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AKIZ – Integrated Waste Water Concept for Industrial Zones as Shown for an Industrial Zone in Vietnam

Integrated Water Resources Management: From Research to Implementation – IWRM

Due to the rapid economic development over the past two decades, there are now more than 200 registered industrial zones in Vietnam. The number will continue to increase in the years to come. Most of the industrial zones have no, or only inadequate, waste water infrastructures. This leads to considerable environmental pollution and risks to public health. The purpose of the AKIZ project is the development of an integrated management concept ensuring sustainable operation of waste water systems in industrial zones in Vietnam. In addition to technical aspects, such as decentralized and centralized waste water treatment, the scheme also includes economic issues.

Approximately 40 % of all industrial zones in Vietnam have no adequate waste water systems. Where central waste water infrastructures exist, significant shortcomings in their operation and management can be observed. Functioning and sustainable operation of the waste water systems in industrial zones in Vietnam often is not ensured.

This means that waste water from industrial zones in Vietnam continues to pollute significantly the surrounding water bodies which, in many cases, are used as drinking water resources. Besides polluting the environment, this also presents an immediate health risk to people.

Development of an integrated management concept ...

In the AKIZ project, German and Vietnamese universities and industrial partners cooperate on various aspects of a comprehensive management concept as shown here for the Tra Noc Industrial Zone in Can Tho. The purpose of the work is to investigate and develop technical approaches to the treatment of various types of industrial waste water, on the one hand, and to develop economic approaches to sustainable management of waste water systems, on the other hand. The concept includes the operation of decentralized waste water treatment plants, located on the sites of industrial enterprises, as well as of a centralized waste water treatment plant currently under construction. The concept ranges from metrological monitoring to cost accounting and financing.

... for sustainable waste water disposal ...

Specific technical solutions for decentralized pre-treatment of industrial waste water are tested and implemented in pilot plants directly on site at the industrial enterprise. This includes concepts for removal of toxic substances, for energy generation, and for recovery of valuable materials. The relevant technologies are established and employed in industrialized countries, but must be adapted to the specific conditions and the

Operation of a pilot plant with membrane technology for the treatment of process waste water of an industrial operation in Vietnam.

tropical climate in Vietnam and other emerging countries. The necessary investigations are carried out on pilot plants built by the German industrial partners and located at companies' sites in the Tra Noc Industrial Zone. The industries involved include pesticide processing, fish processing, brewery, and life science.
Furthermore, a treatment concept is worked out for the disposal and recycling of sewage sludge produced in both centralized and decentralized waste water treatment plants. The development of a sustainable solution for waste water disposal in industrial zones is based on studies of the problem of applying environmental standards in Vietnam and on research into sustainable financing of waste water infrastructure operation by waste water tariffs.

... in Vietnam and other emerging countries

The results of the project will be published in guidelines on the development of integrated waste water concepts and funding concepts. These will be provided to decision makers in both Germany and Vietnam. At the same time, these guidelines should advance waste water management in industrial zones located in other developing countries under tropical conditions similar to those in Vietnam.

Funding Measure
Integrated Water Resources Management:
From Research to Implementation – IWRM

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CuveWaters – sustainable use of scarce water resources in Namibia

Integrated Water Resources Management: From Research to Implementation – IWRM

Namibia is the most arid country in southern Africa. The effects of climate change, a rapidly growing population and the rural exodus are increasing the pressure on scarce water resources. This is especially true of the Cuvelai-Etosha-Basin in northern Namibia. Weather extremes, such as extreme drought or torrential rainfall and floods, determine the pattern of everyday life. The goal of the German-Namibian joint project is to improve living conditions over the long term through regionally adapted Integrated Water Resources Management. During many years of research work, pilot plants for harvesting rain- and floodwater, for water reuse and for groundwater desalination were established in the Cuvelai-Etosha-Basin. A vital factor which has contributed to the success of the project is the close cooperation between the local population and Namibian partners from government and industry.

Up till now, a long-distance water supply system from Angola has supplied northern Namibia with water. This makes Namibia dependent on the neighbouring country and its political situation. However, not all the settlements in the region are connected to the supply system. The rapidly growing population and continuing urbanisation are exacerbating the situation – in a region in which nearly half of the Namibian population lives.

Against this backdrop, the research project CuveWaters relies on solutions that adapt themselves flexibly to current needs and that use various sources, types and qualities of water for different purposes. The aim is to give the population long-term and reliable access to clean water, and also to reduce poverty and disease.

Needs-oriented solutions...

To ensure that this goal is reached, various technologies have been adapted to local conditions: Solar-driven desalination plants treat the groundwater so that up to four cubic metres of fresh drinking water are available daily at the respective sites. Until now, the population only had access to water from traditional hand-dug wells. Microbiological contamination and high salt concentrations brought with them significant health risks. Desalination reduces these risks.

During the summer months, rain- and floodwater is collected with the help of novel harvesting and storage plants, which also allow the newly-established vegetable gardens to be irrigated year round. This enables several families to grow vegetables to sell at local markets, thus tapping into new sources of income.

Desalination plant: Cleaning the solar panels

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...for sustainable development in the region...

The energy-efficient sanitation and wastewater concept implemented in a pilot plant since 2013 is also innovative: A vacuum system pipes the wastewater from settlements to a treatment plant. Together with the nutrients, the purified water is then used for irrigation. A farmers' cooperative uses it to farm agricultural areas and sells the crops at local markets. Biogas is also generated during the wastewater treatment process, which in turn is used to generate electricity and heat. This concept opens up new perspectives for small settlements in rural areas, but also for fast-growing urban districts.

...to benefit the population

CuveWaters' success is based in large part on integrating the population on the ground, with German and Namibian partners discussing and developing the technical implementation together with local inhabitants. In addition, technological innovations always go hand in hand with conveying the necessary expertise – so called "capacity development". This strengthens local people's sense of responsibility for "their" plants and reduces unemployment and poverty at the same time. The project team also develops concepts for "good governance" and supports regional institutions in establishing structures for sustainable water resources management. Concomitantly, the researchers study the social-ecological conditions within the project area.

In view of the globally increasing pressure on the resource water and the growing consequences of climate change, the results of this research are highly relevant. They give valuable insights into how to successfully implement IWRM in other regions of the world with similar issues. The results also show the positive impact that IWRM has on food security, on health, and on combating poverty.

Funding Measure
Integrated Water Resources Management:
From Research to Implementation – IWRM

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EWATEC-COAST – Technologies for Sustainable Protection of Coastal Regions in Vietnam

International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment – CLIENT

More than two decades after the beginning of the economic transformation in Vietnam, the Vietnamese economy continues to develop at a high level. This rapid growth of economy puts massive environmental pressure on river catchments in Vietnam. A number of rivers and canals are heavily polluted, since wastewater from cities, municipalities, trade and industrial zones were discharged untreated or not sufficiently cleaned. In the river region of the Thi Vai river and the Can Gio mangrove forest in South Vietnam, for instance, this pollution has resulted in major ecological damage and, at the same time, caused health problems in the population. Together with partners on the spot, EWATEC-COAST therefore is developing innovative technologies for treating industrial waste water as well as a planning system to be used for sustainable improvement of the environment and of living conditions.

The overall objective of the EWATEC-COAST joint project is the development and use of water treatment and environmental technologies and service tools for coastal regions. The transdisciplinary approach takes into account natural variability of the climate and future climate changes.

An Integrative Approach...

Major key points of the research project are the generation and provision of meteorological information in high resolution in terms of time and space. That information will be used to prepare data measured over many years for modeling the water balance, water quantity, and the groundwater. In addition, the data will be used to study the sea level and the mangrove ecosystem. Points of special interest in this regard are investigations into the flow and transport processes in the Thi Vai river system, which are influenced by high and low tides. Moreover, sediment analyses are carried out, and the interaction is studied of river water and groundwater together with the potential of the mangrove forest as “a natural sewage treatment plant.”

The integrative analysis of simultaneous extreme events inside the country and at sea is a special challenge to coastal protection, as is modeling the protective ability of existing mangrove forests in reducing the impact of storm floods in the coastal region. As increasing air pollution carries pollutants into the water as well, this load is modeled in the interest of predicting effects on water resources.

Innovative water technologies are implemented for the showcase of treatment of industrial waste water from tanning industries in a multi-stage pilot plant in an industrial zone near the Thi Vai river. Moreover, the project partners investigate re-using the treated waste water in industrial operations. If that function turns out to be successful, scaling up of the plant concept to a technical scale is to be assessed in economic terms. In this way,

The Thi Vai river is to be used both for transport purposes and as a lifeline of the region.

EWATEC-COAST is to provide decision-making support for the treatment of tanning effluents under the boundary conditions existing in Vietnam and other countries in Southeast Asia, all of which will be fed into the management system.

... to a Management System for the Region...

The subprojects will be integrated in a model-based management system. At the end of the project, this will be available in a basic version containing the results of model applications for different scenarios. These scenarios and measures will be developed by the future Vietnamese users – water authorities, ministries and engineers in the field. For this purpose, some preliminary datasets are being developed together with Vietnamese partners for action options in the interest of sustainable protection of bodies of water, nature, and the environment.

... in German-Vietnamese Partnership

The project is aimed at transferring the EWATEC-COAST concept to other river regions within Vietnam and to other countries. At the same time, the management strategies are to be assessed in economic terms, and users on the spot are to be educated further within a "capacity building" setup.

The project is carried out in close cooperation with the competent institutions on a regional and national level, and is application-oriented. If it succeeds, the findings therefore may be assumed to be introduced into practice.

Funding Measure
International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment – CLIENT

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Technologies for Sustainable Protection of Coastal Regions in Vietnam (EWATEC-COAST)
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EXPOVAL – Transfer-oriented research in the wastewater sector: validation at industrial-scale plants

Adaptation of German standards for the design of wastewater treatment plants to situations in other countries

In many areas of the world, sewage pollutes rivers, lakes, and coastal waters. If not treated accordingly, this sewage poses a threat to our natural water resources. Particularly developing and emerging countries with exceptional climatic conditions have a considerable backlog regarding the installation of wastewater treatment plants. In Germany, experience has been accumulated over the years for planning a large variety of wastewater treatment facilities. However, these time-tested rules are designed to cope with local conditions. The partners of the EXPOVAL joint project are therefore working to adapt these rules to the situations existing in other regions of the world. This is the basis for the transfer of wastewater technologies and engineering services. Simultaneously, protection of international water resources is facilitated.

Biological processes play a major role in the treatment of wastewater and the resulting sewage sludge. These processes are strongly dependent on the local boundary conditions, such as wastewater composition and temperature. If applied under the specific conditions abroad, the standards developed for German conditions may lead to uneconomical overdimensioning of plants.

Extension of standards...

Within the framework of the EXPOVAL joint project, German design rules are to be adapted to and tested for use in other countries. The work will focus inparticular on higher and lower wastewater temperatures and elevated salt concentrations.
The corresponding investigations will be carried out at industrial-scale plants in various climatic zones worldwide. Based on the results obtained, design rules and recommendations will be adapted to other countries. For the solution of specific problems, additional investigations are planned to be carried out at smaller container-based test plants for instance.

... for sewage treatment facilities...

The joint project covers the review of design rules for municipal wastewater treatment processes that are commonly used all over the world and of particular significance to developing and emerging countries. To that end, EXPOVAL consists of several sub-projects in the fields of wastewater and sludge treatment.

One of these sub-projects deals with the design of the widely-used activated sludge process, in which the prevailing water temperatures have a great impact on the optimum size and, consequently, on the costs of the treatment tank or on the design of the oxygen supply system for the bacteria that are used for wastewater

Construction of trickling filters at a sewage treatment plant in South America

treatment purposes. Several sub-projects are devoted to wastewater treatment processes that are commonly found all over the world, such as trickling filters, anaerobic reactors, and wastewater ponds. In addition, some project partners investigate means to improve the treatment, recycling, or disposal of the sewage sludge obtained from wastewater treatment in order to optimize these processes for varying climatic conditions. To this end, they use solar-based methods for drying sewage sludge, for example. Another focus will be placed on the disinfection of the pre-purified effluents in treatment plants for reuse, especially in agriculture. Here, removal of the helminth eggs commonly found in wastewater in developing countries plays a major role.

... all over the world

Under the EXPOVAL project, academic and industrial partners are working together to produce practicable standards that can be applied all around the world. Among others, these will be compiled in a monograph of the German Association for Water, Wastewater, and Waste (DWA) and made available to internationally operating plant suppliers and engineers.

In this way, German know-how and existing technologies for wastewater treatment plants can be deployed more efficiently under the exceptional climatic conditions abroad. EXPOVAL supports suppliers in their efforts to transfer wastewater technologies and accompanying engineering services. At the same time, it will decisively contribute to the protection of worldwide water resources.

Project title
Technology transfer-oriented research and development in the wastewater sector – validation at industrial-scale plants (EXPOVAL)
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MoMo – Integrated Water Resources Management in Central Asia: Model Region Mongolia

Integrated Water Resources Management: From Research to Implementation – IWRM

The catchment of the river Kharaa in Mongolia reflects the multiple region-specific challenges of water management in Central Asia. Located between Mongolia's capital in the South and the Russian border and Lake Baikal in the North, it is one of the most dynamically developing parts of Mongolia. Water scarcity and contamination are already a reality, and only a holistic management concept can prevent further and irreversible damages to natural ecosystems and local livelihoods.

Extreme environmental conditions...

The highly continental location of Mongolia and neighboring regions of Central Asia has important implications for water management. Because of the large distance to the nearest ocean, water resources are naturally limited. Even in the most humid parts of the country, annual precipitation is considerably less than in Central Europe. Cloudless skies and the intensive radiation of the sun mean that a large part of the precipitation evaporates. Therefore, only limited amounts of ground and surface water are available. Extremely low winter temperatures, which often fall to -40°C and less, are a major challenge for water management. In urban areas, both drinking and waste water infrastructures are either underdeveloped or in a poor technical state.

... and increasing water problems...

The water consumption in the project area has been increasing in recent years due to positive economic development in the mining sector and an expansion of irrigated agriculture. A series of relatively dry years since the mid 1990s and a rising pressure on the natural vegetation have resulted in a drastic reduction of forested areas, and consequently to reduced runoff generation and the partial drying of streams. At the same time, both ground and surface water resources face increasing chemical contamination, which damages aquatic ecosystems and puts local drinking water supply at serious risk. The most relevant problems include riverbank erosion due to intensive grazing, nutrient and pathogen intrusion due to inadequate waste water treatment and high livestock densities, and chemical contamination resulting from mining activities.
Because of a growing competition on limited resources, efficient water use and consequent waste water treatment are necessary

... require adapted solutions

Urban water management is of central importance to the project – with regard to both drinking water supply and waste water management. However, there are large differences between urban centers which are connected to central infrastructures, and periurban fringes and smaller settlements without centralized water supply and sewage systems. In Darkhan, the third largest city in Mongolia, about half of the population is connected to the municipal water supply. In this distribution system,

Typical Mongolian scenery: Nomads keeping large herds of sheep and goats

RESEARCH

at least 40% of the water is lost due to leakage. Since pipelines are typically installed at a depth of about 4 m to protect them against low winter temperatures, the project developed an innovative methodology for sensor-based leak detection. For the city's almost completely dysfunctional central waste water treatment plant, a rehabilitation concept was developed which is based on the well-established sequencing batch reactors (SBR) principle, which was adapted to Mongolia's harsh environmental conditions. One specific advantage of this system is its scalability: it can simply grow with the city. Two more waste water treatment plants were implemented and tested for decentral settings. One of them, using a special biofilm carrier system, has already been duplicated due to its simple and robust operation even under adverse conditions. The other treatment plant is based on constructed wetlands and integrates waste water treatment and wood production. Such concepts can help to ease the deforestation pressures in riverine floodplains.

The dry separation toilet system iPiT is another example for an integrative approach: While improving sanitary conditions in urban ger districts and preventing the contamination of local drinking water sources, the system constitutes the basis for nutrient recycling (i.e. fertilizer production) and energy production (fermentation of feces in a biogas reactor). Even though these approaches are very diverse, they are all components of one holistic concept for sustainable water management.

Funding Measure
Integrated Water Resources Management: From Research to Implementation – IWRM

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