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Calculation methods for energy efficiency and energy consumption variations at country, region and city levels

Méthode de calcul pour l'efficacité énergétique et les variations de consommation d'énergie aux niveaux national, régional et urbain

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Foreword

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This document was prepared by Technical Committee ISO/TC 301, *Energy management and energy savings*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Due to the increasing role of energy efficiency improvements and of controlling the energy consumption growth in international climate and energy policies, there is a need for harmonization of methods to evaluate the impact of these policies at the international level.

This document is concerned with the evaluation of energy consumption and energy intensity changes through explanatory factors, as well as the calculation of an energy efficiency index, at national and regional levels. The practical application can be different due to specific restrictions, such as methodologies, availability of data at lower levels of disaggregation, or difficulty in understanding and communicating.

The methods presented here can provide valuable insights into trends in energy use and factors linked to those trends. Still, not all aspects of the phenomena that affect energy use are accounted for by the methods in this document, as these methods are primarily descriptive. While the analysis presented here can reveal patterns or shifts in patterns of energy use, they do not necessarily reveal causality, an aspect that can also require additional analysis.

The user should be aware of some issues associated with the methods presented in this document. Some of these arise from analytic issues. For example, whether to combine all fuels in a sector into a single energy variable or to treat them separately is a question best addressed by clear reference to the purpose of the analysis using the methods presented here. Other aspects are phenomena not explicitly included in the methods presented here. An example is the role of the prices of energy or other goods, which can require additional methods.

This document is composed of three different calculation methods:

— evaluation of structure effects in the variation of energy intensity;

— calculation of energy efficiency indices;

— decomposition analysis of energy consumption variation.

Energy intensity is often considered as an indicator of energy efficiency at aggregate level when limited data are available. Their use as a proxy for energy efficiency can be improved by removing from their variations changes in economic structures: this is the objective of the first part of this document.

With more detailed data on energy consumption available by subsectors or energy uses (e.g. space heating) or by modes of transport (e.g. cars), it is possible to assess energy efficiency trends through a more accurate indicator than energy intensity, called “energy efficiency indices”: this is the objective of the second method of calculation presented in this document.

The variation of energy consumption can be related to change in economic activity, to energy savings as well as to other explanatory factors: the purpose of the third method of calculation described in this document is to present the method of decomposition of changes in energy consumption. It makes use of indicator-based savings, i.e. energy savings calculated according to the indicator-based method, as described in ISO 17742.

This document considers all end-use sectors, such as industry, transport, households, services (also known as the “tertiary sector”) and agriculture. It does not generally incorporate the energy supply sectors, such as power plants, refineries or coal mines. However, the integration of the power sector can be considered in the decomposition of the primary energy consumption to account for the effect of variations in energy efficiency and energy mix in the power sector.

Energy consumption considered in this document excludes feedstock energy, such as oil feedstock used to produce plastics or natural gas used as a feedstock for the production of fertilisers, as they are not affected by energy efficiency policies.

This document can be used by any interested parties (decision-makers, companies, researchers, NGOs, etc.) that want to understand changes in the energy intensity or the energy consumption, as well as to assess energy efficiency by sector over a specific period.

This document is part of a set of documents developed by TC 301 (see Figure 1) and builds on the general principles outlined in ISO 17743, including reporting and system boundaries, and on the energy savings calculations presented in ISO 17742.

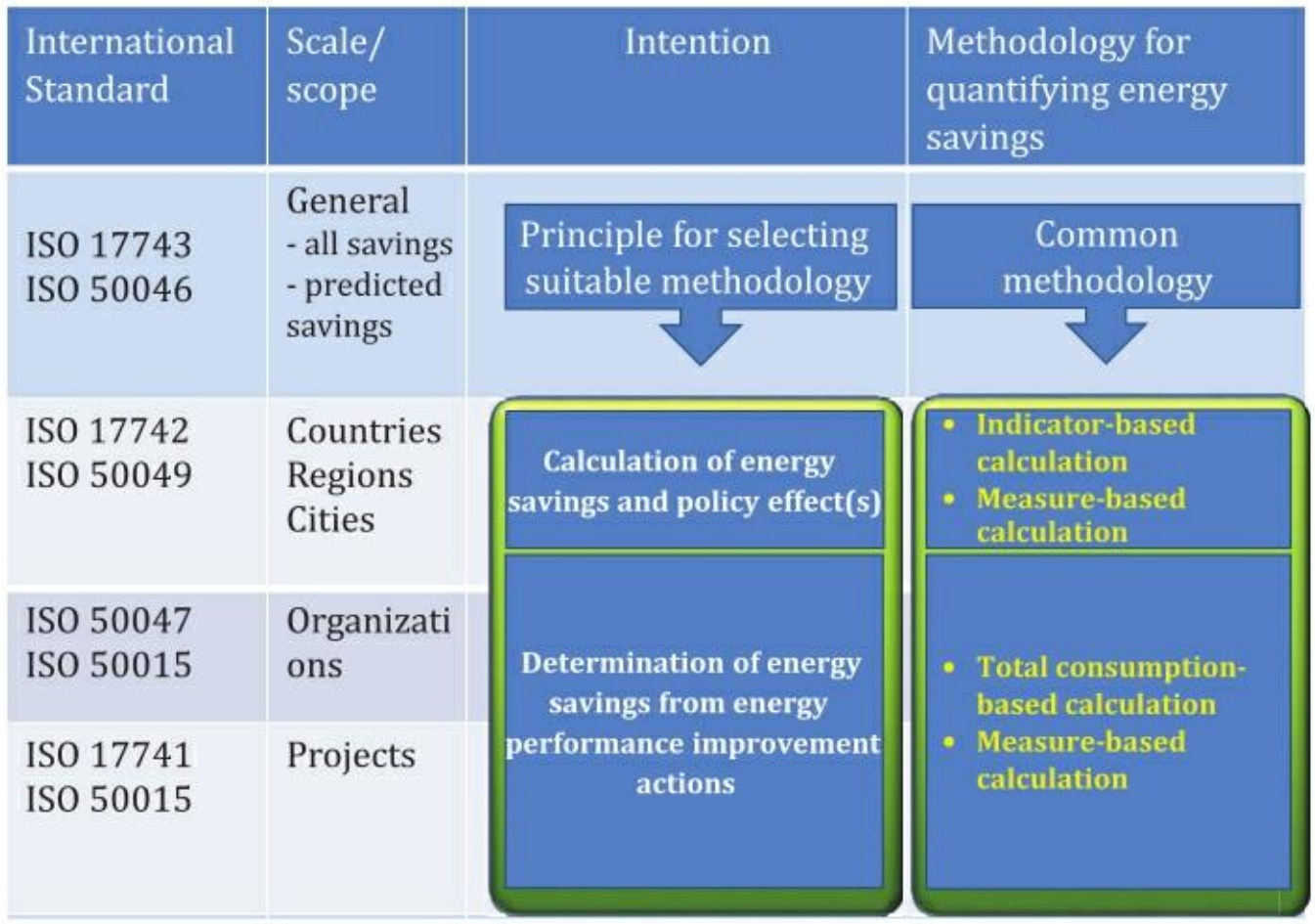

Figure 1 — Relationship between documents

The document covers more precisely three types of calculation methods based on energy efficiency indicators. Compared to ISO 17742, it details more advanced methodologies that facilitate a more comprehensive understanding of changes in: a) energy intensity, b) energy efficiency and, finally, c) energy consumption. The evaluation of energy efficiency trends relies on the calculation of energy efficiency indices. Variations in energy consumption are explained from a decomposition into different explanatory factors, one of which being energy savings. Therefore, this document complements ISO 17742 on energy savings calculation methods. More specifically, it complements how ISO 17742 deals with indicator-based methods. For each calculation method, examples of specific calculations are presented separately in Annexes A to C.

When applying this document, the user can choose between different options of the methods proposed. In order to be transparent in the way results have been obtained, the user of this document should specify the methodology used when presenting the results.

The general methodologies to evaluate trends in energy intensity, energy efficiency and energy consumption and its link to energy savings are presented in Clause 4. The calculation of the influence of structural changes in the energy intensity variation is described in Clause 5. The calculation method for the energy efficiency index is described in Clause 6. Finally, the method of decomposition of the energy consumption is given in Clause 7. Annexes A to C provide examples to illustrate various types of calculations. Annex D presents the methodology of climatic corrections, as most of these calculations should be done with energy efficiency indicators adjusted to a normal climate.