

Packaging — Optimization of energy recovery from packaging waste

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National foreword

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Packaging - Optimization of energy recovery from packaging waste

Emballage - Optimisation de la valorisation énergétique des déchets d'emballages

Verpackung - Optimierung der energetischen Verwertung von Verpackungsabfällen

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Foreword

This document has been prepared by CEN /TC 261, "Emballage".

This document is actually submitted to the publication.

Introduction

The Directive on Packaging and Packaging Waste, Annex II, 3(b) states that *Packaging waste processed for the purpose of energy recovery shall have a minimum inferior calorific value to allow optimization of energy recovery* (Ref. 1).

The Commission's Mandate M 200 Rev. 3 asks CEN to propose a standard on *Requirements for packaging recoverable in the form of energy recovery, including specification of minimum inferior calorific value* (EN 13 431).

Energy recovery is defined in Article 3.8 of the Directive : *'energy recovery' shall mean the use of combustible packaging waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat.*

EN 13431 shall apply to packaging placed on the market in order to allow optimization of energy recovery of packaging waste by specifying minimum inferior calorific value and other supplementary requirements. It cannot and does not consider conditions or contaminants of packaging waste at arrival to furnace at the energy recovery plant.

1 Scope

The objective of this report is to identify and define properties of packaging and packaging waste to allow optimization of energy recovery.

This report takes a wide approach to the process of energy recovery in order to identify the items to be standardised according to the Directive and the Mandate.

2 Terminology

Net calorific value (inferior calorific value), Q_{net} : defined in ISO 1928 :1995 (Ref. 3).

Required energy H_a : energy necessary to adiabatically heat the post combustion substances of a material and excess air from ambient temperature to the specified final temperature.

Calorific gain : the positive difference between the energy released on combustion of a material (the net calorific value) and H_a .

Available calorific gain : recovered heat providing useful energy.

3 Packaging and packaging waste

The statement in Annex II of the Directive quoted above refers to **packaging waste**, whereas the Mandate wording refers to **packaging**. Packaging waste can be used for energy recovery, but it is the packaging placed on the market that has to meet the specific requirements for energy recovery and therefore is subject to meeting the standard. The link between the Directive and the Mandate can be described in the following manner :

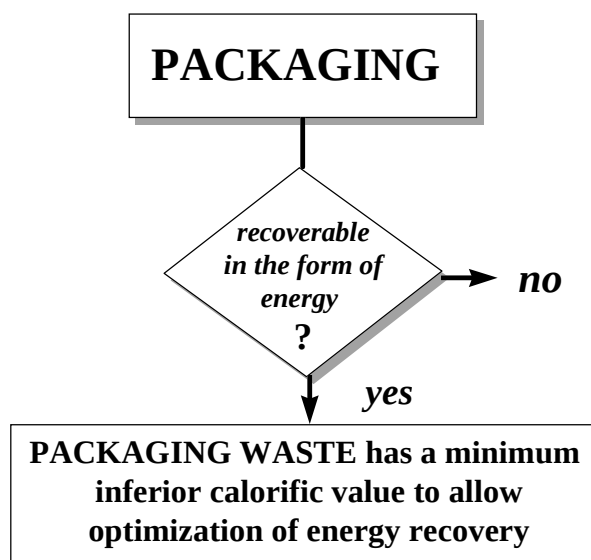


Figure 1

As shown in Figure 2, packaging materials, packaging, used packaging and packaging waste form a sequence from production and consumption to waste, without intrinsic change of the chemical material properties which are essential for energy recovery.

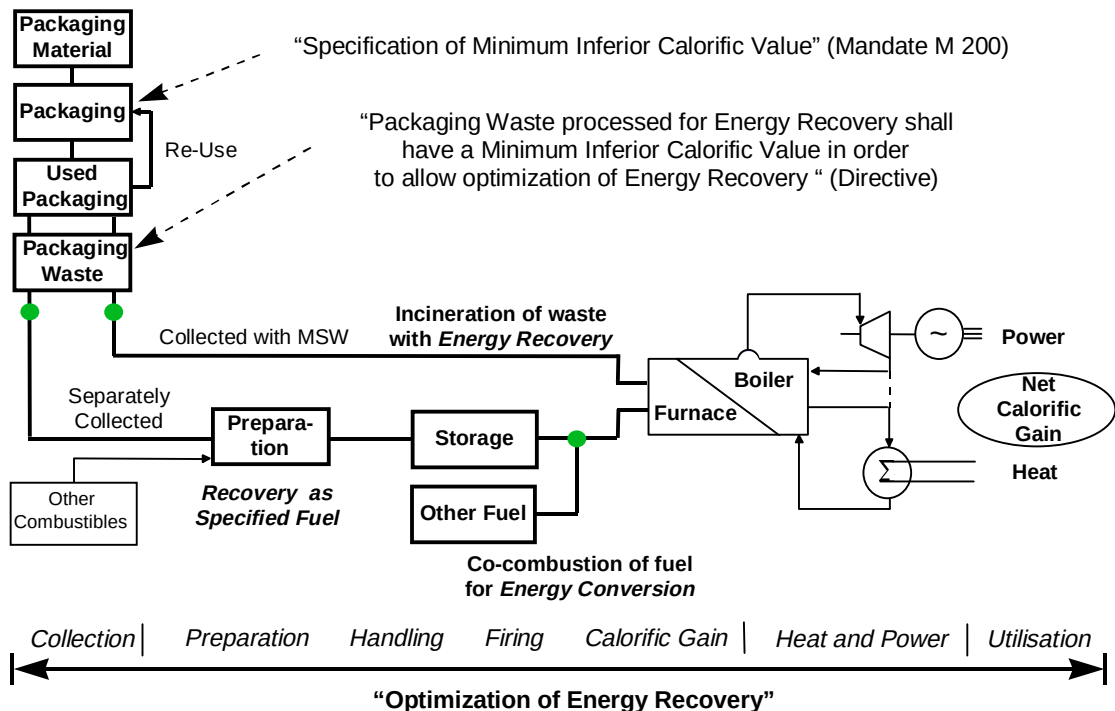


Figure 2 - The Overall System of Optimization of Energy Recovery

4 Optimization of energy recovery

The objective of this report is to identify and define properties of packaging and packaging waste to allow optimization of energy recovery. **Optimization of Energy Recovery** from packaging waste involves the overall system including properties of packaging, waste collection systems, preparation, storage and energy conversion to provide net calorific gain as shown in Figure 2. Some steps included in the overall system are not related to the packaging itself, and therefore not considered influential to the requirements of the packaging. Combustion plants, for example, are subject to specific regulation and the use of produced energy depends on local circumstances.

Figure 3 shows the relationship between packaging, packaging waste and their relevant requirement in the framework of the overall system of optimization of recovery in the form of energy. These issues are discussed in detail in the following.

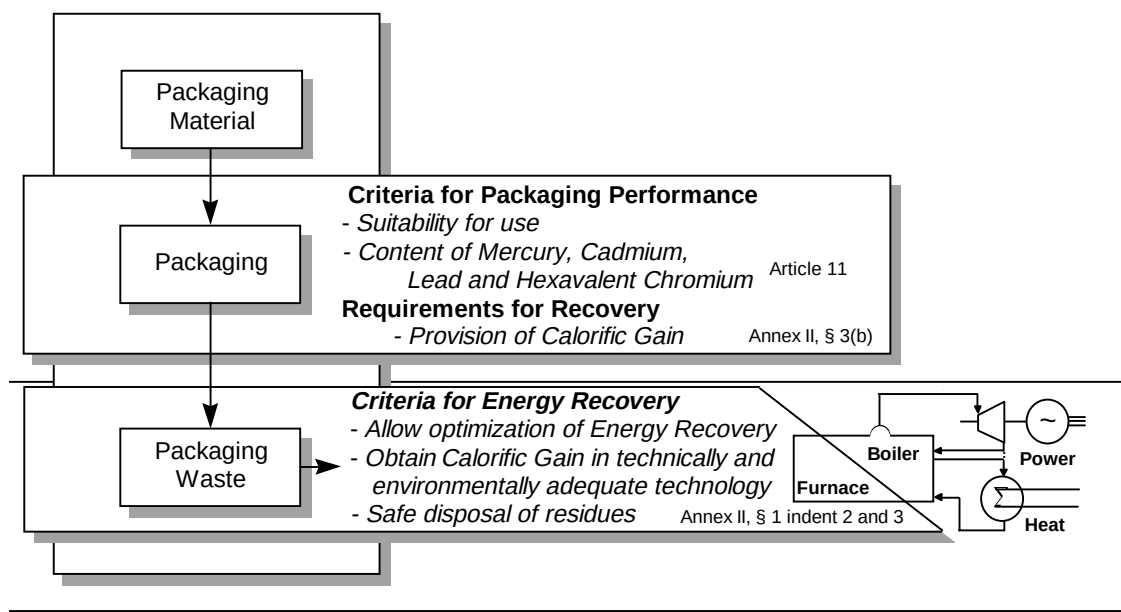


Figure 3 - Relevant Issues of Directive of Packaging and Packaging Waste and Mandate M 200 Rev. 3

Collection system and preparation

In order to optimize energy recovery from used packaging, the waste collection system should be designed and managed so that the energy content and other fuel properties of used combustible packaging are preserved. The extent of preparation necessary to transform packaging waste into a fuel, depends on the requirements of the actual energy conversion plant.

Today, two different methods of collection and preparation or pre-treatment are prevailing (Figure 2) :

- 1) packaging waste is collected with other Municipal Solid Waste (MSW) for direct incineration in MSW incinerators. This type of incinerator is efficient, proven and requires little pre-treatment of the mixed waste ;
- 2) separation of combustible waste gives a combustible fraction, known as Refuse-Derived Fuel, RDF. Source separation and preparation of combustible packaging waste allows for the production of an energy-rich solid fuel with specific properties (Packaging-Derived Fuel, PDF).

These derived fuels can be used as a single fuel or used in co-combustion with other fuels in existing solid fuel fired combustion systems. In all these processes, combustible packaging waste substitutes primary fuels.

Energy conversion and generation of net calorific gain

Energy conversion of chemically bound energy to generate net calorific gain consists of three main process steps :

- combustion of a fuel in a combustion chamber, resulting in hot flue gases and solid residues, such as ashes and slag ;
- utilization of the heat content of the hot gases in a heat recovery system ;
- conversion of the recovered heat to provide end-use energy in the form of electricity and/or heat.

Combustion

Combustion efficiency is related to the degree of completeness of combustion. It is mainly affected by fuel particle size, fuel-to-air ratio, temperature, residence time and turbulence (mixing of fuel and air) in the furnace. Products of incomplete combustion are carbon monoxide, volatile organic compounds and soot particles in flue gas and unburnt carbon in ashes and slag. In the combustion process, organic substances are decomposed and transformed into gaseous components. Depending on the combustion conditions, inorganic compounds are either unaffected or transformed into insoluble oxides, sulphides, or water-soluble chlorides and sulphates. High combustion efficiency therefore means minimisation of these pollutants.