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Overview of Standardization of Energy Efficiency

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Since the oil shocks of the 1970s, many countries worldwide have promoted energy efficiency improvements across all sectors of their economies. As a result of these policies and structural changes in their economies, these countries have been able to decouple primary energy use from economic growth.

The rate of decline in energy intensity has not remained constant over time; in most countries the rate of decline tended to be higher from 1970 to 1990[1].

The International Energy Agency (IEA) reports that the oil price shocks of the 1970s and the resulting energy policies have apparently been more effective in controlling the growth in energy demand and CO_2 emissions than the energy efficiency and climate policies implemented in the 1990s[2].

However, since the early 2000s, the rate of improvement in energy intensity has tended to increase, possibly in association with the increase in energy prices and greater attention to climate change issues.

It goes without saying that, these days, improving energy efficiency has become a priority in the political agenda of all countries, being key to addressing energy security and both environmental and economic challenges.

In order to support governments with their implementation of energy efficiency, many organizations have worked out a broad range of recommendations and proposed actions for

[1] IEA (2007), Energy Use in the New Millennium – Trends in IEA countries, OECD/IEA, Paris.
[2] IEA (2007), Energy Use in the New Millennium – Trends in IEA countries, OECD/IEA, Paris.

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well identified priority areas[3]. Each country would select the policies that best suit its efficiency commitment as well as its unique economic, social and political situation.

A classification of these policy options and measures[4] is given by the World Energy Council[5] as follows:

- Institutions and programmes
  - Institutions: agencies (national, regional and local), Ministry department
  - National programmes of energy efficiency with quantitative targets and laws
- Regulatory measures
  - Minimum efficiency standards and labels for electrical appliances (e.g. refrigerators, washing machines, AC, lamps, water heaters, motors), cars and buildings (new and existing)
  - Other regulations for designated consumers: mandatory energy managers, mandatory energy consumption reporting, mandatory energy saving and mandatory maintenance
  - Obligation of energy savings for energy companies at consumers' premises
- Financial and fiscal measures
  - Subsidies for audits by sector (industry, commercial, public, households, low income households transport)
  - Subsidies or soft loans (i.e. loans with subsidised interest rates) for energy efficiency investment and equipment by sector
- Fiscal measures
  - Tax credit
  - Accelerate depreciation
  - Tax reduction for efficiency investment, by type of tax (import, VAT, purchase, annual car registration) and by type of equipment (appliances, cars, lamps)
- Cross-cutting measures
  - Innovative communication tools
  - Voluntary agreements.

Exercises have been carried out extensively to measure how effective these energy efficiency policies are. As an example, IEA reviews the state of the art of the energy efficiency policies, highlighting strengths and areas for improvement (Table 1.1 and Table 1.2).

Despite having a huge potential, energy efficiency policies[8] are difficult to implement. Why? Energy efficiency faces pervasive barriers, including lack of access to capital for energy efficiency investments, insufficient information, and externality costs that are not reflected in energy prices. Moreover political commitment to maximizing the implementation of energy efficiency policies may also have been challenged by the current economic crisis. Energy

[3] For example IEA recommended the adoption of a set of specific energy efficiency policy measures to the last four G8 summits; for further information on the full set of recommendations, refer to http://www.iea.org/textbase/papers/2008/cd_energy_efficiency_policy/index_EnergyEfficiencyPolicy_2008.pdf

[4] A comprehensive database of energy efficiency policies and measures is provided by IEA (http//www.iea.org/textbase/pm/index_effi.asp)

[5] WEC, *Energy Efficiency: A Recipe for Success*, 2010, p. 40.

[6] IEA, *Implementing Energy Efficiency Policies*, 2009, p. 23.

[7] IEA, *Implementing Energy Efficiency Policies*, 2009, p. 33.

[8] It is worth mentioning that there is literature on most common criticisms of energy efficiency policies and programmes. These critics argue that energy efficiency policies and programmes are unwarranted or are a failure. IEA promoted the publication of a paper that compiles, categorises, and then evaluates those criticisms of energy efficiency policies (see 7).

Table 1.1 Summary of strengths and innovations in IEA member countries' energy efficiency policies in the building, industrial and transport sectors[6]

Buildings	
	• Full implementation of building certification in several EU countries • Policies promoting passive energy houses • Energy efficiency requirements in building codes
Industry	
	• High coverage of industry energy statistics in all countries • Policies for promoting energy management • Ad hoc policies for SMEs • Policies for cogeneration, energy efficient electric motors
Transport	
	• Policies aimed at rolling resistance of tyres • Fuel efficiency standards for light and heavy duty vehicles (JP only) • Eco drive policies • Scrappage schemes encouraging purchase of more efficient and less polluting new vehicles

Table 1.2 Summary of challenges and areas for improvement in IEA member countries' energy efficiency policies in the building, industrial and transport sectors[7]

Buildings	• Establish stronger energy efficiency requirements for buildings • Strengthen support for Passive Houses and zero-energy buildings • Increase promotion of energy efficiency windows and glazing
Industry	• Establish measures to optimize energy efficiency in motor driven systems • Set up policies and measures to assist SMEs
Transport	• Ensure the implementation fuel efficiency standards of planned policies • Create fuel efficiency standards for heavy duty vehicles

efficiency programmes must compete for funding with other priorities such as employment, health and social security.

1.1 Standardization

As stated above, energy efficiency faces barriers to success. Examples of such barriers include: the lack of awareness of the savings potential, inadequate performance efficiency information and metrics, the tendency to focus on the performance of individual components rather than the energy yield or consumption of complete systems, split incentives and the tendency to focus on lowest initial cost rather than life cycle cost. Standards can help in overcoming some of these barriers. Standards, for instance, can provide common measurement and test methods to assess the use of energy and the reductions attained through new technologies and processes, as well as providing a means of codifying best practices and management processes for efficient energy use and conservation.

Furthermore, standards can provide design checklists and guides that can be applied to both the design of new systems and the retrofit of existing systems; they can provide standard

calculation methods so that sound comparisons of alternatives can be made in specific situations and they can help with the adaptation of infrastructure to integrate new technologies and aid interoperability.

An overview of the current standardization activities on energy efficiency is given in the following sections.[9]

1.1.1 ISO

The work of the ISO (International Organization for Standardization) on energy efficiency began in June 2007 when the ISO Council Task Force on Energy Efficiency and Renewable Energy Sources identified five areas of high priority that were deemed to have the highest potential to contribute substantially to energy savings and greenhouse gas emission reductions, namely:

- Calculation methods
- Energy management standards
- Biofuels
- Retrofitting and refurbishing
- Buildings.

In line with the Council's request[10], the Technical Management Board (TMB) established a Strategic Advisory Group (SAG) on Energy efficiency and renewable energy sources[11] for an initial period of 2 years (until February 2010). SAG E was asked to provide advice and guidance to TMB on priority standards and actions, including involving stakeholders' collaboration with other international organizations and co-ordination between ISO and TCs, etc. The goal was to speed up the process of devising a standardization programme in this field that will serve public policy objectives and market needs.

SAG-E produced an extensive report, providing 66 recommendations, which were endorsed by the TMB. SAG-E activity has been extended for another 3 years.

1.1.1.1 ISO 50001

In February 2008, the ISO Technical Management Board approved the establishment of a new project committee, ISO/PC 242, Energy management[12], building on practices and existing national or regional standards.

ISO 50001 will establish an international framework for industrial and commercial facilities, or entire companies, to manage all aspects of energy, including procurement and use. After four committee meetings, spanning a period of two years, the document was published in June 2011 and was adopted by CEN and CENELEC as ISO EN 50001 in October 2011. The

[9] This overview took into account standardization, directly concentrating on energy efficiency from a system approach point of view.

[10] Resolution 28/2007.

[11] ISO Technical Management Board Resolutions 22/2008.

[12] ISO Technical Management Board Resolutions 15/2008.

standard is intended to provide organizations and companies with a recognized framework for integrating energy efficiency into their management practices.

ISO 50001 will provide organizations and companies with technical and management strategies to increase energy efficiency, reduce costs, and improve environmental performance.

1.1.1.2 ISO/IEC JPC 2

In 2009, ISO and the International Electrotechnical Commission (IEC) created the joint project committee ISO/IEC JPC 2, Energy efficiency and renewable energy sources – Common terminology, whose primary objective is to develop a standard that will identify cross-cutting concepts with terms and definitions associated with energy efficiency and renewable energy sources, while taking into account terminology that has already been elaborated in sector-specific ISO and IEC technical committees.

Three working groups (WG) were established at the first meeting of ISO/IEC JPC in January 2010:

- WG 1, Energy efficiency : Concepts and diagrams, coordinated by ANSI (USA)
- WG 2, Inputs from existing reference documents, coordinated by SIS/SEK (Sweden)
- WG 3, Renewable energy sources – Terms and definitions, coordinated by AFNOR (France).

The Committee Draft (CD) step was launched in October 2011.

1.1.2 IEC

IEC's vision on Energy efficiency is outlined in its White Paper, 'Coping with the Energy Challenge'[13]. Developed by the IEC Market Strategy Board (MSB), this document maps out global energy needs and potential solutions over the next 30 years and the IEC's role in meeting the challenges.

IEC thinks that a system approach that takes into account all aspects of generating, transporting and consuming energy must be considered to cope with the energy efficiency challenges and that measurement procedures and methods of evaluating energy efficiency must be specified in order to assess potential improvements properly and to optimize technological issues (Best Available Technology, BAT).

1.1.2.1 SG1 'Energy Efficiency and Renewable Resources'

In 2007 IEC began to establish subsidiary bodies to advise its Management Board on strategic issues that would determine future technical work. Among these was the SG1, which was established on the specific topic of energy efficiency.

[13] http://www.iec.ch/smartenergy/

SG 1 was established at the beginning of 2007 and was tasked to:

- analyse the status quo in the field of energy efficiency and renewable resources (existing IEC standards, on-going projects)
- identify gaps and opportunities for new work in IEC's field of competence
- set objectives for electrical energy efficiency in products and systems
- formulate recommendations for further actions.

Since then experts from other groups inside the IEC and other organizations such as IEA, CIE, etc. have met to present their activities and achievements in the areas of energy efficiency and renewable resources and to provide their input to the discussions.

The main outcomes of SG1's work are 34 recommendations that were sent to SMB and TC members for comments.

1.1.2.2 SG3 'Smart Grid'

In this context it is worth mentioning another Study Group (SG) that is linked to energy efficiency: SG3 'Smart Grid'. SG3, set up in 2008, provides advice on fast-moving ideas and technologies that are likely to form the basis for new International Standards or IEC Technical Committees in the area of Smart Grid technologies.

SG3 has developed the framework and provides strategic guidance to all Technical Committees involved in Smart Grid work and has developed the Smart Grid Roadmap[14], which covers standards for interoperability, transmission, distribution, metering, connecting consumers and cyber security.

1.1.2.3 SG4 'LVDC Distribution Systems up to 1500 V DC'

SG 4 was set up in 2009 with the objective of having a global systematic approach and to align and coordinate activities in many areas where LVDC is used, such as green data centres, commercial buildings, electricity storage for all mobile products (with batteries), EVs, etc, including all mobile products with batteries, lighting, multimedia, ICT, etc. with electronic supply units.

SG4 is another example of an area of activity that is not directly dedicated to energy efficiency but whose role could be strategic in harvesting energy efficiency potential.

1.1.3 CEN and CENELEC

CEN and CENELEC were the most proactive standardization organizations as they started in 2002, to analyse the challenges of standardization in the field of energy efficiency and to elaborate general strategy.

Another interesting and valuable aspect is that CEN and CENELEC decided to start this activity jointly, thus implementing de facto an integrated system approach that is of utmost importance.

[14] http://www.iec.ch/smartgrid/downloads/sg3_roadmap.pdf

Table 1.3 CEN–CENELEC Joint Working Groups active in the field of Energy Management and Energy Efficiency standardization

Technical body	Scope of work
JWG1 'Energy Audits'	
JWG2 'Guarantees of origin and energy certificates'	Standardization on guarantees of origin for trading and/or disclosure/labelling of electricity and CHP and on energy certificates
JWG3 'Energy Management and related services – General requirements and qualification procedures'	To elaborate EN standards in the energy management and related services field: • Energy Management Systems: definition and requirements • Energy Service Companies (ESCO): definition, requirements and qualification procedures • Energy Managers and Experts: roles, professional requirements and qualification Procedures
JWG4 'Energy efficiency and saving calculation'	Standards for common methods of calculation of energy consumption, energy efficiencies and energy savings and for a common measurement and verification of protocol and methodology for energy use indicators

The CEN/CENELEC BT JWG 'Energy management' was set up at the beginning of 2002 to initiate a European collective view of the general strategy for improvement of energy efficiency standardization and to set an agreement between all CEN/CENELEC members on the objectives to be achieved.

The working group acted as an advisory group to CEN and CENELEC BTs on all political and strategic matters relating to standardization in the field of energy efficiency from 2002 to 2005. The main results of the work are synthesized in a report[15] that gives an overview of proposals in standardization in the field of energy management, classified into three level of priorities[16]. This document is still the basis for CEN and CENELEC standardization activity in the field of energy efficiency.

The key technical bodies involved in energy efficiency standardization are summarised in Table 1.3 together with the most important standardisation activities (Table 1.4).

1.1.3.1 SFEM

In response to the CEN/CENELEC BT JWG 'Energy management' recommendation, CEN and CENELEC have created a horizontal structure, a Sector Forum Energy Management (SFEM), dedicated to the definition of a common strategy for standardization in the field of energy management and energy efficiency. SFEM is a platform for stakeholders to share information and experiences, and to identify priorities regarding standardization in the energy sector.

[15] http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/Forum/Documents/BTN7359FinalReportJWG.pdf

[16] Level A – for immediate action; Level B – that need further investigation or research before standardisation could be done; Level C – that need to be discussed in the context of a strategic and holistic view, i.e. policy questions.

Table 1.4 CEN–CENELEC standards and projects in the field of Energy Management and Energy Efficiency

Publication/Project	Title
EN 16001:2009 (pr=22320)	Energy management systems – Requirements with guidance for use
EN 15900:2010 (pr=22416)	Energy efficiency services – Definitions and requirements
prEN 16247-1:2011 (pr=23294)	Energy audits – Part 1: General requirements
prEN 50XXX (pr=23227)	Guarantees of origin related to energy – Guarantees of origin for electricity
prEN PT EEB Doc:2010 (pr=23079)	Energy efficiency benchmarking methodology
EN ISO 50001:2011 (pr=23639)	Energy management systems – Requirements with guidance for use
prEN 16212:2010 (pr=23138)	Standard on top down and bottom up methods of calculation of energy consumption, energy efficiencies and energy savings

SFEM is designed:

- to maintain and enlarge the network of partners created during the lifetime of the CEN/CENELEC BT JWG "Energy Management", especially with regards to new members;
- to initiate further investigation and to evaluate in which field or for which subject, further standardization work is needed and including subjects identified as Priority B or C by the former CEN/CENELEC BT JWG "Energy Management";
- to coordinate on-going European Standardization activities concerning Energy Management;
- to organize the CEN and CENELEC response to European legislation and Europe general strategy in the Energy Management sector;
- to maintain the exchange of information, experience and prospecting especially on the initiatives in course in the different countries or at European level.

SFEM meets twice a year, does not carry out any standardization activity and formulates recommendations to CEN and CENELEC for further actions. CEN and CENELEC usually react by setting up dedicated technical bodies (usually joint working groups) with specific scopes of work.

Further Readings

H. Geller and S. Attali, The experience with energy efficiency policies and programmes in IEA countries. Learning from the Critics, IEA Information Paper, 2005.

IEA, *Implementing Energy Efficiency Policies*, 2009, OECD/IEA, Paris.

WEC, WEC: *Energy Efficiency: A Recipe for Success*, 2010.