



MSW THERMAL TREATMENT – AN OVERVIEW ON THE ENVIRONMENTAL ASPECTS

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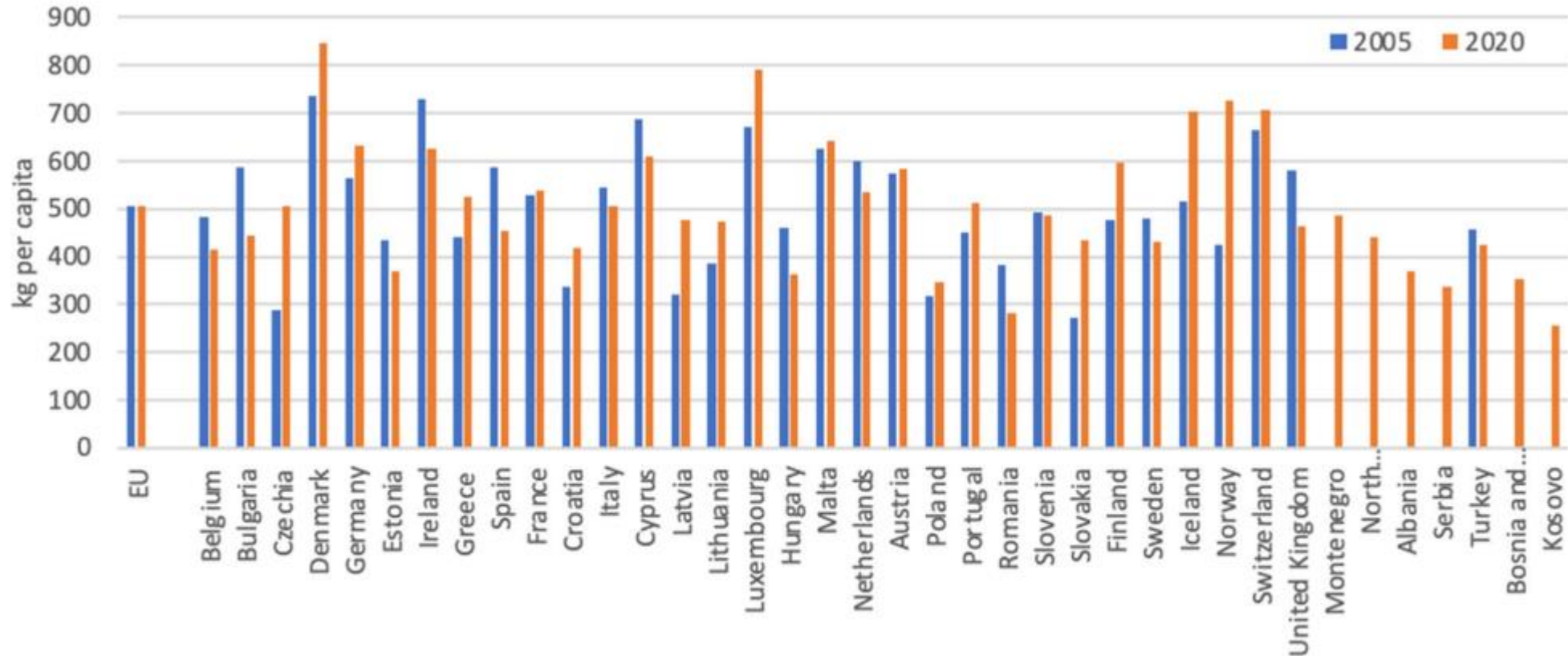


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23th June 2023

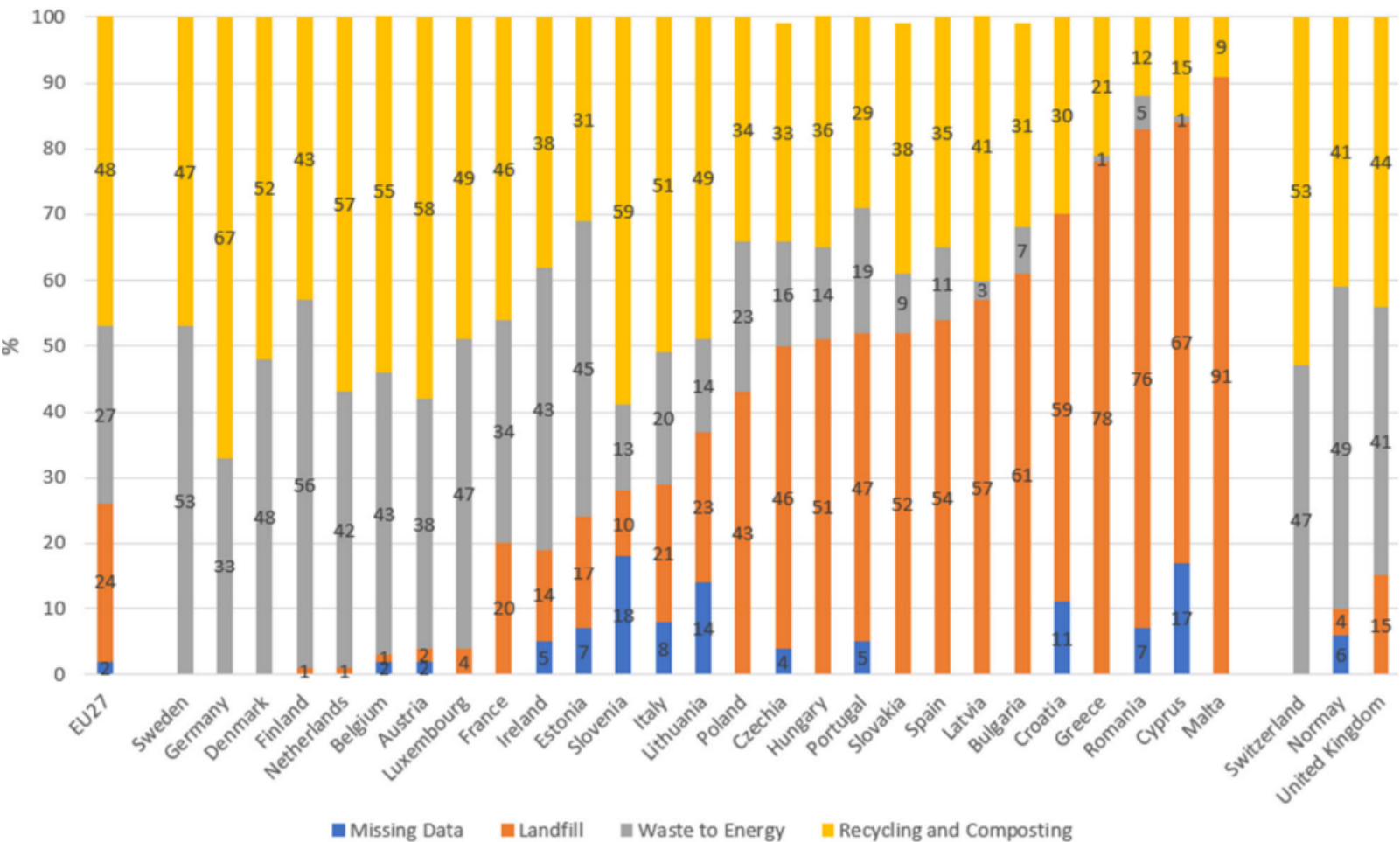


MSW generated in EU, 2005 and 2020



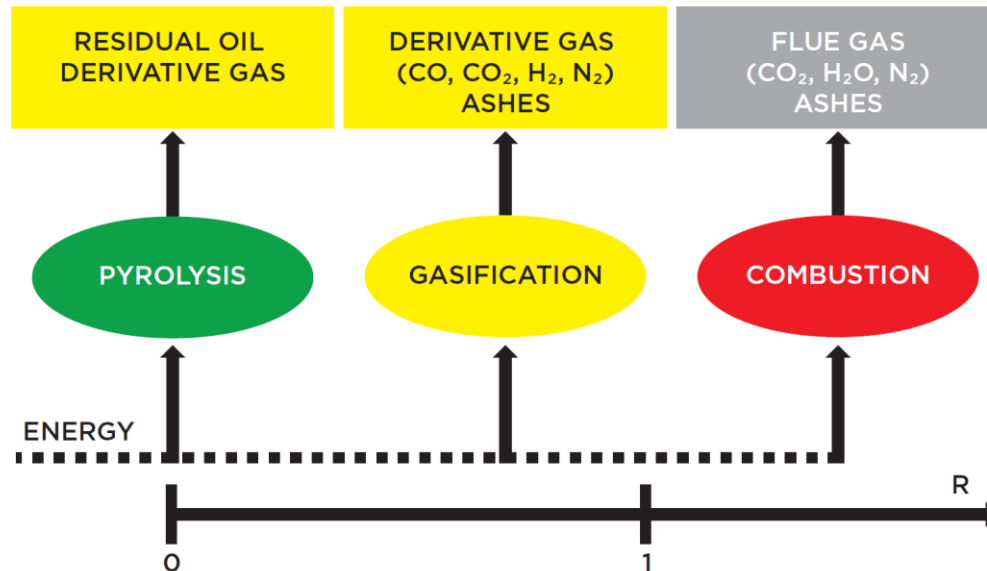
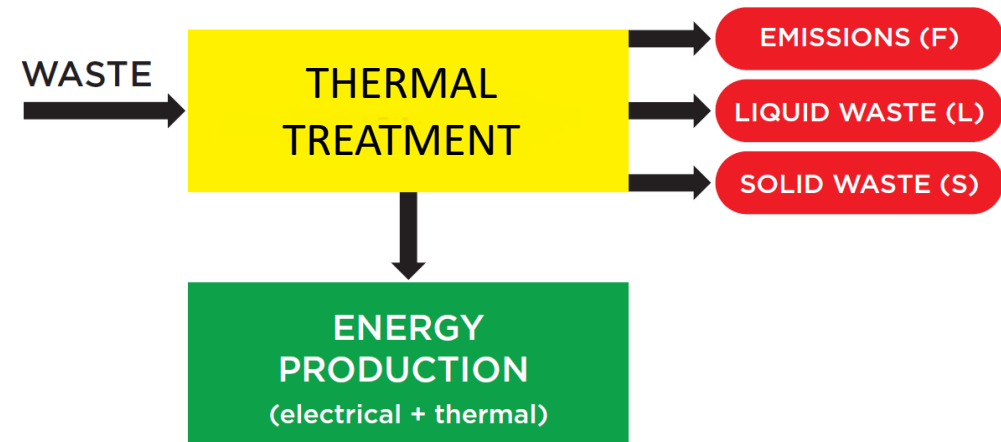


MSW treatment in 2019 (EU27 + Switzerland, Norway and United Kingdom)





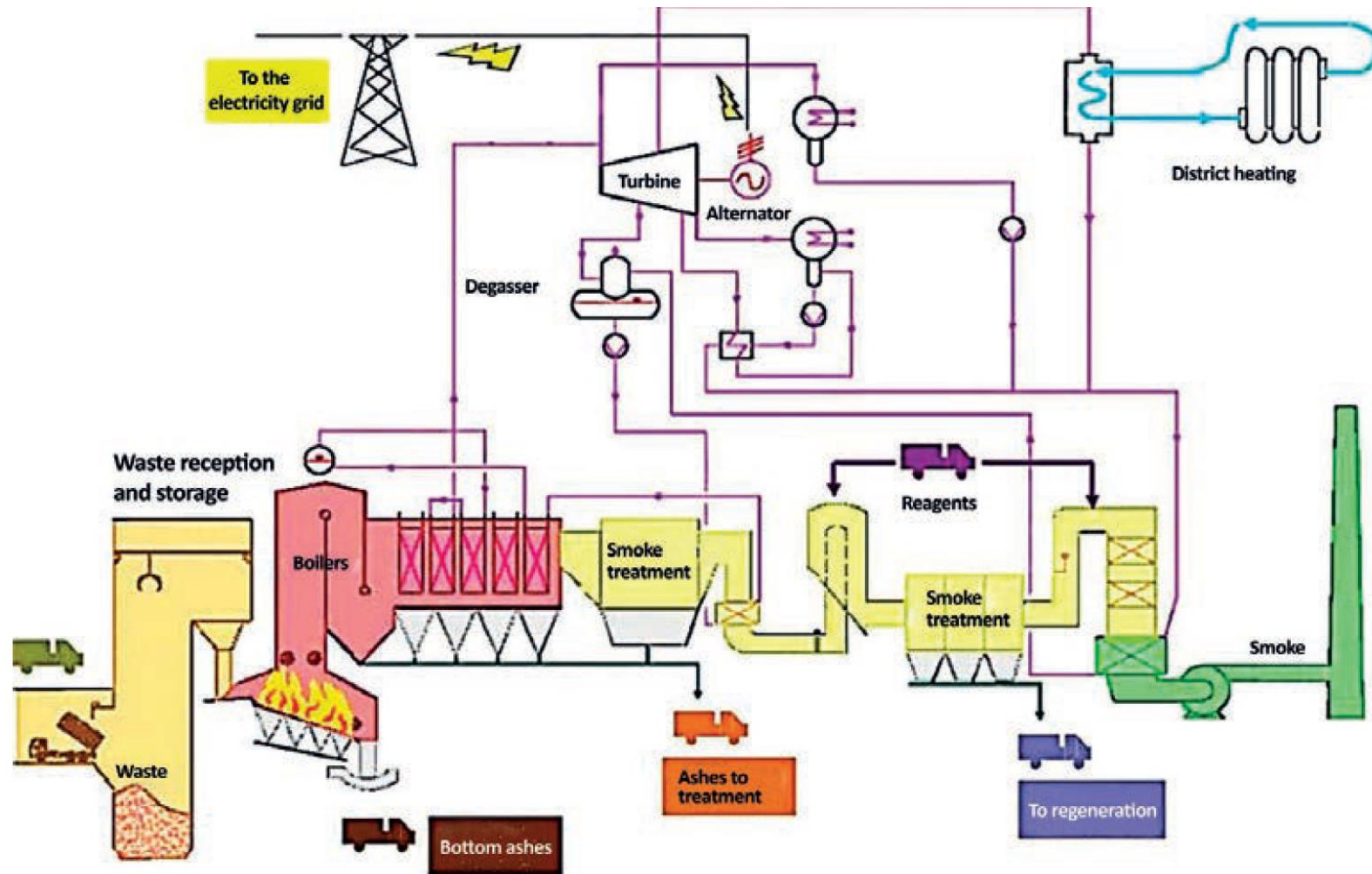
- direct combustion (INCINERATION)
- GASIFICATION
- PYROLYSIS



R = ratio between the effective quantitative of oxidant agent (air and / or oxygen) and theoretical quantitative ("stoichiometric")



Thermal treatment scheme





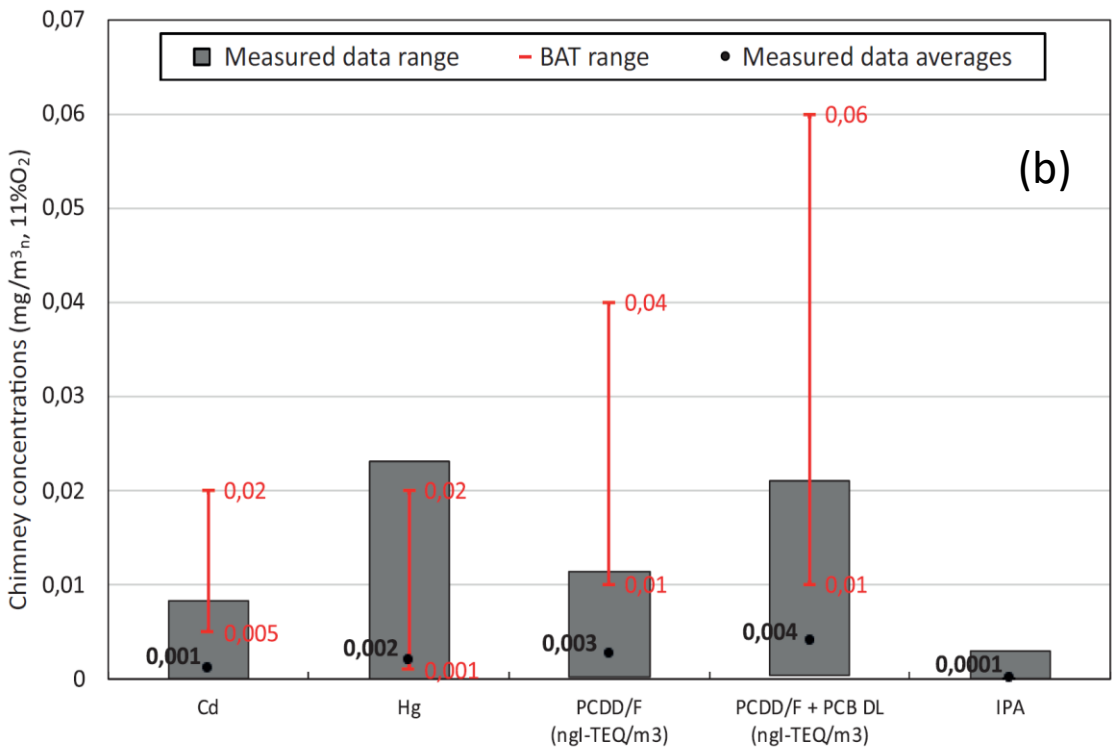
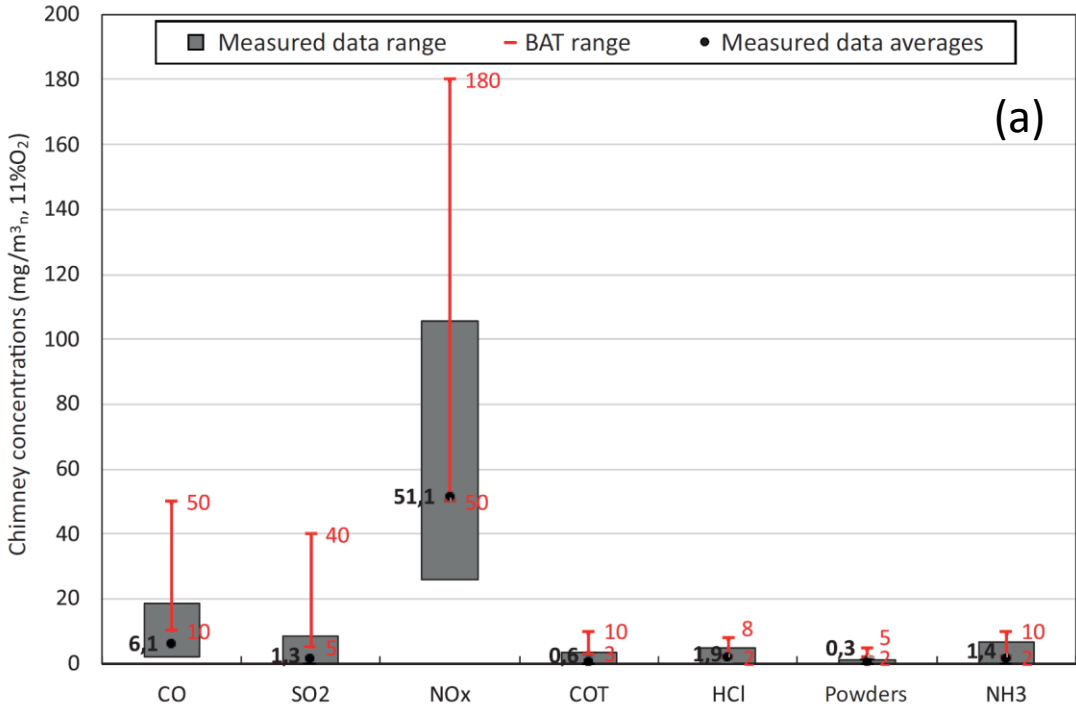
Current emission limits (2010/75/EU, Industrial Emissions Directive) and emission ranges associated with BAT (daily average values expressed in mg/m³ unless otherwise stated)

Contaminant	2010/75/EU, IED	BAT ⁽¹⁾
Powders	10	<2-5
HCl	10	<2-8
HF	1	<1
SO ₂	50	5-40
NO _x (as NO ₂)	200	50-150 (180 without SCR)
TOC	10	<3-10
CO	50	10-50
Hg	0,05	0,001-0,02
Cd + Tl	0,05	0,005-0,02
Other metals	0,5	0,01-0,3
PCDD/F (ng _{TEQ} /m ³)	0,1	<0,01-0,08
NH ₃	-	2-10
PAHs (µg/m ³)	10	-

⁽¹⁾ values reported in the "Conclusions on best available techniques for waste incineration" of 3 December 2019



Comparison of emission measurements measured in the three-year period 2016-2018 by Italian plants and ranges associated with industry BAT for conventional (a) and trace toxic contaminants (b)



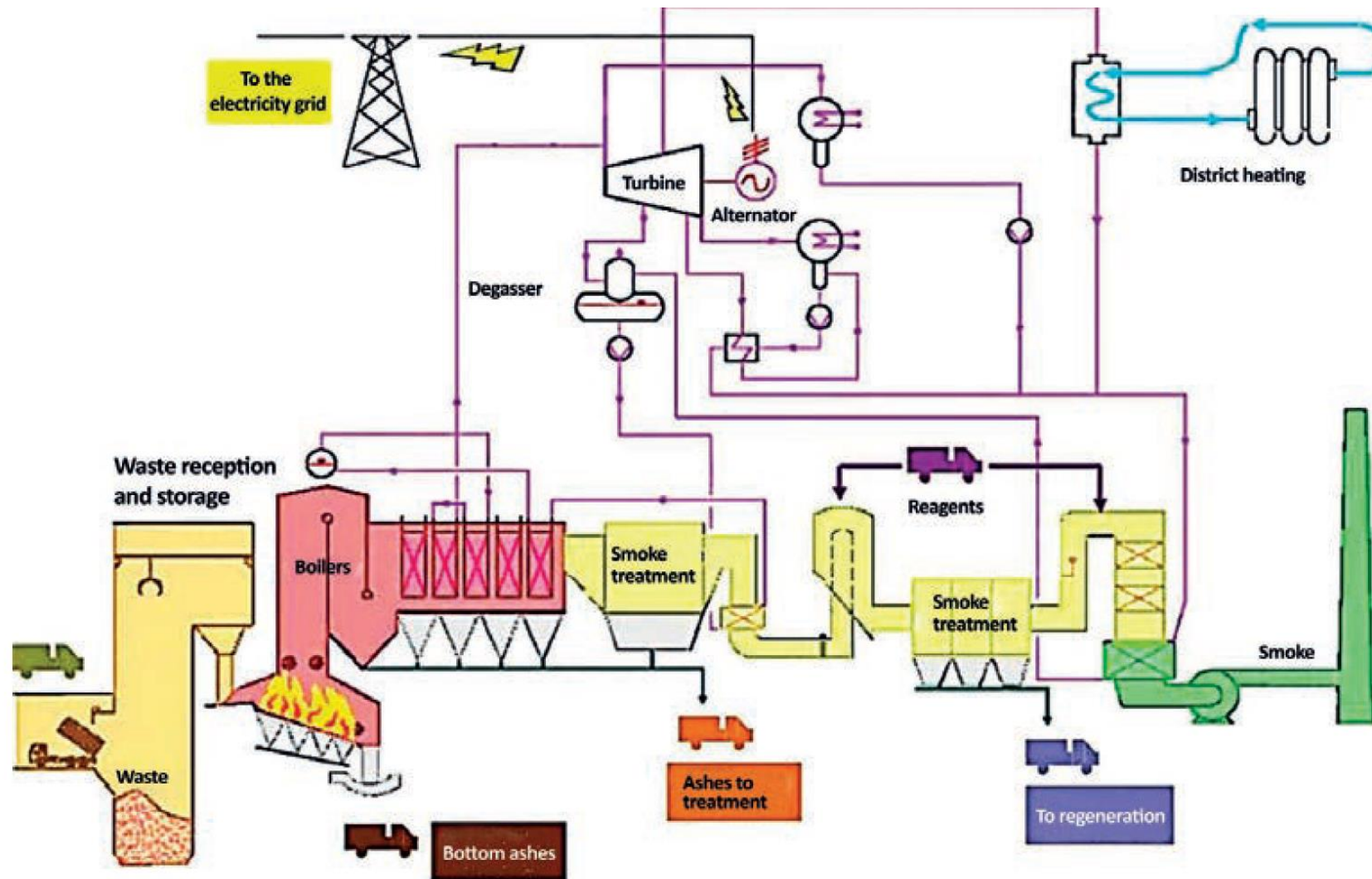


2000	Residential and commercial combustion	Energy production and distribution	Combustion in industry	Production processes	Road transportation	waste incineration
SO ₂	3,5%	66,4%	14,2%	3,4%	1,6%	1,3%
NO _x	11,7%	11,6%	12,2%	0,4%	50,6%	0,16%
PM ₁₀	35,0%	8,1%	8,6%	7,2%	21,2%	0,01%
CO	22,1%	1,2%	6,7%	2,6%	63,5%	0,002%
Cd	25,0%	0,0%	62,5%	12,5%	0,0%	2%
Hg	7,7%	46,2%	23,1%	23,1%	0,0%	1%
Pb	2,7%	0,5%	16,0%	6,9%	72,5%	0,3%
PCDD/F	41,7%	2,2%	22,0%	29,9%	4,2%	5,3%
PAHs	79,6%	4,0%	0,0%	12,6%	3,3%	0,1%
2018	Residential and commercial combustion	Energy production and distribution	Combustion in industry	Production processes	Road transportation	waste incineration
SO ₂	9,4%	33,3%	24,0%	12,4%	0,4%	1,2%
NO _x	13,0%	7,0%	9,4%	0,8%	43,5%	0,8%
PM ₁₀	53,8%	1,0%	4,7%	9,3%	11,8%	0,02%
CO	61,9%	1,9%	4,1%	3,6%	19,9%	0,04%
Cd	9,4%	3,3%	38,1%	29,1%	7,7%	1,2%
Hg	7,0%	19,3%	27,4%	43,0%	2,6%	2,6%
Pb	6,8%	1,1%	44,8%	40,6%	5,1%	2,7%
PCDD/F	37,5%	1,7%	20,2%	32,1%	3,8%	0,2%
PAHs	78,1%	0,7%	0,8%	13,9%	3,8%	0,007%

Incidence of annual emissions of the main sectors of activity in Italy in 2000 and 2018 for the contaminants of greatest interest



Turin incineration Plant
421.000 t/y – 3 lines
lhv = 11 MJ/kg



Emissions at chimney

PARAMETRO	Unità di misura	Limite di Legge (D.Lgs. 152/2005)	Valori autorizzati per i primi due anni di esercizio (fase iniziale – LIMITE 1)	Valori autorizzati dopo i primi due anni di esercizio (fase a regime – LIMITE 2)
Polveri	mg/Nm ³	10	10	5
Acido Cloridrico (HCl)	mg/Nm ³	10	10	5
Acido Fluoridrico (HF)	mg/Nm ³	1	1	0.5
Ossidi di Zolfo (SO ₂)	mg/Nm ³	50	50	10
Ossidi di Azoto (NO _x)	mg/Nm ³	200	200	70
Carbonio Organico Totale (TOC)	mg/Nm ³	10	10	10
Monossido di Carbonio	mg/Nm ³	50	50	50
Ammoniaca (NH ₃)	mg/Nm ³	-	5	5
Idrocarburi Policiclici Aromatici (IPA)	mg/Nm ³	0.01	0.01	0.005
Diossine e Furani (PCDD + PCDF)	ngTEQ/Nm ³	0.1	0.1	0.05
Cadmio e Tallio (Cd+Tl)	mg/Nm ³	0.05	0.05	0.03
Mercurio (Hg)	mg/Nm ³	0.05	0.05	0.05
Zinco (Zn)	mg/Nm ³	-	0.5	0.5
Metalli pesanti (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V+Sn)	mg/Nm ³	0.5	0.5	0.3

Flue gas in output = 120.000 Nm³/h for each line

Emissions - TRM



Turin plant

NOx (as NO ₂)		PM10	
Waste to energy plant (µg/m ³)	Presence of background in the area (µg/m ³)	Waste to energy plant (µg/m ³)	Presence of background in the area (µg/m ³)
0,02 (max 0,3)	50 - 67	0,0004 (max 0,005)	54 - 62



Comparison between annual average NO_x and PM₁₀ concentrations estimated by model for the plant emissions and the presence detected in the area of plant settlement for some Italian case studies

Plant	NO _x (as NO ₂)		PM ₁₀	
	Waste to energy plant (µg/m ³)	Presence of background in the area (µg/m ³)	Waste to energy plant (µg/m ³)	Presence of background in the area (µg/m ³)
Milan ⁽¹⁾	0,17	34-56	0,0003	34-40
Turin ⁽²⁾	0,02 (max 0,3)	50-67	0,0004 (max. 0,005)	54-62
Bolzano ⁽³⁾	0,015 (max. 0,4)	31,3	0,0003 (max. 0,01)	17
Brescia ⁽⁴⁾	1,1 (max)	44-70	0,005 (max)	39-54
Acerra ⁽⁵⁾	0,29 (max)	25-34	0.03 (including secondary powders)	35-56
South Milan ⁽⁶⁾ (project not completed)	0,08	39-55	0,008	48-60
Schio ⁽⁷⁾	0,08	21	0,0006	25

⁽¹⁾ ATS Milan, 2019; ⁽²⁾ Panepinto, 2014; ⁽³⁾ DICAM, 2017; ⁽⁴⁾ Brescia Municipality, 2011; ⁽⁵⁾ CNR ISAFOM, 201;

⁽⁶⁾ DIIAR, 2009; ⁽⁷⁾ AVA, 2020



	Piedmont	Lombardy	Trentino South Tyrol	Veneto	Friuli Venezia Giulia	Emilia Romagna
Treated wastes [t/y]	560,000	2,400,000	130,000	240,000	147,000	1,100,000
Produced Energy [MWh]	1,443,750	4,568,675	255,244	519,452	241,500	1,991,139
Produced CO ₂ [t/y]	924,000	3,792,000	209,300	379,200	236,670	1,573,000
tCO ₂ /t wastes	1.65	1.58	1.61	1.58	1.61	1.43
tCO ₂ / MWh	0.64	0.83	0.82	0.73	0.98	0.79
Avoided CO ₂ [t/y]	518,000	1,600,000	90,000	185,000	86,000	707,000
tCO ₂ /t wastes	0.73	0.91	0.92	0.81	1.02	0.79
tCO ₂ / MWh	0.28	0.48	0.47	0.37	0.62	0.43



MSW landfill → 3.28 t CO₂/t MSW





- ✓ Consolidated technology
 - ✓ With the use of the BAT the emissions are always lower than the law limits
 - ✓ Incidence of the WtE emissions are lower than the incidence of other industrial sector
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Thank you for your attention

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