BIOMASS SUPPLYING THE HEATING MARKET IN THE NETHERLANDS

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The Bioeconomy in the Netherlands: Valorization from biomass to high-end products

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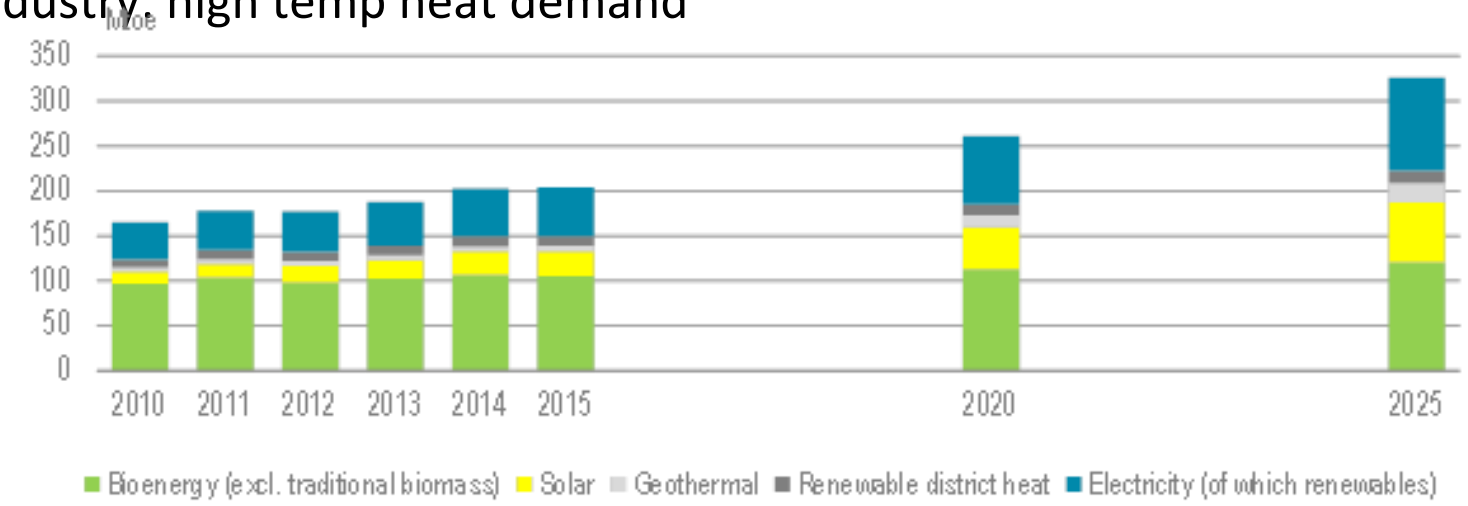
Netherlands Embassy, Tokyo

Global picture from IEA (tracking clean energy progress, 2018)

- Globally, heat in buildings and industry represents over 50% of our final energy demand
- Buildings are almost half of that
  - Renewable heat in buildings needs to increase from 9% today to 16% in 2025 to meet the 2DS scenario
  - Bioenergy currently largest source, but growth rates of solar and heat pumps are larger
  - IEA recognises significant growth potential in replacing old stoves with modern stoves and pellet boilers. Also for larger boilers in combination with district heating
- Industry: high temp heat demand



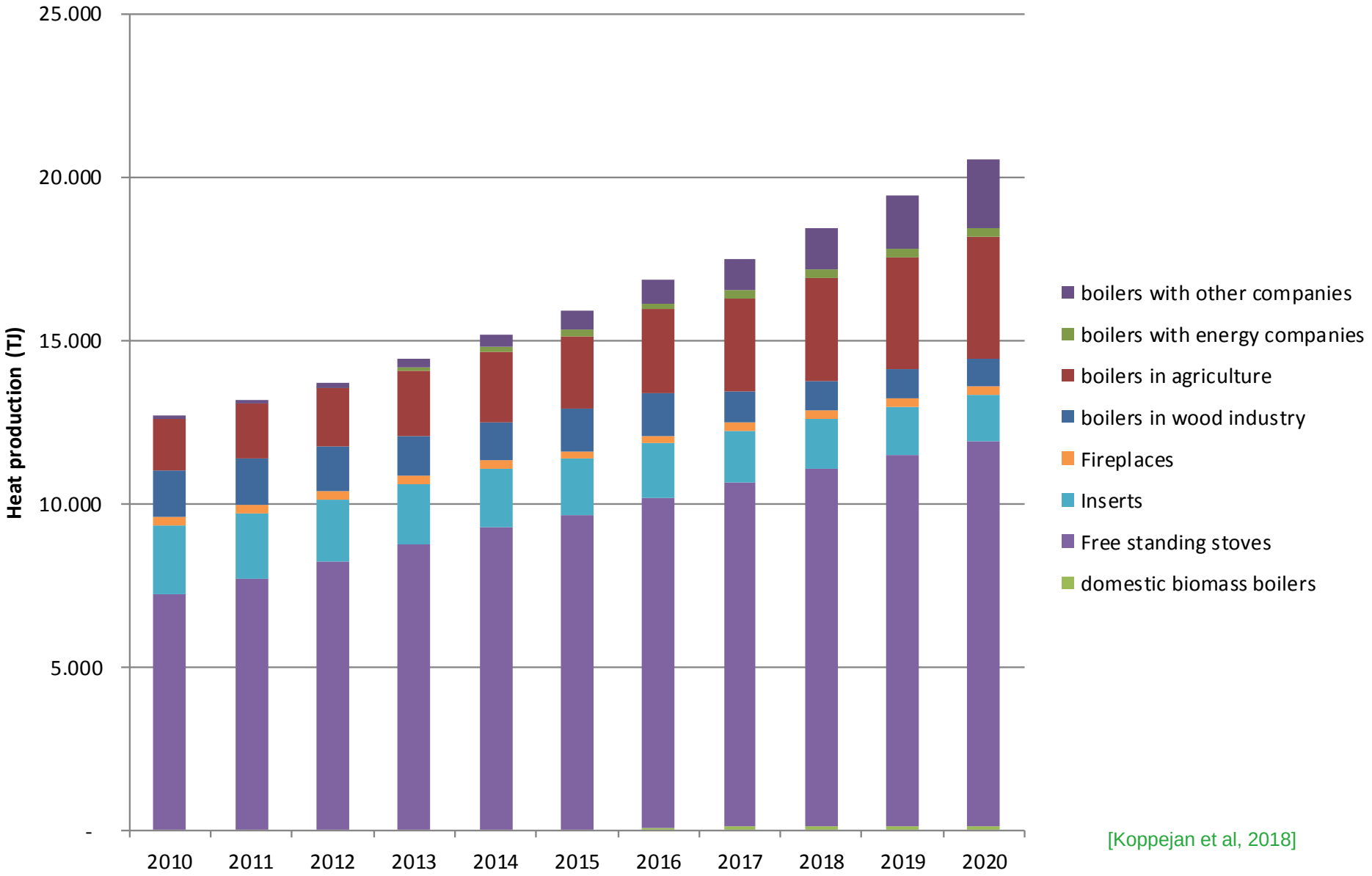
In the Netherlands, biomass heat provides substantial contribution in achieving renewable energy targets

Source	TJ total	%	TJ heat	%
hydropower	339	0,02		
wind energy	34.710	1,66		
solar energy	8.876	0,42	1.139	0,05
geothermal	7.126	0,34	7.126	0,34
biomass	83.874	4	54.208	2,59
WTE plants	*20339*	*0,97*	*13347*	*0,64*
biomass cofiring	*2462*	*0,12*	*493*	*0,02*
domestic wood combustion	***19465***	***0,93***	***19465***	***0,93***
industrial biomass boilers	***17585***	***0,84***	***13199***	***0,63***
biogas	*10.539*	*0,5*	*6.683*	*0,32*
liquid biofuels	*13.483*	*0,64*	*1.021*	*0,05*
all renewable energy sources	138.331	6,6	65.877	3,14

Source: CBS, 2018. provisional figures for 2017

About 1.5% of national energy consumption or 23% of current renwable energy consumption

Today, biomass for heat is 23% of renewable energy targets



[Koppejan et al, 2018]

Small scale biomass from heat

fireplace

insert

Free standing stove

Pellet stove

Domestic pellet boiler 16 kW

Wood chip fired boiler 500 kW

Wood chip fired boiler 5000 kW

Problem with public perception

- old wood stoves cause significant polution and impact public perception of wood combustion
- Realising new projects based on state of the art boilers also becomes difficult.

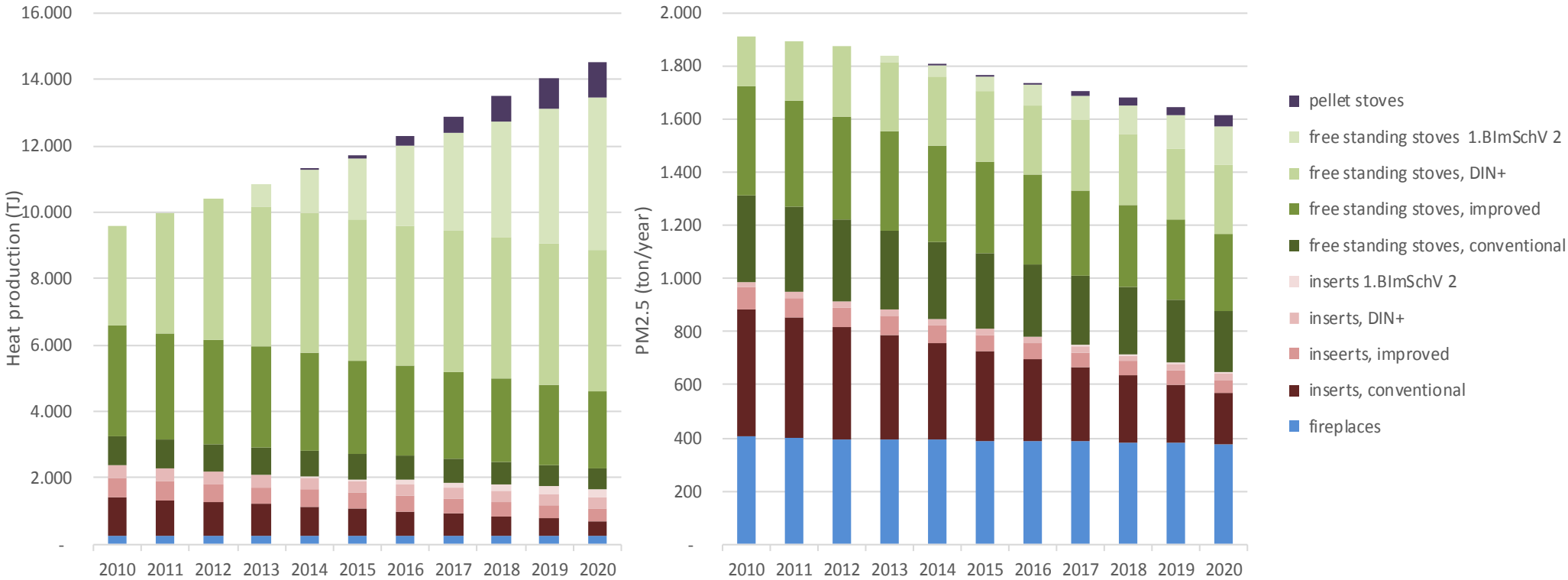
Huge difference in emission factors!

Toestel	Direct emission		Indirect emission	Total emission factor	
	PM_{10}	$PM_{2.5}$		PM_{10}	$PM_{2.5}$
	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
Fireplace	161	154	484	645	638
Conventional stove	194	186	323	517	509
Modern stove (DIN+)	52	50	80	132	130
Domestic pellet boiler	32	31	2	33	33
Industrial boilers (0-1 MW)	15	14	1	16	15
Industrial boilers (1-5 MW)	7	7	1	8	8

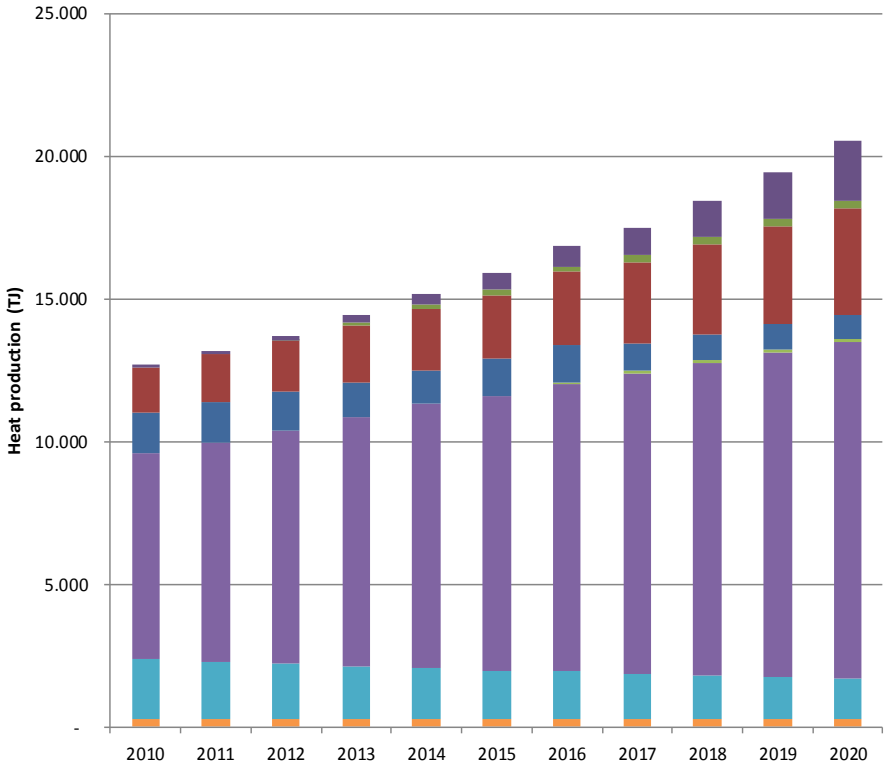
Factor of about 100!

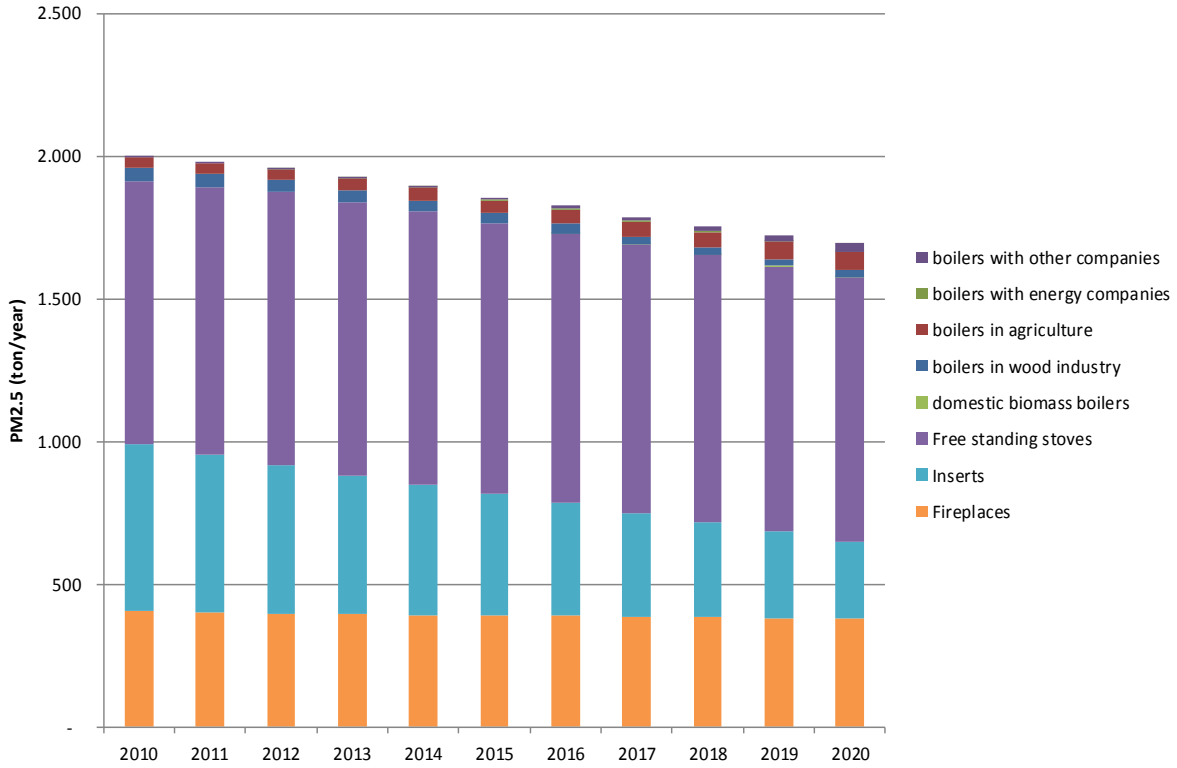
	number	Heat production (TJ)	Biomass consumption (TJ)	CO (ton/year)	Dust (ton/year)	PM10 (ton/year)	NOx (ton/year)	VOC (ton/year)	PCDD/F (g/year)	PAK10 (ton/year)	CO2 savings (kton/year)
domestic biomass boilers	3.000	0,1	0,1	24	3	2	9	0	0,00	-	5
Free standing stoves	570.000	10,9	14,3	40.624	1.013	973	1.851	5.577	2,11	40	570
Inserts	121.000	1,6	2,6	12.471	362	347	336	1.960	0,44	12	81
Fireplaces	366.000	0,2	2,5	8.272	416	399	192	4.492	4,01	8	13
boilers in wood industry	761	0,9	1,0	750	27	26	150	21	0,01	-	57
boilers in agriculture	2.239	3,2	3,6	605	60	58	286	12	0,06	0	197
boilers with energy companies	20	0,2	0,3	46	3	3	21	1	0,00	-	15
boilers with other companies	658	1,3	1,5	244	19	18	113	5	0,01	0	80
Total	**1.063.677**	**18,4**	**26,0**	**63.037**	**1.902**	**1.827**	**2.958**	**12.068**	**6,64**	**60**	**1.017**

Because of replacement of old stoves with cleaner stoves with lower emission factors, increased heat production from direct heating appliances does not lead to higher PM emissions!



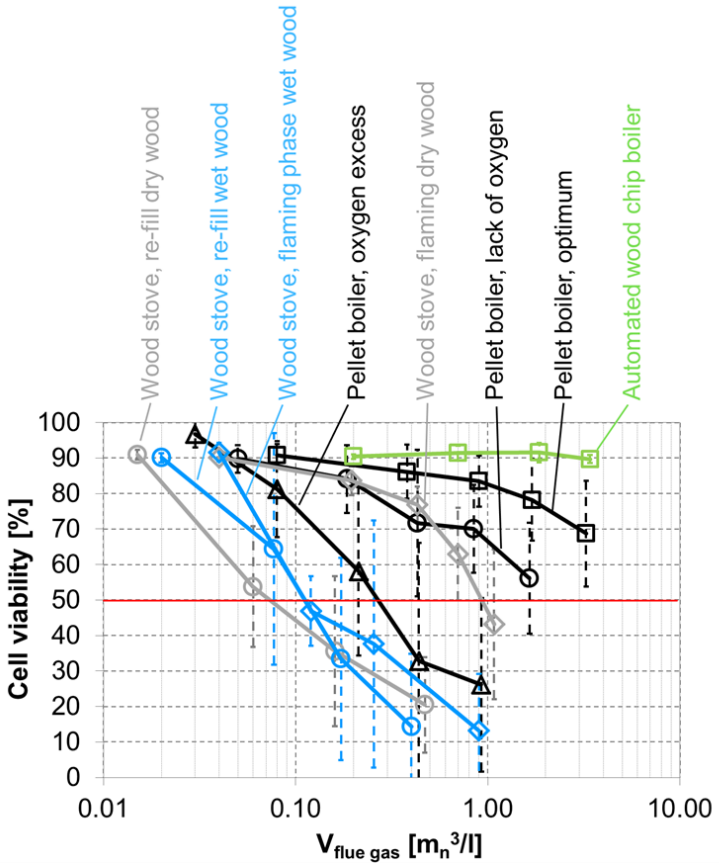
Overall picture for PM2.5 emissions

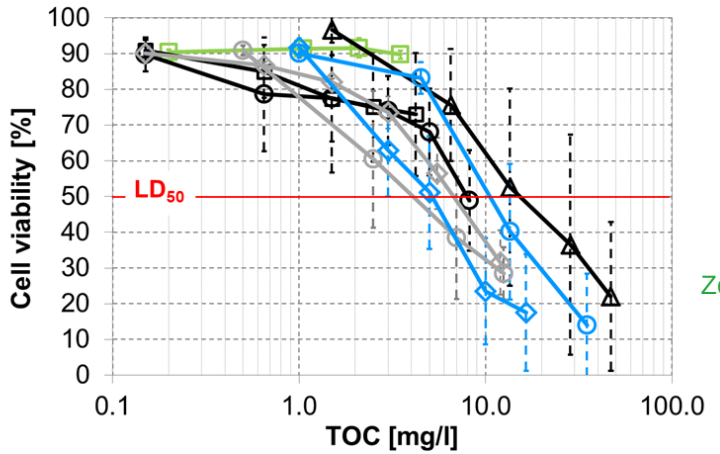




Low emission devices generate dust with lower toxicity

Biomass heating device	PM (g/GJ)	%OC
Open fireplace	322 - 1610	40 - 75%
Simple log stove	140 - 225	50%
Modern log wood stove	46 - 90	20%
Pellet Stove	3 - 43	10%
Pellet Boiler	3 - 29	5%
Biomass boiler with emissions control <1 MW	28 - 57	3%*
Biomass boiler with emissions control 1-5 MW	8 - 15	2%*





Zotter et al, 2016

Conclusions

- Health effect to society = quantity x health effect
- Open fires, fireplaces and older woodstoves should be stopped
- No significant health effect from state of the art boilers with flue gas cleaning
- Adequate policy measures should be defined and used

What to do now?

- Phasing out older woodstoves and fireplaces
- More stringent building legislation (chimney location, ventilation, ..)
- Municipal laws and better law enforcement. Forbidding open fires
- Product Directive (Ecodesign) in 2022 for improved product quality of stoves and boilers
- More strict emission limits for boilers
- Quality requirements for installers
- More stringent air quality requirements for PM10 and PM2.5

3.5 MW wood chip fired CHP plant heating 2500 homes in Zaandam (a suburb of Amsterdam)