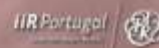




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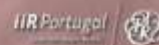


# Normalização de biocombustíveis sólidos

*Cláudia Mendes*

15 de Outubro de 2009

*Centro da Biomassa para a Energia*



- Associação científica e técnica de direito privado, sem fins lucrativos
- De apoio à promoção tecnológica
- Exerce a sua actividade desde 1989



## ÂMBITO DE ACTIVIDADE

Promoção da utilização da biomassa, em todas as formas disponíveis, para fins energéticos, em estreita ligação com as empresas e outros departamentos de investigação nacionais e estrangeiros.



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**Biomassa** consiste na “fracção biodegradável de produtos e resíduos provenientes da agricultura (incluindo substâncias vegetais e animais), da silvicultura e das indústrias conexas, bem como a fracção biodegradável de resíduos industriais e urbanos”. (2001/77/EC)

São excluídos do termo “Biomassa” todos os produtos utilizados com fins alimentares e industriais bem como os combustíveis fósseis.

**A produção de energia a partir de biomassa é denominada de Bio-energia.**

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Actividades florestais



Actividades pecuárias



Fracção orgânica dos resíduos sólidos urbanos e equiparados



Actividades agrícolas



Actividades humanas



Indústrias agro-alimentares



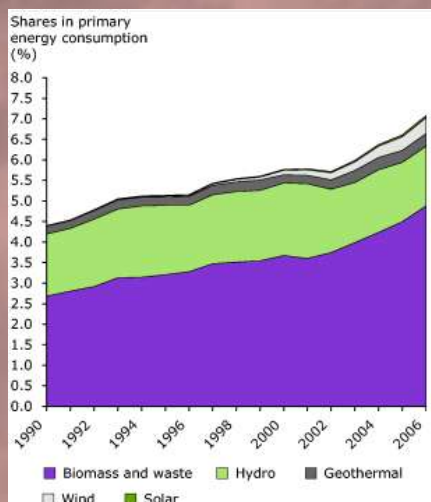
Culturas e plantações energéticas

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## Contribuição das renováveis para o consumo de energia primária



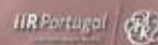
EU-27, 1990-2006



Fonte:EEA

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## Plano de acção da biomassa (2005)

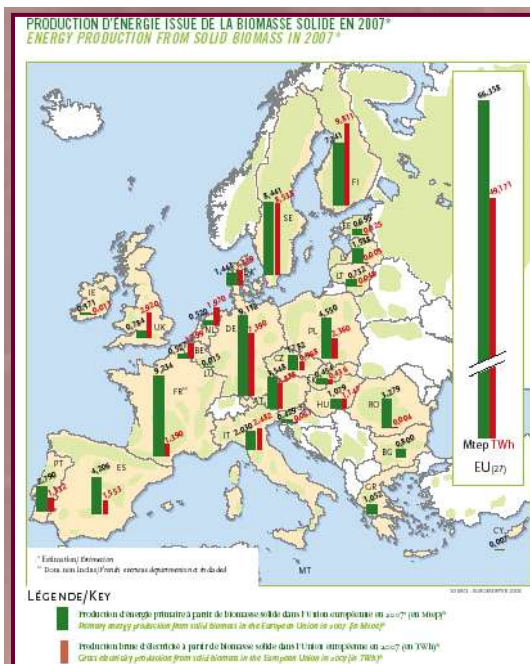


- Aumento na utilização de biomassa
  - biomassa sólida
  - biogás
  - biocombustíveis líquidos
  - fracção renovável dos resíduos urbanos

≈ 150 milhões de tep em 2010:

- 55 Mtep destinados à produção de electricidade
- 75 Mtep destinados à produção de calor
- 19 Mtep destinados ao transporte

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## BIOMASSA SÓLIDA Situação europeia

Na União Europeia, em 2007, a produção de energia primária a partir de biomassa sólida:

- madeira
- resíduos de madeira
- outros materiais sólidos de origem vegetal e animal

atingiu 66 milhões de toneladas equivalente de petróleo (Mtep)

O desenvolvimento futuro da biomassa deve considerar:

- Elevadas eficiências de conversão
- Competitividade
- Sustentabilidade

A biomassa é a fonte de energia renovável mais importante na Europa, com grande potencial de crescimento.

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IIR Portugal 

*Exemplos de  
Biocombustíveis sólidos*



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*Vantagens da utilização de biocombustíveis*

IIR Portugal 

- diminuição da poluição atmosférica (fonte energética neutra, em termos de emissões de CO<sub>2</sub>)
- criação de emprego na floresta e indústria
- melhoria das condições de vida da população rural
- diminuição da dependência energética externa
- não apresenta riscos para a saúde o transporte e o armazenamento

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## Aplicações de biocombustíveis sólidos

- Habitações individuais
- Redes de aquecimento domiciliário
- Indústria



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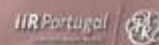
## Situação europeia



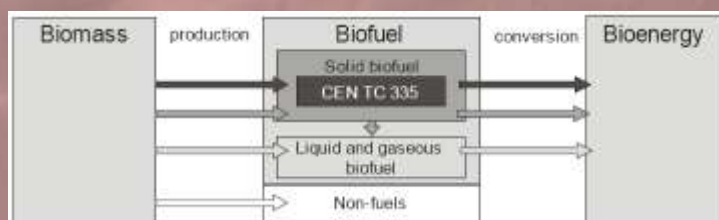
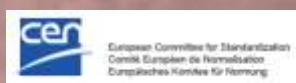
É necessário:

- Conhecer a origem da biomassa e a qualidade final dos biocombustíveis sólidos
- Definir parâmetros de qualidade
- Normalizar os biocombustíveis sólidos

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A CEN (European Standardization Organization) desenvolve *Technical Specifications* para biocombustíveis sólidos, a implementar nos Estados Membros



Technical Committee (TC) 335

Centro da Biomassa para a Energia

## CEN TC 335 Grupos de trabalho

- WG1 – Terminologia, definições e descrição (Alemanha)
- WG2 – Especificações e classes dos biocombustíveis  
Garantia de qualidade (Finlândia)
- WG 3 – Amostragem e redução da amostra (Holanda/UK)
- WG 4 – Ensaio físicos e mecânicos (Suécia)
- WG 5 – Ensaio químicos (Holanda)

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## Documentos publicados

CEN/TC 335- Published standards									
Standard reference	Title	Status in C3	Objective						
CEN/TR 15569:2009	Solid biofuels - A guide for a quality assurance system	No	-						
CEN/TS 14388:2005	Solid biofuels - Terminology, definitions and abbreviations	No	-						
CEN/TS 14774-1:2004	Solid biofuels - Methods for determination of moisture content - Oven dry method - Part 1: Total moisture - Reference method	No	-						
CEN/TS 14774-2:2004	Solid biofuels - Methods for the determination of moisture content - Oven dry method - Part 2: Total moisture - Simplified method	No	-						
CEN/TS 14774-3:2004	Solid biofuels - Methods for the determination of moisture content - Oven dry method - Part 3: Methods on general physics sample	No	-						
CEN/TS 14775:2004	Solid biofuels - Method for the determination of ash content	No	-						
CEN/TS 14776:2004	Solid biofuels - Sampling - Part 1: Methods for sampling	No	-						
CEN/TS 14778-1:2003	Solid biofuels - Sampling - Part 2: Methods for sampling particulate material transferred in bulk	No	-						
CEN/TS 14779:2003	Solid biofuels - Sampling - Methods for preparing sampling plans and sampling certification	No	-						
CEN/TS 14785:2003	Solid biofuels - Methods for sample preparation	No	-						
CEN/TS 14818:2003	Solid biofuels - Method for the determination of cyclic water	No	-						
CEN/TS 14861:2003	Solid biofuels - Fuel specification and classes	No	-						
CEN/TS 15103:2003	Solid biofuels - Methods for the determination of bulk density	No	-						
CEN/TS 15104:2003	Solid biofuels - Calculation of calorific value	No	-						
CEN/TS 15105:2003	Solid biofuels - Methods for the determination of volatile matter	No	-						
CEN/TS 15106:2003	Solid biofuels - Methods for the determination of ash fusion characteristics	No	-						
CEN/TS 15107:2003	Solid biofuels - Methods for the determination of ash fusion characteristics - Part 1: Charbonniz temperature method	No	-						
CEN/TS 15108:2003	Solid biofuels - Calculation of calorific value	No	-						
CEN/TS 15109:2003	Solid biofuels - Methods for the determination of the water soluble content of chloride, sodium and potassium	No	-						
CEN/TS 15140:2003	Solid biofuels - Method for the determination of the content of soluble matter	No	-						
CEN/TS 15149-1:2004	Solid biofuels - Methods for the determination of particle size distribution - Part 1: Sieving method using sieve apertures of 0,15 mm and above	No	-						
CEN/TS 15149-2:2004	Solid biofuels - Methods for the determination of particle size distribution - Part 2: Airflow method using sieve apertures of 0,15 mm and below	No	-						
CEN/TS 15149-3:2004	Solid biofuels - Methods for the determination of particle size distribution - Part 3: Risicle screen method	No	-						
CEN/TS 15150:2004	Solid biofuels - Methods for the determination of particle density	No	-						
CEN/TS 15205-1:2003	Solid biofuels - Methods for the determination of mechanical stability of pellets and briquettes - Part 1: Pellets	No	-						
CEN/TS 15205-2:2003	Solid biofuels - Methods for the determination of mechanical stability of pellets and briquettes - Part 2: Briquettes	No	-						
CEN/TS 15206:2003	Solid biofuels - Fuel quality assurance	No	-						
CEN/TS 15208:2004	Solid biofuels - Determination of total content of sulfur and chlorine	No	-						
CEN/TS 15209:2004	Solid biofuels - Determination of major elements	No	-						
CEN/TS 15209:2004	Solid biofuels - Calculation of analysis to different bases	No	-						
CEN/TS 15207:2004	Solid biofuels - Determination of impurities	No	-						
CEN/TS 15210-1:2004	Solid biofuels - Method for the determination of ash melting behaviour - Part 1: Charbonniz temperature method	No	-						

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Documentos em desenvolvimento



CEN/TC 335- Standards under development					
Project reference	Title	Coordinate Clashes	Current status	EN	
0033007	EN 14961-1	Sold	Under Approval	2009-12	0033007
0033004	EN 14910-2009	Sold	Under Approval	2009-11	0033004
0033042	EN 15103-2009	Sold	Under Approval	2009-11	0033042
0033043	EN 14776-1:2009	Sold	Approved	2009-10	0033043
0033044	EN 14776-2:2009	Sold	Approved	2009-11	0033044
0033002	EN 15210-1:2009	Sold	Under Approval	2009-11	0033002
0033063	EN 14776-3:2009	Sold	Under Development	2012-04	0033063
0033046	EN 12240-2009	Sold	Approved	2009-11	0033046
0033047	EN 14776-2009	Sold	Approved	2009-11	0033047
0033003	EN 15210-1:2009	Sold	Under Approval	2009-11	0033003
0033065	EN 14776-3:2009	Sold	Under Development	2012-04	0033065
0033066	EN 14776-3:2009	Sold	Under Development	2012-04	0033066
0033083	EN 14961-1	Sold	Under Development	2012-04	0033083
0033090	EN 14910-2009	Sold	Under Development	2012-04	0033090
0033087	EN 14961-2	Sold	Under Development	2012-04	0033087
0033088	EN 14961-2	Sold	Under Development	2012-04	0033088
0033089	EN 14961-4	Sold	Under Development	2012-04	0033089
0033070	EN 14961-5	Sold	Under Development	2012-04	0033070
0033071	EN 14961-6	Sold	Under Development	2012-04	0033071
0033072	EN 12241-1	Sold	Under Development	2012-04	0033072
0033073	EN 12241-2	Sold	Under Development	2012-04	0033073
0033074	EN 12241-3	Sold	Under Development	2012-04	0033074
0033075	EN 12241-4	Sold	Under Development	2012-04	0033075
0033076	EN 12241-5	Sold	Under Development	2012-04	0033076
0033077	EN 12241-6	Sold	Under Development	2012-04	0033077

Documentos em desenvolvimento



CEN/TC 335- Standards under development					
Project reference	Title	Coordinate Clashes	Current status	EN	
0033007	EN 14961-1	Sold	Under Approval	2009-12	0033007
0033004	EN 14910-2009	Sold	Under Approval	2009-11	0033004
0033042	EN 15103-2009	Sold	Under Approval	2009-11	0033042
0033043	EN 14776-1:2009	Sold	Approved	2009-10	0033043
0033044	EN 14776-2:2009	Sold	Approved	2009-11	0033044
0033002	EN 15210-1:2009	Sold	Under Approval	2009-11	0033002
0033063	EN 14776-3:2009	Sold	Under Development	2012-04	0033063
0033046	EN 12240-2009	Sold	Approved	2009-11	0033046
0033047	EN 14776-2009	Sold	Approved	2009-11	0033047
0033003	EN 15210-1:2009	Sold	Under Approval	2009-11	0033003
0033065	EN 14776-3:2009	Sold	Under Development	2012-04	0033065
0033066	EN 14776-3:2009	Sold	Under Development	2012-04	0033066
0033083	EN 14961-1	Sold	Under Development	2012-04	0033083
0033090	EN 14910-2009	Sold	Under Development	2012-04	0033090
0033087	EN 14961-2	Sold	Under Development	2012-04	0033087
0033088	EN 14961-2	Sold	Under Development	2012-04	0033088
0033089	EN 14961-4	Sold	Under Development	2012-04	0033089
0033070	EN 14961-5	Sold	Under Development	2012-04	0033070
0033071	EN 14961-6	Sold	Under Development	2012-04	0033071
0033072	EN 12241-1	Sold	Under Development	2012-04	0033072
0033073	EN 12241-2	Sold	Under Development	2012-04	0033073
0033074	EN 12241-3	Sold	Under Development	2012-04	0033074
0033075	EN 12241-4	Sold	Under Development	2012-04	0033075
0033076	EN 12241-5	Sold	Under Development	2012-04	0033076
0033077	EN 12241-6	Sold	Under Development	2012-04	0033077

## Fuel Specifications and classes



EUROPEAN STANDARD	FINAL DRAFT
NORME EUROPÉENNE	FprEN 14961-1
EUROPÄISCHE NORM	
April 2009	
ICS 75.160.10	ISO supersedeas CEN/TS 14961:2008

English Version

**Solid biofuels - Fuel specifications and classes - Part 1: General requirements**

**Biomasse für die Erzeugung von Wärme und Strom - Teil 1: Allgemeine Anforderungen**

The draft European Standard is submitted to CEN members for unique acceptance procedures. It has been drawn up by the Technical Committee (CEN/TC 335).

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for granting this European Standard the status of a technical specification without any alteration.

This draft European Standard was developed by CEN in three official versions (English, French, German); a version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official version.

CEN members on the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Warning: This document is not a European Standard. It is drafted for information and comments. It is subject to change without notice and should be regarded as a draft European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre Avenue Marnix 17, B-1000 Brussels

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## Fuel Specifications and classes



This European Standard determines the fuel quality classes and specifications for solid biofuels. According to the mandate given for the standardisation work, the scope of the CEN/TC 335 only includes solid biofuels originating from the following sources:

- a) products from agriculture and forestry;
- b) vegetable waste from agriculture and forestry;
- c) vegetable waste from the food processing industry;
- d) wood waste, with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, and which includes in particular such wood waste originated from construction and demolition waste;
- e) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and heat generated is recovered;
- f) cork waste.

**NOTE 1** For the avoidance of doubt, demolition wood is not included in the scope of this European Standard. Demolition wood is "used wood arising from demolition of buildings or civil engineering installations" (CEN/TS 14588).

**NOTE 2** Aquatic biomass is not included in the scope of this European Standard.

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Fuel Specifications and classes



Biocombustíveis sólidos classificados segundo a:

- o Origem e matéria prima
- o Forma comercializável
- o Propriedades

Wood pellet	<b>Producer</b>	SAA Portugal Rua 102 P.O. Box 100, Avôndup PT +351 20 722 2940 E-mail: info@saa.pt
	<b>Origin and source</b>	1,2,12 Wood waste (SAA) (SAA) (SAA)
	<b>Traded form</b>	Final
	<b>Country and location</b>	Azambuja, Portugal
	<b>Normative (EN 14961-1)</b>	
	<b>Dimensions (mm)</b> (Length (L) and height (H))	D30 (D) min + 1mm (± 3.75 + 1 + 40 (D)H), H = 40 mm
	<b>Moisture</b> (% as received)	M10 (± 10 w%)
	<b>Ash</b> (% dry basis)	A0.7 (± 0.7 w%)
	<b>Mechanical durability</b> (% pellets after testing)	(M10) 3
	<b>Fines</b> (% < 3.15 mm)	F10 (1) w% at factory gate when mixing
	<b>Additives</b> (% of pressing mass)	< 1 w% (max)
	<b>Informative (EN 14961-1)</b>	
<b>Bulk density (kg/m³)</b>	D000 (± 100 kg/m³)	
<b>Net calorific value as received</b>	C4.7 (MJ/kg)	

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Fuel Specifications and classes



Table 4 — Specification of properties for pellets

<b>Master table</b>	
Origin According to 6.1 and Table 1	Woody biomass (1), Herbaceous biomass (2), Pean biomass (3), Starchy and molasses (4)
Traded Form (see Table 2)	Pellets
<b>Key</b>	 L Length    D Diameter
Figure 3 — Dimensions (mm)	
<b>Diameter (D) and length (L)<sup>1</sup></b>	
D 30	6 mm ± 1.0 mm and 3.15 ≤ L ≤ 40 mm
D 38	8 mm ± 1.0 mm and 2.15 ≤ L ≤ 40 mm
D 50	10 mm ± 1.0 mm and 2.15 ≤ L ≤ 40 mm
D 75	12 mm ± 1.0 mm and 3.15 ≤ L ≤ 50 mm
D 85	20 mm ± 1.0 mm and 10 ≤ L ≤ 60 mm
<b>Moisture, M (w% as received)</b>	
M10	± 10 %
M20	± 15 %
<b>Ash, A (w% as received)</b>	
A0.5	± 0.5 %
A0.7	± 0.7 %
A1.0	± 1.0 %
A1.5	± 1.5 %
A2.0	± 2.0 %
A3.0	± 3.0 %
A5.0	± 5.0 %
A7.0	± 7.0 %
A10.0	± 10.0 %
A15.0	± 15.0 %
<b>Mechanical durability, DM (w% of pellets after testing)</b>	
DM1.0	± 1.0 %
DM2.0	± 2.0 %
DM3.0	± 3.0 %
DM5.0	± 5.0 %
DM10.0	± 10.0 % (maximum value to be stated)
<b>Residual of fines, R (w% &lt; 3.15 mm after production when tested or packed)</b>	
R10	± 1.0 %
R2.0	± 2.0 %
R3.0	± 3.0 %
R5.0	± 5.0 %
R10.0	± 10.0 % (maximum value to be stated)
<b>Additives (w% of pressing mass)</b>	Type and content of pressing aids, slugging inhibitors or any other additives have to be stated
<b>Bulk density (kg/m³ as received) (kg/m³)</b>	
D000	± 100 kg/m³
D050	± 50 kg/m³
D060	± 60 kg/m³
D070	± 70 kg/m³
D070+	> 70 kg/m³ (maximum value to be stated)
<b>Net calorific value as received, (MJ/kg) or (kWh/kg)</b>	(Maximum value to be stated)

<b>Moisture, M (w% of dry basis)</b>		<b>Chemicals</b>
M0.5	± 0.5 %	Chemically treated biomass (1, 2, 3, 1.2, 2.2, 3.2, 3.2) or if ash containing additives have been used:  <b>Informative:</b> All fuels that are not chemically treated (see the exceptions above)
M0.75	± 0.75 %	
M1.0	± 1.0 %	
M1.5	± 1.5 %	
M2.0	± 2.0 % (maximum value to be stated)	
<b>Mechanical durability, DM (w% of dry basis)</b>		<b>Chemicals</b>
DM0.5	± 0.5 %	Chemically treated biomass (1, 2, 3, 1.2, 2.2, 3.2, 3.2) or if ash containing additives have been used:  <b>Informative:</b> All fuels that are not chemically treated (see the exceptions above)
DM0.75	± 0.75 %	
DM1.0	± 1.0 %	
DM1.5	± 1.5 %	
DM2.0	± 2.0 % (maximum value to be stated)	
<b>Residual of fines, R (w% of dry basis)</b>		<b>Chemicals</b>
R0.5	± 0.5 %	Chemically treated biomass (1, 2, 3, 1.2, 2.2, 3.2, 3.2) or if ash containing additives have been used:  <b>Informative:</b> All fuels that are not chemically treated (see the exceptions above)
R0.75	± 0.75 %	
R1.0	± 1.0 %	
R1.5	± 1.5 %	
R2.0	± 2.0 % (maximum value to be stated)	
<b>Informative: Ash melting behaviour (°C)</b> Deformation temperature, DT should be stated		

<sup>1</sup>Amount of pellets longer than 40 (or 50 mm) can be 5 w%. Maximum length for classes D05, D05 and D10 shall be < 45 mm.  
<sup>2</sup>Fines shall be determined by using the hand screening operation as described in CEN/TS 15216-1.

<sup>3</sup>The maximum amount of additive is 20 w% of pressing mass. Type stated (e.g. stearic) if present a greater than the material for pellet & listed.

## Fuel quality assurance Qualidade normalizada para peletes

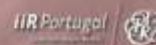


Três níveis de qualidade para os peletes:

- **A1**, comparável em qualidade com a norma DIN Plus
- **A2**, para mercados menos exigentes
- **B**, para a indústria

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## Fuel quality assurance Qualidade normalizada para peletes



Property <sup>1)</sup>	A Class		B Class
	1	2	
Origin and source	1, 1.3 and 1.2.1 <sup>2)</sup>	1, 1.2, 1, 1.3, 1, 1.4, 1, 1.5, 1.2.1 <sup>2)</sup>	1, 1, 1.2 and 1.3 <sup>2)</sup>
Dimensions: D and L	6 or 8 mm (L ≤ 40 mm)		6 or 8 mm (L ≤ 40 mm)
Moisture: M (w-%)	≤ 10%		≤ 10%
Ash: A (w-% d.b.)	≤ 2.5 % and ≤ 0.7 %	≤ 1.0 %	≤ 3.0 %
Mechanical durability	≥ 97.5 %		≥ 97.5 %
Fines: F (< 3.15 mm)	1 % at factory gate in bulk (transport and in small bags, up to 20 kg, when delivered to end user, 0.5% in small bags at factory gate)		
Bulk density: BD	≥ 600 kg		≥ 600 kg
Net calorific value: Q	≥ 16.5 MJ/kg (d.b. kWh/kg)		≥ 15.0 MJ/kg (d.b. kWh/kg)
Additives (w-% d.b.)	≤ 2 % if pressing used, type and amount of additive has to be stated		
Nitrogen: N (w-% d.b.)	≤ 0.2 %	≤ 0.2 %	≤ 0.3 %
Sulphur: S (w-% d.b.)	≤ 0.05 %		≤ 0.05 %
Chlorine: Cl (w-% d.b.)	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %
Ash melting behaviour: DT (deformation temperature)	> 1200 °C	≥ 1100 °C	≥ 1100 °C

<sup>1)</sup> 1.1) Softwood; 1.2) 1) Chemically untreated wood  
<sup>2)</sup> 1.1) 1) White pine, arbutus, cork; 1.1.2) Spruce; 1.1.4) Logging residues; 1.1.5) Bark; 1.2.1) Chemically untreated wood residues  
<sup>3)</sup> 1) Forest, plantation and other virgin wood; 1.2) By-products and residues from wood processing industry; 1.3) Used wood  
 w-% S, Cl and HCl are on a dry basis; F (see material is chemically treated biomass)  
 \* Additionally, pellet requirements were defined for AS, Cl, Cr, Cu, Pb, Hg, Ni, Zn

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- A norma é uma regulamentação estabelecida a nível europeu
- No entanto, só é aplicada através de um sistema de certificação
- O certificado EN plus foi criado pelo Instituto Alemão de Peletes (DEPI)



Os peletes vão ser os primeiros biocombustíveis certificados com reconhecimento em todos os países da União Europeia.

*Laboratório especializado em  
biocombustíveis sólidos do  
Centro da Biomassa para a Energia*

### Preparação da amostra



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### Ensaio realizados



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### Exemplos de resultados de análises realizadas a peletes

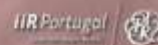


Peletes	Humidade %	Cinzas b.s. %	PCI MJ/kg	Densidade aparente kg/m <sup>3</sup>	Dimensões mm
Amostra A	7,5	0,66	17,2	620	D=6 ; 3,15<L<40
Amostra B	6,8	0,69	17,3	640	D=6 ; 3,15<L<35
Amostra C	8,2	3,9	17,3	720	D=8 ; 3,15<L<46
Amostra D	7,2	1,6	16,7	640	D=6 ; 3,15<L<45
Amostra E	6,0	4,6	17,0	690	D=6 ; 3,15<L<40



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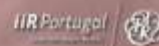
### Conclusões



- A garantia de fornecimento de biomassa de qualidade é fundamental para o crescimento do mercado
- Para garantir a disponibilidade de biomassa de alta qualidade para os consumidores são necessárias novas estruturas para a comercialização
- Regras transparentes na qualidade da matéria prima e nas suas especificações são necessárias para conquistar a confiança dos consumidores
- As normas europeias são a ferramenta apropriada para definir a qualidade dos biocombustíveis. As normas permitem que o produtor e o consumidor concordem com a qualidade que necessitam caso a caso

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## Desafios futuros...



Os novos desafios:

- A limitação da disponibilidade de resíduos limpos de madeira obrigam ao uso de novas matérias primas
- Investigação com novos materiais
- Propriedades químicas e físicas diferentes dos biocombustíveis levam a comportamentos na queima diferentes e a repensar os equipamentos existentes
- Redução de gastos energéticos na produção dos biocombustíveis

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Obrigada pela vossa atenção!



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