



# Sustainable Water and Wastewater Management in Urban Growth Centres . Coping with Climate Change – Concepts for Lima Metropolitana (LiWa), Peru

## Overview and Findings to Date

The project “Sustainable Water and Wastewater Management in Urban Growth Centres Coping with Climate Change – Concepts for Lima Metropolitana (Perú) – (LiWa)” aims at sustainable planning and management of one of the crucial lifelines – water and sanitation. This will be done in one of the urban growth centres of the world, Lima, with particularly adverse boundary conditions.

The project draws special attention to the impacts of climate change on and the promotion of energy efficiency in water and sanitation systems. Research carried out in the project builds upon previous studies and investigations of the consortium partners and, in particular, the results, contacts and intensive forms of cooperation that were accomplished during the successful preparatory phase of the project. The relevant stakeholders have been identified and working relationships have been established. Furthermore, potential technologies of wastewater disposal and treatment have been analysed. Also, a preliminary version of a macro modelling tool, simulating water and wastewater fluxes in Lima, facilitating analysis of scenarios and variants, assisting stakeholder discussions and decision making, has been set up.

## Objectives of the Project

The LiWa project particularly focuses on the development and application of fundamental procedures and tools for participatory decision making, based on informed discussions. The project builds upon modelling and simulation of the entire water supply and sanitation system within the urban growth centre system of Lima. Furthermore, the project develops

and evaluates options for redesigning the water tariff system to meet economic, ecological and social requirements. With this approach, key issues and challenges of energy and climate-efficient structures of water and wastewater management will be adequately addressed.



Due to its importance, not only to Lima, but also globally, the lifeline «water» is chosen as the focal topic of the LiWa-project. Using the example of Lima (a case with particular challenges), methods and tools will be developed to analyse a life-line system. Based on this analysis, strategies and governance proposals will be generated that promise to combat effects of climate change in a sustainable way.

## Specific project objectives and work plan

The following main tasks and specific project objectives have been identified for the LiWa project (besides project management and dissemination):

### 1. Integrated scenario development

Scenario definition: Due to the uncertainty of climate change impacts and the variability in selecting and implementing mitigation and adaptation measures, it is mandatory to work with a set of scenarios that reflect a breadth of developmental options and provide orientation for the decision makers.

### 2. Climate downscaling, water balance, water supply and hydropower modelling

The main objectives here are: Downscaling of climate change scenarios to the local scale and the simulation of the regional river basin catchments in the climate scenarios to include the effects of climate change on the water resources available for water supply, ecosystems and hydropower generation.

### 3. Macro-modelling and simulation system

The main objective here is to develop a simulator for the visualisation, modelling and simulation of the entire water system and other resource fluxes within the urban growth centre of Lima. This simulator will be applied for the evaluation of scenarios and operational variants and will help in long-term planning, taking into account climate change impacts and incorporating different sets of values and preferences.

### 4. Participation and governance approach

The main objective here is to develop and test suitable processes for stakeholder and public involvement that link the outcomes of the integrated models (analytic component) with deliberative methods of decision making and public involvement. Other objectives include: Exemplary implementation for resolving specifically salient conflicts and development of an Integrated Governance Framework that includes government officials, economic players, representatives of sciences and civil society. Only if these forces interact and cooperate is positive change likely to occur.

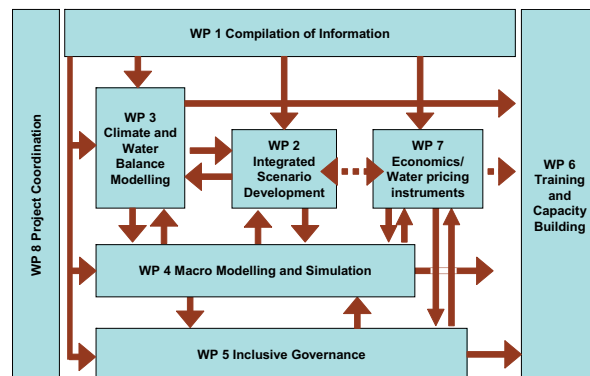
### 5. Education and capacity building

The main objective here is to assist managers in capacity building and capability empowerment with respect to further mitigation and adaptation measures including cooperative structures between public authori-

ties, Lima's water company, stakeholders and future professionals. The underlying goal is to implement institutional structures that assure effective, efficient, financially viable and socially acceptable ways to manage water resources.

### 6. Economic evaluation of water pricing options

The main objectives here are to identify and evaluate water pricing options that promise to overcome water quality and quantity problems in Lima. It will be analysed how well different options are able to recover the costs of water supply, meet distributional goals and overcome institutional and political-economical obstacles. Moreover, light will be shed on possible changes of the institutional framework, which may be necessary to implement a pricing reform.



## Expected Contributions to an Energy- and Climate-Efficient Development of Future Megacities

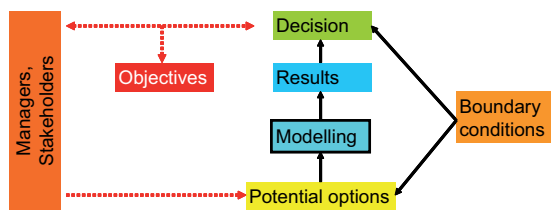
### Knowledge, Technologies and Performance

As the project will develop methods of model-based participation approaches, ensuring informed discussions and decisions with ownership of the stakeholders involved, it contributes to knowledge in a variety of areas, including social science (governance, participation, evaluation of water-pricing options) as well as environmental and systems engineering (macro-modelling). The methods and tools that are being developed assist in the evaluation and selection of the most appropriate technologies and strategies for

the given megacity context. Thus, they ensure maximum performance of the critical lifeline system.

### Applicable Instruments, Tools and Methodologies

The simulation models developed within the LiWa project will provide a better understanding and estimation of the water related affairs (water supply, wastewater, energy). The models consider climate change and population growth as boundary conditions. As opposed to conventional, detailed modelling approaches, simulation models aim at representing the water system of Lima as a whole

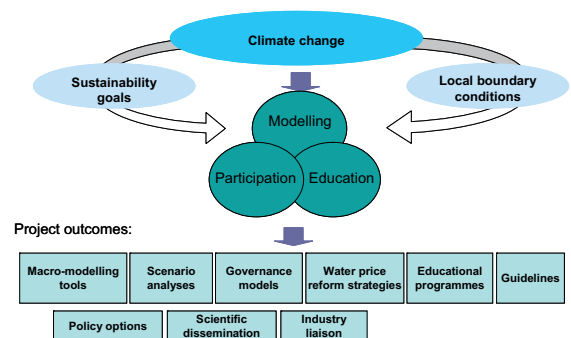


(macro-modelling). Thus, the simulation models allow for impacts of potential measures to be assessed on a system-wide scale. Climate scenarios and river catchment impacts will be fed into this framework. Strategic decisions that have to be taken on adaptation and mitigation of climate change will sometimes cause conflicts between economic development, ecological quality and social demands. In the long term, the efficiency and effectiveness of strategies to combat climate change depend on the cooperation among authorities as well as between authorities, citizens and other stakeholders. Thus, the inclusion of public concerns in the decision between technical options and/or required changes in behavioural patterns is crucial. Consequentially, new models of governance, where societal groups can articulate their interests and exercise their rights, will be designed and applied in the water sector. A focal aspect will be potential trade-offs between ecological, economic and social values. Moreover, new strategies are developed to redesign the water prices in Lima. These strategies represent one field where the governance models will be tested.

### Results of the previous steps: Suggestion of measures to be implemented in Lima. Capacity Building, Integration and Networking of Institutions

Educational and capacity building measures are included in the project as a means to ensure the continuity of the project’s objectives and the implementation of the project’s results, even after the project is finished. This activity will foster further educational cooperation and student exchanges between the university partners of the project. Additionally, specific training sessions will be held on modelling and participation methods.

Integration of institutions and networking is ensured by structuring a governance process that links governmental, economic, scientific and civil society actors. The special feature of the LiWa project is that it initiates and sustains networks among these actors and provides them with the necessary tools to develop new forms of cooperation. Furthermore, a communication platform for dissemination of results will be established. This innovative approach consists of the so called “LiWa Ambassadors”.



Within the ambassadors program, major stakeholder groups are engaged to provide local (institutional) knowledge to the project team and disseminate LiWa’s results to a wider audience. This will facilitate local ownership of the issue and of the planned changes. Moreover, it will lead to stakeholder groups being directly involved in the dissemination of the most important results.

## Socio-Economic, Integrative and Overall Sustainability Aspects

Sustainable water management means that the measures to be taken have to be effective, ecologically sound, economically efficient and socially acceptable. The integration of modelling tools and economic instruments within a governance model ensures that the best scientific knowledge is the guiding principle for designing policies and, at the same time, that technically and economically feasible options are generated and evaluated in a participatory process. The underlying concept of the participatory part of the project is inclusive governance. Inclusive governance is based on the conviction that the four major actors in risk decision making, i.e. the political, economic, scientific and civil society players should be involved in the process of problem framing, generating policy options, evaluating these options, and coming to a joint conclusion. The involvement of these various actors is meant to ensure that systematic knowledge, public preferences, cultural values and ethical considerations are all integral parts of the decision making process. This inclusive procedure has two advantages. First, much more information can be gathered and made available to policy makers in governments and civil organisations. Second, the participation of stakeholders and the public may enhance the quality of the decision making process as it includes different perspectives, concerns, and expectations. Thus an inclusive governance approach contributes to a wider perspective regarding water resource and sanitation management.

The project will also provide a better understanding of the interrelations between the ecological and technical characteristics and the economic and social conditions of the Lima water sector. New strategies for water pricing will bridge the gap between economic (recovery of water supply costs), ecological (improvement of water quality, reduction of water consumption) and social (low water prices) requirements.

## German Partners

- ifak Magdeburg (ifak)
- Leuphana University Lüneburg – Campus Suderburg
- Universität Stuttgart – Interdisciplinary Research Unit for Risk Governance and Sustainable Technology Development (ZIRN)
- Universität Stuttgart – Institute of Hydraulic Engineering, Chair of Hydrology and Geohydrology (IWS)
- Helmholtz Centre for Environmental Research - UFZ, Leipzig
- Dr. Scholz & Partner Consultant Engineers

## Cooperative Partners in Host Country

- Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL)
- Foro Ciudades Para la Vida (FCPV)
- Fomento de la Vida (FOVIDA)
- Universidad Nacional de Ingeniería (UNI), Lima

## Coordinator/Contact

Dr Manfred Schütze, ifak e. V. Magdeburg  
E-Mail: [manfred.schuetze@ifak.eu](mailto:manfred.schuetze@ifak.eu)

Internet: [www.lima-water.de](http://www.lima-water.de)