D.T1.5.1 – ESTABLISHING REEF 2W ISA METHODOLOGY

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METHODOLOGICAL CONCEPT

This deliverable describes the intended methodological approach for integrated sustainability analysis (ISA) of REEF 2W applications. The following figure 1 summarizes and highlights the key aspects of the procedure to be applied in the five case studies.

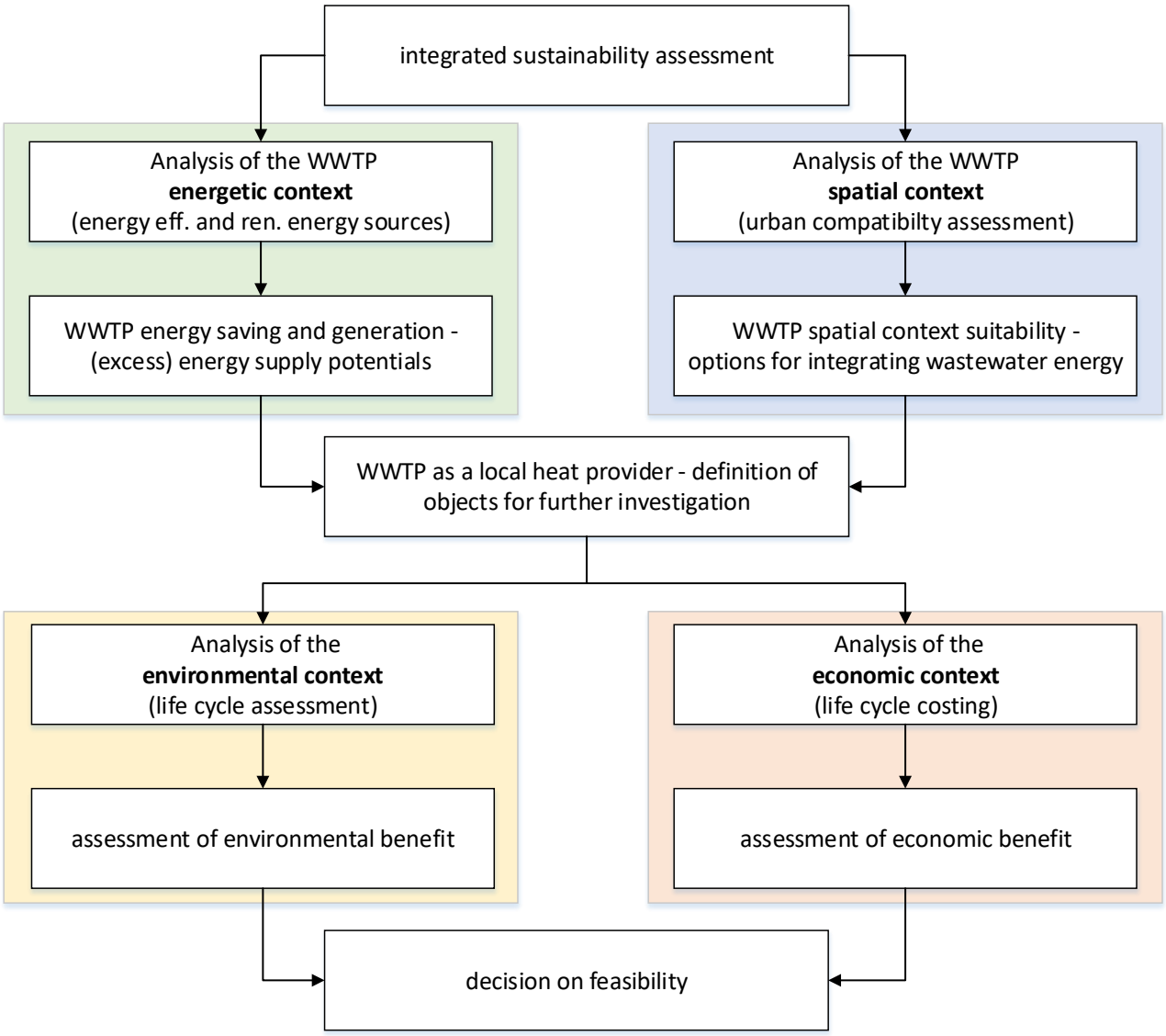

Fig. 1: Methodological approach for integrated sustainability assessment

CRITERIA FOR MEASURING SYSTAINABILTY

The proposed methodology for ISA supports decision making from a fourfold perspective: in a first step the (1) energetic context of the wastewater treatment plant

(WWTP) will be analysed (supply side). This comprises both, the identification of potentials for energetic optimisation and possibilities for the provision of renewable (surplus) energy for external supply to the adjacent urban infrastructure. However, an approach for external energy supply directly implies a parallel investigation of the WWTP's (2) spatial context (demand side). This includes the identification of energetic optimisation potentials in the existing and future settlement structures and the localisation of possible energy consumers as well as of other available (location-bound) energy sources and supply infrastructures. Based on these investigations objects/locations can be defined, which appear suitable for being supplied from the WWTP. In a second step the (3) environmental as well as the (4) economic context of the designated supply systems will be analysed. In principle, these analyses are comparisons of current (mostly fossil) and future (renewable) CO_2 emissions and energy prices, respectively. Finally, the assessment of the related environmental and economic benefits support the decision on the feasibility of the planned implementations.

Furthermore, apart from the above described more technical orientated issues the methodological approach shall also address participatory aspects related to a targeted stakeholder involvement in the temporal sequence of the entire procedure.

TECHNOLOGIES FOR ENERGY PROVISION

Basically, wastewater contains two different types of energy: chemical energy in the form of organic carbon and thermal energy in the form of wastewater heat. While the former can be made available as sewage gas by means of anaerobic digestion the latter can be recovered by the application of heat exchangers and heat pumps. Furthermore, wastewater infrastructure provides opportunities for hydro-, wind and solar power installations.

REEF 2W has a clear focus on the generation of sewage gas (enhanced by applying co-fermentation) and the related application possibilities. On the one hand, sewage gas can be used in combined heat and power installations (CHP units) for the generation of electric and thermal energy. On the other hand, it can be technically upgraded (cleaned) to be used as a substituted for natural gas in public supply grids. However, also heat recovery from wastewater will be in the focus of the project's interest. Consequently, REEF 2W investigations will distinguish three possible

supply rails from the WWTP to the urban settlements: (1) electrical energy supply, (2) thermal energy supply and (3) biogas or biomethane supply.

SCENARIOS AND TIME HORIZONS

In general, depending on local boundary conditions (quantities of available (excess) energy at a WWTP, specific energy demand in the adjacent infrastructure) three different scenarios will be distinguished within the project: (1) supply of electric energy (feed-in to existing electric grid), (2) supply of thermal energy (feed-in to existing or new thermal grid), and (3) supply of biogas or biomethane (feed-in to existing or new gas grid). For ISA related analysis the spatial context primarily concerns supply distances between WWTP and potential energy consumers. For electricity feed-in this issue is almost neglectable. In contrary, it is of great concern for heat supply (transportation heat loss) as well as for the construction of new supply grids (construction costs).

From a temporal point of view, investigations are planned on annual basis for rough evaluation as well as on monthly basis for a more detailed (subsequent) analysis.

ASSESSMENT ON A LIFE CYCLE BASIS

It is intended, to carry out both, the environmental as well as the economic assessment on a live cycle basis.

MULTI-CRITERIA DECISION ANALYSIS

As mentioned above, the presented approach addresses energetic, spatial, environmental and economic aspects of potential REEF 2W applications. In a first step, the available (excess) energy (electricity, heat, sewage gas) at a WWTP will be compared to existing and, if required, future energy demands in the adjacent urban infrastructure. Based on these (spatial-energetic) boundary conditions possible energy consumers can be identified and related supply scenarios defined. In a subsequent step the economic and environmental benefits of the intended scenarios will be assessed. This evaluation provides the basis for multi-criteria feasibility judgment and decision making from a multidisciplinary perspective.