#EUGreenWeek
13–17 MAY 2019

European Commission

POLITECNICO MILANO 1863

cewep Confederation of European Waste-to-Energy Plants

CEWEP - ESWET Green Week Partner Event

How to Ensure a Clean Circular Economy?

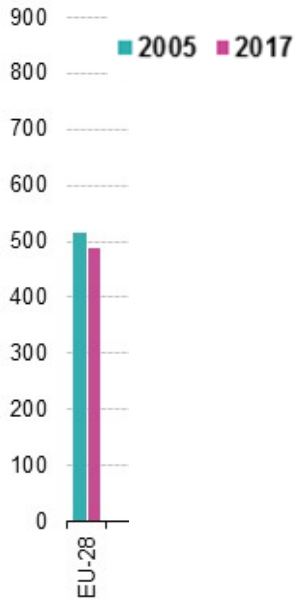
Brussels, May 20th 2019

Summary

- Background & title of the presentation
- Our case study
  - Methods
  - Results
- Conclusions

Is it a real circle?

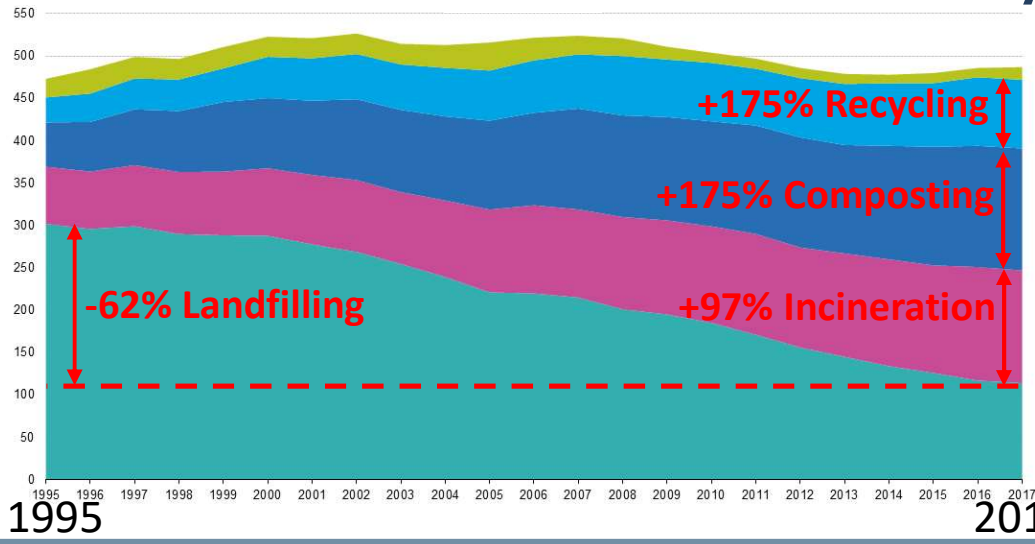
EU-28 Municipal waste generated in 2005 and 2017



487 kg per capita of MW generated in the EU in 2017.

Circular economy

A "virtuous circle"



29% of MW was recycled in 2017

eurostat

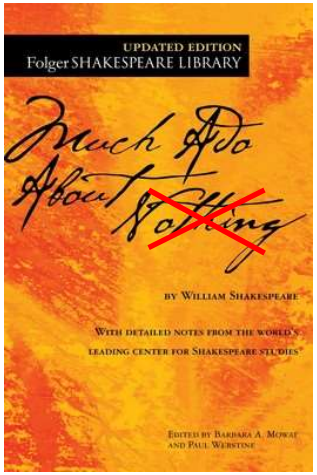
Public concerns

Though human health risk assessment show **acceptable incremental risk, i**ncineration and Waste to Energy (WTE) facilities frequently face **strong protests** from local communities:

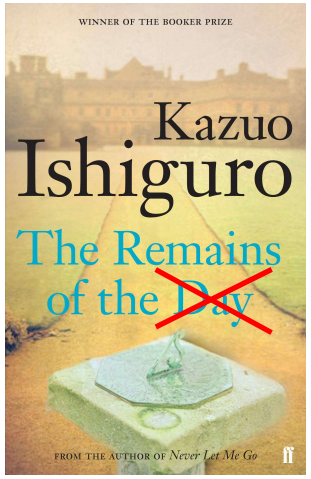
- **concern** about possible **adverse health effects** associated with atmospheric emissions
- **mistrust** in plant operators and control authorities
- **biased risk perception**, lacking proper environmental education (i.e.: levels of risk awareness and knowledge)
- scarce **awareness on risk** associated with everyday life sources (e.g.: road traffic, domestic heating through biomass burning).
- **political position** driven preconception

Title of the presentation

Public concern



Every day evidence



Circular economy

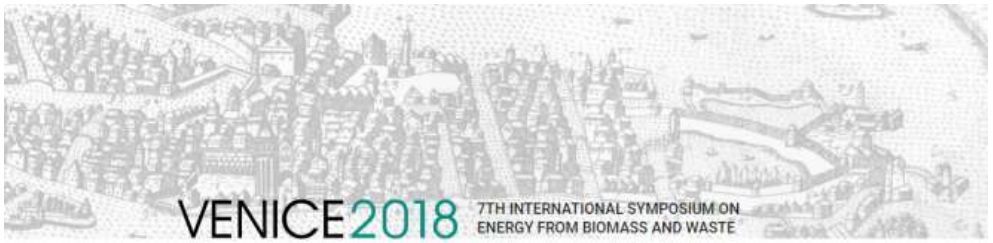
A "virtuous circle"

Much ado about the remains of the circle

by Giovanni Lonati

Our case study

VENICE2018
SCUOLA GRANDE DI SAN GIOVANNI EVANGELISTA / VENICE . ITALY
15-18 OCTOBER 2018



Session E7
Control of contaminants in waste management and health protection

The actual contribution of WTE plants emissions to air quality: a case study from Northern Italy

Alberto Cambiaghi – BEA SpA
***Giovanni Lonati** – DICA Politecnico di Milano*

Brianza Energia Ambiente

POLITECNICO MILANO 1863

Study goals

- **assess** the **actual impact of a WtE plant** on local air quality based on its real emission data
- **assess the impact** on plant's emissions and ensuing impact on air quality **of the latest plant retrofit in 2016**,
- **compare the impact** on local air quality **of the WtE plant**'s stack emissions with the impact **of road traffic** emissions from the main roads crossing the municipality where WtE plant is located

Case study for this work is
Desio WtE plant run by BEA SpA
(Northern Italy – Lombardia Region)

Desio WtE plant

1976 – Plant start-up

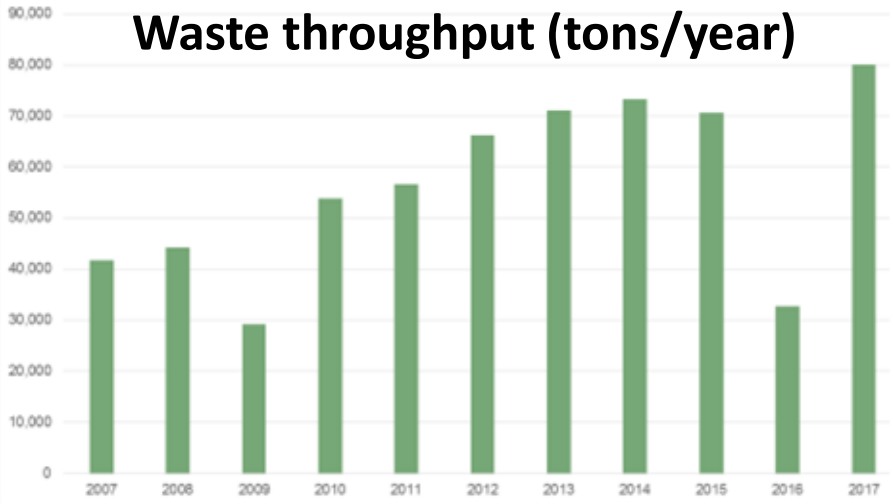
1989 – Energy recovery start-up

1997 – District heating start-up

2016 – Plant revamping:

- 40% increase in the incineration capacity,
- new steam turbine
- new SCR (Selective Catalytic Removal) unit for NOx

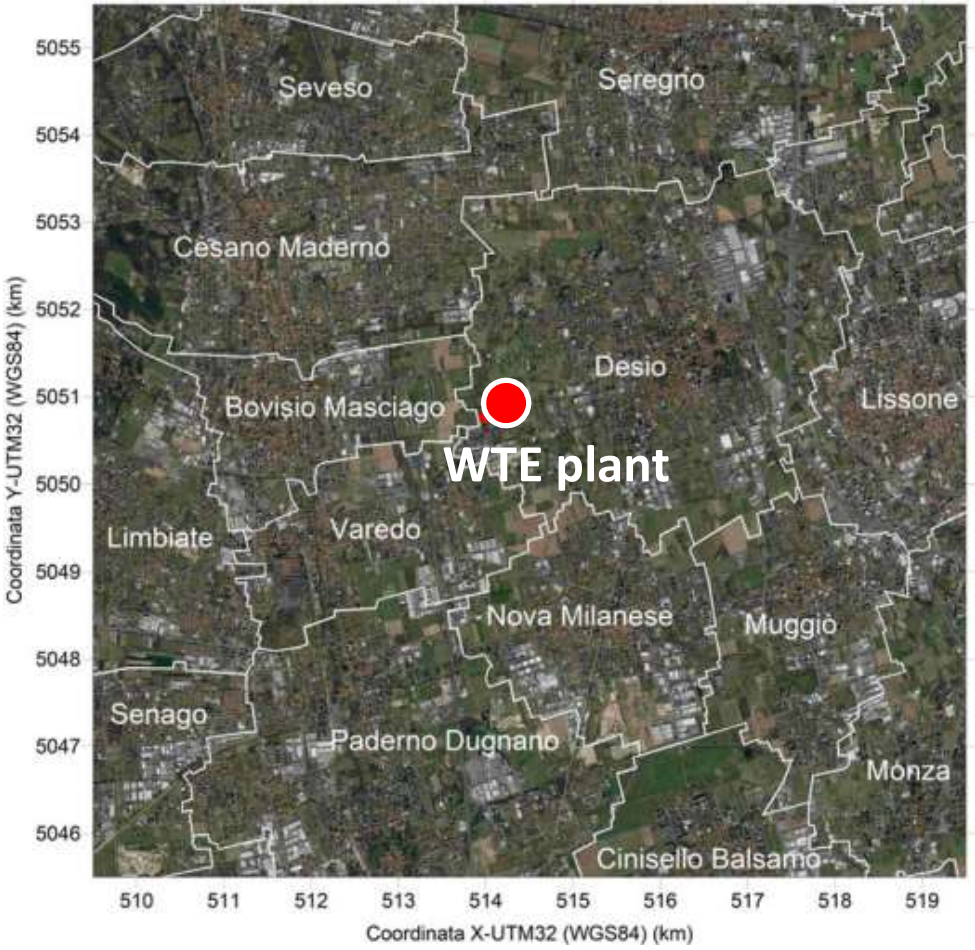
Waste throughput (tons/year)



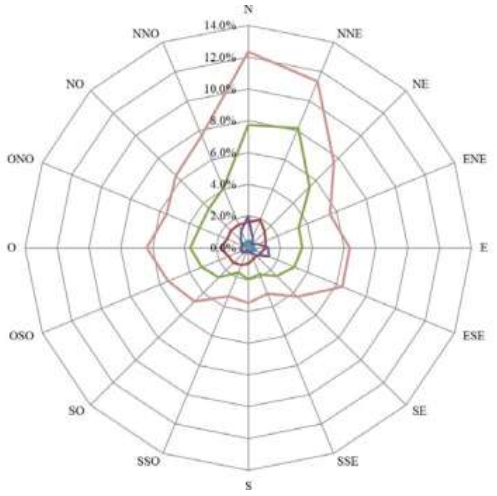
Continuous emission monitoring system

Study area

- Desio municipality and surroundings



2016 meteorological data from Regional EPA



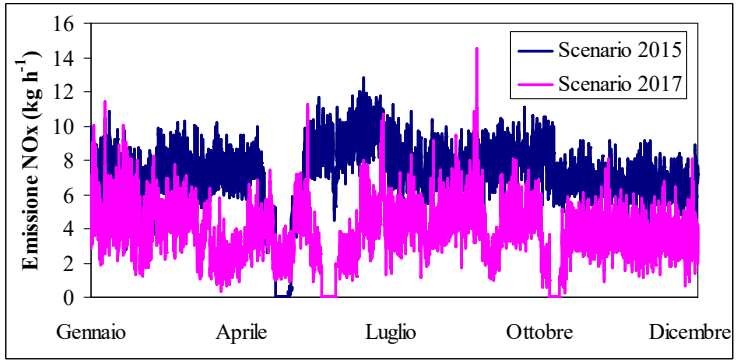
Methods

- **Hourly emission data from CEM system:**
  - flue gas temperature and speed, PM10 and NOx
- **PCDD/F concentrations from discontinuous monitoring:**
  - Monthly averaged concentration from continuous sampling for PCDD/F (dioxins)
- **Two Scenarios simulated**
  - Scenario A (before plant revamping)
  - Scenario B (after plant revamping)
- **Calpuff atmospheric dispersion model** to assess the plant's impact on air quality (hourly, daily, yearly average)

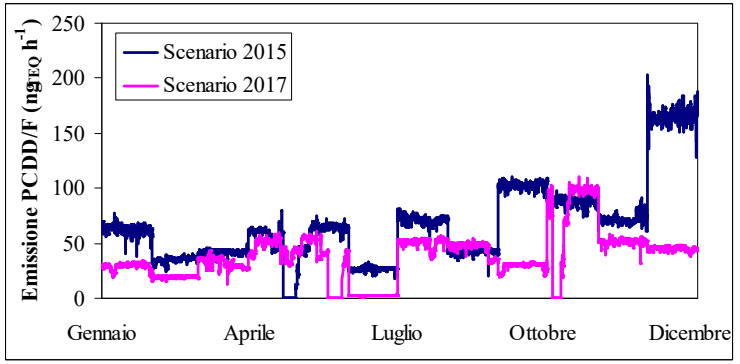
WtE Plant's real emissions

- Emissions were/are well below maximum authorized limits
- Improved performance for NOx & PCDD/F (*thanks to SCR*)
- Worse performance for PM10 (*due to larger waste throughput*)

Parameter	PM10 (g h^{-1})		NOx (kg h^{-1})		PCDD/F (ng_{TEQ} h^{-1})	
	Sc. A	***Sc. B***	***Sc. A***	***Sc. B***	***Sc. A***	***Sc. B***
Average	**15.5**	**20.9**	**7.38**	**4.00**	**69.1**	**39.9**
Median	10.8	21.6	7.38	4.00	64.8	40.7
Minimum	0.4	1.4	0.07	0.22	3.2	1.8
Maximum	205.6	72.7	12.82	14.54	202.7	110.2
Maximum Authorized	**1100**		**22**		**11000**	



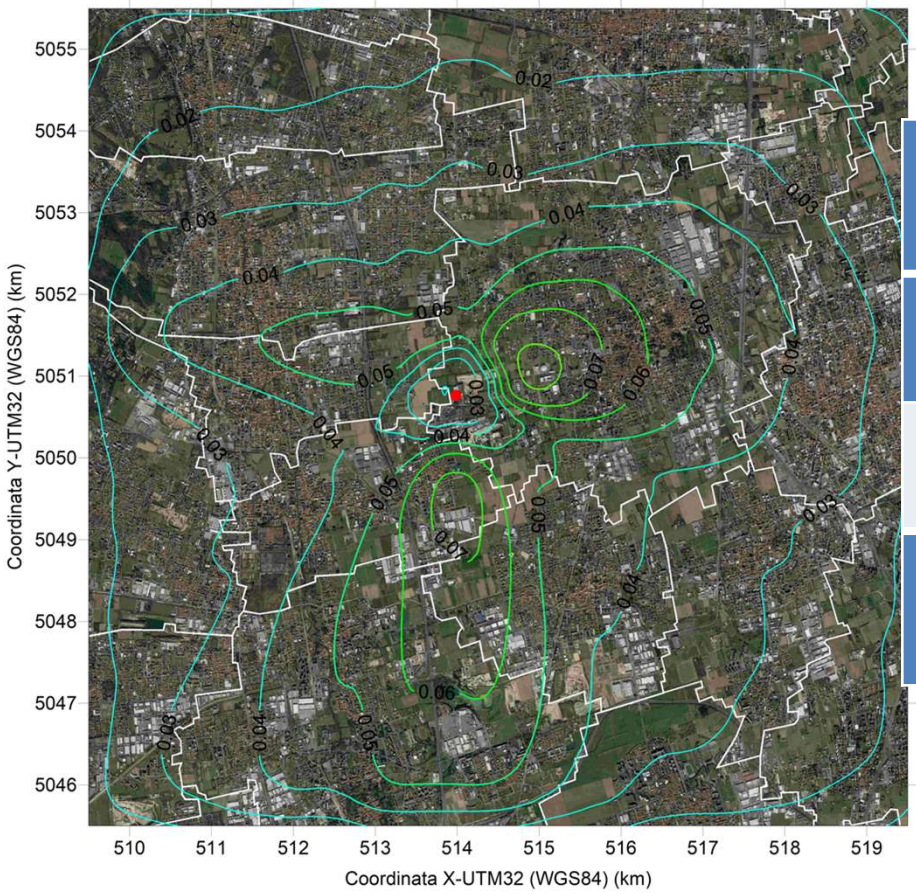
Authorized flow rate: 22 kg h^{-1}



Authorized flow rate: 11000 ng_{TEQ} h^{-1}

WtE impact on air quality

- **NO_2 annual average concentration (plant contribution)**



	PM10 (µg m^{-3})	NO_2 (µg m^{-3})	PCDD/F (fg_{TEQ} m^{-3})
Max. value	$4.4 \cdot 10^{-4}$	0.08	$8.1 \cdot 10^{-4}$
Urban area	$2\text{-}3.5 \cdot 10^{-4}$	0.05-0.07	$5\text{-}7 \cdot 10^{-4}$
AQ limit	40	40	150 (*)

Scenario B (after revamping)
Max: 0.08 µg/m³
Desio urban area: 0.05-0.07 µg/m³

2016 NO_2 annual average concentration (Desio: 46.4 µg m^{-3})

Road traffic impact on air quality

Methods

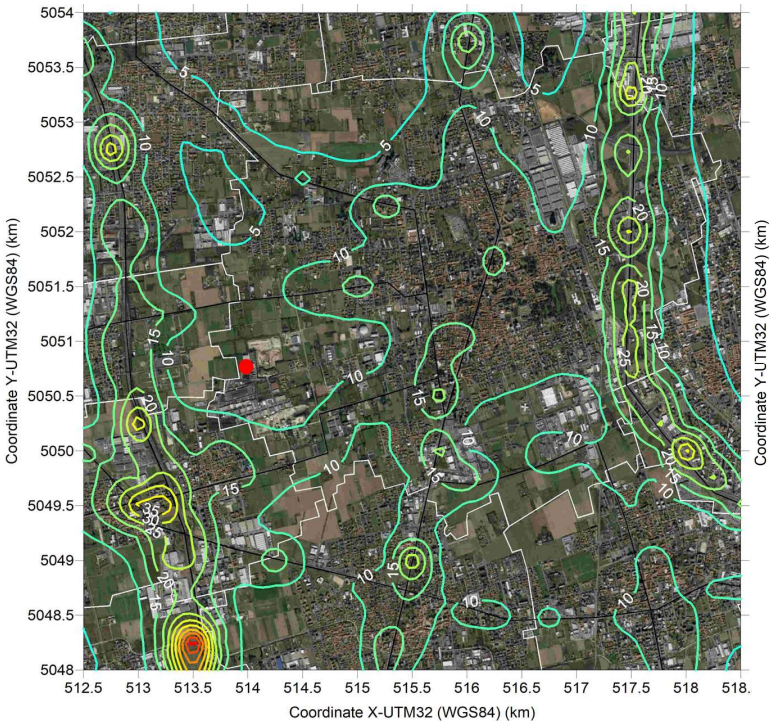
- Assessment restricted to main roads (i.e.: national and highly-trafficked local roads): **about 70% of total traffic emission**
- Dedicated study for hourly traffic flow of 3 vehicles' classes
- Emission assessment based on literature emission factors

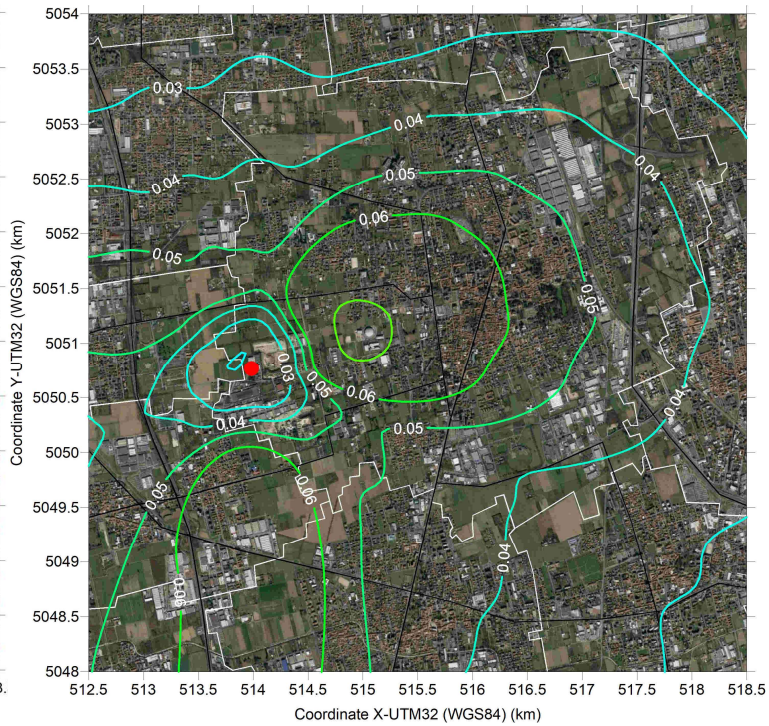
	Cars	LDV	HDV
PM10 (mg km^{-1})	39.9	77.4	217.9
NO_2 (mg km^{-1})	152.8	347.9	598.3
PCDD/F (pg_{TEQ} km^{-1})	21.3	39.6	49.4


Main roads considered (red arches)

Road traffic vs. WtE plant

Contribution to NO_2 & PM10 annual average concentration





Road traffic

Max: 15-20 µg/m³

Desio urban area: 6-10 µg/m³

Max: 5-6 µg/m³

Desio urban area: 2-3 µg/m³

WTE plant - Scenario B

Max: 0.08 µg/m³

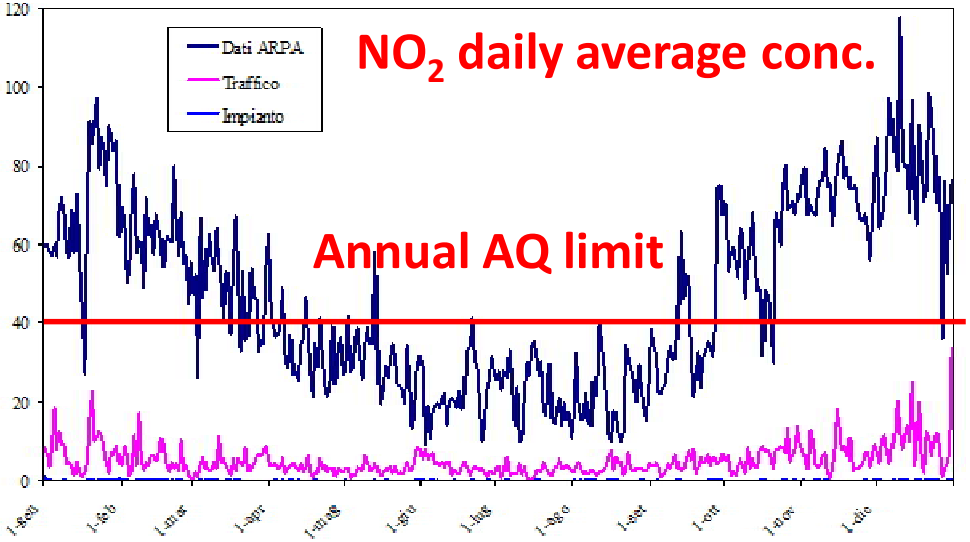
Desio urban area: 0.05-0.07 µg/m³

Max: $4.4 \cdot 10^{-4}$ µg/m³

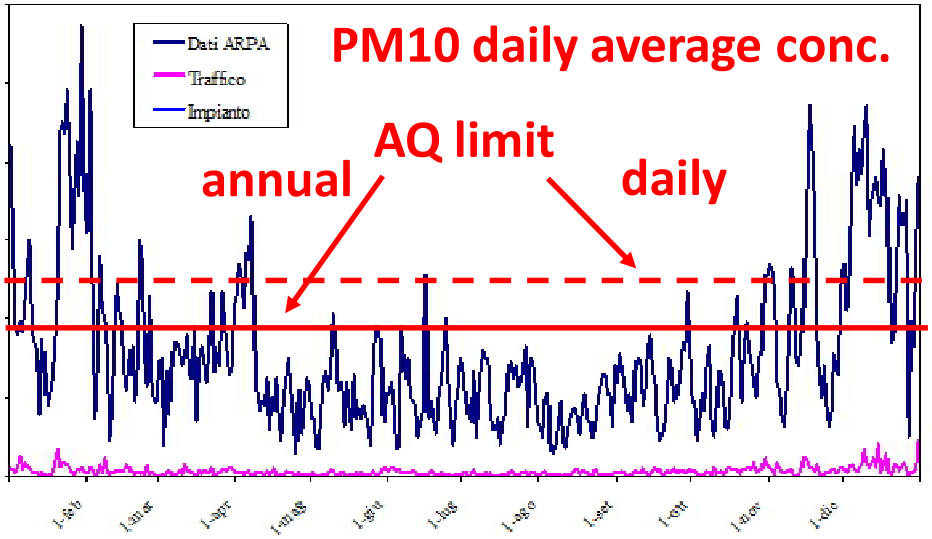
Desio urban area: $2.0\text{-}3.5 \cdot 10^{-4}$ µg/m³

Road traffic vs. WtE plant

Road traffic and WtE plant contribution vs. air quality data



Desio urban area, calendar year 2016



Case study Conclusions

- ***Confirmation*** of WtE plant impact on air quality in Desio urban area
- ***Relevant downsizing*** of WtE plant actual impact on local air quality (at least 5x factor for NOx, up to 250x factor for PCDD/F)
- ***Positive effect*** of flue gas treatment revamping with strong reduction (60%) of air quality impact for NOx and PCDD/F thanks to SCR in spite of the increased incineration capacity

  Max NO_2 annual avg. from 0.003 $\mu g/m^3/kt_{waste}$ down to 0.001 $\mu g/m^3/kt_{waste}$
- ***Extremely modest contribution*** of WtE plant emission to ambient concentration levels, both as annual average and as short-term values
- ***Air quality impact of road traffic emission definitely greater than WtE*** (orders of magnitude), not only for criteria pollutants (PM10 and NOx) but also for organic and inorganic trace pollutants

Conclusions

- Municipal waste management is not a closed circle, currently …..

  …. *but in the future, maybe*

- Waste-to-Energy plants are a viable option to deal with residual waste ….

  …. *recovering energy, as well*

- WtE plant have an impact on air quality ….

  …. as *other sources, too*

- Regulation, monitoring, transparency, communication are mandatory ….

  …. *to rise the acceptance of plants*

Thanks for your attention