The Waste-to-Energy plant of Modena

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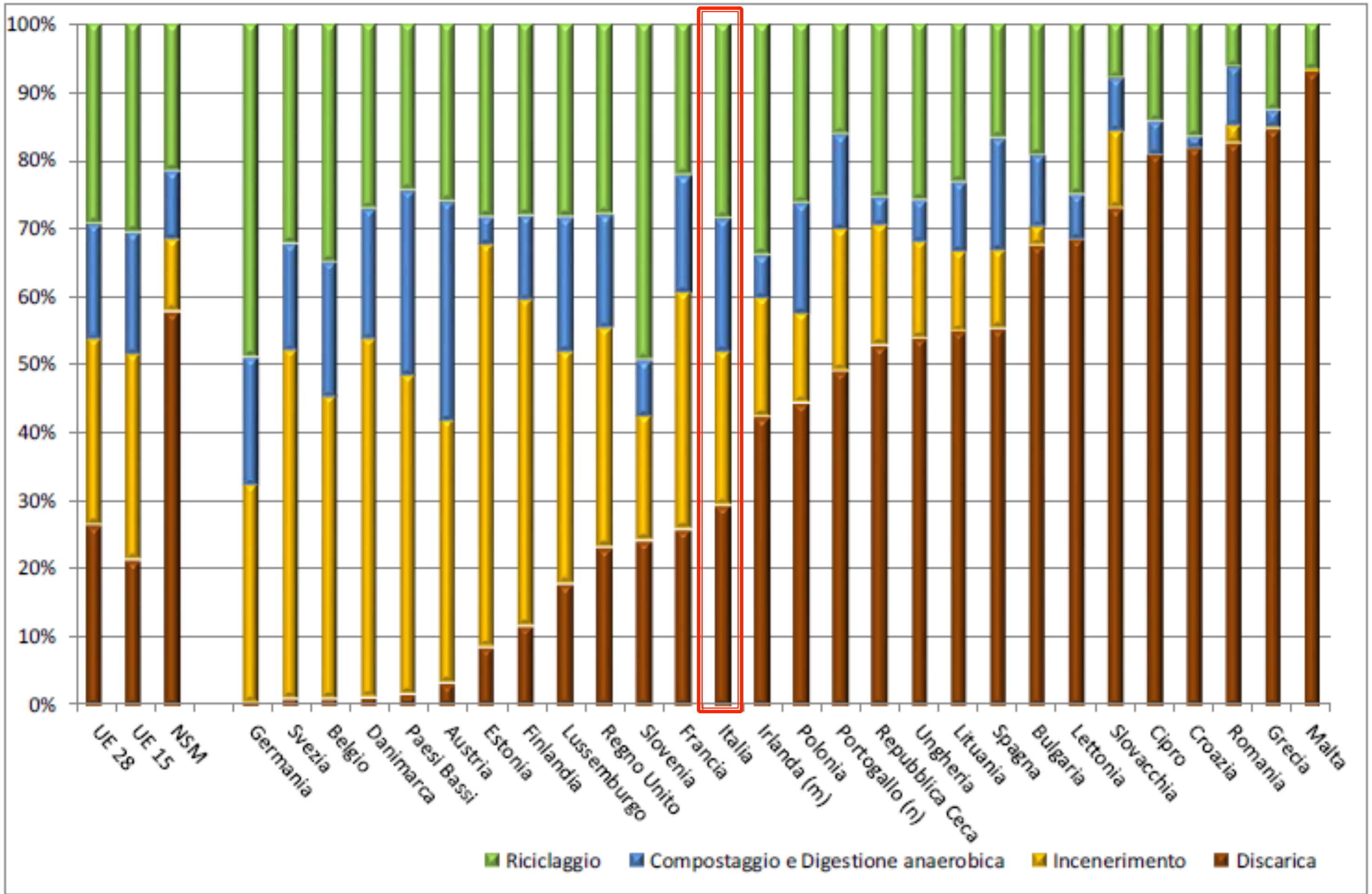
Urban Waste Management – UE

Figura 1.5 – Ripartizione percentuale della gestione dei rifiuti urbani nell'UE, anno 2015 (dati ordinati per percentuali crescenti di smaltimento in discarica)



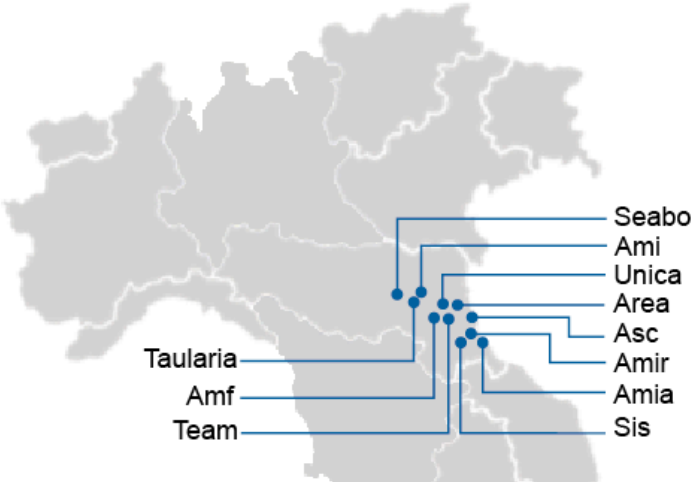
Note: (m) dato 2012; (n) dato 2014.
Fonte: elaborazioni ISPRA su dati Eurostat

ISPRA
Rapporto Rifiuti Urbani – Edizione 2017

GRUPPO HERA HISTORY

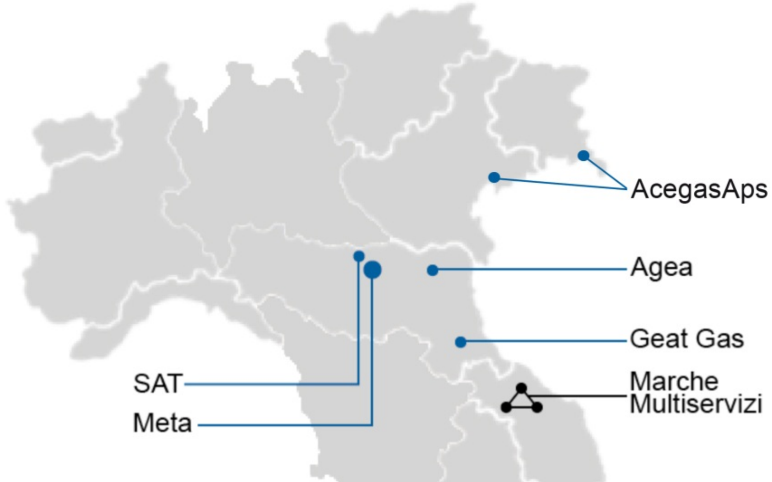
Waste
Hera
WTE Modena

Founded in 2002 from the merger of 11 companies…



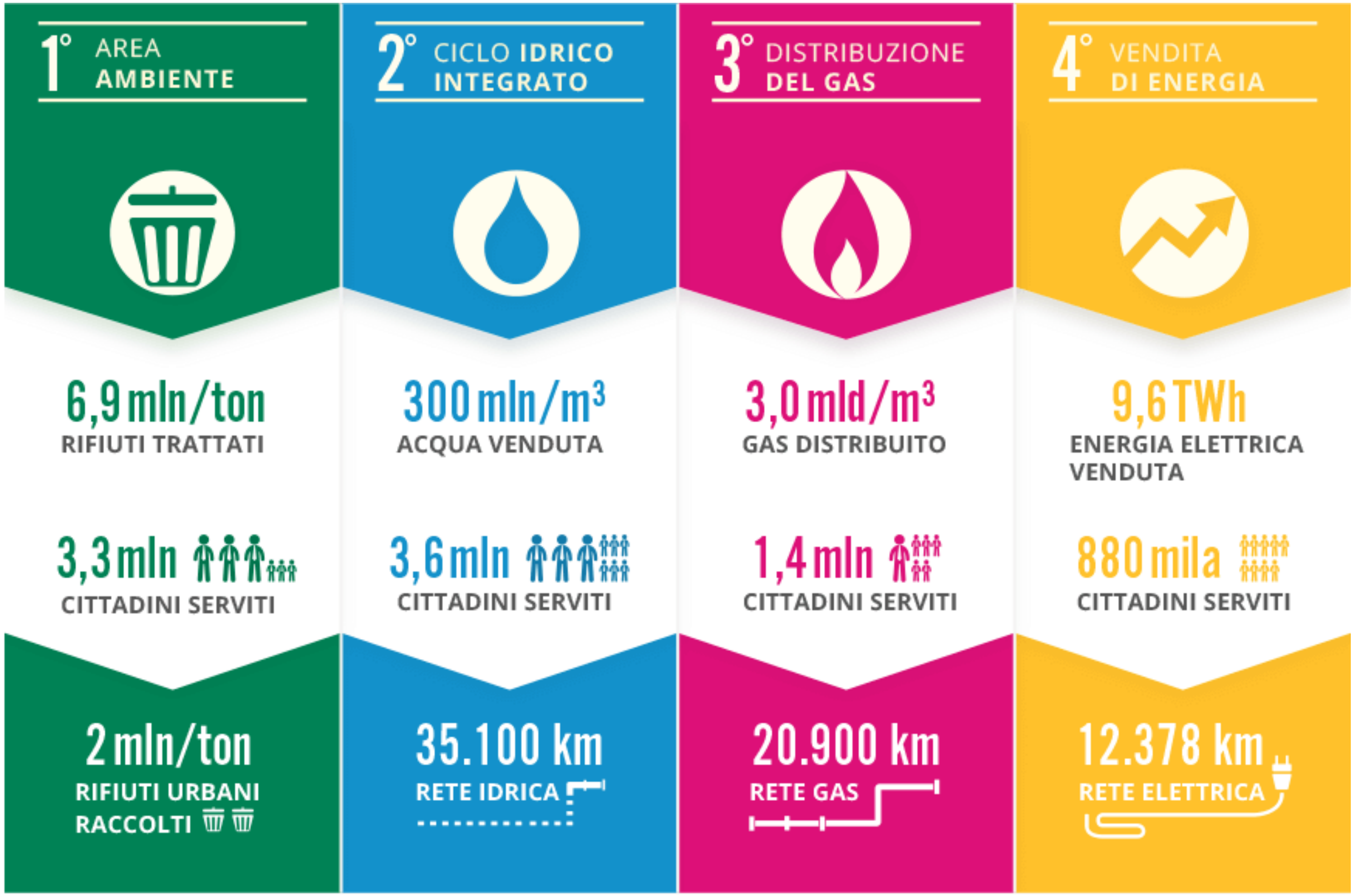
In 2003, **44.5%** of Hera's share capital was placed on the **Stock Exchange**

… with **further expansion** in the following years

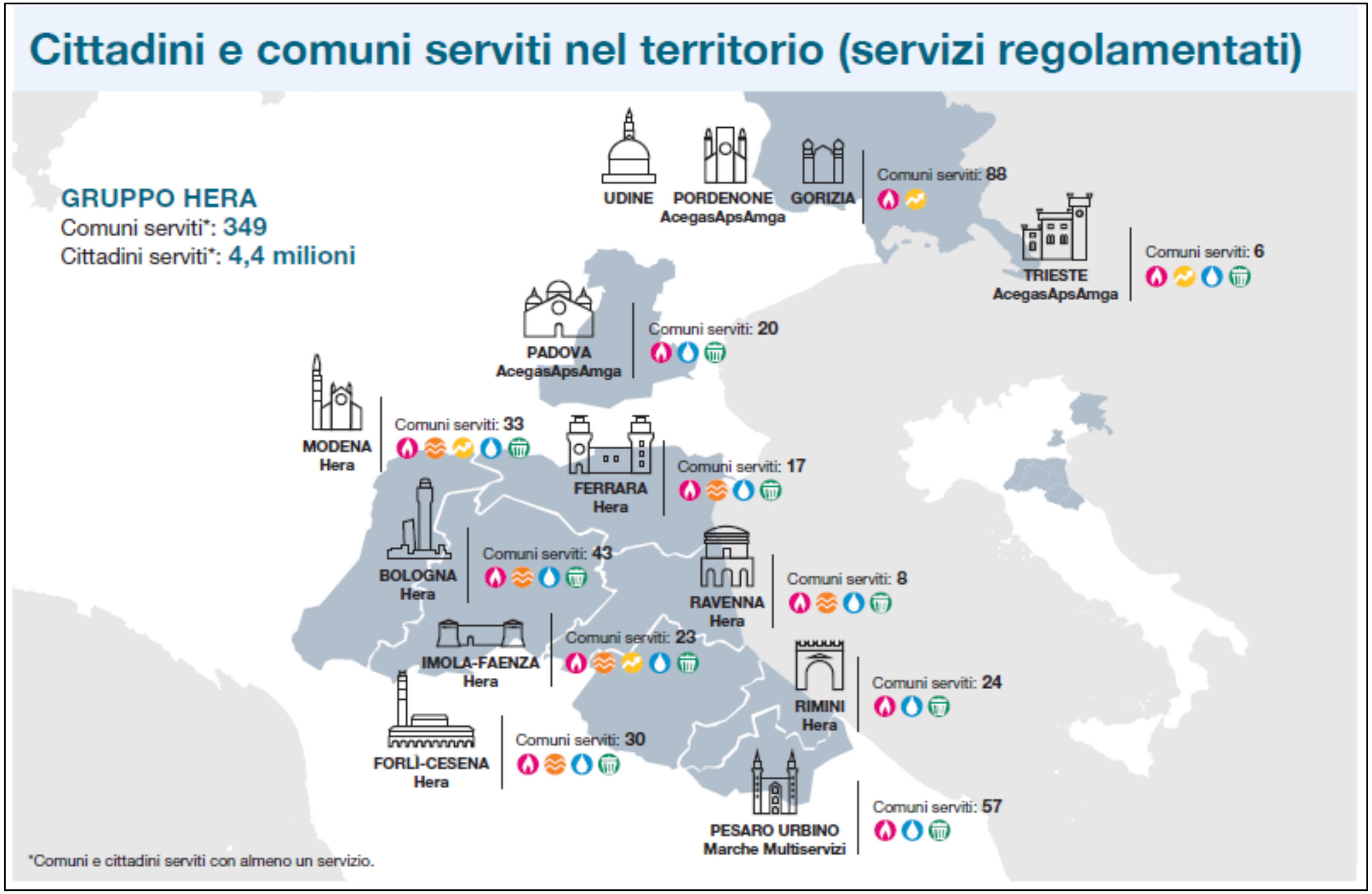


The **growth continued** in the following years with acquisitions and mergers of other companies

What – Hera

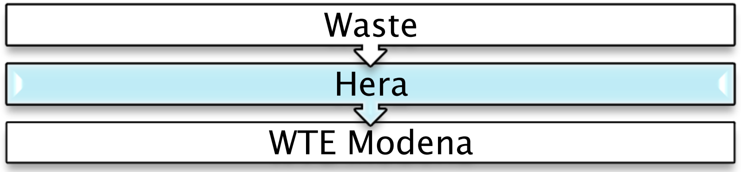

1° AREA AMBIENTE
6,9 mln/ton
RIFIUTI TRATTATI
3,3 mln
CITTADINI SERVITI
2 mln/ton
RIFIUTI URBANI RACCOLTI
2° CICLO IDRICO INTEGRATO
300 mln/m³
ACQUA VENDUTA
3,6 mln
CITTADINI SERVITI
35.100 km
RETE IDRICA
3° DISTRIBUZIONE DEL GAS
3,0 mld/m³
GAS DISTRIBUITO
1,4 mln
CITTADINI SERVITI
20.900 km
RETE GAS
4° VENDITA DI ENERGIA
9,6 TWh
ENERGIA ELETTRICA VENDUTA
880 mila
CITTADINI SERVITI
12.378 km
RETE ELETTRICA

Where – Hera



HERA – Bilancio di sostenibilità 2017

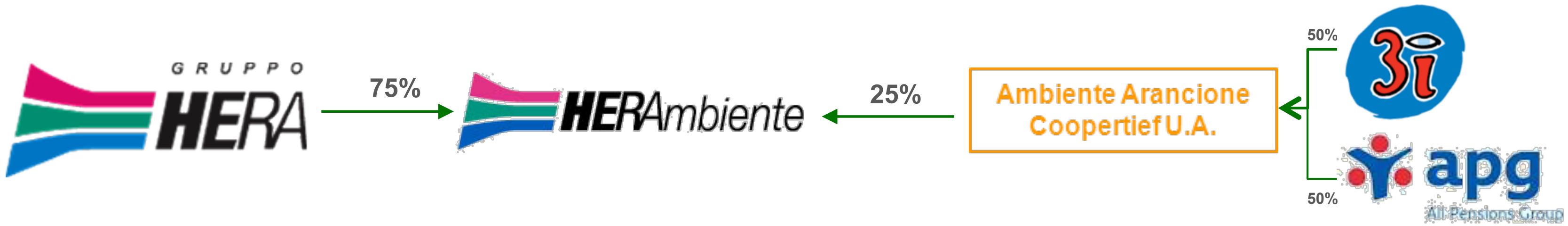
Separate collection and recycling– HERA



HERA – Sulle tracce dei rifiuti – 2016

Herambiente

Herambiente is the Hera Group company, established in 2009, which deals with the treatment and disposal of waste, both urban and industrial, both solid and liquid, both hazardous and non-hazardous.



The main 2017 Data:

Waste disposal
6,3 Milioni ton

Electric Energy Production
940 GWh

Thermal Energy Production
156 GWh

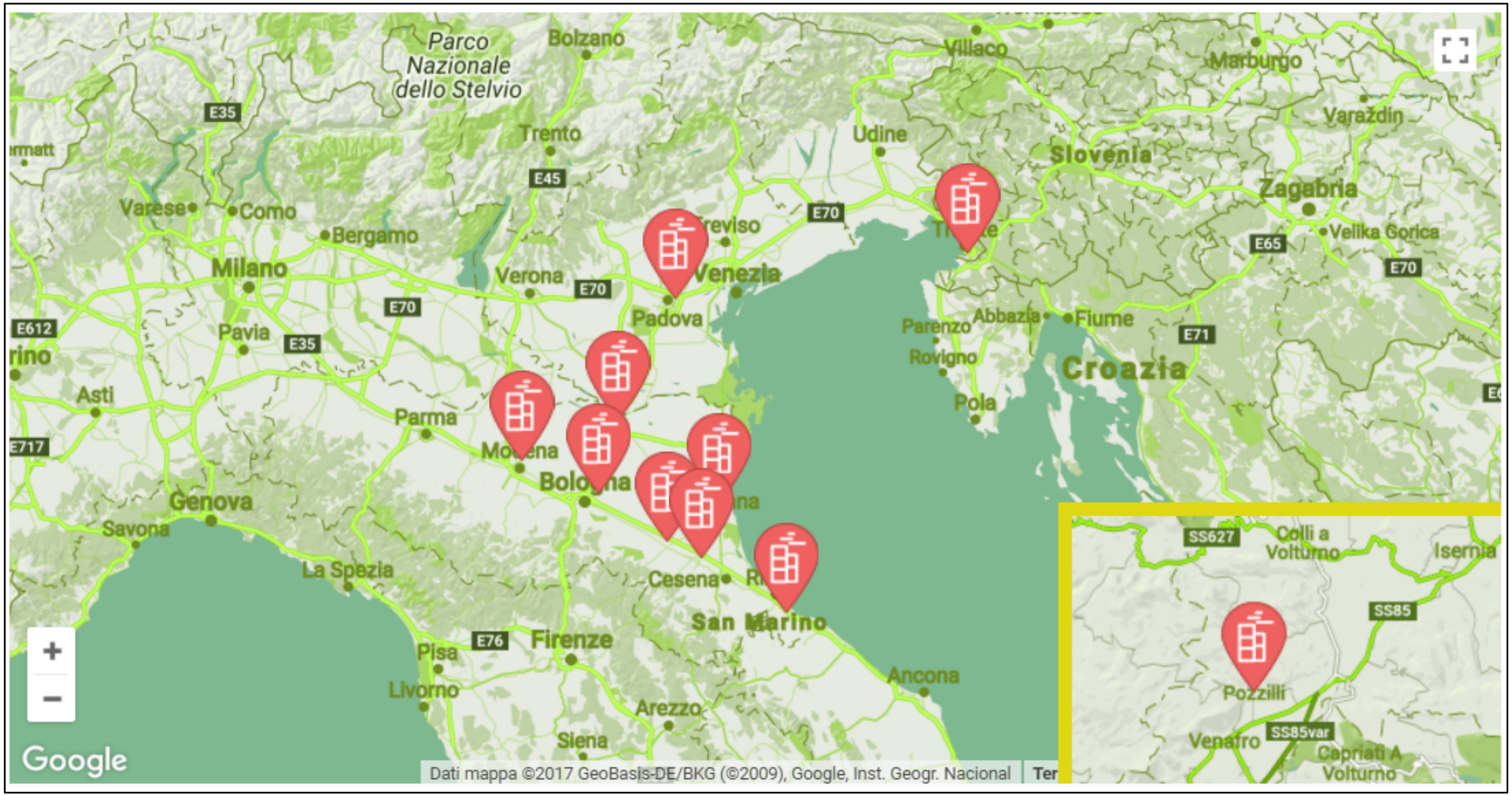
Herambiente Plants

Waste
↓
Hera
↓
WTE Modena

Herambiente is the largest company in the waste treatment sector, with a park of 91 plants.

Waste
Hera
WTE Modena

WtE Herambiente



The plant park consists of 9 waste-to-energy plants.

WtE Modena – Herambiente

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Start–Up Linea 4	April 2009
Disposal capacity Linea 4	22,4 ton/h – 538 ton/day (con PCI 3000 kcal/kg)
Total thermal capacity	78 MWt
Nominal turbine power	18,6 MWe
Working hours in a year	7.800

Waste
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WtE Modena – Herambiente

The plant has the following configuration:

1. Section for receiving waste, storage and feeding;
2. Combustion line with grill oven equipped with steam generator
3. Flue gas purification system
4. Electricity generation system designed for the recovery of thermal energy
5. Emissions monitoring system (SME)

Process

Waste
Hera
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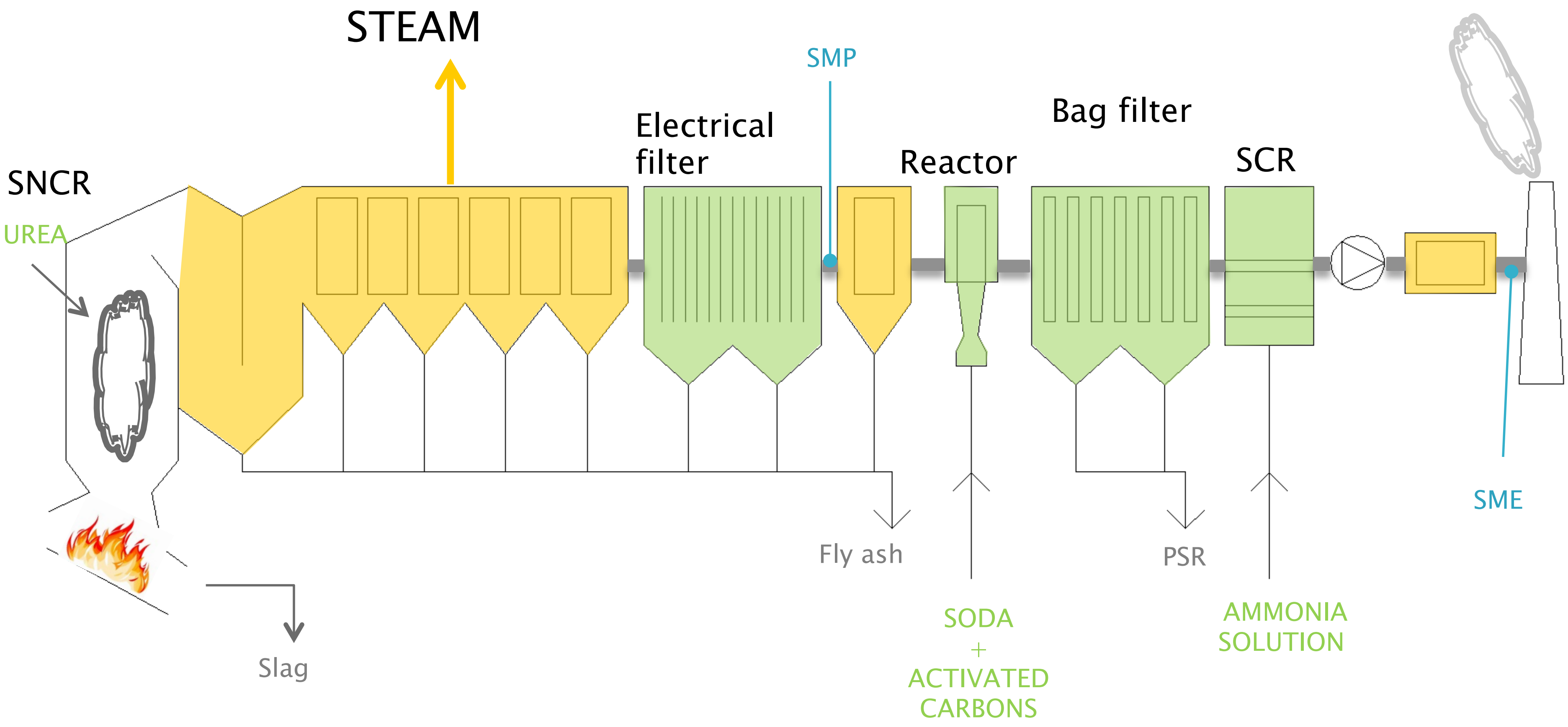


Section for receiving waste

1. Radioactivity control
2. Load vehicle weighing;
3. Document control (identification of the lender / transporter, form control);
4. Weight registration;
5. Start at the point of discharge into the pit (semaphore signaling of the access routes available);
6. Positioning of the vehicle and discharge of waste in a storage pit;
7. Unload vehicle weighing (tare);
8. Return of documents with proof of disposal;
9. Removal of the vehicle.

Waste

Hera

WTE Modena

Section for storage and feeding waste

1. Discharge of the waste of the vehicle in the bunker (about 16 m high);
2. Mixing and homogenisation of the waste with an octopus crane;
3. From the storage bunker the waste is fed into the loading hopper by bridge crane;
4. The loading hopper is always kept full to avoid backfires;
5. The bunker is maintained in depression and the extracted air is used as primary combustion air.

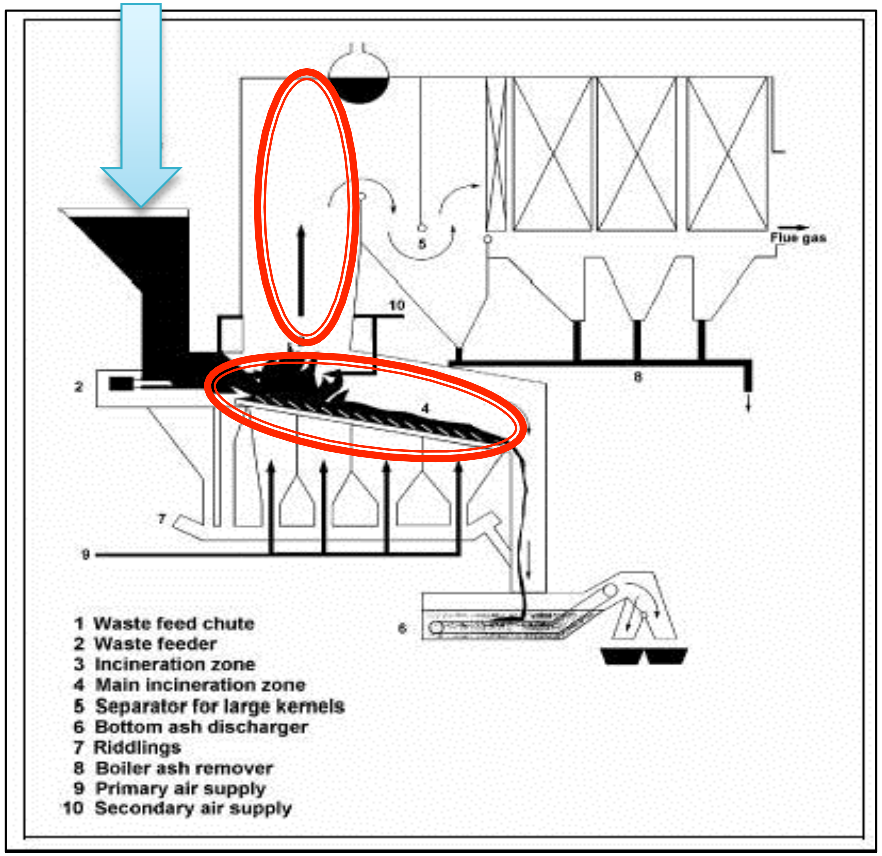
Waste

Hera

WTE Modena

Combustion line

1. Feeding along the hopper channel up to the grid, water-cooled;
2. Stages of combustion on the grid: drying, ignition / combustion and demining;
3. The grid is divided into 5 sectors for each side.
4. Optimization of the combustion air dosage for correct and complete combustion;
5. Post-combustion chamber sized to guarantee the permanence of flue gases at T> 850 ° C for at least 2 seconds in order to break down dioxins (equipped with auxiliary burners);



Combustion

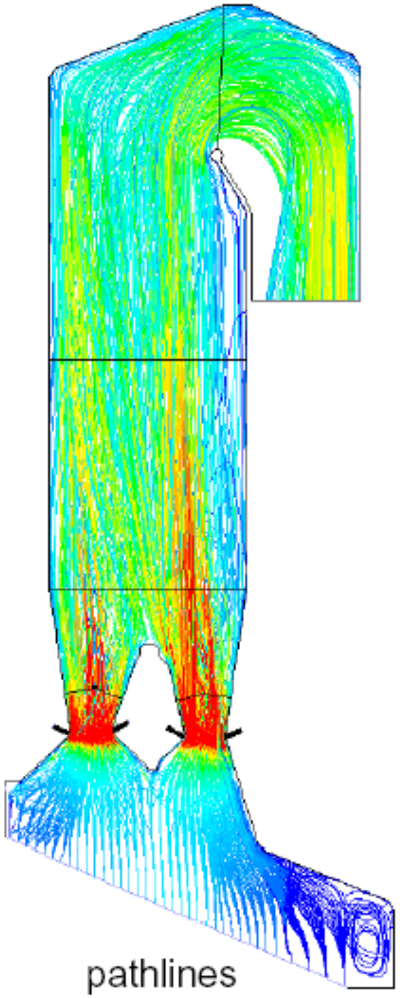
1. Combustion of waste takes place advancing on the grid, in whose end section takes place the slagging;
2. Fall of the slag produced and their transport first through redler (immersed in water for their shut down) and then through tape to storage;
3. Water used for extinguishing is a process waste → water resource saving;
4. Storage of the slag takes place in a slag bunker before being transported for recovery and/or disposal.
5. The heat recovered from the cooling of the grill is used to preheat the primary air, whose temperature is adjustable according to the characteristics of the waste.

Steam generator

1. The flue gases generated by combustion, after the post-combustion chamber, pass through the steam generator;
2. The generator consists of pipes filled with demineralized water with large exchange surfaces that are kept clean by automatic hammer systems;
3. The generator has a dual function: recovery of the heat contained in the fumes and cooling at the same time for the subsequent purification steps;
4. The flue gases enter about 950 ° C and leave at about 190 ° C;
5. The heat from the flue gases is transferred to the water in the pipes, which is transformed into steam at high T (400 ° C) and P (50 bar), subsequently exploited for the production of electricity;

Waste → Hera → WTE Modena

Flue Gas purification system– SNCR



- The first phase of flue gas purification consists of a selective non-catalytic reduction (SNCR) performed by injection of Urea (NH2CONH2), in order to reduce the content of Nitrogen Oxides (NOx)
- The reagent is sprayed (by spears) inside the Post Combustion Chamber in which there are temperatures between 850 ° C and 1000 ° C and a good turbulence: these conditions facilitate the reduction reaction;

$$NO_X + Urea \rightarrow N_2 + H_2O$$

- The ammonia which can be generated as a secondary effect of this reaction is then exploited in the final catalytic phase of NOx reduction as an activating element of the catalyst;

Flue Gas purification system

- The flue gases leaving the boiler are a first dedusting phase, from an electrofilter in order to remove the bigger particles;
- The fumes coming out of the electrofilter will enter a Reactor, in which there is the injection of sodium bicarbonate (NaHCO3) and activated carbons to eliminate acid gases (HCl, HF and SO2) and Micropollutants (PCDD, PCDF, IPA and PCBs). Metals);
- There is a second phase of dedusting through a bag filter, in order to remove the finer particles and the PSR.
- The PSR are the following products, ie the reaction products between bicarbonate and acid compounds, which are accumulated in silos and subsequently sent for recovery.

$$2NaHCO_3 \Rightarrow Na_2CO_3 + CO_2 + H_2O\,(T > 130\ °C)$$

$$2HCl + Na_2CO_3 \Rightarrow 2NaCl + CO_2 + H2O$$

$$SO_2 + Na_2CO_3 + 1/2\ O_2 \Rightarrow Na_2SO_4 + CO_2$$

Flue Gas purification system– SCR

- The last stage of purification is considered by selective catalytic reduction (SCR). The ammonia agent (NH3);

$$NO_X + NH_3 \rightarrow N_2 + H_2O$$

- The flue gases come into contact with catalytic surfaces (titanium oxide) honeycomb that in the presence of ammonia solution cause the reduction of nitrogen oxides and marginally of compounds based on dioxin and furans;
- The ammonia solution is evaporated in line by direct injection through atomization nozzles with compressed air;
- The ideal temperature for the reaction to occur is about 180/190 ° C;
- The purification efficiency is about 80/85%.

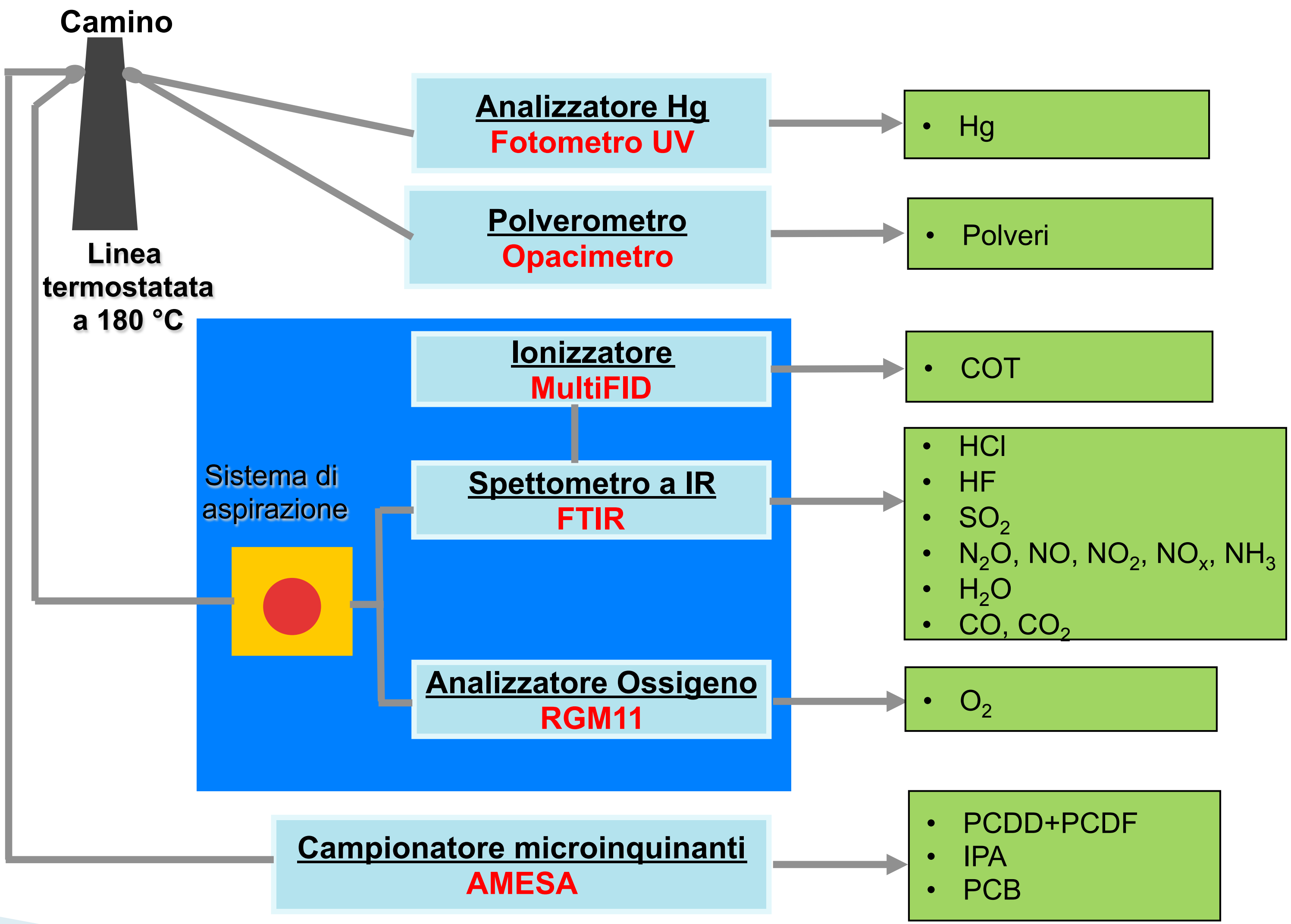
Energy recovery system

- The superheated steam produced in the steam generator is fed into a turbine coupled with a three-phase alternator, in order to produce electricity;
- At the moment the alternator group uses all the steam produced for the production of electricity. However, a connection is still provided to exploit a part of the steam in a possible district heating network.
- The steam coming out from the turbine enters in an air condenser, which ensures its condensation and recirculation in the steam generator of the condensates produced.

Emissions monitoring system

- The treated flue gases are conveyed to the chimney where a continuous monitoring system analyzes the gas emitted allowing to verify compliance with the legal limits;
- All analysis equipment is certified in order to offer maximum guarantees of quality and reliability;
- The monitored pollutants are: HCl, NOx, SO2, N2O, CO, CO2, COT, HF, Hg, NH3 and Powders;
- The readings of each pollutant are carried out continuously and the related results are sent with certain cadences to the Control Authorities;
- Further analyzes are carried out periodically by discontinuous sampling, using accredited laboratories;
- The online service for monitoring atmospheric emissions of all Herambiente waste-to-energy plants is active on the HERA Group website

Sistema di monitoraggio delle emissioni



WtE Modena – Certifications

Waste
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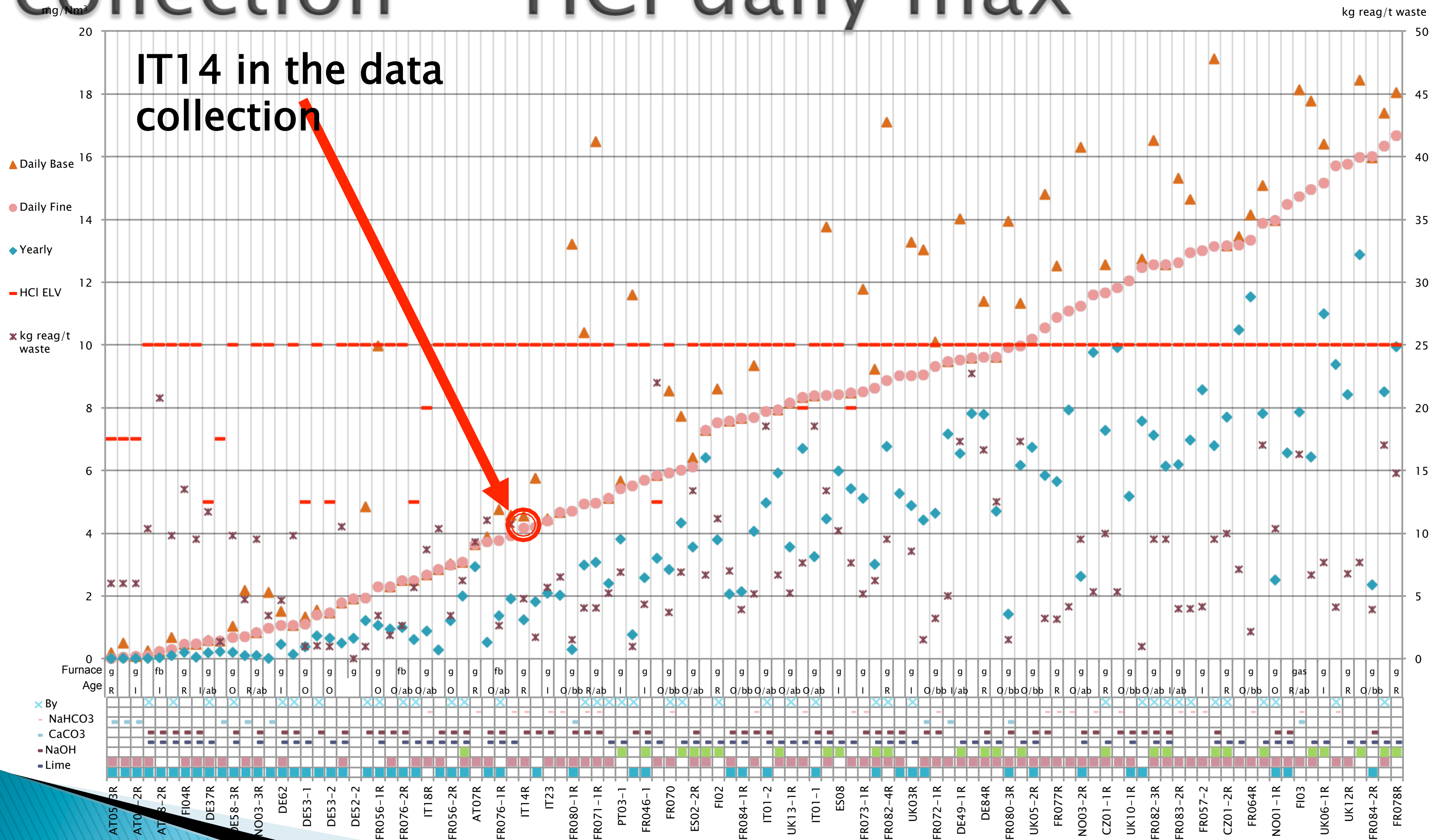
The integrated waste-to-energy management system has been developed according to the most important standards in terms of quality, safety and environment, allowing continuous improvements and obtaining the following certifications:

- EMAS
- UNI EN ISO 9001:2015 *“quality”*
- BS OHSAS 18001 “*safety”*
- UNI EN ISO 14001:2015 “*environment”*

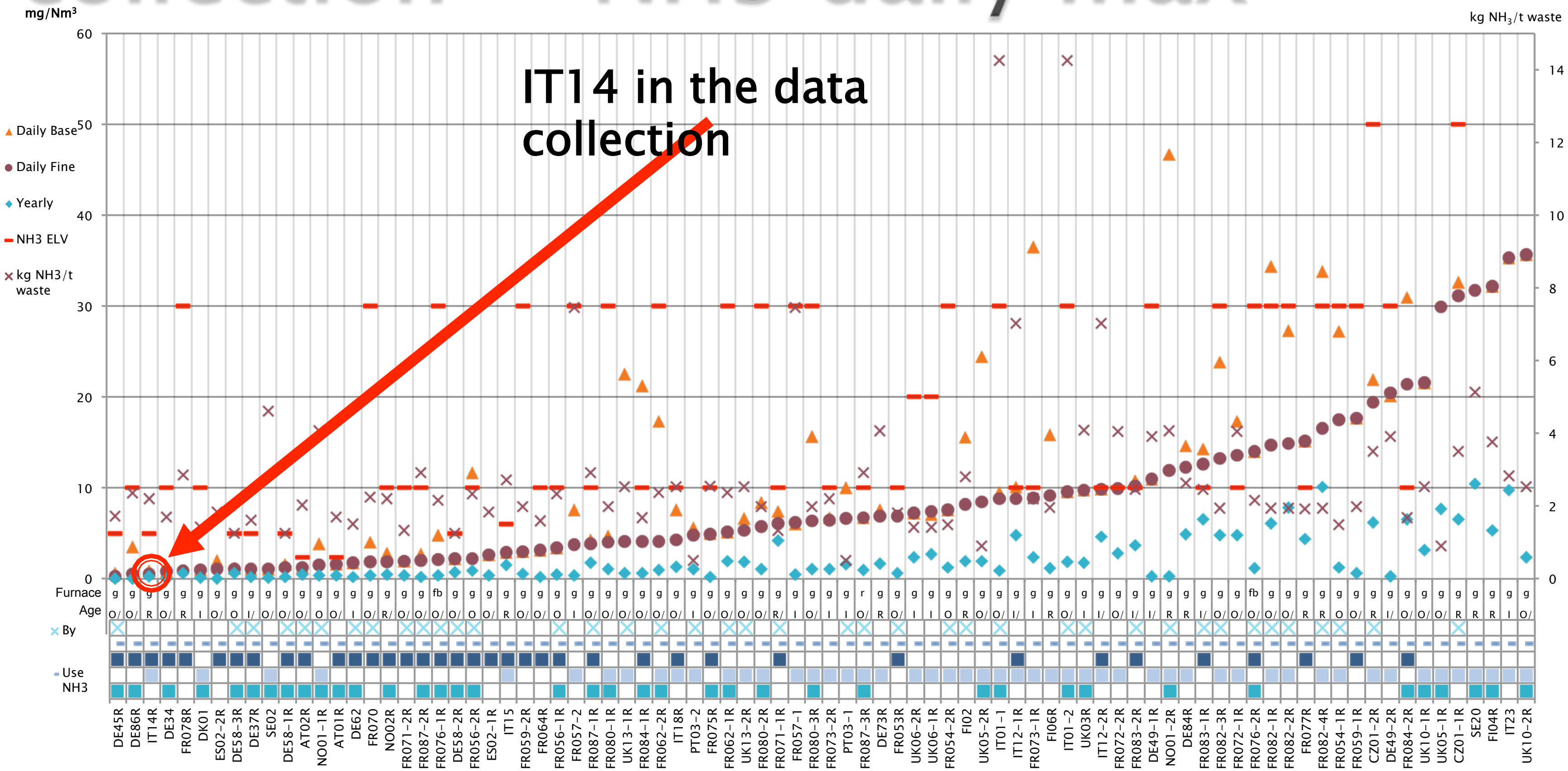
The Environmental Statement is drawn up annually with the analysis of all the environmental aspects related to the waste-to-energy plant and is published on the website:

www.ha.gruppohera.it/qsa/dichiarazioni_ambientali

Case plant against BREF data collection – HCl daily max

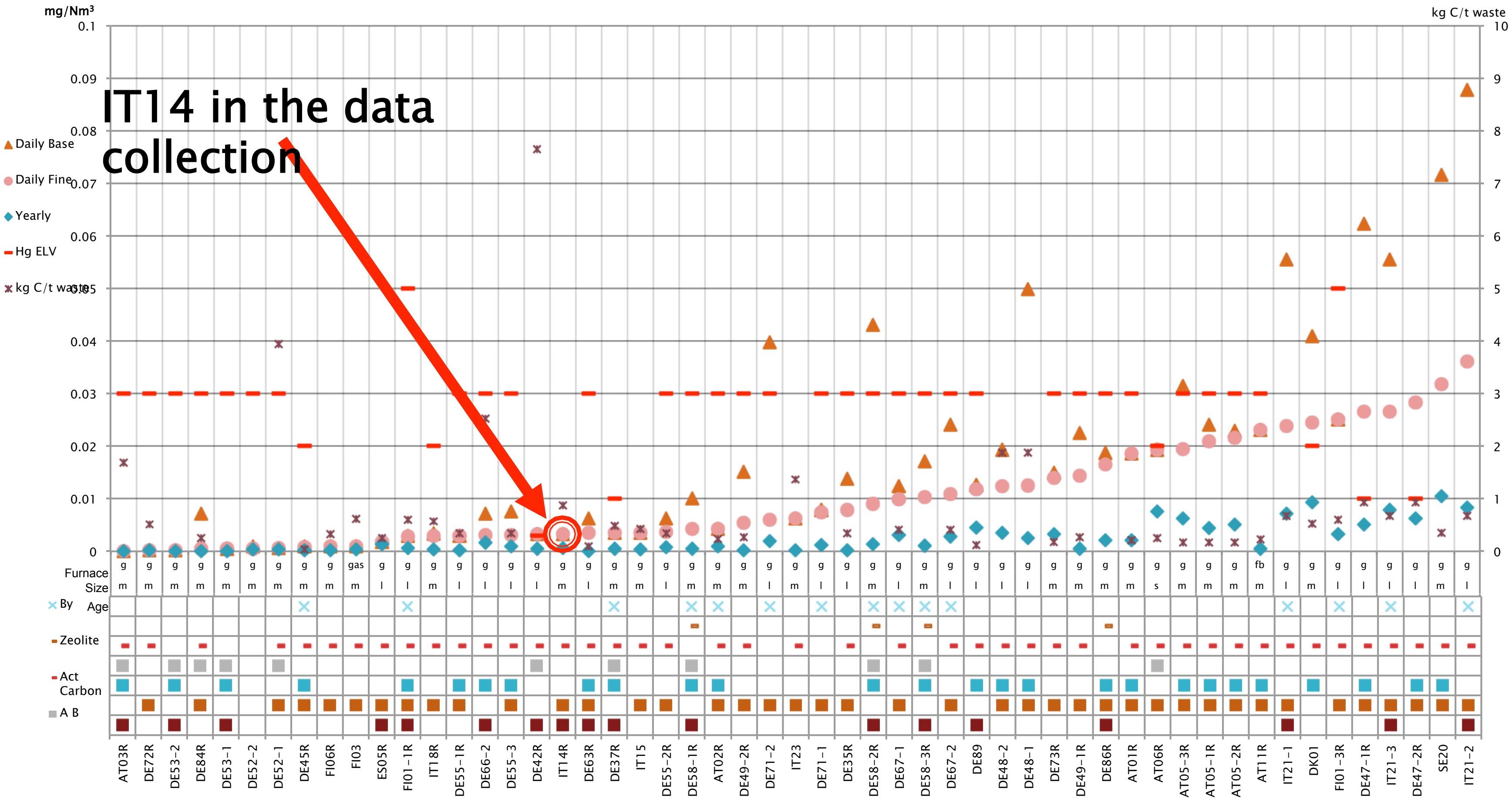


Case plant against BREF data collection – NH3 daily max

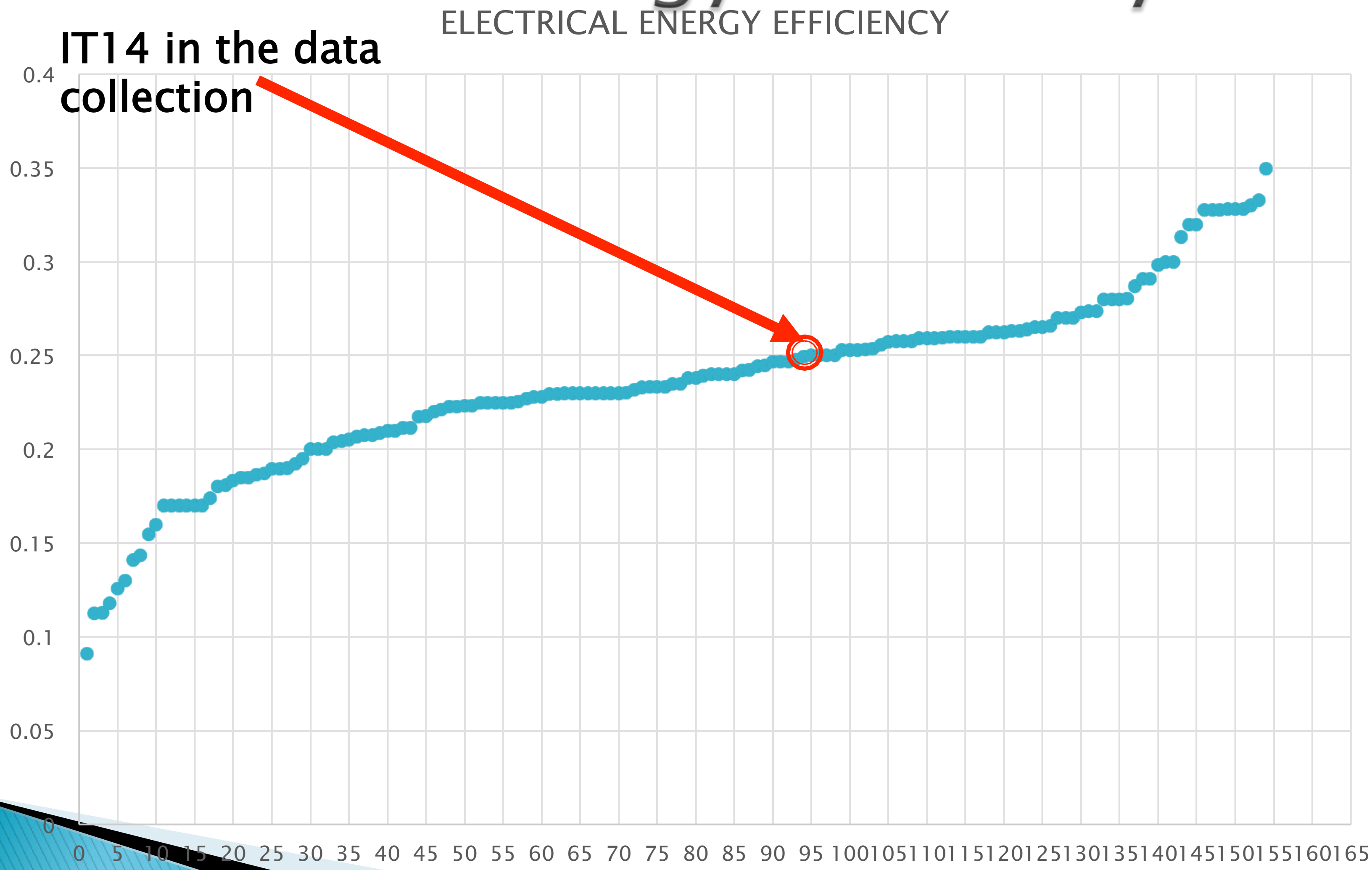


The plant is equipped with both SNCR and SCR system

Case plant against BREF data collection - Hg daily max



Case plant against BREF data collection – Energy efficiency




Thanks for attention!

Bologna WtE plant

Scheme of the installation