# ON SOME DEVELOPMENTS
# IN OPTIMAL WATER NETWORK DESIGN

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This contribution deals with investigations on designing water network (WN), which have been carried out at RUT and KPI. Water network is a system that consists of water using processes and wastewater treatment / regeneration units. An optimal design of WN yields substantial reductio of both freshwater consumption and wastewater generation. This is achieved by proper wastewater reuse and regeneration. Water networks exist in process systems particularly in chemical, petrochemical, food processing and related industries. Also, this notion can be applied for water integration in industrial districts (called often eco-industrial parks) as well as urban water systems.

The works at RUT and KPI focused on two subsystems: water usage network (WUN) and wastewater treatment network (WWTN). In both cases we have developed systematic approaches. For WUN the algorithms are based on superstructure optimisation. This superstructure embeds all possible connections amongst processes. To solve the problem we have applied stochastic optimisation – Adaptive Random Search (PhD Thesis of G. Poplewski and, also, some papers). As the alternative, A. Shakhnovsky applied some assumptions that result in easier optimization problem that can be solved by deterministic methods. K. Wałczyk in his PhD Thesis applied linearization that finally allowed solution of simultaneous water and heat integration. That yields both energy as well as water saving. In regards to WWTN we have developed two classes of methods. I. Dzhygyrey developed a hybrid approach that combines insight-based elements with mathematical optimization. This two-stage method allows reduction of optimisation problem complexity and is user driven. Hence, it is a good technique for retrofitting industrial systems. The method of employing stochastic optimization to WWTN superstructure has also been used with success.

It can be stated that several alternative techniques have been developed that allow solution of WN problem for various scenarios. It is of importance, that these methods found applications in various Ukrainian plants. They were also presented in many journal papers, chapters of books and conference proceedings. At present we are focusing on applying possibly accurate models of wastewater treatment processes in WWTN and implementing computer aids for designing WUN at uncertain data.

# ВИВЧЕННЯ ПИТАНЬ ЕНЕРГОЗБЕРЕЖЕННЯ В ПРОЦЕСІ
# ПІДГОТОВКИ ФАХІВЦІВ ТЕХНІЧНИХ СПЕЦІАЛЬНОСТЕЙ

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Останні десятиліття характеризуються катастрофічними масштабами техногенного впливу людини на навколишнє середовище. Це вимагає вироблення радикальних заходів щодо цілей і пріоритетів розвитку суспільства. Розвиток суспільства повинен відбуватись без втрат екологічної ємкості природного середовища і не вносити незворотних змін у природу, не створювати загрози для існування людини як біологічного виду.