Deliverable 2.6

WP2, Task 2.5: Worldwide and EU current practices in market surveillance

Document published: 18.01.2018 – Revised Report
Lead author of this document: ENEA
Project coordinator: WIP

Co-funded by the Horizon 2020 programme of the European Union

Horizon 2020 programme
Project acronym: INTAS
Project full name: Industrial and tertiary product Testing and Application of Standard

Project Title	**Industrial and tertiary product Testing and Application of Standards**
Deliverable Title	Worldwide and EU current practices in market surveillance
Due Date for Deliverable:	28 February 2017
Actual Submission date:	28.02.2017 - Revised version published on 18.01.2018
Lead Beneficiary	ENEA
Author(s)	Milena Presutto, with input from Juraj Krivosik (SEVEn)
Dissemination level	This revised version of the report is intended for public dissemination.
Keywords	Transformers, Fans, Market Surveillance, Testing, Europe, Energy, Ecodesign Directive
Contract n.	Grant Agreement Number 695943
Project duration	March 2016 – February 2019

Table of Contents

About the INTAS project **6**
Executive summary **9**
1. Introduction **10**
1.1 An overview 10
2. The desk research **12**
2.1 Technical boundaries 12
2.2 Geographical boundaries 12
2.3 Certification and compliance verification for transformers and fans 13
2.3.1 Australia and New Zealand 13
2.3.1.1 Greenhouse and Energy Minimum Standards Act 13
2.3.1.2 GEMS legislation for distribution transformers and industrial fans 14
2.3.1.2.1 Fans 14
2.3.1.2.2 Transformers 14
2.3.1.3 GEMS legislation compliance verification 15
2.3.1.3.1 The Australian "check testing" procedure 17
2.3.1.3.2 Compliance verification results 20
2.3.1.4 Compliance verification actions for fans and transformers 20
2.3.2 USA 20
2.3.2.1 The requirements for transformers 20
2.3.2.1.1 Compliance verification results 21
2.3.2.2 The requirements for commercial and industrial fans 22
2.3.2.3 ENERGY STAR compliance verification 23
2.3.2.3.1 The Department of Energy approach 23
2.3.2.3.2 The Energy Star Certification Body approach 24
2.3.2.3.3 The Energy Star Pilot Component Inspection Approach 26
2.3.2.4 Federal efficiency requirements certification and compliance verification 28
2.3.2.4.1 Certification 29
2.3.2.4.2 Enforcement testing 29
2.3.2.4.3 Alternative efficiency determination and rating methods 29
2.3.2.4.4 Procedures for transformers 30
2.3.2.4.5 Alternative approach for low-volume, custom built products 31
2.3.2.4.6 Compliance verification results 31
2.3.2.5 Compliance verification actions for fans and transformers 33
2.3.3 Canada 34
2.3.3.1 The Canadian energy efficiency legislation 34
2.3.3.1.1 Responsibility of dealers 34
2.3.3.1.2 Energy Efficiency Report 34
2.3.3.2 Energy Efficiency verification mark 35
2.3.3.3 Legislation compliance verification 36

2.3.3.4 The legislation for fans and transformers 36
2.3.3.5 Compliance verification actions for fans and transformers 37
2.3.4 India 37
2.3.4.1 The Standards and Labelling Program 37
2.3.4.1.1 Monitoring, verification and enforcement 37
2.3.4.2 Energy efficiency labelling for transformers 39
2.3.4.3 The BIS Product Certification Scheme 40
2.3.4.4 Compliance verification actions for fans and transformers 42
2.3.5 Mexico 42
2.3.5.1 Energy efficiency regulation for transformers 42
2.3.5.1.1 Mandatory efficiency requirements 42
2.3.5.1.2 Voluntary endorsement label 44
2.3.5.2 Compliance verification actions for fans and transformers 45
2.3.6 China 45
2.3.6.1 The legislation for transformers 46
2.3.6.2 The legislation for industrial fans 48
2.3.6.3 Compliance verification actions for fans and transformers 48
2.3.7 Japan 48
2.3.7.1 The Top Runner for transformers 48
2.3.7.2 The Energy-saving labelling program 50
2.3.7.3 The legislation for industrial for industrial fans 51
2.3.7.4 Compliance verification actions for fans and transformers 51
2.3.8 European Union 51
2.3.8.1 Regulation 548/2014 51
2.3.8.2 Regulation 327/2011 53
2.3.8.3 The Modules within the EU New Approach legislation 55
2.3.9 European Union Member States 58
2.3.9.1 Nordic countries within Nordsyn 58
2.3.9.2 Sweden 58
2.3.9.2.1 Compliance verification actions for fans and transformers 61
2.3.9.3 Denmark 61
2.3.9.3.1 Compliance verification actions for fans and transformers 63
2.3.10 Private certification schemes 63
2.3.10.1 NEMA 63
2.3.10.2 AMCA 65
2.4 Other approaches 67
2.4.1 Bidding procedure 67
2.4.2 Custom test plans for manufacturers 69
2.4.3 Testing at manufacturer's premises 69
2.4.3.1 Agreement between the national Authority and the manufacturers in Belgium 69
3. Task conclusions 73
3.1 Summary of the MV&E techniques worldwide 73

3.2 Desk research conclusions 86
Annex A: Energy File Report Requirements for commercial steam cookers 88
Annex B: DoE determination of compliance for distribution transformers 91
Annex C: The Belgian Convention 94
Abbreviation list 99
References 100
List of Figures 101
List of Tables 102

NOTE: according to international standards dealing with quantities and units, the numbers in this study are written according to the following rules:

- the comma "," is the separator between the integer and the decimal part of a number
- numbers with more than three digits are divided by a blank in groups of three digits
- in case of monetary values the numbers are divided by a dot in groups of three digits

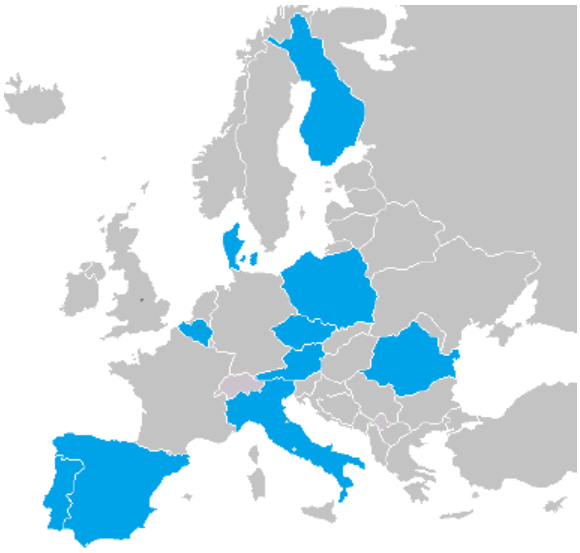
About the INTAS project

The aim of the INTAS project is to provide technical and cooperative support, as well as capacity building activities, to Market Surveillance Authorities (MSAs). The need for the INTAS project arises from the difficulty that MSAs and market actors face in establishing and verifying compliance with energy performance requirements for large industrial products subject to requirements of the Ecodesign Directive, specifically transformers and industrial fans. Therefore, the project aims to:

- Support European Member State MSAs deliver compliance for large products (specifically for transformers and large fans);
- Support industry to be sure of what their obligations are under the Ecodesign Directive and to deliver compliance in a manner that will be broadly accepted by MSAs;
- Foster a common European approach to the delivery and verification of compliance for these products.

List of project partners:

WIP Renewable Energies	Europe
European Environmental Citizens' Organisation for Standardisation	Europe
European Copper Institute	Europe
Engineering Consulting and Design	Europe
Waide Strategic Efficiency	Europe
Austrian Energy Agency	Austria
Federal Public Service Health, Foodchain, Safety and Environment	Belgium
SEVEn Energy Efficiency Center	Czech Republic
Danish Technological Institute	Denmark
Finnish Safety and Chemicals Agency	Finland
The Polish Foundation for Energy	Poland
Directorate General of Energy and Geology	Portugal
Romanian Regulatory Authority for Energy	Romania
Foundation for the Promotion of Industrial Innovation	Spain
Italian National Agency for New Technologies, Energy and Sustainable Economic Development	Italy
Economic and Food Safety Authority	Portugal



It is currently believed that no Member State has tested large fans or transformers in relation to the ecodesign requirements since the publication of Regulation 548/2014 for transformers and Regulation 327/2011 for fans and Regulation 1253/2014 for ventilation fans.

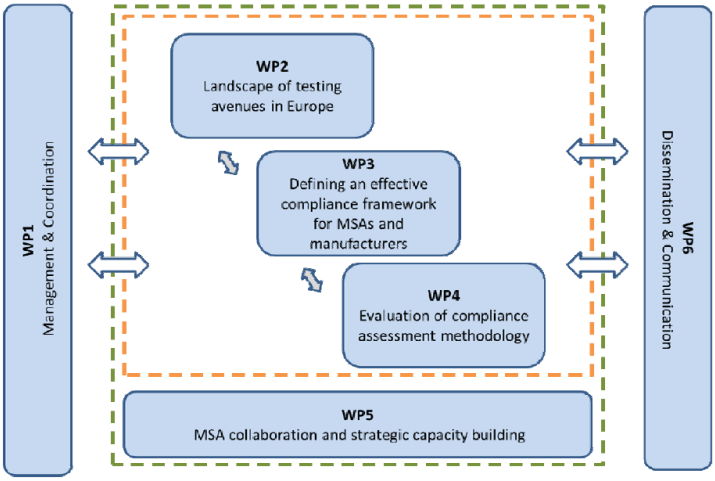
In general large fans are considered those with a motor input power larger than 10 kW, while large transformers are typically those with a power higher than 40 MVA, but also smaller equipment could be considered.

In short, the reasons for the lack of market surveillance can be as follows: lack of expertise within the market surveillance authorities (MSAs) for these particular products, lack of resources (human, financial, time), lack of experience in testing large products, or even lack of specialised testing laboratories.

The INTAS project aims to address all of these issues, and providing meaningful and customised tools and support to initiate testing for market surveillance purposes across the EU.

A key part of the project activities will be to identify and share existing experience and best practices for market surveillance and ecodesign enforcement, to be used as the basis for developing, validating and proposing an effective procedure for large industrial products.

This is the aim of the project's Work Package 2 "Landscape of testing avenues" is to analyse in depth the existing testing avenues in Europe and the rest of the world, and to explore test standards, facilities, procedures and methods already in place. The overall goal is to help:



(1) EU and worldwide MSAs to set up a sustainable and effective market verification of energy performance compliance and information requirements for large products with a specific focus on power transformers and fans.

(2) EU (and worldwide) Standardisation bodies to amend actual standards for energy performance compliance and information requirements for large products with a specific focus on power transformers and fans.

(3) EC to enhance ecodesign policy measures on energy performance of large products with a specific focus on power transformers and fans.

The work in this work package is a prerequisite for defining a common approach at European level, to develop common MSA methods and tests convergence at EU scale. WP2 is divided into 5 Tasks:

- Task 2.1 – Worldwide and EU Technical standard and legislative framework
- Task 2.2 – Worldwide and EU Testing facilities framework
- Task 2.3 – Accreditation bodies
- Task 2.4 – Market commercial testing practice framework
- Task 2.5 – Worldwide and EU current practices in market surveillance.

These Tasks are designed to define the state of the art at EU and worldwide level, useful to derive indications, elements and criteria for a common approach at European level to allow MSAs to perform a practicable but effective energy efficiency related verification of large products overcoming the actual constraints of this type of action, for example:

- large products like large power transformers cannot be removed from service for the purposes of after installation verification testing, due to high costs of out of service
- difficulties/costs/impossibility to transport large products for verification testing purposes to the specific location of test laboratories
- unclear compliance of existing testing procedures with technical and legislative prescriptions
- limited current available testing possibilities for large products in the EU.

The main scope is to provide the elements to help European MSA to set up a system for market verification of power transformers and fans, avoiding duplication of testing, and foster the cooperation of the main actors involved in the process: MSAs, laboratories, manufacturers, purchasers/users and importers.

Information coming from WP 2 will then feed in to the work for the remaining part of the project.

This Report describes the outcome of Task 2.5 and is Deliverable 2.6 of the INTAS project.

Executive summary

The INTAS project's Task 2.5 "*Worldwide and EU current practices in market surveillance"* is under the responsibility of ENEA, for both transformers and fans. The scope is to collect information and build a firm understanding of the monitoring, verification and enforcement techniques used in major economies for these products. The boundaries for the task analysis were availability of information in an understandable language and sufficiently detailed about the applied procedures for fan and/or transformers, and not the simple information that market surveillance for these products is set. In this respect the main conclusions are that sufficient freely available information is available in English, but that in all investigated Countries no information about actual best practices is available.

The monitoring, verification and enforcement procedures have been looked for worldwide: in America (North & South: Canada, USA and Mexico), in Asia (China, India, Japan), in Oceania (Australia and New Zealand) and in Europe (EU and some Member States), along with the assessment of private certification schemes and of potential alternative techniques. All collected methods have been examined to identify the most interesting elements to be considered as suggestions and advices for the market surveillance procedure to be developed within the INTAS project for the EU ecodesign.

Monitoring, verification and enforcement techniques are applicable in all investigated Countries, but no information is available on their actual application or of the achieved results. The difficulty for the compliance verification for large industrial products is well known, but also without a unique and validated solution. The investigated procedures differ in terms of the emphasis given to the documental inspection, third party certification, physical testing by the national authority and also on the response to allegations or complaints. When physical testing is foreseen, the number of units to be tested differs among the investigated procedures.

Alternative procedures have been proposed, at least as pilot projects, to take into consideration the actual difficulties in the compliance verification or in case of low-volume, custom built products or where adequate laboratory facilities are unavailable. In this respect, the use of witnessed testing and/or reduced sample sizes can be foreseen, to permit effective enforcement testing without imposing unreasonable burdens on manufacturers. Unfortunately, it is unclear if these procedures have been successfully applied.

Other approaches or techniques do exist for certifying the performance of large products: private certification schemes - to assess the compliance of product to own requirements - appear to be more largely applied due to the strong involvement of manufacturers and their Associations. On the other side utilities generally procure transformers through a competitive bidding process encompassing a complex qualification process that includes an audit of production and quality processes, verification of certain ISO certifications, and inspection of the manufacturing environment. Finally a number of testing laboratories can develop custom test plans that meet manufacturers' specific needs for those products where a published standard is not available; one reason for developing a custom test plan is to check equipment performance against marketing claims made by the equipment manufacturer, or to check the performance of a product against a competitor's product.

Additions to this report revision (January 2018): Tables summarising, for each product and country analysed, the existing mandatory (minimum) energy efficiency requirements and certification schemes are presented in the Task conclusions.

1. Introduction

1.1 An overview

The INTAS project's Task 2.5 "*Worldwide and EU current practices in market surveillance"* is under the responsibility of ENEA – the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, for both transformers and fans and is aimed at collecting information and to build a firm understanding of the monitoring, verification, and enforcement techniques used in the world's other major economies.

The work is divided into three main levels:

1. establish current practices or plans set up by MSA, **if any**, for energy efficiency related market surveillance of large products of interest. This work, correlated to the outcome of T2.1 because if no standard or legislation do exist no market surveillance is (logically) possible, has the following planned outcomes:
   - establish the characteristics of the conformity documentation required and the process for assessing its validity
   - establish verification report contents and documents on the basis of the relevant energy (eco-design[1]) performance verification tests
   - establish if and how product verification testing is scheduled around the product's production/delivery/installation sequence;

2. evaluate the possibility to schedule market surveillance/product compliance verification testing around the product's production/delivery/installation sequence together with testing already foreseen by manufacturer and/or purchaser to avoid the high cost to end-users (and hence impracticality) of having the product removed from service for the purposes of verification testing.
   The possibility to set-up product verification in this way is also strictly correlated to the outcome of other previous WP2 Tasks:
   - adoption of standard test methods (T2.1)
   - availability of industry test labs guaranteeing the appropriate performance measurements (T2.2 and T2.3)
   - market commercial test framework (T2.4) for example in terms of industry collaboration in providing in due time scheduling of production and testing of large products
   - MSA availability/objections in adopting other approaches than actual practice;

3. explore other possible approaches/methodologies and useful information can support this:
   - explore the feasibility of collaboration between manufactures and the MSAs for coordinating efforts and resources for product compliance verification and market surveillance

[1] Ecodesign is specific for the EU, while in other countries outside Europe terms like "minimum energy efficiency requirements", "MEPS-minimum performance requirements" or "minimum standards" are used.

- for transformers, explore the feasibility of collaboration between the electricity distribution and transmission companies and the MSAs;

4. describing exceptions/exemptions from the applicable Regulations and the nature and reason for the exception/exemption.

2. The desk research

2.1 Technical boundaries

Transformer: distribution transformers reduce the voltage of the electricity supplied by the utility's substation to a level that is suitable for use by industrial, commercial and residential customers. Liquid-type transformers are used by electrical utilities to supply electricity to all users. Dry-type transformers, in comparison, are used for many indoor commercial and small industrial applications. In general large transformers are typically those with a power higher than 40 MVA, but also smaller equipment could be considered.

Fan: means a rotary bladed machine that is used to maintain a continuous flow of gas, typically air, passing through it and whose work per unit mass does not exceed 25 kJ/kg, and which:

- is designed for use with or equipped with an electrical motor with an electric input power (≥ 125 W and ≤ 500 kW, to drive the impeller at its optimum energy efficiency point,
- is an axial fan, centrifugal fan, cross flow fan or mixed flow fan,
- may or may not be equipped with a motor.

In general 'large fans' are considered those with a motor input power larger than 10 kW.

Although INTAS project is focused on transformers and large industrial fans, it is possible that these two products have not been subject to a market surveillance or conformity verification action in a specific country, listed hereafter, that is indeed running surveillance actions for large household/non-household products with similar problems. In this cases information has been collected since it was considered that it could be in any case of interest for the project and its stakeholders.

2.2 Geographical boundaries

Information about market surveillance procedures for large products has been gathered the following continents and Countries:

- America: Canada, USA, Mexico
- Oceania: Australia and New Zealand
- Asia: China, India and Japan
- Europe: EU and some Member States

and for private verification/certification schemes as well as for potential alternative techniques.

2.3 Certification and compliance verification for transformers and fans

2.3.1 Australia and New Zealand

The following paragraphs refer mostly to the Australian legislation and procedures, part of which are also in place in New Zealand. The legislative framework scheme between the two countries is shown in Figure 1[2]

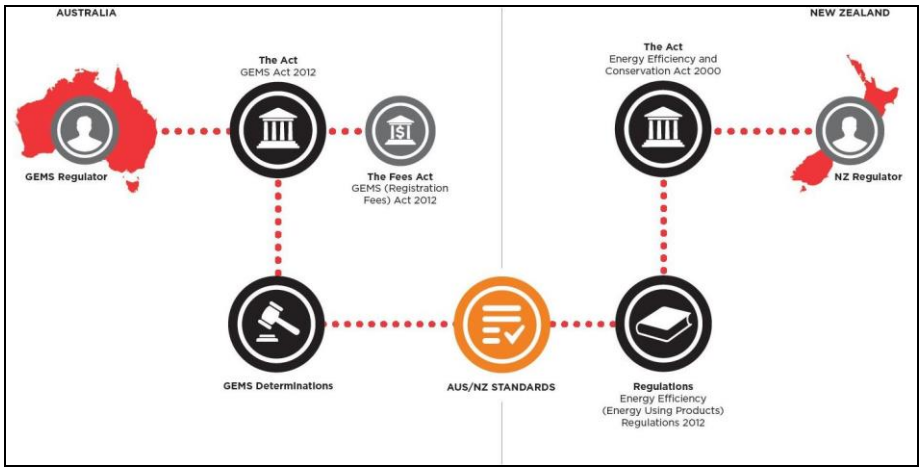


Figure 2-1: Australia and New Zealand legislative framework

2.3.1.1 Greenhouse and Energy Minimum Standards Act

The national Equipment Energy Efficiency (E3) Program has existed in some form in Australia for more than 20 years with a later engagement by New Zealand. On 13 September 2012 the Greenhouse and Energy Minimum Standards Act 2012 (also known as GEMS) was passed in Australia by the Australian Parliament, to commence on 1 October 2012. It establishes a national framework for regulating the energy efficiency of products supplied or used within Australia, implementing Australian Government and the Council of Australian Governments commitments to establish national legislation to regulate energy efficiency and labelling requirements for appliances and other products.

The new national legislation permits the Australian Government to set mandatory minimum efficiency requirements for products and to set nationally-consistent labelling requirements, to increase Australians' awareness of options to improve energy efficiency and reduce energy consumption, energy costs and greenhouse gas emissions. GEMS replaced seven State and Territory legislative frameworks, harmonising the regulation of equipment energy efficiency[3].

The Act provides also for enhanced monitoring, verification and enforcement and allows the scope of the previous E3 Program to be expanded. The Australian GEMS Regulator, in addition to the continuation of the

[2] see http://www.energyrating.gov.au/suppliers/legislation
[3] http://www.energyrating.gov.au/commencement-of-gems-legislation/

practice of the State regulators under the previous E3 Program to issue infringement notices or ask businesses to compensate consumers for the cost of products that do not comply with regulations, has also the power - for more serious breaches of the law - to allow the courts to impose financial penalties. Another novelty is the requirement for registrants to Australian GEMS regulator to submit annual data on sales and import/export of each registered model, as already required by the New Zealand regulator. The data will facilitate the establishment of revised minimum requirements levels and labelling algorithms and will improve the evaluation of the previous E3 Program.

Importers, manufacturers or suppliers of products that are regulated for energy efficiency under the GEMS Act are required to register their products, for which they are charged a fee. The registration fees collected by the Commonwealth recover part of the costs of providing a product registration service and the compliance monitoring and enforcement program required under the Act. Approval to charge these fees derives from the GEMS (Registration Fees) Act 2012.

2.3.1.2 GEMS legislation for distribution transformers and industrial fans

2.3.1.2.1 Fans

Fans are not currently regulated for energy efficiency in Australia and New Zealand. A Regulation Impact Statement (RIS) considering policy options for increasing the energy efficiency of new fan-units (fan plus electric motor combination) sold into the Australian and New Zealand markets, including regulatory options, is currently under preparation and was expected to be released for consultation around the middle of 2016[4].

2.3.1.2.2 Transformers

From 1 October 2004, distribution transformers manufactured in or imported into Australia must comply with minimum efficiency requirements set out in the standard AS 2374.1.2-2003[5]. The requirements apply to oil-immersed and dry-type both single and three phase:

- with power ratings between 10 and 2500 KVA
- with a system highest voltage of 24 kV and
- that are designed for 11 or 22kV networks.

This covers transformers installed both in public and privately owned electrical distribution systems, whether installed within on-main grid systems, or off-main grid systems such as mining sites etc. Privately owned transformers installed in commercial or industrial facilities where the voltage of the primary winding is either 11 or 22 kV are also covered.

The standard also defines minimum efficiency levels for “High Power Efficiency Transformers”: only products meeting the specified efficiency levels can apply this term to promotional or advertising materials. Standards and test procedures for distribution transformers are published by Standards Australia:

- AS 2374.1.2: Power Transformers Part 1.2: Minimum Energy Performance Standard (MEPS)

[4] at the time of drafting this report no RIS has been released.
[5] Australia standards are not publicly available, they must be purchased.

requirements for distribution transformers

- AS 2374.1: Power transformers Part 1: General
- AS 2735: Dry-type power transformers.

The minimum efficiency requirements for distribution transformers are set out as power efficiency levels at 50% of rated load in AS 2374.1.2 when tested in accordance with AS 2374.1 or AS 2735, as applicable. Transformers within the scope of minimum efficiency requirements are required to have on their rating plate a statement that indicates compliance with AS 2374.1.2.

All regulated distribution transformers must be registered before being offered for supply or used commercially. A test report is not required to be submitted as part of the registration process. However, manufacturers or importers are required to provide a copy of the test report to the Regulator on request. To streamline compliance checks it is recommended that an electronic copy of the test report be uploaded when making a registration application.

2.3.1.3 GEMS legislation compliance verification[6]

With the introduction of GEMS it was considered appropriate to review the suitability of the E3 selection criteria for the new compliance and enforcement capacities contained in the new legislation. GEMS products[7] can only be supplied or offered for supply, or used for a commercial purpose, if:

- the model of the product is registered under the GEMS Act against the relevant determination; and
- the product complies with the determination; and
- the supply, offer, or use complies with the determination.

The GEMS Regulator, who is responsible for monitoring and enforcing compliance with the Act, is assisted by inspectors who use inspection, monitoring and investigation powers provided by the Act. The compliance objective is to maximise the number of responsible parties who choose to voluntarily comply with the Act, whilst implementing strategies and responses to identify, and then deter, non-compliance. The Regulator is committed to:

- assisting responsible parties to understand the requirements of the Act
- monitoring responsible parties' compliance with the requirements; and,
- actively pursuing those who opportunistically or deliberately contravene the Act.

The GEMS Act provides the Regulator with educative, administrative, civil, and criminal response options. Each response considers a responsible party's history, behaviour, motivation, and intention; and, is proportionate to the risk posed by the non-compliance according to the scheme in Figure 2[8]:

[6] http://www.energyrating.gov.au/suppliers/compliance
[7] a GEMS product is a product that uses energy or affects the amount of energy used by another product and, is in a product class covered by a GEMS determination.
[8] http://www.energyrating.gov.au/suppliers/compliance

Figure 2-2: Non-compliance risk and response options in Australia

Regulator responses include:

- suspending a model's registration.
- cancelling a model's registration.
- enforceable undertakings.
- infringement notices.
- civil penalty orders.
- injunctions.

The Act also allows to publicise details relating to enforcement responses including the names of registrants and the model numbers of the products.

Market surveillance: refers to the verification activities undertaken to ensure that products meet the registration and labelling requirements of the relevant GEMS determination, once products are in the marketplace. It is conducted by inspectors and focused on retailers, suppliers, importers, and where applicable, manufacturers. Market surveillance is also conducted to ensure that products offered for supply on-line meet the registration requirements.

Allegations: the Regulator receives allegations of suspected non-compliance with the Act from a variety of sources. Each instance of suspected or alleged non-compliance is assessed and, if appropriate, investigated. Investigations incorporate the views of subject matter experts and provide transparent and defensible conclusions and recommendations for the Regulator to consider. A specific email address <E3.Compliance@industry.gov.au> is available to send allegations.

Check testing: also known as 'verification testing', refers to the activities undertaken to ensure that products meet the relevant GEMS determination's:

- level requirements relating to energy use and greenhouse gas production: specifically minimum energy efficiency requirements
- labelling requirements: as they relate to energy efficiency claims
- Other requirements: specified performance requirements.

Models are selected for check testing using an intelligence led, risk based approach, with the products sourced directly from the market and generally purchased anonymously. Check tests are conducted by

National Association of Testing Authorities (NATA) accredited or affiliated bodies either in Australia or overseas.

In addition a GEMS Compliance Monitoring Program is in force that annually outlines the Regulator's check testing and market surveillance focus for a specific year. No information are available about previous or future compliance monitoring program for this specific product. The 2016-2017 plan is already available online at E3[9]: the Regulator will focus on air conditioners, clothes dryers, clothes washing machines, monitors, computers, dishwashers, electric water heaters, external power supplies, gas water heaters, household refrigerators/freezers, refrigerated display cabinets, televisions and three phase cage induction motors.

2.3.1.3.1 The Australian "check testing" procedure

The check testing program is an important part of monitoring and enforcement. It is the way the performance of individual product models is verified in laboratory conditions to see if they meet legal requirements and the claims of manufacturers and suppliers.

The check testing program follows five main steps. At the first step product models are selected for testing according to defined criteria and risk factors. the *Stage One* check test is developed at the regulator's expense. If the *Stage One* test indicates the model complies with the requirements, the person responsible for the product's registration (registrant) is informed and no further action is taken.

If the *Stage One* test indicates the model does not comply with relevant requirements, the registrant must either cancel the registration or may arrange for further (*Stage Two*) testing. If the registrant elects to cancel the registration, the Regulator may pursue other enforcement action such as infringement notices, compensation, or fines.

If the registrant considers the results of the *Stage One* test do not accurately reflect the model as a whole, the registrant may arrange for *State Two* testing. *Stage Two* testing is conducted at the registrant's expense, in line with reasonable instructions given by the regulator. If the *Stage Two* test indicates the model complies with relevant requirements, no further action is taken. If the test indicates the model does not comply, the product registration must be cancelled and the regulator may take further enforcement action.

Step 1 – Selecting models for check testing: the regulator selects models for check testing using a range of risk-based criteria. The broad objectives of the selection criteria are to:

1. identify models with a higher risk of non-compliance;

2. identify product categories that have the greatest potential impact on energy consumption and greenhouse gas emissions; and

3. test each type of product regulated under the E3 Program

Step 2 – Acquiring models for check testing: units of models selected for check testing will, where possible, be purchased anonymously from the market for example from a retail outlet. In limited circumstances section 57 of the Act permits the regulator to compulsorily acquire units of a product model from a registrant. A product can only be acquired for testing under section 57 where the regulator has

[9] http://www.energyrating.gov.au/document/2016-2017-gems-compliance-monitoring-program

evidence that it would not be practical to purchase the product (e.g. because purchase has been refused, or because no units can be found on the market). The regulator must provide adequate compensation for units acquired under section 57 (e.g. market sale price).

Step 3 – The *Stage One* check test: after acquiring units for check testing, the regulator contracts a test laboratory to conduct the *Stage One* check test. The test is normally performed on one unit of the selected model, although for some product types more than one sample is necessary. The test is conducted according to the requirements set out in the relevant test standard. Wherever possible, the regulator uses only those laboratories accredited by the National Association of Testing Authorities (NATA), Australia or an accreditation body having mutual recognition with the NATA, Australia.

If the *Stage One* test indicates the model meets relevant product standards, the regulator notifies the registrant of the test and the pass result and take no further action. If the test indicates the model fails to meet performance and/or labelling requirements, the regulator issues a *Notice of Non-compliance with GEMS Determination – Stage One Check test*, to inform the registrant of the failed test. The purpose is to advise the registrant that they may be issued with a formal Notice under the GEMS Act 2012 and provides the registrant an opportunity to respond within 14 days to the results of the *Stage One* check test.

If the registrant provides evidence that the regulator agrees is sufficient to demonstrate that the *Stage One* unit was defective or damaged or that there was an error in the conduct of the *Stage One* check test, the test result are voided and the test is repeated – either on the same unit after repairs or on a second unit chosen randomly by the regulator. Costs associated with inspection and repair of the original unit or provision of a replacement unit must be met by the registrant. If the unit passes the repeat *Stage One* check test the model is deemed to meet the relevant requirements and no further action is taken.

If a registrant does not respond to the Interim Notice within 14 days, or is unable to show cause for *the Stage One* test to be voided, or the *Stage One* re-test results in a fail result, the regulator issues a formal Notice under the GEMS Act 2012, the so called s61 Notice. The s61 Notice requires the registrant to either:

(a) cancel the product registration, or

(b) apply for further testing (*Stage Two* Check test).

If the registrant elects to cancel the product registration, they will be required to complete the prescribed form to '*Elect to cancel registration*', provided with the s61 Notice. Following cancellation of the registration, the Regulator will consider the appropriate enforcement response (see Step 5 – Enforcement Action).

Step 4 – The *Stage Two* check test

If a registrant does not elect to cancel a product model's registration, the registrant must arrange and pay for *Stage Two* testing, to be carried out in accordance with any reasonable instructions issued by the regulator. In general, these instructions will include:

- the requirements that a test laboratory must satisfy to be authorised to test a GEMS product
- the timeframe in which *Stage Two* testing must be completed; and
- a requirement for the registrant to provide a list of serial numbers of all products held in stock, from which the regulator will select the units for testing.

The registrant must provide the necessary information, before going ahead with the test process.

Number of Stage Two units

Where the *Stage One* failure relates to a performance requirement, e.g. a mandatory minimum energy performance requirement, the registrant must test a minimum of two units from the list of serial numbers nominated by the regulator (*Stage Two [a] testing*).

- If both units pass the test, the regulator will conclude that the model meets relevant performance requirements.
- If both units fail, the regulator will conclude that the model does not meet relevant performance requirements.
- If one unit passes and one unit fails, one additional unit from the list of units selected by the regulator is tested (*Stage Two [b] testing*) and must pass the test for the model to meet relevant performance requirements.

For some product types, such as lighting products, more than two units are tested at *Stage Two*.

Where the *Stage One* failure relates to a performance claim by the registrant, e.g. the energy efficiency claimed on a label, a minimum of three units from the list of serial numbers nominated by the regulator are tested. If a majority of the units pass the test the model meets relevant performance claims.

For *Stage Two* check testing the Regulator will only allow laboratories accredited by NATA or with a mutual recognition agreement with NATA, that are independent of the registrant for the model being tested.

By arrangement, the Regulator will only accept the results of *Stage Two* testing from the registrant's own accredited facility where there is no reasonable alternative. Under these circumstances, the registrant must, by agreement with the regulator, engage an independent witness to monitor and verify the testing procedure. The regulator may advise any necessary qualifications for the witness. The witness must provide a written statement to the regulator following completion of *Stage Two* check testing confirming that the check testing was conducted according to the relevant test standard and in accord with NATA requirements. The registrant must cover the costs associated with the witness.

Step 5 – Enforcement response to non-compliance

When a model does not comply with relevant requirements, whether at *Stage One* or *Stage Two* testing, a registrant may be liable for fines or other enforcement action. The regulator determines the most appropriate response, in line with internal enforcement procedures and the GEMS Compliance Policy:

- the first response is that the model's registration must be cancelled. The registration of any products that are registered using the same test report - and are therefore equivalent in terms of performance - will also be cancelled, whether registered as a family or registered separately;
- if the product model failed testing on the grounds that measured performance did not meet performance claims, but did meet the relevant performance requirements, the model may be re-registered if accompanied by an accurate test report;
- if the model does not meet one or more of the relevant performance requirements, or is not registered, then the product cannot not be sold or used in Australia.

- In addition to de-registration, the regulator may issue infringement notices or fines, or pursue an 'enforceable undertaking' where the registrant agrees to compensate consumers or the environment.

2.3.1.3.2 Compliance verification results

When a model's registration is suspended or cancelled by the Regulator, the registrant must take all reasonable steps to ensure that any person the registrant is aware might supply products of the model is informed of the suspension or cancellation. The downstream supplier is then responsible for ensuring that they do not contravene the Act by supplying an unregistered product. To assist suppliers to comply with these obligations, the regulator publishes a list of models with suspended or cancelled registrations. The list updated at 30 May 2016[10] includes 26 products among household appliances, TVs and lamps.

2.3.1.4 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.2 USA

The US energy efficiency legislation is based on three different programmes: minimum efficiency and functional performance requirements set at Federal as well as at the State levels and two labelling programmes: the voluntary ENERGY STAR (ES) - a joint program of the U.S. Department of Energy (DoE) and the U.S. Environmental Protection Agency (EPA) - and the mandatory Energy Guide. Each programme has is own market surveillance Authority and rules.

2.3.2.1 The requirements for transformers

Some transformer types are covered by both ES and DoE efficiency requirements, as highlighted in Figure 3[11].

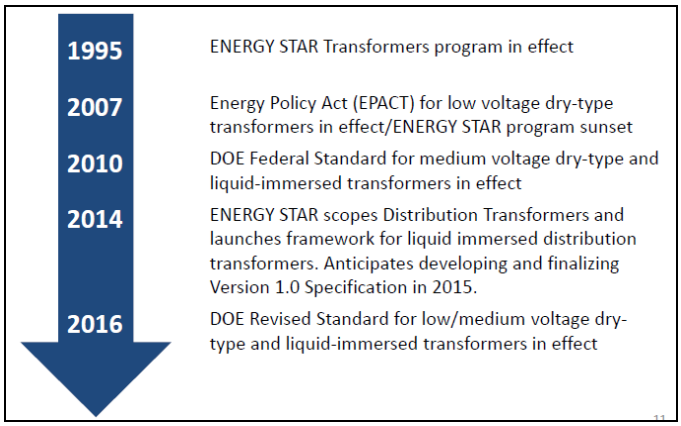


Figure 2-3: Time scale for the legislation about transformers in USA

[10] The list is downloadable at: http://www.energyrating.gov.au/file/1910/download?token=k1eOtdQp
[11] EPA, ENERGY STAR Distribution Transformers Draft 1 Specification, In-Person Stakeholder Meeting August 20, 2015

The DoE has regulated the energy efficiency level of low-voltage dry-type distribution transformers since 2007 and of liquid-immersed and medium-voltage dry-type distribution transformers since 2010. In 2016 newly amended energy efficiency requirements for distribution transformers are effective, further decreasing electrical losses by about 8% for liquid-immersed transformers, 13% for medium-voltage dry-type transformers, and 18% for low-voltage dry-type transformers.

It is worth noting that the distribution transformers final rule was the DoE's first "*negotiated rulemaking*", conducted under the "Federal Advisory Committee Act and the Negotiated Rulemaking Act" and is viewed as an alternative to traditional procedures for drafting proposed regulations.

The requirements and test procedures for this product are described in the "*Rulemaking for Liquid-Immersed and Medium-Voltage Dry-type Distribution Transformers Energy Conservation Standard*"[12] and "*Rulemaking for Low-Voltage Dry-Type Distribution Transformers Energy Conservation Standard*"[13].

The first ES transformer programme started in 1995 and was ended in 2007. In late 2013/early 2014, EPA conducted a *Scoping Report for Distribution Transformers* to determine the energy and monetary savings potential. Results show that the largest opportunity lies in liquid-immersed, medium voltage distribution transformers and that significant energy savings can be realized beyond the 2016 DoE requirements. Draft 1 *Specification for Liquid-Immersed Distribution Transformers* is under discussion among EPA and stakeholders. In particular EPA proposes that manufacturers use the AEDM (Alternative Efficiency Determination Method) to certify products to ES, to align with the process in place for self-certification to the DoE Final Rule and to use industry accepted definitions, and aligns with the definitions adopted by DoE in the Code of Federal Regulations, 10 CFR 431.192. EPA proposal was to set efficiency requirements and at the same time to include a separate tool for purchasers to calculate total cost of ownership. Designs will then be grouped by optimal capacity factor from 10% to 70% (in 5% increments). At each capacity factor, EPA proposed levels that recognize the top performing products while ensuring that more than one steel type can meet.

A transformer design could earn the ES label at one or more capacity factors. ES certified liquid-immersed transformers are tested using the DoE test procedure (outlined in 10 CFR 431.193). Basic model are selected for testing according to the requirements laid out in the DoE's Certification Requirements for Distribution Transformers (10 CFR 429.47). For qualification of an individual product model, the basic model must be equivalent to that which is intended to be marketed and labelled as ES.

The EPA requires all ES products to be third-party certified. Products are tested in an EPA-recognized laboratory and reviewed by an EPA-recognized certification body before they can carry the label. However for transformers additional models may be certified through DoE's AEDM [outlined in 10 CFR 429.70(d)], that allows manufacturers to self-certify the performance of transformer designs using computer modelling thus reducing time and testing burden for certification.

2.3.2.1.1 Compliance verification results

For qualification of all products under the basic model definition, the Alternative Efficiency Determination Method can be used to qualify all subsequent models that meet the basic model parameters. But any

[12] https://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/44
[13] https://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/43

subsequent testing failures (e.g., as part of verification testing) of any model in this family of products will have implications for all models in the family. The AEDM is derived from a mathematical model that represents the energy consumption characteristics of the basic model and is based on:

- engineering or statistical analysis,
- computer simulation or modelling, or
- other analytical evaluation of performance data.

Manufacturers must apply the AEDM to at least 5 of their basic models (two of which are among the five basic models with the highest unit volumes of production in the prior year) that have been selected for testing and calculate the power loss for each of these basic models. In particular:

- test at least five units of each of these basic models and power loss must be calculated
- no two basic models should have the same combination of power and voltage ratings
- at least one basic model should be single-phase and at least one should be three-phase.

2.3.2.2 The requirements for commercial and industrial fans

DoE signalled the intent to establish a federal efficiency standard for commercial and industrial fans, blowers, and fume hoods in June 2011. The regulatory processes could result in a fan efficiency regulation in effect and being enforced between 2018 and 2020. The *Framework Document* was published in the Federal Register on 1 February 2013, presenting DoE's perspective of the fan market and the options under consideration for regulating commercial and industrial fans. A provisional analysis of the potential economic impacts and energy savings that could result from promulgating an energy conservation standard for commercial and industrial fans and blowers has been also completed.

Currently DoE is not proposing an energy conservation standard but the performed analysis may be used in support of the Appliance Standards Federal Rulemaking Advisory Committee (ASRAC) commercial and industrial fans Working Group negotiations to develop a recommendation for regulating commercial and industrial fans.

ASRAC will allow DoE to use negotiated rulemaking as a means to engage all interested parties, gather data, and attempt to reach consensus on establishing energy efficiency requirements. Rules drafted by negotiation may be more pragmatic and implemented at earlier dates than under a more traditional rulemaking process.

The US Appliance and Equipment Standards Program established ASRAC in an effort to further improve the process of establishing energy efficiency requirements for certain appliances and commercial equipment. ASRAC was created as a discretionary advisory committee to provide advice and recommendations related to:

- development of minimum efficiency requirements for appliances and equipment
- development of product test procedures
- certification and enforcement of efficiency requirements
- labelling for various appliances and equipment

- specific issues of concern to the Energy Department.

For additional information about a possible negotiated rulemaking for commercial and industrial fans and blowers see point 2.3.10.2 of this Report.

2.3.2.3 ENERGY STAR compliance verification

In spring 2011 DoE and EPA introduced a new verification testing procedure in support of the ES program. Both DoE and EPA administer testing programs that protect consumers by ensuring ES certified products deliver the expected energy savings and collaborate to minimize duplicate testing, except where such testing result in a more effective program. The two programs are complementary and are based on lessons learned from the 2010 DoE pilot verification testing program.

The DoE program focuses on government-run testing for a subset of ES products that are part of the DoE's regulatory program. EPA's verification program focuses on testing of at least 10% of ES certified basic models through third-party certification bodies: in addition to certifying products CBs verify that a certain percentage of basic models they have certified continue to meet the requirements through verification testing on an annual basis.

2.3.2.3.1 The Department of Energy approach

DoE manages the ES verification testing program for DoE covered products. Program management includes:

- determining ES product types to test
- selecting ES models for verification testing based on specific programmatic criteria
- securing testing services using third-party test laboratories having the appropriate capabilities and accreditations
- procuring all ES models selected for verification testing
- developing and maintaining test report templates
- monitoring test laboratories to ensure adherence to prescribed test procedures and established quality assurance/quality control programs
- approving laboratory test reports
- comparing test results to relevant ES requirements, DoE energy conservation and certification requirements
- notifying the manufacturer if a model does not meet ES specifications
- notifying EPA if test results indicate that a product is not in compliance with ES specifications
- notifying the Federal Trade Commission (FTC) if test results indicate that a model is not appropriately rated or labelled
- arranging for re-use or disposal of products after testing.

DoE or a DoE representative is responsible for obtaining samples for testing from retail.

In 2010, DoE launched a Pilot Program to verify the energy efficiency and water-use characteristics of selected products through laboratory testing. The results helped to identify several issues with product selection and procurement that were remedied in the revised verification program process:

- lack of information regarding manufacturer's basic model[14] identification caused difficulty in selecting individual models and may have led to multiple models within the same basic model being tested. DoE has published revised certification reporting requirements for products covered by Federal energy conservation standards. Following the compliance date for these requirements DoE will have access to manufacturer-supplied basic models for all ES products that are also covered by DoE Energy Conservation Standards Program. This information, cross-referenced with the ES database, should provide sufficient information to identify ES qualified basic models and their derivative models and prevent the from conducting testing of multiple models within a single basic model;
- once models were identified, procurement was often difficult because models were no longer available for sale on the market: in this respect DoE will target products that have more recently entered the market, based on certification dates provided as part of the certification reporting outlined above;
- statistical deficiencies inherent in procuring multiple units of the same model from one vendor: DoE has specified that units should be purchased from multiple vendors, where possible.

2.3.2.3.2 The Energy Star Certification Body approach

Among conditions and criteria for recognition of Certification Bodies for the ES, detailed specifications relate to the verification testing. The CB shall operate an ES partner-funded verification testing procedure that fulfils the verification testing requirements as follows:

(1) ensure products meet all product performance parameters as in the relevant ES product specification;

(2) number of products:

  (a) annually test at least 10% of all ES qualified models the CB has certified or for which it has received qualified product data

  (b) in the case of ES specifications that address multiple product types, the CB annually tests at least 10% of each type

  (c) when determining the number of models subject to verification testing, the CB considers product families as defined in the relevant product specification, and in consultation with EPA

  (d) in the event of significant product failures, EPA may advise the CB to increase the number of models tested in subsequent years. The minimum number of products tested may differ by product category;

(3) products are selected by the CB according to the following general guidelines:

  (a) the CB selects models for verification testing from the ES qualified models the CB has certified;

[14] basic model means "all units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency" (10 FR 430;2)

(b) approximately 50% of models to be tested are randomly selected; although the more recently a model has undergone verification or challenge testing the less likely it should be selected in this random selection process;

and

(c) the remaining models comprise referrals from EPA as provided, and models selected in consideration of the following factors:

(i) product classes from ES partners for which previous models failed verification testing;

(ii) referrals from third parties such as consumers, consumer groups or regulatory agencies regarding the accuracy of ratings; and,

(iii) models with high sales volumes if this data is available to the CB.

Each year[15], post-market verification testing of a sampling of certified products are decided. CBs recognized by the EPA to oversee this testing, and the product brand owners have certain basic responsibilities designed to make the process run more smoothly and efficiently:

- Certification Body responsibilities:
  - maintain up-to-date ES product availability information, including where products may be obtained
  - determine number of products to test, based on the number of unique products in each category (products sold under multiple labels/brands and members of a model family are all eligible for testing, but only count once toward testing obligations)
  - select products to test, which include up to 50% nominated products from EPA and the remainder selected randomly
  - obtain products and have them tested in a third-party EPA-recognized laboratory
  - report products tested to EPA every six months. For products that fail testing, report to EPA within two business days. Products that fail testing will be handled by EPA according to ES disqualification procedures.
- Brand owner partner responsibilities:
  - maintain updated contact information with the CB associated with each ES product. Brand owner partners are responsible for verification testing even if an OEM facilitated the initial certification
  - on an ongoing basis, notify CBs regarding availability of certified products so they are represented accurately on ES product lists. Products that are no longer available are removed from the product lists and are not subject to verification testing
  - respond in a timely manner to CB requests for information regarding product availability and regarding products selected for verification testing. Note: CBs are required to notify EPA within five business days if partners are unresponsive to or do not cooperate with verification testing related requests

[15] http://www.energystar.gov/index.cfm?c=third_party_certification.tpc_verification_testing

- understand the CB's fee structure for maintaining and updating ES certifications. CBs are required to provide a transparent fee structure for all certification services
- provide documentation to the CB if a model that was tested in the previous year has been selected for verification testing. The CB will select an alternate model for verification testing
- contact EPA directly via <certification@energystar.gov> with any questions or concerns about the verification testing process.

At the beginning of the calendar year, EPA provides CBs with nominations for verification testing in each product category. These nominations comprise up to half of the CB's total testing responsibility in that category. The remainder are selected randomly according to the percentages shown in Table 1[16]:

For commercial food service categories (commercial dishwashers, fryers, griddles, hot food holding cabinets, ice machines, ovens, refrigerators/freezers and steam cookers) CBs should test no more than 10% of unique certified models per product category for each partner.

Table 2-1: Additional percentages for randomly selection of products for verification in US

A minimum of 20% of unique models:

- Compact Fluorescent Lamps (CFLs)

A minimum of 10% of unique models:

- Boilers
- Ceiling Fans
- Central Air Conditioners and Air-Source Heat Pumps
- Clothes Dryers
- Clothes Washers
- Commercial Dishwashers
- Commercial Fryers
- Commercial Griddles
- Commercial Hot Food Holding Cabinets
- Commercial Ice Machines
- Commercial Ovens
- Commercial Refrigerators and Freezers
- Commercial Steam Cookers
- Commercial Water Heaters
- Decorative Light Strings
- Dehumidifiers
- Furnaces
- Geothermal Heat Pumps
- LED Light Bulbs
- Light Commercial HVAC
- Light Fixtures
- Non-solar Water Heaters
- Pool Pumps
- Residential Clothes Dryers
- Residential Dishwashers
- Residential Refrigerators and Freezers
- Roof Products
- Room Air Cleaners
- Room Air Conditioners
- Vending Machines
- Ventilating Fans
- Water Coolers

A minimum of 5% of unique models:

- Audio/Video
- Computers
- Displays
- Enterprise Servers
- Imaging Equipment
- Large Network Equipment
- Set-top Boxes
- Small Network Equipment
- Telephony
- Televisions
- Uninterruptible Power Supplies

2.3.2.3.3 The Energy Star Pilot Component Inspection Approach

EPA is developing a pilot program for certifying and verifying ES commercial steam cookers (Figure 4) via "component inspection" in consultation with stakeholders. Although not directly related to industrial fans or transformers, the characteristics of this new approach could be ofinterest for other large commercial products, therefore it is worth describing it for further consideration by the INTAS project partners.

[16] ENERGY STAR Verification Testing by Product Category. Date: 01/12/16

Figure 2-4: Examples of steam cookers

After identifying the components used in steam cookers that would impact energy consumption, EPA documented these in the Energy File Report Requirements as the basis for conducting component inspections of products, aligning with those used for verifying compliance with safety certifications.

The participation to the pilot program is optional. EPA is working with certification bodies who want to offer this option and partners who want to fulfil their verification obligations in 2016 using this approach[17]. The pilot is intended to provide EPA and partners with better information about the feasibility and usefulness of this approach for steam cookers and more in general as an opportunity to test and evaluate it based on both the ability of CBs to successfully inspect products as well as stakeholder feedback on the long-term feasibility of this approach.

The transferability of this approach to other products such as commercial refrigeration equipment was questioned, due to concerns about the impact of the manufacturing process on energy consumption. In this respect, EPA is confident that any changes in energy efficiency for steam cookers will be identifiable based on a component inspection due to the limited tooling and configurability of these products. The transferability concern will need to be addressed to the extent EPA considers this approach for other products.

Prior to participating in the pilot manufacturers will need to have an energy file report created by a participating CB for all models to be included in the pilot. In addition, throughout the component inspection portion of the pilot manufacturers will need to provide the CB with information regarding when models will be manufactured and available for inspection.

The procedures for certifying and verifying ES steam cookers using the pilot component inspection approach is based on:

- ***Certification***: in addition to the standard requirements for certifying ES products, for this pilot CBs are required to generate an energy file report for every unique certification in order for the models to be included in the pilot. This report must document the full list of critical components outlined in the *Energy File Report Requirements for ES Steam Cookers* (see Annex 1) and be kept on file in association with the product certification. Partners are required to report any component changes to the CB immediately. If any critical components change, the CB is required to identify the extent of the change and determine if the product needs to be retested to maintain certification. CBs will need to document any changes in

[17] https://www.energystar.gov/products/spec/compliance_assessment_pilot_program_pd

the energy file report, along with information on the nature of the changes and new test information if applicable.

- ***Verification***: products certified using this approach will not be subject to the verification testing requirements for the ES. Instead, CBs are required to conduct random inspections of manufacturing facilities throughout the year similar to the process for verifying product safety. At a minimum, each relevant manufacturing facility would be inspected twice over the course of the pilot. Each visit would include an inspection of at least one currently certified model to determine compliance with components listed in the energy file. Should an inspection uncover changes not previously approved, CBs are required to document any actions, including additional product testing if required. In the event that a model is retested due to component changes and fails to meet ES requirement, CBs are required to report the failure to EPA consistent with standard reporting procedures.
- ***Reporting***: consistent with reporting for standard verification testing of ES products, under this pilot CBs will be required to report to EPA in July 2016 and January 2017 a list of the locations visited and models inspected. In addition, CBs will need to note all models available for inspection at the time of each visit, even if not selected for random inspection.

2.3.2.4 Federal efficiency requirements certification and compliance verification

DoE's activities in legislation compliance and enforcement include:

- Certification
- Enforcement
- Testing
- Current and past rulemakings.

During 2011 the new provision about market surveillance set in the final rule "*Energy Conservation Program: Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment*", entered into force, revising the DoE existing certification, compliance and enforcement regulations for certain consumer products and commercial and industrial equipment. These compliance and enforcement regulations provide for:

- sampling plans used in determining compliance with existing requirements
- manufacturer submission of compliance statements and certification reports to DoE
- maintenance of compliance records by manufacturers
- the availability of enforcement actions for improper certification or non-compliance with an applicable legislation.

The main modifications introduced by the new rule are:

- removing the current provision requiring DoE to receive a written complaint before it can perform enforcement testing
- allowing the DoE to select units from retail, distribution or manufacturer sources, to ensure enforcement test results that are as unbiased, accurate and representative as possible

- recognising that the current regulatory approach, involving DoE selected units and third party testing, may be impracticable for low-volume, custom built products or where adequate laboratory facilities are unavailable. An alternative approach is allowed in such exceptional cases: DoE witnessed testing at the manufacturer's lab and/or reduced sample sizes, to permit effective enforcement testing without imposing unreasonable burdens on manufacturers.

2.3.2.4.1 Certification

Manufacturers of all products covered by Federal requirements must submit a certification report before a basic model is distributed in commerce, annually thereafter, and if there is an increase of the consumption or decrease of the efficiency for the basic model so that the certified rating is no longer supported by the test data.

Certification Reporting System: each basic model of a covered product (for example: a group of refrigerator models that differ only in colour) must be certified using DoE's online certification tool, the Compliance Certification Management System (CCMS) and preformatted, standardized, product-specific excel templates. CCMS allows manufacturers, importers and third-party representatives to create, submit and track their certification reports and also allows DoE to review and assess compliance and certification information.

Compliance Certification Database: the database houses certification reports and compliance statements submitted by manufacturers. The new database offers users an easy-to-use search function for existing records in an easily downloadable format. There is also a consumer-friendly selection tool as well as a search-by-model function.

2.3.2.4.2 Enforcement testing

Cost allocation for testing: the cost of enforcement testing remains with the DoE.

Third-party laboratory requirements for enforcement testing: DoE has taken the initial steps towards establishing some type of laboratory accreditation program for enforcement testing by requiring that any laboratory be accredited to ISO/IEC 17025:2005. This requirement, while limiting the laboratories to be used provides interested parties with additional reassurance in the robustness and accuracy of the test results. DoE will continue to consider additional accreditation requirements, including test procedure-specific requirements in the next certification, compliance and enforcement rulemaking.

Witnessed enforcement testing: in recognition of the concerns of the rare instances when laboratories may be unavailable to test certain products or equipment, DoE is adopting a provision that allows DoE to use its discretion to perform DoE-witnessed enforcement testing at a manufacturer's laboratory when there are extenuating circumstances that make testing at an independent laboratory inadequate or unrealistic.

2.3.2.4.3 Alternative efficiency determination and rating methods

DoE is proposing to revise and expand its existing regulations governing the use of alternative efficiency determination methods (AEDM) and alternate rating methods (ARM) for covered products as alternatives to testing for the purpose of certifying compliance.

2.3.2.4.4 Procedures for transformers

As far as transformers are concerned, the 2011 Energy Conservation Program states:

Certification:

- for each basic model of distribution transformer, efficiency must be determined either by testing or by application of an appropriate AEDM;
- for each basic model selected for testing, if the manufacturer produces five or fewer units of a basic model over 6 months each unit must be tested. A manufacturer may not use a basic model with a sample size of fewer than five units to substantiate an AEDM. If the manufacturer produces more than five units over 6 months, a sample of at least five units must be selected and tested;
- any represented value of efficiency of a basic model must satisfy the condition:

$$RE \leq \frac{100}{1+\left(\frac{100-\bar{x}}{\bar{x}}\right)\left(\frac{\sqrt{n}}{\sqrt{n}+.08}\right)}$$

  where x is the average efficiency of the sample and RE is the applicable DoE efficiency or is the labelled efficiency;

- the basic model number or kVA grouping model number (depending on the certification method) for each brand must be submitted. Manufacturers must report the characteristics of the most and least efficient basic models within the kVA grouping. The term “kVA grouping” is defined to mean a group of basic models which all have the same kVA rating, have the same insulation type, have the same number of phases and - for medium-voltage dry-types - have the same basic impulse isolation level (BIL) group rating. In this respect, the manufacturer assumes the risk that if one model in a kVA grouping is found non-compliant all of the models in that grouping are non-compliant.

Enforcement testing: is described in Appendix C to Subpart C of part 429 - sampling plan for enforcement testing of distribution transformers. It includes:

- *sampling*:
  - a) When testing distribution transformers, the number of units in the sample (m_1) shall be in accordance with §429.47(a) and DoE shall perform the following number of tests:

    (1) If DoE tests four or more units, it will test each unit once;

    (2) If DoE tests two or three units, it will test each unit twice; or

    (3) If DoE tests one unit, it will test that unit four times.
  - b) DoE determines compliance as described in Annex 2 of this Report.
- *Kilovolt ampere (kVA) grouping*: see above.
- *basic model compliance*
  - DoE will use an initial sample size of not more than five units. If fewer than five units of a basic model are available for testing when the manufacturer receives the test notice, then:

(A) DoE will test the available unit(s); or

(B) if one or more other units of the basic model are expected to become available within 30 calendar days, the Department may instead, at its discretion, test either:

(1) the available unit(s) and one or more of the other units that subsequently become available (up to a maximum of five); or

(2) up to five of the other units that subsequently become available;

- in an enforcement action, DoE should be able to determine all of the individual models that fall within a kVA grouping certification, using the required certification information and basic model design and testing information. While DoE is not requiring manufacturers to disclose all the individual model numbers that fall into a kVA grouping, DoE expects manufacturers to make this information available, as necessary, during enforcement actions.

2.3.2.4.5 Alternative approach for low-volume, custom built products

If testing of the available or subsequently available units of a basic model would be impractical, as for example when a basic model has unusual testing requirements or has limited production, DoE may in its discretion decide to base the determination of compliance on the testing of fewer than the otherwise required number of units. DoE will base the compliance determination on the results of such testing in accordance with the *Sampling plan for enforcement testing of covered equipment and certain low-volume covered products* (Appendix B to Subpart C of Part 429).

2.3.2.4.6 Compliance verification results

In order to ensure that ES labelled products meet consumer performance expectations, a subset of models are subject to verification testing each year. This testing occurs through three complimentary programs, one of which is focused exclusively on lighting. ES qualified models that fail the verification testing are subject to EPA's disqualification procedures. For the 2014[18] cycle, 2.070 models underwent verification testing and of these:

- 1.933 models were tested through verification testing administered by EPA-recognized certification bodies
- 99 appliance, heating and cooling equipment, commercial food service equipment and other models were tested through DoE-administered verification testing
- 38 compact fluorescent lamp models were tested through the ES CFL third party testing and verification program
- the overall compliance rate was 97%. Table 2 provides a detailed summary of results
- EPA disqualified 58 unique models as a result of verification testing and separately-branded versions of the 58 models (but they are not included in the 58).

DoE enforcement activities fall within three categories:

[18] U.S. Environmental Protection Agency, ENERGY STAR® Labeled Products: Verification Testing 2014 Summary

- conservation standards cases: deal with manufacturers that distributed products in the U.S. that DoE has found do not meet the required energy standards. In this respect an up to date web page[19] lists a number of case documents. Each case document describes the Compromise Agreement entered into between the DoE and the specific manufacturer to resolve the case initiated to pursue a civil penalty for distributing in commerce a product that failed to meet the applicable standard for energy conservation;
- compliance certification cases: deal with manufacturers that either have not certified that the products that they manufacture and distribute in the U.S. have been tested and meet the applicable energy conservation standards or have submitted invalid compliance certifications;
- with respect to ES, DoE refers to the EPA any tested products that do not meet the ES specification.

Table 2-2: Detailed summary of 2014 results for Energy Star verification

Products	**Tested models** (number)	**Unique models disqualifications** (number)
Appliances		
Clothes Dryers	1	--
Clothes Washers	37	--
Dishwashers	18	--
Refrigerators and Freezers	60	--
Total	**116**	**0**
Heating and Cooling		
Boilers	38	--
Central Air Conditioners and Air Source Heat Pumps	84	--
Commercial Water Heaters	13	--
Dehumidifiers	37	--
Furnaces	34	2
Geothermal Heat Pumps	26	1
Light Commercial HVAC	10	--
Room Air Cleaners and Purifiers	40	--
Room Air Conditioners	65	--
Water Heaters	30	--
Total	**377**	**3**
Commercial Food Service		
Commercial Dishwashers	10	--
Commercial Fryers	7	--
Commercial Griddles	6	1
Commercial Hot Food Holding Cabinets	8	--
Commercial Ice Machines	25	--

[19] http://energy.gov/gc/conservation-standards-enforcement

Commercial Ovens	2	--
Commercial Refrigerators and Freezers	75	3
Commercial Steam Cookers	5	--
Total	**138**	**4**
Electronics and Office Equipment		
Audio/Video	12	--
Battery Charging Systems (BCSs)	1	--
Computers	169	7
Displays	95	--
Enterprise Servers	7	--
Imaging Equipment	108	--
Set-Top Boxes and Cable Boxes	12	--
Telephony	16	--
Televisions	69	1
Uninterruptable Power Supplies	21	--
Total	**510**	**8**
Lighting and Fans		
Ceiling Fans	34	4
Compact Fluorescent Lamps (CFLs)	38	11
Decorative Light Strings	32	--
Integral LED Lamps	69	3
Luminaires	204	14
Ventilating Fans	45	7
Total	**422**	**39**
Home Building Materials		
Roofs	191	2
Windows, Doors, and Skylights	286	1
Total	**477**	**3**
Others		
Pool Pumps	9	--
Vending Machines	13	--
Water Coolers	8	1
Total	**30**	**1**
Total models	**2.070**	**58**

2.3.2.5 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.3 Canada

2.3.3.1 The Canadian energy efficiency legislation

Canada's *Energy Efficiency Act*[20] provides for the making and enforcement of regulations concerning minimum energy performance requirements for energy-using products. It also provides for the labelling of such products. The first *Energy Efficiency Regulations*[21] came into effect in 1995. They are amended periodically.

The energy efficiency Regulations apply to dealers who:

a) import regulated energy-using products into Canada for sale or lease or

b) ship regulated energy-using products that are manufactured in one Canadian province to another for sale or lease (inter-provincial shipment).

2.3.3.1.1 Responsibility of dealers

A dealer is defined in the Act as a person engaged in the business of:

1. manufacturing energy-using products in Canada
2. importing energy-using products into Canada or
3. selling or leasing energy-using products obtained directly or indirectly from a person engaged in a business described in a) or b) or an agent thereof.

Section 5 of the Energy Efficiency Regulations require that dealers comply with the following two reporting requirements:

1. before shipping an energy-using product interprovincially or importing it, the dealer must ensure that an energy efficiency report has been filed with NRCan
2. when importing an energy-using product into Canada, the dealer must include the information required in Part VI of the Energy Efficiency Regulations in a customs release document.

A dealer must file an energy efficiency report with NRCan only when a product model is not already listed in NRCan's database. Dealers can check with NRCan to find out if an energy-using product is already listed with NRCan.

Products that are included in NRCan's web list of compliant models can be imported into Canada and shipped between provinces, provided no changes have been made to the product that affect its energy efficiency. If a product is not yet listed with NRCan, the dealer must submit a report for the product before importing it or shipping it between provinces.

2.3.3.1.2 Energy Efficiency Report

The energy efficiency report should include the following data:

[20] see http://laws-lois.justice.gc.ca/eng/acts/E-6.4/
[21] see http://www.nrcan.gc.ca/energy/regulations-codes-standards/6859#a1 for the list of regulated products.

- product type
- brand name
- model number
- manufacturer
- name of the organization or province that carried out the product energy performance verification and authorized the verification mark that will be put on the product
- specific information about the energy efficiency and energy-use characteristics of the product.
- purpose for which the product is being imported:
    - for sale or lease in Canada without modification;
    - for sale or lease in Canada after modification to comply with energy efficiency standards;
    - or for use as a component in a product being exported from Canada.

NRCan checks the information in an energy efficiency report to make sure that the product meets the prescribed energy efficiency requirements. If it does, the product model is added to NRCan's web list of models. If a product does not meet the prescribed energy efficiency level, NRCan will contact the dealer to correct the situation before the first importation or shipment of the product. NRCan will also request information from dealers who do not file the required energy efficiency reports, or who file incomplete reports.

Canada Border Services Agency (CBSA) regularly sends information about importations of regulated products to NRCan. This information is cross-matched with information in the database to determine compliance with the Regulations. NRCan can instruct customs officials to stop the importation of a product that does not meet the prescribed energy efficiency regulation.

Under certain circumstances, a dealer importing or shipping energy-using products between provinces can be exempted from submitting an energy efficiency report to NRCan and the product can be exempted from meeting the prescribed energy efficiency standard. Exemptions apply if:

1. a dealer is importing or shipping between provinces an energy-using product that will be modified to meet the energy efficiency standard. In this case, the dealer has 90 days to ensure that the product is modified and meets the energy efficiency standard. Within 120 days after the product was imported or shipped, the dealer must submit an energy efficiency report to NRCan;
2. a dealer is importing or shipping between provinces an energy-using product that will be incorporated into another product and then exported from Canada;
3. a dealer is importing or shipping between provinces an energy-using product, only to export it from Canada.

2.3.3.2 Energy Efficiency verification mark

The Canadian regulations also require manufactures to have the efficiency testing verified by an

independent testing facility. In fact, regulated energy-using products imported into Canada or shipped between provinces must bear an 'energy efficiency verification mark' from a certification body accredited for energy efficiency verification by the Standards Council of Canada (SCC). The mark indicates that the energy performance of the product has been verified. It is not a safety certification mark.

Under some provincial laws, a province can issue a provincial label that indicates that the product meets the provincial energy efficiency levels. NRCan accepts provincial labels as verification marks if the provincial energy efficiency levels are equivalent to, or exceed, the federal levels.

The verification mark must be affixed to a surface of the product in such a way that it is readily visible. In the case of lamps the verification mark can be affixed to the exterior of the product's package.

The energy efficiency verification mark can be placed on a product as soon as the product has met the terms of the applicable energy-performance verification program. At the latest, the dealer must ensure that the verification mark is on the product before the product leaves the dealer's possession or, if the product has been passed on to a consignee, before it leaves the consignee's possession.

The Standards Council of Canada has accredited a number of certification bodies for electrical and electronic products, fuel-burning equipment or gas-fired appliances and equipment[22].

2.3.3.3 Legislation compliance verification

A high compliance rate with the proposed Regulations is achieved through support from manufacturers, third-party verification, customs monitoring, cooperation with regulating provinces, communication activities, market surveys, and product testing, as required.

In addition to ongoing compliance and marketplace monitoring activities, Natural Resources Canada would survey and test products in the context of monitoring compliance outcomes with product-specific compliance audits. Depending on the product Natural Resources Canada would conduct in-store audits and/or test products.

NRCan would also conduct product testing on a complaint-driven basis. The market is highly competitive and suppliers know the performance claims made by their competitors. Challenge procedures by which performance claims can be questioned exist in all verification programs.

2.3.3.4 The legislation for fans and transformers

In Canada dry-type transformers are covered by energy efficiency regulations, industrial fans are currently not addressed. Dry-type transformers are regulated since 2005 and a revision of the legislation has been done in 2010. This amendment come into force on April 12, 2012. The applicable test standard is CAN/CSA C802.2-06 *Minimum Efficiency Values for Dry-type Transformers*. Efficiency requirements are harmonised with those established for similar products in the United States. Transformers that meet the TP-1 efficiency levels[23] also meet the Canadian C802.2 standard. The regulation should be again amended in spring 2017.

Dry-type transformers are not covered by the EnerGuide label, but as all energy-using products must carry

[22] www.scc.ca
[23] see NEMA certification in Chapter 2.3.10 of this Report.

an energy efficiency verification mark.

The energy efficiency report required for dry-type transformers includes a number of product specific information. This report must be submitted, by the dealer, to NRCan (Natural Resources Canada) before the product is imported into Canada or traded interprovincially for the first time.

2.3.3.5 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.4 India

2.3.4.1 The Standards and Labelling Program

Government of India enacted the Energy Conservation Act 2001 to achieve energy efficiency through reduced energy consumption. The Act provides the legal framework, institutional arrangements and regulatory mechanisms for energy efficiency mandatory and voluntary programmes including the Standards & Labelling Program.

The objective of the Standards & Labelling Program[24] is to provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the household and other equipment on the market. The scheme for Energy Efficiency Labelling (guidelines for permittee) is described in document *Guidelines for Permitee-Standards and Labelling Programme of BEE (*Bureau of Energy Efficiency)[25].

Manufacturers, importers, traders can participate to the scheme by registering with the Bureau. The applicant applies on-line through the portal and then submits copies of the application along with supporting documents to BEE. A star rating from 1 to 5 in the ascending order of energy efficiency is provided to product registered with the Bureau. An endorsement label is also provided for some products.

In order to participate to the labelling programme participants will be required to deposit fee at various stages: security deposit, application fee, labelling fee. The BEE star label includes details such as the unique identification number of the manufacturers, star rating, energy performance values and important details of the product including the BEE logo. The label is affixed in a way that is not easily removable from the product as described in the regulation for each product.

The mandatory labelling scheme applies to certain liquid-filled distribution transformers. The labelling scheme defines a series of maximum losses at 50% and 100% of rated load, and a corresponding number of stars that relate to those maximum losses.

2.3.4.1.1 Monitoring, verification and enforcement

The document *Guidelines for Permitee - Standards and Labelling Programme of BEE* describes also the

[24] https://www.beestarlabel.com/#
[25] Version 1, January 2016, downloadable at: https://www.beestarlabel.com/#

monitoring, verification and enforcement procedure. BEE would conduct label verification survey in the market about the availability of registered models at various authorized dealers/retailers/warehouse of user of label.

The user of the label has to submit quarterly details of the products manufactured by them, indicating the number of products a particular model has sold in the market and also the location details about the availability of the models. The user has also to ensure that a model for which the production has started would be available in the market for a period of at least one year. The model cannot be withdrawn during the period.

The Monitoring, Verification and Enforcement Framework sets the principles adopted by BEE to optimise compliance with the Act and other relevant legislation and regulations relating to the energy labelling of appliances and equipment. The non-compliance is assessed through Check testing and Challenge testing:

- *Check testing elements*:
  - it assesses whether the declaration of the energy performance of individual products are accurate under the conditions defined in the relevant product regulation/schedule
  - BEE would conduct random sampling in the market and would buy models from the market
  - the selection of the product for testing is done by the BEE or its designated Agency based on a sampling based approach, and then the product is procured from the market and tested in a third party NAB (National Accreditation Body) accredited laboratory
  - the test laboratory submits a test report to the Bureau to be evaluated by the Bureau or its designated Agency to evaluate if the test and the results conforms to the applicable schedule/standard/regulation
  - In case first model fails, BEE would buy another two samples of the same model from the market and would keep them for witness testing. The user of the label would be informed about the failure and would be asked to witness the second testing..
- *Second check testing elements*:
  - the two additional samples are tested in the same laboratory
  - the user of the label is informed about the failure of the first check testing and is asked to deposit the cost of the sample and of the check testing. If no deposit is done the Bureau goes on with the testing but will not process any further applications for new products and will block the S&L portal of the user of the label
  - in case additional samples are not available, even provided by the user of the label, the results of the first sample are considered binding
  - the user of the label is informed about the date of the second check testing and is asked to witness it
  - once the test is completed, the designated Agency reviews the test reports and forward recommendations and the test report to the Bureau
  - in case on the two additional sample fails the test, the user of the label shall correct the star level on

the label of the product or make the product compliant within 2 months, and withdraw all the stock of the product from the market and change the information on advertising material

- BEE
  - will publish the name of any user of the label, brand and model name or number, logo and other information in any national or regional daily newspaper within two months
  - intimate the State Designated Agency to initiate further controls on the user of the label /trader under section 27 of the Act.
- the user of the label shall report all actions done on the prescribed format to the Bureau
- if the user of the label fails to comply with the indications of the Bureau it shall:
  - withdraw the permission granted to the user of the label
  - send report to the Central Government
  - publish the name of any user of the label, brand and model name or number, logo and other information in any national regional daily newspaper within two months
  - intimate the State Designated Agency to initiate further controls on the user of the label under section 27 of the Act.

- *Challenge testing elements*:
  - is carried out when any written compliant is received regarding the information on the star label or any other requirement of a covered product
  - in case a complaint is received about a wrong or fraudulent declaration the testing of the product/model is carried out in an independent laboratory
  - the complainant will commit to pay all expenses in case the compliant is proven wrong. In case the compliant is proven correct all expenses are paid by the user of the label
  - the procedure follows the same steps as for check testing.

2.3.4.2 Energy efficiency labelling for transformers

On 5 January 2010, India adopted a mandatory labelling scheme for specific types of liquid-filled, naturally air-cooled, three-phase distribution transformers.

BEE classifies distribution transformers in the range from 25 up to 200 kVA into 5 categories from 1 Star (high loss) to 5 Stars (low loss) as shown in Figure 5: 5 Stars represents world-class performance, 3 Stars is being proposed as a minimum efficiency requirement and is being widely followed by utilities. The label shall be applied on the front base of the equipment near the name plate, so as to be prominently visible[26]. More specifically, the standard ratings covered under the energy labelling scheme are 16, 25, 63, 100, 160 and 200 kVA. In June 2013, BIS[27] issued the document number ETD 16(6648) "Outdoor type oil immersed distribution transformers up to and including 2500 kVA, 33kV [Fourth Revision of IS 1180 (Part 1)]" addressed to all members of the Transformers Sectional Committee (ET16), all members of the

[26] https://www.beestarlabel.com/Content/Files/Schedule4_DT.pdf
[27] http://www.bis.org.in/sf/etd/ET16%20_6648.pdf

Electrotechnical Division Council and other interested parties. In this document, the revision of the national distribution transformer standard extends the scope of coverage beyond 200 kVA and up to and including 2500 kVA and 33 kilovolts.

Figure 2-5: Labelling scheme for transformers in India and sample of display

The qualifications criteria and sampling plan for check testing for the star label are:

- the products should conform to minimum requirements of IS 1180 (part 1): 1989 to participate in BEE S&L Programme.
- BIS product certification or at least Quality Certification such as ISO -9000 should be required to participate in BEE S&L Programme
- sampling for test checking would be carried out after the deliveries are made to the utility on the basis of tender. Sampling would be guided by IS 2500 (part-I) -2000: Sampling Schemes indexed by Acceptance Quality Limit (AQL) for lot-by-lot inspection.

On 19 December 2016 the star rating programme for transformers was amended through the publication of an alert document[28]. Amendments to the standard losses are effective from 1st January 2017.

2.3.4.3 The BIS Product Certification Scheme

The Bureau of Indian Standards[29] was empowered by the Indian Parliament through the Bureau of Indian Standards Act of 1986, to operate a product certification scheme - the BIS Product Certification Scheme - to grant licences to manufacturers for a large number of products. The certification allows the licensees to use the "ISI Mark", which has become synonymous of quality products for the Indian and neighbouring markets over the last 55 years.

[28] see document: F__BEESL_BEE_SL_BEESL_Alerts_Important Instructions to all in Distribution Transformer manufacturers and permittee. _Alert for DT amendment.pdf, downloadable from: https://www.beestarlabel.com/Home/showAlert/2226
[29] http://www.bis.org.in/home_product.asp

The powers, functions and responsibilities of BIS are published by the Government of India as the Bureau of Indian Standards Act, 1986, BIS Rules, 1987 and BIS (Certification) Regulations, 1988. The procedure for operating a licence is described in the document The Scheme of Testing and Inspection (STI). The scheme is reviewed by the 'Certification Advisory Committee', composed by representatives of manufacturers, consumers, Government agencies and industries associations.

The BIS product certification scheme is voluntary and is largely based on ISO/IEC Guide 28 which provides general rules for third party certification system of determining conformity with product standards through initial testing and assessment of a factory quality management system and its acceptance followed by surveillance that takes into account the factory Quality Management system and the testing of samples from the factory and the open market. All BIS certifications are carried out in accordance with Indian Standards (IS).

The BIS Product Certification Scheme is open to manufacturers in all countries. Overseas applicants are also granted licence for use of ISI mark under a separately designed scheme.

Considering public interest, for example public health and safety, security, infrastructure requirements, mass consumption, the Government of India has enforced mandatory certification on various products through Quality Control Orders issued under various legal Acts. While BIS continues to grant licences on application, the enforcement of compulsory certification is done by the Authorities defined in each quality control order.

Under separate arrangements with Statutory agencies, some products have been placed under special certification schemes of lot or batch inspection carried out by BIS Inspecting officers. A majority of Gas cylinders, regulators and valves are certified through such schemes. For all other products, the manufacturer is permitted to self certify the products after ascertaining its conformity to the Standard licensed for. Through its surveillance operations, the Bureau verifies the quality of certified goods.

BIS has set up eight laboratories in different cities of India for testing samples of products taken during preliminary and surveillance operations. In addition, independent laboratories complying with IS/ISO/IEC 17025 have been recognized for testing of samples. The certification scheme operates through a network of 34 Branch Offices set up in State capitals or major industrial towns and 5 Regional Offices overseeing the work of the Branch offices.

The Scheme of Testing and Inspection specifies the control over production process which the company is required to exercise for operating the certification marks licence. This is prepared by BIS in consultation with the first applicant for the product. For subsequent applications, the applicability of the available STI is reviewed and changes made if necessary. The STI contains, inter alia the following provisions:

- markings to be applied on the product and the method of applying the Standard Mark
- definition of control unit
- the levels of control to be applied
- acceptance criteria, control unit wise
- frequency of sampling and tests on raw materials, in process materials and finished products
- directions to licensees in event of quality related problems
- a clause requiring free replacement of goods in case a complaint is established *bonafide*.

The out door type Oil immersed Distribution Transformers up to and including 2500 kVA, 33 KV-specification Part 1 Mineral oil immersed are subject to the mandatory certification according to IS 1180 (Part-1).

2.3.4.4 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.5 Mexico

All products need to comply with Mexican Regulations on packaging and product information guidelines before they can be imported and put into Mexican market. To achieve this, vendors must work with Mexican agencies to certify products for commercialization in Mexico. There are two main regulations enforced by the government of Mexico:

- NOM (*Norma Oficial Mexicana*, Official Mexican Standard): all products imported, stored, transported, commercialized, sold or used in Mexico must comply with specific NOM Standards, which apply depending on the nature of the product. NOM requirements could be divided into two main categories: commercial information requirements (packaging) and safety requirements (certification through lab testing).
- LASE (*Ley para el Aprovechamiento Sustentable de la Energía*, Law on Sustainable Energy Use): is a law that is being enforced since September 2011. The two ministries in charge of enforcing this law are PROFECO (Ministry for consumer protection in Mexico) and CONUEE (National Commission for Efficient Use of Energy). It requires all manufacturers and importers in Mexico to declare how much energy a specific product consumes, to be determined based on the testing criteria established in this law and in the documents that it makes reference to. LASE is intended to provide data to consumers so that in addition to cost, quality and other information, they can consider energy consumption as a variable to make the best possible purchase with aims to saving energy. As of today, LASE does not set any energy consumption limits for any products. It only asks to declare the information.

The CCNNPURRE (Comité Consultivo Nacional de Normalización para la Preservación y Uso Racional de los Recursos Energéticos or National Consultative Committee of Standards for the Preservation and Rational Use of Energy Resources) is responsible for reviewing all mandatory energy efficiency requirement proposals.

Mexico has its own test procedures for transformers and mandatory efficiency requirements for liquid-type distribution transformers and voluntary standards for dry-type transformers. No legislation is in force for large industrial fans.

2.3.5.1 Energy efficiency regulation for transformers

2.3.5.1.1 Mandatory efficiency requirements

Mexico began regulating distribution transformers in 1977 when it enacted NOM-J116 in 1977. However, in 1989, a presidential decree modified the Normas Oficiales Mexicanas (Official Mexican Standards) from a

mandatory to a voluntary standard and NOM[30]-J116 became NMX-J116 (Norma Mexicana or Mexican Standard). In 1992, the Federal Law on Metering and Standards (Ley Federal sobre Metrología y Normalización) re-established the mandatory character of NOMs. In addition, this law empowered the Energy Secretariat (Secretaría de Energía) to formulate and enact mandatory standards for electrical equipment.

The mandatory standard NOM-001-SEMP-1994 was enacted in 1994 to regulate the energy efficiency and safety of electrical equipment including distribution transformers, and was revised in 1997 through the standard NOM-002-SEDE-1997, enacted two years later in October 1999. It regulates liquid-immersed units and is the only mandatory efficiency regulation for distribution transformers in Mexico. In fact, dry-type distribution transformers are not regulated in Mexico. NOM-002 provides two sets of tables with the specified minimum efficiency levels and the permitted losses, both tested at 100% of nameplate load. For small manufacturers with cumulative annual production under 9 kVA a less stringent, 18 month transitional standard, was also enacted, but in May 2001 at the end of the transition period the Mexican Government's Energy Secretariat found that small manufacturers had not enough time to bring their production in compliance with the requirements in NOM-002. Since these manufacturers represent an important source of employment the Government decided to extend the transitional period for small manufacturers without specifying the duration of this extension.

In 2014 NOM-002-SEDE/ENER-2014 *Requisitos de seguridad y eficiencia energética para transformadores de distribución or Mandatory safety and minimum energy efficiency requirements for distribution transformers* was introduced. The new requirements apply to domestically-produced and imported distribution transformers, including pole, substation, pedestal and submersible transformers. In addition, transformers must be built with a hermetic tank in order to preserve their insulating liquid. Energy efficiency requirements depend on the transformer nominal power in kWA as well as on whether the transformer is mono-phase or three-phase. Transformers are also required to comply with certain specifications regarding energy loss, test methods, sampling, acceptance criteria, marking and labelling, instructions, warranties and conformity assessment procedures. The new requirements entered into force on 29 December 2015.

Figure 6 [31] shows the evolution of the Mexican legislation for transformers. To join the program manufacturers must supply a certificate provided by ANCE (Asociación de Normalización y Certificación), ONNCCE (Organismo Nacional de Normalización y Certificación de la Construcción y Edificación) or LOGIS (Organismo de Certificación de Productos), private entities authorised by the Ministry of Economy. Manufacturers must also provide a test report from a laboratory accredited by the EMA (the Mexican accreditation entity) along with registration documents for each model, and annual sales data. According to CONUEE, there are 54 test laboratories available that have been authorized by the Ministry of Economy.

A third party is commissioned by the government Agency to undertake import controls and visual checks of test certificates and registration details to ensure that the minimum energy efficiency requirements are met. Verification testing is also conducted within the program.

[30] in Mexico, the NOM generally includes the test procedure, recommended minimum levels, and labelling instructions; the term "norma" is used to refer to minimum efficiency performance requirements.
[31] http://www.prolecge.com/images/pdf/Evolucin_de_las_Eficiencias_Energticas.pdf

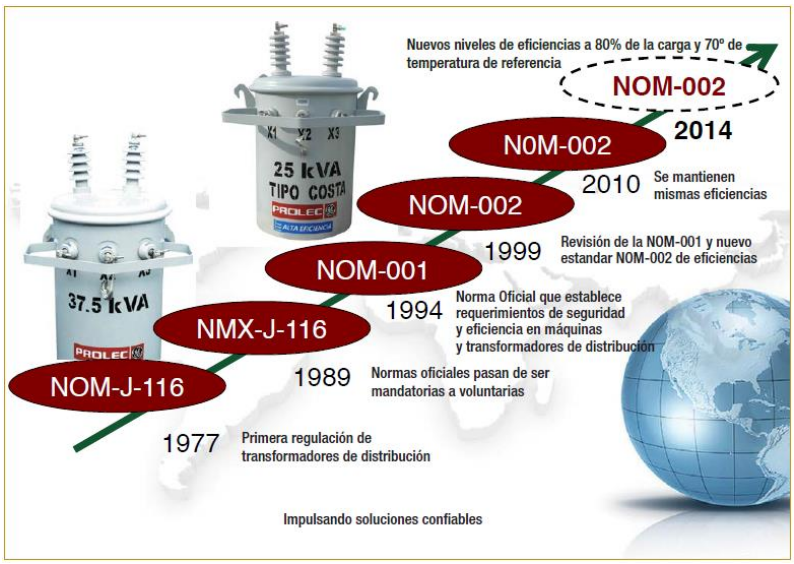


Figure 2-6: Evolution of the Mexican legislation for transformers

2.3.5.1.2 Voluntary endorsement label

The Sello FIDE is a voluntary endorsement label awarded by the Fideicomiso para el Ahorro de Energía Eléctrica (FIDE), a private non-profit organization financed by the largest public utility, the CFE (Federal Power Commission). The Sello FIDE program was introduced in Mexico in 1995. The voluntary label Sello FIDE No. 4148[32] was implemented for transformers in 2012.

This endorsement label establishes specifications for pole mounted, pad mounted, substation and liquid-filled transformers, self-cooled, single phase rated from 5 to 167 kVA, and three phase rated from 15 to 500 kVA, 60 Hz, with insulation class of 15, 25 and 34,5 kV. The relevant standard for energy efficiency is NMX-169-ANCE *Transformadores y autotransformadores de distribución y potencia – métodos de prueba*. To join the programme manufacturers must provide a test report from a certified laboratory. The label is shown on the catalogues, packaging or on the transformers.

The verification procedure is included in the label specifications:

- the energy characteristics and placement of the Sello FIDE label on certain models of branded products are verified. The verification can be applied at any time during the term of the License for Use of Sello FIDE
- place and date of sampling: sampling of transformer models to be evaluated by a representative of FIDE during the period of the License for Use, with full acceptance of the company, either at the factory, warehouse or distribution centre and the date agreed by both parties
- sample size: the sample size is defined by FIDE, depending on the number of qualified models, similarity in design and manufacturing, energy consumption and number of distribution centres as well as the

[32] Especificación SELLO FIDE No. 4148 Transformadores de Distribución Revisión: 1, Fecha: 20-feb-2012.

presence of the FIDE quality control mark for the manufacturer on the models to be verified

- placing the label: FIDE verifies compliance with the placement of the label for the selected models in accordance with the provisions of section 8 of the specifications
- witness testing: to check compliance with the limit values and guarantee the energy characteristics of the selected models the company must perform the appropriate tests in the presence of a representative of the FIDE and in a laboratory accredited by EMA.

2.3.5.2 Compliance verification actions for fans and transformers

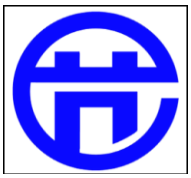
At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.6 China

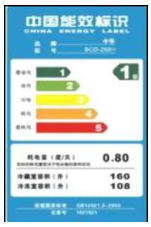
In China all products - including transformers and industrial products - are controlled by China government and supervision organizations from the component material, design, manufacture, use and recycling points of view.

Three major programs related to energy efficiency of products do exist:

- mandatory minimum efficiency requirements, developed by China National Institute of Standards (CNIS), now cover more than 20 types of major products, including most residential and commercial appliances, and lighting, heating and cooling equipments
- voluntary energy efficiency labels: this programme encourages more than 300 manufacturers to produce energy efficient appliances by allowing them to use a special label if their products meet certain requirements. Manufacturers are subject to annual on-site audits of production facilities, undertake third-party testing in certified laboratories and comply with ISO 9000 standards. Currently, the program covers about 50 products including home appliances, consumer electronics and office equipment



- mandatory energy information labels: launched in 2005 as an adaptation of the European Union energy labelling. The label shows consumers how close an appliance comes to meeting minimum efficiency requirements, ranging from 100% (meeting the minimum requirements) to 55% of the minimum requirements. The labels covers 19 products, including air conditioners, household refrigerators, and clothes washers. Manufacturer declarations are based on self-declarations.



Different type of standards are defined in China: GB standards are mandatory, GB/T are instead voluntary; a local standard or an industry standard can be named DL, JB, DB, NB, etc, and in general is voluntary. Standards related to products quality, carbon emission, safety, environmental and water protection, are mandatory. For example, the '3C safety label' or the 'energy efficiency label' are mandatory.

In general the Government or supervision centre select every year some manufactures and their products to check the quality and compliance to standards and specifications. For the verification some units are

selected to be controlled.

For example, when a power utility procures transformers a team is sent to check the procured products at the suppliers' plant when still in the process of production, including documents, products, management, etc, and the visiting time is random. The reports of the supervision result are not publicly available.

Historically[33], the government's primary focus has been on the setting of the efficiency requirements, while less attention was paid to monitoring and enforcement, with a minimal allocation of resources and administrative capacity in this area. The establishment of a monitoring system of the compliance with the mandatory requirements and the energy information label is a major area of improvement. CNIS has already begun working on this issue under international collaboration with CLASP and Japan's Ministry of Economy, Trade and Industry (METI). CNIS has conducted modest sample testing in 2006 for refrigerators, freezers and room air-conditioners, and repeated the same task in 2007 with a similar sample size for refrigerators, freezers, air-conditioners and clothes washers. In early 2007[34] a report was compiled summarizing the findings from these activities. The report concluded that although the existing legal basis for monitoring and enforcement is sufficient compared with international best practices, with multiple laws and regulations defining the responsibility of each government Agency and specifying a system of fines and penalties for non-compliance, there is still a big gap in the actual monitoring and enforcement efforts. The report concluded that the verified sample size is far smaller than the mid-term goal of developing a regular check testing program for 20% of the market for each of the three above mentioned products.

2.3.6.1 The legislation for transformers

The annual electricity loss in the country remains above 20 billion kWh, with power transmission and distribution accounting for about 30-40% of the grid's total electricity loss. Power loss due to inefficient transformers accounts for more than 3% of the total installed capacity of the national grid. Transformers have a great energy saving potential due to their wide application and long running time, especially for the widely applied middle and small sized models. Reducing losses and improving the efficiency of power supply and distribution have become a priority for the Chinese government to save energy.

In March 2010 the "EU-China Higher Efficiency Power and Distribution Transformers Promotion Project" [35] was launched. The project involved a close partnership between ICA (International Copper Association China), CNIS, China Electrical Equipment Industrial Association, China Electricity Council, and Action Sustainable Development (ASD-France).

In 2012 the State of Council of China issued the Energy Conservation and Emissions Reduction's Twelfth Five-Year Plan, outlining specific targets to reduce the load loss of transformers by 17% to 19%. Contemporarily support instruments were also issued, such as the fiscal subsidy programme "*Energy-saving products & people-benefit project implementing rules for the promotion and application of High Energy Efficient Transformers*". Finally, efficient transformers will be included in the China Catalogue of High-Efficient Products used in public procurement of local administration.

[33]https://www.researchgate.net/publication/239883509_Status_of_China's_Energy_Efficiency_Standards_and_Labels_for_Appliances_and_International_Collaboration, Zhou Nan, China Energy Group of Lawrence Berkeley National Laboratory, 2008.
[34]https://www.researchgate.net/publication/255197277_Check-Testing_of_Manufacturer_Self_Reported_Labeling_Data_Compliance_with_MEPS
[35] www.switch-asia.eu/projects/higher-efficiency-of-transformers/

Minimum efficiency requirements and the energy efficiency label apply to power transformers. Minimum efficiency requirements are described in:

- GB 24790-2009 - Minimum Allowable Values of Energy Efficiency and the Energy Efficiency Grades for Power Transformers
- GB 20052-2013 Three Phase Distribution Transformer Energy Efficiency Limit Value and Grade. The standard specifies the energy efficiency grades, minimum values of energy efficiency, evaluating values of energy conservation and test methods for three-phase distribution transformers. The standard applies to 3-phase, 10 kV, off-circuit tap-changing oil-immersed distribution transformers with the rated capacity being 30 kVA ~ 1600 kVA, and dry-type distribution transformers with the rated capacity being 30 kVA ~ 2500 kVA. Gas filled transformers are excluded. Distribution transformers are divided into three grades of energy efficiency, of which Grade 1 is the highest, with the least loss. Mandatory minimum requirements are set at the lowest Grade 3, while for the purpose of evaluating the values of energy conservation of transformers a minimum of Grade 2 is asked for. The no-load loss and load loss must be tested in accordance with the requirements of GB 1094.1 and GB 1094.11.

The energy efficiency label - the China Energy Label - applies to three-phase oil-immersed power transformer whose rate frequency is 50 Hz, voltage level between 35 kV and 220 kV, and rated capacity 3150 kVA and above[36]. It does not apply to dry-type transformer. The label is shown in Figure 7.

The manufacturer or importer can use its own testing capacity, or entrust testing agencies certified by China National Accreditation Service for Conformity Assessment to test the product. Energy efficiency inspecting laboratory is required to submit relevant filing material including personnel capabilities, equipment capabilities, test management codes, etc. The authorized institution is required to check and examine the test capabilities of the test laboratory.

Figure 2-7: Energy efficiency label for transformers in China

The energy efficiency ranking is identified according to the currently valid edition of GB 24790 and the test report.

[36] http://www.energylabel.gov.cn/en/LabelNews/LabelRelatedActivities/detail/563.html

The manufacturer or importer submits the Power Transformers Energy Efficiency Label Filing Form via letters and submit related filing materials within 30 days upon using the label and fill in related filing information on “China energy efficiency label website” (www.energylabel.gov.cn) at the same time.

The manufacturer or importer shall submit a report on use of the label in the previous year to the competent authority before March 15 of every year. The report includes the registration of the labels used for products of different specification, supervision and punishment related to the label and other materials related to use of the label.

Beside the standards and legislation specifications, there are additional provisions from central government or local governments. Old distribution transformer with no load loss information and load loss higher than the minimum mandatory level and in use by more than 30 years are mandatorily replaced. The requirement is included in a Government Notification by central government and will be supervised by local supervision centres.

2.3.6.2 The legislation for industrial fans

No legislation is in force in China for the large industrial fans covered by the INTAS project.

2.3.6.3 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.7 Japan

In Japan transformers are covered by the Top Runner Program and the Energy-Saving Labelling Program.

2.3.7.1 The Top Runner for transformers

In 1998 the Top Runner approach was adopted in Japan in the revision of the Energy Conservation law. The scope of the Top Runner Programme is based on three criteria:

- products involving large domestic shipments
- products that consume a substantial amount f energy in the use phase
- products with considerable room to improve energy efficiency.

The programme started with nine products and gradually expanded. The revision of criteria is triggered when the target year for a product group approaches, or earlier when the criteria have been met well before the target year. The programme encompasses a strong involvement of industry associations in the process of setting requirements.

For each company that manufacture or import a product covered by the Top Runner Program, the product category's weighted average value must achieve a target value by the target fiscal year. To confirm achievement of Top Runner requirements, questionnaires are distributed to manufacturers soon after the

target fiscal year, and information is obtained on the number of units shipped, energy consumption efficiency, etc. in the target fiscal year. The surveys are conducted by the Agency for Natural Resources and Energy that is responsible for enforcing the Energy Conservation Law.

Enforcement within the Top Runner Program relies on “blame and shame”. For non-compliance, following penalties are foreseen:

1. recommendation
2. publication of the name of the company
3. order
4. penalty (under one million yen penalty).

To verify display implementation, product catalogues are periodically and continuously collected. For displays on products themselves, submission of name plates, etc. or retail store surveys are conducted. If the results of the energy efficiency surveys show that improvements in energy efficiency is needed, METI (Minister of Economy, Trade and Industry) offers recommendations to the manufacturer. If this advice is not followed, the recommendations are made public and the manufacturer can be ordered to follow the recommendations.

Manufacturers subject to these recommendations and advice should be limited to those whose performance improvements in manufacturing and import of products are considered to have a substantial impact on energy consumption in Japan. In addition, targets should be limited to manufacturers whose organizational capacity is economically and financially robust to avoid social problems.

For each product covered by the Top Runner Program a cutback in shipping volume will be set according to production and import volume. Moreover, if there are product categories that partially fail to achieve goals it will not be appropriate to advise the manufacturer immediately. Instead, reasons why goals were not achieved, other companies’ achievement records in the same field, achievement records in other product categories of the company in question, and percentages of product categories that have not achieved the targets out of all categories, and other factors will be comprehensively evaluated.

For manufacturers not complying with product information display cutbacks based on production and import volume are not applied and all companies are subject to these measures in spite of small volume in production/import.

Power transformers requirements were set in 2006/2007 and revised in 2013. The Super Efficient Transformer has been rebranded as the Top Runner Transformer 2014 in accordance with the second evaluation criterion of the revised 2014 Energy Act. Covered transformers are single phase and three-phase liquid-filled and moulded (using resin insulating materials), 50 and 60 Hz. Efficiency was improved by about 13,1% over the financial year 1999 level by the fiscal year 2009 and by about 12,5% by the target year (fiscal year 2014).

Energy consumption efficiency is expressed in term of the total loss acquired through the no-load loss and load loss measured using the methods set by standard JIS C 4304 and C 4306. In the target fiscal year and each subsequent fiscal year, energy consumption efficiency in each category shall be at or lower than the target standard value.

Target Requirements of Recommendations and Orders are for manufacturers or importers whose manufacturing/import volume (limited to shipment to the domestic market) is 100 units or more.

2.3.7.2 The Energy-saving labelling program

The Energy-Saving Labelling Program was started in 2000. The purpose of this program is to promote diffusion of high energy efficient products by means of information to consumers on their energy performance. The energy saving labelling program now covers 21 products including transformers. According to the Energy Conservation Law, energy efficiency labelling is mandatory.

The label does not compare the energy consumption/efficiency of products but shows the achievement rate of the Top Runner target. Four items are shown on the label: a symbol used to show the degree that energy saving requirements had been achieved, energy saving standard achievement rate, energy consumption efficiency, and the Top Runner target fiscal year (Figure 8) . The label for the product main unit is shown in Figure 9.

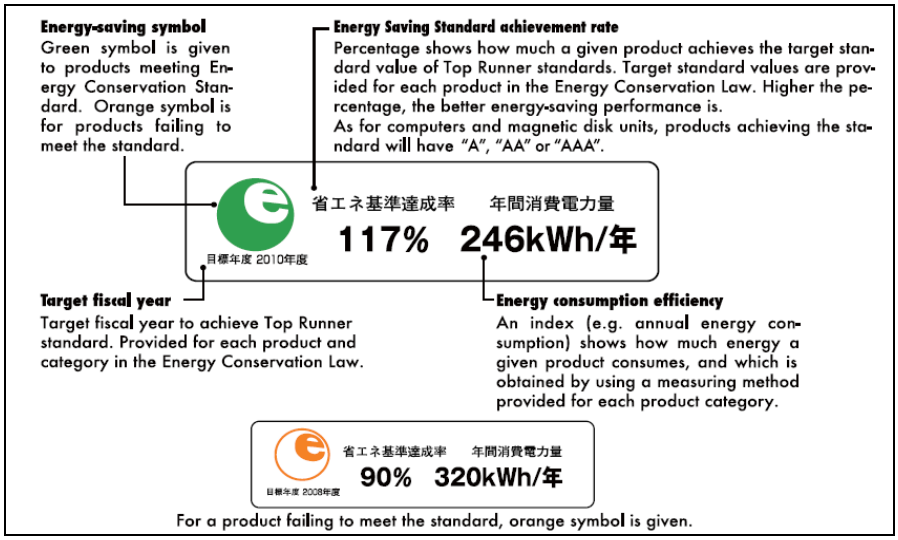


Figure 2-8: Example of energy saving label in Japan

Figure 2-9: Japan label for the product main unit

Although it is a voluntary program based on JIS standards, Energy-Saving Labels are actively utilized in product catalogues by manufacturers and point-of-purchase displays at retail stores.

A compliance evaluation was conducted in 2009 to ensure the accuracy of labelling and to increase consumers' confidence on the labels on the products sold in the market. For 150 manufactures the accuracy of labelling was evaluated and results were reported to the Agency for Natural Resources and Energy. The main outcome was that some products were labelled better than the actual performance due to mistakes in showing "Annual electricity consumption", "Top-runner achievement rate", and "Number of stars", some products were labelled worse than the actual performance.

Actions for ensuring labelling compliance differ by industry association. For products - including transformers - covered by the industrial association JEMA (Japan Electrical Manufacturers' Association), the Association decided to investigate the causes for the wrong labelling and share the outcomes among the member companies, followed by a periodical voluntary review by each company, and confirmation by JEMA. Only for refrigerators random performance test were done to check the accuracy of labelling.

Although mandatory third-party labelling inspection is not specified by law, the peer-review among member companies are effective option in Japan to increase labelling compliance.

2.3.7.3 The legislation for industrial for industrial fans

No legislation is in force in Japan for the large industrial fans covered by the INTAS project.

2.3.7.4 Compliance verification actions for fans and transformers

At the time of drafting this Report no examples or best practices in the compliance verification of large industrial fans and distribution transformers are available.

2.3.8 European Union

2.3.8.1 Regulation 548/2014

The procedure of Regulation 548/2014 gives the possibility to Member State authorities to undertake the verification procedure for transformers at the premises of manufacturers, before they are put into service in their final destination, given the weight and size limitations in the transportation of medium and large power transformers. The practical procedure to be followed is left to each Member State.

This possibility is not foreseen by Regulation 327/2011 for fans nor in Regulation 1253/2014 for ventilation units, another large industrial product.

The verification procedure of Regulation 548/2014 has been amended by Article 19 of the horizontal Regulation 2016/2282[37] on the use of tolerances in verification procedures, in force since 10 January 2017, where Annex III to Regulation (EU) No 548/2014 is amended in accordance with Annex XIX (pages 95-96) to Regulation 2016/2282.

[37] Regulation (EU 2016/2282 of 30.11.2016 amending Regulations .... (EU) No 548/2014, ... with regard to the use of tolerances in verification procedures, OJ L 346 / Volume 59, 20 December 2016, p. 51.

ANNEX XIX

Amendments to Annex III to Regulation (EU) No 548/2014

Annex III is replaced by the following:

'ANNEX III

Product compliance verification by market surveillance authorities

The verification tolerances defined in this Annex relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.

When verifying the compliance of a product model with the requirements laid down in this Regulation and its Annexes pursuant to Article 3(2) of Directive 2009/125/EC, for the requirements referred to in this Annex, the authorities of the Member States shall apply the following procedure:

(1) The Member State authorities shall verify one single unit of the model. Given the weight and size limitations in the transportation of medium and large power transformers, Member States authorities may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination.

(2) The model shall be considered to comply with the applicable requirements if:

(a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values), and, where applicable, the values used to calculate these values, are not more favourable for the manufacturer or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and

(b) the declared values meet any requirements laid down in this Regulation, and any required product information published by the manufacturer or importer does not contain values that are more favourable for the manufacturer or importer than the declared values; and

(c) when the Member State authorities test the unit of the model, the determined values (the values of the relevant parameters as measured in testing and the values calculated from these measurements) comply with the respective verification tolerances as given in Table 1.

(3) If the results referred to in point 2(a), (b) or (c) are not achieved, the model shall be considered not to comply with this Regulation.

(4) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to point 3.

The Member State authorities shall use the measurement and calculation methods set out in Annex II.

The Member State authorities shall only apply the verification tolerances that are set out in Table 1 and shall only use the procedure described in points 1 to 4 for the requirements referred to in this Annex. No other tolerances, such as those set out in harmonised standards or in any other measurement method, shall be applied.

L 346/96 EN Official Journal of the European Union 20.12.2016

Table 1

Verification tolerances

Parameters	Verification tolerances
Load losses	The determined value shall not exceed the declared value by more than 5 %.
No-load losses	The determined value shall not exceed the declared value by more than 5 %.
The electrical power required by the cooling system for no-load operation	The determined value shall not exceed the declared value by more than 5 %.'

Annex XIX to Regulation 2016/2282:

1. reaffirms that given the weight and size limitations in the transportation of medium and large power transformers, Member States authorities may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination.
2. describes with more details the procedure for the documental and physical verification of the compliance, that can result in a model being non-compliant if:
    a. the values in the technical documentation are more favourable for the manufacturer or importer than the results of the corresponding measurements,
    b. the declared values do not meet the ecodesign requirements, and product information published by the manufacturer or importer contains values that are more favourable for the manufacturer or importer than the declared values
    c. the values determined by testing the unit of the model by the Member State authorities do not comply with the respective verification tolerances
3. states that in no case the verification tolerances can be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means
4. states the obligation for a Member State authorities to provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the transformer model.

2.3.8.2 Regulation 327/2011

Regulation 327/2011 on fans foresaw the more traditional verification procedure within the ecodesign Directive, consisting of two phases, where 1 + 3 units of the model under verification were tested, with some limitations only for models produced in quantities of less than five per year. It has also been amended by Regulation 2016/2282 and a new Annex on verification procedure has been prepared.

ANNEX X

Amendments to Annex III to Regulation (EU) No 327/2011

Annex III is replaced by the following:

'ANNEX III

Product compliance verification by market surveillance authorities

The verification tolerances defined in this Annex relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.

When verifying the compliance of a product model with the requirements laid down in this Regulation pursuant to Article 3(2) of Directive 2009/125/EC, for the requirements referred to in this Annex, the authorities of the Member States shall apply the following procedure:

(1) The Member State authorities shall verify one single unit of the model.

(2) The model shall be considered to comply with the applicable requirements if:

(a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values), and, where applicable, the values used to calculate these values, are not more favourable for the manufacturer or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and

(b) the declared values meet any requirements laid down in this Regulation, and any required product information published by the manufacturer or importer does not contain values that are more favourable for the manufacturer or importer than the declared values; and

(c) when the Member State authorities test the unit of the model, the determined values (the values of the relevant parameters as measured in testing and the values calculated from these measurements) comply with the respective verification tolerances as given in Table 3.

(3) If the results referred to in point 2(a) or (b) are not achieved, the model shall be considered not to comply with this Regulation.

(4) If the result referred to in point 2(c) is not achieved:

(a) for models that are produced in quantities of less than five per year, the model shall be considered not to comply with this Regulation;

(b) for models that are produced in quantities of five or more per year, the Member State authorities shall select three additional units of the same model for testing. The models shall be considered to comply with the applicable requirements if, for these three units, the arithmetical mean of the determined values complies with the respective verification tolerances given in Table 3.

(5) If the result referred to in point 4(b) is not achieved, the model shall be considered not to comply with this Regulation.

(6) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 4(a) and 5.

The Member State authorities shall use the measurement and calculation methods set out in Annex II.

L 346/76 EN Official Journal of the European Union 20.12.2016

The Member State authorities shall only apply the verification tolerances that are set out in Table 3 and shall only use the procedure described in points 1 to 6 for the requirements referred to in this Annex. No other tolerances, such as those set out in harmonised standards or in any other measurement method, shall be applied.

Table 3

Verification tolerances

Parameter	Verification tolerance
Overall efficiency (η_e)	The determined value shall not be lower than the value representing 90 % of the corresponding declared value.'

Annex X to Regulation 2016/2282 reaffirms that for fans the two-Step verification procedure involving the testing of 1+3 units has to be followed, with some limitations for models that are produced in quantities of less than five per year. The second step of the procedure, encompassing the re-testing of three additional units is limited to the parameters subject to laboratory testing and not to the documental inspection and the check of the misuse of the tolerances by manufacturers or importers.

2.3.8.3 The Modules within the EU New Approach legislation

The following analysis of Decision No 768/2008/EC[38] has been added to this report following the suggestion of the Chairman of the ADCO Group on Energy labelling and Ecodesign, after the presentation of the INTAS project at the meeting of 22 November 2016.

Decision No 768/2008/EC is a common framework for the marketing of products in the EU that:

- sets out common principles and procedures which EU legislation must follow when harmonising conditions for marketing products in the EU and the European Economic Area (EEA)
- includes reference requirements to be incorporated whenever product legislation is revised. As such, it is a template for future product harmonisation legislation
- lays down rules for CE marking, which is subject to the general principles defined by Regulation 765/2008[39]
- provides clear definitions for relevant terms, such as 'manufacturer', 'placing on the market', 'recall' or 'withdrawal' of products and defines:
  - CE marking: that indicates that a product meets the applicable health, safety and environmental requirements and has undergone the relevant conformity assessment procedure
  - Conformity assessment: the process confirming that a product satisfies the necessary process, service, system, person or body requirements.

[38] Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC
[39] Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93

Key points of Decision 768/2008 are:

- clear divisions of responsibility for manufacturers, importers and distributors along the product chain:
  - 'manufacturers' must ensure their products comply with the relevant legislation and follow the appropriate conformity assessment procedure. They must place the CE marking on the product once compliance is demonstrated
  - 'importers' must make sure the manufacturer has complied with the appropriate conformity assessment procedure and the product is accompanied by the necessary documentation and CE marking
  - 'distributors' must act with due care and verify the product has the necessary documentation and CE marking;
- uniform rules are laid down for designating and supervising Notified Bodies which may carry out the conformity assessments on the basis of EU legislation. The rules lay down their responsibilities when third-party product conformity assessments (i.e. certification of conformity by an independent body) are required
- market surveillance rules deal with products which present a health or safety risk or do not comply with the relevant legislation
- a common set of different conformity assessment procedures, known as "Modules", is provided, from which the Legislator can choose the most appropriate depending on the risk a product might present
- where legislation requires conformity assessment, it may provide for the assessment to be carried out by public authorities, manufacturers or notified bodies
- where the conformity assessment is to be carried out by public authorities, the legislation shall provide that the conformity assessment bodies on which those authorities rely for technical assessments must comply with the same criteria as those set out for notified bodies.

Conformity assessment modules, from A (internal production control) to H (full quality assurance) defined by the Decision are described in Figure 10[40], the conformity assessment procedures through the modules is summarised in Figure 11[41]. Modules A, B, G and H can be applied to the product design, the other modules to the assessment of the production process conformity.

Currently Module A encompassing manufacturer self-certification is applied for the ecodesign Directive, however, the Commission will assess the opportunity to introduce third party certification for some industrial products and will present the results to the ecodesign Consultation Forum not later than August 2018 for

[40] Presentation 3 - Conformity Assessment & Product Compliance.pdf, downloadable from http://www.tehnis.privreda.gov.rs/sw4i/download/files/box/_id_315/Presentation%203%20-%20Conformity%20Assessment%20&%20Product%20Compliance.pdf.
[41] ibid

Regulations 2015/1189[42] (solid fuel boilers) and 2015/1185[43] (solid fuel local space heaters) and not later than January 2019 for Regulation 2015/1188[44] (local space heaters).

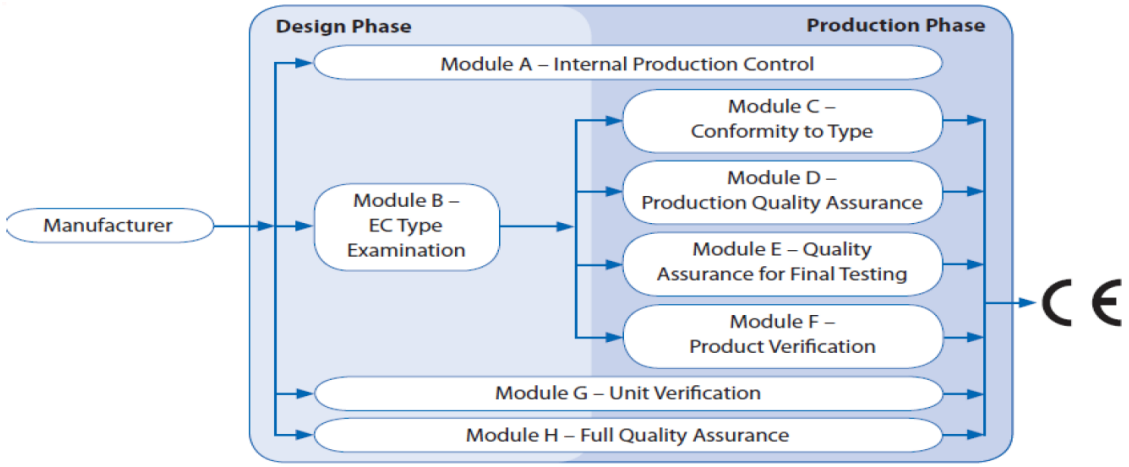


Figure 2-10: EU Conformity assessment modules for CE marking

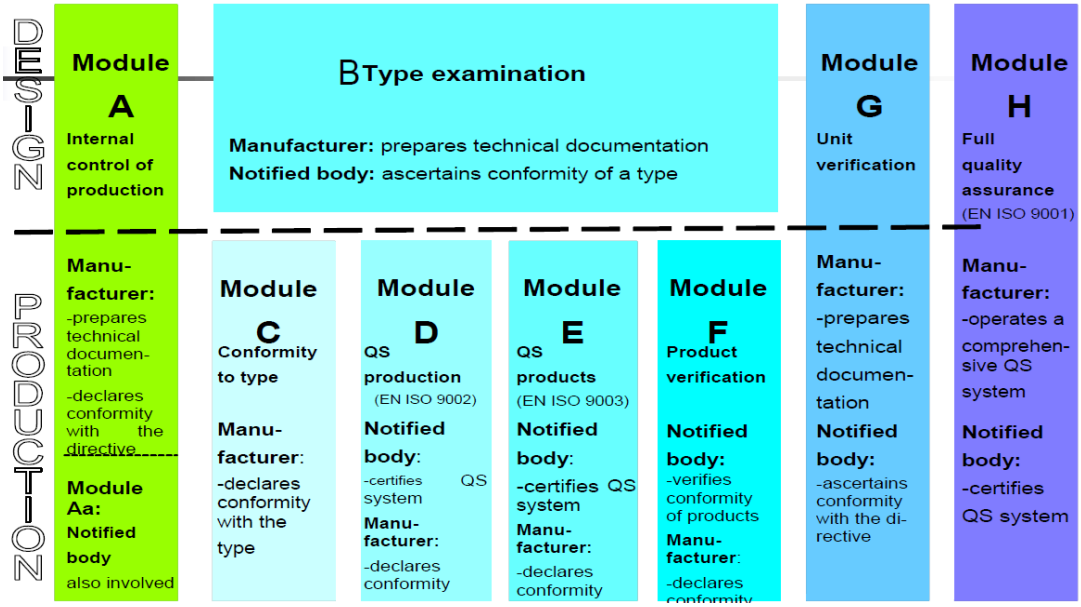


Figure 2-11: The conformity assessment procedures of the new approach through the modules

[42] Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers
[43] Commission Regulation (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel local space heaters
[44] Commission Regulation (EU) 2015/1188 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for local space heaters

2.3.9 European Union Member States

2.3.9.1 Nordic countries within Nordsyn

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland. "Green Growth"[45] has been one of the priority programmes of the Nordic Council of Ministers since it was launched by the Nordic Prime Ministers in November 2011. Eight focus areas were identified, among which "Green technical norms and standards". Three main projects have been started within this focus area: *The Nordic region as a standard maker*, *The Swan's ecolabelling for building renovations* and *Market surveillance of ecodesign and energy labelling* or *Nordsyn*.

Since 2013, all Nordic market surveillance authorities have participated actively in the *Nordsyn* project, aiming to ensure a consistent implementation of the energy labelling and ecodesign legislation and to improve market surveillance in the Nordic region. The project is directed primarily towards the Nordic market surveillance authorities and has given a significant contribution to the Nordic collaboration on market surveillance through coordination, increased dialogue on the interpretation of legislation, collaboration on test and information activities, and sharing of test results and market surveillance plans. *Nordsyn* has initiated a number of in-depth studies, including *Effects of Market Control*, *Strategic Nordic Products*, and *Survey SME*, and has developed a number of guidelines about market surveillance and technical documentation.

In 2015 *Nordsyn* has focused on three initiatives: *Continual working methods*, *How to overcome barriers to collaboration* and the project *Challenges for market control* about the market control of products that are difficult to monitor.

2.3.9.2 Sweden

In Sweden the Market Surveillance Council is a national coordinating body for issues relating to market surveillance. It primarily functions as a forum for the exchange of information and experience between authorities. The Market Surveillance Council consists of 17 market surveillance authorities.

The Swedish Energy Agency is responsible for market surveillance of the EU ecodesign and energy labelling Directives[46]. The aim of the Swedish Energy Agency's supervision is to ensure effective and legally safe supervision.

The market surveillance plan assigns the product group and type of surveillance on the basis of a risk assessment as well as the relevance to energy, consumers and industry. The selection of a product for surveillance is based on its:

- great potential for energy-efficiency improvements
- new or amended requirements for the product group in question
- great relevance for Swedish industry

[45] Nordic Council of Minister, The Nordic Region - Leading in Green Growth, Status report for the Nordic Prime Ministers Summer Meeting 2015, 2015.
[46] Swedish Energy Agency, Market Surveillance Plan 2015 - Market surveillance in the areas of the Eco-design and Energy Labelling of energy-related products, 9 December 2014.

- great relevance for Swedish consumers, for example owing to other conditions such as the Nordic climate, consumption patterns or other national conditions that differ from those in other parts of the European Union.

Three main principles are followed for the selection of specific models for a particular product group:

- targeted selection
- random selection
- selection in response to reports or complaints received (reactive market surveillance).

The Swedish Energy Agency's market surveillance is largely proactive and is governed by the annual market surveillance plan. There is also a certain amount of "reactive market surveillance", although the number of reports or complaints received concerning ecodesign and energy labelling is still relatively low. Reactive market surveillance means supervision resulting from reports or complaints received concerning a particular product or group of products may be carried out if the Agency deems it necessary.

A special reporting form has been developed on the Agency website, where it is possible for the person submitting the report to remain anonymous. The Agency is obliged to receive reports of this kind, and such information may prove valuable in directing direct or future initiatives. However, there is no obligation for the Agency to act on reports.

A summary is provided in Table 3 for the market surveillance initiatives planned for 2015 for various product groups. Further activities may be performed if resources are available.

During 2015, it was planned to examine how market surveillance for larger systems (composed of several subcomponents), site-built products and unique products (where only a single item is manufactured), can be operated effectively.

Due to the decrease of resources for market surveillance some of the planned activities suspended, and therefore some of the activities planned for 2015 were suspended, whilst testing of large circulators and water pumps and store checks on heat pumps, hot-water storage tanks and water heaters were not carried out.

Since requirements for transformers entered into force during 2015, it was considered necessary to commence the surveillance of individual products during 2016 and 2017. The plan for 2016 foresees to test transformers as shown in Table 4[47]. In addition a large part of the information campaigns will be targeted at operators producing and selling products which have recently become subject to legal requirements, such as central ventilation systems, heat pumps, hot-water storage tanks and online shops along with the analysis on how market surveillance for larger systems and site-built products can be conducted in an effective manner.

For 2016-2018 it is expected to continue the collaboration on market surveillance of energy-related products within the *Nordsyn* programme (see paragraph 2.3.9.1) and four sub-projects are also being carried out as part of this programme.

[47] The Swedish Energy Agency, Market Surveillance Plan for 2016, Ecodesign and Energy Labelling of energy-related products, 8 December 2015

Table 2-3: Market surveillance activities relating to adopted and published regulations in Sweden, 2015

2015	Ecodesign testing	Energy labelling testing	Documentation checks	Shops, internet, advertising	Reactive cases	Preventative information initiatives	Other
Lighting							
Home lighting	x	x			x	x	Also under Prosafe
Lamps/LED	x	x			x	x	Also under Prosafe
Street and office lighting	x	x			x	x	
Household equipment							
Tumble driers	x	x	x		x		
Dishwashers					x		
Washing machines			X		x		
Vacuum cleaners	x	x		x	x		
Fridge freezers	x	x			x		
Ovens, hobs and extractor hoods				x	x	x	
Coffee machines (included in Standby Regulation)	x				x	x	
IT/Electronics							
TVs					x		
Computers and servers	x				x		
External power supply units	x				x		
Simple set-top boxes					x		
Heating systems and buildings							
Circulation pumps	x				x		
Air conditioning, including air heat pumps				x	x		
Boilers (electric, gas, oil) and heating pumps for hydronic central heating systems				x	x	x	Also under Prosafe
Water heaters and accumulator tanks				x	x	x	Also under Prosafe
Industry							
Electric motors					x		
Fans	x				x		
Water pumps			x		x		
Transformers					x	x	
Tyres							
Tyres				x	x	x	
Horizontal requirements							
Energy labelling on the internet				x	x	x	
Networked standby					x	x	Included as a sub-element of other tests

Table 2-4: Market surveillance activities relating to adopted and published regulations in Sweden, 2016

2016	Ecodesign testing	Energy labelling testing	Documentation checks	Shops, internet, advertising	Reactive cases	Information initiatives	Other
Local space heaters						X	New product, legal requirements January 2018
Industry							
Electric motors	x				x		IE3 motors, legal requirements January 2015
Fans					x		Testing in 2015.
Water pumps	x		x		x		Prior to revision of Regulation (EU) No 547/2012. Not carried out in 2015.
Transformers	x				x		Preliminary study in 2015. New product.

2.3.9.2.1 Compliance verification actions for fans and transformers

It is worth noting that for the two products covered by the INTAS project reactive actions were foreseen for 2015 plus some testing for fans. In 2016 also transformers had to be tested. Due to the cutback in resources also the investigations into how market surveillance should best be conducted for new, more complex products could not be carried out, but the analysis was planned for 2016. However, at the date of drafting this Report no further information or results were available.

2.3.9.3 Denmark

The Danish Energy Agency, within the Ministry of Energy, Utilities and Climate, is responsible for monitoring compliance with the requirements of ecodesign and energy labelling. The Secretariat for Ecodesign and Energy Labelling of Products is responsible for practical tasks related to the surveillance on behalf of the Danish Energy Agency. The Secretariat activities are divided into four main categories: (i) concrete inspections, (ii) guidance, (iii) enquiries and reports and (iv) assistance in the international work of the Danish Energy Agency.

In 2015 the secretariat has completed laboratory measurements, inspection of technical documentation, inspection of energy labelling in shops and inspection of energy labelling in on-line shops. In the planning of measurement verifications and inspection of technical documentation for 2015 the Danish Energy Agency prioritized product areas where previous inspections have shown that a significant share of the products failed laboratory measurements, or where manufacturers have previously had difficulties in providing documentation of own products.

As illustrated in Figure 12, the challenge is to make the assessment and guidance period as efficient and short as possible while at the same time ensuring a service-minded and uniform case handling. The

experience from previous years shows that focused information and guidance – e.g. sector information meetings – help reduce this time period in relation to the inspections.

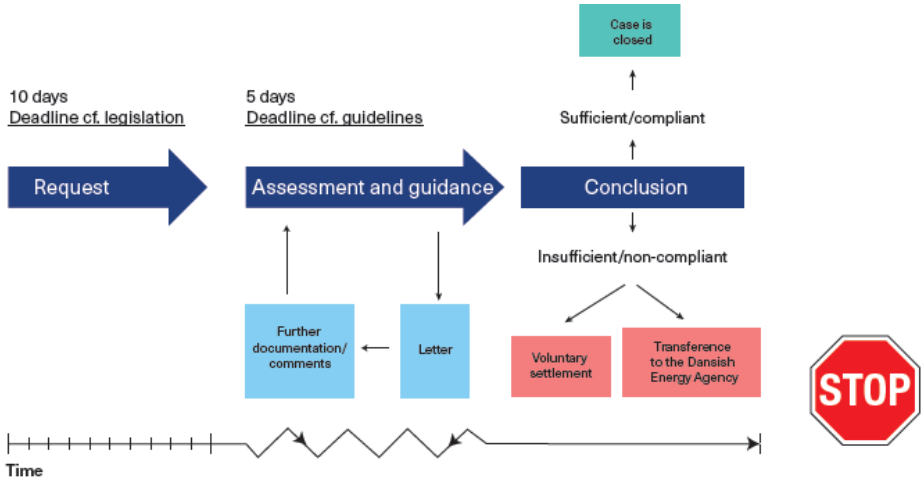


Figure 2-12: Inspection process in Denmark[48]

Results of 2015 inspections are summarised in Table 5[49]: 104 inspections were completed for a total of 96 product models. For eight product models both the inspection of the documentation and the laboratory measurements were carried out.

Table 2-5: Results of completed inspections in 2015 in Denmark

	Laboratory measurement			Technical documentation	
Product group	Number of tested products	Comply with ecodesign require-ments	Comply with energy labelling re-quirements	Number of products inspected	Meet require-ments
Fridge freezers	13	6 (46%)	6 (46%)	10	3 (30%)
Vacuum cleaners	6	5 (80%)	5 (80%)	-	-
Computers	6	6 (100%)	6 (100%)	-	-
Air-to-air heat pumps	-	-	-	6	1 (17%)
Mobile air conditioners	4	1 (25%)	1 (25%)	8	4 (50%)
Water pumps	3	3 (100%)	-	-	-
Ventilators		-	-	9	6 (67%)
External power suppliers	5	5 (100%)	5 (100%)	-	-
Range hoods		-	-	8	2 (25%)
Lamps	14	4 (19%)	4 (19%)	10	7 (70%)
Water heaters	-	-	-	1	0 (0%)
Televisions	-	-	-	1	1 (100%)
Products in total	51 pcs.			53 pcs.	

[48] ibid.
[49] Energistyrelsen Danish Energy Agency, Secretariat for Ecodesign and Energy Labelling of Products, Annual report 2015.

Fans were considered in 2014 (4 products tested in laboratory, 100% passed) and 2015 (9 products inspected by control of technical documentation, 67% passed), but the physical dimensions are not known.

2.3.9.3.1 Compliance verification actions for fans and transformers

No compliance verification for the products covered by the INTAS project was developed in Denmark. Very likely the fans investigated in 2015 were not large models. However investigated products such as water heaters and air to air heat pump can also have large dimensions. Therefore some of the Danish experience could support the development of a verification procedure within INTAS.

2.3.10 Private certification schemes

Private certification schemes are formal, documented systems that are developed and administered by the private sector. Unlike the third party certification that certifies the compliance of a product to a specific law or standard enforced by a different subject, private schemes are defined to respond to specific (industrial) needs not yet covered by legislation or standardisation.

2.3.10.1 NEMA

The US National Electrical Manufacturers Association (NEMA) is the association of electrical equipment and medical imaging manufacturers. Member companies manufacture products including power transmission and distribution equipment. In 1996 NEMA responded to the industry need for higher transformer efficiencies with the publishing of the NEMA TP1 standard, followed by the publication of other standards for the efficiency of various types of distribution transformers:

- NEMA TP1-2002, Guide for Determining Energy Efficiency for Distribution Transformers
- NEMA TP2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers, and
- NEMA TP3, Standard for the Labelling of Distribution Transformer Efficiency.

NEMA TP1 was updated in 2002 and TP1 requirements were included into the US EPA Energy Star program. TP 1-2002 was later adopted by the US DoE as the national energy-efficiency rule for low-voltage dry-type distribution transformers (see Chapter 2.3.2).

The demand for units with higher efficiency than TP-1 levels led to the definition in 2010 of the new NEMA Premium Efficiency Transformer (NEMA CSL-3) designation, that requires 30% lower losses than existing DoE regulations for low-voltage dry-type distribution transformers. The program covers dry-type distribution transformers, for single phase between 15 kVA and 333 kVA, and for three-phase between 15 kVA and 1000 kVA. Transformers covered under this program are typically used in commercial and industrial applications, however some electric utilities are considering the NEMA program for their commercial and industrial energy-efficiency rebate programs. Actual efficiencies for the premium transformers range from 98% to more than 99%, depending on the size of the transformer.

Eleven major manufacturers have committed to providing NEMA Premium Efficiency Transformers to the marketplace.

NEMA recommends that the manufacturer place the NEMA Premium® mark on all qualifying product models, which meet or exceed the Premium Efficiency specifications (see Table 6), their packaging, and product-related materials such as brochures, manuals, catalogues, advertisements, and web sites.

Table 2-6: NEMA low-voltage dry-type distribution transformers

Single-phase		Three-phase	
kVA	Efficiency (%)	kVA	Efficiency (%)
15	98.39%	15	97.90%
25	98.60%	30	98.25%
37.5	98.74%	45	98.39%
50	98.81%	75	98.60%
75	98.95%	112.5	98.74%
100	99.02%	150	98.81%
167	99.09%	225	98.95%
250	99.16%	300	99.02%
333	99.23%	500	99.09%
		750	99.16%
		1000	99.23%

In addition, NEMA TP-1 has been used as a guideline by Canada, Australia, New Zealand and (partially) Mexico and was adopted in US by by Massachusets, Minnesota, Wisconsin, New York, Vermont, California and Oregon. The new DoE 2016 efficiency levels are very close to the CSL3 levels, but do not require higher efficiency levels for the single phase units. Table 7 below lists the minimum efficiencies of low-voltage dry-type three phase distribution transformers required for their kVA rating[50].

Table 2-7: Minimum efficiencies of low-voltage dry-type three phase distribution transformers

KVA (Three Phase)	NEMA TP-1 (Energy Star) Federally Mandated	NEMA PREMIUM CSL-3* Not Federally Mandated	DOE 2016 Standards Federally Mandated
15 kVA	97.0	97.90	97.89
30 kVA	97.5	98.25	98.23
45 kVA	97.7	98.39	98.40
75 kVA;	98.0	98.60	98.60
112.5 kVA	98.2	98.74	98.74
150 kVA	98.3	98.81	98.83
225 kVA	98.5	98.95	98.94
300 kVA	98.6	99.02	99.02
500 kVA	98.7	99.09	99.14
750 kVA	98.8	99.16	99.23
1000 kVA	98.9	99.23	99.28

* Published CSL-3 efficiency percentages may vary by manufacturers.
Note: All efficiency values are at 35 percent of nameplate-rated load, determined according to the DOE Test Method for Measuring the Energy Consumption of Distribution Transformers under Appendix A to Subpart K of 10 CFR part 431.

[50] http://www.mgmtransformer.com/industry-buzz/department-of-energy-2016-efficiency-standards-low-voltage-distribution-transformers/

The manufacturer shall determine the energy efficiency of own transformers in accordance with the Test Procedures for Distribution Transformers in the US Code of Federal Rule (10 C.F.R. Part 431).

2.3.10.2 AMCA

The energy efficiency of commercial and industrial fans and blowers is not regulated in US, despite DoE estimates that commercial fans and blowers consume 139.533 GkWh of electricity per year and industrial fans and blowers consume 90.057 GkWh of electricity per year with a potential 20% energy savings. However, codes and standards for energy or green construction do exist including fan-efficiency requirements. Core U.S. Codes & Standards for fan efficiency (see Figure 13):

- ASHRAE 90.1 model energy standard
- ASHRAE 189.1 model green construction standard
- International Energy Conservation Code (IECC)
- International Green Construction Code (IgCC)
- AMCA 205 rating standard for fan efficiency metric (the reference rating standard for metrics).

U.S. Codes set a minimum Fan Efficiency Grade (FEG) and establish scope of coverage and exemptions, while ASHRAE 90.1-2013 describes the baseline requirement that is in turn based on AMCA 205.

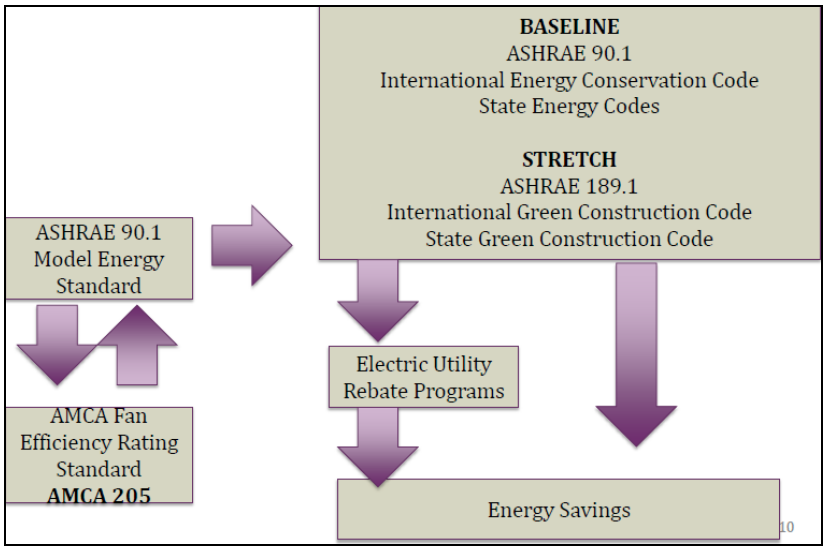


Figure 2-13: US approach for the commercial building energy code 2007-2020[51]

AMCA 205 *Energy Efficiency Classification for Fans*, the first version of a fan efficiency rating standard, was published in 2010 by AMCA, the Air Movement and Control Association International. It defines fan efficiency grade rating (metric) for the fan alone without motor and drive at peak total efficiency, and is limited to fans

[51] M. Ivanovich, Fan Efficiency Codes & Standards in the United States, International Symposium on Fan Efficiency Regulation, 26 June 2014.

having an impeller diameter of 5 in. (125 mm) or greater, operating with a shaft power 1 hp (750 W) and above, and having a total efficiency calculated in accordance with procedures specified in established fan test standards including AMCA 210, ISO 5801, AMCA 230, AMCA 260.

Since 2010 AMCA 205 has become the reference standard for minimum fan efficiency requirements in ASHRAE 90.1-2013, International Green Construction Code 2012, and International Energy Conservation Code 2015. All 3 codes prescribe minimum FEG and sizing/selection windows. AMCA 205 is currently being revised, after which it will be harmonized with AMCA 211. FEG is a numerical rating that classifies fans by their aerodynamic ability to convert mechanical shaft power, or impeller power in the case of a direct driven fan, to air power and applies to the efficiency of the fan only and not to the motor and drives. FEG ratings can be applied to custom built single fans and to series-produced fans manufactured in large quantities.

In 2015, AMCA and other organisations proposed DoE a possible negotiated rulemaking for commercial and industrial fans and blowers, that should be developed according to Figure 14.

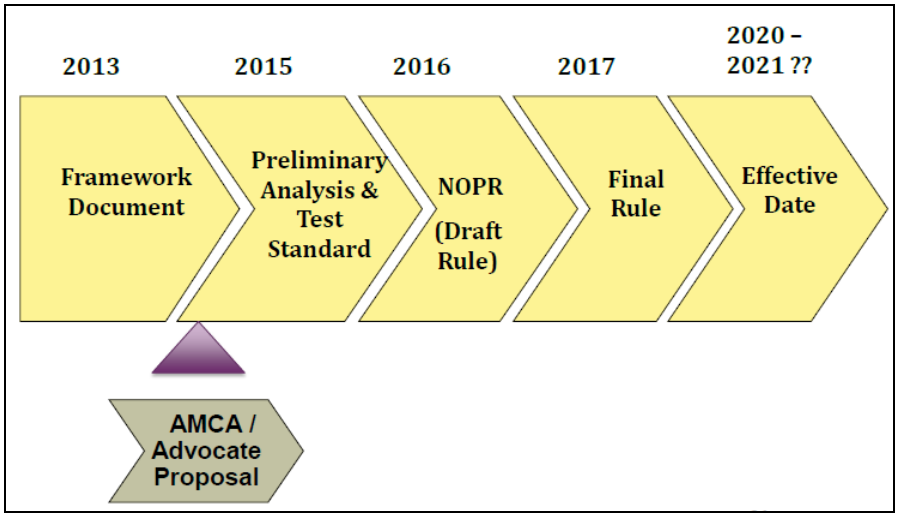


Figure 2-14: US approach for negotiated rulemaking for commercial and industrial fans and blowers[52]

Once implemented, US DoE rulemaking (see Figure 15) will apply directly to manufacturers and overwrite codes/standards requirements. The new legislation will cover wire-to-air metrics and extended products such as fans with non-building use.

An AMCA Certified Ratings Program is now in place to provide third-party verification of FEGs as specified in AMCA 211-13 *Certified Ratings Program - Product Rating Manual for Fan Air Performance*. The requirements of the Program became effective on August 21, 2013. It applies only to fans, and is not applicable to their component parts such as fan impellers and housings.

[52] ibid.

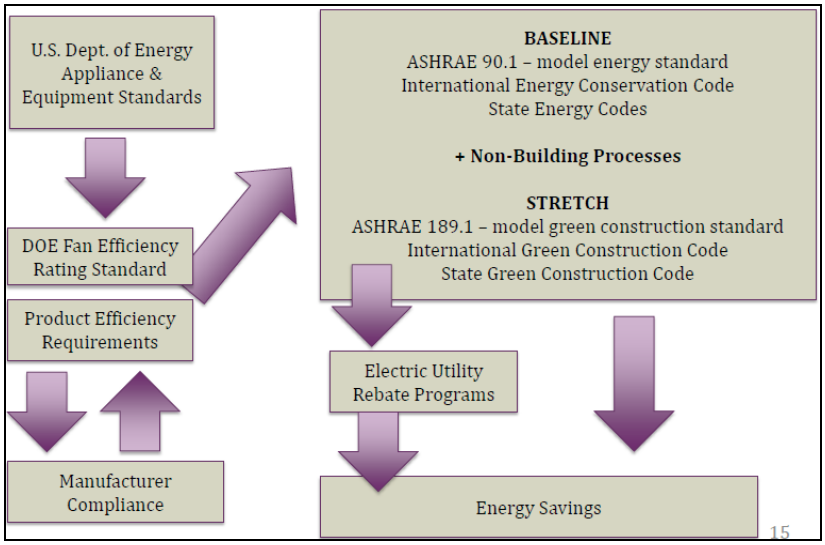


Figure 2-15: US approach for the commercial building energy code after 2020[53]

2.4 Other approaches

Other existing approaches to the control of the energy efficiency and other characteristics of transformers and fans have been collected in this part of the Report, to be used as sources of elements for a more effective market surveillance for these products.

2.4.1 Bidding procedure

Large power transformers are custom-made equipment that incurs significant capital costs. Utilities generally procure transformers through a competitive bidding process, which all interested producers must prequalify to be eligible to bid. Prequalification is a lengthy process that can take years. A typical qualification process includes an audit of production and quality processes, verification of certain ISO certifications, and inspection of the manufacturing environment. This process can often be rigorous and costly to purchasers; however, it is an important step, as the manufacturing environment and capability can significantly affect reliability of the product, especially of high-voltage power transformers.

A standard bidding process is initiated by a purchaser who sends commercial specifications to qualified transformer producers. The producers then design the transformer to meet the specifications, estimate the cost, and submit a bid to the purchaser. The bids not only include the power transformer but also services such as transportation, installation and warranties. Except for a few municipalities, most US utilities[54] do not announce the amount of the winning bid or the identity of the winning bidder. The winning bidder is notified, and bid terms normally require that the results be kept confidential by all parties involved.

The several distinct steps and procedures as well as the estimated time for each step required in power transformer manufacturing and procurement are illustrated in Figure 16. At least theoretically the compliance

[53] ibid.
[54] see: DOE/OE/ISER, Large power transformers and the U:S:. electric grid, June 2012.

of the transformer with the legal provision can be assessed at different stages of the process.

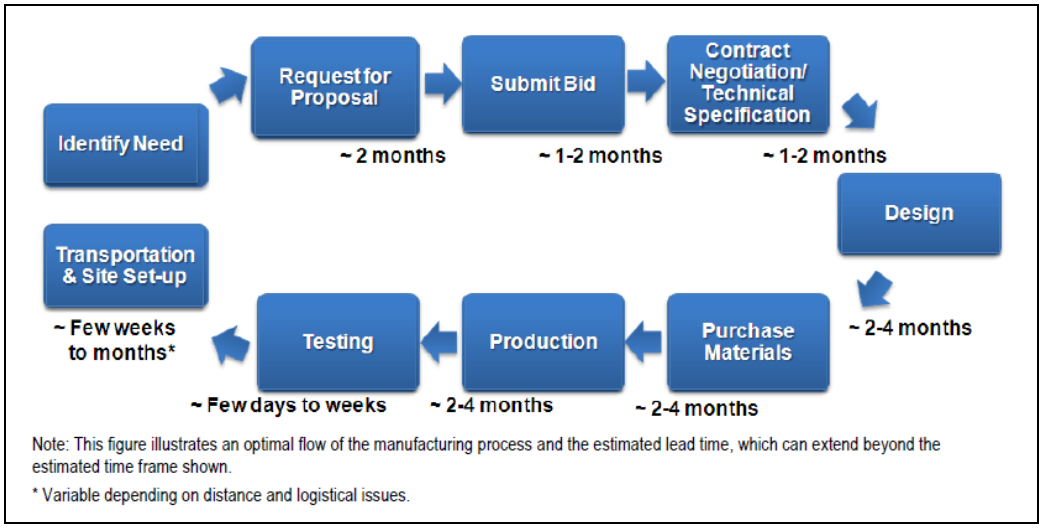


Figure 2-16: Large power transformer procurement process and estimated time[55]

In the manufacturing process, certain parts can be produced either at the transformer plant or at another vendor or subsidiary location, depending on how vertically integrated the particular plant is, whether the plant has the necessary tools and capabilities, as well as economic reasons. The typical manufacturing process consists of the following steps:

1. *Engineering and design*: transformer design is complex, balancing the costs of raw materials (copper, steel, and cooling oil), electrical losses, manufacturing labour hours, plant capability constraints, and shipping constraints;
2. *Core building*: core is the most critical component and requires highly-skilled work force and cold-rolled grain-oriented laminated electrical steel;
3. *Windings production and assembly of core and windings*: windings are predominantly copper and have an insulating material;
4. *Drying operations*: excess moisture must be removed from the core and windings, because moisture can degrade the dielectric strength of the insulation;
5. *Tank production*: a tank must be completed before the winding and core assembly finish the drying phase so that the core and windings do not start to reabsorb moisture;
6. *Final assembly of the transformer*: the final assembly must be done in a clean environment; even a tiny amount of dust or moisture can deteriorate the performance of the transformer;
7. *Testing*: testing is performed to ensure the accuracy of voltage ratios, verify power ratings, and determine electrical impedances.

[55] ibid.

2.4.2 Custom test plans for manufacturers

Most electrical product testing is to a published standard, but not always. Therefore testing Laboratories have developed custom test plans that meet manufacturers' specific needs.

One reason for developing a custom test plan is to check equipment performance against marketing claims made by the equipment manufacturer, or to check the performance of a product against a competitor's product. Performance can include reliability, accuracy, safety, energy efficiency, or other factors.

An example is described by MET-Lab[56]: a recent customer example comes from a large industrial solutions company that asked MET to test the performance of its noise isolation transformer against its own marketing claims. The transformers are sold to schools, hospitals and small offices (especially in high lightning strike areas) to protect against transient overvoltage, spikes/surges and other undesirable noise.

The company asked the Laborarory to measure the capacitance and the common and normal mode noise attenuation between the primary and secondary of their transformers. Since no established test procedure standard to refer to was available the Laboratory developed one and had it approved by the customer.

2.4.3 Testing at manufacturer's premises

2.4.3.1 Agreement between the national Authority and the manufacturers in Belgium

In Belgium the Public Service Health, Food Chain Safety and Environment has set out a specific "Convention" stating the conditions on market surveillance campaign 2006 on the determination of the sound power level of construction equipment. The Convention is between the Belgian competent Authority and the representatives of a number of manufacturers or their Belgian importers.

Although not related to the products covered by the INTAS project nor with the ecodesign Directive, but to construction materials covered by Directive 2000/14/EC, this example is useful to complete the panorama of the existing practices for the market surveillance of complex products for which the traditional verification procedure is not applicable.

The procedure described in the convention (the full text - made anonymous - is available in Annex C) includes two options:

- Option A
  - each participating company delivers three machines, each of the same type on his own measurement place and on a predetermined time;
- Option B:
  - B.1 each participating company delivers one machine on a measurement place predetermined by organising authority and on a predetermined time or
  - B.2. each participating company delivers three machines each of a different type on his own measurement place and on a predetermined time.

[56] http://www.metlabs.com/blog/emc/no-standard-no-problem-custom-test-plans-measure-reliability-accuracy-efficiency-2/

Depending on the number of the equipment to be tested the test can be done on the manufacturer own measurement place, or at a measurement place predetermined by national Authority.

The purpose of the project[57] was to test the verification methodology, it was not a market surveillance in strict sense. The verification methodology was aiming at:

- leading to realistic results
- be acceptable by industry and authorities
- be verifiable (the declared noise value under control of production and market surveillance)
- have reference to international or at least European standard
- be easy to handle.

The proposed solution was the use of the procedure set in the standard EN ISO 7574-4 in combination with realistic values of σ_R (standard deviation of reproducibility) and σ_M (reference standard deviation. to be used for noise declaration and verification procedure). A number of preconditions were also set to allow the use of the σ_R and σ_M values reported in the standard as shown in Figure 17[58]

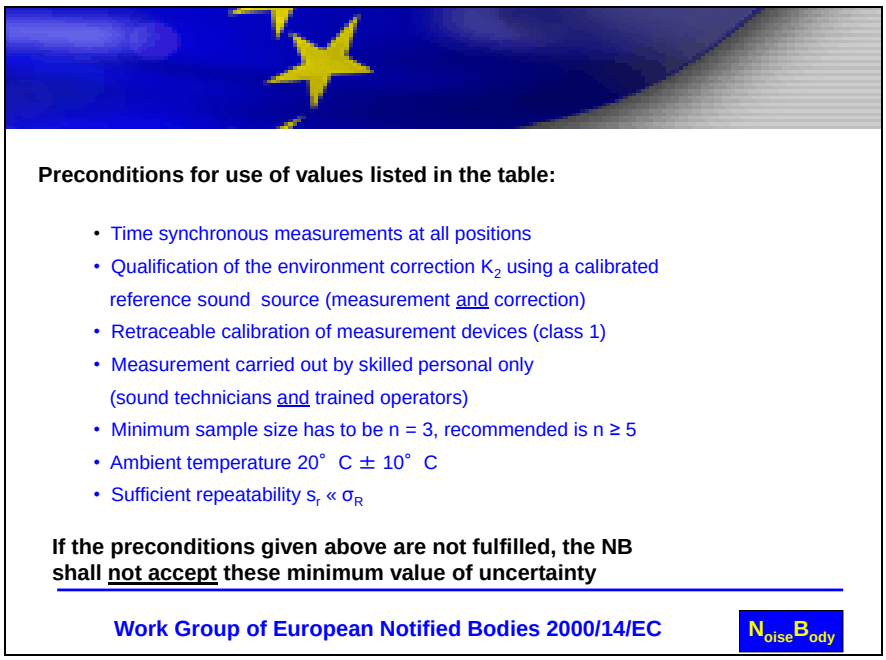


Figure 2-17: Preconditions for the use of σ_R and σ_M values reported in EN ISO 7574-4

EN ISO 7574-4 7574-4 defines the declaration and verification procedure so that the risk for producer (to have products rejected) and the risk for consumer (to have non-compliant products accepted by authorities) are limited to a certain acceptable value. It also defines acceptable tolerances as function of the number of

[57] private communication with Belgian Public Service Health, Food Chain Safety and Environment, November 2016.
[58] ibid.

tested machines and the verification scheme (single scheme with all units tested at once) of double scheme (units to be tested in two steps). The standard is based on three statistical parameters - reproducibility, repeatability and production variability - which should be known before the testing.

The proposed procedure for the verification of the declared values is shown in Figure 18[59]

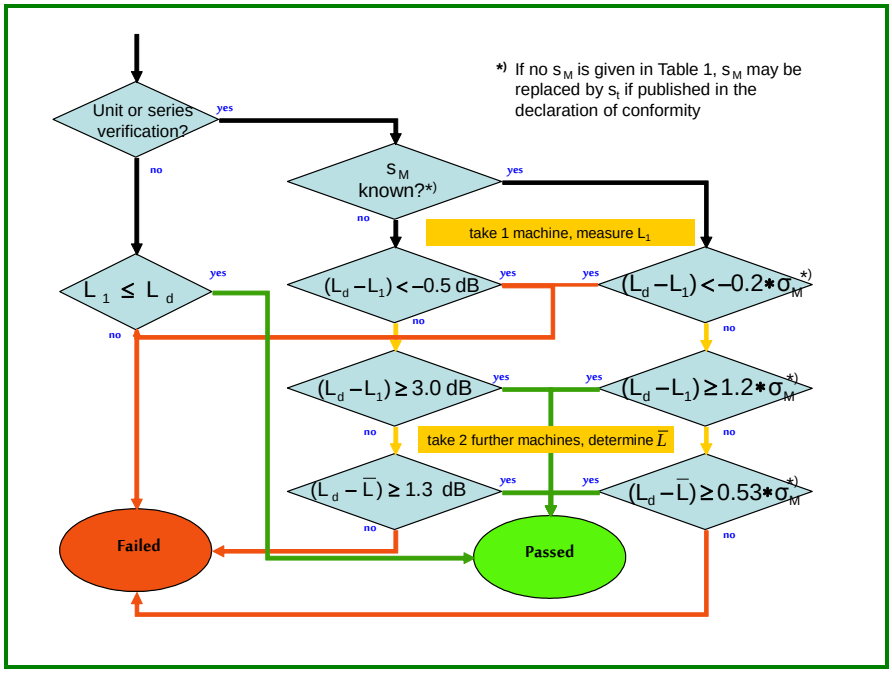


Figure 2-18: Proposed procedure for the verification of the noise declared values for transformers

The testing was done in a place provided by the organising authority and not at manufacturer premises. Manufacturers provided the products, trained operators at the measurement place, etc. The authority was interested in:

- solving difficulties with testing large machines (i.e.: transport, correct operation)
- verifying whether the verification methodology (the decision trees) was clear and applicable
- having an idea of the noise emissions, deviations of the authority testing procedure and measurement results from those used by manufacturer.

No enforcement in case of non-compliance was possible and manufacturers were cooperating on own costs in turn for some benefit (image, confirmation of own test results, etc). Unfortunately the number of tests was not sufficient to judge it accuracy from statistical point of view, But the method was however accepted as guidance by third bodies (laboratories helping manufacturers to define declared values for their products) and by the national Belgium market surveillance and Notified Bodies with the following remarks:

- the tabled values σ_R should be verified by means of small-scale Round Robin tests
- an improved equation based only on σ_t (total standard deviation) should be used with a factor depending on probability of acceptance and quality level should be used

[59] ibid.

- producers risk and quality level should be accepted by all stakeholders
- correction to the reference atmospheric conditions should be done (see drafts of new ISO 3740 family) instead of limitations of ambient temperature
- double sample scheme (1+2) can be applied by market surveillance
- new statistical verified Guidelines have to be obligatory for Notified Bodies, Member State and industry (t-student probability method shall be withdrawn)
- procedure should follow the principle of shared risk
- because the rounding to the integer, it may be necessary to subtract 0,5 dB before comparing a result under market surveillance
- market surveillance measurement has to be carried out following the same conditions used (and declared) by the manufacturer
- manufacturer should have the authorization to be present during the measurements. This is necessary to check that machines are running under correct conditions
- if necessary correction for temperature influence must be taken into account.

3. Task conclusions

The scope of Task 2.5 was to collect information and build a firm understanding of the monitoring, verification and enforcement techniques used in major economies for transformers and large fans. The boundaries for the task analysis were:

- information available in an understandable language
- detailed information about the applied procedures for fan and/or transformers and not the simple information that market surveillance for these products is defined or foreseen.

In this respect the main conclusions are that sufficient freely available information is available in English, but that in all investigated Countries no information about actual best practices is available. Therefore this paragraph will summarise the most interesting elements of the procedures defined worldwide, to be considered as suggestions and advices for the market surveillance procedure to be developed within the INTAS project,

3.1 Summary of the MV&E techniques worldwide

The monitoring, verification and enforcement techniques used in major economies for transformers and large fans in major worldwide countries have been investigated, along with private schemes and alternative approaches. Major outcome are:

1) **Australia and New Zealand**

- Distribution transformers manufactured in, or imported into, Australia must comply with minimum efficiency requirements. Fans are not currently regulated for energy efficiency in Australia and New Zealand.
- Market surveillance authority is allowed to publicise details relating to market surveillance responses, including the names of registrants and the product model numbers. The list updated at 30 May 2016 includes 26 products.
- A specific email address <E3.Compliance@industry.gov.au> is available to send allegations. All allegations are considered and if necessary investigated.
- The Regulator may suspend or cancel a model's registration for a variety of reasons. Once informed by the registrant, the downstream supplier is then responsible for ensuring that they do not contravene the legislation by supplying an unregistered product. In addition to de-registration, the Regulator may issue infringement notices or fines, or pursue an 'enforceable undertaking' where the registrant agrees to compensate consumers or the environment.
- Check testing: or 'verification testing', includes two Steps, involving 1+2+1 units or 1+3 units
  - for Stage One, wherever possible, the Regulator uses only laboratories accredited by the National Association of Testing Authorities (NATA), Australia or an accreditation body having mutual recognition with the NATA

- for Stage Two check testing the Regulator will only use laboratories accredited by NATA or with a mutual recognition agreement with NATA, that are independent of the registrant for the model being tested
- results of Stage Two testing from the registrant's own accredited facility are accepted where there is no reasonable alternative. The registrant must engage an independent witness to monitor and verify the testing procedure. The Regulator may advise any necessary qualifications for the witness. The witness must provide a written statement to the Regulator following completion of Stage Two confirming that the testing was conducted according to the relevant test standard and in accord with NATA requirements. The registrant must cover the costs associated with the witness.

- Units of models selected for check testing will, where possible, be purchased anonymously from the market. In limited circumstances the Regulator can compulsorily acquire units of a product model from a registrant.

2) **USA**

- Transformers are covered by both Energy Star (ES) and DoE efficiency requirements. Industrial fans will be covered by DoE requirements between 2018 and 2020.
- For certain appliances and commercial equipment ASRAC (Appliance Standards and Rulemaking Federal Advisory Committee) will allow DoE to use negotiated rulemaking as a means to reach consensus on establishing energy efficiency requirements.
- ES: products are tested in an EPA-recognized laboratory and reviewed by an EPA-recognized Certification Body before they can carry the label.
- AEDM: for transformers additional models may be certified through DoE's *Alternative Efficiency Determination Method* (AEDM), allowing manufacturers to self-certify the performance of transformer designs using computer modelling, thus reducing time and testing burden for certification. The method can be used to qualify all subsequent models that meet the basic model parameters. But any subsequent testing failures (e.g., as part of verification testing) of any model in this family of products will have implications for all models in the family.
- *Component inspection approach*: for commercial steam cookers, EPA is developing for ES a *component inspection approach pilot program***,** to test a potential alternative to verification testing. EPA is working with certification bodies who want to offer this option and partners who want to fulfil their verification obligations in 2016 using this approach. However the transferability of this approach to other products was questioned, due to concerns about the impact of the manufacturing process on energy consumption. The transferability concern will be addressed to the extent EPA considers this approach for other products.
- Federal efficiency requirements improvements include:
  - recognising that the current regulatory approach, involving DoE selected units and third party testing, may be impracticable for low-volume, custom built products or where adequate laboratory facilities are unavailable

- an alternative approach is allowed in such exceptional cases: *DoE witnessed testing* at the manufacturer's lab and/or reduced sample sizes, to permit effective enforcement testing without imposing unreasonable burdens on manufacturers, for example in the rare instances when laboratories may be unavailable to test certain products or equipment, or when there are circumstances that make testing at an independent laboratory inadequate or unrealistic.

- For transformers:
  - each basic model of distribution transformer, efficiency must be determined either by testing or by application of an appropriate AEDM
  - for each basic model selected for testing, if the manufacturer produces five or fewer units of a basic model over 6 months, each unit must be tested. A manufacturer may not use a basic model with a sample size of fewer than five units to substantiate an AEDM. If the manufacturer produces more than five units over 6 months, a sample of at least five units must be selected and tested
  - in an enforcement action, DoE should be able to determine all of the individual models that fall within a kVA grouping certification using the required certification information and basic model design and testing information. While DoE is not requiring manufacturers to disclose all the individual model numbers that fall into a kVA grouping, DoE expects manufacturers to make this information available, as necessary, during enforcement actions
  - recognising that the current regulatory approach, involving DoE selected units and third party testing, may be impracticable for low-volume, custom built products or where adequate laboratory facilities are unavailable. An alternative approach is allowed in such exceptional cases: DoE witnessed testing at the manufacturer's lab and/or reduced sample sizes, to permit effective enforcement testing without imposing unreasonable burdens on manufacturers

3) **Canada**

- Dry-type transformers are covered by energy efficiency Regulations in Canada, industrial fans are currently not addressed.
- A dealer importing or shipping energy-using products between provinces can be exempted from submitting an energy efficiency report to NRCan (Natural Resources Canada) and the product can be exempted from meeting the prescribed energy efficiency standard. Exemptions apply if:
  - a dealer is importing or shipping between provinces an energy-using product that will be modified to meet the energy efficiency standard;
  - a dealer is importing or shipping between provinces an energy-using product that will be incorporated into another product and then exported from Canada;
  - a dealer is importing or shipping between provinces an energy-using product, only to export it from Canada.
- Regulated energy-using products imported into Canada or shipped between provinces must bear an 'energy efficiency verification mark' from a certification body accredited for energy efficiency verification by the Standards Council of Canada (SCC).

- As part of marker surveillance, NRCan (Natural Resources Canada) would also conduct product testing on a complaint-driven basis. The market is highly competitive and suppliers know the performance claims made by their competitors. Challenge procedures by which performance claims can be questioned exist in all verification programs.

4) **India**

- India has mandatory labelling scheme for specific types of liquid-filled, naturally air-cooled, three-phase distribution transformers. The labelling scheme defines a series of maximum losses at 50% and 100% of rated load and a corresponding number of stars that relate to those maximum losses.
- 3 Stars is being proposed as a minimum efficiency standard, and is being widely followed by utilities.
- The Monitoring, Verification and Enforcement Framework sets the principles adopted by BEE (Bureau of Energy Efficiency) to optimise compliance with the Energy Conservation Act and other relevant legislation and regulations relating to the energy labelling of appliances and equipment. The non-compliance is assessed through Check testing and Challenge testing:
  - **Check testing:** selection of the product is done by the BEE or its designated Agency based on a sampling based approach, and then the product is procured from the market and tested in a third party NAB accredited laboratory.
    - In case first model fails, BEE would buy another two samples of the same model from the market and would keep them for witness testing.
  - **Second check testing:** the two additional samples are tested in the same laboratory.
    - The user of the label is informed about the failure of the first check testing and is asked to deposit the cost of the sample and of the check testing.
    - If no deposit is done the Bureau goes on with the testing but will not process any further applications for new products and will block the S&L portal of the user of the label
    - in case additional samples are not available, even provided by the user of the label, the result of the first sample are considered binding
  - **Challenge testing**: is carried out when any written compliant is received regarding the information on the star label or any other requirement of a covered product. The complainant pays all expenses in case the compliant is proven wrong. In case the compliant is proven correct all expenses are paid by the user of the label.
- The out door type mineral oil immersed distribution transformers up to and including 2500 kVA, 33 KV are subject to the mandatory certification according to the BIS (Bureau of Indian Standards) Product Certification Scheme.
- The BIS product certification scheme is voluntary and is largely based on ISO/IEC Guide 28 which provides general rules for third party certification system of determining conformity with product standards through initial testing and assessment of a factory quality management system and its acceptance followed by surveillance that takes into account the factory Quality Management system and the testing of samples from the factory and the open market. All BIS certifications are carried out in accordance with Indian Standards.

5) **Mexico**

- Mexico has mandatory efficiency requirements for liquid-type distribution transformers and voluntary standards for dry-type transformers and a voluntary endorsement label. No legislation is in force for large industrial fans.
- A third party is commissioned by the government agency to undertake import controls and visual checks of test certificates and registration details, to ensure that the minimum energy efficiency standards are met. Verification testing is also conducted.
- For the verification of the voluntary label:
  - sampling of distribution transformers models is done by a representative of FIDE either at the factory, warehouse or distribution centre
  - witnessing testing: to check compliance with the limit values and guarantee the energy characteristics of the selected models the company must perform the appropriate tests in the presence of a representative of the FIDE (Fideicomiso para el Ahorro de Energía Eléctrica) and in a laboratory accredited by EMA (Entidad Mexicana de Acreditación).

6) **China**

- Minimum efficiency requirements and the energy efficiency label apply to power transformers. Efficient transformers are included in the China Catalogue of High-Efficient Products used in public procurement of local administration.
- The manufacturer or importer can use its own testing capacity, or entrust testing agencies certified by China National Accreditation Service for Conformity Assessment to test the product. Energy efficiency inspecting laboratory is required to submit relevant filing material including personnel capabilities, equipment capabilities, test management codes, etc.
- The authorized institution is required to check and examine the test capabilities of the test laboratory.

7) **Japan**

- In Japan transformers are covered by the Top Runner Program and the Energy-Saving Labelling Program.
- To verify display implementation, product catalogues are periodically and continuously collected. Also retail store surveys are conducted to confirm the implementation of the legislation.
  - If the results of the energy efficiency surveys show that improvements in energy efficiency is needed, METI (Minister of Economy, Trade and Industry) offers recommendations to the manufacturer. If this advice is not followed, the recommendations are made public and the manufacturer may be ordered to follow the recommendations.
  - Manufacturers subject to these recommendations and advice should be limited to those whose performance improvements in manufacturing and imports of products are considered to have a substantial impact on energy consumption in Japan.
  - Also, targets should be limited to manufacturers whose organizational capacity is economically and financially robust to avoid social problems.

- Target Requirements of Recommendations and Orders are for manufacturers/importers whose manufacturing/import volume (limited to shipment to the domestic market) is 100 units or more.

8) **The European Union**

Following the principle of subsidiary, market surveillance is done by each Member State through the appointed Market Surveillance Authority(ies).

- The current procedure of Regulation 548/2014 gives the possibility to Member State authorities to undertake the verification procedure for transformers at the premises of manufacturers, before they are put into service in their final destination, given the weight and size limitations in the transportation of medium and large power transformers. This possibility is not foreseen by Regulation 327/2011 for fans. The verification procedure of both Regulations has been amended by Regulation 2016/2282 on the use of tolerances in verification procedures, in force since 10 January 2017 that reaffirms the same principles and clarifies the procedure for the documental and physical verification of the compliance, that can result in a model being non-compliant.
- At EU level Decision 768/2008 defined a number of compliance assessment modules available for the manufacturer to assess the compliance of own products for the CE marking. These modules foresee manufacturer own declarations or on third party certification and can be applied to the design phase or to the manufacturing process.

9) **EU Member States**

At Member State level Nordic Countries within *Nordsyn*, Sweden and Denmark have addressed the compliance of transformers:

- **Nordic Countries**: Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.
  - "Green Growth" project has been one of the priority programmes of the Nordic Council of Ministers (involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland, and Åland) since it was launched in November 2011. One of the identified focus areas was *Green technical norms and standards* among which three main projects have been started: *The Nordic region as a standard maker*, *The Swan's ecolabelling for building renovations*, and *Market surveillance of ecodesign and energy labelling or Nordsyn*. aiming to ensure a consistent implementation of the energy labelling and ecodesign legislation and to improve market surveillance in the Nordic region. The project is directed primarily towards the Nordic market surveillance authorities and has given a significant contribution to the Nordic collaboration on market surveillance through coordination, increased dialogue on the interpretation of legislation, collaboration on test and information activities, and sharing of test results and market surveillance plans.
  - In 2015 Nordsyn has focused *inter alia* the project *Challenges for market control* about the market control of products that are difficult to monitor.
- **Denmark**: the Danish Energy Agency is responsible for monitoring compliance with the requirements of ecodesign and energy labelling. The Secretariat for Ecodesign and Energy Labelling

of Products is responsible for practical tasks related to the surveillance on behalf of the Danish Energy Agency.

- In 2015 the Danish Energy Agency has prioritized product areas where previous inspections have shown that a significant share of the products failed laboratory measurements, or where manufacturers have previously had difficulties in providing documentation of own products. Results of 2015 inspections show 104 completed inspections of 96 product models. For eight product models both the inspection of the documentation and laboratory measurements were carried out. Fans were considered in 2014 (4 products tested in laboratory, 100% passed) and 2015 (9 products inspected by control of technical documentation, 67% passed), but the physical dimensions are not known.
- No compliance verification for the products covered by the INTAS project was developed in Denmark. Very likely the fans investigated in 2015 were not large models. However investigated products such as water heaters and air to air heat pump can also have large dimensions. Therefore some of the Danish experience could support the development of a verification procedure within INTAS.

- **Sweden**: in Sweden The Swedish Energy Agency is responsible for market surveillance of the EU ecodesign and energy labelling Directives.
  - Three main principles are followed for the selection of specific models for a particular product group: targeted selections, random selections or selections in response to reports or complaints received (reactive market surveillance).
  - Proactive and reactive market surveillance are developed, for the latter a special reporting form has been developed on the Agency website to receive reports or complaints.
  - During 2015, it was planned to examine how market surveillance for larger systems (composed of several subcomponents), site-built products and unique products (where only a single item is manufactured), can be operated effectively. Due to the decrease of resources for market surveillance some of the planned activities suspended, and therefore testing of large circulators and water pumps and store checks on heat pumps, hot-water storage tanks and water heaters were not carried out. The plan for 2016 foresaw to test transformers. In addition a large part of the information campaigns will be targeted at operators producing and selling products which have recently become subject to legal requirements, such as central ventilation systems, heat pumps, hot-water storage tanks and online shops along with the analysis on how market surveillance for larger systems and site-built products can be conducted effectively.

10) **Private certification schemes**

Private certification schemes are formal, documented systems that are developed and administered by the private sector and are defined to respond to specific (industrial) needs not yet covered by legislation or standardisation.

- **AMCA**: AMCA is the US Air Movement and Control Association International.
  - The energy efficiency of commercial and industrial fans and blowers is not regulated in US, while codes and standards for energy or green construction do exist including fan-efficiency

requirements. Core U.S. Codes & Standards for fan efficiency include the AMCA 205 rating standard for fan efficiency metric.

- AMCA 205 *Energy Efficiency Classification for Fans*, was published in 2010 and has become the reference standard for minimum fan efficiency requirements in ASHRAE 90.1-2013, International Green Construction Code 2012, and International Energy Conservation Code 2015.
- In 2015, AMCA and other organisations proposed DoE a possible negotiated rulemaking for commercial and industrial fans and blowers, that should lead to a Final Rule in 2017 and be effective in 2020-2021. Once implemented, US DoE rulemaking (will apply directly to manufacturers and overwrite codes/standards requirements.

- **NEMA**: the US National Electrical Manufacturers Association (NEMA) is the association of electrical equipment and medical imaging manufacturers.
  - In 1996 NEMA responded to the industry need for higher transformer efficiencies with the publishing of the NEMA TP1 standard, was updated in 2002. TP1 requirements were included into the Energy Star program and TP 1-2002 was later adopted by the U.S. DoE as the national energy-efficiency rule for low-voltage dry-type distribution transformers.
  - The demand for units with higher efficiency than TP-1 levels led to the definition in 2010 of the new NEMA Premium Efficiency Transformer (NEMA CSL-3) designation, and NEMA Premium® mark, that requires 30% lower losses than existing US-DoE regulations for low-voltage dry-type distribution transformers.
  - Manufacturer can place the NEMA Premium® mark on all qualifying product models, which meet or exceed the Premium Efficiency specifications, their packaging, and product-related materials such as brochures, manuals, catalogues, advertisements, and web sites.
  - NEMA TP-1 has been used as a guideline by Canada, Australia, New Zealand and (partially) Mexico and was adopted in US by Massachusetts, Minnesota, Wisconsin, New York, Vermont, California and Oregon. The new DoE 2016 efficiency levels are very close to the CSL3 levels.

11) **Other approaches**

Other existing approaches to the control of the energy efficiency and other characteristics of transformers and fans have been collected, to be if possible used as sources of elements for a more effective market surveillance for these products.

- **Bidding procedure**: large power transformers are custom-made equipment that incurs significant capital costs:
  - utilities generally procure transformers through a competitive bidding process, which all interested producers must prequalify to be eligible to bid. Prequalification is a lengthy process that can take years. A typical qualification process includes an audit of production and quality processes, verification of certain ISO certifications, and inspection of the manufacturing environment
  - despite being a rigorous and costly process to purchasers, it is an important step, as the

manufacturing environment and capability can significantly affect reliability of the product, especially of high-voltage power transformers

- **Custom test plans for manufacturers**: a number of testing laboratories have large experience of developing custom test plans that meet manufacturers' specific needs for those products where a published standard is not available. One reason for developing a custom test plan is to check equipment performance against marketing claims made by the equipment manufacturer, or to check the performance of a product against a competitor's product. Performance can include reliability, accuracy, safety, energy efficiency, or other factors.
- **Testing at manufacturer's premises**: a specific "Convention" between the national Authority and the manufacturers/importers was agreed in Belgium, stating the conditions on market surveillance campaign on the determination of the sound power level of construction equipment:
  - the purpose of the project was to test the verification methodology foreseeing test on the manufacturer own measurement place or at a measurement place predetermined by national Authority, although the actual testing was done in a place provided by the organising authority and not at manufacturer premises
  - the testing was done in a place provided by the organising authority and not at manufacturer premises. Manufacturers provided the products, trained operators at the measurement place, etc.
  - the authority was interested in solving difficulties with testing large machines (i.e.: transport, correct operation), verifying whether the verification methodology (the decision trees) was clear and applicable and having an idea of the noise emissions
  - the number of tests was not sufficient to judge it accuracy from statistical point of view, but the method was however accepted as guidance by third bodies (laboratories helping manufacturers to define declared values for their products) and by the national Belgium market surveillance and Notified Bodies with some remarks.

A summary of existing mandatory minimum efficiency requirements for fans and transformers is presented in Tables 3-1 and 3-2.

Table 3-1: Mandatory minimum efficiency requirements and certification schemes for transformers worldwide

Country	Efficiency requirements	Description	Product type
National legislation			
EU	YES	Regulation 548/2014	minimum power rating of 1 kVA used in 50 Hz electricity transmission and distribution networks or for industrial applications
Australia & New Zealand	YES	Minimum efficiency requirements set out in the standard AS 2374.1.2-2003. The standard also defines minimum efficiency levels for "High Power Efficiency Transformers": only products meeting the specified efficiency levels can apply this term to promotional or advertising materials.	oil-immersed and dry-type both single and three phase, with power ratings between 10 and 2500 KVA, with a system highest voltage of 24 kV and that are designed for 11 or 22kV networks.
USA	YES	Energy Star: the EPA requires all ES products to be third-party certified. Products are tested in an EPA-recognized laboratory and reviewed by an EPA-recognized certification body before they can carry the label. However for transformers additional models may be certified through DoE's AEDM that allows manufacturers to self-certify the performance of transformer designs using computer modelling	Energy Star: liquid-immersed medium voltage
		DoE efficiency requirements in Code of Federal Regulations, 10 CFR 431.192.	DoE: low-medium voltage dry type and liquid-immersed
Canada	YES	CAN/CSA C802.2-06 *Minimum Efficiency Values for Dry-type Transformers*. Efficiency requirements are harmonised with US. Regulated energy-using products imported into Canada or shipped between provinces must bear an 'energy efficiency verification mark' from a certification body accredited for energy efficiency verification by the Standards Council of Canada (SCC)	Dry type
India	under consideration	Mandatory labelling scheme: 3 stars level of the mandatory labelling scheme is being proposed as a minimum efficiency requirement, and is being widely followed by utilities	specific types of liquid-filled, naturally air-cooled, three-phase in the range from 25 up to 200 kVA, later extended to transformers up to and including 2500 kVA, 33 KV

Country	Efficiency requirements	Description	Product type
		Mandatory certification according to the BIS Product Certification Scheme. Considering public interest the Government of India has enforced mandatory certification on various products including transformers	outdoor type mineral oil immersed distribution transformers up to and including 2500 kVA, 33 KV
Mexico	YES	Mandatory, standard NOM-002-SEDE/ENER-2014	liquid-type, with the exclusion of small manufacturers with cumulative annual production under 9 kVA, including pole, substation, pedestal and submersible transformers. In addition, transformers must be built with a hermetic tank in order to preserve their insulating liquid
		voluntary standard	dry-type
China	YES	GB 20052-2013 Three Phase Distribution Transformer Energy Efficiency Limit Value and Grade. Mandatory minimum requirements are set at the lowest Grade 3 Efficient transformers are included in the China Catalogue of High-Efficient Products used in public procurement of local administration	3-phase, 10 kV, off-circuit tap-changing oil-immersed distribution transformers with the rated capacity being 30 kVA ~ 1600 kVA, and dry-type distribution transformers with the rated capacity being 30 kVA ~ 2500 kVA. Old distribution transformer with no load loss information and load loss higher than the minimum mandatory level and in use by more than 30 years are mandatorily replaced.
Japan	YES	Top Runner power transformers requirements were set in 2006/2007 and revised in 2013. The Super Efficient Transformer has been rebranded as the Top Runner Transformer 2014 in accordance with the second evaluation criterion of the revised 2014 Energy Act.	single phase and three-phase liquid-filled and moulded (using resin insulating materials), 50-60 Hz. Applies to manufacturers or importers whose manufacturing/import volume (limited to shipment to the domestic market) is 100 units or more
Private certification schemes			

Country	Efficiency requirements	Description	Product type
AMCA	US Air Movement and Control Association International	NO	--
NEMA	US National Electrical Manufacturers Association	NEMA Premium Efficiency Transformer (NEMA CSL-3) designation	low-voltage dry-type distribution transformers

Table 3-2: Mandatory minimum efficiency requirements and certification schemes for fans worldwide

Country	Efficiency requirements	Description	Product type
National legislation			
EU	YES	Regulation 327/2011	fans, including those integrated in other energy-related products as covered by Directive 2009/125/EC
Australia & New Zealand	NO	under consideration	--
USA	NO	under consideration	--
Canada	NO	NO	--
India	NO	under consideration	--
Mexico	NO	NO	--
China	NO	NO	--
Japan	NO	NO	--
Private certification schemes			
AMCA	US Air Movement and Control Association International	AMCA 205 *Energy Efficiency Classification for Fans*, published in 2010 and has become the reference standard for minimum fan efficiency requirements in ASHRAE 90.1-2013, International Green Construction Code 2012, and International Energy Conservation Code 2015	It defines fan efficiency grade rating for the fan alone without motor and drive at peak total efficiency, and is limited to fans having an impeller diameter of 5 in. (125 mm) or greater, operating with a shaft power 1 hp (750 W) and above
NEMA	US National Electrical Manufacturers Association	NO	--

3.2 Desk research conclusions

It is complex to draw conclusions from the amount of worldwide collected information, however some main general aspects can be highlighted:

- Minimum efficiency requirements and/or (mandatory or voluntary) energy labelling apply mostly to power transformers, although to different types depending on the specific Country, while large fans are much less covered by energy efficiency legislation.
- In all Countries the difficulties of the compliance verification for large industrial products is well known, but also without a unique and validated solution.
- Certification by a third party certification body is requested for a product to enter in some Countries, but also sometimes as a proof of compliance, to be then possibly followed by a verification action by the national market surveillance authority.
- Monitoring, verification and enforcement techniques are applicable in all investigated Countries, but no information is available on their actual application or on the achieved results.
- The defined procedures differ in terms of the emphasis given to the documental inspection, physical testing by the national authority and also on the response to allegations or complaints. In this respect the general consideration is that the market is highly competitive and suppliers know the performance claims made by their competitors.
- When physical testing is foreseen, the number of units to be tested differs among the investigated procedures.
- Alternative procedures are proposed, at least as pilot projects, to take into consideration the actual difficulties in the compliance verification: for example the AEDM Alternative Efficiency Determination Method and the Energy Star Pilot Component Inspection Approach in US, or in case of low-volume, custom built products or where adequate laboratory facilities are unavailable, the use of witnessed testing and/or reduced sample sizes, to permit effective enforcement testing without imposing unreasonable burdens on manufacturers. However it is unclear if these procedures have been applied and how successfully they are.
- In the EU:
  - Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland, and Åland. This cooperation led to the launching ff several projects among which the *Market surveillance of ecodesign and energy labelling or Nordsy*n, aiming to ensure a consistent implementation of the energy labelling and ecodesign legislation and to improve market surveillance in the Nordic region. The project is directed primarily towards the Nordic market surveillance authorities and has given a significant contribution to the Nordic collaboration on market surveillance through coordination, increased dialogue on the interpretation of legislation, collaboration on test and information activities, and sharing of test results and market surveillance plans.
  - However, only two countries have planned to test transformers: Sweden and Denmark, although no actual testing has been done yet.

- Other approaches: a number of different approaches or techniques do exist for certifying the performance of large products:
  - Private certification schemes - to assess the compliance of product to own requirements - appear to be more largely applied due to the strong involvement of manufacturers and their Associations. The requirements of these scheme, once largely applied by manufacturers, can them become or largely influence the future national mandatory minimum requirements.
  - Bidding procedure: utilities generally procure transformers through a competitive bidding process, which all interested producers must prequalify to be eligible to bid. A typical qualification process includes an audit of production and quality processes, verification of certain ISO certifications, and inspection of the manufacturing environment. Despite being a rigorous and costly process to purchasers, it is an important step, as the manufacturing environment and capability can significantly affect reliability of the product, especially of high-voltage power transformers
  - Custom test plans for manufacturers: a number of testing laboratories have large experience of developing custom test plans that meet manufacturers' specific needs for those products where a published standard is not available. One reason for developing a custom test plan is to check equipment performance against marketing claims made by the equipment manufacturer, or to check the performance of a product against a competitor's product. Performance can include reliability, accuracy, safety, energy efficiency, or other factors.
  - Testing at manufacturer's premises: an attempt to define a procedure stating the conditions on market surveillance campaign on the determination of the sound power level of construction equipment was done via a specific "Convention" between the national Authority and the manufacturers/importers in Belgium. The purpose of the project was to test the verification methodology foreseeing test on the manufacturer own measurement place or at a measurement place predetermined by national Authority, but the actual testing was done in a place provided by the organising authority and not at manufacturer premises.

Annex A: Energy File Report Requirements for commercial steam cookers

For purposes of Energy Star (ES) certification under the pilot component inspection option for commercial steam cookers[60], Certification Bodies are required to document information about products for purposes of energy inspection audits. The following information and critical components are required to be included in the energy file report at the time of ES certification in order to participate in the pilot component inspection approach. The check marks listed in the boxes below indicate whether any one type of steam cooker listed will need to include the corresponding critical component in that product's energy file.

The following definitions should be used to determine how to categorize each steam cooker for purposes of developing the energy file report:

- boiler-based steamer: a steam cooker with a separate heating boiler that supplies steam to the cooking compartment at a pressure range from 0 to 15 psig, and both the generator and cooking cavity are housed in a single unit
- boiler-less steamer with an open steam generator: a steam cooker that generates steam inside the cooking cavity under atmospheric pressure. The water reservoir inside the cavity is manually accessible.
- boiler-less steamer with a closed steam generator: a commercial steam cooker that generates steam inside the cooking cavity under atmospheric pressure. The water reservoir inside the cavity is not manually accessible.

[60] Pilot Program for Component Inspection of ENERGY STAR Steam Cookers - ENERGY STAR Certification and Verification Testing, 2 March 2015.

Electric Steam Cooker Information	Gas Steam Cooker Information
Make/Model	Make/Model
Pan Capacity	Pan Capacity
ENERGY STAR Ratings	ENERGY STAR Ratings
Electrical Ratings	Gas Ratings
Specification Sheet Dimensions	Electric Rating (i.e., fan motor, controls, secondary electric heating element if applicable, etc.)
	Specification Sheet Dimensions

		Electric, boiler-less		Gas, boiler-less		Electric, boiler-based	Gas, boiler-based
Critical Component List	Comments	with an open steam generator	with a closed steam generator	with an open steam generator	with a closed steam generator		
Door Gasket	A change in door gasket material or dimensions would affect the rate of heat loss from the unit.	✓	✓	✓	✓	✓	✓
Cooking Cavity	A change in cooking cavity dimensions is unlikely, given the standardization of pan design. However, a change in cooking cavity design is indicative of other changes in the steamer, which would impact energy performance.	✓	✓	✓	✓	✓	✓
Thermal Insulation	Amount of heat loss from the unit is heavily dependent on thermal insulation thickness and placement.	✓	✓	✓	✓	✓	✓

Steam Vent and Steam Exhaust Tubing	Steam vent and exhaust tubing design will affect the rate of steam withdrawal from the cooking cabinet. Any change in these components is expected to affect energy consumption.	✓	✓	✓	✓	✓	✓
Temperature Control and Hold Thermostat	Whether electromechanical or electronic, changes in the temperature controller or thermostat would inevitably affect overall unit energy consumption.	✓	✓	✓	✓	✓	✓
Heating Elements	The rating and construction of the heating element may directly affect energy consumption.	✓	✓	If applicable	If applicable	✓	
Combustion Fan	Fan air orifices and speed setting affect combustion and efficiency.			✓	✓		✓
Gas Burner	Burner design (i.e., orifice size and manifold pressure) and air shutter adjustments will affect combustion and efficiency. The orifice size may be adjusted due to installation altitude.			✓	✓		✓
Gas Valve	Gas valve design: fast opening, slow opening, staged, and modulating. Changes to these settings is expected to affect efficiency.			✓	✓		✓
Flue	Flue design will affect combustion and draft during non-heating mode.			✓	✓		✓
Air Openings	Location and size of primary air openings will affect combustion and efficiency.			✓	✓		✓
Steam Generator Parameters	Wall thickness, tube diameter, number of tubes, and tube length will affect efficiency.		✓		✓		
Pressure Switch	The pressure switch controls the burner/power and changes to the boiler pressure may impact efficiency.					✓	✓

Annex B: DoE determination of compliance for distribution transformers

DoE shall determine compliance as follows:

(1) Compute the mean (X_1) of the measured energy performance of the n_1 tests in the first sample as follows:

$$X_1 = \frac{1}{n_1}\sum_{i=1}^{n_1} X_i \qquad [1]$$

where X_i is the measured efficiency of test *i*.

(2) Compute the sample standard deviation (S_1) of the measured efficiency of the n_1 tests in the first sample as follows:

$$S_1 = \sqrt{\sum_{i=1}^{n_1} \frac{(X_i - X_1)^2}{n_1 - 1}} \qquad [2]$$

(3) Compute the standard error ($SE(X_1)$) of the mean efficiency of the first sample as follows:

$$SE(X_1) = \frac{S_1}{\sqrt{n_1}} \qquad [3]$$

(4) Compute the sample size discount ($SSD(m_1)$) as follows:

$$SSD(m_1) = \frac{100}{1 + \left(1 + \frac{0.08}{\sqrt{m_1}}\right)\left(\frac{100}{RE} - 1\right)} \qquad [4]$$

where m_1 is the number of units in the sample, and RE is the applicable DoE efficiency (when the test is to determine compliance with the applicable energy conservation legislation), or is the labelled efficiency (when the test is to determine compliance with the labelled efficiency value).

(5) Compute the lower control limit (LCL_1) for the mean of the first sample as follows:

$$LCL_1 = SSD(m_1) - tSE(\bar{X}_1) \qquad [5]$$

where *t* is statistic based on a 97,5% one-tailed *t test* with degrees of freedom (n_1-1).

t-distribution values for certification testing, one-sided, are:

Degrees of freedom (from Appendix D)	Confidence Interval			
	90%	95%	97.5%	99%
1	3.078	6.314	12.71	31.82
2	1.886	2.920	4.303	6.965
3	1.638	2.353	3.182	4.541
4	1.533	2.132	2.776	3.747
5	1.476	2.015	2.571	3.365
6	1.440	1.943	2.447	3.143
7	1.415	1.895	2.365	2.998
8	1.397	1.860	2.306	2.896
9	1.383	1.833	2.262	2.821
10	1.372	1.812	2.228	2.764
11	1.363	1.796	2.201	2.718
12	1.356	1.782	2.179	2.681
13	1.350	1.771	2.160	2.650
14	1.345	1.761	2.145	2.624
15	1.341	1.753	2.131	2.602
16	1.337	1.746	2.120	2.583
17	1.333	1.740	2.110	2.567
18	1.330	1.734	2.101	2.552
19	1.328	1.729	2.093	2.539
20	1.325	1.725	2.086	2.528

(6) Compare the mean of the first sample (X_1) with the lower control limit (LCL_1) to determine one of the following:

(i) if the mean of the first sample is below the lower control limit, then the basic model is not compliant and testing is at an end.

(ii) if the mean is equal to or greater than the lower control limit, no final determination of compliance or non-compliance can be made; proceed to Step (7).

(7) Determine the recommended sample size (n) as follows:

$$n = \left[\frac{tS_1(108 - 0.08RE)}{RE(8 - 0.08RE)}\right]^2 \qquad [6]$$

Given the value of n, determine one of the following:

(i) If the value of $n \leq n_1$ and if the mean energy efficiency of the first sample $(X_1) \geq (LCL_1)$, the basic model is in compliance and testing is at an end.

(ii) If the value of $n > n_1$, the basic model is not compliant. The size of a second sample n_2 is determined to be the smallest integer equal to or greater than the difference $n-n_1$. If the value of n_2 so calculated is greater than $21-n_1$, set n_2 equal to $21-n_1$.

(8) Compute the combined (X_2) mean of the measured energy performance of the n_1 and n_2 units of the combined first and second samples as follows:

$$\bar{X}_2 = \frac{1}{n_1 + n_2} \sum_{i=1}^{n_1+n_2} X_i \qquad [7]$$

(9) Compute the standard error ($SE(X_2)$) of the mean full-load efficiency of the n_1 and n_2 units in the combined first and second samples as follows:

$$SE(\bar{X}_2) = \frac{S_1}{\sqrt{n_1 + n_2}} \qquad [8]$$

Note that S_1 is the value obtained above in (2).

(10) Set the lower control limit (LCL_2) to,

$$LCL_2 = SSD(m_1) - tSE(\bar{X}_2) \qquad [9]$$

where *t* has the value obtained in (5) and $SSD(m_1)$ is sample size discount determined in (4), and compare the combined sample mean (X_2) to the lower control limit (LCL_2) to determine one of the following:

(i) if the mean of the combined sample (X_2) is < (LCL_2), the basic model is not compliant and testing is at an end.

(ii) if the mean of the combined sample (X_2) ≥ (LCL_2), the basic model is in compliance and testing is at an end.

Annex C: The Belgian Convention

CONVENTION

**PRECISING CONDITIONS ON
MARKET SURVEILLANCE CAMPAGN 2006
ON THE DETERMINATION OF THE
SOUND POWER LEVEL OF CONSTRUCTION EQUIPMENT**

**BETWEEN THE BELGIAN COMPETENT AUTHORITY
AND REPRESENTATIVES OF X MANUFACTURERS OR THEIR BELGIAN IMPORTERS**
(datum)

The parties signed the Convention,

- The Belgian Public Service Health, Food Chain Safety and Environment, represented by XXXX XXXX, director-general of the competent authority as defined in the Royal Decree of 6 march 2002 concerning the sound power level of outdoor equipment and transposing the Directive 2000/14/EC into Belgian law, further called the organising authority,
- and the representatives of the following companies :
  -
  -
  -
  - ,

further called the participating companies,

have agreed the following :

Article 1. §1. The organising authority issues a tender call in view of noise measurements of construction equipment, according to the purposes and methodologies mentioned in the Directive.
The tender call will be distributed to notified bodies, as foreseen by Directive 2000/14/EC, having technical competences for testing according to appendix VI or for appendix VII of Directive. The organising authority selects the notified body, further called the chosen notified body, and covers the retribution of the chosen notified body.

§2. The effective start of the measurements is scheduled on September/October 2006. X measurements days and X supplementary measurement days are scheduled according to the following scheme:

	Datum	Time	Company	Equipment	Address measurement place
Measurement day			Company X		
Supplementary day			Company X		
Measurement day			Company Y		
Supplementary day			Company Y		

Article 2.

Option A	Option B
§1. Each participating company delivers three machines, each of the same type, as agreed with the representative of the organising authority, on his own measurement place and on a predetermined time.	§1. (Option B.1) Each participating company delivers one machine, as agreed with the representative of the organising authority, on a measurement place predetermined by organising authority and on a predetermined

The participating companies provide an access of the chosen notified body and representatives of the organising authority to the measurement place (if this is restricted).	time. §1. (Option B.2). Each participating company delivers three machines each of a different type, as agreed with the representative of the organising authority, on his own measurement place and on a predetermined time. The participating companies provide an access of the chosen notified body and representatives of the organising authority to the measurement place (if this is restricted).

§2. The participating companies offer each a craftsman for the duration of the measurement of their machine types. The craftsman shall be able to operate the machine in all necessary operation modes. He shall follow the instructions of the chosen notified body in charge of coordinating all activities on the measurement place.

Article 3. The participating companies agree to pay any cost in favour of the organising authority, which should have been due to the non-respect of the obligations as described in article 2.

Article 4.

Option A. If three machines of the same type have been provided for the measurements:	Option B. If a type is represented by one machine:
§1. Three machines of the same type shall be measured once, according to the measurement procedure laid down by the Directive 2000/14/CE. The mean value of these three measurements is further called “a result”.	§1. One machine of each type shall be measured once, according to the measurement procedure laid down by the Directive 2000/14/CE. The result of the measurement is further called “a result”.
§2. The participating companies agree that if the result is equal or lower than the permissible sound power level according article 12 of Directive 2000/14/CE, further called “the threshold”, minus the product 0.56 σ_M[61], these three machines are considered to represent a batch/type, in accordance with Annex C.2 of ISO 4871, of an equipment type provisionally fulfilling the permissible sound power level legal requirement.	§2. The participating companies agree that if any result is equal or lower than the permissible sound power level according article 12 of Directive 2000/14/CE, further called “the threshold”, minus the product 1.2 σ_M[1], the machine tested is considered to represent a batch, in accordance with Annex C.1 of ISO 4871, of an equipment type provisionally fulfilling the permissible sound power level legal requirement.
§3. The participating companies agree that if the result is higher than the threshold minus the product 0.56 σ_M, these three machines are considered to represent a batch/type, in accordance with Annex C.2 of ISO 4871, of an equipment type provisionally not fulfilling the	§3. The participating companies agree that if the result is higher than the threshold plus the product 0.2 σ_M, the machine tested is considered to represent a batch/type, in accordance with Annex C.1 of ISO 4871, of an equipment type provisionally not fulfilling the

[61] Here and further σ_M=2.5, but σ_M can be replaced by σ_t which is defined as $\sigma_t = \sqrt{s_p^2 + \sigma_R^2}$ according to the proposal of NB. The value σ_p is provided by the participating company together with a relevant justification. The reproducibility error σ_R shall be taken from the proposal of NB. Taking into account a preliminary character of figures on reproducibility error at the proposal, conclusions on (non) compliancy would be made only provisionally.

permissible sound power level legal requirement.	permissible sound power level legal requirement.
§4. (Empty)	§4. The participating companies agree that the result lying between the threshold plus the product 0.2 σ_M and the threshold minus the product 1.2 σ_M, the result is considered to be inconclusive, in accordance with Annex C.1 of ISO 4871. Such a result must lead to measurements of 2 additional machines of the same type as one having been measured. These additional measurements shall be done by the same notified body as the first measurement at the place indicated by the organising authority. The participating companies deliver 2 machines to the measurement place and provide a craftsman. The organising authority organises the noise measurements for delivered equipment on its own costs (the retribution to the notified body). The average result of additional measurements and of the first measurement shall be treated as in option A.
§5. If a result exceeds essentially (by 2 σ_R [62]) the threshold minus 0.56 σ_M, three machines tested are considered to represent a batch/type of an equipment type not fulfilling the permissible sound power level legal requirement. In this case the participating companies provide a technical documentation and protocols of internal production control to prove that the guaranteed level for the batch/type is defined properly and that production uncertainties are kept under the control.	§5. If a result exceeds essentially (by 2 σ_R^2) the threshold plus 0.2 σ_M, the machine tested is considered to represent a batch/type of an equipment type not fulfilling the permissible sound power level legal requirement. In this case the participating companies provide a technical documentation and protocols of internal production control to prove that the guaranteed level for the batch/type is defined properly and that production uncertainties are kept under the control.

§6. The participating companies agree that, for the case that the according Directive 2000/14/EC labelled sound power level would be lower than the permissible sound power level, the clauses 1-5 apply where the word "permissible" will be replaced by the word "labelled". Renewed sound power labelling fitting better to the measurements result will be concluded after a thorough investigation.

Article 5. §1.The organising authority will verify the representativeness of the machines under test for serial production machines. To that purpose, the manufacturer has to set available relevant sales literature and at the test site a technical file according to Annexes VI, VII & VIII of the Directive 2000/14/EC.

[62] The reproducibility error σ_R shall be taken from the proposal of NB.

The organising authority and the participating companies have the right to take detailed photographs during the measurements in order to verify aforementioned representativeness or to register the measurement conditions.

§2. The participating companies agree that the organising authority will publish, without reference to mark or type, a report containing the measurement results inclusive all further relevant observations made by the chosen notified body or by the representative of the organising authority, with exception of the photographs mentioned in §1. This publication will be made without prejudice of any reporting rights or obligations of the organising authority to the European Commission by means of its representative in the Committee as defined in article 18 of the Directive 2000/14/EC, or otherwise.

§3. Results of measurements paid by the organising authority remain its property and may not be distributed to thirds without written permission of the organising authority.

Annex: Decision chart.

The organising authority :
Mr. XXXXXX,
Director general of the Belgian competent authority (R.D. of 6.3.2003)

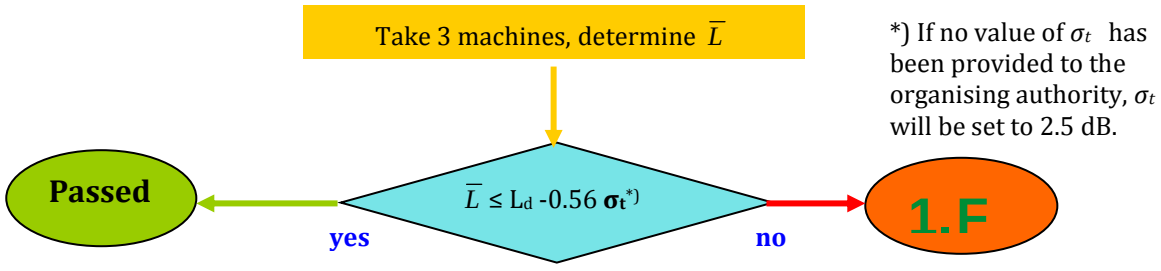
The participating companies :

XXXXXXXXXXXXXXX

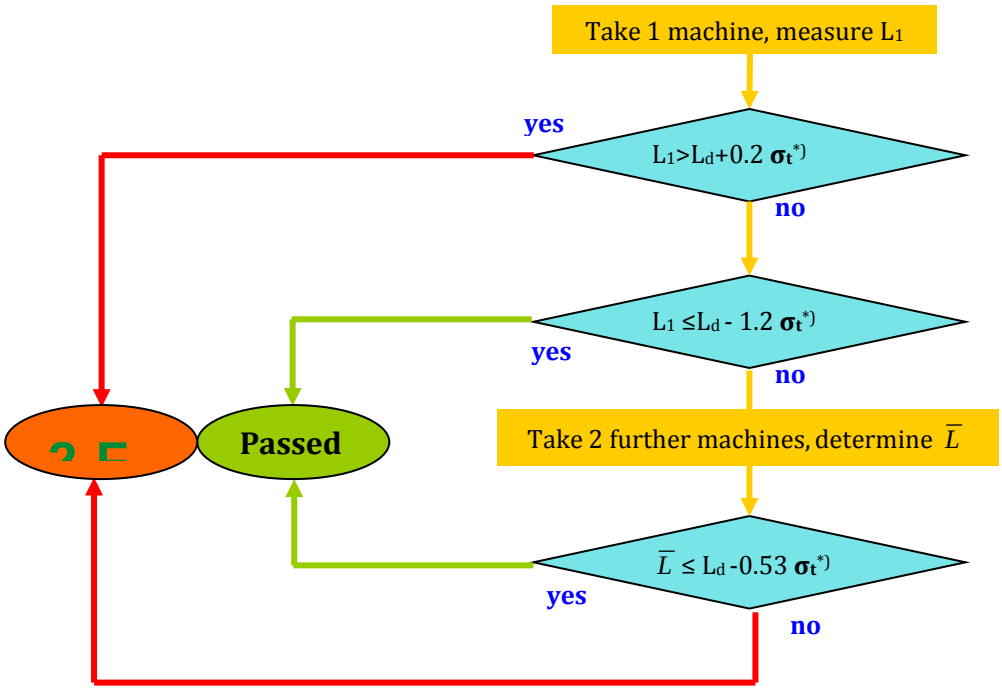
Brussels, (datum), in X copies, one for each contracting party.

Annex: Decision chart

Option A. Three machines have been provided (single sampling inspection)



Option B. One machine is provided to the measurements (double sampling inspection):



Abbreviation list

AEDM – Alternative Efficiency Determination Method
AMCA – the Air Movement and Control Association International
ANCE – Asociación de Normalización y Certificación
ARM – Alternate Rating Methods
ASRAC – Appliance Standards and Rulemaking Federal Advisory Committee
BEE – Bureau of Energy Efficiency
BIL – Basic Impulse Isolation Level
CB – Certification Body
CCMS – Compliance Certification Management System
CCNNPURRE – Comité Consultivo Nacional de Normalización para la Preservación y Uso Racional de los Recursos Energéticos or National Consultative Committee of Standards for the Preservation and Rational Use of Energy Resources
CFE – Federal Power Commission
CNIS – China National Institute of Standards
CONUEE – National Commission for Efficient Use of Energy
DoE – (US) Department of Energy
E3 – Equipment Energy Efficiency Program
EMA – Entidad Mexicana de Acreditación, Mexican accreditation entity
EPA – Environmental Protection Agency (US)
ES – Energy Star
EU – European Union
FEG – Fan Efficiency Grade
FIDE – Fideicomiso para el Ahorro de Energía Eléctrica
GEMS – Greenhouse and Energy Minimum Standards Act 2012
ICA – International Copper Association China
ISO – International Standardization Organisation
JEMA – Japan Electrical Manufacturers' Association
LASE – Ley para el Aprovechamiento Sustentable de la Energía, Law on Sustainable Energy Use
LOGIS – Organismo de Certificación de Productos
MEPS – Minimum Energy Performance Standard
METI – (Japan) Minister of Economy, Trade and Industry
MSA – Market Surveillance Authority
NAB – National Accreditation Body
NATA – National Association of Testing Authorities
NEMA – US National Electrical Manufacturers Association
NOM – Norma Oficial Mexicana, Official Mexican Standard
NRCan – Natural Resources Canada
ONNCCE – Organismo Nacional de Normalización y Certificación de la Construcción y Edificación
PROFECO – Ministry for consumer protection in Mexico
SCC – Standards Council of Canada

References

The references of this Report are reported as footnotes.

Co-funded by the Horizon 2020 programme
of the European Union

List of Figures

Figure 2-1: Australia and New Zealand legislative framework 13
Figure 2-2: Non-compliance risk and response options in Australia 16
Figure 2-3: Time scale for the legislation about transformers in USA 20
Figure 2-4: Examples of steam cookers 27
Figure 2-5: Labelling scheme for transformers in India 40
Figure 2-6: Evolution of the Mexican legislation for transformers 44
Figure 2-7: Energy efficiency label for transformers in China 47
Figure 2-8: Example of energy saving label in Japan Figure 2-9: Japan label for the product main unit 50
Figure 2-10: EU Conformity assessment modules for CE marking 57
Figure 2-11: The conformity assessment procedures of the new approach through the modules 57
Figure 2-12: Inspection process in Denmark 62
Figure 2-13: US approach for the commercial building energy code 2007-2020 65
Figure 2-14: US approach for negotiated rulemaking for commercial and industrial fans and blowers 66
Figure 2-15: US approach for the commercial building energy code after 2020 67
Figure 2-16: Large power transformer procurement process and estimated time 68
Figure 2-17: Preconditions for the use of σ_R and σ_M values reported in EN ISO 7574-4 70
Figure 2-18: Proposed procedure for the verification of the noise declared values for transformers 71

List of Tables

Table 2-1: Additional percentages for randomly selection of products for verification in US 26
Table 2-2: Detailed summary of 2014 results for Energy Star verification 32
Table 2-3: Market surveillance activities relating to adopted and published regulations in Sweden, 2015 60
Table 2-4: Market surveillance activities relating to adopted and published regulations in Sweden, 2016 61
Table 2-5: Results of completed inspections in 2015 in Denmark 62
Table 2-6: NEMA low-voltage dry-type distribution transformers 64
Table 2-7: Minimum efficiencies of low-voltage dry-type three phase distribution transformers..... 64
Table 3-1: Mandatory minimum efficiency requirements and certification schemes for transformers worldwide 82
Table 3-2: Mandatory minimum efficiency requirements and certification schemes for fans worldwide..... 85

More information
about the INTAS project activities
and all of its results
are published on:

www.INTAS-testing.eu

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement Number 695943.