Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

Analysis of experiences in the production and use of refuse derived fuel (RDF) in Southeast Europe and EU countries

April 2021

TABLE OF CONTENTS

1 Introduction

- The document "**Analysis of experiences in the production and use of refuse derived fuel (RDF) in Southeast Europe (SEE) and European Union (EU) countries**" is prepared under the project "Waste to Energy for Western Balkans Countries Cement Industry" (W2E_WBCI)
- Project is implemented by Open Regional Fund for South-East Europe Modernization of municipal services (GIZ)
- Founded by Federal Ministry of Economic Cooperation and Development of Germany (BMZ) and the companies Titan Antea Cement sh.a (Albania), Titan Cement Usje (North Macedonia) and Titan Cement Kosjeric (Serbia), within develoPPP.de programme
- The document serves as a knowledge exchange platform in terms of provision of regional experience to the use of RDF/SRF and by comparing the experiences in the production and use of alternative fuels (AFs) in SEE and individual EU member states

2 EXPERIENCES IN THE PRODUCTION AND USE OF RDF IN SEE AND EU MEMBER STATES

Scope

- The analysis covers 13 following countries: Austria, Germany, Croatia, Slovenia, Italy, Greece, Hungary, Bosnia and Herzegovina, Albania, North Macedonia, Serbia, Montenegro and Kosovo.
- The following data need are collected for each country:
    - RDF production, use and product placement market
    - RDF quality control
    - Air emissions monitoring and data availability
    - Reactions of the general public regarding the use of RDF as an energy source
    - Economic and environmental justification of the use of RDF
    - The impact of RDF co-combustion on human health (conducted research and research results)
    - Plans and perspectives in the future (local and national)
    - The status of Waste Management services in the Western Balkan (WB) countries.
- Data sources: 47 publications, 37 web-pages and 6 surveys obtained from WB cement industries (Salonit Anhovo, Tvornica cementa Kakanj d.d., Fabrika cementa Lukavac d.d., ANTEA Cement SH.A., Cementarnica Usje, Titan cementara Kosjerić)

1. Austria

Production: 14 MBT plants with total capacity of 665,700 (t/y)

The following types of waste were primarily used:

- municipal solid waste (MSW) and similar commercial waste with approx. 58%
- residues from mechanical waste processing with approx. 18%
- fractions prepared for biological treatment for disposal" with approx. 9%
- aerobically stabilized sludge with approx. 4%
- bulky waste with approx. 4% and
- other waste categories with approx. 6%.

Public reactions: Generally accepted by the society with no specific resistance identified.

1. Austria

- **Users of AFs including RDF and SRF:** Thermal waste treatment plants (11) and cement plants (9)

An international comparison shows that Austria has the highest rate of use of alternative substitute fuels in the world. Among the largest consumers is the cement industry, with 9 plants for cement production. All plants use alternative fuels as the basic source of thermal energy.

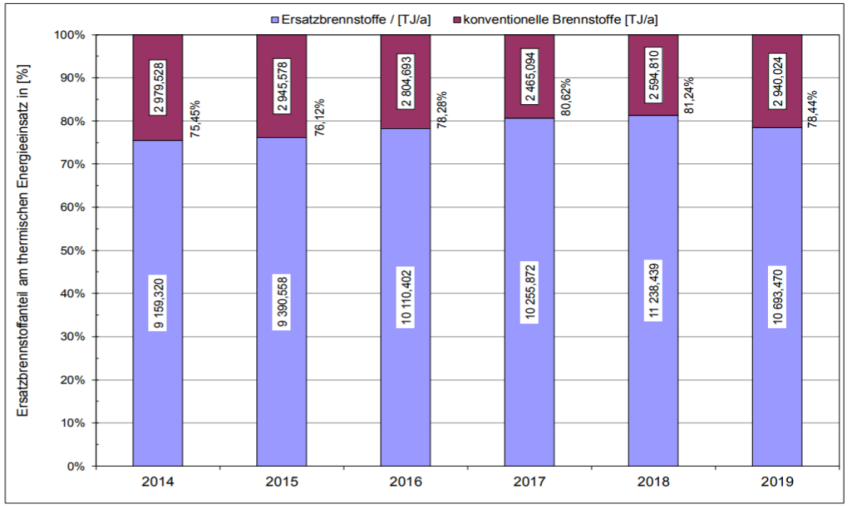


Figure shows that since 2014, the use of alternative fuels in the Austrian cement industry has been steadily increasing, and reached its maximum in 2018, when 81.2% of the thermal energy demand in the Austrian cement plants was covered by alternative fuels.

- **Trade market:** In 2018, 250,000 t imported and260,000 t exported

1. Austria

Quality parameters controlled: Sb, As, Pb, Cd, Cr, Co, Ni, and Hg (standard ÖNORM 15442 SRF)

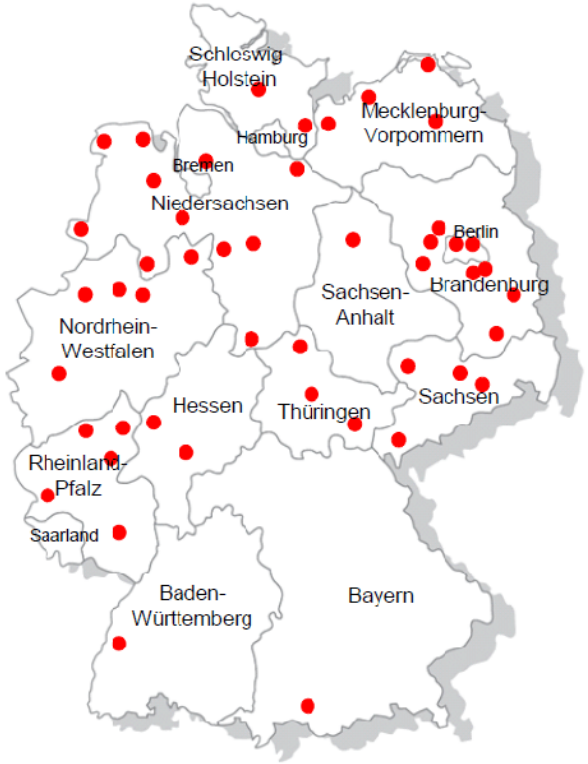
Key parameter	Statistics	Limit value	Unit	End used boundaries
Sb	Median	7	mg/MJ, d	According to the Austrian legal act (annex 8, (1.1)), the limit values apply to those part of cement production plants in which cement clinker are burned (furnace system in accordance with art. 2(1) (c) of the Cement Regulation (ZemetV) 2007, BGBI II n° 60/2007, consisting of rotary furnace, the cyclone or grate preheater and the calciner
	80th perc.	10	mg/MJ, d	
As	Median	2	mg/MJ, d	
	80th perc.	3	mg/MJ, d	
Pb	Median	20	mg/MJ, d	
	80th perc.	36	mg/MJ, d	
Cd [a]	Median	0,23	mg/MJ, d	
	80th perc.	0,46	mg/MJ, d	
Cr	Median	25	mg/MJ, d	
	80th perc.	37	mg/MJ, d	
Co	Median	1,5	mg/MJ, d	
	80th perc.	2,7	mg/MJ, d	
Ni	Median	10	mg/MJ, d	
	80th perc.	18	mg/MJ, d	
Hg	Median	0,075	mg/MJ, d	
	80th perc.	0,15	mg/MJ, d	

[a]For quality-assured waste fuels (code number 91108 in accordance with List of Waste Ordinance, BGB1 n. 570/2003, in the applicable version) a limit value of 0,45 mg/MJ applies to the median and a limit value of 0,7 mg/MJ applies to the 80th percentile.

Availability of air emissions monitoring data: Results on air emission monitoring of all cement plants are published annually in reports “Emissionen aus Anlagen der österreichischen Zementindustrie”

2. Germany

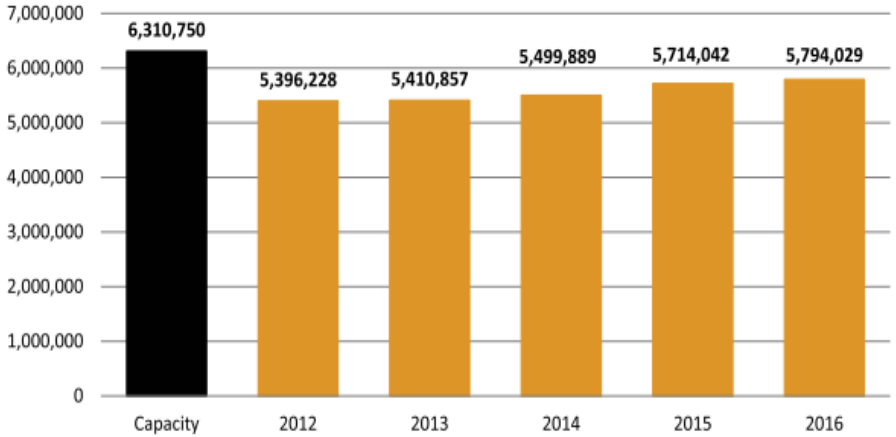
- **Production:** 48 MBT plants with total capacity of 5,400,000 (t/y). Total RDF/SRF production amounted to 2.24 million tons.



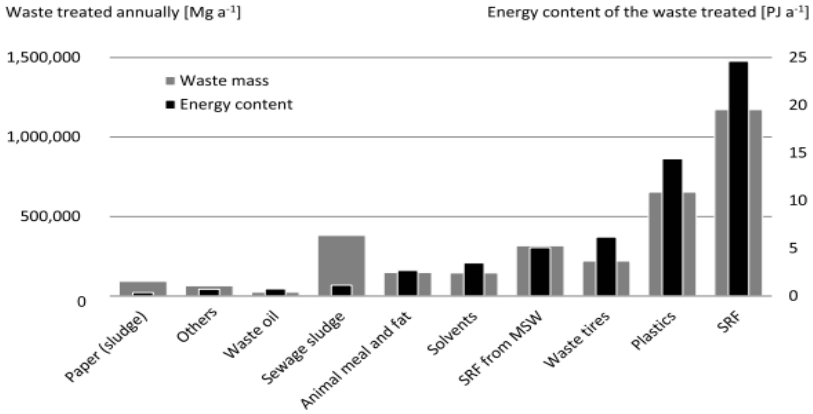
Geographical location of MBT plants in Germany

2. Germany

- **Users of AFs including RDF and SRF:** RDF power plants (32), cement plants (33), industrial power plants (31), and coal-fired power plants (22)
- **Trade market:** In 2018, 1.23 t imported and 709,000 t exported



According to data available, in the period from 2012 to 2016 almost all available capacity of German RDF power plants was fully utilized (left Figure)



Total amount of waste incinerated in cement plants in that year was 3.79 million tons, out of which around 1.15 million tons is categorized as SRF (right Figure)

2. Germany

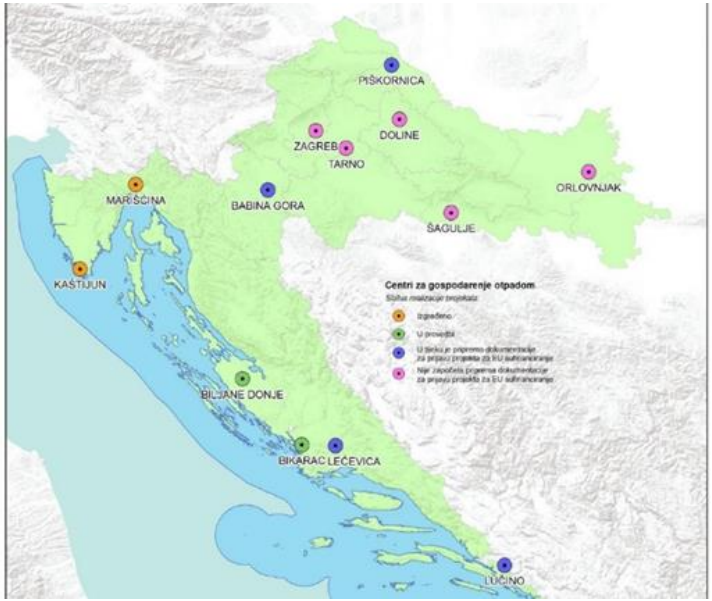
- **Quality parameters controlled:** NCV, moisture, ash, Cl, F, S, As, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, Sn, Te, Tl, and V
- **Standard:** RAL GZ 724
- **Public reactions:** Generally accepted by the society with no specific resistance identified
- **Availability of air emissions monitoring data:** Results on air emission monitoring of all cement plants are published annually in reports "Umweltdaten der deutschen Zementindustrie"
- Data is available also on German Cement Industry Assosiation website

Key parameter	Unit	BPG™ 1 Value	BPG™ 2 Value	BPG™ 3 Value	SBS™ 1 Value	BPG™ 2 Value
NCV	MJ/kg, ar	16-20	20-24	23-27	13-18	18-23
Moisture	%, ar	<35	<20	<12.5	<35	<20
Ash	mg/kg d	<20	<15	<9	<20	<15
Cl	%, dm	<1.0	<1.0	<1.0	<0.7	<1.0
F	%, dm	<0.05	<0.05	<0.05	<0.05	<0.05
S	%, dm	<0.2	<0.3	<0.3	<0.5	<0.8
As	mg/kg, d	<10	<10	<10	<10	<10
Be	mg/kg, d	<1.0	<1.0	<1.0	<1.0	<1.0
Cd	mg/kg, d	<9	<9	<9	<9	<9
Co	mg/kg, d	<12	<12	<12	<12	<12
Cr	mg/kg, d	<120	<120	<120	<250	<250
Cu	mg/kg, d	<400	<400	<400	<1000	<1000
Hg	mg/kg, d	<0.5	<0.5	<0.5	<1.0	<1.0
Mn	mg/kg, d	<100	<100	<100	<400	<400
Ni	mg/kg, d	<50	<50	<50	<160	<160
Pb	mg/kg, d	<100	<100	<100	<400	<400
Sb	mg/kg, d	<120	<120	<120	<120	<120
Se	mg/kg, d	<4	<4	<4	<5	<5
Sn	mg/kg, d	<70	<70	<70	<70	<70
Te	mg/kg, d	<4	<4	<4	<5	<5
Tl	mg/kg, d	<1	<1	<1	<1	<1
V	mg/kg, d	<15	<15	<15	<25	<25

3. Croatia

- **Production:** 3 MBO plants with total capacity of 285,000 (t/y)

Plant	EWC	Waste type as an input
MBT Kaštijun	20 03 01	Mixed municipal waste
MBT Marišćina	20 03 01	Mixed municipal waste
MBT plant C.I.O.S Varaždin	04 02 99	Waste from the textile industry not otherwise specified
	20 03 01	Mixed municipal waste, etc.
	and various other municipal and industrial waste types	



Position of planned WMCs according to the WMP of the Republic of Croatia for the period 2007-2015 and considering the status of realization in 2016

- **Users of AFs including RDF and SRF:** Cement plants (4)
- **Trade market:** Prohibited import and export

3. Croatia

- **Quality parameters controlled:** NCV, moisture, ash, Cl, F, S, As, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, Sn, Te, Tl, and V
- **Standard:** HRN EN ISO 15359:2012
- **Public reactions:** Citizens have shown a negative attitude towards the construction of incinerators, power plants, and co-incineration of waste in the cement plants. "Zero Waste Croatia" coalition is conducting active campaign to raise awareness of the harmful effects of waste incineration in industrial plants.

Key parameters	Unit	SRF plant 1	SRF plant 2	SRF plant 3
NCV	MJ/kg, ar	16,6	14,4	23,8
NCV	MJ/kg, d	20,6	18,3	28,1
Total C (TC)	%, d	49,6	46,6	62,9
Biomass content (related to TC)	w%, d	34,7	52,4	20,7
Non-biomass content (related to TC)	w%, d	65,3	47,6	79,3
Fossil CO_2 emission	g/MJ, d	57,5	44,4	65,0
Ash	w%, d	19,4	18,6	11,0
Cl	g/kg, d	4,8	4,9	7,4
S	g/kg, d	2,6	3,0	1,3
Sb	mg/MJ, d	0,9	1,2	1,5
As	mg/MJ, d	0,1	0,1	0,1
Pb	mg/MJ, d	4,4	4,6	1,2
Cd	mg/MJ, d	0,026	0,014	0,009
Cr	mg/MJ, d	2,6	2,1	0,7
Co	mg/MJ, d	0,3	0,3	0,1
Ni	mg/MJ, d	0,8	0,8	0,3
Hg	mg/MJ, d	0,012	0,014	0,09

4. Slovenia

- **Production:** 8 MBT plants with total capacity of 352,600 (t/y)
  - Simbio (Celje) with capacity 61,500 t/y
  - Snaga (Ljubljana) with capacity 175,500 t/y
  - CERO Puconci (Prekmurje) with capacity 27,500 t/y
  - Kocerod (Slovenj Gradec) with capacity 16,600 t/y
  - Ceroz (Hrastnik) with capacity 13,000 t/y
  - Komunala Slovenska Bistrica (Styria) with capacity 10,800 t/y
  - Komunala Laško (Savinja) with capacity 2,700 t/y and
  - Kostak (Lower Sava) with capacity 45.000 t/y.

- **Users of AFs including RDF and SRF:** cement plant (Salonit Anhovo) and energy plant (Celje)
- **Trade market:** Import of RDF/SRF to Slovenia is allowed, so in addition to the local market, the company procures RDF and SRF from the regional market, mainly from Italy.

4. Slovenia

- **Quality parameters controlled:** NCV, Cl, Hg, S, ash content, moisture, density, granulation

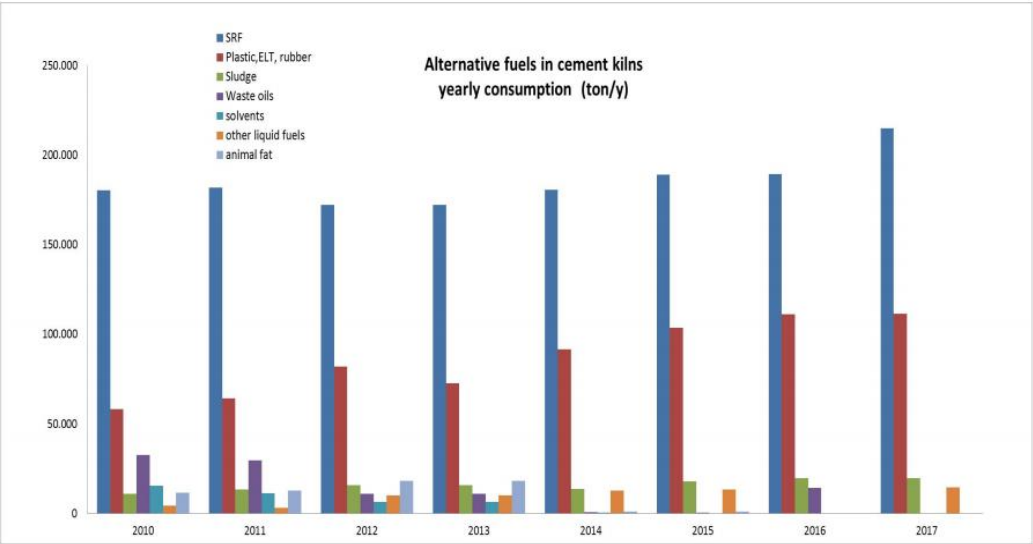
Table - RDF internal quality requirements – Salonit Anhovo

No.	Internal RDF quality requirements*	Value	Unit (e.g. mm, MJ/kg, mg/kg, % ...)
1.	Net calorific value	Calciner: min. 10, Kiln: min. 15	MJ/kg
2.	Chlorine content (Cl)	Max. 2	%
3.	Mercury content (Hg)	Average below 0,08	mg/MJ
4.	Sulphur content (S)	-	
5.	Ash content	-	
6.	Moisture	Calciner: max. 25, Kiln: max. 20	%
7.	Density	Max. 250	kg/m3
8.	Granulation (RDF size)	Kiln: 30	mm in 2D

- **Public reactions:** Eco Circle, along with local residents, had legal battle with the Lafarge cement factory Trbovlje for 10 years, due to the burning of alternative fuels in their plant, causing air pollution in the area around the factory. The campaign resulted in a complete ban and the loss of the environmental permit for the Lafarge cement plant.

5. Italy

- **Production:** 130 MBT plants with total capacity of 10,800,000 (t/y)
- **Users of AFs including RDF and SRF:** incineration (28) plants and cement plants (34)



Utilization of SRF in the national cement industry in 2017 amounted to 213,000 tons, which is equal to 59% of the total 360.000 ton of alternative fuels utilized.

- **Public reactions:** There have been cases of mass protests against waste treatment in incinerators in Florence and Terni. In 28 incinerators irregularities were found in the data transparency concerning the type of incinerated waste and the impact on health and the environment.

5. Italy

- **Trade market:** In 2017, 131,000 t exported, data on import are not available
- **Quality parameters controlled:** Cd, Tl, As, Co, Cr, Cu, Mn, Ni, Pb, Sb, V, Hg, and Cl, in accordance to UNI/TS 11553

Key parameter	Limit Value (statistic: median)	Unit	Boundary (End-use)
Cd	10	mg/kg, d	incineration coal co-combustion (cement kiln) coal co-combustion (power plant) co-incineration
Tl	10	mg/kg, d	
As	15	mg/kg, d	
Co	20	mg/kg, d	
Cr	500	mg/kg, d	
Cu	2000	mg/kg, d	
Mn	600	mg/kg, d	
Ni	200	mg/kg, d	
Pb	600	mg/kg, d	
Sb	150	mg/kg, d	
V	150	mg/kg, d	
Hg	Limit values for classes 1 and 2 in table 1 of EN 15359	MJ/kg, ar	
Cl	Limit values for classes 1, 2 and 3 in table 1 of EN 15359	%, d	

6. Greece

- **Production:** 5 MBT plants, data on capacity are not available
- **Users of AFs including RDF and SRF:** cement plants (7). The utilization of AFs in the Greek cement industries is very low compared with the EU average value. In 2020 company Eunomia was commissioned by the GIZ to deliver a study which assesses the current, and likely future, scale of the use of alternative fuels, derived from waste, in Greece. Facilities for clinker production operated by Titan Cement Company S.A. use waste tires, sewage sludge, biomass and RDF. Data available for Kamari plant show the total use of AF in 2015 of 62,000 tons. Cement facilities operated by Aget-Heracles S.A. (LafargeHolcim), for clinker production in 2016/17 used around 20% of AF (14% of waste, and 5.8% of biomass).
- **Trade market:** In 2018, 18,715 t exported, data on import are not available
- **Quality parameters controlled:** No data available
- **Public reactions:** No data available

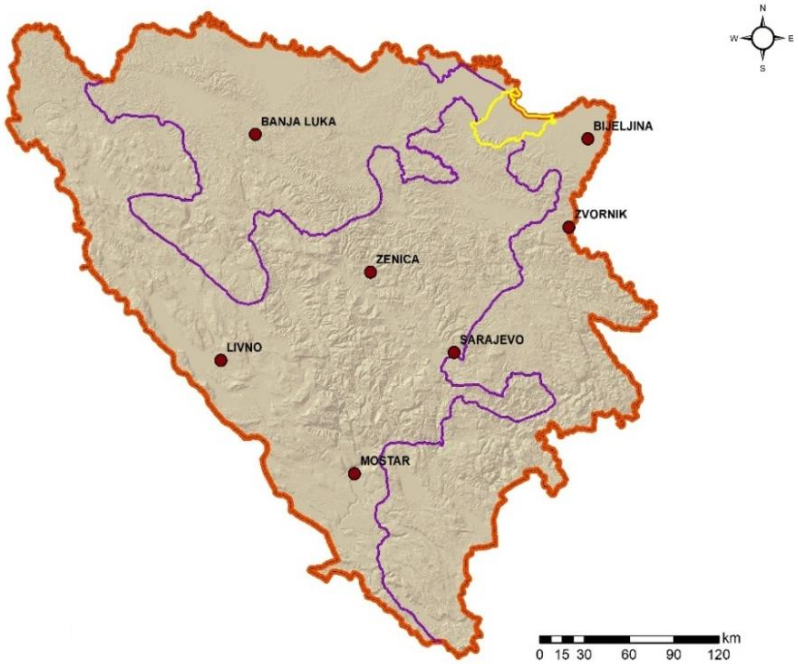
7. Hungary

- **Production:** 23 MBT plants with capacity of 1,190,000 (t/y)
- **Users of AFs including RDF and SRF:** cement plants (3)
- **Trade market:** Hungarian cement factories prefer to use RDF imported Italy, Austria and Slovenia, rather than use RDF produced in the domestic MBT plants
- **Quality parameters controlled:** No data available
- **Public reactions:** No data available

8. Bosnia and Herzegovina

Waste management:

- In 2019, out of 1.2 million tons of waste generated, 95% was permanently disposed.
- Around 75% of the population is covered by a waste collection service.
- Despite the existing municipal waste treatment infrastructure in the form of sorting lines (5) and recycling facilities (e.g. Omorika), disposal at **regional sanitary landfills (7)** and municipal non-compliant landfills, without prior processing, is still the main management option.



Locations of built regional sanitary landfills in Bosnia and Herzegovina

8. Bosnia and Herzegovina

- **Production:** 1 privately owned MBT plant, data on capacity are not available
- **Users of AFs including RDF and SRF:** cement plants (2)
- **Trade market:** Import from Croatia, Slovenia, Italy, and Austria
- **Quality parameters controlled:** NCV, Cl, Hg, S, ash content, moisture, density, granulation, shape, Cd, TI, Sb, As, Pb, Cr, Co, Ni, V, Bromine + Iodine, PCB/PCT, dioxins and furans (note: internal quality requirements differ for 2 cement companies)

8. Bosnia and Herzegovina

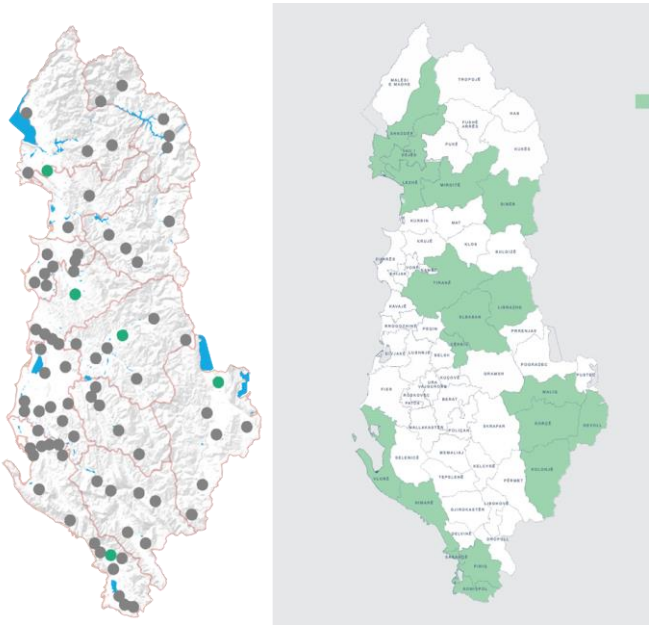
- **Public reactions:** Cement plants encountered resistance from local authorities and the general public due to the use of RDF/SRF as an alternative fuel in their plants. Through projects with GIZ and UNIDO, project “Visit us”, organization of study trips, round tables, conferences and presentations, seek to alleviate prejudices against waste incineration.
- To make the public aware of the benefits of using waste as a fuel, company representatives also use promotional materials such as videos and brochures.

https://www.youtube.com/watch?v=IKE19ZUPpQs&t=208s

9. Albania

Waste management:

- Organized disposal of municipal waste is not at its advanced level.
- In 2019, 1,2 million tons of MSW generated (90.4% managed and 9.6% not managed). The recycling rate was 18.7%, while 78% of waste was disposed of in landfills, 2.4% of waste illegally dumped in uncontrolled areas, and 0.9 % of waste incinerated.
- 7 legal landfills (not sanitary) currently in operation, two under construction
- 285 illegal dumpsites
- Total coverage by MSW service 88% (2019)



On the left - Open deposit sites (gray) and sanitary landfills (green); On the right Administrative units (green) which send MSW within sanitary landfills

9. Albania

- **Production:** No RDF production at the moment
- **Users of AFs including RDF and SRF:** incineration plant and cement plants (potential users)
- **Trade market:** RDF import/export is prohibited
- **Quality parameters controlled:** NCV, Cl, Hg, S, ash content, moisture, density, granulation, shape, Cd, TI, Sb, As, Pb, Cr, Co, Ni, V, Bromine + Iodine, PCB/PCT, dioxins and furans (internal quality requirements for Antea Cements that possesses EP for co-combustion of AFs including RDF)

Internal RDF quality requirements	Value	Unit
Net calorific value	3,500	Kkal/kg
Chlorine content (Cl)	0.7	% max. as received
Mercury content (Hg)	2 - 3	mg/kg max. as received
Sulphur content (S)	3	% max. as received
Ash content	15	%
Moisture	25	%
Density	0.15	t/m3
Granulation (RDF size)	0-80	mm (2 D-two dimensional)

- **Public reactions:** No data available

10. North Macedonia

Waste management:

- In 2019, 915,942 tons of MSW generated, 99.7% disposed of in landfills
- Only **one landfill** with permit for disposal of non-hazardous waste
- The total coverage with MSW collection service is 78%

Active municipal landfills with their environmental risk

10. North Macedonia

- **Production:** 1 MBT plant, but installation for RDF production is not yet operational
- **Users of AFs including RDF and SRF:** cement plant (1) - TITAN Cementarnica Usje
- **Trade market:** In the past, Cementarnica supplied RDF from Italy. The use of RDF in the plant is currently hampered by the ban of RDF import.
- **Quality parameters controlled:** Particle size, flash point, bulk density, moisture, NCV, ash, S, F, Cl, P, Na_2Oeq, Cd+Tl, Hg, As, Pb, Cr, Co, Cu, Mn, Ni, V, Sb, Cr, V, Sn, Zn, PCDDs/PCDFs, PCBs
- **Public reactions:** Negative reactions are present but mitigated by informing and education via social media and web sites about the benefits of using RDF/SRF and the positive effects on the environment.

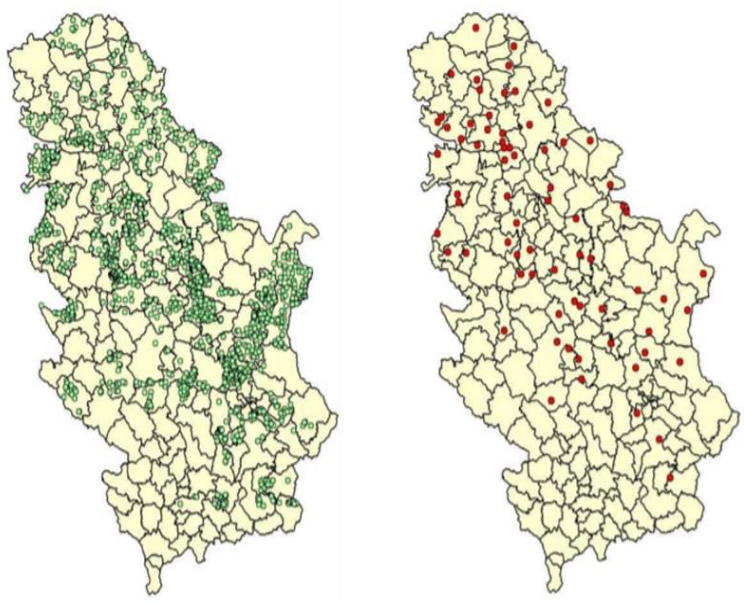
Internal RDF quality requirements	Value	Unit
Particle size	-	-
Flash point (min)	Min. 100	^0C
Bulk density	Min. 200	kg/m^3
Moisture	Max. 20	%
NCV	Min. 19	MJ/kg
Ash	Max. 20	%
S	Max. 1.0	%
F	Max. 300	mg/kg
Cl	Max. 1	%
P	Max. 20000	mg/kg
Na_2Oeq	Max. 10000	mg/kg
Cd + Tl	Max. 30	mg/kg
Hg	Max. 1	mg/kg
As+Pb+Cr+Co+Cu+Mn+Ni+V+Sb	Max. 10000	mg/kg
Cr	Max. 1000	mg/kg
V	Max. 300	mg/kg
Sn	Max. 1000	mg/kg
Zn	Max. 2000	mg/kg
PCDDs/PCDFs	Max. 2.5	mg/kg I-TEQ
PCBs	Max. 25	mg/kg

Table - Internal quality requirements for Cementarnica Usje that possesses EP for co-combustion of AFs including RDF)

11. Serbia

Waste management:

- In 2018, 2.23 million tons of MSW generated, most of which was disposed of in landfills
- According to sources, the current recycling rate is 3%
- Organized waste collection is performed on 80% of the territory
- Although the National Waste Management Strategy for the period 2010-2019 envisaged the construction of 29 regional **sanitary landfills**, only **11** have been built by the end of 2019 (two under construction).



Locations of illegal landfills (left) and locations of unsanitary landfills (right)

11. Serbia

- **Production:** 1 MBT plant Sapphire CRH that supply **CRH Serbia** cement industry with AFs
- **Users of AFs including RDF and SRF:** cement plants (3 plants, 2 current users)
- **Trade market:** RDF import/export is prohibited
- **Quality parameters controlled:** No data available
- **Public reactions:** Citizens protested against the incineration of waste tires and municipal waste in the Lafarge BFC cement plant through the "Spasimo Beočin" initiative. The company stated that the results of measuring air emissions are publicly available and that they do not exceed the limit values.

12. Montenegro

Waste management:

- In 2019, 340,832 tons of MSW generated (no data is available on the amount of treated and disposed waste).
- The total percentage of the population covered with municipal waste collection services is 86.2%
- There are **2 sanitary landfills**, 155 small unregulated landfills, and around 335 illegal dumpsites

RDF/SRF:

- **Production:** No RDF production
- **Users:** No potential users
- **Trade market:** Non-existent
- **Quality parameters controlled:** /
- **Public reactions:** /

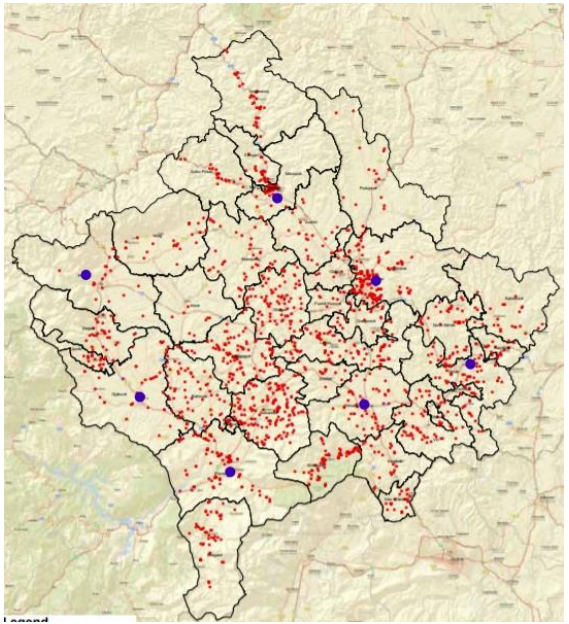
13. Kosovo

Waste management:

- In 2019, the total amount of MSW collected by the operators was 452,000 tons, of which 446,000 tons was disposed of in regional landfills
- In 2019, the coverage of the population with waste collection services was 76%.
- According to the data from 2018, Kosovo has **7 sanitary** landfills and 4 unsanitary landfills, and 1,527 illegal open dumpsites in 38 municipalities

RDF/SRF:

- **Production:** No RDF production
- **Users:** cement plant (potential user)
- **Trade market:** Non-existent
- **Quality parameters controlled:** /
- **Public reactions:** /



Locations of sanitary landfills (blue) and illegal dumpsites (red)

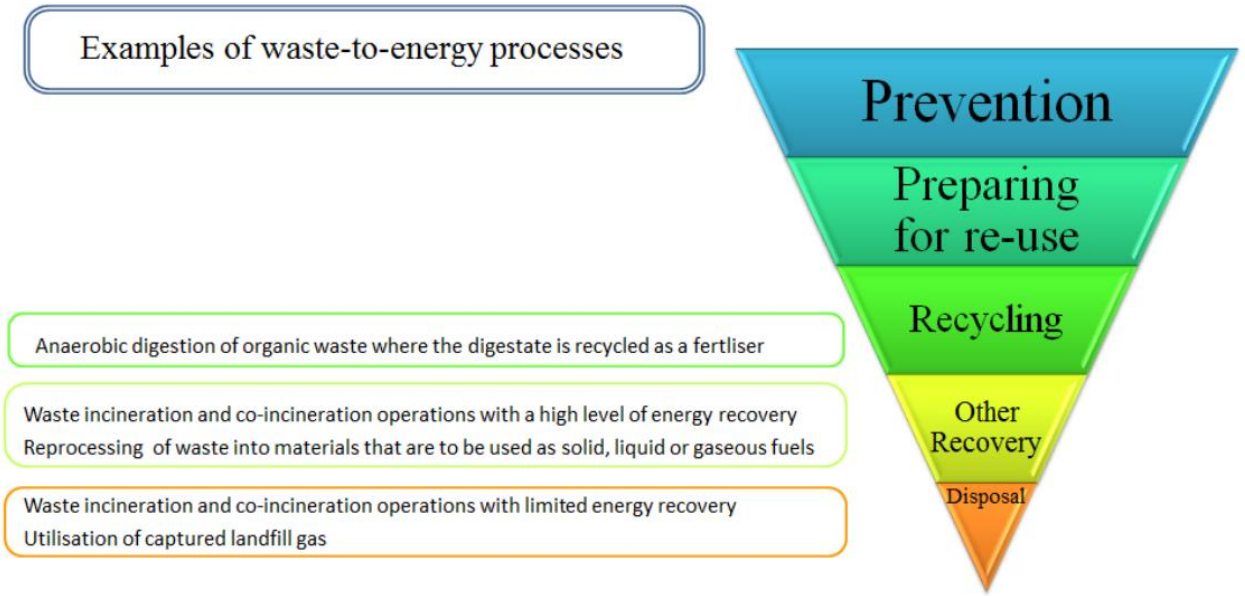
3 CONCLUSIONS

General

- The European Commission has adopted an **EU Circular Economy Package**, which should encourage the European transition to a circular economy.
- The Strategy contains an **Action Plan** that establishes a concrete and ambitious program of action, with measures covering the entire cycle: from waste production and consumption to the development of the secondary raw materials market.
- Regarding waste management, the Action Plan envisages following measures:
  1. **Revised legislative framework on waste management**
  2. Improved cooperation with the Member States to better implement EU waste legislation and combat illegal end-of-life vehicles shipments
  3. Identifying and disseminating good practices in waste collection systems
  4. Accelerate the implementation of the revised Waste Shipment Regulation
  5. Promoting the voluntary certification of industry-led key waste/recycling facilities
  6. **Initiative for energy production from waste within the Energy Union**

General

- In the EU, waste management is developed on the concept of the waste management hierarchy.
- Position of Waste to energy technologies in hierarchy is displayed below



RDF – related experiences in the selected EU member states

Use of RDF/SRF as the alternative fuel in EU countries is at very high level.

- **Production:** Italy as leader with 130 MBT plants and annual capacity of 10.8 million tons, followed by Germany (48 MBT plants – 5.4 million tons), Hungary (23 MBT plants – 1.19 million tons), and Austria (14 MBT plants – 665,700 tons).
- **Users of AFs including RDF and SRF:** In addition to the cement industry, which is considered the main user, in Austria, Germany, Slovenia, and Italy, RDF/SRF is also used in incinerators, RDF dedicated power plants and industrial power plants.
- In German cement industry, alternative fuels account for 70% of total fuel use for production. In Austria, the share of alternative fuels including RDF/SRF, used by the cement industry is the largest in Europe at 81.2%. In less developed EU countries (e.g. Greece and Croatia), RDF/SRF use is significantly lower compared to other alternative fuels.

RDF – related experiences in the selected EU member states

- **Trade market:** EU countries are mostly supplied with RDF by England, followed by Italy as the largest producer and to some extent Austria and Slovenia. In the most EU countries (except Croatia), the import and export of RDF/SRF is allowed.
- **Quality parameters controlled:** Quality requirements are defined by national standards that are in line with EU legislation (EN 15359). The most commonly controlled quality parameters are net calorific value, amount of heavy metals, Sb, As, Pb, Cd, Cr, Co, Ni, and Hg.
- **Emissions monitoring:** Carried out in accordance to EU and national legislation. Regulary monitored parameters are: SO_2, NOx, dust, TOC, CO, HCl, HF, heavy metals (Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V), dioxins and furans. The monitoring results are often available on the plant's website as well as in the company's annual reports. (On the Salonit Anhovo‘s website, the 24-hour average of the concentrations of measured parameters are updated every half hour.)

RDF – related experiences in the selected EU member states

- **Public reactions:** In the countries with the longest tradition of waste to energy treatment, Germany and Austria, the use of waste combustion technology is generally accepted by the community, and no concerning complaints have been reported. (In the City Vienna, such plant (Spittelau) is located in the city's center).
- Croatia, Slovenia, and Italy have encountered public resistance to incineration and co-incineration of any waste in plants such as cement plants, and in some cases, there have been protests against the construction of incinerators.

Plant Spittelau

RDF – related experiences in the WB countries

- While EU countries view waste as a source of income, the WB countries still face the problems of illegal landfills, providing waste collection services for all citizens, unsanitary landfills, lack of infrastructure for primary and secondary selection.
- Statistical data indicate that treatment options are not following the waste hierarchy as the most common way of waste disposal is landfilling without prior processing (Albania 78%, N. Macedonia 99.7%, of the total collected waste). As for other methods of waste treatment very small quantities are recycled (e.g. 3% in Serbia) or incinerated (e.g. Albania 0.9%).
- Low awareness of the benefits and importance of waste prevention, reuse, and recycling combined with inadequate policies and lack of investment in separate collection and treatment infrastructure has led the WB countries to dispose of 95% of their waste and thus permanently lose valuable resources.

RDF – related experiences in the WB countries

- **Production:** Recorded only in Bosnia and Serbia, which have one MBT plant each, owned by private companies, and with a very small capacities. There is one plants in N. Macedonia, but it is still not in operation.
- **Users of AFs including RDF and SRF:** Current beneficiary is only the cement industry (BiH - Cement plants in Kakanj and Lukavac, Serbia - Lafarge, CHR, and S. Macedonia - TITAN cement factory Usje). The Lukavac Cement Factory, pioneer in the use of alternative fuels in BiH and the region, in 2019 achieved a record share of these fuels in regards to total fuel consumption in the amount of 45%.
- **Trade market:** In Albania, S. Macedonia and Serbia, the import of waste for energy recovery purposes is prohibited. BiH imports RDF from Italy, Austria, Croatia and Slovenia.

RDF – related experiences in the WB countries

- **Quality parameters controlled:** Regulated by internal quality requirements of the cement production plants (depending on the technology available). Parameters controlled are NCV, ash content, moisture, Cl, S, BCP, A, Sb, Cu, Be, V, Hg, Cd, Sn, Co, Ni, Pb, Ta, Cr and Zn.
- **Emissions monitoring:** All cement plants perform regular monitoring of air emissions (mostly internally, occasionally by external expert). Parameters measured are namely SO2, NOx, dust, TOC, CO, HCl, HF, heavy metals (Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V), dioxins and furans. Results are usually available on webistes and annual reports.
- **Public reactions:** The use of waste for energy technologies in WB is still quite new and incineration of waste and RDF/SRF is not very accepted by the public. Representatives od some companies try to mitigate the negative reactions by informing the public about the positive effects of using RDF/SRF and by organizing meetings, conferences, and round tables, but also by creating creative and informative content.

The way forward for the WB countries – the EU recommendations

- In the document *The Role of WtE Technologies in the Circular Economy*, the European Commission sets out basic recommendations for member states, including those with underdeveloped WtE infrastructure.
- For these countries, it is recommended to give priority to the development of separate collection schemes and recycling infrastructure in accordance with the EU legislation.
- When a country evaluates the possibility of building a WtE plant it is necessary to evaluate the following factors:
    - the impact of existing and proposed separate collection obligations and recycling targets on the availability of raw materials for the operation of WtE plants over their lifetime (20-30 years);
    - available co-combustion capacity in combustion plants and in cement kilns or in other suitable industrial processes, and
    - planned or existing capacities in neighboring countries.

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

THANK YOU!