a management representative (Energy Manager)
  - Review the EnMS at regular intervals to test if for results
  - Communicate the importance of the EnMS within the organisation
- Reasons why management doesn't introduce an EnMS
  - No one is responsible for energy matters
  - Energy costs are seen as fixed costs
  - Employees regard "their processes" as optimised and are sceptic

Energy Policy

- Starting point for a functioning EnMS
- Sets out energy-related guidelines, operating principles and long-term overall objectives for the company
- Measurement for the effectiveness of the energy management over time
- Includes **commitment** of top management to continuously improve energy efficiency
- Supports the purchase of energy-efficient products/services

PDCA cycle in energy management

1. Plan

Establishing energy-saving targets, determining the strategy, identifying measures and responsibilities, providing the necessary resources, preparing the action plan

2. Do

Establishing management structures for maintaining a continuous process, undertaking improvement measures (e.g. efficient technologies)

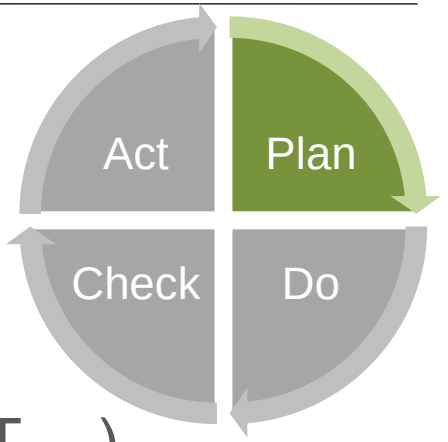
3. Check

Reviewing the level of target achievement and the effectiveness, collecting new ideas (energy audits), if necessary, consulting an external expert

4. Act

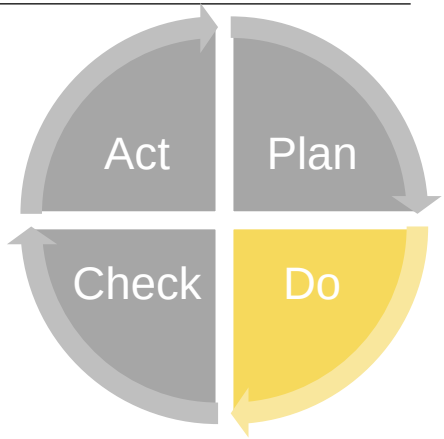
Strategic optimisation by consolidating the current energy data, audit results and new information, evaluating the progress with the help of current energy market data, deriving new objectives

Plan



1. Identifying responsibilities
   Energy manager: resources
2. Including legal obligations (EuP, EnEff, BAT,…)
3. Reviewing the consumption, costs and production figures of energy (complete energy flow)
4. Processing and documenting the collected data
5. Defining energy objectives and targets
   Specific, **M**easurable, **A**ppropriate, **R**ealistic, **T**ime-bound
6. Formulating an energy management programme and an action plan

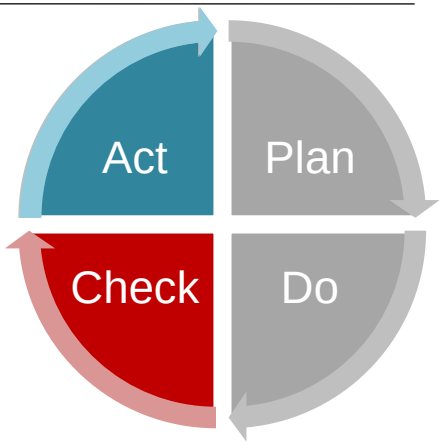
Do



Effective implementation

1. Securing the availability of necessary resources for implementing the EnMS and establishing the action plans
2. Raising and building awareness
3. Training the employees
4. Communication of the EnMS
5. Documentation of the EnMS and monitoring the documentation
6. Operational control of all the relevant processes, including acquisition, purchase and maintenance

Check & Act



To be considered during a regular review

1. Monitoring and measurement: detect inefficiencies, measure achievements
2. Reviewing compliance with legal obligations
3. Internal audits: determine current performance, assess effectiveness, analyse problems
4. Nonconformity, corrective and preventive action
5. Planning and structuring records
6. Review by top management

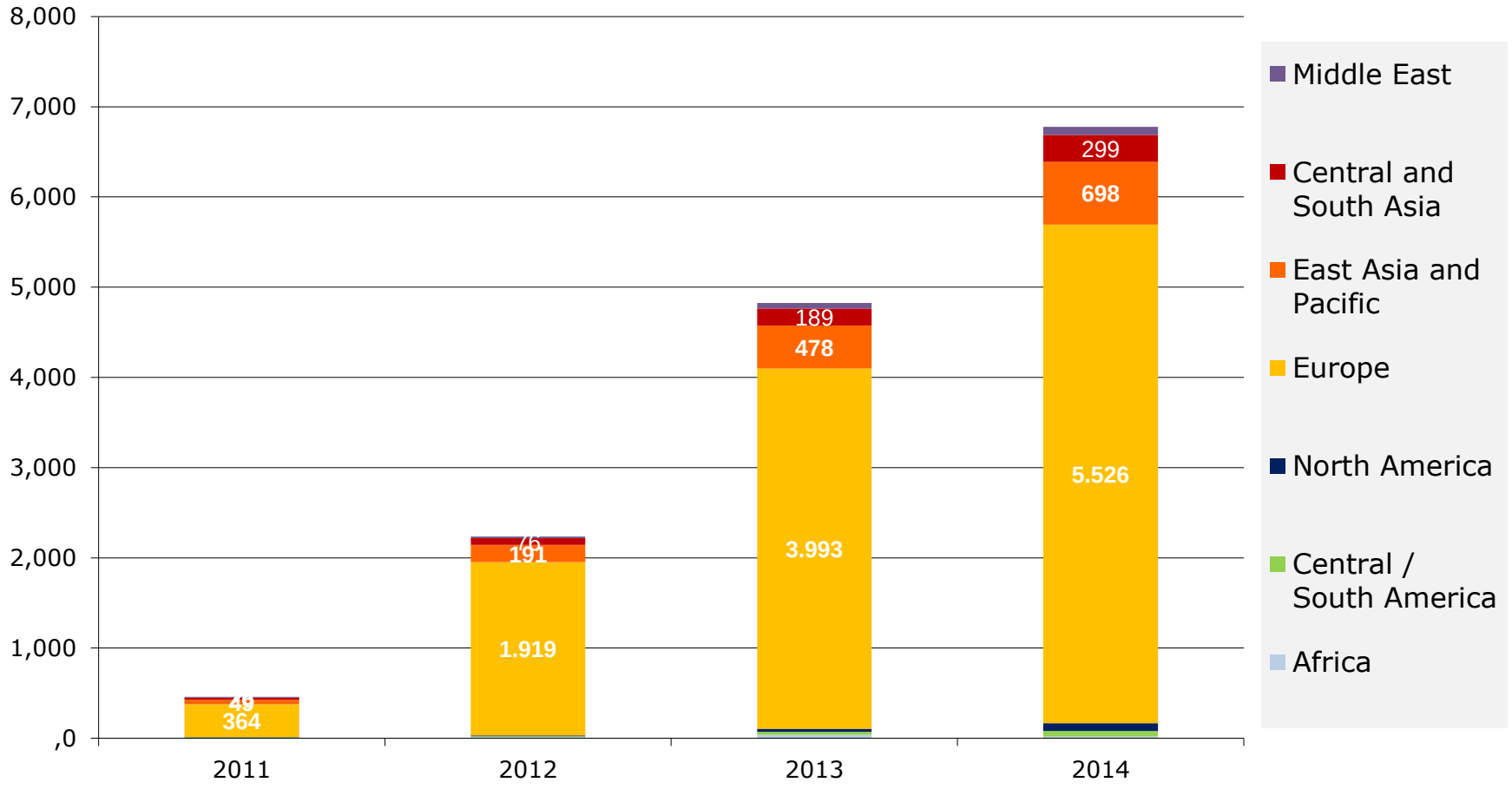
Certification

- Increase relevance of the EnMS and improve image
- Independent external certifier approve compliance of EnMS with requirements of ISO 50001
- Pre-audit
  - Business strategies, already fulfilled requirements of the standard
  - Review the documentation of EnMS (energy policy, action plan,…)
- Certification audit: agreement between defined targets and performance against these
- Annual audits by the certifier
  - Assess, enhance and optimise performance systematically
- Re-certification necessary before validity of certificate expires

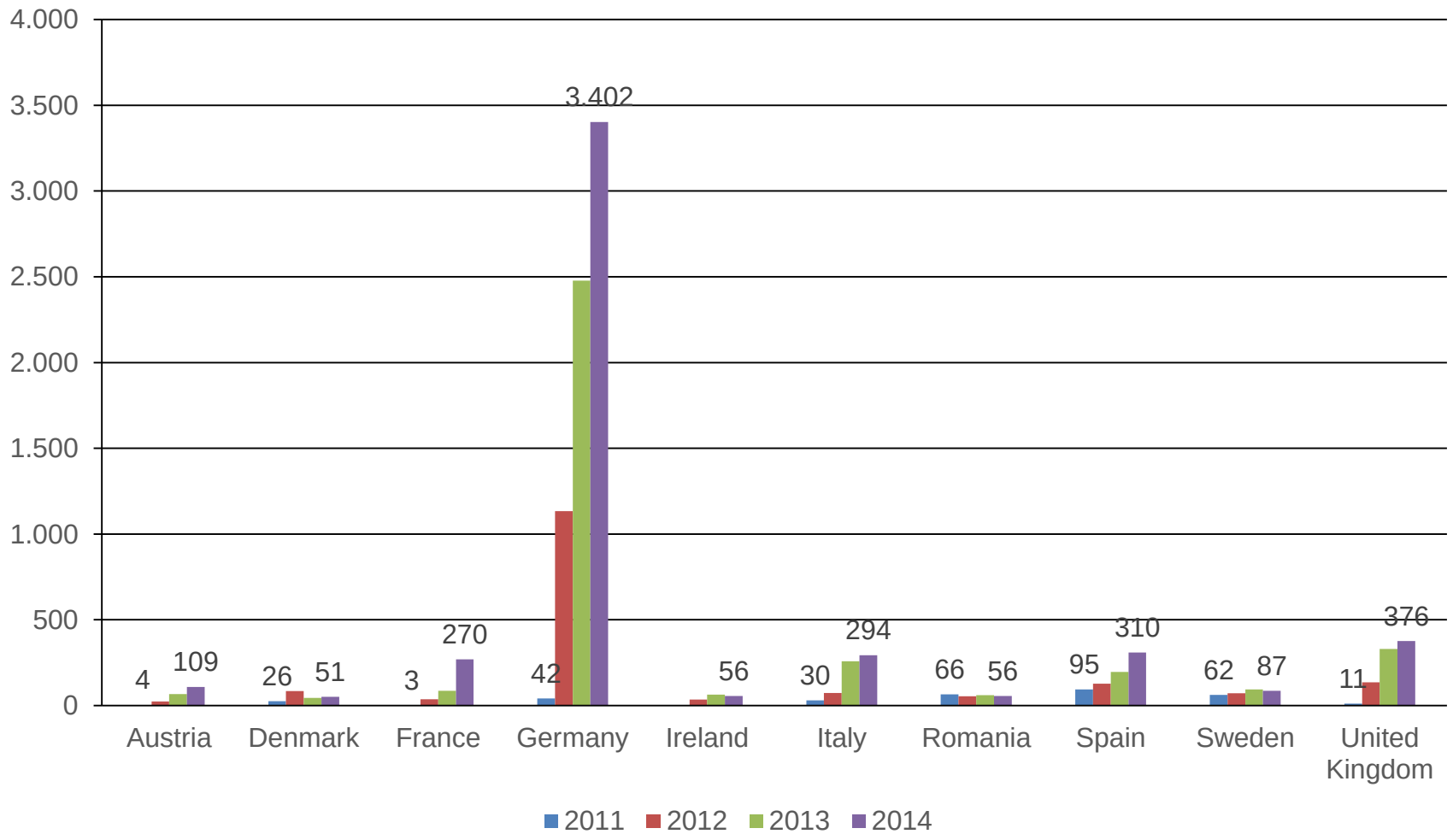
External communication

- Opportunity to highlight the credibility of your company‘s energy policy
- Include EnMS in the annual or sustainability report, menu item “energy management” on homepage, etc.
- Include certification in marketing strategy
- Prevent false statements
  - Certified according to ISO
  - DIN EN ISO 50001:2011 accredited
  - ISO 50001 is no product standard
  - Certified by

ISO 50001- Worldwide total



ISO 50001 Europe: selected countries



Energy Management Systems in Practice

ISO 50001: A Guide for Companies and Organisations

Document

Thank you for your attention!

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