

VertiKKA – A vertical air-conditioning and water recycling system

The funding measure Resource-efficient urban districts for the future (RES:Z)

The Project VertiKKA is a response to land-use pressure in cities and combines façade greening with renewable energy production. The VertiKKA is a multifunctional façade greening module that is irrigated with greywater. Furthermore, it generates electricity through an installed PV module.

The German Federal Ministry of Education and Research (BMBF) is funding the project as part of the funding measure Resource-efficient urban districts for the future (RES:Z). The funding measure focuses on the resource-efficient use of water, land, material flows, energy and urban greenery in urban areas. The goal is integrative planning and sustainability-oriented management of urban neighborhoods with the participation and coordination of all relevant stakeholders.

Green Your City

Climate change brings many challenges, especially in densified cities. Urban planning is faced with the problem of increasing densification of urban spaces and less space for urban greenery. Façade greening can enormously increase the proportion of greenery in cities, even with little available space, and offers a wide range of advantages. The innovation of the VertiKKA – façade greening module lies in its multifunctionality: façade greening, greywater purification and energy generation through photovoltaics are combined. The positive effects lie in the combination of the individual advantages of façade greening systems and photovoltaic modules, which generate electricity and at the same time protect the plants from extreme weather conditions. The combined greywater treatment provides the plants with nutrients and a permanent supply of water, so that the use of drinking water can be completely dispensed with.

From Container to Wall

In the first funding phase, different variants were developed and optimized in test modules with regard to the components photovoltaic, greywater purification performance and plant vitality. The purification performance of the module proved to be effective in reducing the chemical oxygen demand (COD) in the artificially mixed grey water without impairing the vitality of the plants. The building physics investigations revealed a demonstrable improvement in the microclimate in the city by lowering the air temperature and the mean radiation temperature in urban areas in summer.

Simulations on an external wall also showed that greenery provides better insulation and allows less heat to pass through.



Projection of the VertiKKA2 design on the facade of the real laboratory (not to scale).

Implementation and stabilisation of the results

The implementation and consolidation phase is built upon these results. The aim is the successful scientific, technical and impact-related further development of the VertiKKA module. The former container wall is now replaced by a façade of a building of the Bauhaus-Universität Weimar. For this real laboratory, VertiKKA modules are attached to a wall. There, the cleaning performance using real greywater, the determination of the renewable electricity yield and other important effects (e. g. cooling of the environment, protection of the outer wall, fire protection, etc.) are examined. The aim is to show the advantages of green spaces in cities within the restrictions of missing space and drinking water.

A software application is being developed to classify and evaluate the VertiKKA in comparison to other blue-green infrastructure measures. The most effective measures should be selected according to objective standards so that further planning steps can be initiated based on them. As one measure, VertiKKA combines blue and green infrastructure planning. With a successful presentation of the positive overall effects, a rethinking of the possibilities of greywater use in the city and the need for greening is pushed.



Determination of the parameters COD, nitrite, water hardness, and nitrate in raw wastewater using cuvette tests.

Funding initiative

Resource-efficient urban districts for the future (RES:Z)

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VertiKKA – A vertical air-conditioning and water recycling system

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