The contribution of Water to Circular Economy

Practices of water reuse across Europe

12 January 2016
08:00-09:30
Members Salon
European Parliament, Brussels

Chaired by:

Michel Dantin MEP

Chair of the "*Agriculture and Water Management*" Working Group of the EP Intergroup on "*Climate Change, Biodiversity, and Sustainable Development*"

Italy- The case of Milano-Nosedo municipal WWTP

Ing. Roberto Mazzini Milanodepur President
Dr.saFrancesca Pizza process & Laboratory Manager
Brussels 12-1-16

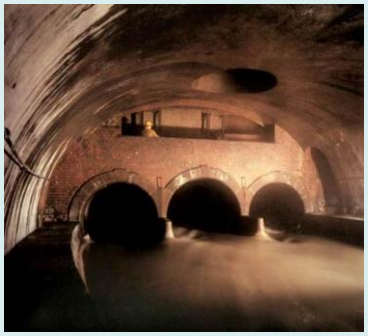
Milano WWTP NOSEDO

- **INDEX**

- **Nosedo- key data**
- **Water Reuse**
- **Thermal energy Recovery from treated WW**
- **Sludge:**
  - **Nutrient Recovery**
  - **Energy Recovery**
- **Wwtp comunication**

Milano-864.000 m3/day

- 300
  - millions
  - m3/year
- 10
  - m3/sec
  - Dry w.
- 30
  - m3/sec
  - wet



Nosedo-432.000 m3/day

- 150
  - **millions**
  - m3/year
- 5
  - **m3/sec**
  - dry w
- 15
  - m3/sec
  - wet

Population 1.250.000 e.h.

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MILANO NOSEDO WWTP Joint Venture

Type of contract: 19 year concession
Design-Built-Operate and Transfer
This was the first BOT scheme in Italy
in water field (2000-2019)

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VEOLIA
MANDATARIA

suez
environnement

PASSAVANT IMPIANTI spa

UNIECO

Bonatti

ITINERA

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EUROPE-ITALY-MILAN

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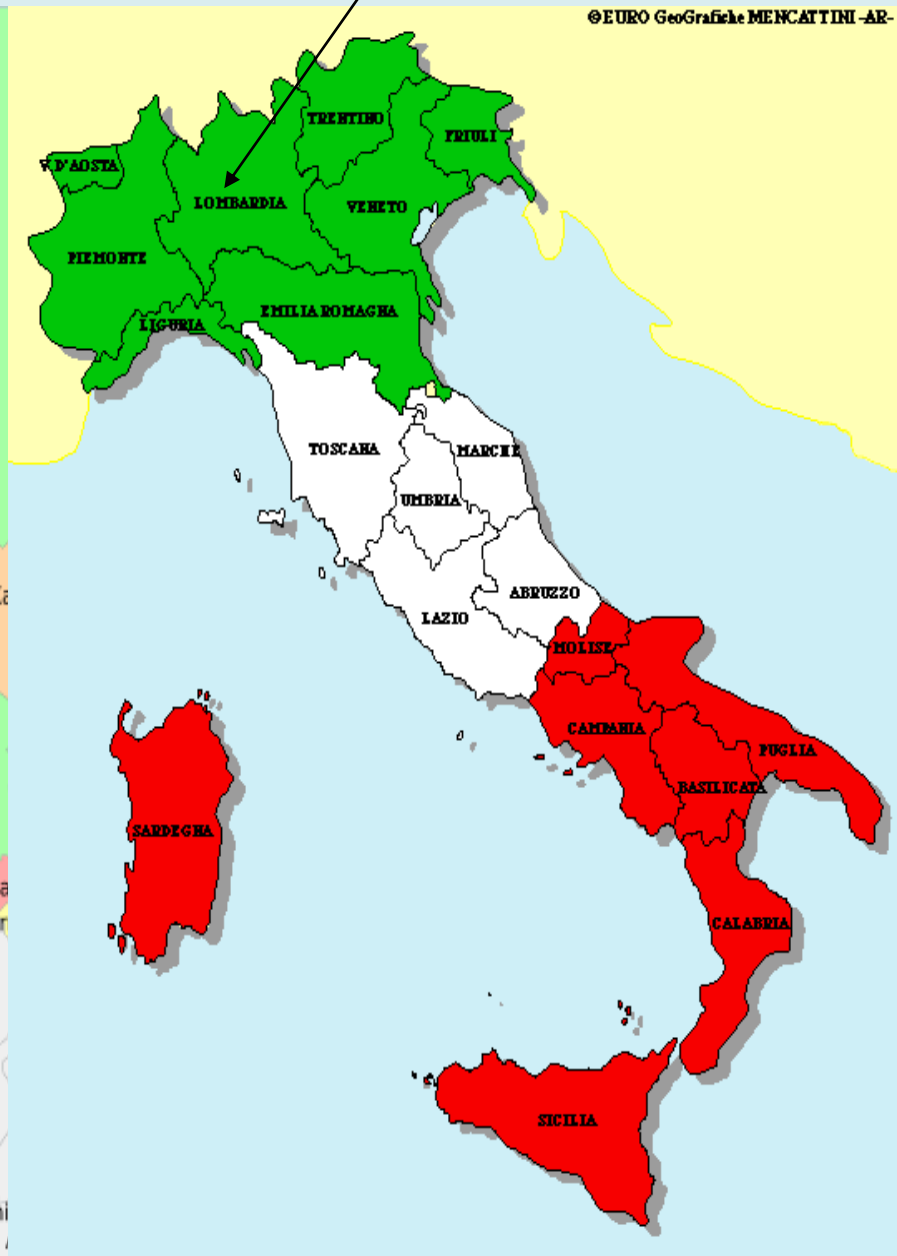
1. San Marino
2. Città del Vaticano
3. Liechtenstein
4. Lussemburgo
5. Principato di Monaco
6. Andorra
7. Malta
8. Montenegro
9. Kosovo



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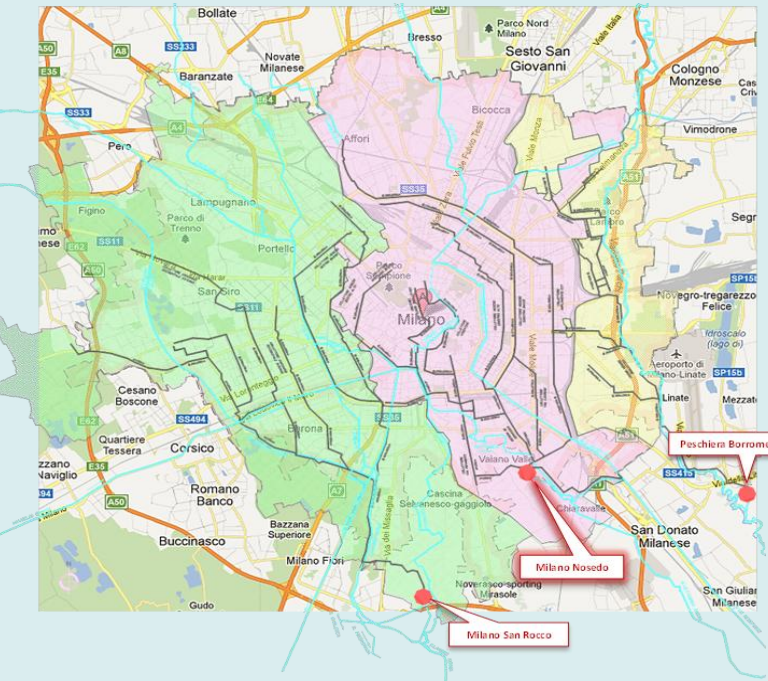
Milan and the main Italian rivers



It's the largest WWTP serving Tthe city of Milano

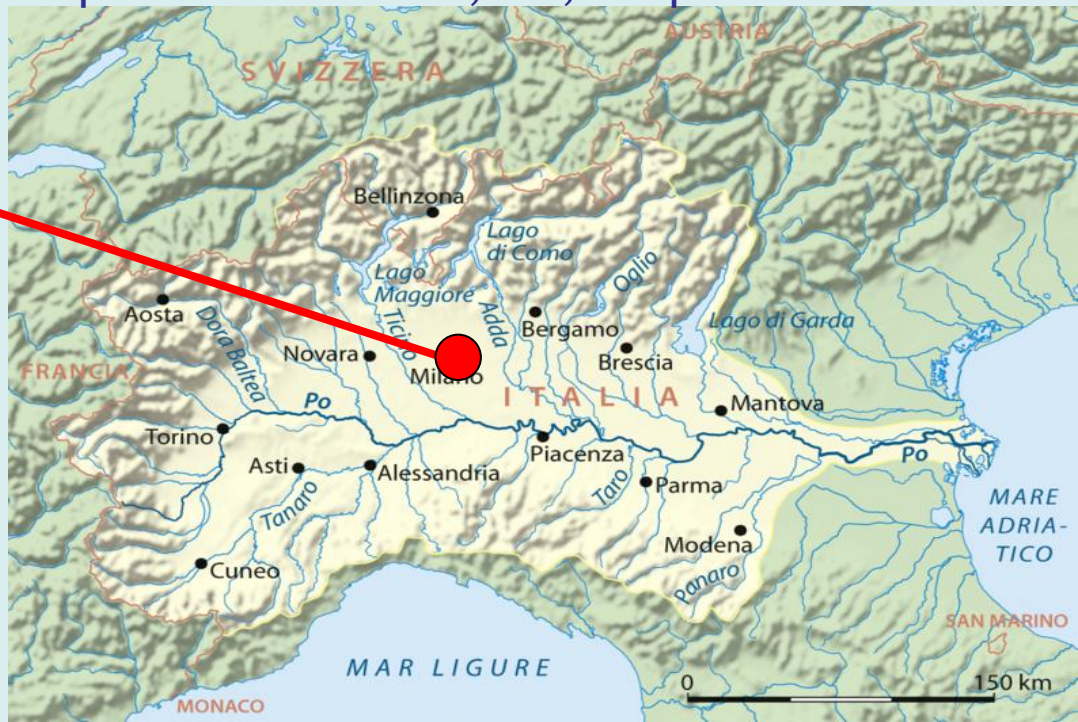
It treats sewage coming from the central and eastern area of the city, that means about 150,000,000 m^3/year of wastewater

- Total surface area involved: 40 ha
- Area occupied by the plant: 16 ha
- Population served: 1,250,000 p.e. *

MILANO

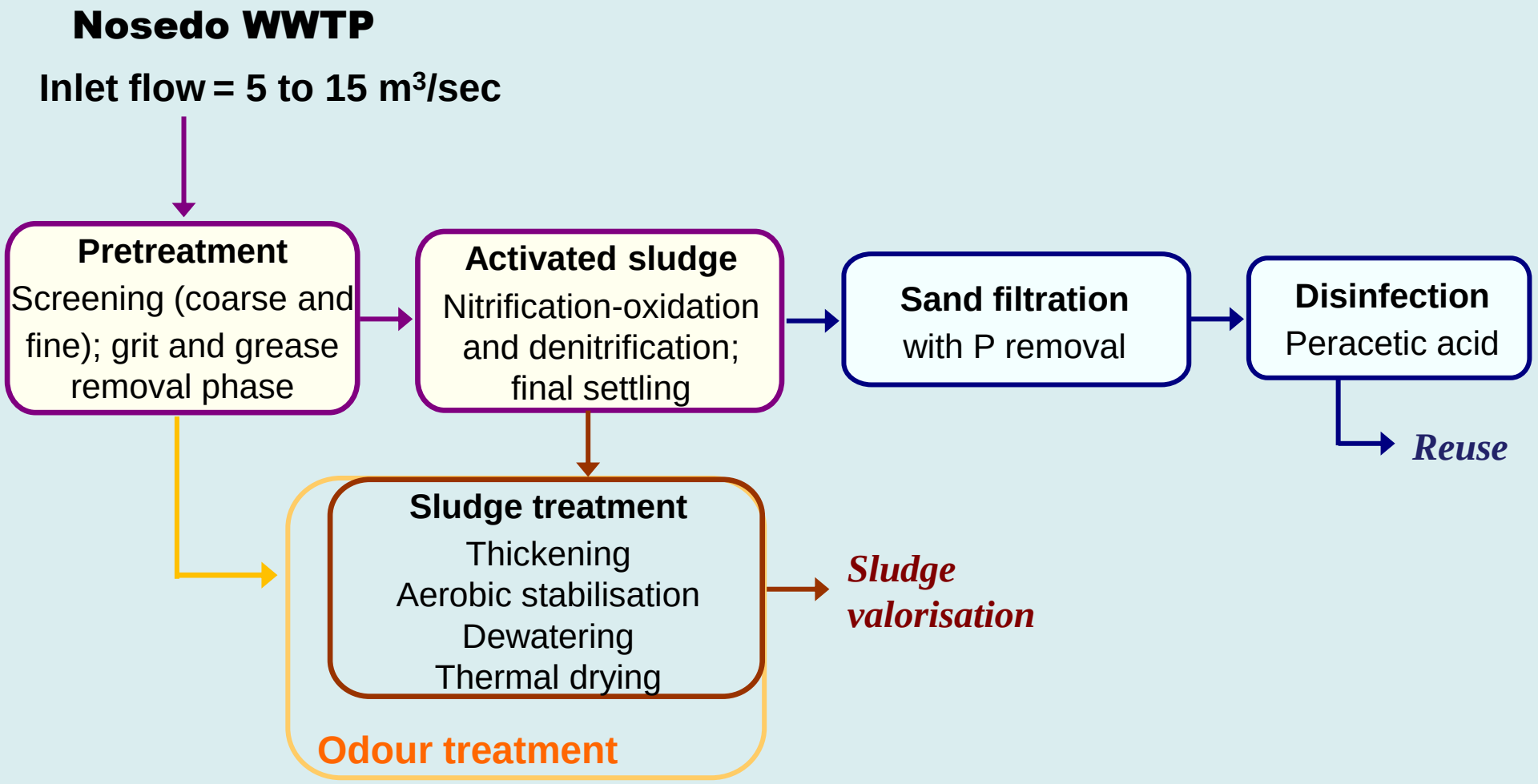
RIVER PO VALLEY
PIANURA PADANA

The most important agricultural area of Italy



The WWTP of Milano Nosedo

Flow sheet



The WWTP of Milano Nosedo

Main features

Dry weather average inlet flow: **5 m^3/s** – 430,000 m^3/d

Max. inlet flow (wet weather): **15 m^3/s** of which 11 m^3/s to complete treatment

(4 m^3/s subjected only to pretreatment)

Average values of incoming and treated wastewater

Parameter	IN mg/L	OUT mg/L	% Removal
BOD_5	170	**< 5**	**99**
COD	300	**< 15**	**97**
Nitrogen tot.	27	**6.5**	**76**
P tot.	3.5	**0.9**	**74**
TSS	190	**< 5**	**99**

Milano-Nosedo WWTP

Treated water quality: contractual, legal and actual values

	BOD_5 mg/l	COD mg/l	E.Coli UFC/100ml
CONTRACT	10	100	10
LAW 185/2003 reuse	20	100	10
ACTUAL	<5	<15	<10

Water Reuse

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A large agricultural district, just on the outskirts of the city…

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Indirect reuse

Roggia Vettabbia stream

Consorzio di Roggia Vettabbia: General Data

Total surface irrigated by Roggia Vettabbia	**ha**	**4108**	**39**	**78**
Consorzio's area – original permission	ha	3168	21	28
Cavo Taverna surface addition	ha	940	18	50

Length of Roggia Vettabbia from Milano to Melegnano **approx 22 km**

Difference in height between Center of Milan to mouth in Melegnano approx 30 m

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VETTABBIA Farmers Consortium

- **84 farmers member ; 90 farms**
- **Irrigated Area: 4100 ha**
- **Farmers pay 1827,42 euros/year as a concession value to Regione Lombardia, to have the concession rights to take water from the Vettabbia stream**

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Milano-Nosedo WWTP: agricultural reuse of treated wastewater

Annual volumes of treated water suitable for irrigation reuse

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Treated water (Mm^3)	143.8	143.4	137.9	136.3	148.6	157.4	149.0	148.7	152.3	157.4

Crops cultivated in the Vettabbia area:

- 45% Corn
- 15% Rice
- 40% Grass and grains

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Milan water reuse scheme: following in footsteps of Cistercian Monks…

One of the most important «key to success» of the water reuse scheme in Milan is the existence of a very old complex network of irrigation canals and an ancient agricultural activity that dates back to the **Middle Ages, when the Cistercian monks realized the first land reclamation.**

and the Monks continue to control

Milano-Nosedo

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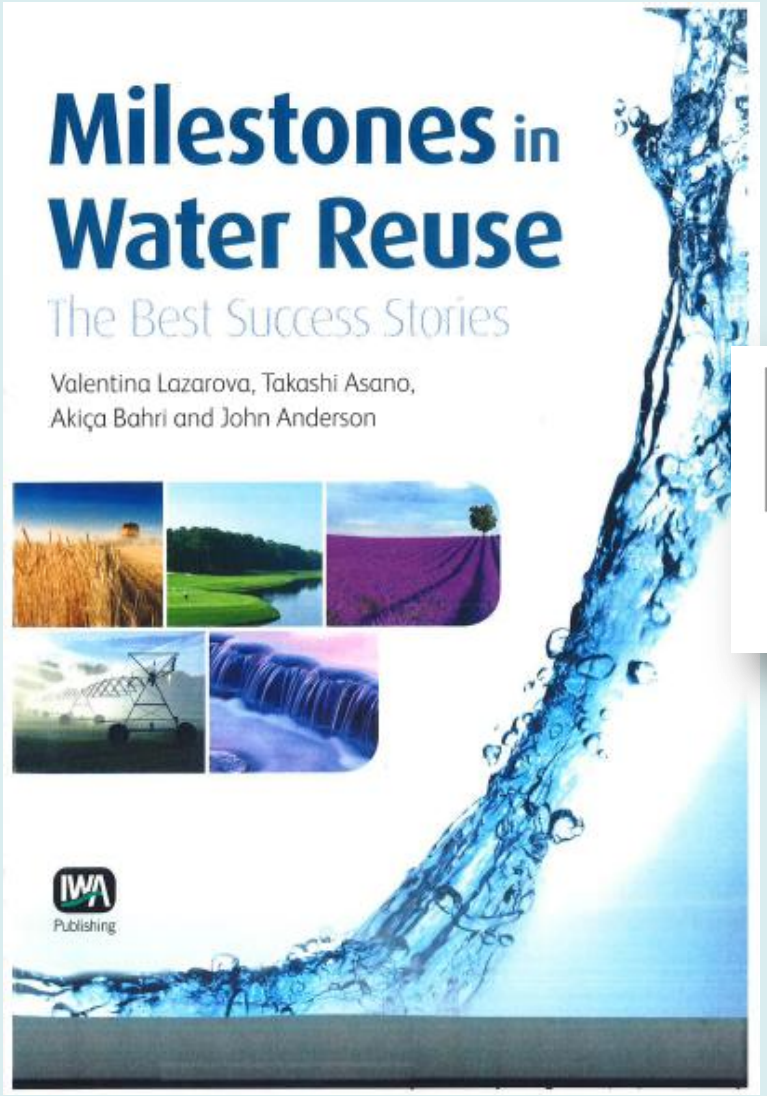
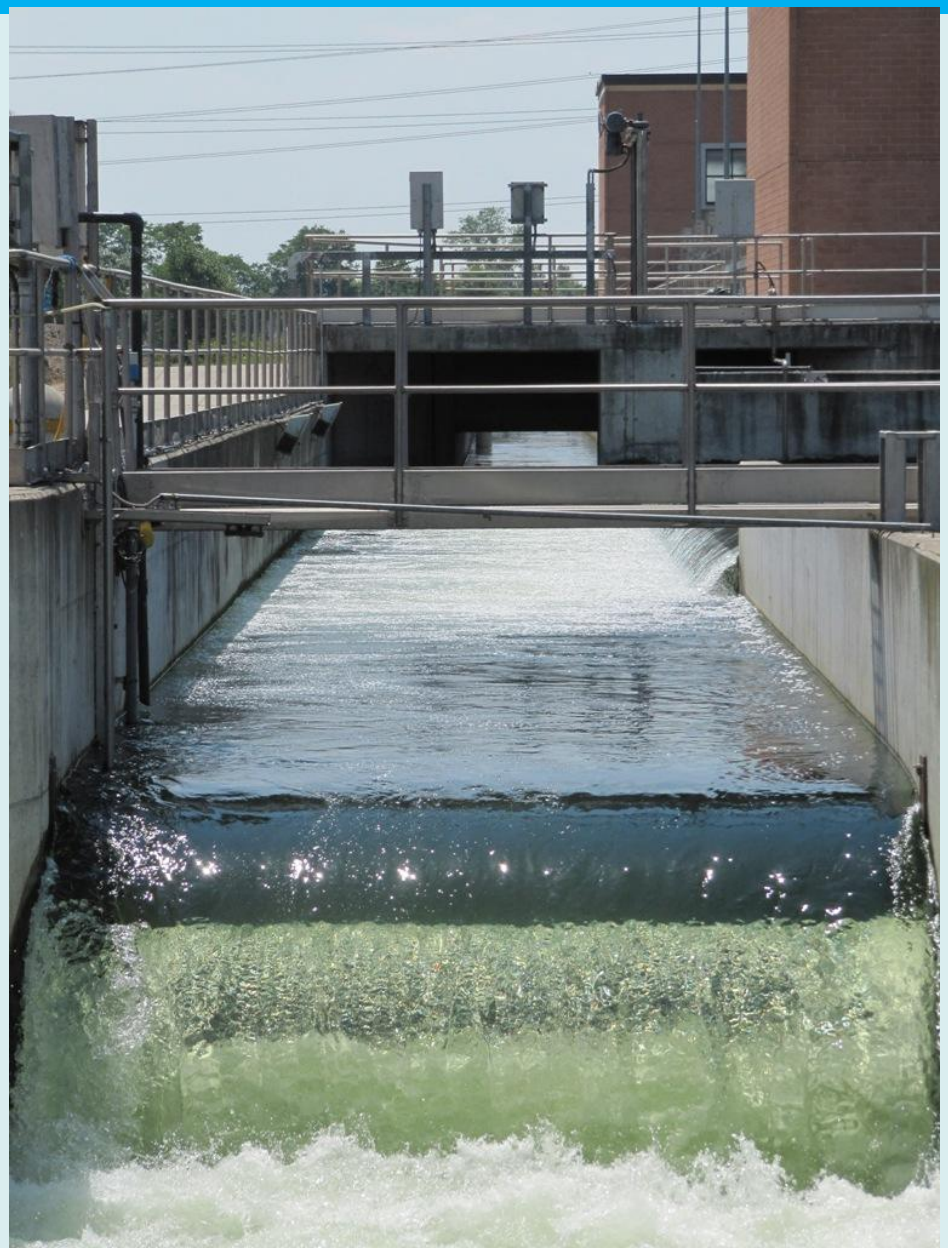


15 **Production of high quality recycled water for agricultural irrigation in Milan**

Roberto Mazzini, Luca Pedrazzi and Valentina Lazarova

Thermal energy Recovery



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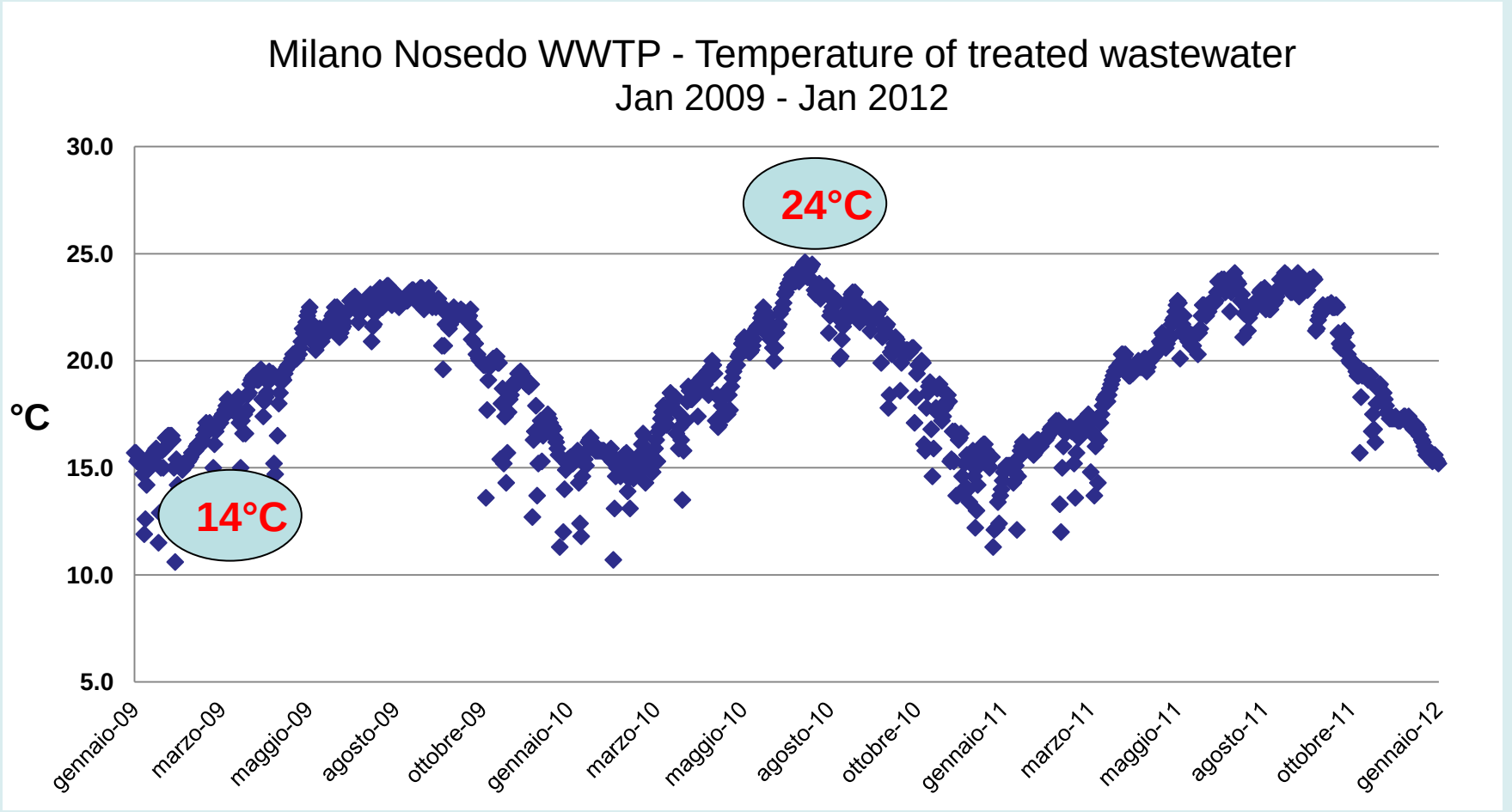
Renewable energy source: exploit the thermal value of wastewater



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The realized system for heating/cooling of buildings located into the WWTP

A DEMONSTRATIVE PLANT

installed to improve the pre-existent air conditioning system

Total volume of the two buildings ≈5100 m³

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The realized system for heating/cooling of buildings located into the WWTP

Total Power 400 kW

C.O.P. = 4.5 - E.E.R. = 5.5

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The realized system for heating/cooling of buildings located into the WWTP

- CO2

Savings obtained

Monitoring period [days]		Total energy consumption		Energy saving	CO_2 emissions reduction
		Air-to-water system [kWh]	Water-to-water system [kWh]	[%]	[kg]
Summer air-conditioning (April 16th - August 2nd)	109	167,184	101,764	39.13%	-28,340
Winter air-conditioning (November 1st - April 15th)	166	113,363	70,852	37.50%	-18,416

- 40%

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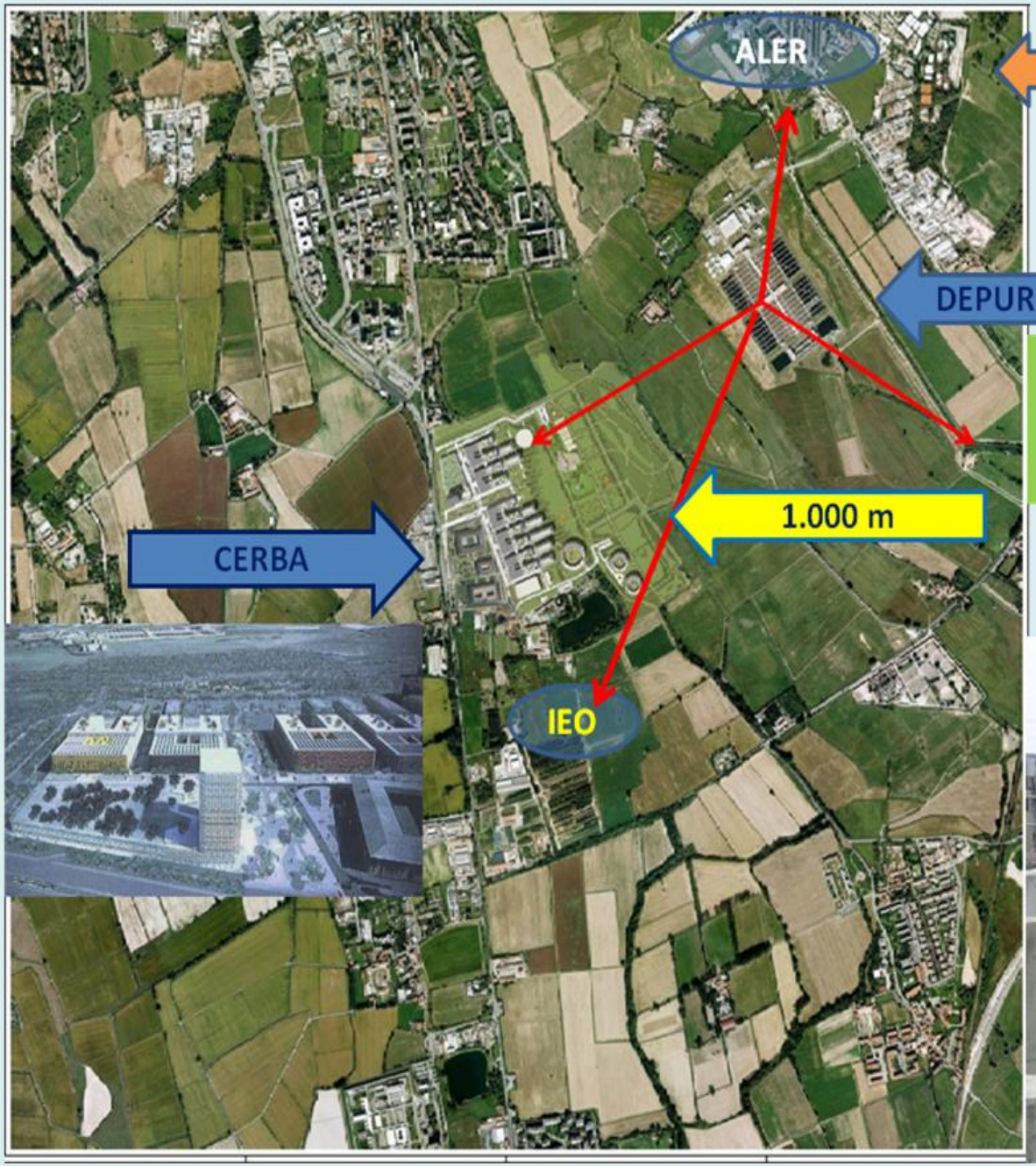
The WWTP of Milano Nosedo as «thermal power plant» for the neighborhood

The plant is located in an area where it could be possible (and relatively easy!) to create an «heating and cooling» district, based on heat pump system exploiting treated wastewater.

Fluids produced at the WWTP Central System could feed:

- An **heating network at high enthalpy** (90°C/65°C) for existing buildings;
- An **heating system with low enthalpy** (50°C/35°C) for new buildings with low temperature heating systems;
- A **network of cooling** (7°C/15°C) for new buildings with air conditioning/heating.



WW TP as Thermal Well

NOSEDO VETTORE ENERGETICO

Pompe di calore

NOSEDO THERMAL STORAGE UNIT

50

- MWT
- thermal

17.000

- **HC**
- **New APARTMENTS**

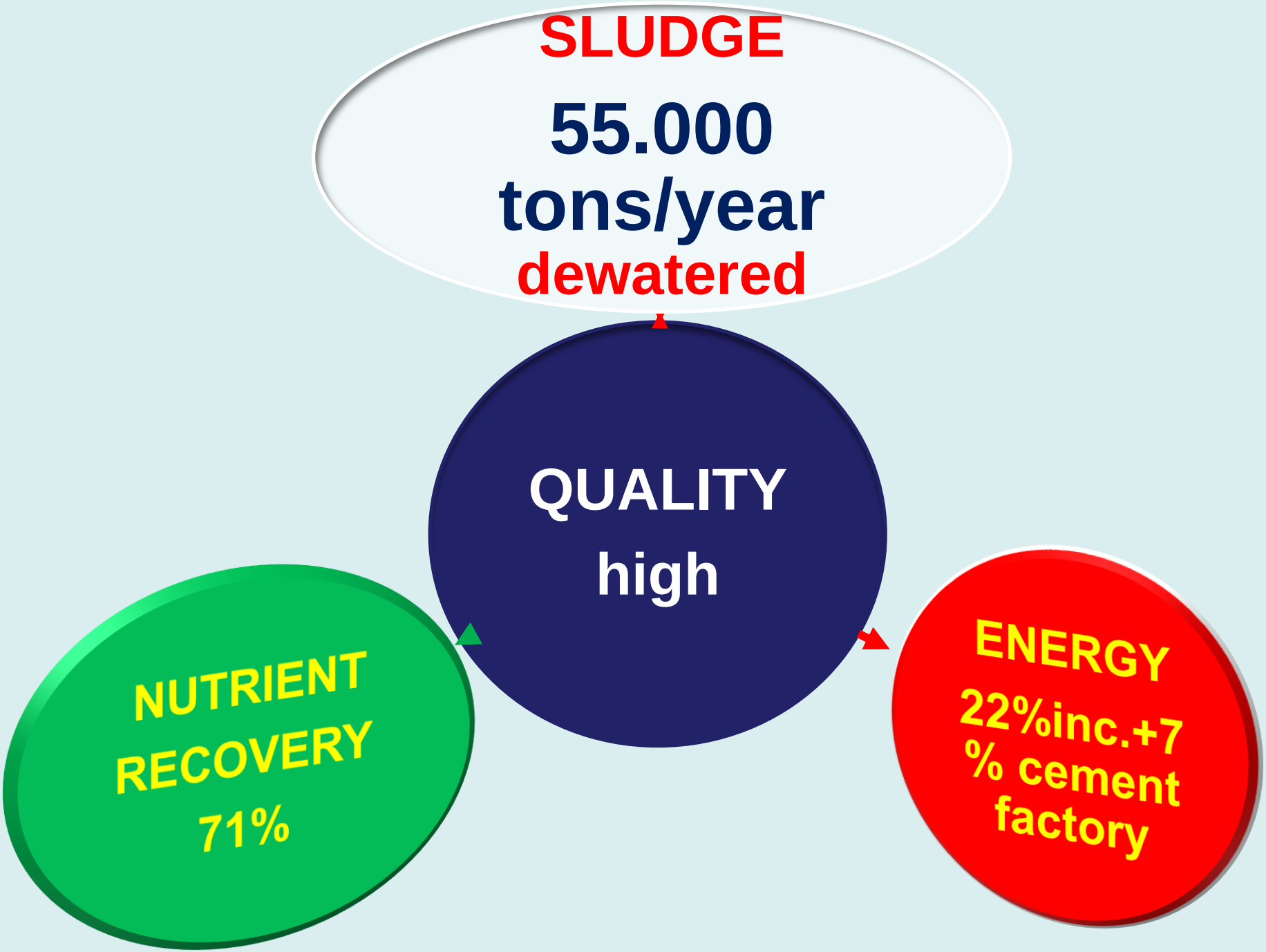
IEO hospital

- **At 1000 m from WWTP**
- **Cold and hot water**

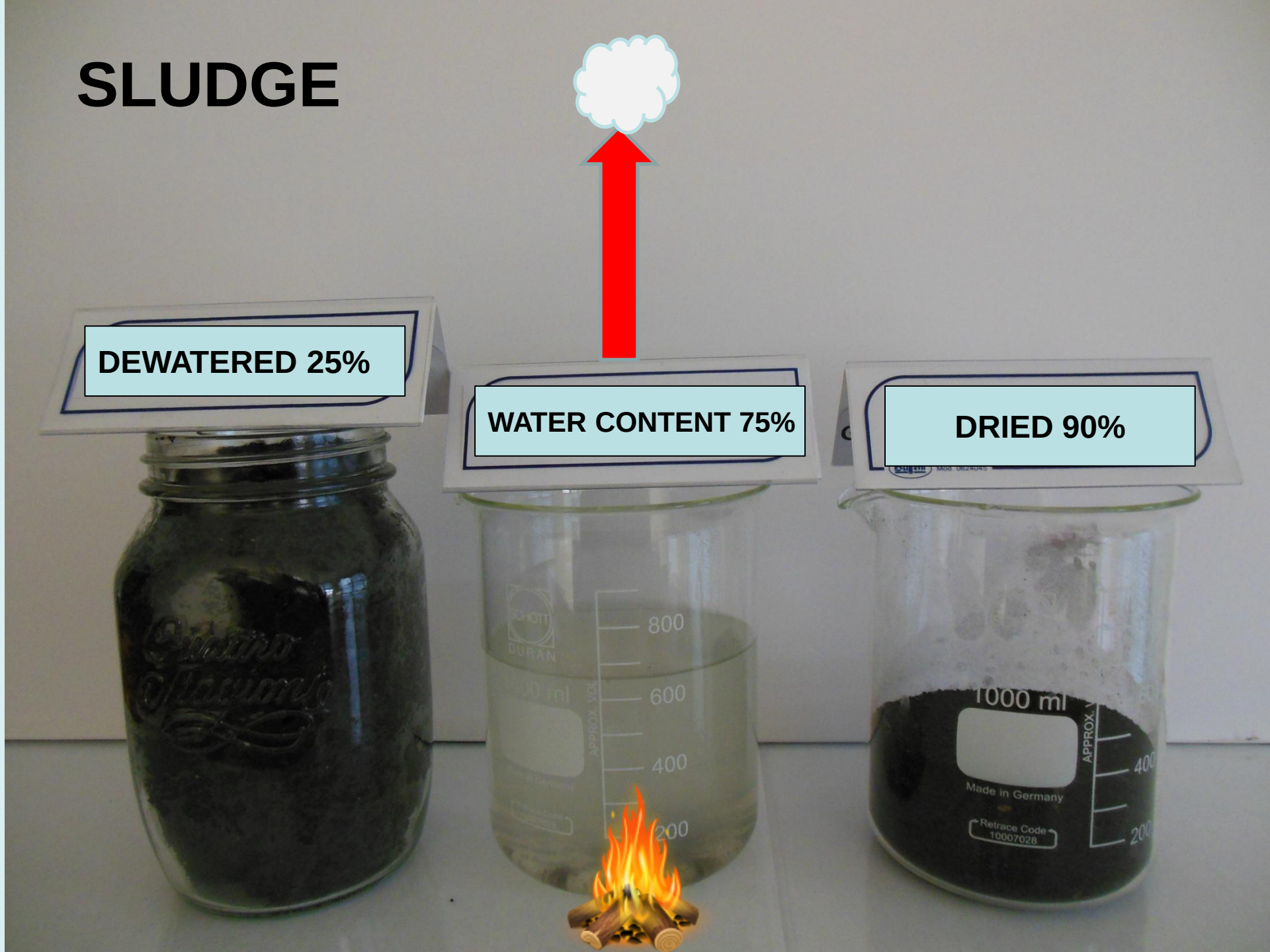
Sludge
Nutrient Recovery

C-N-P

Sludge:
Energy Recovery


SLUDGE
55.000
tons/year
dewatered
QUALITY
high
NUTRIENT
RECOVERY
71%
ENERGY
22%inc.+7
% cement
factory

SLUDGE


DEWATERED 25%
WATER CONTENT 75%
DRIED 90%
800
600
400
200
1000 ml
Made in Germany
Retrace Code
10007028

SLUDGE

- **NUTRIENT Recovery C-N-P**
  - **Special attention to Phosphorus recovery- not renewable resource**
  - Conflict in areas with intensive breeding- manure disposal or Biogas plant with digestate to be disposed.
- **A cement plant**: termal energy **Recovery**
  - renewable fuel, but the wwtp operator **pay** cement factory

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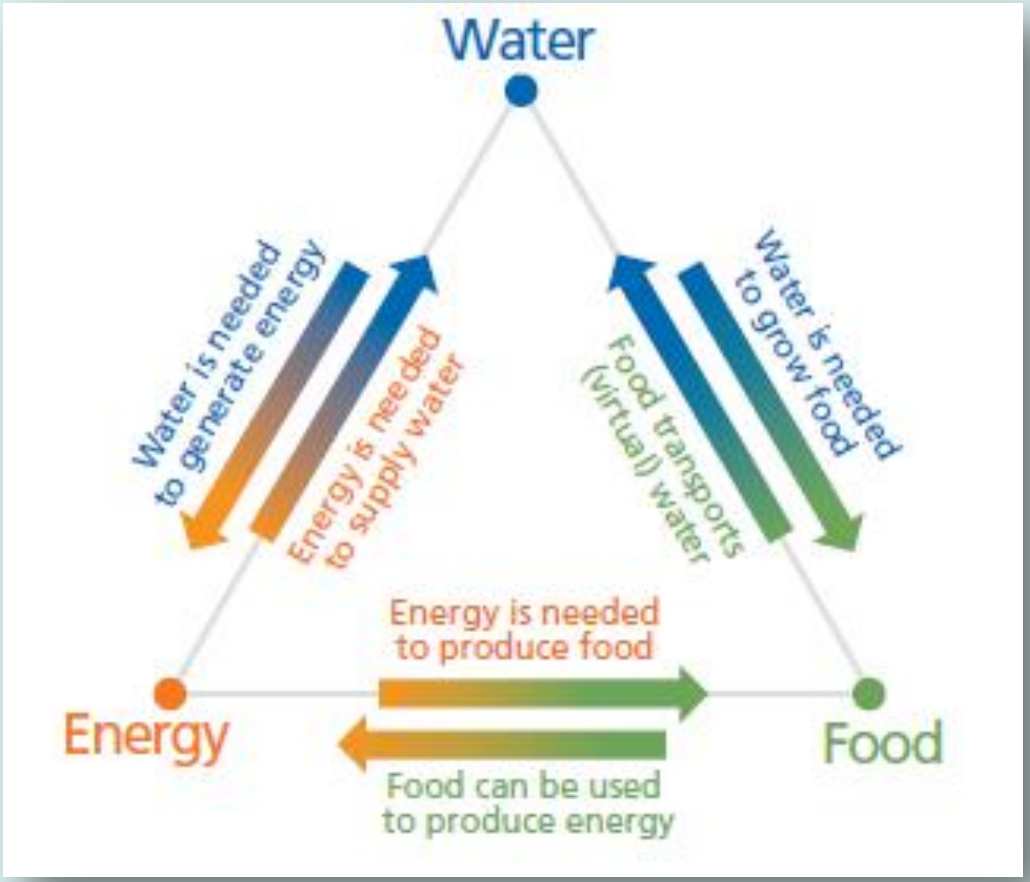
A new integrated and CIRCULAR vision of the Water Cycle

«water-food-energy nexus»



The growing demand for energy, food and water resources, linked to the rise and development of the world population, puts WWTPs at the center of this issue, given the chance to get from the wastewater treatment
WATER AND NUTRIENTS FOR AGRICULTURE
and RENEWABLE ENERGY

COMUNICATION

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WWTP of Milano-Nosedo

A plant open to citizens...

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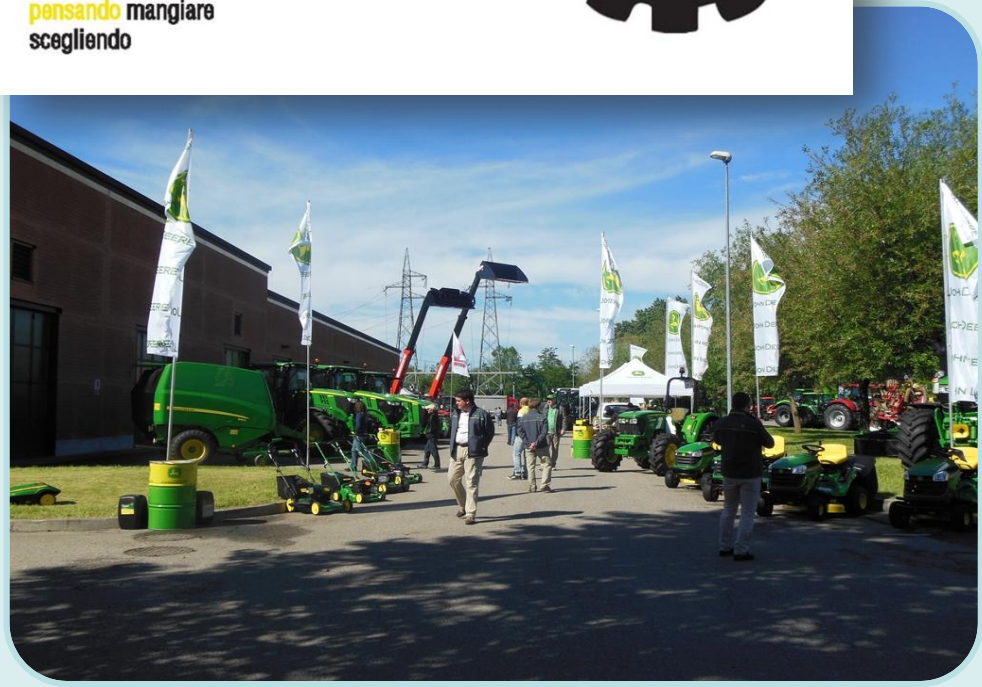
WWTP of Milano-Nosedo

...open to agriculture and local farmers...



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WWTP of Milano-Nosedo

... and open also to artists!!!

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Concluding remarks: the successful reuse of urban treated wastewater

- ✓ Delivery of high quality recycled water, ensured by an optimal treatment efficiency and by daily controls operated by qualified staff
- ✓ Cheap water resource, available all year
- ✓ The nourishing value of the nutrient enriched effluent improves the crop yields, and so the farmers' revenues (is difficult to have a figures per hectar)
- ✓ Reduced need of artificial fertilizers
- ✓ Valorisation of historical heritage and peri-urban agriculture ("zero-kilometer products")
- ✓ Public education programs and collaborations with non-profit organisations, research centers and Universities

Thank you!
Grazie

http://www.depuratorenosedo.eu

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Francesca Pizza