

Circular economy indicators in the European water and wastewater sector

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The European Union (EU) is currently in the transformation process toward a circular economy (CE) which aims to reduce unsustainable management of raw materials from primary and secondary sources. In 2018, the European Commission (EC) proposed the monitoring framework for measuring the transformation towards the CE in European countries. Since the economy is a very wide-ranging concept (e.g. it applies to all branches of industry, including water and wastewater sector) there is no indicator that can be a single measurement for the CE. However, several existing indicators could be helpful in measuring performance in selected areas that directly or indirectly contribute to the development of the CE model. Paper presents a set of indicators proposed for measuring the progress toward the CE implementation in the water and wastewater sector. The selected indicators were grouped in the specific areas indicated in the CE model framework in the European water and wastewater sector, developed under international project entitled MonGOS. The CE model framework includes six specific areas of actions: i) *reduction* - prevent wastewater generation in the first place by the reduction of water usage and pollution reduction at source; ii) *reclamation (removal)* - an application of effective technologies for the removal of pollutants from water and wastewater; iii) *reuse* - reuse of water / wastewater as an alternative source of water supply (non-potable usage); iv) *recycling* - recovery of water from wastewater for potable usage; v) *recovery* - recovery of resources such as nutrients and energy from water-based waste, vi) *rethink* - rethinking how to use resources to create a sustainable economy, which is 'free' of waste and emissions. In the current research, already existing CE indicators (developed by scholars, consulting companies and governmental agencies) were grouped and proposed for each of the presented areas of actions, based on the specific user's needs and requirements. The novelty of the presented CE model framework concerns integration of all possible ways of implementation of CE principles in the water and wastewater sector, including technological, organisational and societal changes. Application of the proposed model may help the European economy to make further transformations towards the CE model, while the usage of recommended CE indicators could help to monitor and assess the CE implementation progress at macro, meso or/ and micro level.

Key words: circular economy (CE), monitoring, indicators, roadmap, strategy, Europe

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