

INCREASED RENEWABLE ENERGY AND ENERGY EFFICIENCY BY INTEGRATING, COMBINING URBAN WASTEWATER AND WASTE MANAGEMENT SYSTEM

TAKING
COOPERATION
FORWARD



REEF 2W Final Conference



REEF 2W STRATEGY



Florian Kretschmer, BOKU Vienna, Marko Zlonoga, REGEA

Different options for energy generation from wastewater

Electric and thermal energy from digester gas (bio gas) combustion (only at WWTPs with anaerobic sludge treatment)

Thermal energy from wastewater heat (and cold) recovery in the effluent of WWTPs

Electric and (thermal energy) from solar installations on the premises of WWTPs

(Electric energy from hydropower in the effluent and wind power at the premises of WWTPs)



INVENTORY OF WWTPS IN CEU

Table 1: WWTPs in CEU (based on EEA, s. a.)

Country	amount of WWTPs (≥ 2.000 PE)*	Treatment capacity [PE]	Entering load [PE]	Data availability
AT	640	21 582 000	14 526 000	100 %
CZ	671	15 459 000	9 622 000	91 %
DE	2059	69 614 000	52 166 000	99 %
HR	281	4 019 000	3 423 000	34 %
HU	635	14 855 000	10 666 000	100 %
IT	2554	48 107 000	33 568 000	58 - 92 %
PL	1692	52 609 000	47 382 000	100 %
SI	113	2 321 000	1 872 000	90 %
SK	336	6 297 000	3 808 000	82 %
Total CEU	8981	234 863 000	177 033 000	94 %

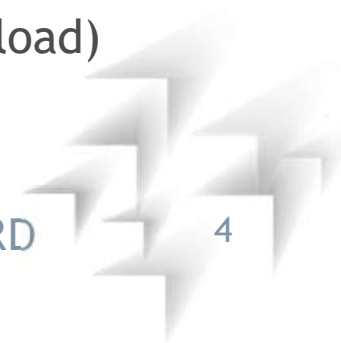
* approximate values



Table 2: wastewater amounts and availability of anaerobic digestion (AD)

Country	Total wastewater flow [m ³ /h]	Amount of WWTPs with AD	Share of AD
AT	90 800	155	24 %
CZ	60 100	92	14 %
DE	326 000	379	18 %
HR	21 400	3	1 %
HU	66 700	15	2 %
IT	209 800	98	4 %
PL	296 100	93	5 %
SI	11 700	11	10 %
SK	23 800	52	15 %
Total CEU	1 106 400	898	10 %

Assumption: wastewater flow of 150 l/PE*d (based on WWTP entering load)



ESTIMATED ENERGETIC POTENTIAL

Table 3: estimated energetic potential

Country	digester gas [m ³ /d]	digester gas el. [MWh/a]	digester gas th. [MWh/a]	heat recovery potential [kW]	heat pump [MWh/a]	PV (solar) el. [MWh/a]
AT	223 800	167 900	335 800	526 600	3 159 300	41 899
CZ	137 000	102 800	205 600	348 800	2 092 700	32 497
DE	717 200	537 900	1 075 700	1 891 000	11 346 100	83 706
HR	21 500	16 100	32 300	124 100	744 500	11 980
HU	100 000	67 900	127 000	386 600	2 319 900	31 998
IT	345 300	259 000	518 000	1 216 900	7 301 100	48 776
PL	55 000	37 300	69 900	1 717 600	10 305 600	99 502
SI	15 200	11 400	22 800	67 900	407 200	5 616
SK	55 000	37 300	69 900	138 100	828 300	11 425
Total CEU	1 670 000	1 237 600	2 457 000	6 417 600	38 504 700	367 399

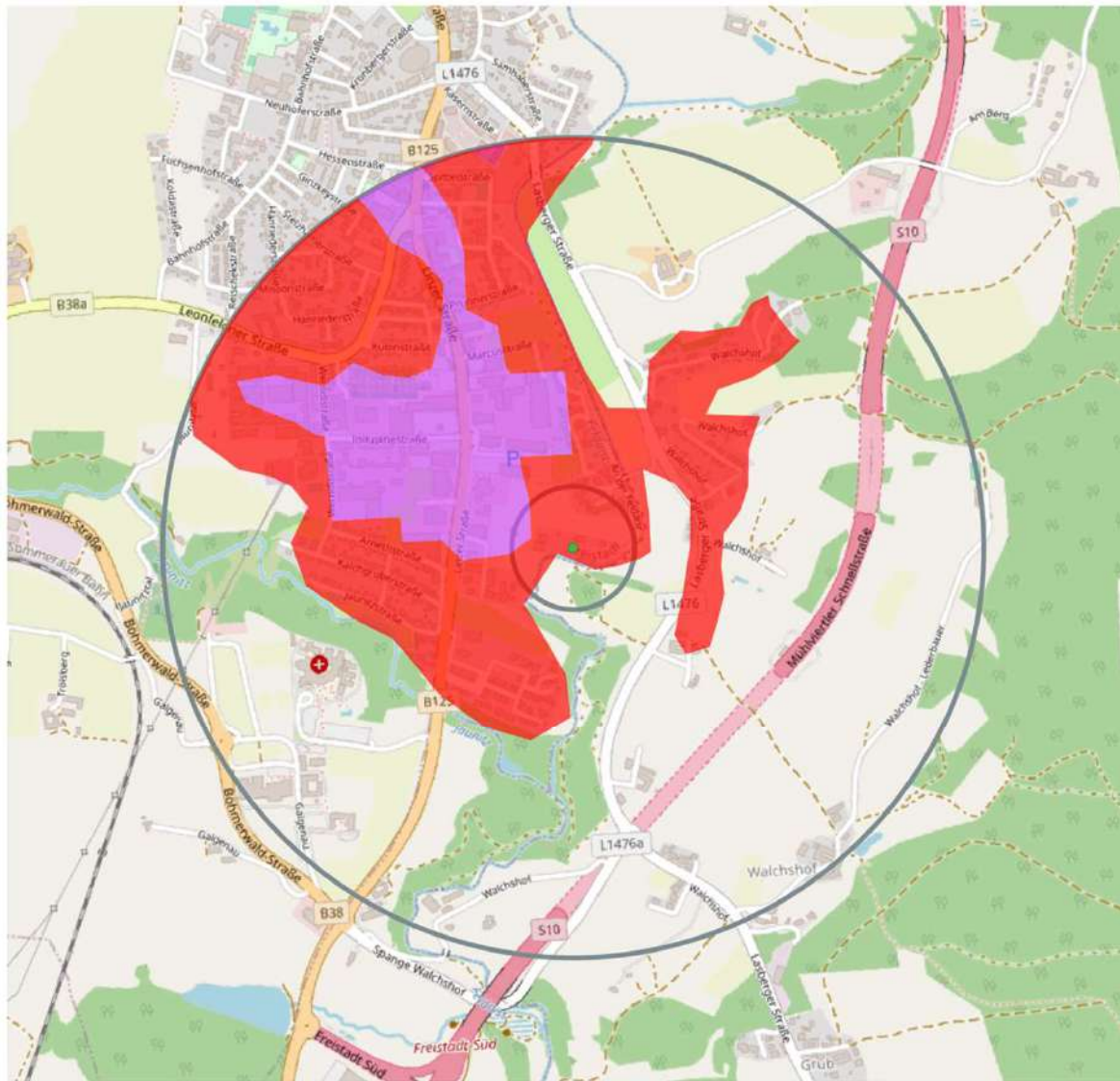
Assumptions:

digester gas: production 20 l/PE*d, electric energy 15 kWh/PE*a, thermal energy 30 kWh/PE*a (all based on WWTP entering load)

wastewater heat: wastewater temperature reduction 5 K, COP heat pump 4, heat pump operation 4.500 h/a



SPATIAL CONTEXT OF WWTPS



Spatial context:
A...within the
settlement






Distribution of
spatial contexts

Legend

Treatment capacity of the WWTP:
5,000 - 50,000

CORINE land cover 2018:

-  111 - Continuous urban fabric
-  112 - Discontinuous urban fabric
-  121 - Industrial or commercial units

Sources:

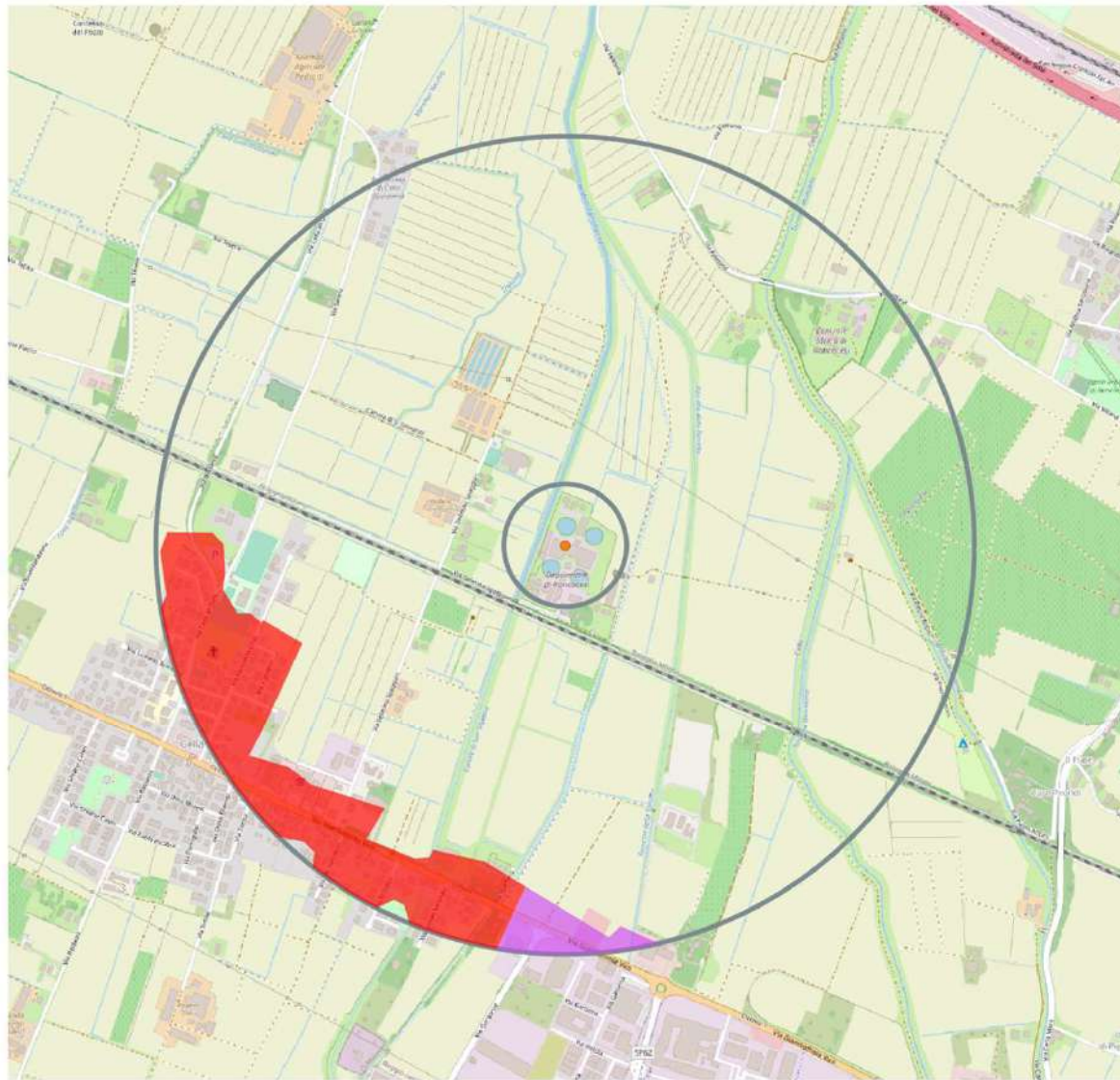
EEA (WWTP data)
Copernicus land portal, EEA (CORINE land cover)
OpenStreetMap

Adaptation:

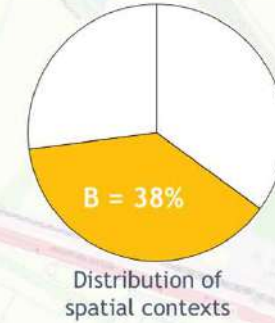
Peter Lichtenwöhler
Georg Neugebauer
(IRUB)



SPATIAL CONTEXT OF WWTPS






Spatial context:
B...near to
the settlement



Legend

Treatment capacity of the WWTP:
> 150,000

CORINE land cover 2018:

-  111 - Continuous urban fabric
-  112 - Discontinuous urban fabric
-  121 - Industrial or commercial units

Sources:

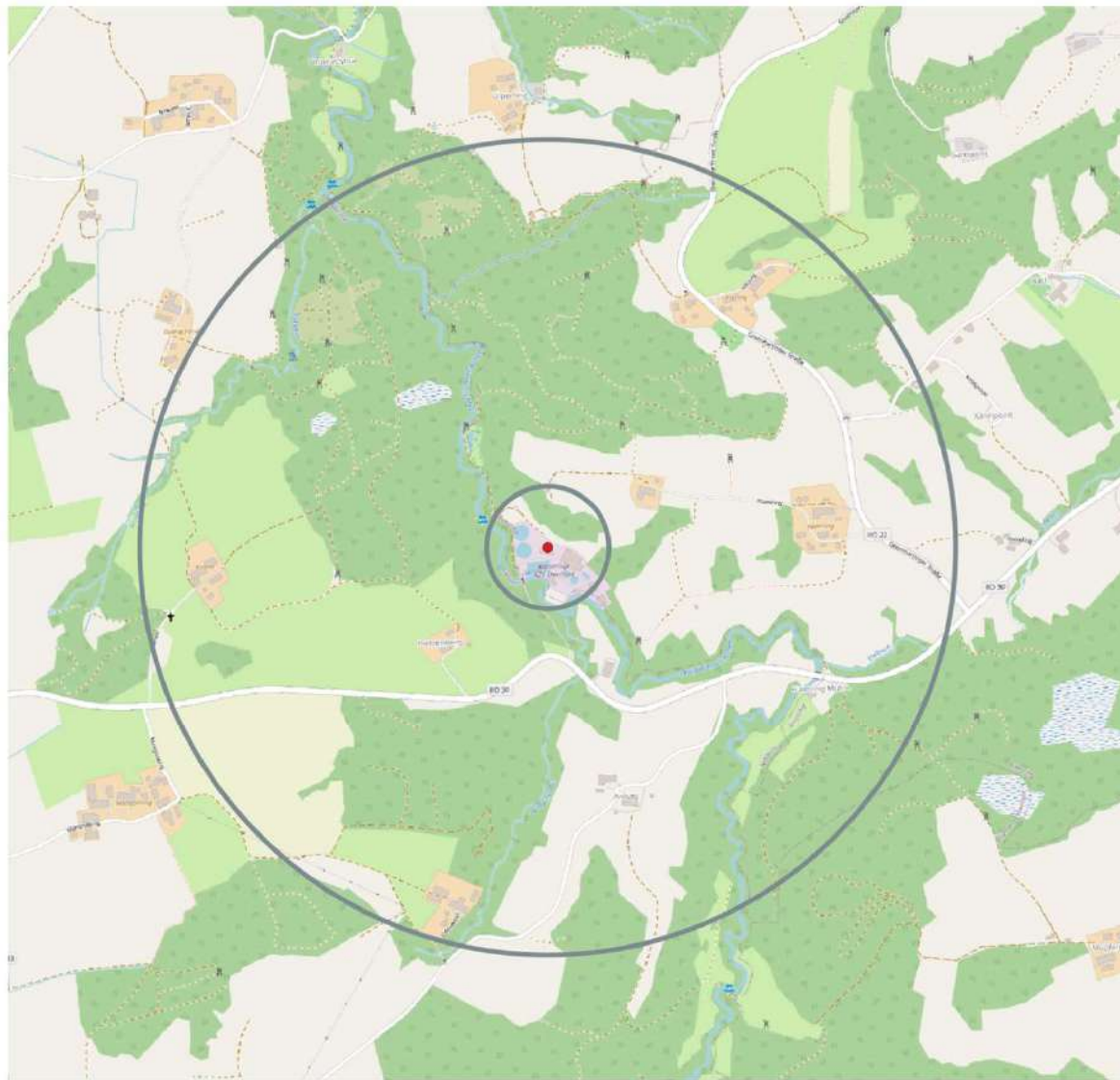
EEA (WWTP data)
Copernicus land portal, EEA (CORINE land cover)
OpenStreetMap

Adaptation:

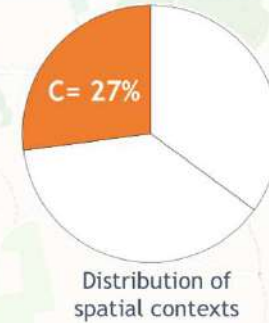
Peter Lichtenwöhler
Georg Neugebauer
(IRUB)



SPATIAL CONTEXT OF WWTPS






Spatial context:
C...far from
the settlement



Legend

Treatment capacity of the WWTP:
50,000 - 150,000

CORINE land cover 2018:

-  111 - Continuous urban fabric
-  112 - Discontinuous urban fabric
-  121 - Industrial or commercial units

Sources:

EEA (WWTP data)
Copernicus land portal, EEA (CORINE land cover)
OpenStreetMap

Adaptation:

Peter Lichtenwöhler
Georg Neugebauer
(IRUB)



Written on the basis of the 5 regional strategies,
CEU Program Area Strategy
is a **higher strategy paper**,
that highlights opportunities and impacts of REEF 2W
at CEU level



Written on the basis of the 5 regional strategies,
CEU Program Area Strategy
is a **higher strategy paper**,
that highlights opportunities and impacts of REEF 2W
at CEU level

aligned with EU Directive 2018/2001
and goals of European Green Deal



EU DIRECTIVE 2018/2001 - Article 2

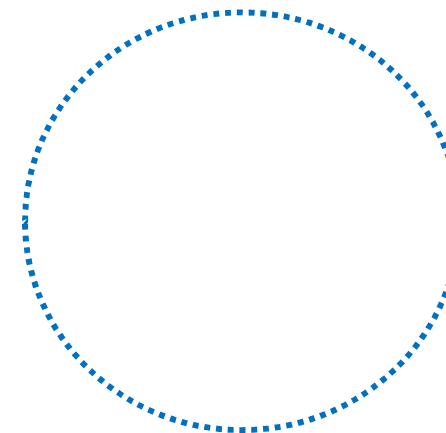
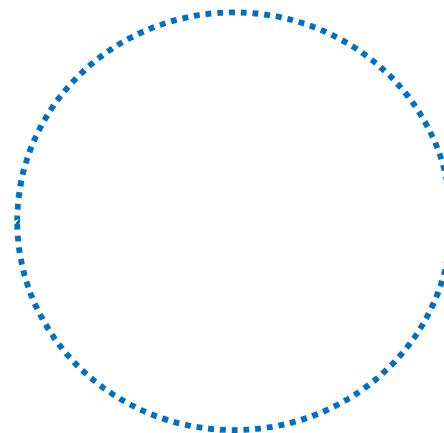
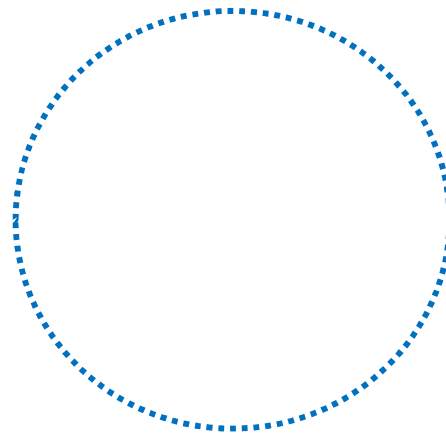
- (1) *‘energy from renewable sources’ or ‘renewable energy’ means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas;*
- (2) *‘ambient energy’ means naturally occurring thermal energy and energy accumulated in the environment with constrained boundaries, which can be stored in the ambient air, excluding in exhaust air, or in surface or sewage water;*



CEU PROGRAM AREA STRATEGY



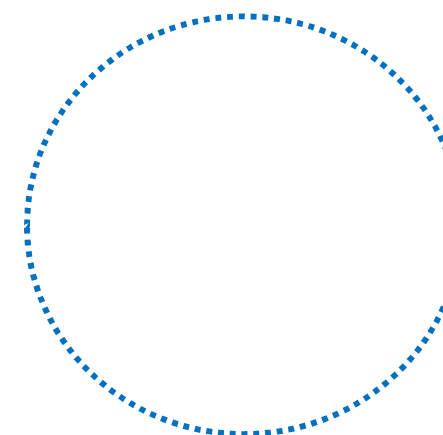
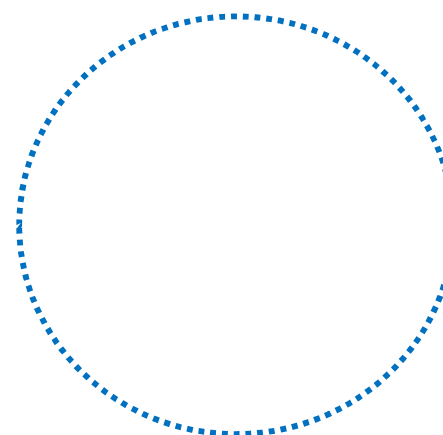
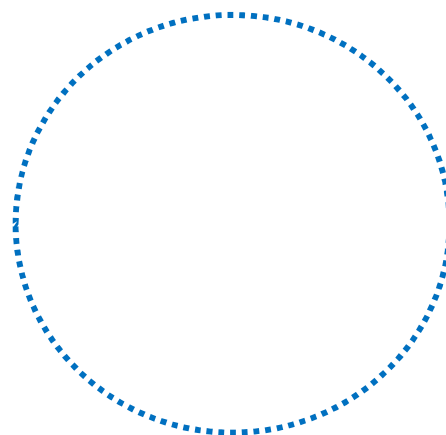
**Legislative
Part**



CEU PROGRAM AREA STRATEGY



**Legislative
Part**



Adjust **legal and policy framework** in order to link energy, wastewater and solid waste sectors to **maximise their synergy and remove barriers** for implementing **joint RES solutions**





Legislative Part

- Increase support by making additional **regulatory pressure**
- Identify all stakeholders on national levels which support is needed for **removing barriers**
- Make **combined approach** across sectoral legislation and policy at various different political-administrative levels
- Make **legal and policy preconditions** for every phase of RES implementation (including sludge treatment)
- Integration of wastewater as renewable source of energy in legal framework, **energy planning and spatial planning** framework

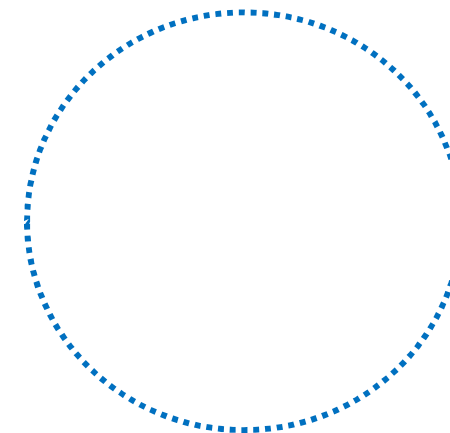
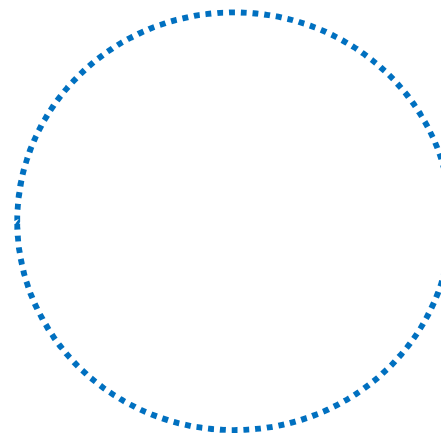


CEU PROGRAM AREA STRATEGY

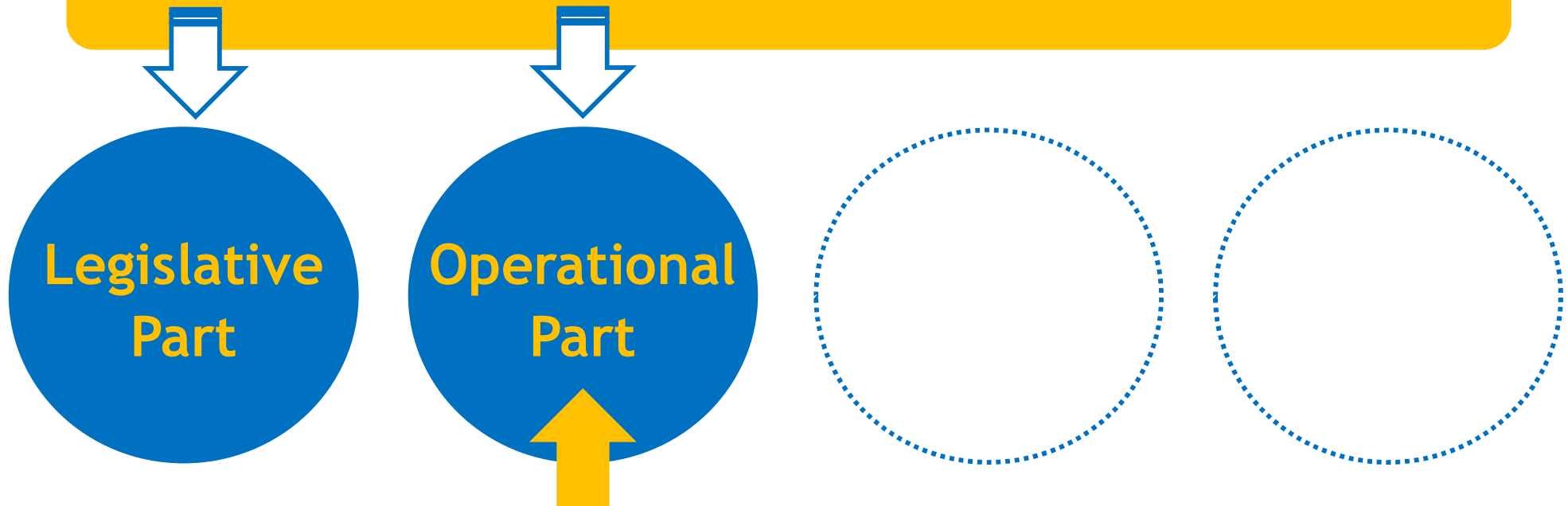


**Legislative
Part**

**Operational
Part**



CEU PROGRAM AREA STRATEGY

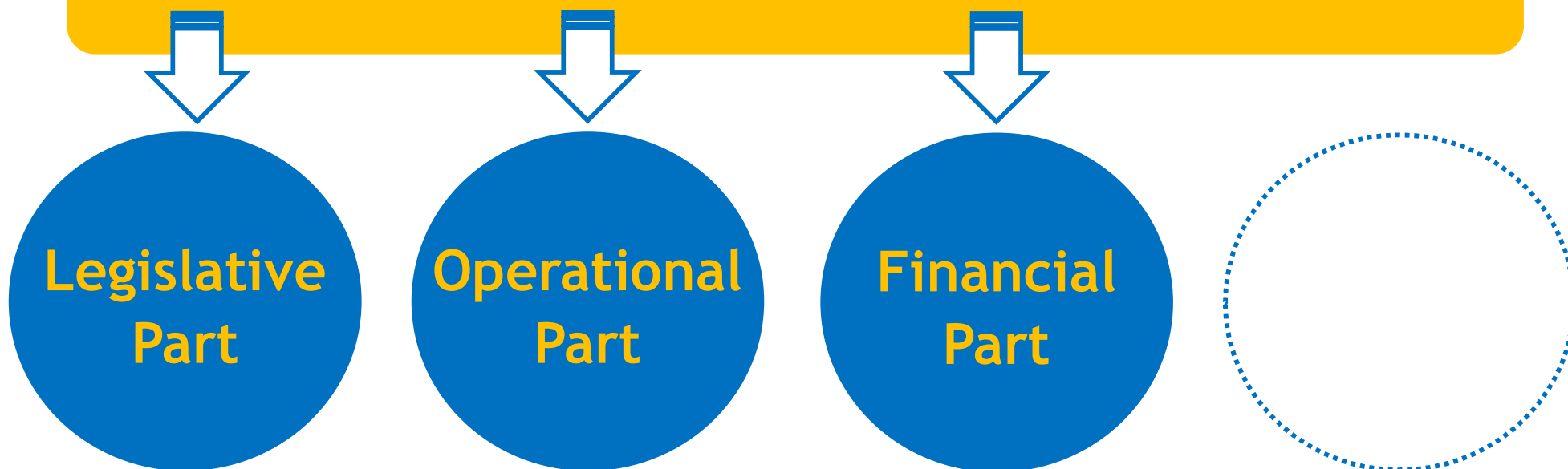


Adjusting **operational models** of utilities running WWTPs in order to **improve business case of WWTPs**

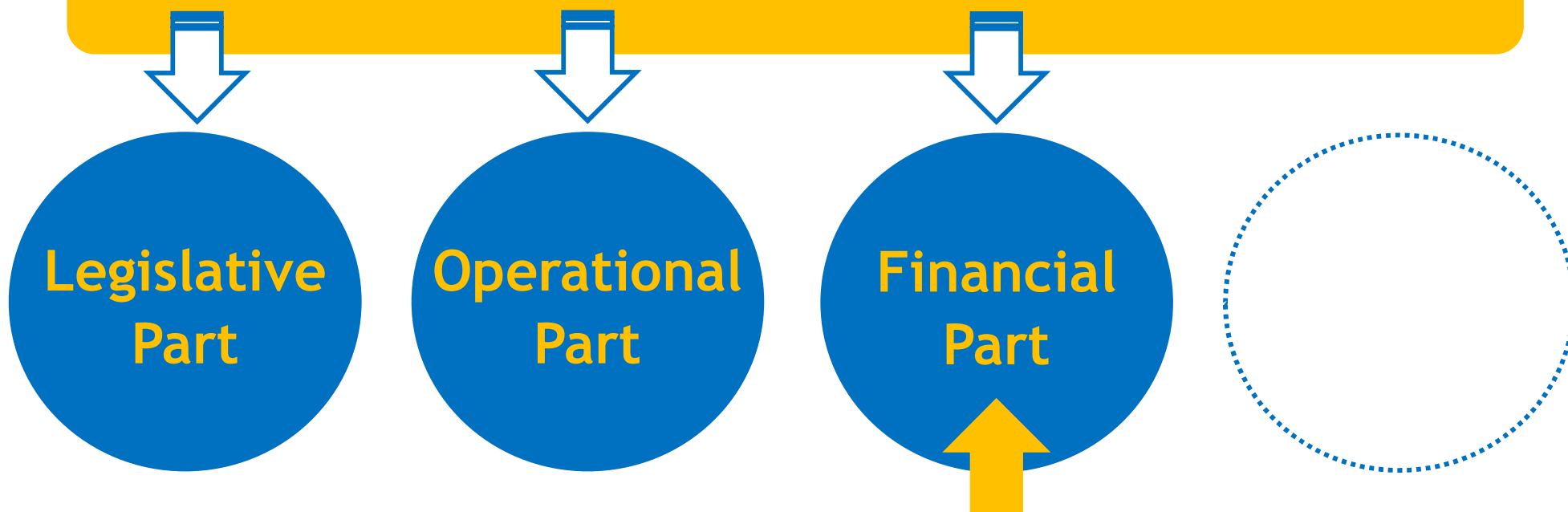




CEU PROGRAM AREA STRATEGY

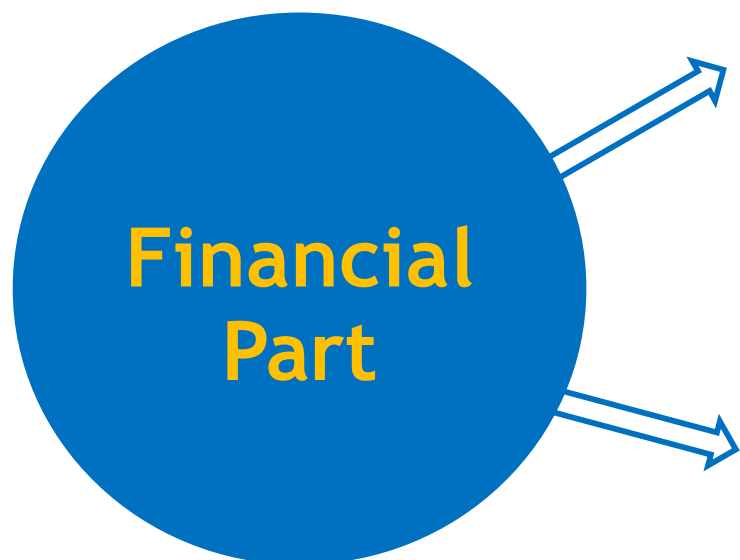


CEU PROGRAM AREA STRATEGY



Provide **sufficient, predicatable, long-term financial models and support** for RES implementation tailored to synergy of energy, water and solid waste sectors.



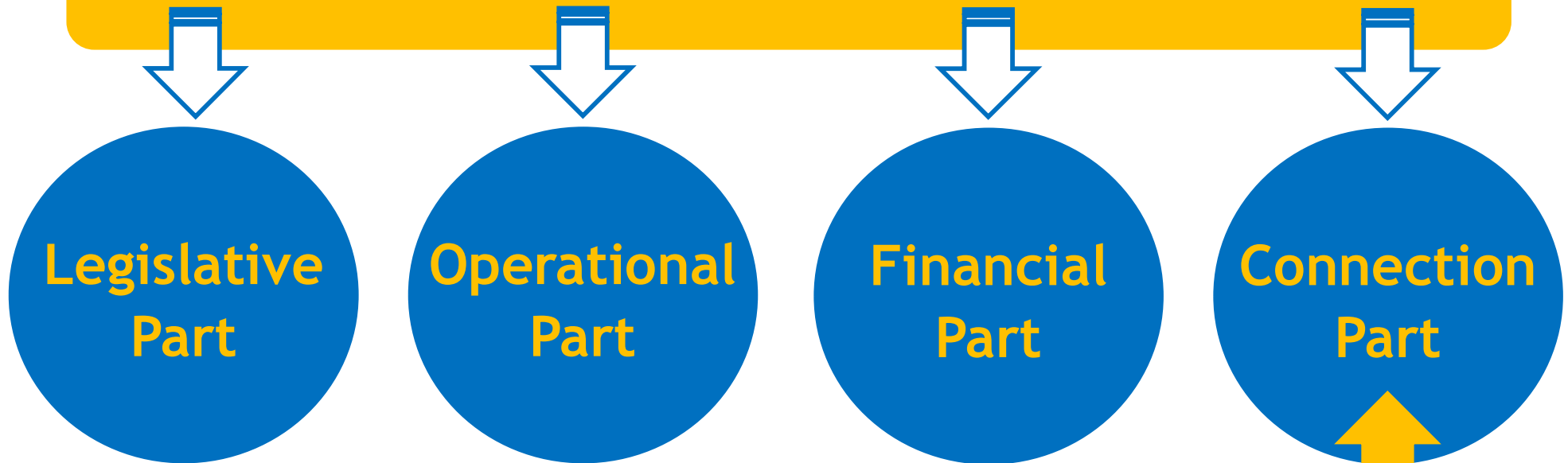


- Establish a clear **subsidies, co-financing and other suitable financial models**, connecting EU and national levels that will foster investments in RES in WWTP sector and broader (extend to all waste-to-energy solutions)
- Establish and promote **public-private investment models** such as PPP, EPC or community (citizens) investment models



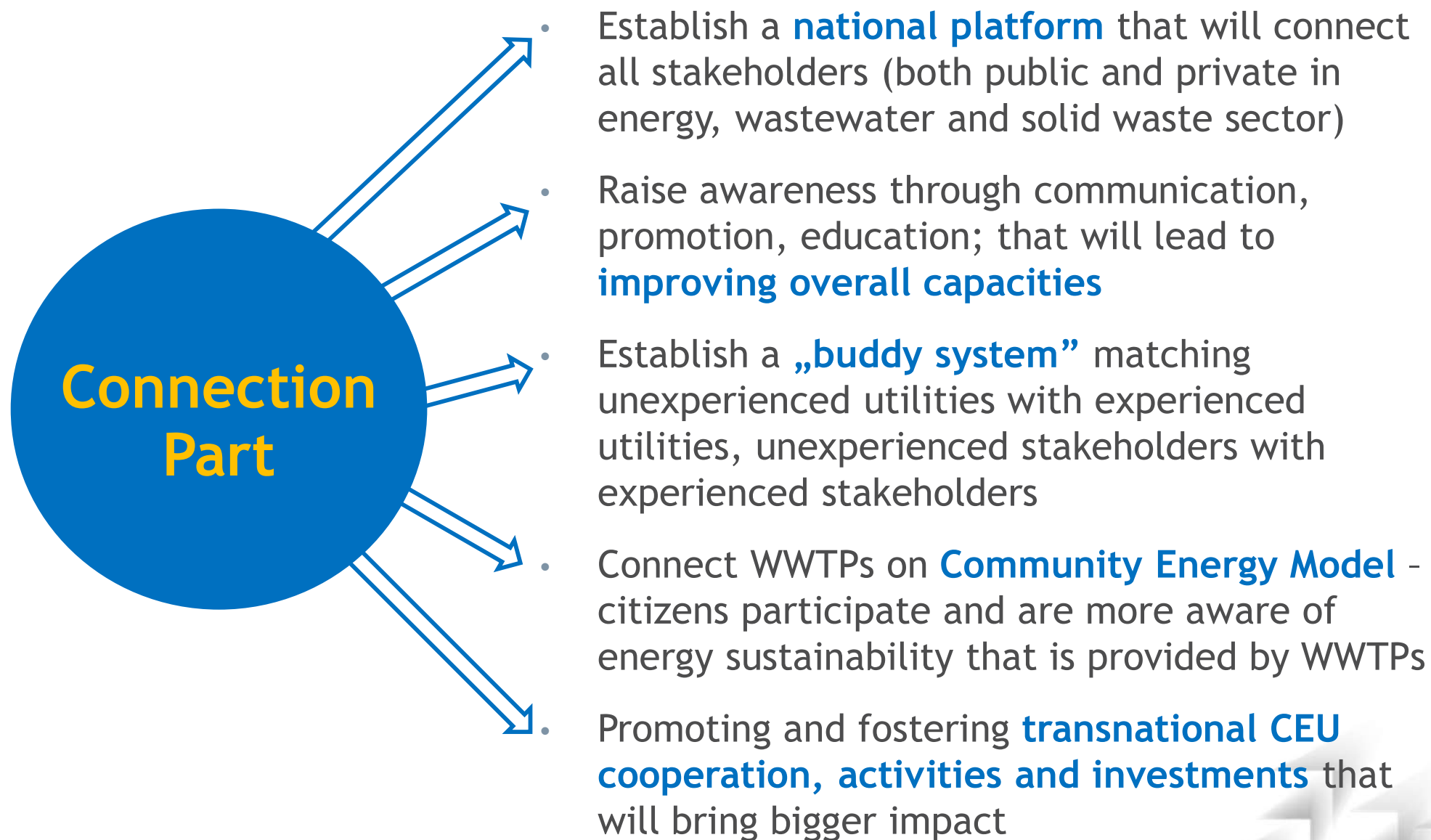


CEU PROGRAM AREA STRATEGY



Connect all stakeholders from energy, wastewater and solid waste sector through **national platform**, increase **information, communication, education** and **capacity building**





Energetic potential

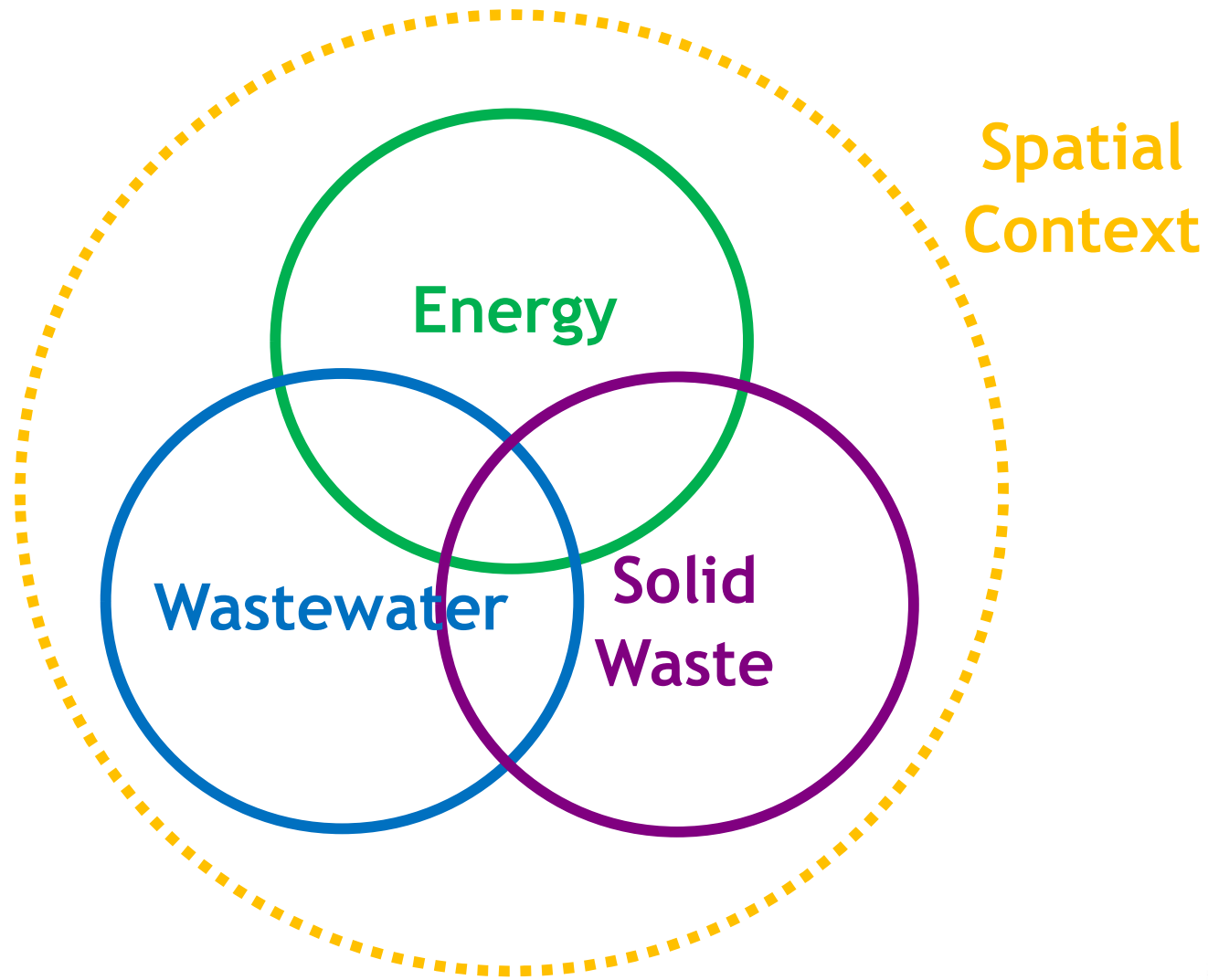
- Estimations show that large amounts of (thermal) energy are available at CEU's WWTPs.
- Activating the widely unexploited potential can support the energy transition towards more climate-friendly systems.

Required actions

- DIRECTIVE (EU) 2018/2001 recognizes wastewater as a renewable source of energy
- Link energy, wastewater and solid waste sector in spatial context to maximise their synergy for implementing joint RES solutions
- Actions set in four parts: legislative, operational, financial, connection



TAKE-HOME MESSAGE



DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources (recast)

EEA - European Environment Agency (s. a.): Waterbase - UWWTD: Urban Waste Water Treatment Directive - reported data. Online in the Internet: <https://www.eea.europa.eu/data-and-maps/data/waterbase-uwwtd-urban-waste-water-treatment-directive-6> (accessed in Apr. 2020)



Contact details



Names: Florian Kretschmer, Marko Zlonoga



www.interreg-central.eu/reef-2w
www.boku.ac.at/wau/sig
www.regea.org



[mailto: florian.kretschmer@boku.ac.at](mailto:florian.kretschmer@boku.ac.at)
[mailto: mzlonoga@regea.org](mailto:mzlonoga@regea.org)



Off.: +43 1 47654 81115
+385 1 3098 315

