SRF: a practical example from the EU-project RECOMBIO:

Part 1: Project overview
Part 2: Production and use of BIOBS
Part 3: Back-up

Part 1:

Project overview

Aims/targets
of RECOMBIO

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- Combined use of bio-residues and SRF
  - Enlarged fuel basis
  - Increased **flexiblity** of fuel-producers and users
  - Improved **combustion behaviour** of fuel mixture
- Creation of **regional fuel markets**
- **High efficient combined heat and power generation** and **high availability** using bio-residues and SRF in CHP-plants (> 7.500h/a)
- Generating substantial **transfer guidelines** for new applications by long-term assessment of high efficient CHP technologies
- Demonstration of a **sustainable** and short-term available **fuel production and utilisation** chain for bio-residues and waste
- Cost-effective CO_2-reduction

Technical aspects/ideas
of RECOMBIO

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- Definition and optimization of **critical fuel parameters** (K, Na, Cl, ...)
- Technical measurements to **reduce inorganic and organic Cl** within fuel-production (improved NIR-systems)
- Technical measurements to **maximize Fe-/NF-separation** within SRF-and bio-residue production
- **On-line** and high speed **analysis** for key parameters (i.e. Cl, H_2O, NCV)
- Implementation and assessment of CEN-TC 343 and CEN-TC 335-methods and standards
- **Appropriate** QMS for biomass and SRF
  - production
  - use (HCl-raw-gas and/or on-line corrosion measurement)

Project RECOMBIO

Partners

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•	REMONDIS	SRF/biofuel-production + coordination
•	RWE Power	Biofuel/SRF-use
•	University Stuttgart (IVD and KIT)	lab. and full scale measurements
•	Forschungszentrum Karlsruhe	lab. and full scale measurements
•	ECN	ash properties, corrosion, fuel characterisation
•	L & T	SRF/biofuel-production
•	Stora ENSO	Biofuel/SRF-use
•	VTT	lab. and full scale measurements
•	Metso	additives, corrosion
•	TiTech (Norway)	optical sorting technology (NIR)
•	JRC (Belgium)	Life Cycle Analyses
•	Turow (Poland)	dissemination

Total funding: 4,04 Mio €

Project RECOMBIO

Target area in terms of electric efficiency and steam temperature

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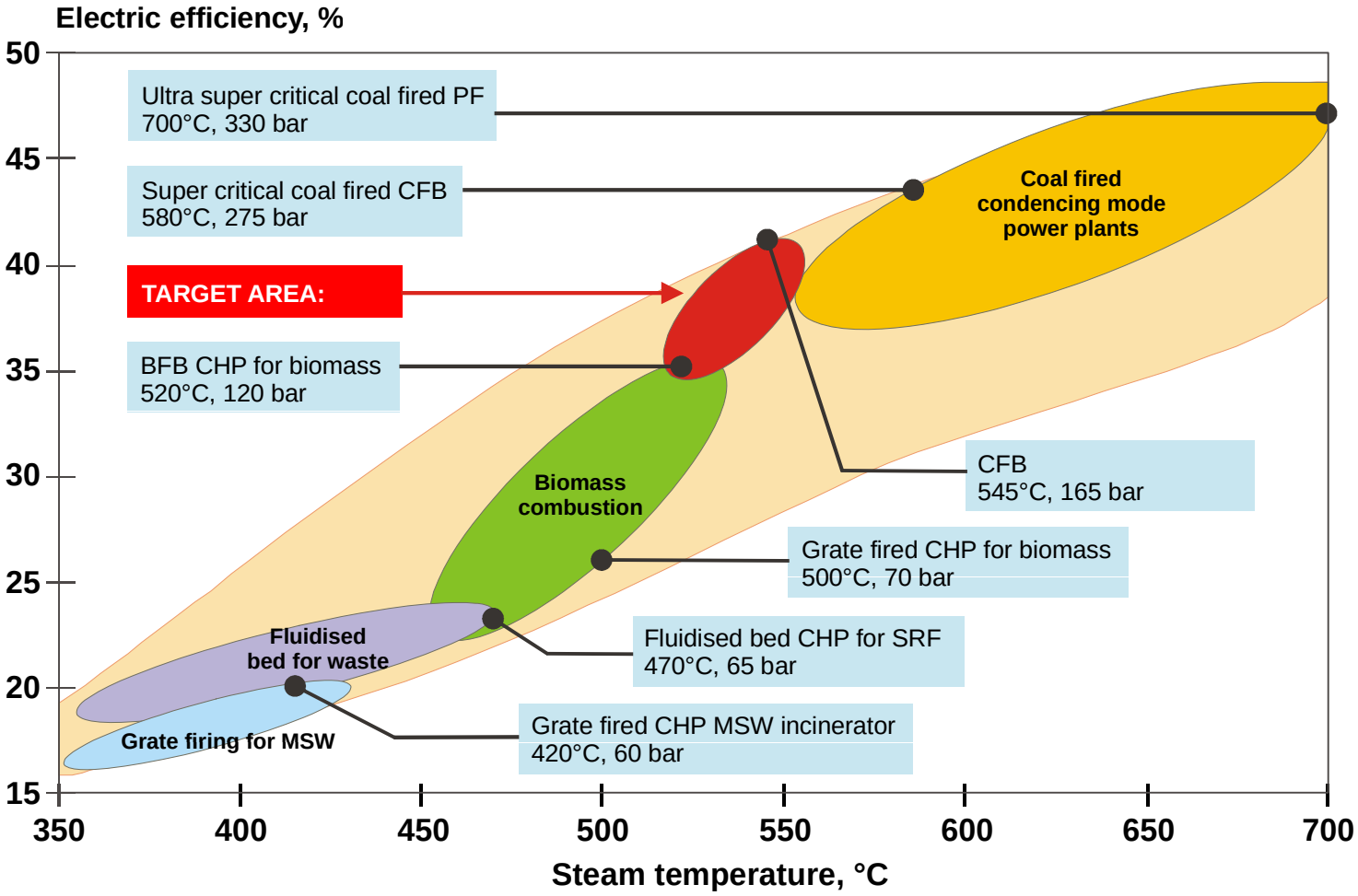

Target area: efficiency > biomass plants and >> MSWI

Part 2:

Production and use

of BIOBS

Three quality groups

since 1995/1998/2009

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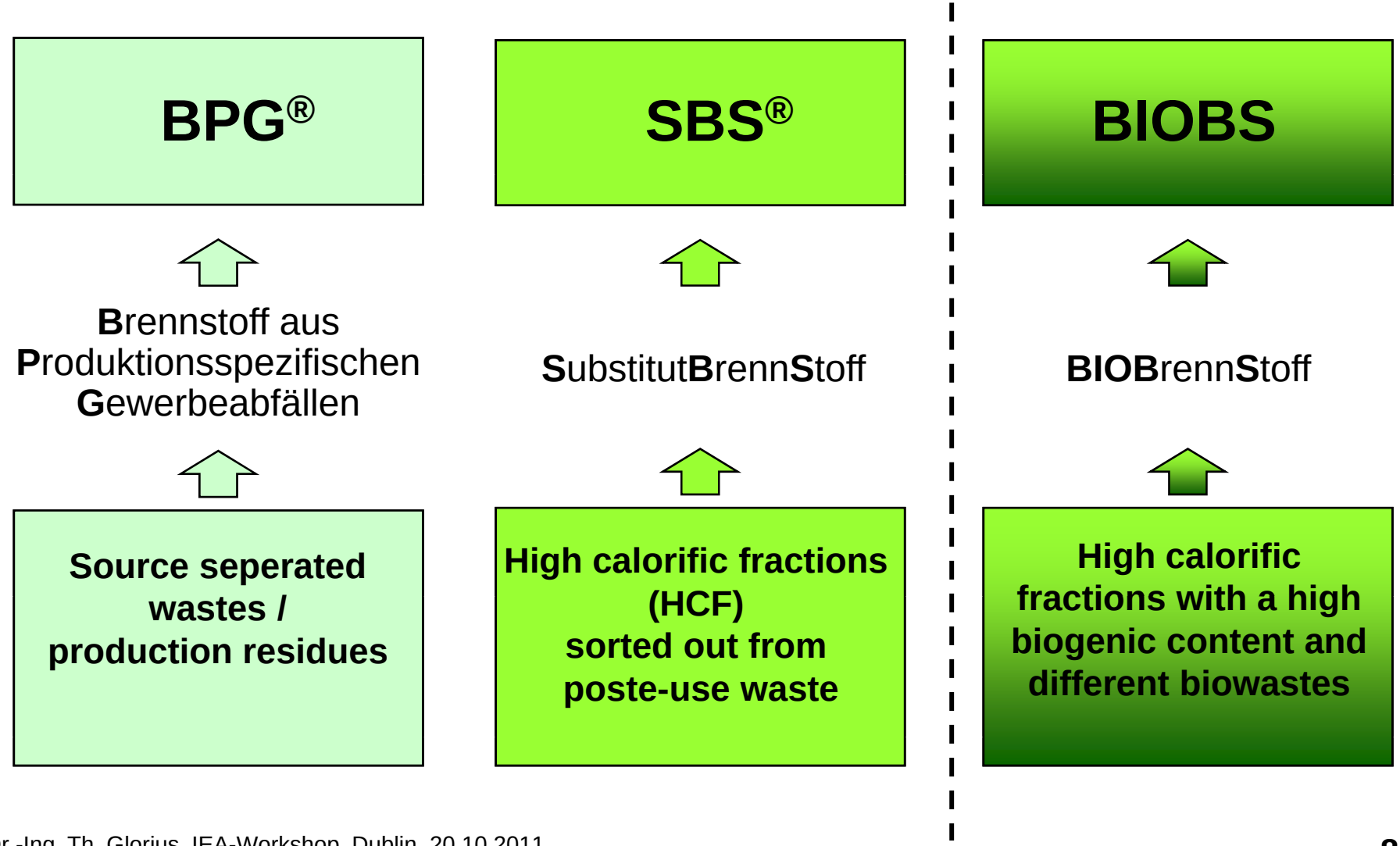

Input materials
for BIOBS

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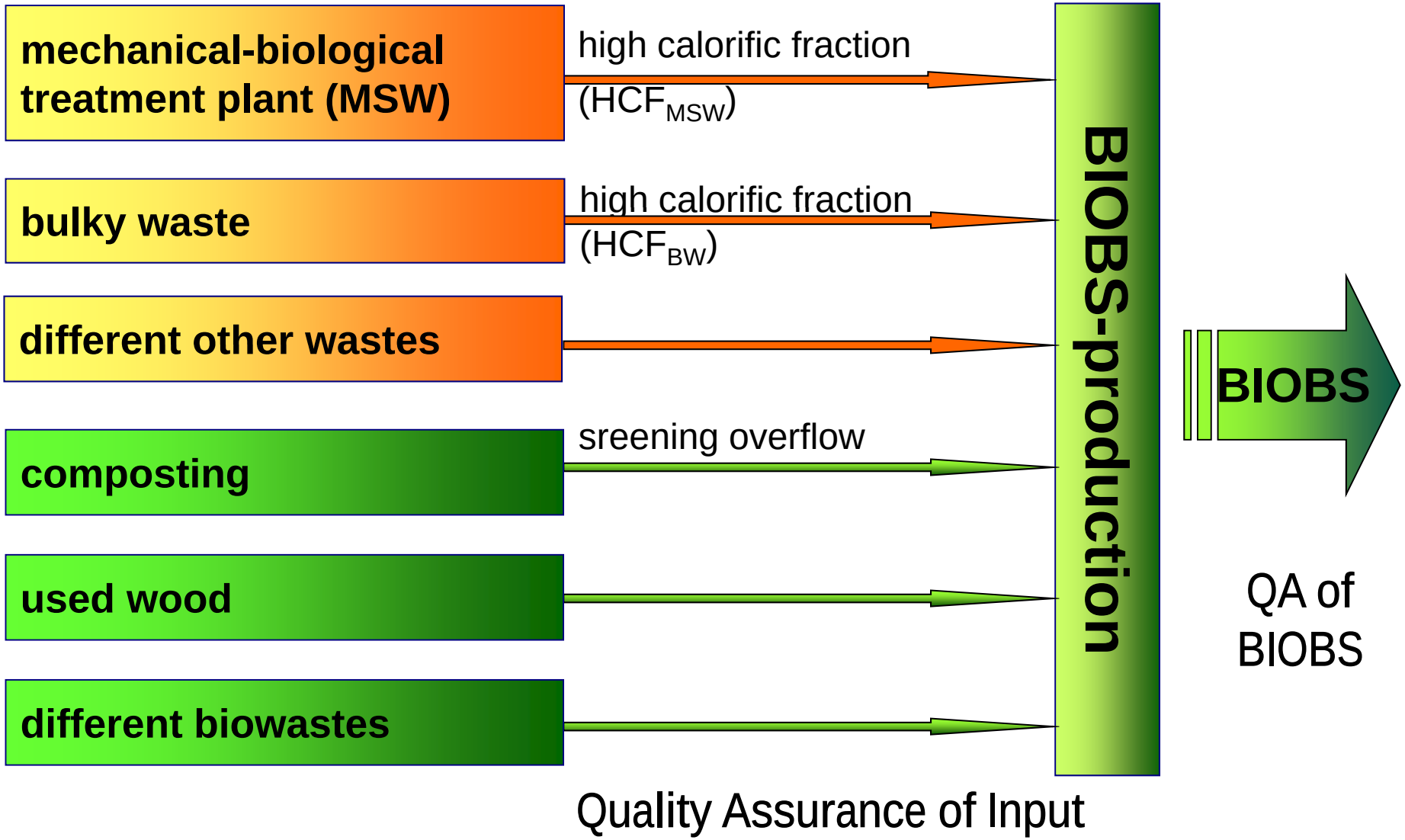

Waste treatment center VZEK, Erftstadt

Flow-sheet for BIOBS-production (11/2010)

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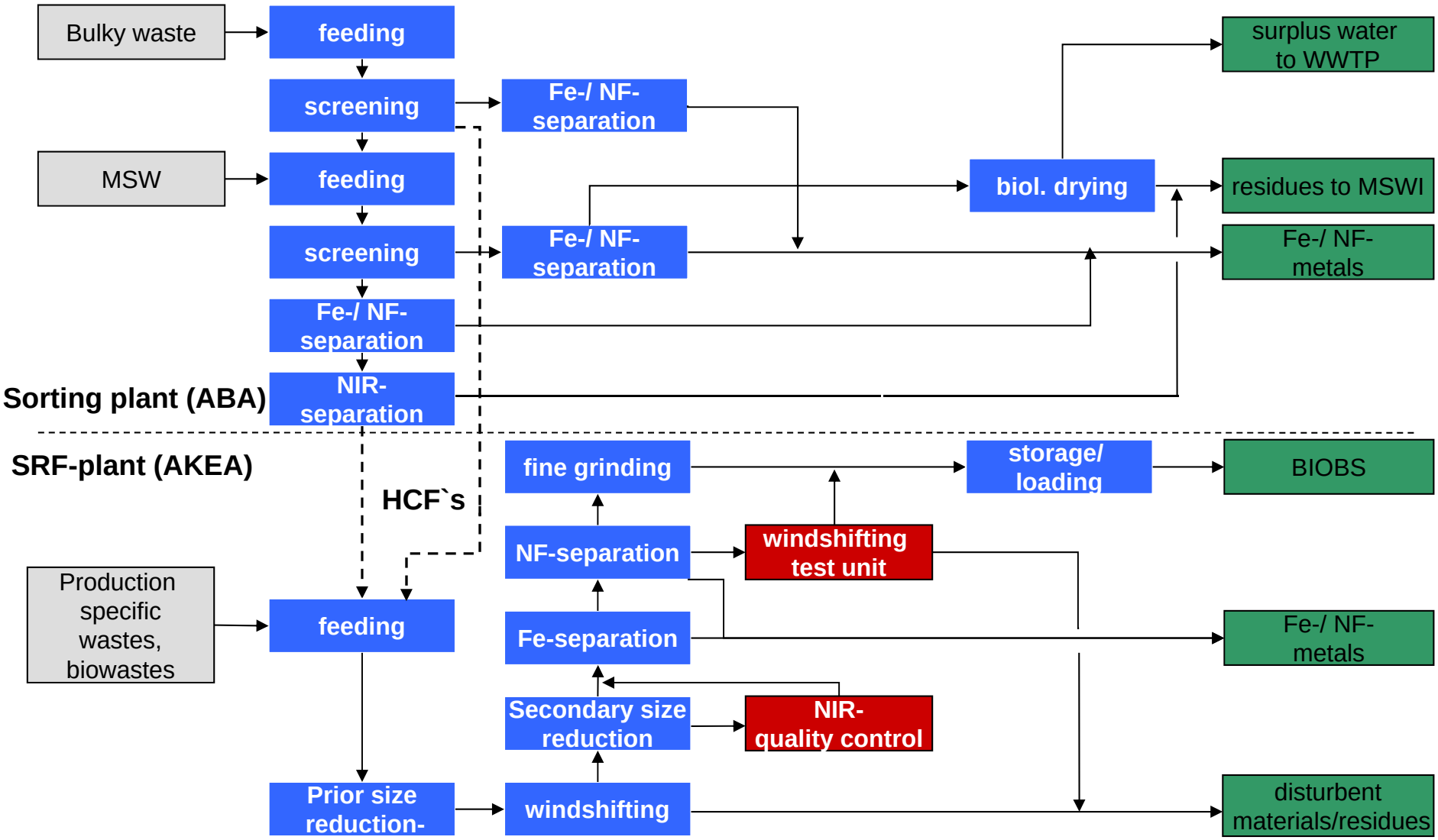

HCF-Sorting with NIR-systems

key technology for low-chlorine SRF

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Quality/product control according RAL-GZ 724 and prEN 15442

Sampling behind last step of size reduction

Regular sampling during production
Analysis of H_2O in the plant

Single samples are combined to 500-Mg-mixed-samples,...

Delivery to the customer

Every 1.500 Mg additional parameters are analysed:

UCL

Analysis report – Number ...
1.500-Mg-analysis
for BPG® and SBS®
Parameter:
ds, H_2O, Cl, Ash, NCV, F, ...
HM Group I-III:
As, Be, Cd, Co, Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Te, Tl, V, Zn
Ash:
Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, Na_2O, P_2O_5, SiO_2, SO_3, TiO_2, ZnO

... and are analysed by an external laboratory :

UCL

Analysis report – Number ...
500-Mg-analysis
for BPG® and SBS ®
Parameter:
ds, H_2O, Cl, Ash, NCV
+ 2 HM (changing monthly)

QMS

for the production of BIOBS in Erftstadt

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Process-chain	QA-chain
Acceptance area	Input control
Positive sorting of HCF	Process control
SBS®-Production	Process control
SBS®-Storage	Product control: Internal and external

ISO 9001: ✔

EFB: ✔

RAL-GZ 724: in preparation

CEN TC 343: ✔

Online-analysis with NIR-device

chlorine, water and NCV (bypass)

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Calibration activities ongoing, first promising results
(i.e. in comparision to raw-gas HCl-measurements)

Windshifting

test device and heavy fraction

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Intentions:

1.) Reduced energy consumption

2.) Improved SRF-quality (Cr, Cu, Ni, ...)

3.) Increased recycling rate

Quality of SBS®1$_{Erftstadt}$ and BIOBS

compared to Rhenish lignite (incl. 09/2011)

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	Unit	Lignite from the Rhine (Inden), Mean	SBS 1, Mean 2009 - 2010	BIOBS, Mean 2009 - 2010	BIOBS, Mean 2011
Short analysis					
Net. Calorific Value	MJ/kg o.s.	8,15	13,5	11,8	11,4
H_2O	% o.s.	58,8	25,2	26,8	23,6
Ash	% o.s.	3,0	9,2	9,9	12,8
Chlorine	% o.s.	0,02	0,38	0,26	0,2
Volatile	% o.s.	53,8	53	48	49,5
Elementary analysis					
C_{org}	% o.s.	24,8	33,9	32	32
H	% o.s.	2,2	4,6	3,6	3,6
O	% o.s.	10,6	23,4	25	25,5
N	% o.s.	0,4	1,6	1,3	1,1
S	% o.s.	0,2	0,18	0,2	0,2
Addtional parameters					
Biogenic C	% of TOC	n.a.	71	82,2	86,9
Chlorides	mg/kg d.s.	n.a.	2.050	2.100	1.365
Al	mg/kg d.s.	n.a.	4.375	5.100	6.400
K	mg/kg d.s.	n.a.	2.360	4.250	2.850
Na	mg/kg d.s.	n.a.	2.670	1.670	1.370
Zn	mg/kg d.s.	n.a.	370	205	210

Classification code according prEN 15359 of SBS®1 and BIOBS: NCV: 4; Cl: 2; Hg: 1

Energy specific CO_2-emissions
of different fuels

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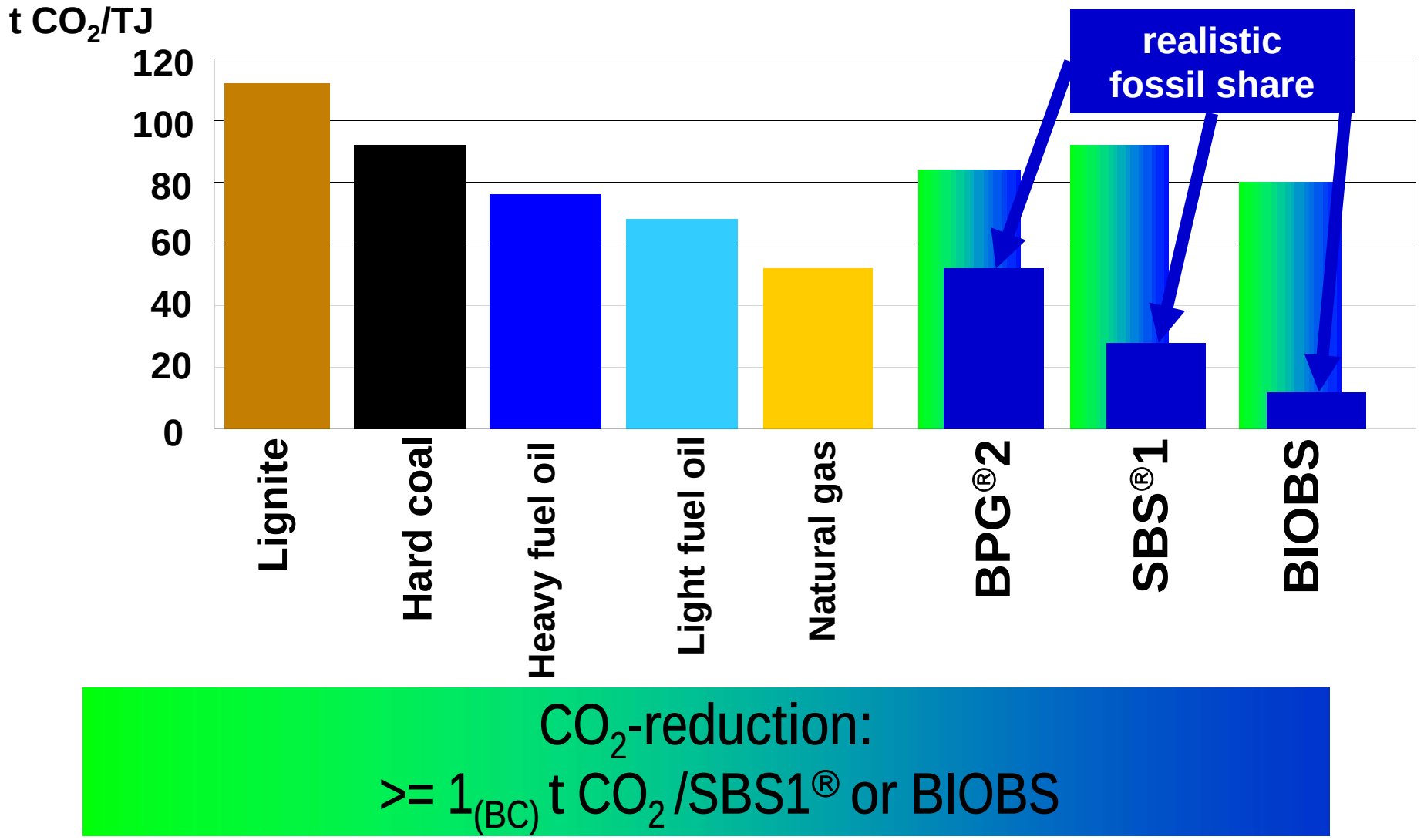

Development of annual SRF-production

in Erftstadt (AKEA: BPG®, SBS® and BIOBS)

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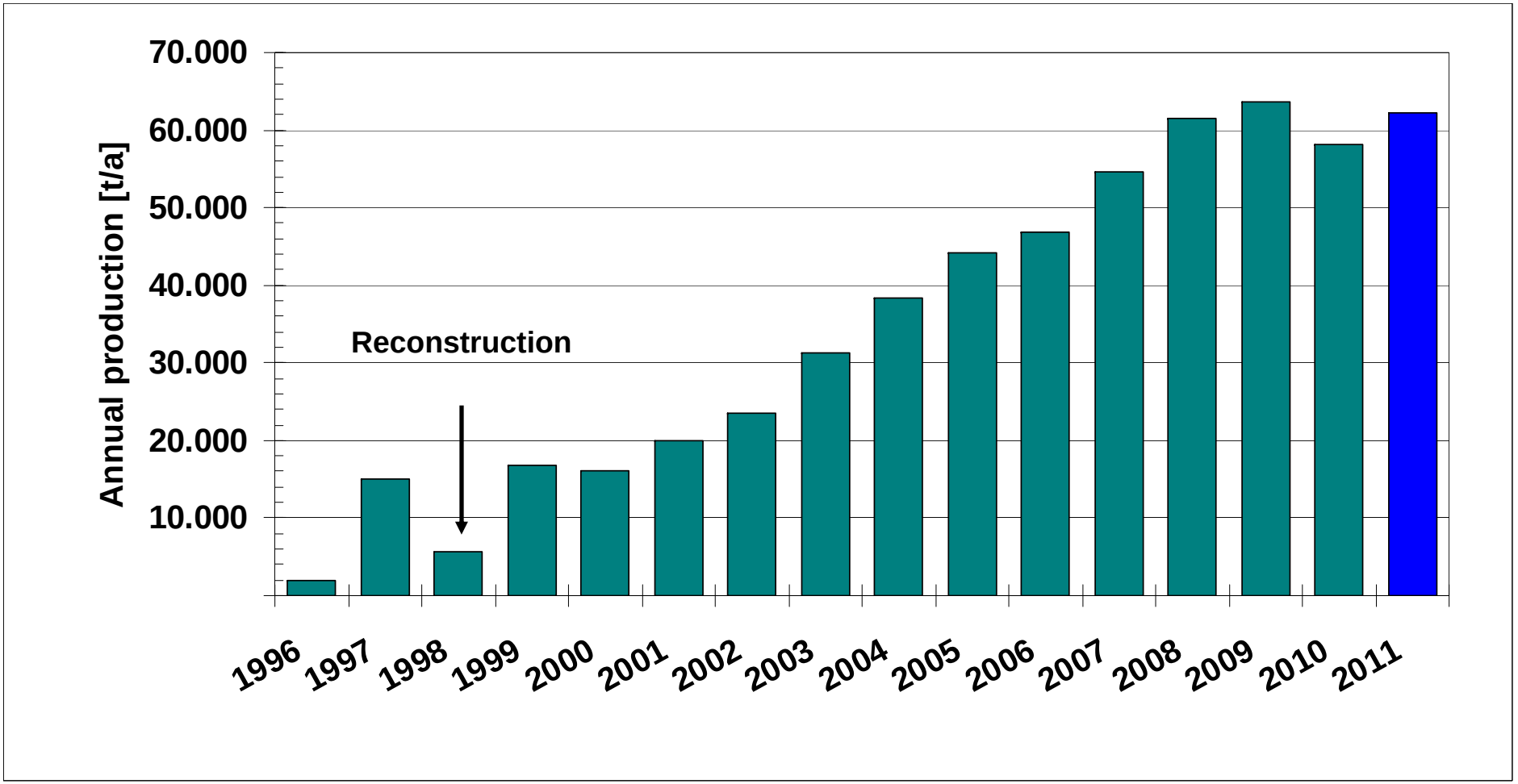

Total production since 1996: ca. 560.000t

Summary

activities so far

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- Regular SRF-production in Kerava (L&T) and Erftstadt (REMONDIS)
- Installation/operation of NIR-online-measurement device in Kerava and Erftstadt
- Installation of windshifting-test device in Erftstadt
- Preparation of an additional fuel-storage for BIOBS in Erftstadt
- Accompayning research of RECOMBIO-partners (ECN, IFK, KIT, TITECH, VTT, ...) to study corrosion risk and necessity of additives (METSO) for power plants of Wachtberg (RWE) and Anjalankoski (STORA)
- BIOBS fuel-delivery:
  - ca. 5.000t in 2010 to CHP-plant Berrenrath of RWE Power
  - ca. 8.000t in 2011 to CHP-plant Wachtberg of RWE Power (ca. 10% thermal share)
- Activities to improve new SRF-feeding device in CHP-plant Wachtberg
- Preparations in Anjalankoski to achieve a substitution level of 50%
- Data collection for LCA (JRC) and dissemination (PGE-ElTurow)

Planned

activities 2011-12 in Germany

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- Extension of input-materials for BIOBS-production
- Increased BIOBS-production:
  - ca. 15 - 20.000t/a in 2011
  - ca. 30 - 40.000t/a in 2012
- Evaluation of the use of NIR-online measurement device
- Installation of two stationary windshifters (2 x 10t/h)
- Regular and stepswise increased BIOBS-delivery to CHP-plant Wachtberg up to 25% incl. 6% sewage sludge

Planned

activities RECOMBIO Finland 2012

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Production and use of ca. 75.000t SRF = 50% thermal share

at Stora Enso, Anjalankoski

Part 3:

Back-up

Business areas
of CEN/TC 343

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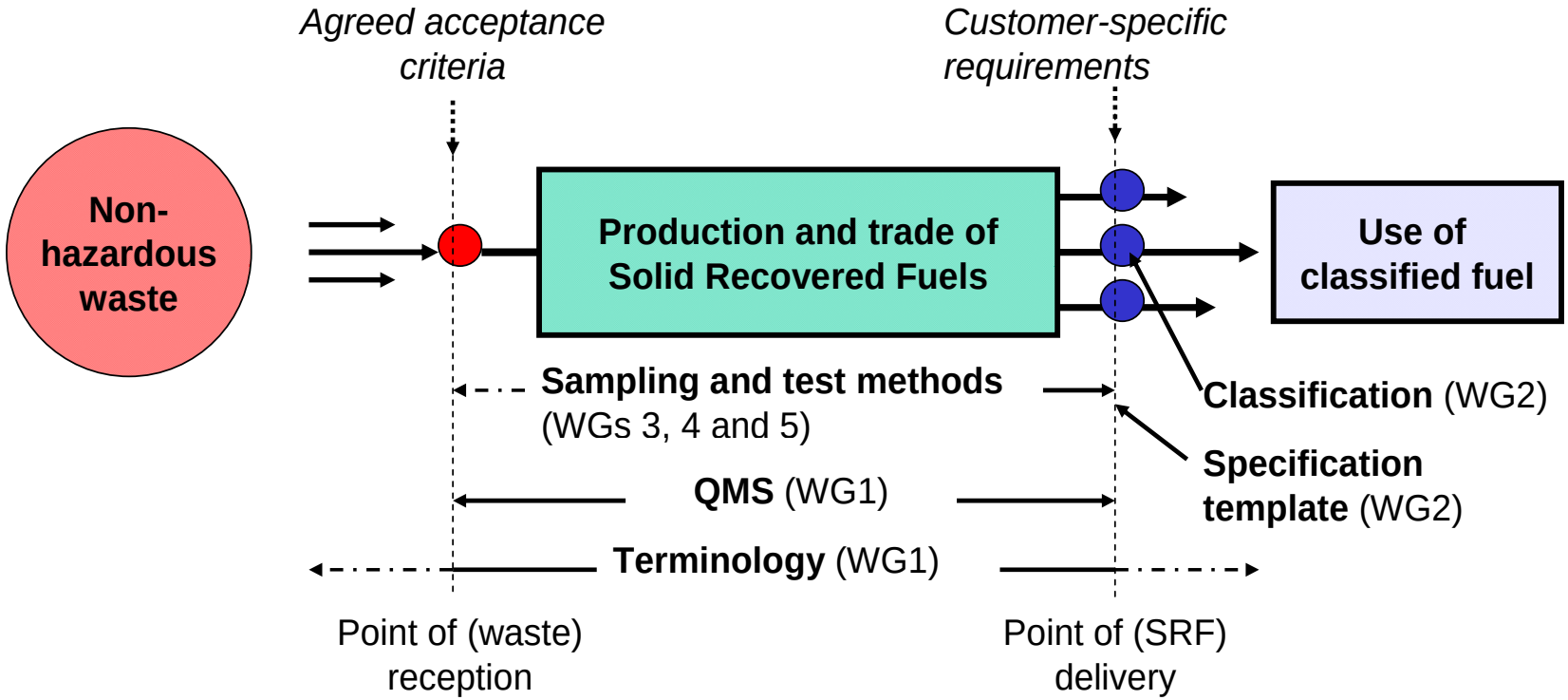
The Commission gave a mandate to CEN to develop **Technical Specifications** (TS) for SRF and further transform these technical specifications into **European Standards** (EN) by a public enquiry. The standardization activities related to **S**olid **R**ecovered **F**uels are combined and coordinated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



Classification of SRF

according CEN TC 343

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3 parameter for classification with 5 classes each

Economy	Technology	Environment	
Heating value (NCV)	Chlorine (Cl)	Mercury (Hg) mg/MJ	
MJ/kg, af mean	%-wf, mean	median	80%percentile
≥ 25	≤ 0,2	≤ 0,02	≤ 0,04
≥ 20	≤ 0,6	≤ 0,03	≤ 0,06
≥ 15	≤ 1,0	≤ 0,08	≤ 0,16
≥ 10	≤ 1,5	≤ 0,15	≤ 0,30
≥ 3	≤ 3,0	≤ 0,50	≤ 1,00

Classification for fast comparision – Specification for bilateral agreements

Definitions

RDF - SRF

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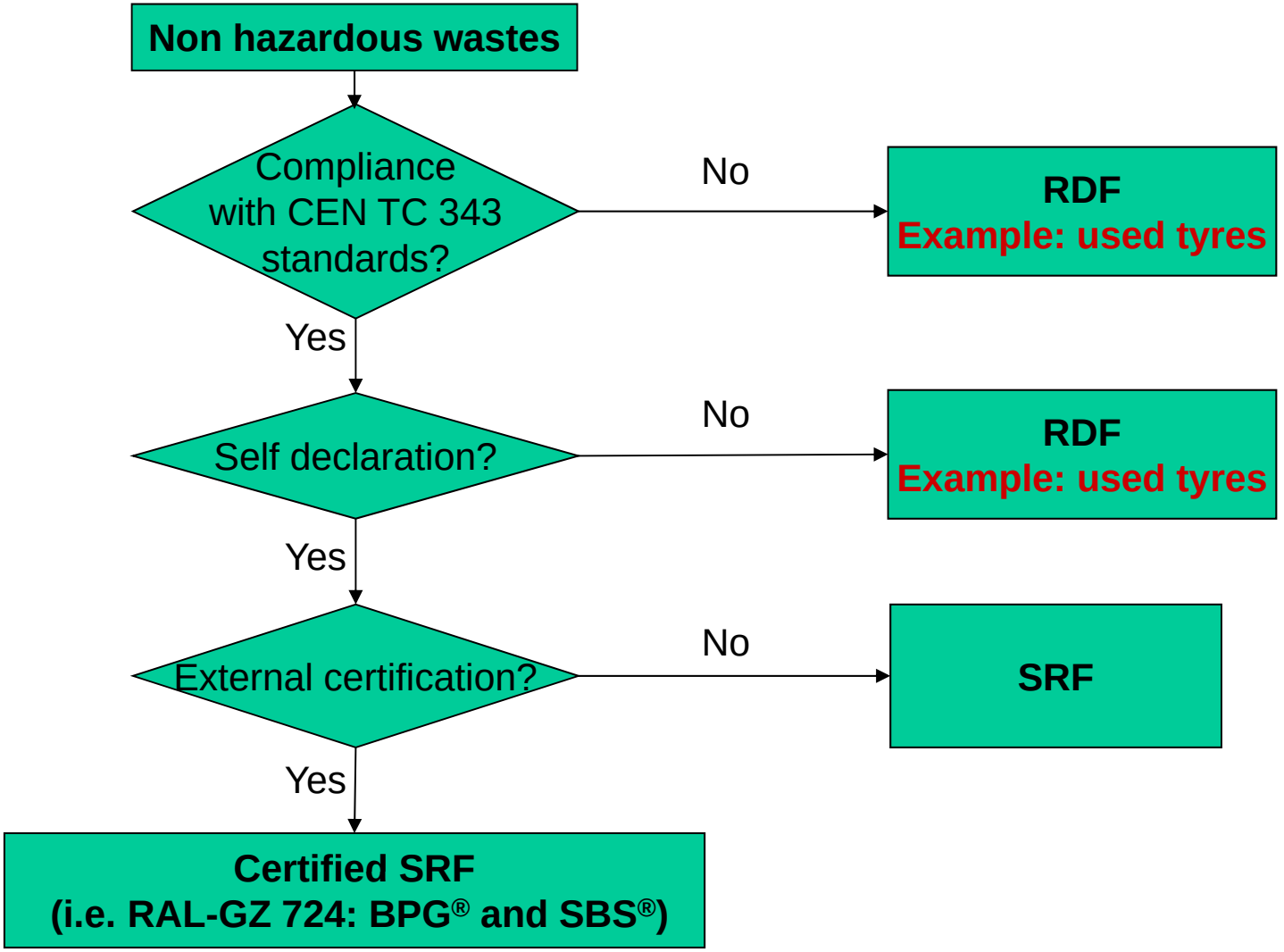

History of SRF

Main steps I

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- Energy crisis 1973/74 and 1979/1980:
  - Efforts to produce RDF from 1980 – 1990
  - Insufficient quality
  - No sustainable market development
- Development of two new generations of alternative fuels BPG® and SBS® since 1995 by TRIENEKENS/REMONDIS
- Increasing interest of cement/lime industry
- Foundation of the „BundesGütegemeinschaft Sekundärbrennstoffe e.V.“ in 1999 i.e. to increase the acceptance of SRF`s

History of SRF

Main steps II

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- Support of the European standardization work of CEN TC 343 for SRF`s by BGS since 2002
- EU-project RECOFUEL 2004 - 2008
  - Consortium: 12 partners from 6 countries
  - Coordinator: REMONDIS
  - Aim: Build up a sustainable SRF-production and SRF-use in power plants
- Contribution of several BGS-players within the EU-project QUOVADIS 2005 - 2007 to validate the CEN TC 343 standards
- EU-project RECOMBIO 2010 – 2012
  - Consortium: 12 partners from 6 countries
  - Coordinator: REMONDIS
  - Aim: High-efficient use of SRF`s with increased biogenic content in CHP-plants
- Volume of the SRF-market in Germany 2010 ca. 6,0 Mio Mg/a

Status of QMS

according RAL-GZ 724 and RAL-GZ 727 (05/2011)

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- Until now 16 awards RAL-GZ 724 given:
  - of which 5 to REMONDIS,
    - of which 2 to Erftstadt for BPG® and SBS®
- 2010 ca. 300.000 Mg/a of RAL-certified SRF`s
- Increasing consideration of the BGS-work and the RAL-quality within authorisation procedures of the users (facilitations)
- The work of BGS is a substantial contribution for a sustainable SRF-market

Market development of SRF`s in Germany

based on production specific wastes and HCF`s (10/2011)

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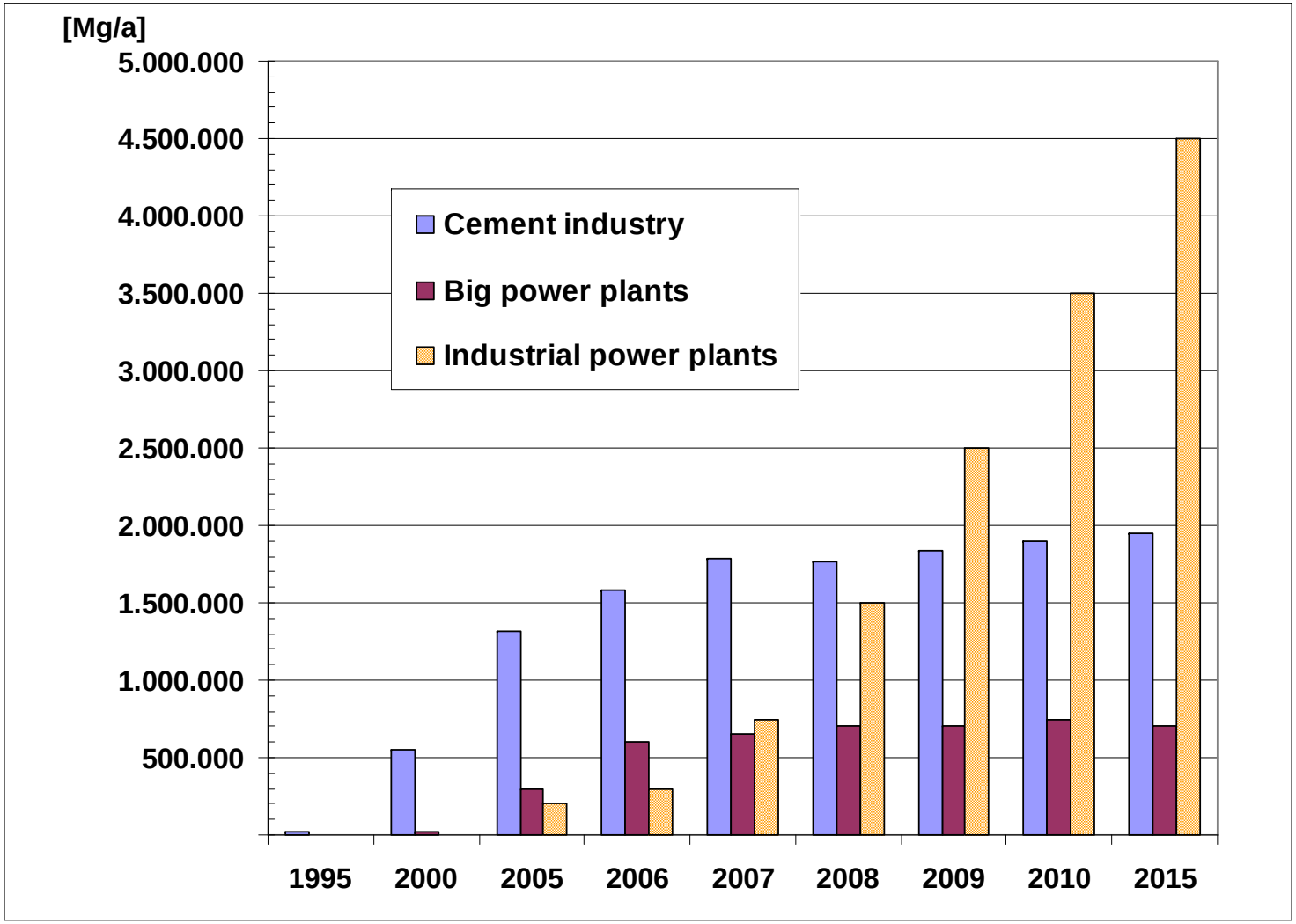

Cement/big power plants stable – dominating industrial power plants

Arguments
to produce SRF

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- Positive effects on employment
  - securing existing jobs (cement-/lime-/power plants)
  - creating new jobs (sorting/SRF-production, > 3 working places/million € invest (reference Germany)
- Cheep technology compared to MSWI
  - low risk of indebtedness
  - low capital lockup (< 1/5, reference Germany), no „chains“
- High efficiency and high CO_2-reduction effect: important contribution to a sustainable energy supply
- Stepwise realisation possible
  - first BPG®
  - later SBS®

Recommendations

to develop a sustainable SRF-market

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- Governmental activities:
  - Implementation of a gradually increasing landfilling tax
  - Support of energy-efficient technologies (CHP, ...)
- Producers:
  - Activities to achieve/increase acceptance i.e. reliable QMS – and certification of SRF
- Producers and users:
  - Intensive cooperation
  - Information of public

Development SRF-co-combustion

depending on

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- Interest of cement/lime industry and electricity/steam producers (fuel market, CO_2-market, ...)
- Acceptance by public, politicians, ... (standardisation/information activities)
- Technical facts of a power plant (steam parameters, burners, after burning grid, flue gas cleaning devices, ...)
- Coal quality (S-, Cl-content, Na-, K-values, ...)
- SRF-qualities (NCV, S, Cl, Chlorides, Na, K, Al, Hg, ...)
- SRF-availability (situation of waste-management-industry)
- Communication/partnership between SRF-producer and SRF-user
- ...

Outlook

on european/international SRF-/RDF-market

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- Regional over-capacities of thermal plants i.e. in Germany as a consequence of
  - incorrect planning (developments of the energy sector have not been considered)
  - lacking prosecution of dubious activities (pretended valorisation/utilization)
  - export of untreated wastes
- Resulting competition (in Germany since 2008) of waste-to-energy plants (located near users of steam running in combined heat-power mode) with
  - MSWI-plants
  - Co-incineration of SRF
- Possible complementation of waste-to-energy-plants and co-incineration of RDF/SRF i.e. in new member states of EU, Africa, Asia, America, ...
  - waste-to-energy plants can profit by the (QA-)experiences of co-incineration (i.e. Cl)
  - waste-to-energy plants do not need high-quality SRF`s
  - waste-to-energy plants can substitute MSWI