# Modelling Water Loss Control Interventions in Urban Water System from a Water-Energy-Environment Nexus Perspective

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Nexus has been highly postulated by researchers and decision-makers because it represents the interlinkages and interdependencies between sectors such as water, energy, food, land use, climate, and environment. Also, Nexus makes the decision-making process more sustainable by identifying potential synergies and minimizing trade-offs between sectors.

The urban water systems generally consist of intake-conveyance-water treatment-transmission-distribution-end use-wastewater collection-wastewater treatment-water reuse process. When municipalities or water authorities establish strategies and interventions for water loss control in the urban water systems, they only consider outputs in the water sector. This study developed the urban water system model using system dynamics to derive the urban water loss management plan from the Water-Energy-Environment Nexus perspective. To quantify the consumption and transfer of resources between sectors, water footprint, total energy use, and carbon footprint are applied as indicators of water, energy, and environment, respectively.

The developed model was analyzed by applying 12 scenarios considering three urban energy intensity levels (low, medium, high) and four water loss levels (good condition, high NRW&low AL, high NRW&medium AL, high NRW&high AL). Reducing apparent losses was prioritized in the conventional economic-oriented water loss control program. However, handling real losses takes a top priority from the Nexus perspective. Besides, it was proved that the energy intensity for unit urban water supply had a significant impact on resource consumption and transfer. Therefore, it should be considered an essential factor to be analyzed in advance. A sustainable, systematic, and feasible water loss management is expected to be possible through this generalized and holistic urban water-energy-environmental Nexus model.