Sustainable water management in the emerging megacity of Lima – Based on macro-modelling and participation

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Motivation

Planning, design and management of water infrastructure always has been a challenging task. Facing the pressing demands and policy objectives of today, such as aiming to achieve the Millennium Development Goals, and also taking into account sustainability with its various facets, including preparedness for climate change, this task appears to be insurmountable. This holds true in particular for megacities such as Lima (urban growth centre) with their large number of population often suffering from insufficient water supply and sanitation services. In addition to that, some particular challenges are faced in Lima by its hydrological boundary conditions.

LiWa Project

LiWa involves several disciplines addressing the problem of water in different perspectives in order to develop and to facilitate methods and tools for a better sustainable planning and management of the water and sanitation system in Lima, focussing on impacts of climate change and promoting energy efficiency.

Macro-modelling simulator "LiWatool"

Main Aspects:

- ❑ Modelling of water and wastewater system, pollution, energy, etc.
- ❑ Highly flexible in definition of processes, parameter and variable sets, etc.
- ❑ Categories of costs (capital and operational expenditure according to the company's categories)
- ❑ Considering the urban water system as an entirety (in a conceptual way, see Figure 2)
- ❑ Test and visualisation of scenarios and variants
- ❑ Output options: Sankey diagrams, Excel und http-files, Report generation, Links to Google Earth, etc.

Objectives:

- ❑ Planning and development of water and wastewater systems in large scale
- ❑ Discussion and participatory decision making:
  - Information on the situation of the entire water and wastewater system
  - Evaluation of future projects (the best solution among various possibilities)
  - Modelling of scenarios and variants taking into account climate change scenarios
  - Supporting informed discussions and decisions

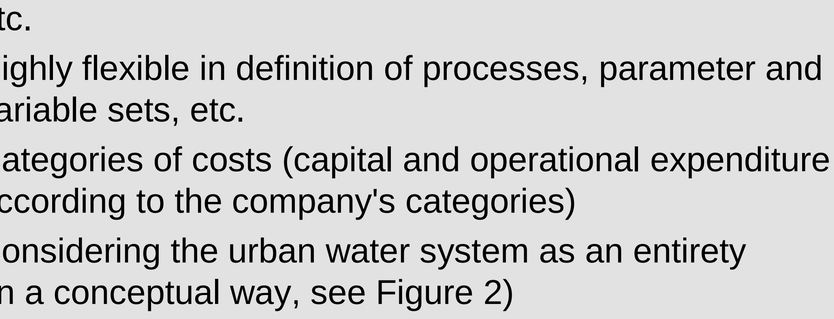

Fig. 1: Macro-modelling on a city-scale as a core element of successful participatory processes

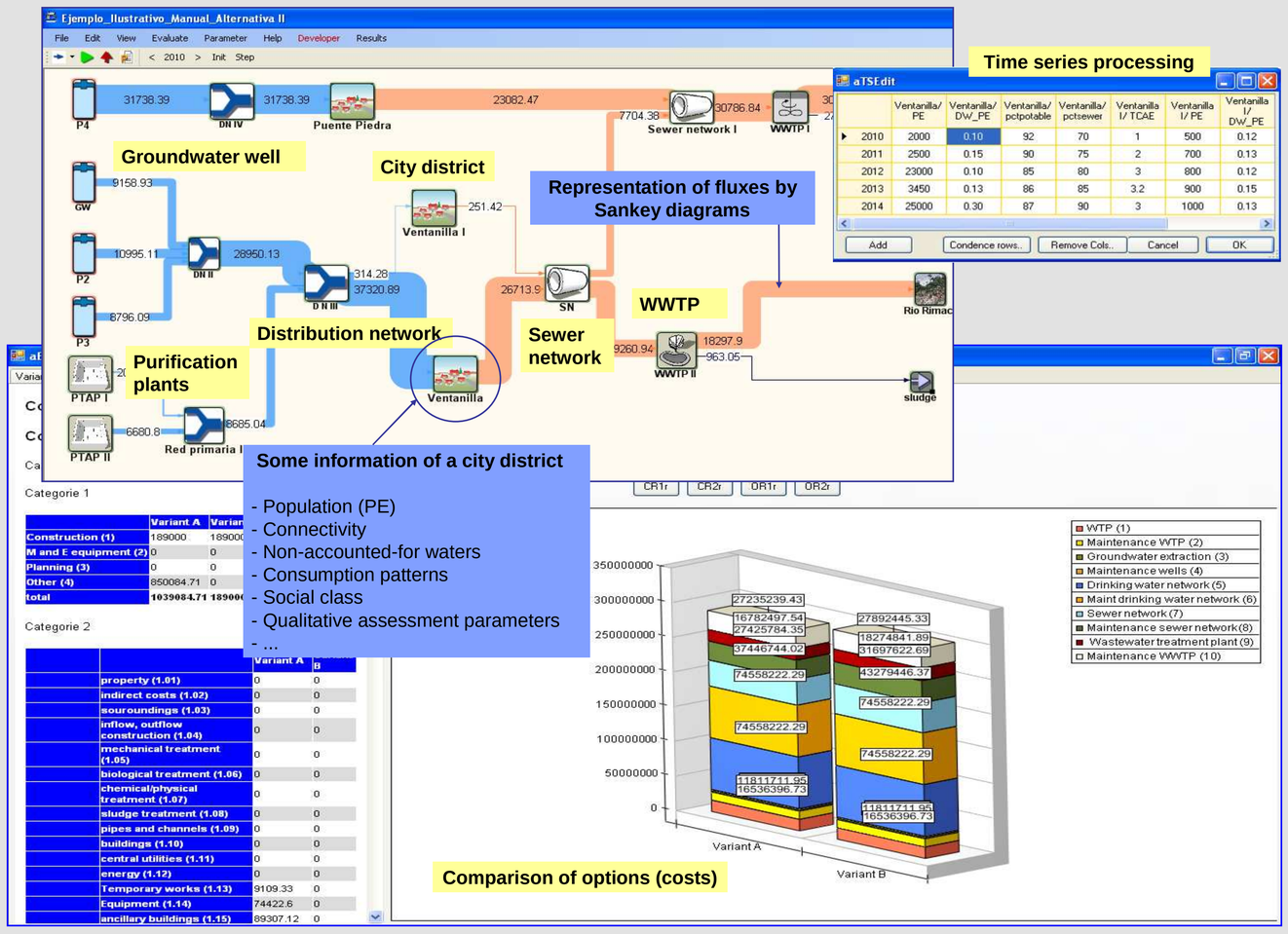

Fig. 2: Parts of the urban water system, costs, time series editor and some information considered within the program LiWatool

Region under study

- ❑ Lima: Urban growth centre: 8 million inhabitants
- ❑ Significant population growth (2.1% p.a.)
- ❑ Desert region, almost no rainfall (9 mm p.a.)
- ❑ Challenging boundary conditions for sustainable drinking water supply
- ❑ Lima's water supply affects Amazon catchment
- ❑ Climate change (intensifies water crisis in Lima)

Fig. 3: Geographic location of Lima

Analysis of the water system using LiWatool

- ❑ Some aspects considered in an initial study :
  - Population growth (of 11 districts in the area under study)
  - Water leakage (reduction by 0.5% in two representative districts of the city)
  - Effects of climate change on the water sources: reduction of Rímac river flow by three different percentages (25%, 30% and 35%)
  - Water consumption (according to water company's historical data)
- ❑ Initial analysis (Period of analysis: 7 years)
  - Availability of the water sources and effects of water leakage reduction
  - Evaluation and comparison of two wastewater treatment plants
- ❑ Results of the initial studies indicated:
  - Reduction of water leakage: Additional water supply to 2502 inhabitants
  - Reduction of river Rímac's stream flow: Groundwater wells shortening by 23.5% - 28% under their actual production capacity.
- ❑ Ongoing work:
  - Application of modelling within participatory processes
  - Integration of the entire water and wastewater system into the model
  - Analysis of the impact of large infrastructure projects
  - Evaluation of innovative alternatives for water purification (e.g. sea water desalination), wastewater treatment, reuse of treated wastewater, etc.
  - Ensuring transferability to other megacities

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