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Environmental management — Material flow cost accounting — Guidance for practical implementation in SMEs

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all of such patent rights.

ISO 14053 was prepared by ISO/TC 207, Environmental management, Working Group 8, Material flow cost accounting.

This is the first edition of ISO 14053.

Introduction

Companies of any size face the challenge from the market, to reduce costs in order to remain competitive or increase competitiveness. Achieving the Sustainable Development Goals (SDGs) as set out by the United Nations in 2015 has become a high priority for society. Especially, Goal 12 requires governments as well as private sectors to ensure sustainable consumption and production patterns. For small and medium-sized enterprises (SMEs), the need to achieve improvements in material and energy efficiency for sustainable production is equally higher as for large organisations.

A series of international standards provide guidance on material flow cost accounting (MFCA) – an approach to assess material efficiency within an organization (ISO 14051) and the approach and opportunities to enhance material efficiency in cooperation with supply-chain partners (ISO 14052). While SMEs are encouraged to implement MFCA based on ISO 14051, they may prefer more simplified approach for MFCA. In this regard, ISO 14053 provides guidance for SMEs to initiate a phased implementation of MFCA. This approach focuses on the most relevant production process for their enhancement of material- efficiency along with cost-reduction, possibly leading to additional business opportunities (e.g. a green supply-chain).

The standard can be used independently of ISO 14051 and ISO 14052. However, the basic philosophy of MFCA as well as the terms and definitions are the same as in ISO 14051. In addition , the standard has been designed to help SMEs to identify new business opportunities regarding material efficiency. Large organisations can also use this standard as a starting point for their implementation of MFCA in a specific department or process.

This International Standard provides the following:

— common terminologies,

— principle,

— calculation approach, analysis and improvement, and

— application of MFCA implementation result.

In addition, the annex illustrates a case example of MFCA implementation in SMEs.

Environmental management – Material flow cost accounting – Guidance for practical implementation in SMEs

1 Scope

This International Standard provides practical guidance for implementation of Material Flow Cost Accounting (MFCA) in the most relevant production process of small and medium -sized enterprises (SMEs). Under MFCA, the flows and stocks of materials within SMEs are traced and quantified in physical units (e.g. mass, volume) and the costs associated with those material flows are also evaluated. The resulting information can act as a motivator for SMEs to seek opportunities to simultaneously generate financial and environmental benefits by reducing material loss and energy consumption.

This Standard is designed for an independent standard for SMEs to implement MFCA in a phased manner. This Standard is applicable to any SMEs, regardless of its level of development, the nature of activities undertaken or the location at which these activities occur.

This Standard provides basic calculation procedures to analyse saving potentials by avoiding material losses. Detailed calculation procedures or information on techniques for improving material or energy efficiency are out of the scope of this Standard.

2 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

2.1
energy cost
cost for electricity, fuels, steam, heat, compressed air and other like media

NOTE Energy cost can be either included under material cost or quantified separately, at the discretion of the organization.

[ISO 14051:2011, definition 3.4]

2.2
energy use
manner or kind of application of energy

EXAMPLE Ventilation; lighting; heating; cooling; transportation; processes; production lines.
[ISO 50001:2011, definition 3.18]

2.3
material
substance that enters and/or leaves a quantity centre

NOTE 1 Materials can be divided into two categories, as follows:

materials that are intended to become part of products, e.g. raw materials, auxiliary materials, intermediate products;

materials that do not become part of products, e.g. cleaning solvents and chemical catalysts, which often are referred to as operating materials.

[ISO 14051:2011, definition 3.10]

2.4

MFCA summary sheet

a spreadsheet that reflects the MFCA information for a production process that is treated as a single quantity centre

2.5

material flow cost accounting

MFCA

tool for quantifying the flows and stocks of materials in processes or production lines in both physical and monetary units

[ISO 14051:2011, definition 3.15]

2.6

material loss

all material outputs generated in a quantity centre, except for intended products

NOTE 1 Material losses include air emissions, wastewater and solid waste, even if these material outputs can be reworked, recycled or reused internally, or have market value.

NOTE 2 By-products can be considered as either material losses or products, at the discretion of the organization.

[ISO 14051:2011, definition 3.16]

2.7

quantity centre

selected part or parts of a process for which inputs and outputs are quantified in physical and monetary units

[ISO 14051:2011, definition 3.20]

2.8

system cost

cost incurred in the course of in-house handling of the material flows, except for material cost, energy cost and waste management cost

EXAMPLE Cost of labour; cost of depreciation and maintenance; cost of transport.

[ISO 14051:2011, definition 3.21]

2.9

waste management cost

cost of handling material losses generated in a quantity centre

[ISO 14051:2011, definition 3.22]

3 Principles

3.1 Understand basic material flow and energy use

The material flows to products and material losses and energy use in the most relevant production process are identified and quantified as physical data.

3.2 Ensure reliability of physical data

Physical data on material flows and energy use is collected in consistent measurement units, preferably mass for material flows.

3.3 Estimate and attribute costs to material losses and energy use

The costs associated with material losses and energy use are estimated, and these costs are attributed to the material losses and energy use.

3.4 Link physical and monetary data

Decision-making on environmental and management issues within SMEs are supported by linking physical data with associated cost.

4 Cost calculations in a phased manner for SMEs

4.1 General

Data on material flows and energy use should be translated into monetary units to support decision-making according to the cost calculations. This process contains one preparation-phase, four calculation-phases and one analytical phase. SMEs can incrementally implement MFCA as indicated in the following.

4.2 Preparation phase: Identification of the most relevant production process in SMEs

SMEs should identify the most relevant production process. In case of a single production process in SMEs, all of the material losses and energy use should be examined. If multiple processes are present, SMEs can select either the most relevant production process or multiple processes as one single production-unit for calculation.

A selection approach for the most relevant production process should be divided into two steps:

— First step – Estimate magnitude of the different material losses and energy use, and

— Second step – Select the process with high raw material unit cost, large volume of material losses and defective products, etc. as the most relevant production process.

4.3 Calculation phase 1: Quantification of material flows in physical units

Amounts of material inputs and outputs should be quantified in physical units such as mass, length, number of pieces, or volume, depending on type of materials. Outputs are divided into products and material losses.

NOTE: Depending on the industry, further output may occur that are not related to the product, e.g. emissions, waste water flows, and auxiliary losses. It is not always recommendable to treat those outputs as material loss.

4.4 Calculation phase 2: Calculation of material costs and waste management costs

Cost calculations should be started with material costs. This includes costs related to these materials used in the most relevant production process which may include raw materials, auxiliary materials, operating materials, and intermediate products. The costs of all material inputs are assigned to products and material losses according to the physical quantity. In addition, waste management costs are calculated.

4.5 Calculation phase 3: Calculation of energy costs

Calculation of energy costs is at the discretion of the organization. When it is determined to be necessary, energy costs should be calculated and allocated to products and material losses according to the physical data quantified at Calculation Phase 1.

4.6 Calculation phase 4: Calculation of system costs

Calculation of system costs is at the discretion of the organization. When it is determined to be necessary, system costs should be calculated and allocated to products and material losses according to the physical data quantified at Calculation Phase 1.

4.7 Analytical phase: Analysis of material loss costs

With the above-mentioned phases, analysis of cost impacts should be conducted. Material loss costs could be understood as saving potentials for SMEs. Material costs assigned to material losses are usually the most important target to be reduced. Additionally, energy costs and system costs can indicate further saving potentials. If multiple processes have been combined as one, it should be ensured that the system costs are actually correlated with the material losses.

5 Calculation format in a phased manner and development of improvement plans

5.1 General

This clause explains the calculation methods and the templates in which the cost calculations should be made.

5.2 MFCA summary sheet

MFCA summary sheet is a general template that can be used for MFCA in a phased manner. The template contains information on target materials, products and material losses as illustrated in Table 1. Calculated costs at each phase are summarised in the MFCA summary sheet.