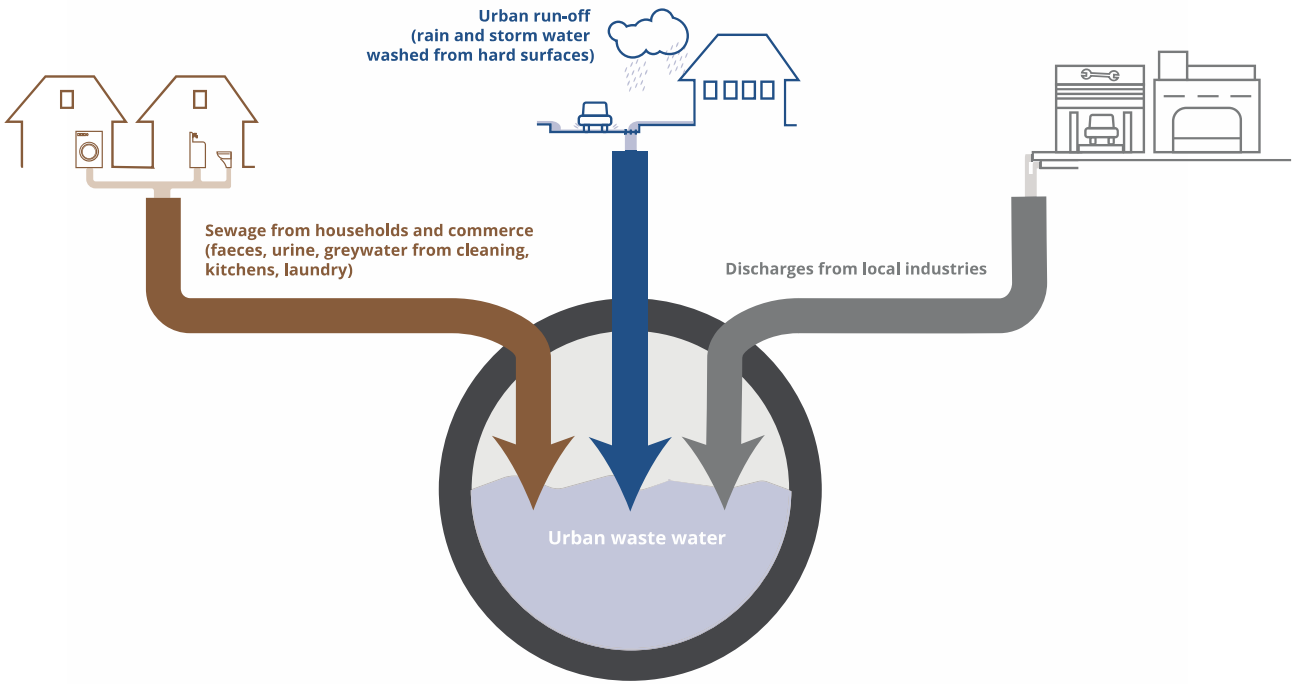
Module 4 : Wastewater treatment in the context of the circular economy

- To target recovery of resources from wastewater
- Embracing the circular theory in wastewater treatment
- Wastewater optimization through integration
- Challenges with technologies and mentality

Composition of sewage water



Components of urban wastewater

Substances	Examples	Source	The impact
Microorganisms	Pathogenic bacteria, viruses, worms and their eggs, protozoa	Faeces	Human health r when bathing in the sea, river, lake
Biodegradable organic substances	Carbohydrates, volatile fatty acids, proteins, cellulose	Feaces , food	Depletion of oxygen in rivers and lakes, bad smell
Other organic substances	Fats and oils, solvents, phenols, surfactants, detergents	Household and kitchen waste	Toxicity , bioaccumulation
Nutrients	Nitrogen, phosphorus	Urine and feces, food	Eutrophication, oxygen depletion, toxicity
micropollutants	Medicine, food additives, phthalates, bioacids, pesticides, plastics, etc.	Urine and faeces, food, human activities, industries	Toxicity , bioaccumulation , at the source
Metals	Zinc, copper, cadmium, lead, chromium, mercury, nickel, silver	Homes and industry	Toxicity , bioaccumulation
Other inorganic substances	Acids (eg hydrogen sulfide), alkalis	Homes and industry	Corrosion , toxicity

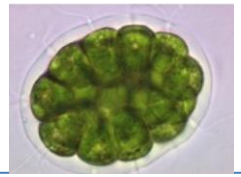
Centralized and De-centralized WWTP

Intensive Technology

O_2

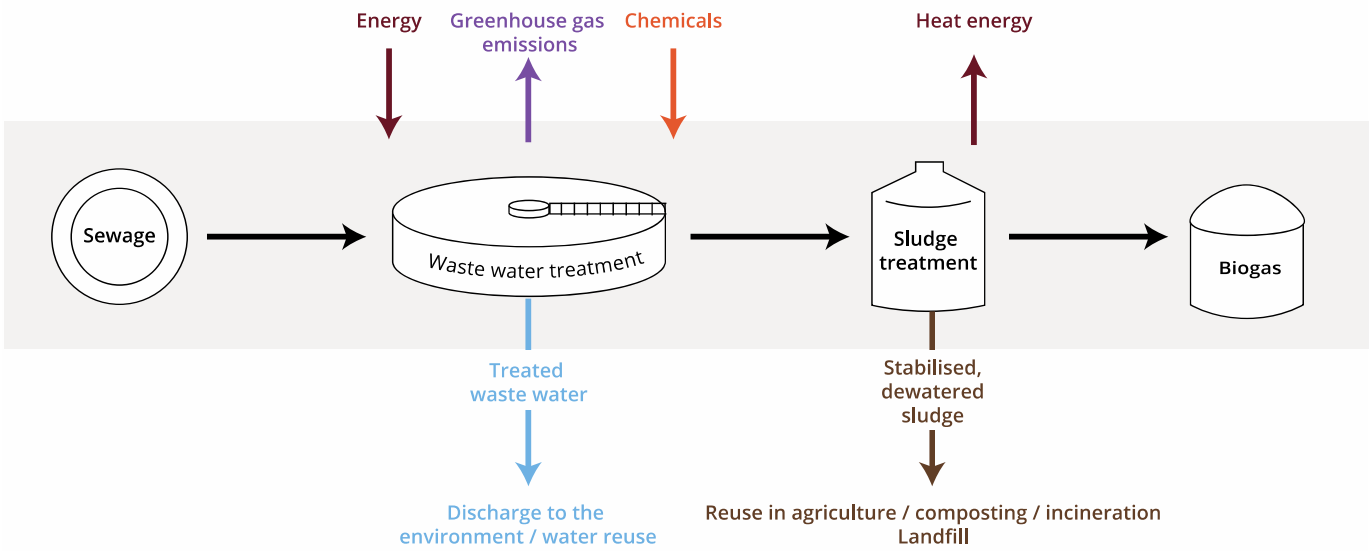
Extensive Technology

O_2

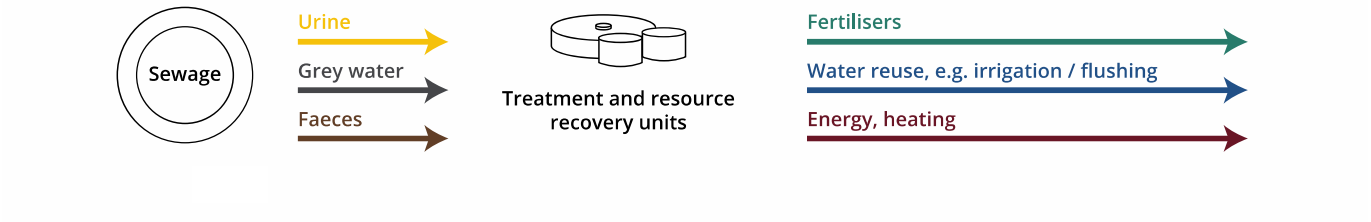


What enters and exits from WWTP

a) Urban waste water treatment plan

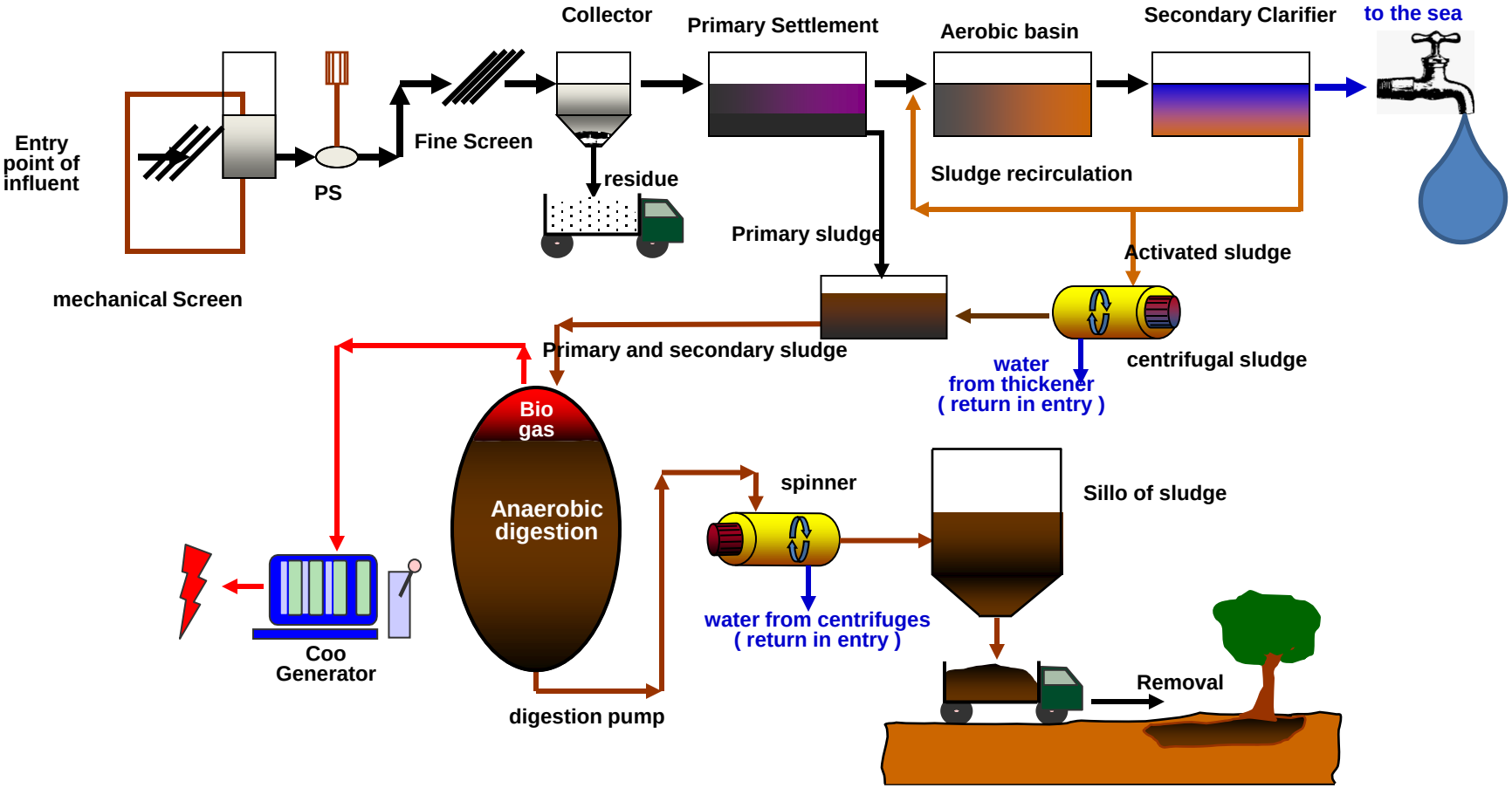


b) Decentralised treatment



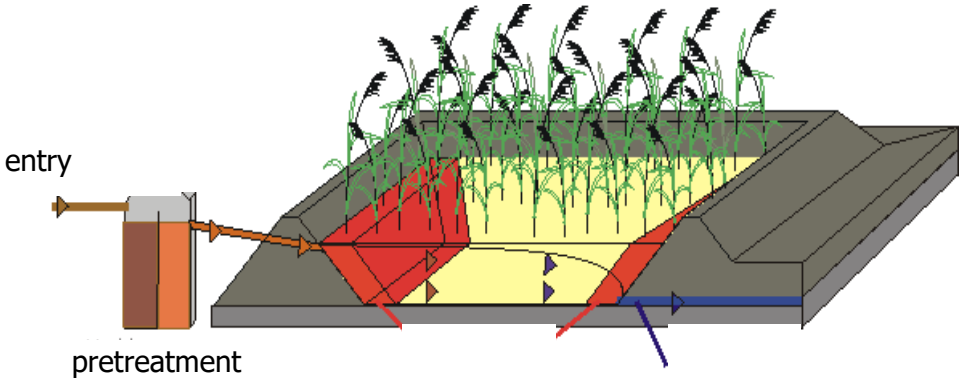
Centralized WWTP

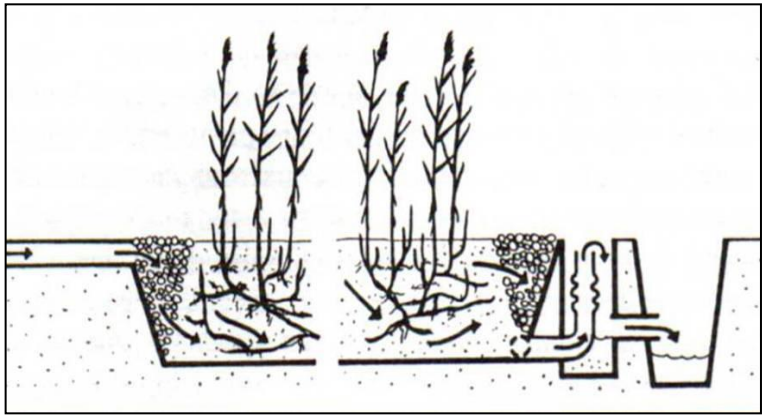
Schematic diagram of wastewater treatment plant



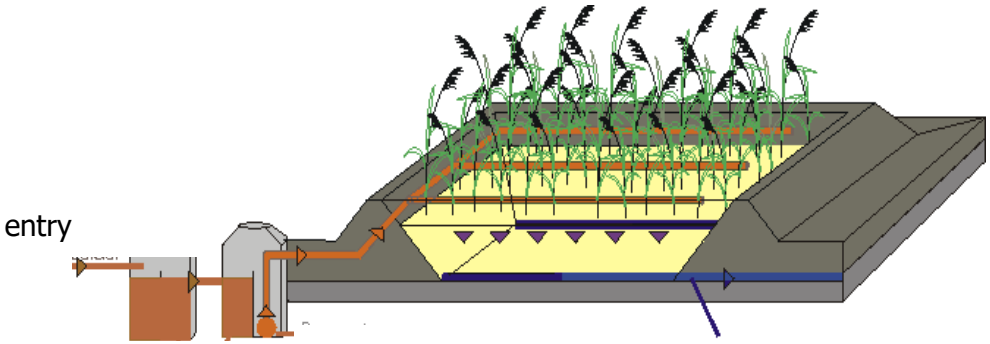
De- Centralized Constructed wetland WWTP

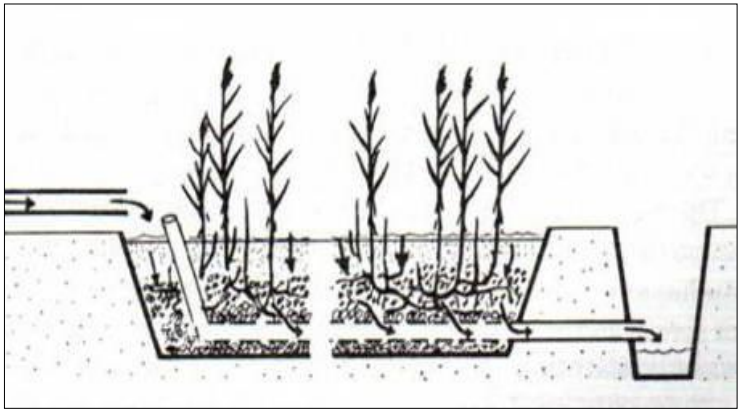
- Horizontal feed





- Vertical Feed



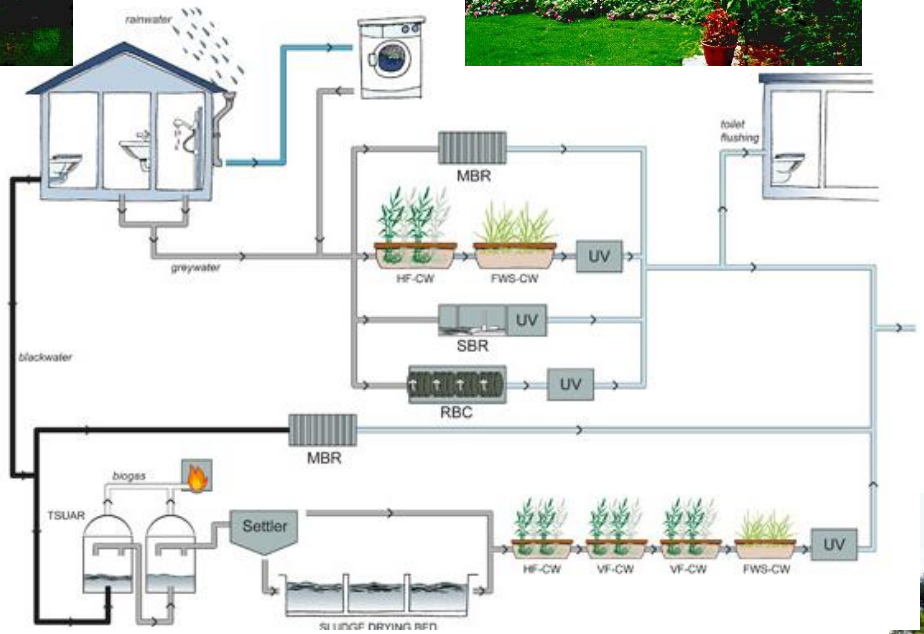


Individual treatment unit, families far from urbanized areas

Septic tank, pipe system

perforated, filter layer with sand and gravel

Zero discharge of polluted water into nature



WWTP towards the circular economy

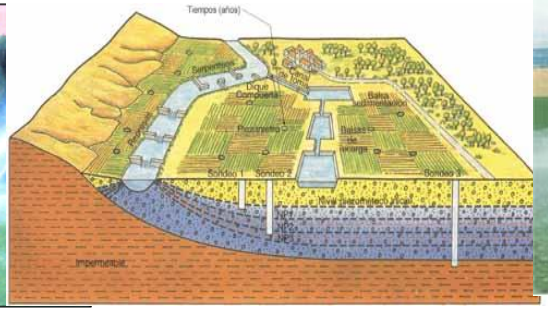
What can we benefit from TREATED WATER ?

Classic plant:

Discharge: to the nearest aquatic environment.

WWT P today towards the Circular Economy :

Re-used: for irrigation, sanitary facilities, secondary uses in industrial areas, aquifer filling.
Used: for creating aquatic environments .
Produced: P-sold as a nutrient in agriculture.



WWTP today towards the Circular Economy

Classic treatment:

Are deposited in the urban waste landfill, if any?!

WWTP today towards the Circular Economy

Used: in agriculture , in construction ,
Produced: electricity,
Produced: bio-fuel=natural gas "0" pollution
Education : Water , health and economy !

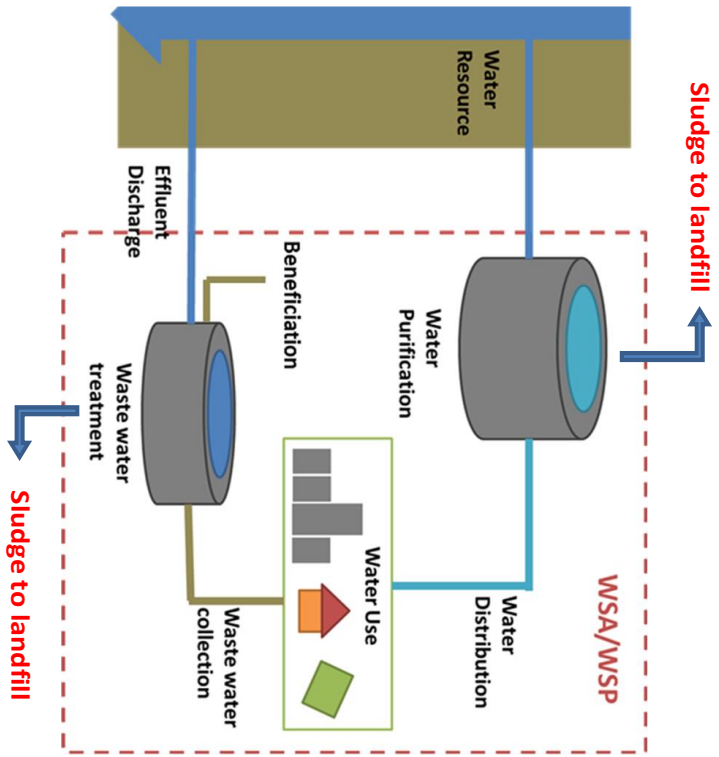
Sludge it's my business !

No Way! Sludge is my business!


HOUSEHOLDS
CITIES
INDUSTRY
It is time to see wastewater as a resource to achieve A CIRCULAR ECONOMY
WASTE WATER

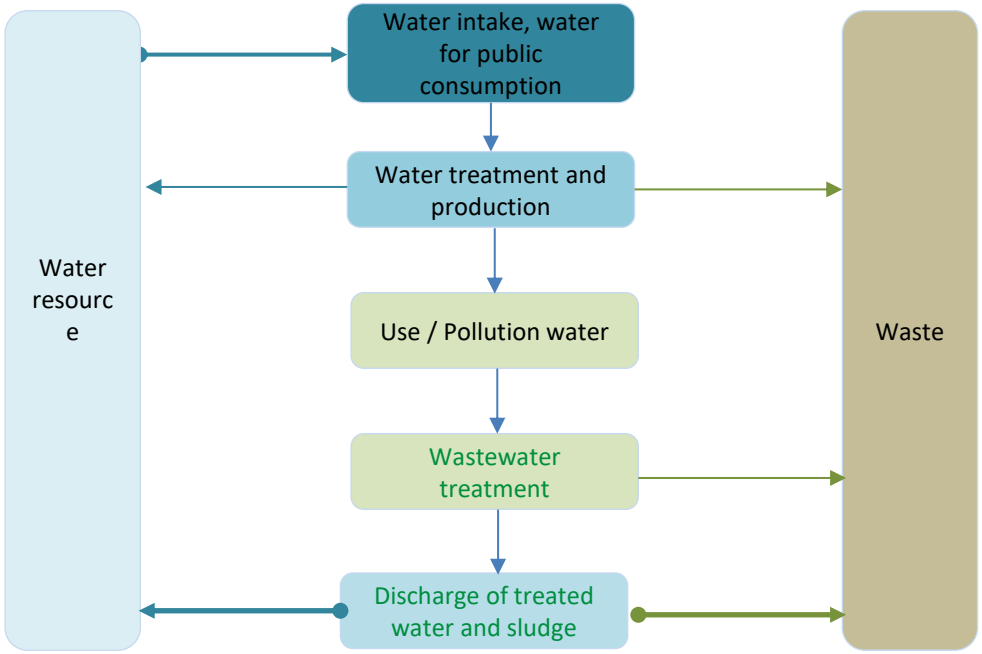
Linear circular, focus: water supply and sewage services

Linear diagram



Linear approach - Water and wastewater business cycle

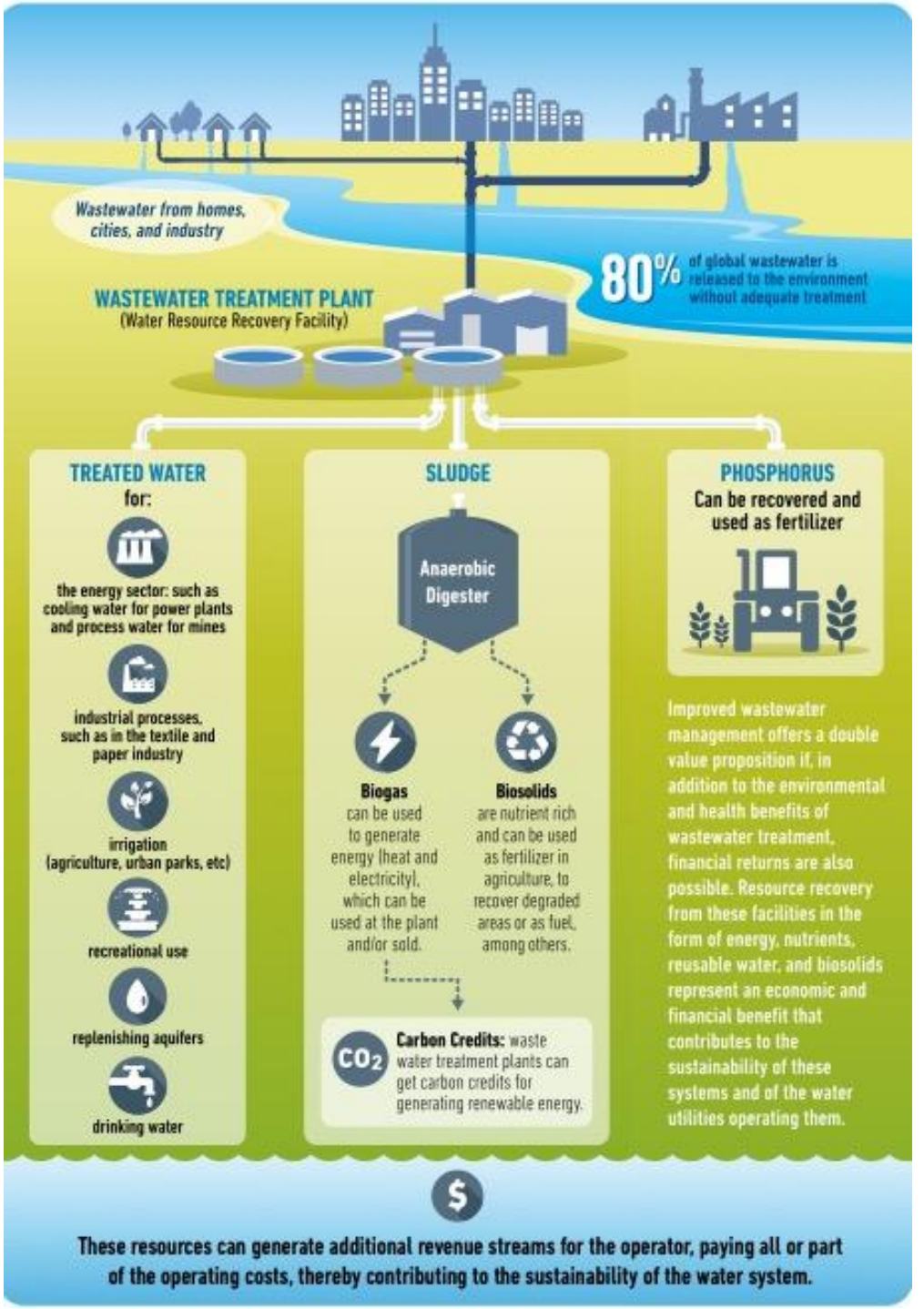
General linear scheme of water supply, use and treatment.



Note: In a better diagram, rainwater and industrial water should be included

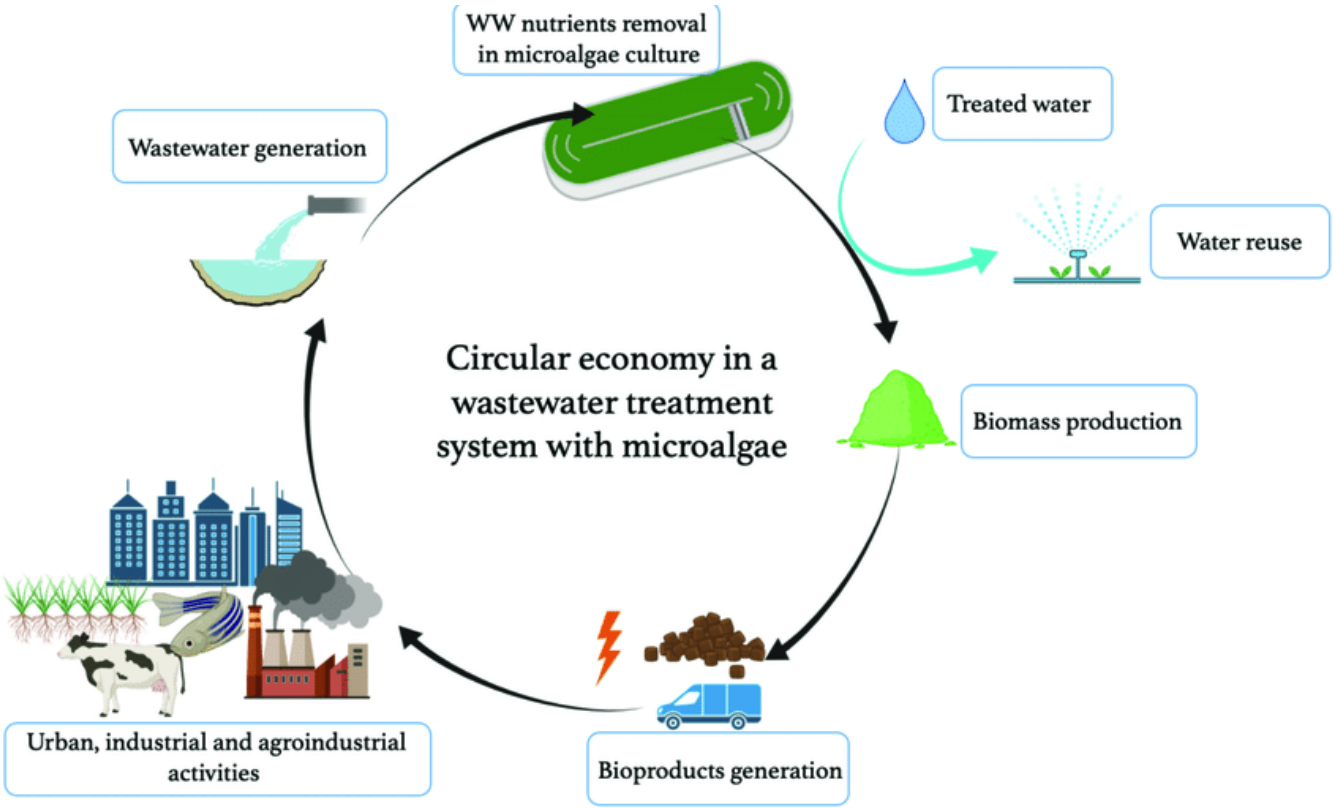
Resource recovery from the wastewater treatment plant

The circular economy, a new intended economic system.

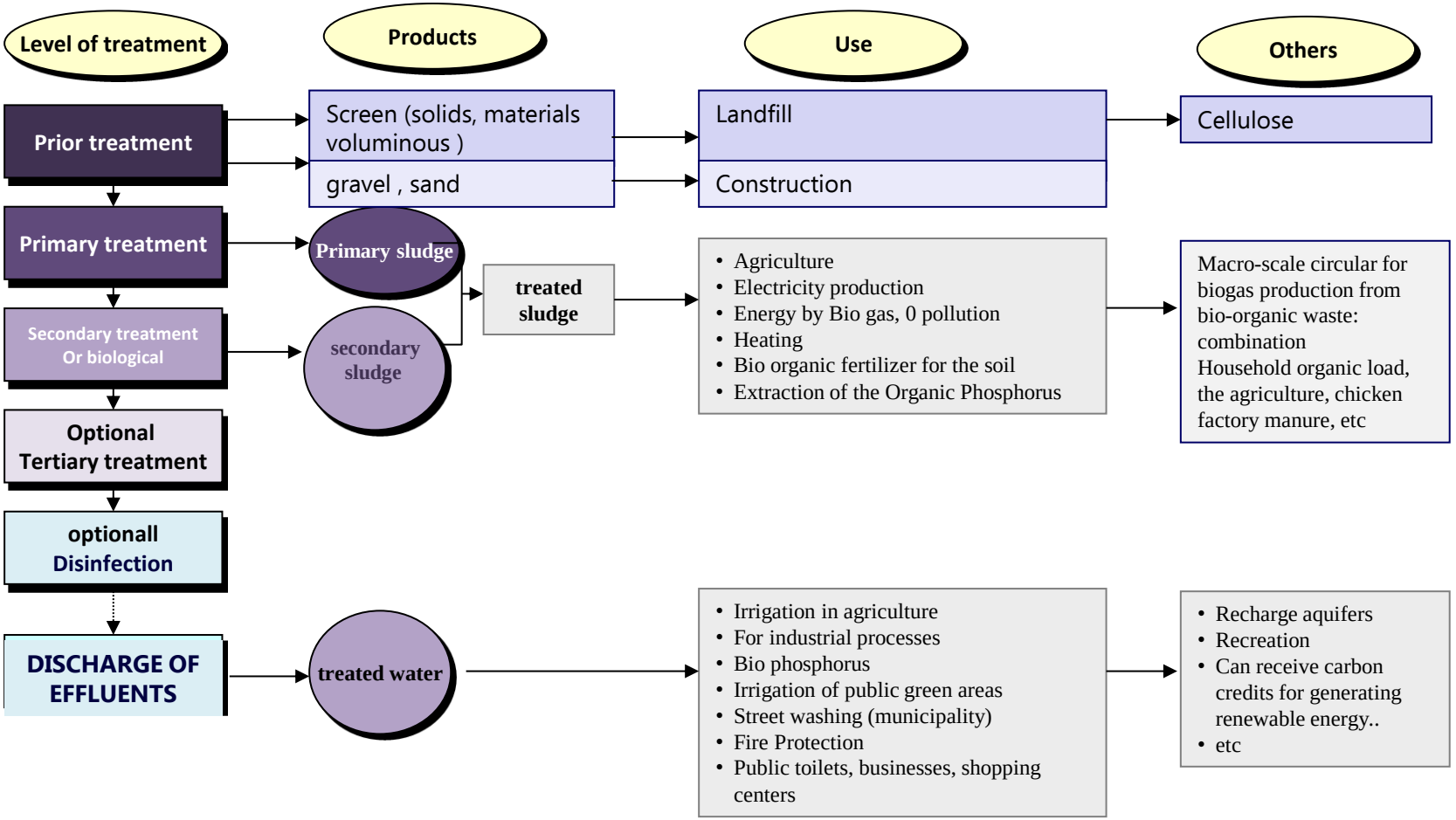


Source: From Waste to Resource: Shifting Paradigms for Smarter Wastewater WB2020

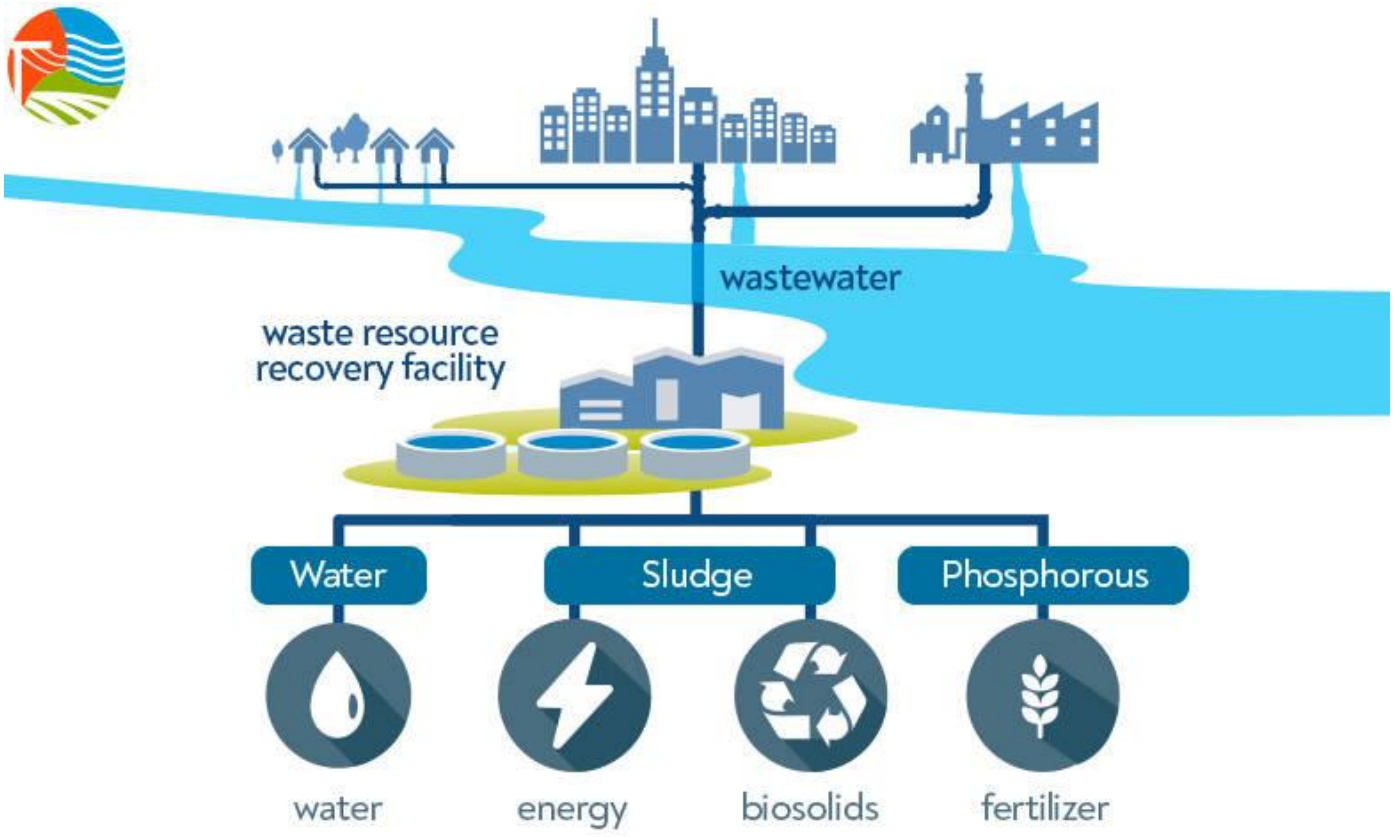
Embracing the circular theory in wastewater treatmen



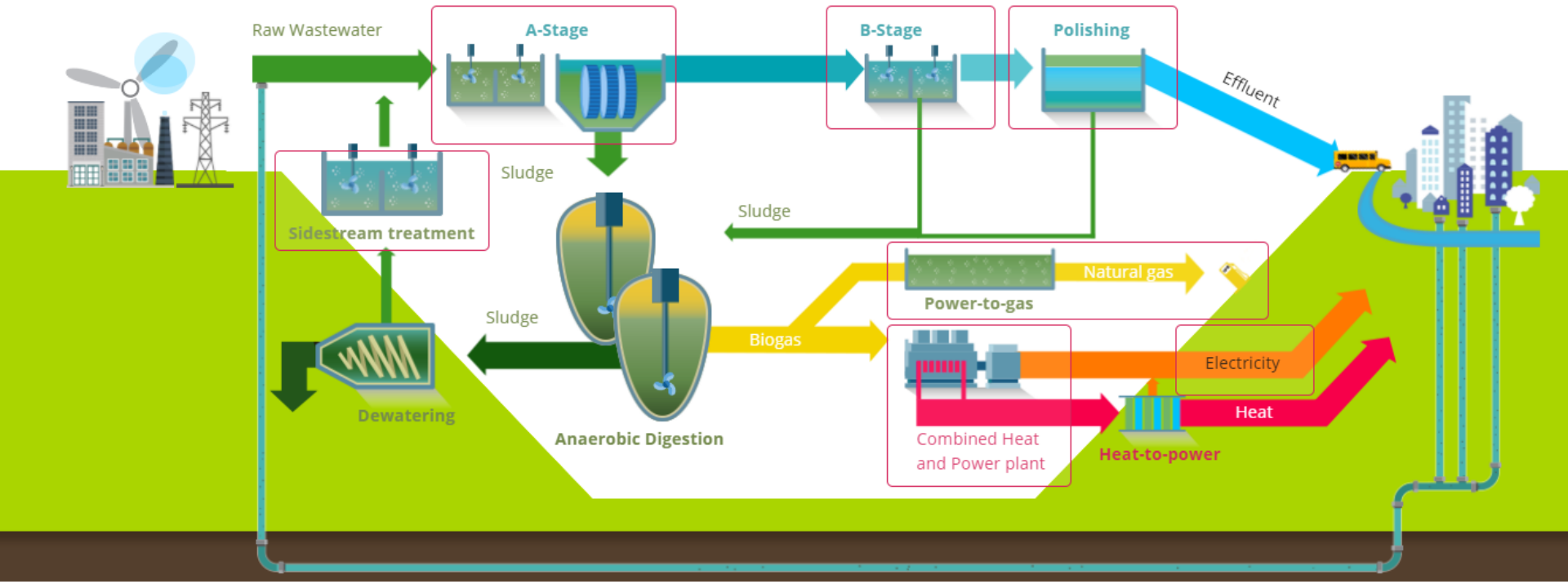
Treatment levels and wwtp products



Wastewater optimization through integration



Wastewater treatment plant guaranty positive energy balance

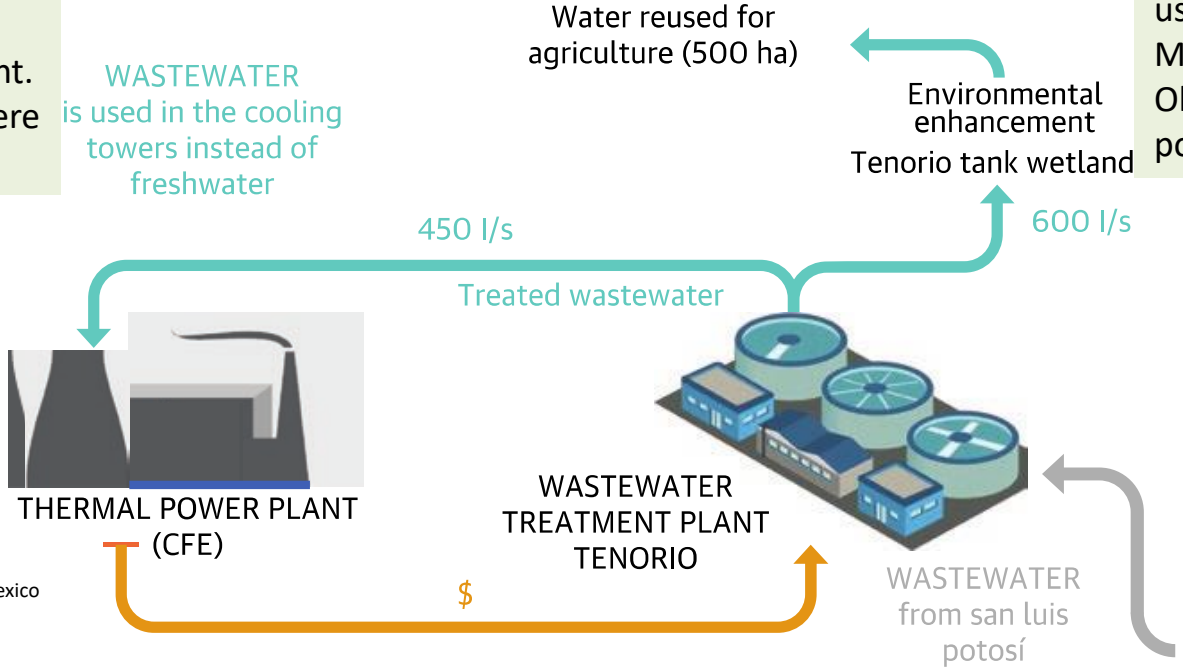


Burimi: Horizon 2020 , the EU's research and innovation funding programme 2014-2020

Wastewater treatment plant guaranty positive balance and profit

The wastewater effluent usage is 33% cheaper than groundwater for the Thermo pawer Plant. After 6 years, $18M were saved.

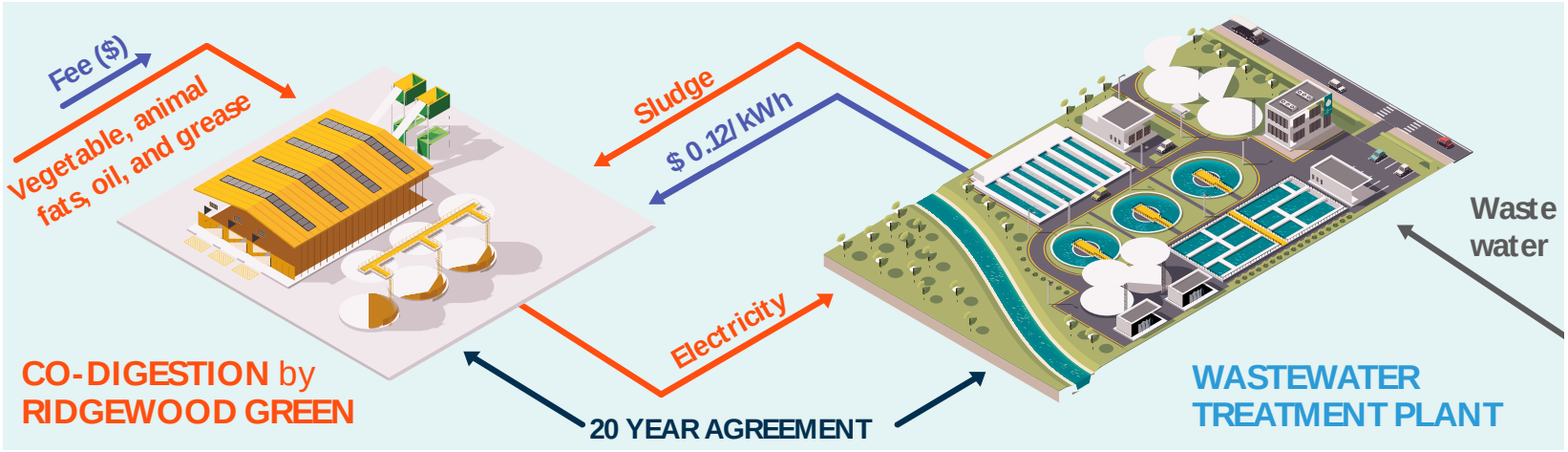
After 6 years of operation, groundwater use was reduced by 48 Mm3, = nearly 20,000 Olympic swimming pools.



Source: World Bank: San Luis Potosí, Mexico

Wastewater treatment plant with positive balance and profit

Mixture:
bio-organic poultry waste,
organic waste of the city,
livestock waste,
ETC.



Source World Bank: Ridgewood Green Village in the USA

Sewage sludge can be turned into oil

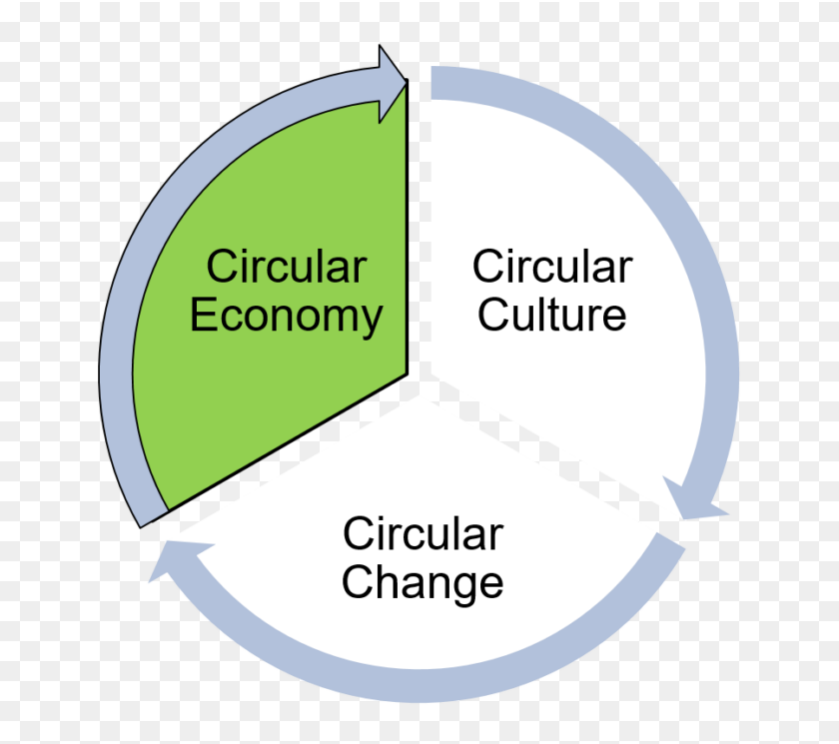
Challenges towards resource recovery from wastewater

Resource recovery is not a new concept!

?!

- Rethinking the value of water and sewage
- Fostering innovation and beneficial partnerships
- Creating new business models and jobs
- Development of new skills and investment for the community
- CO2 reduction

Challenges with technologies and mentality



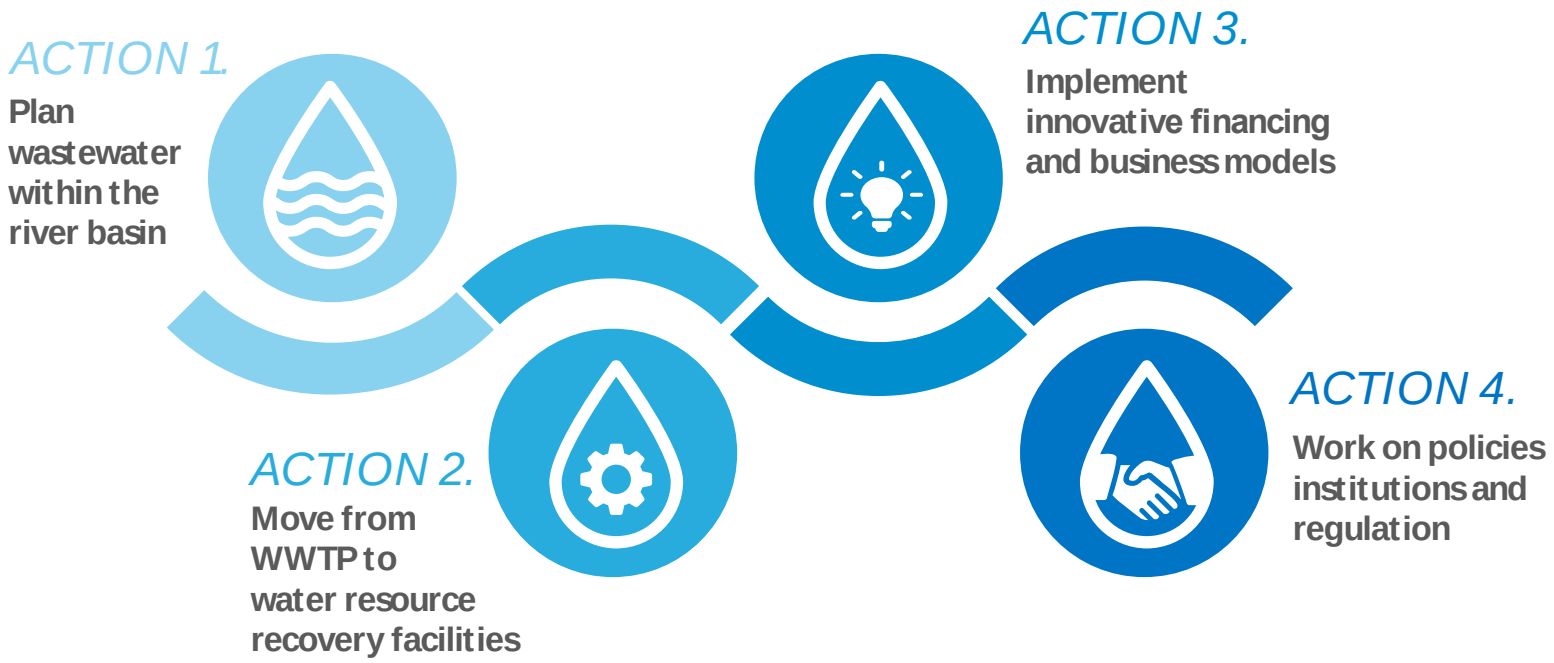
Internal and external barriers for business to become more efficient in resource recovery

Increasing internal barriers

- Inconsistent policies and messages
- Absence of clear price signals
- Absence of consumer demand
- Supply chain constraints
- Thresholds in technology and infrastructural capacity
- Physical limitation (eg location/space)
- External support and assistance
- Incentives to invest
- High cost
- Access to capital
- Lack of objectives and standards
- Business model and sales
- Knowledge and expertise
- Competing priorities
- Internal capacity and resources
- Common behavior
- Negative cultures and attitudes

Internal barriers ever increasing

What needs to be done to overcome the challenges and achieve the necessary changes towards RE.



NATIONAL STATUS, WWTP-2022

WWTP	SUPPORTED BY	€	P.E	Ha	Q=m³/d	Status
1. Kavajë I	KfW	€ 5 M	25,000	3.4	4,500	In work
1. Kavajë 2	IPA	€ 10M	75,000	13.0	13,500	In work
2. Durrës	BB/LUX/EIB/IPA	€ 11,1 M	250,000	70.0	60,000	In work
3. Sarandë+Ksamil	BB/LUX/EIB/IPA KfW/SECO/EU, WBIF	€ 3,8 M	34,,000	30.0	12,240	In work
4. Vlorë	CARDS 2006/IPA 2014 KfW/SECO/EU, WBIF	€ 2,7 M	160,000	3.4	42,000	In work
5. Pogradec I+II	KfW	€ 5,0 M	50,000	12.0	4,500	In work
6. Korçë	EIB/KfW	€ 8,7 M	86,,000	12.0	15,000	In work
7. Tiranë	JBIC	€ 67 M	350,000	53.0	75,000	Discontinued
8. Velipojë	IPA (2007)	€ 3,5 M	85,000	2.8	15,800	In work
9. Orikum	Banka Islamike	€ 3,2 M	53,000	2.0	4,000	Ready to work, + upgrad
10. Shirokë	KfW, SECO, ADA	€ 1,0 M	2,000	0.5	320	Në punë
11. Gramsh	Devoll Hydropower	€ 1,0 M	16,500	6.4	1,920	Në punë
12. Lezhë	BB/LUX/EIB/IPA/KfW	€ 4,9 M	51,000	30.0	12,400	Në punë, + upgrad
13 Lalëz	Gov. ALB	€ 8,4 M	15,000	10.0l	2.932	In work
14. Green Cost	Gov. ALB	€ 8,7 M	1,500	Small	450	In work
15. Porti Durrësit,	EU	NI	340	Small		In work
16. Coca-Cola	Coca Cola (Min of Finance.)	NI	NI	Small	700	In work
17. Aeroporti Nene Tereza	Koncesionari	NI	NI	e vogel	130	In work
18. Erzeni Dairy	Erzeni+Dutch pilot project	NI	COD/BOD = 2,3	NI	2	In construction
19. Rreth Tapi Kuçovë	Min. e Bujqësisë, AZHR	€ 40,000	COD/BOD = 1,7	176 m²	50	In work

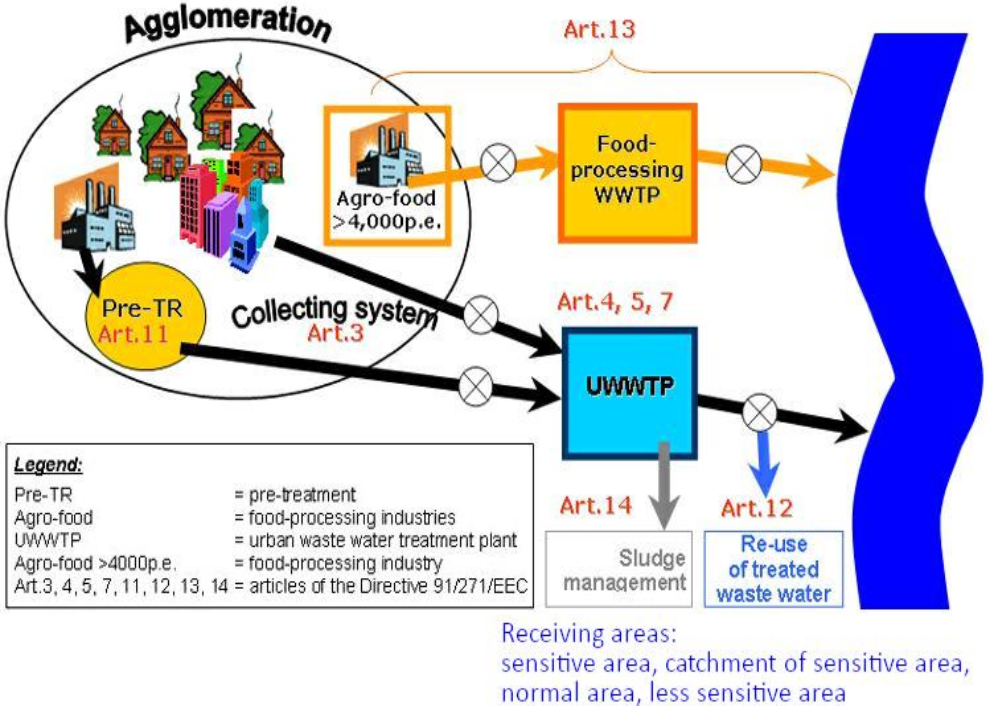
Source: This table was elaborated by Prof. E. Gjinali

NATIONAL STATUS, WWTP-2021

WWTP	SUPPORTED BY	€	P.E	(*) Ha	Q=m³/d	Status
20. Berat	KfW/SECO/EU, WBIF	€ 8,5M	44.000	10.0	10,716	Construction begins
21. Kamëz	KfW/SECO/EU, WBIF	€ 6,0 M	96,990	10.0	15,379	Construction begins
22. Shkoder	KfW, SECO, ADA	€ 6,8 M	100,000	15.0	6,451	Construction begins
23. Himarë (+Dhërmi,+ Jalë)	KfW/SECO/EU, WBIF	€ 8,8	16,000	7.0	6,451	In construction
24. Lunder Tirane	ALB Government	€ 0.63M	6000	NI	450	Designing
25. Fier	KfW/SECO/EU, WBIF	€ 4,2 M	66,000	8.5	14,185	Feasibility is over
26. Gjirokastër	KfW/SECO/EU, WBIF	€ 6,6 M	34,000	8,0	5,928	Feasibility is over
27. Elbasan	KfW/SECO/EU, WBIF	€ 13,5 M	78,198	7.0	13,295	Feasibility is over
28. Lushnje	KfW/SECO/EU, WBIF	€ 7,3	39,000	10.0	6,357	Feasibility is over
29. Kocovë	KfW/SECO/EU, WBIF	€ 7,0 M	29.500	8.5	8,544	Feasibility is over
30. Prrenjas	KfW/SECO	€ 2,0 M	12,000	6.0	1,571	Feasibility is over
31. Librazhd	KfW/SECO	€ 2,2 M	15,000	6.0	1,965	Feasibility is over
32. Çorovodë	Gov. ALB	€ 0,0 M	10,000	9.6	110m³/h	Feasibility is over
33. Spille	Gov. ALB	N/I	N/I	N/I	N/I	Feasibility is done, 2010
34. Divjakë BB	JICA, BB	N/I	N/I	N/I	N/I	Feasibility is done, 2010
35. Landfilli i Bushatit	BE		233 T/d	Leachate WWT		In work
36. Landfilli i Sharrës	Several Donors		1,431T/d	Leachate WWT		In work
37. Landfilli i Korçës	KfW		142 T/d	Leachate WWT		In work
38. Landfilli i Bajkaj t	WB		108 T/d	Leachate WWT		In work
39. Landfilli i Vlorës	BE		115 T/d	Leachate WWT		In construction
40. Korça Prison	BE, (Min of Justice)		300	WWTP		In work
41. Fieri Prison	BE, (Min of Justice)		1,200	WWTP		In work
42. Pogradeci Prison	BE, (Min of Justice)		110	WWTP		In construction
43. Reçi Prison	BE, (Min of Justice)		600	WWTP		In construction

Source: This table was elaborated by Prof. E. Gjinali

Agglomations



Source: European Commission

NISP Project: Helps the implementation

☞ Drinking Water Directive:
- Delineate water supply areas (serving more than 50 people or supplying ≧ 10m3/day)
- Investments forecast (Develop Directive-Specific Implementation Plan, DWD-DSIP)

☞ Urban Waste Water Treatment Directive:
- Delineate agglomerations
- Identify sensitive areas
- Investments forecast (Develop Directive-Specific Implementation Plan, WWTPs-DSIP)

☞ National Sludge Management Strategy

WWTP classification

WWTP class	Class code	Peak load P_P (PE)	Baseline load P_B (PE)	Sensitive area	Treatment level	Anaerobic digestion
Very small	1	<2,000	Not relevant	Not relevant	Secondary	/
Small	2	2,000-9,999	Not relevant	Not relevant	Secondary	/
Medium	3	10,000-49,999	Not relevant	No	Secondary	/
	3-NR	10,000-49,999	Not relevant	Yes	Secondary + Tertiary	/
	4	50,000-99,999	<50,000	No	Secondary	/
	4-NR	50,000-99,999	<50,000	Yes	Secondary + Tertiary	/
	5	50,000-99,999	>=50,000	No	Secondary	Yes
	5-NR	50,000-99,999	>=50,000	Yes	Secondary + Tertiary	Yes
Large	6	>=100,000	<50,000	No	Secondary	/
	6-NR	>=100,000	<50,000	Yes	Secondary + Tertiary	/
	7	>=100,000	>=50,000	No	Secondary	Yes
	7-NR	>=100,000	>=50,000	Yes	Secondary + Tertiary	Yes

WWTP by agglomerations

# ITUN Klasa ITUN	Codi	2020 Nr.	2020 %	2030 Nr.	2030 %	2040 Nr.	2040 %	2050 Nr.	2050 %
Very small	1	1	6.7	1	5.6	4	7.8	37	33.0
Small	2	3	20.0	3	16.7	24	47.1	48	42.9
Medium	3	1	6.7	1	5.6	3	5.9	6	5.4
	3-NR	1	6.7	1	5.6	8	15.7	9	8.0
	4	0	0.0	0	0.0	0	0.0	0	0.0
	4-NR	1	6.7	1	5.6	1	2.0	1	0.9
	5	1	6.7	1	5.6	1	2.0	1	0.9
	5-NR	0	0.0	1	5.6	1	2.0	1	0.9
	6	1	6.7	1	5.6	1	2.0	1	0.9
	6-NR	3	20.0	3	16.7	3	5.9	3	2.7
Large	7	2	13.3	2	11.1	2	3.9	2	1.8
	7-NR	1	6.7	3	16.7	3	5.9	3	2.7
	Totali	**15**	**100.0**	**18**	**100.0**	**51**	**100.0**	**112**	**100.0**

Sludge production

Annual average		2020		2030		2040		2050	
		Sludge Production (Average)		Sludge Production (Average)		Sludge Production (Average)		Sludge Production (Average)	
District		TDS/yr	%	TDS/yr	%	TDS/yr	%	TDS/yr	%
Berat	1	0	0.0	0	0.0	863	2.8	1,063	3.0
Dibër	2	0	0.0	0	0.0	0	0.0	542	1.5
Durrës	3	3,470	16.0	4,197	16.0	4,793	15.5	5,600	15.7
Elbasan	4	30	0.1	1,415	5.4	1,512	4.9	1,708	4.8
Fier	5	0	0.0	1,051	4.0	1,618	5.2	2,220	6.2
Gjirokastër	6	0	0.0	0	0.0	386	1.2	509	1.4
Korçë	7	1,585	7.3	1,496	5.7	1,783	5.8	1,948	5.5
Kukës	8	0	0.0	0	0.0	490	1.6	502	1.4
Lezhë	9	517	2.4	842	3.2	934	3.0	1,563	4.4
Shkodër	10	412	1.9	2,018	7.7	2,057	6.7	2,248	6.3
Tiranë	11	12,880	59.2	12,227	46.5	13,012	42.1	14,003	39.4
Vlorë	12	2,850	13.1	3,039	11.6	3,472	11.2	3,672	10.3
Total		**21,743**	**100.0**	**26,285**	**100.0**	**30,919**	**100.0**	**35,577**	**100.0**

How many agglomerates does Albania need?
In total, 165 agglomerations were identified, in which about two-thirds of the population (2.1 million) currently live.

What is the situation regarding the definition of sensitive areas?
About 111 agglomerations (67% of the total) produce wastewater and discharge it into 18 sensitive areas within seven major river basins.

What is the status of collection systems already built and operational?

- *A total of 1,185 water supply zones (WSZs) have been identified, covering 2,117 villages/towns (about 69% of the total number of villages or about 92% of the population (2.83 million).*
- *The total water demand of approximately 131.4 million cubic meters in 2020 is predicted to increase to 139.4 million cubic meters/year in 2050.*
- *Today, the collection systems in Albania are covered by 336 sewage systems. The existing collection systems located in agglomerations are 197 systems. One hundred twenty-one agglomerations (including 197 villages) are already equipped with a current collection system.*

How many plants should Albania have?
One hundred thirteen wastewater treatment plants (WWTP) would be adequate for treating wastewater from 165 agglomerations.

"If I don't have red, I use blue."

— **Pablo Picasso**

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