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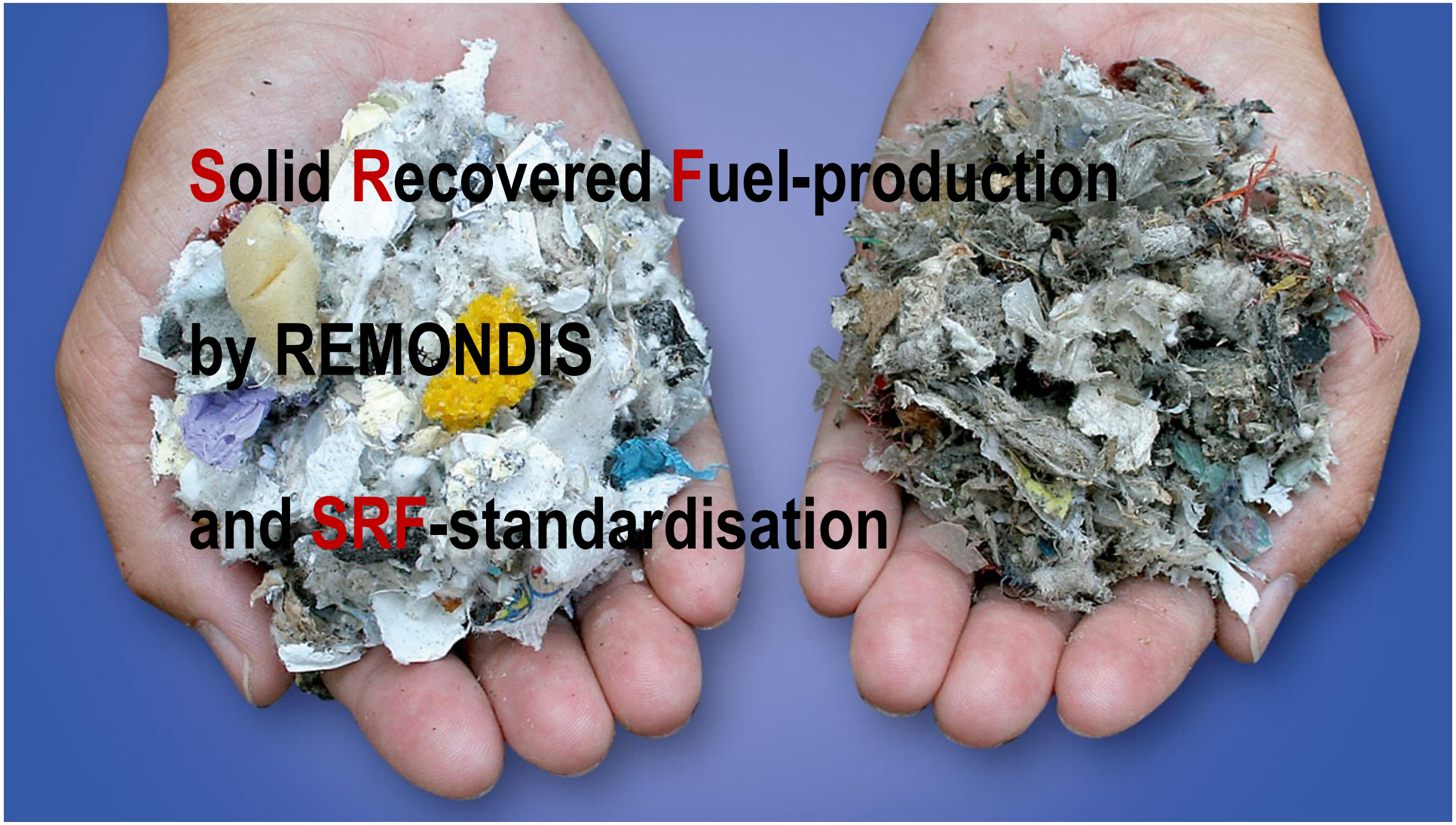

Solid Recovered Fuel-production

by REMONDIS

and SRF-standardisation

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Part 1:

SRF-production in Erftstadt (REMONDIS Rheinland)

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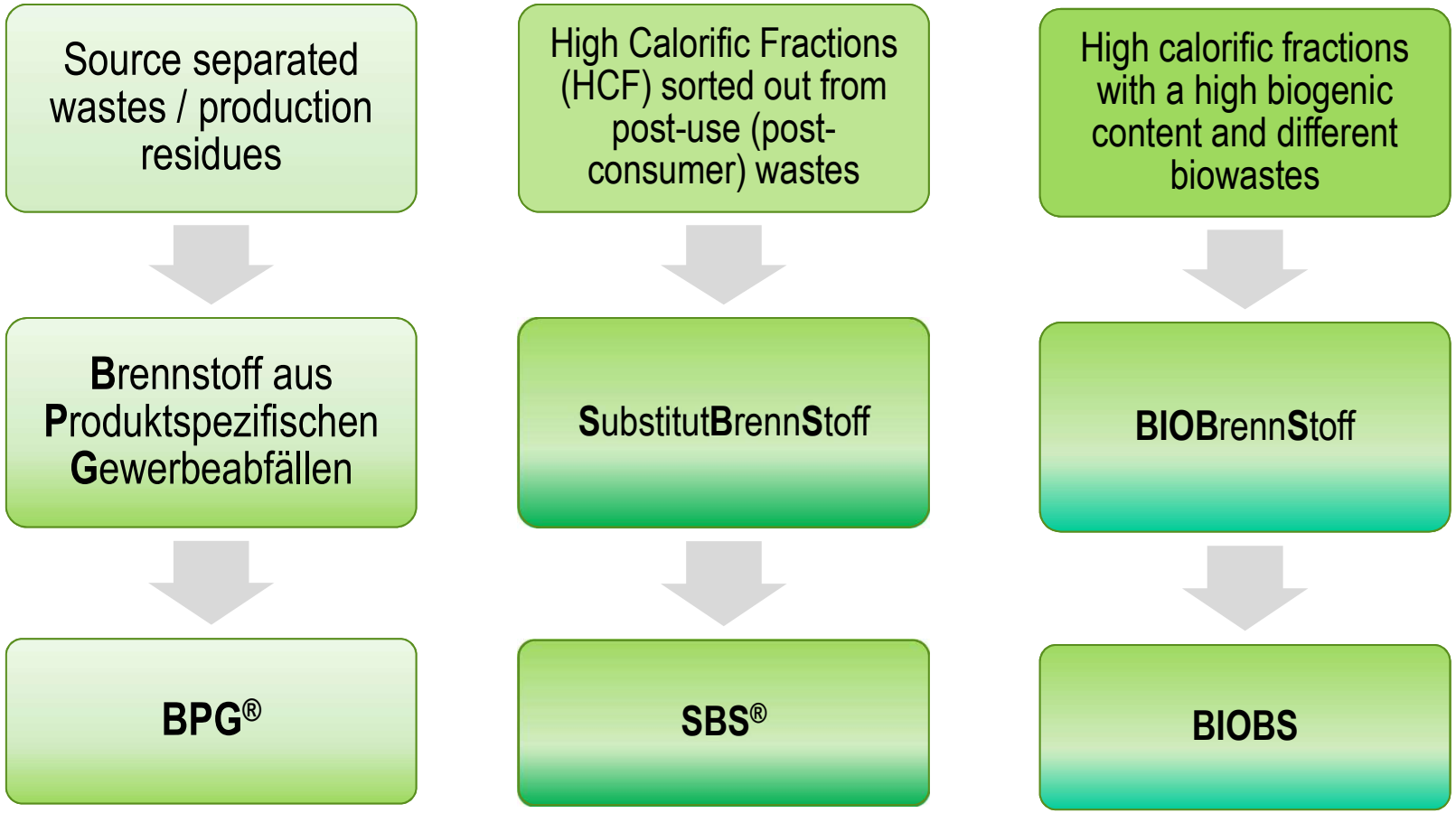
Three quality groups of SRF

since 1995/1998/2009



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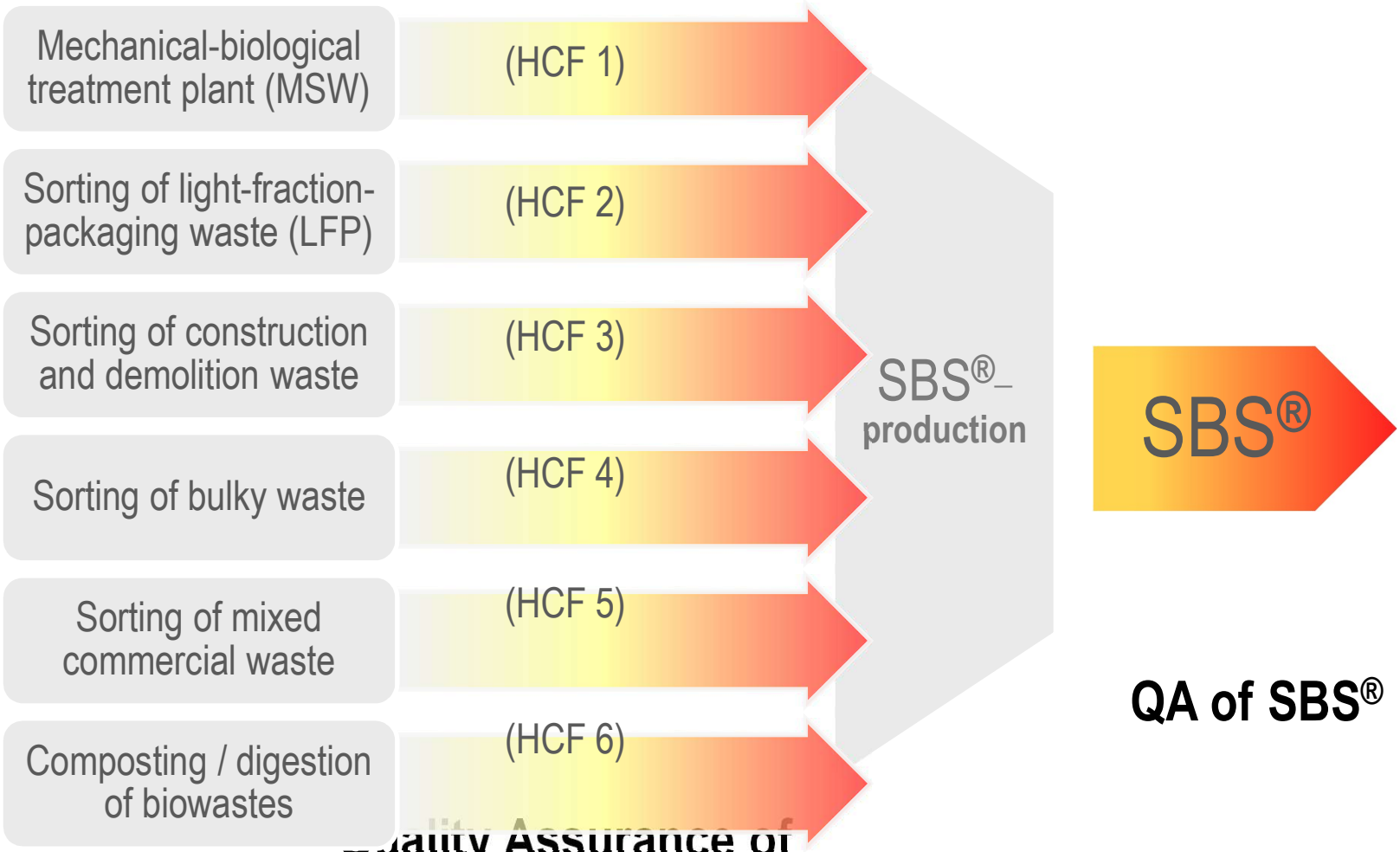
SRF-quality SBS®

input materials



High Calorific Fractions

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QMS

for the production of SRF in Erftstadt

Process-chain	QA-chain
Acceptance area	Input control
Positive sorting of HCF	Process control
SRF-production	Process control
SRF-storage	Product control: Internal and external

ISO 9001: ✔
EFB: ✔
RAL-GZ 724 and 727: ✔
CEN/TC 343: ✔

RAL GÜTEZEICHEN Sekundärbrennstoffe

RAL GÜTEZEICHEN Biogener Anteil Ersatzbrennstoffe Sekundärbrennstoffe

QMS is the fundament for reliable and high SRF-qualities

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Inline-analysis with Near-Infra-Red-device

improving SRF-quality: product stream - 100% = Inline (Online < 100%)

Additional tool of QM after positive results of TAMARA-trials within EU-project RECOMBIO (SRF-layer ca. 15 cm)

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Specifications of Solid Recovered Fuels

produced by REMONDIS Rheinland (04/2019)

REMONDIS® IM AUFTRAG DER ZUKUNFT		Specifications for Solid Recovered Fuels of REMONDIS		
Parameter	**Unit**	**BIOBS power plants (lignite)**	**SBS 1 cement kilns (calcinator) / power plants (lignite)**	**SBS 2 cement kilns / power plants (hard coal)**
NCV	MJ/kg	10 - 14	11 - 16	18 - 23
Cl	% of os	< 0,5	< 0,7	< 1,0
F	% of os	< 0,05	< 0,05	< 0,05
H_2O	% of os	< 40	< 35	< 20
S	% of os	< 0,5	< 0,5	< 0,5
Ash	% of os	< 25	< 20	< 15
Biogenic content	% of TC	> 75	> 60	> 20
As	mg/kg ds	< 10	< 10	< 10
Be	mg/kg ds	< 1	< 1	< 1
Cd	mg/kg ds	< 9	< 9	< 9
Co	mg/kg ds	< 12	< 12	< 12
Cr	mg/kg ds	< 120	< 250	< 250
Cu	mg/kg ds	< 400	< 1.000	< 1.000
Hg	mg/kg ds	< 0,8	< 1,0	< 1,0
Mn	mg/kg ds	< 400	< 400	< 400
Ni	mg/kg ds	< 50	< 80	< 80
Pb	mg/kg ds	< 150	< 250	< 250
Sb	mg/kg ds	< 50	< 60	< 100
Se	mg/kg ds	< 3	< 5	< 5
Sn	mg/kg ds	< 50	< 50	< 50
Te	mg/kg ds	< 2	< 2	< 2
Tl	mg/kg ds	< 1	< 1	< 1
V	mg/kg ds	< 15	< 20	< 20
heavy metal values for digestion with aqua regia in a closed microwave system, standards according to CEN/TC 343, statistical evaluation with 80th-percentile				
Dr.-Ing. Thomas Glorius			Spezifikation.xls, Stand: 17.04.2019	

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Qualities of SBS®1, SBS®2 and BIOBS

compared to Rhenish lignite (02/2022)

	Unit	Lignite from the Rhine, Mean (Berrenrath/Wachtberg)	SBS 1, Mean 2019 - 2022	SBS 2, Mean 2019 - 2022	BIOBS, Mean 2010 - 2013
Short analysis					
Net. Calorific Value	MJ/kg o.s.	10,1	14,4	22,7	11,9
H_2O	% o.s.	54	22,3	13,0	24,7
Ash	% o.s.	2,5	8,1	8,6	11,0
Chlorine	% o.s.	0,02	0,40	0,72	0,23
Volatile	% o.s.	23,5	47,2	67,3	52,7
Elementary analysis					
C (TOC + TIC)	% o.s.	30,5	37,3	48,2	32,5
H	% o.s.	2,2	4,9	6,6	4,1
O	% o.s.	10,3	25,2	22,5	26,2
N	% o.s.	0,4	1,7	0,9	1,2
S	% o.s.	0,2	0,16	0,13	0,1
Addtional parameters					
Biogenic C	% of TC	0	67,0	24,6	84,4
Chlorides	mg/kg d.s.	300	2.350	2.125	1.575
Al	mg/kg d.s.	750	4.120	10.000	4.700
K	mg/kg d.s.	215	2.100	1.475	3.190
Na	mg/kg d.s.	1.400	3.200	3.400	1.420
Pb (50th. Percentile)	mg/kg d.s.	1	50	45	45
Zn (50th. Percentile)	mg/kg d.s.	3,5	250	250	210

Classification codes according EN 15359 of SBS®1 and BIOBS: NCV: 4; Cl: 2; Hg: 1
SBS®2: NCV: 2; Cl: 3; Hg: 1

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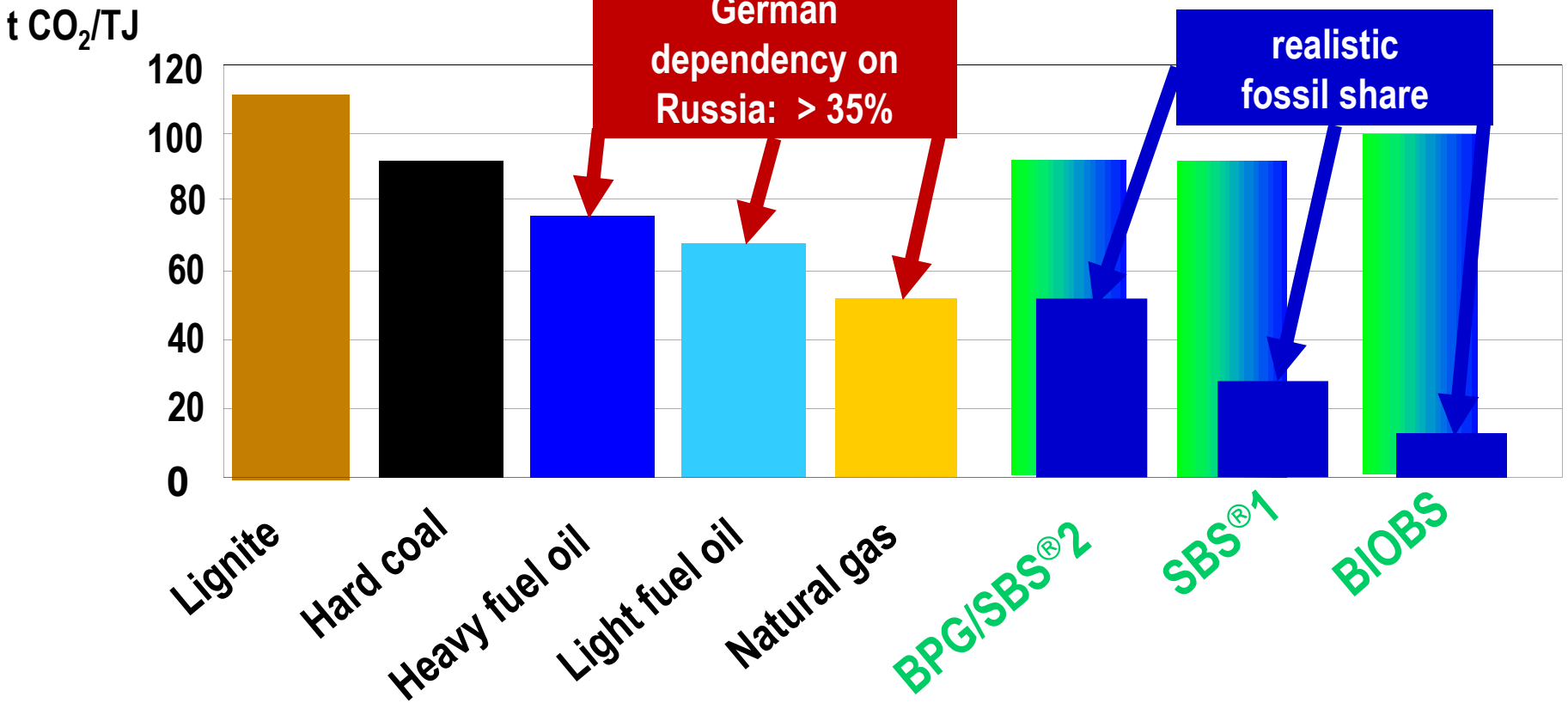
Energy specific CO_2-emissions

of different fuels



1.) CO_2-reduction: >= 1 t CO_2/t SBS1®, SBS2® or BIOBS (substitution of lignite)

Emission factors of SRF certified according to RAL-GZ 727

2.) **No import dependency of SRF**

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New LFP-plant in Erftstadt

close to SRF-production

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CO_2-reduction effect of ABA/AKEA Erftstadt

in comparison (source: EdDE-Dokumentation 13, PROGNOS/INFA, EU-project RECOMBIO and own calculations)

- The **combination of co-combustion, recycling and incineration (MSWI/WtE-plants)** guarantees **high CO_2-reduction effects**:

  case Erftstadt: **0,5 – 0,6 t CO_2/t** input waste (MSW/bulky waste) dependent on the share of recycling and the SRF-production rate

- compared to:
  - use of untreated MSW/bulky waste in MSWI:

    ca. 0,0 – 0,3 t CO_2/t waste
  - use of sorting residues in WtE-plants:

    ca. 0,2 – 0,4 t CO_2/t waste

Erftstadt is a positive example for very good combination of recycling, co-combustion and incineration.

CO_2-effect is dominated by recycling and co-combustion.

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Part 2:
SRF-standardisation:

Classification and specification of SRF (CEN/TC 343 and ISO/TC 300)

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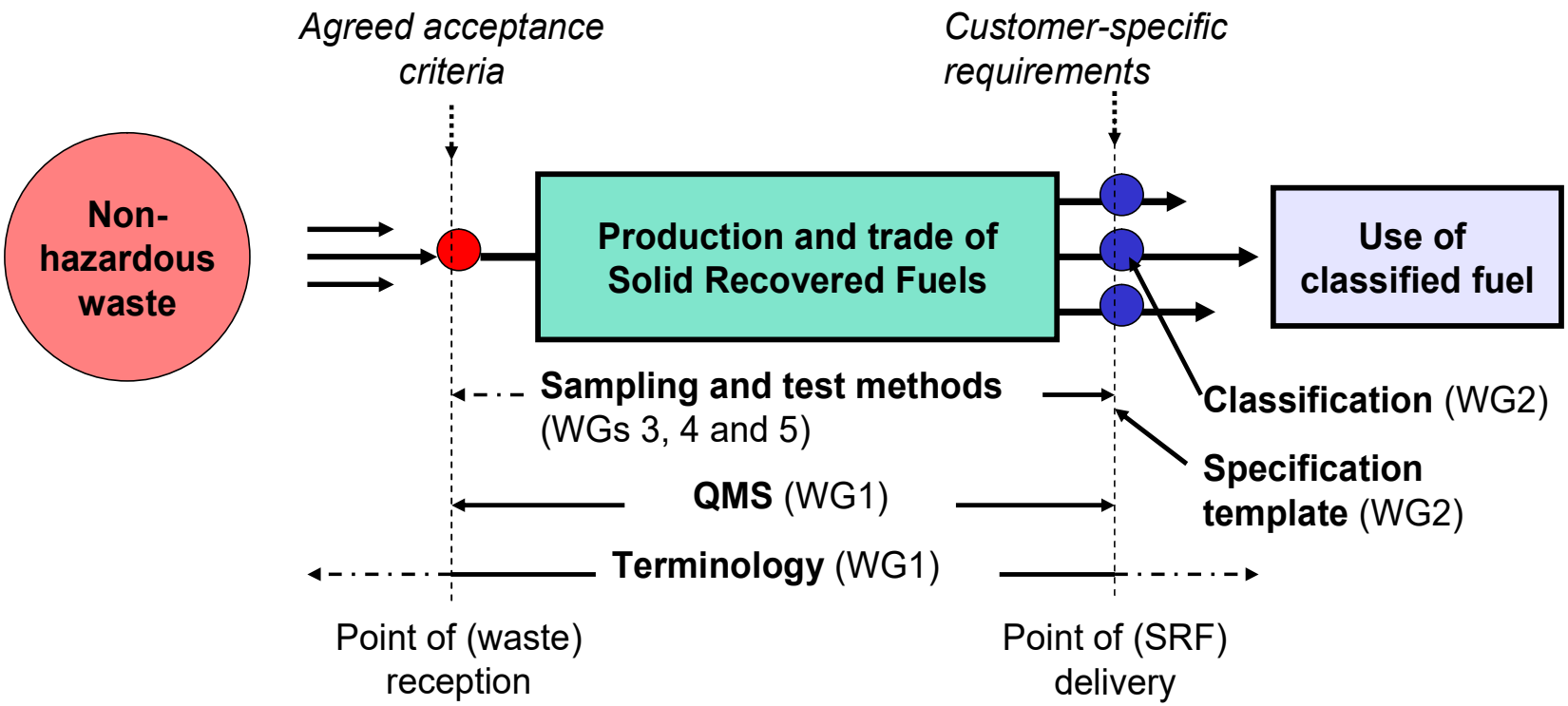
Business area

of CEN/TC 343

The Commission gave a mandate to CEN to develop **Technical Specifications** (TS) for SRF and further transform these technical specifications into **European Standards** (EN) by a public enquiry. The standardization activities related to **S**olid **R**ecovered **F**uels are combined and coordinated in the **CEN/TC 343** and related national mirror committees.



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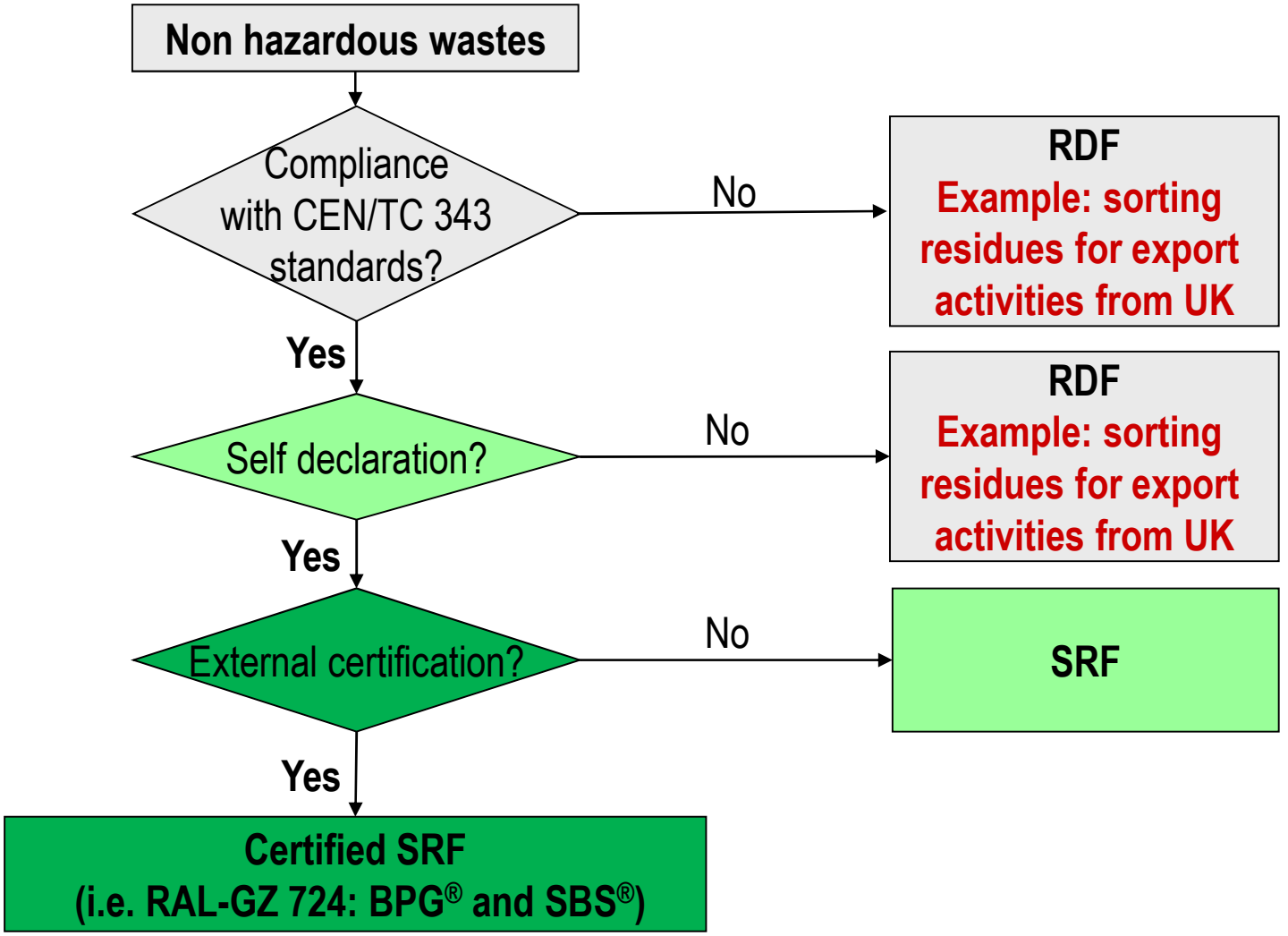
Definitions

RDF - SRF



RDF: no definition – SRF: compliance with EN 15359 (CEN/TC 343)

BREF Mechanical Treatment 2018, pages 306 - 307

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Classification of SRF

according CEN EN 15359 (2011)

3 parameter for classification with 5 classes each

Economy

Heating value (NCV)

MJ/kg ar, mean

≥ 25
≥ 20
≥ 15
≥ 10
≥ 3

Technology

Chlorine (Cl)

% of ds, mean

≤ 0,2
≤ 0,6
≤ 1,0
≤ 1,5
≤ 3,0

Environment

Mercury (Hg) mg/MJ

median	80thpercentile
≤ 0,02	≤ 0,04
≤ 0,03	≤ 0,06
≤ 0,08	≤ 0,16
≤ 0,15	≤ 0,30
≤ 0,50	≤ 1,00

Classification for fast comparison and as European/international framework – More detailed specifications for bilateral agreements

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Standardization, quality assurance and certification of SRF

Motivation and status 2022

- **Neutral assessment** of fuel quality ✓
- **Improvement** of **fuel-quality** (level and homogenity) ✓
- Useful tool for **communication** with users, authorities and public ✓
- **Increased acceptance** ✓
- Fundament for **positiv market developments** ✓
- **Faciliations** of
  - **national trading activities** ✓
  - **international trading activities** **partly**
- **CO_2-emission trading** (certified emission factors in t CO_2/TJ) ✓

(in Germany)

Although drivers for SRF (i.e. high CO_2-credit cost) are now functioning landfilling is still dominating in many MS

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Aspects of quality assurance for SRF

national – international

Clarified aspects	RAL-GZ 724 (Germany)	CEN/TC 343 (Europe)	ISO/TC 300 (global)
Input materials for production described?	EWC-numbers	EWC-groups	Waste groups
Kind of sampling ?	✓	✓	✓
Sample preparation ?	✓	✓	✓
Analytical standards?	✓	✓	✓
Limit values?	✓	no	no
Statistical evaluation?	✓	✓	✓
Classification system for all fuels?	no	✓	✓
Certification / external supervision obligatory?	✓	no	no

National and international standardisation activities are complementing each other and are improving understanding, acceptance, quality and sustainablility of Solid Recovered Fuels

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Classification of SRF

according ISO CD 21640 WD (2019) – WG 2

3 parameter for classification with 5 classes each

Economy

Heating value (NCV)

MJ/kg ar, mean

≥ 25

≥ 20

≥ 15

≥ 10

≥ 3

Technology

Chlorine (Cl)

% of ds, mean

≤ 0,2

≤ 0,6

≤ 1,0

≤ 1,5

≤ 3,0

Environment

Mercury (Hg) mg/MJ

median	80%percentile
≤ 0,02	≤ 0,04
≤ 0,03	≤ 0,06
≤ **0,05**	≤ **0,10**
≤ **0,10**	≤ **0,20**
≤ **0,15**	≤ **0,30**

Significant reductions for Hg-classes 3 – 5 compared to EN 15359 as a result of reduced Hg-values in wastes (i.e. sewage sludges) and improved detection limits of laboratories

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Summary and messages

with respect to SRF-perspectives

- European and global SRF-market will increase, as SRF`s
  - contribute to a significant CO_2-reduction of cement industry etc.
  - with RAL-GZ 724 and 727 are ecologically useful and sustainable
  - neither have a food-or-fuel problematic nor dependency on Russia
- REMONDIS is producing for existing markets and prepared for new markets
  - modern sorting technologies for challenging materials (MSW, LFP, …) are installed
  - longlasting experience with SRF-production
  - qualities according to the needs of the costumers
  - reliable QMS and high quality material (RAL-GZ 724 and 727)
  - additional application of Inline-analysis

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REMONDIS Erftstadt received the award

of the Environmental ministry of NRW for climate friendly activities (08/2017):

WIR SIND DABEI!
KlimaExpo.NRW
Motor für den Fortschritt

Thank you for your attention
and
let`s pray for peace