Press release

Clean water for the future

The worldwide first semicentralized Supply and Treatment Center (STC) is opened in Qingdao, P.R. China

On the occasion of the „World Horticulture Exposition 2014" (WHE) in Qingdao, China, the Supply and Treatment Center (STC) Qingdao of the project SEMIZENTRAL, will be opened April 27, 2014. It is the worldwide first reference plant following the semicentralized, integrated infrastructure approach. The center will serve approximately 12,000 people.

The opening – celebrating a milestone in innovation

On April 27, 2014, the STC will be officially opened, with an extensive program and many high-ranking guests from China and Germany representing the fields of politics, industry, and science. The center is considered a milestone in German-Chinese knowledge transfer with global impact. It is also the result of more than 30 years of cooperative partnership between the Tongji University Shanghai and the Technische Universität Darmstadt.

WHE 2014 in an upcoming metropolis

The World Horticulture Exposition 2014 with its motto „From the Earth, for the Earth" is widely regarded as the global "Olympics of Horticulture". More than 12 million people are expected to visit the exhibition from April to October, 2014. By organizing the WHE, the city in the eastern province of Shandong underlines its claims to realize "green" growth. This is the motivation for the City of Qingdao and the WHE Group to invest in trend-setting infrastructures: Investment as well as operating costs are financed by Chinese institutions.

At present, about 8 million people live in the emerging megacity with a rapidly increasing tendency. Besides two harbors of nationwide importance, Qingdao's economic strength is based on the electronics industry, as well as classic industry branches like chemical, metal, textile, engineering. In close cooperation with German partners in particular, the city is currently experiencing a development based on ecological and sustainable concepts that is trend-setting not only for comparable regions in China but also for the whole world.

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SEMIZENTRAL – From Darmstadt to Qingdao

For many years, Qingdao has been suffering from severe water scarcity. Only one seventh of the water amount that is regarded as the average for China is available to the city's inhabitants. As in many other metropolitan areas worldwide, water and energy play a decisive role in urban development.

Based on an idea by Prof. Dr.-Ing. Peter Cornel from the Chair of Wastewater Technology (IWAR) of the TU Darmstadt, his team, together with partners from science and industry, has initiated and continuously developed the SEMIZENTRAL approach. Their work is supported by public and private organizations.

Owing to the trend-setting infrastructure approach, the demand for fresh water as well as the amount of wastewater in the catchment area is reduced by about 30-40% each. The reuse of water (e.g. street cleaning, irrigation, firefighting) facilitates savings in significantly higher scales. Biogas and subsequently energy are generated in the STC by co-treating sewage sludge and household biowaste. This way, the operation of the center is also energy-autarkic and largely climate-neutral. The project participants are pleased that the main objective of the project has been achieved: to have developed an adaptable, resource-efficient water infrastructure system that facilitates flexible extension according to the growth of its urban environment.

Integration and cooperation for safeguarding the future

For Dr.-Ing. Susanne Bieker, leader of the research focus SEMIZENTRAL at the TU Darmstadt, the reference plant of the SEMIZENTRAL project represents trend-setting technology for the sustainable handling of water and energy. SEMIZENTRAL in Qingdao is not only the result of a long-lasting Chinese-German partnership in research and knowledge transfer, but it also shows the fundamental significance of integrative and cooperative approaches towards a future worth living in.

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SEMIZENTRAL Germany:

Joint research group

During the last 10 years, the SEMIZENTRAL approach has been developed under the general management of the Chair of Wastewater Technology, Institut IWAR, at the Technische Universität Darmstadt, in close cooperation with numerous industry partners from Germany as well as scientific partners from Germany and China. The project is supported by research funding from BMBF and MoST.

Project partners in Germany

Chair of Wastewater Technology – consortium leader (TU Darmstadt, Institut IWAR)
Kocks Consult GmbH
Endress + Hauser Conducta GmbH + Co. KG
Bilfinger Water Technologies GmbH
Emscher Wassertechnik GmbH
m+p consulting Süd GmbH
Institut für sozial-ökologische Forschung (ISOE) GmbH
Chair of Land Management, TU Darmstadt
Chair of Design and Urban Development, TU Darmstadt
Institute for Construction, TU Darmstadt
Cosalux GmbH
Far Eastern - Fernost Beratungs- und Handelsgesellschaft mbH
Gebrüder Heyl Vertriebsgesellschaft für innovative Wasseraufbereitung mbH
Fachhochschule Köln, Gummersbach Environmental Computing Center

Scientific project partners in China

Tongji University Shanghai
Qingdao Technological University

Research funding in Germany

Federal Ministry of Education and Research (BMBF)

Duration of the current project

2013 – 2016 (accompanying research during implementation)

Further information

For further information see http://semizentral.de/media/presse

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3D model of the Qingdao SDC © Tongji Design Institute & Susanna Neunast

The SEMIZENTRAL management team at IWAR: Prof. Peter Cornel (center) with Prof. Martin Wagner (left) and Dr. Susanne Bieker (right) © IWAR, Semizentral

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SEMIZENTRAL GERMANY

TECHNISCHE UNIVERSITÄT DARMSTADT

IWAR Wastewater Technology

Frequently asked questions

SEMIZENTRAL at the World Horticultural Exposition 2014

What is SEMIZENTRAL?

SEMIZENTRAL is an infrastructure approach for future cities. It is an alternative for extensive, centralized systems with long lead times and insufficient scalability. The innovative approach towards semicentralized supply and treatment systems has been developed to serve new-build residential areas in fast-growing metropolitan environments. Each urban district is provided with a flexible integrative infrastructure system for water, wastewater, and waste, adaptable to the respective need.

1. 3D rendering of the Qingdao STC

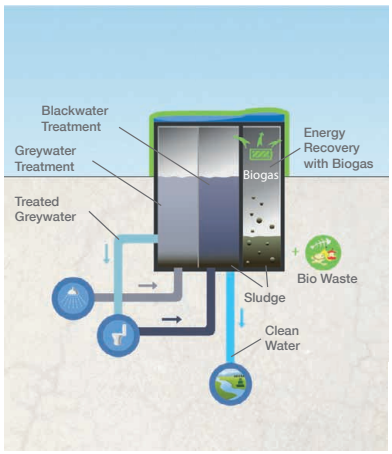
Where does the SEMIZENTRAL approach come from?

In the 21st century, there is a pressing need for action regarding infrastructure planning and development in fast-growing metropolitan areas. Worldwide, urban growth involves an increasing consumption of basic resources, resulting in serious consequences for infrastructure, water supply as well as the treatment and disposal of wastewater and solid wastes. Due to insufficient or non-existent treatment facilities for wastewater and waste, it is not only the quality of life that is impared, but the environment, as well, is at serious risk. In order to meet these extensive challenges, concepts that facilitate increasing resource efficiency are needed. The SEMIZENTRAL approach is such a modern, efficient and trend-setting infrastructure concept.

2. City growth in Asia 2025

What is the advantage in comparison to conventional systems?

SEMIZENTRAL shows an outstanding flexibility. A semicentralized supply and treatment center (STC) integrates different technologies and makes a 30-40% reduction in the drinking water demand possible, via intra-urban water management and, in parallel, reduced wastewater loads. In addition, biogas generation for energy production enables an overall energy-autarkic plant operation.



3. Conceptual scheme of a semicentralized STC

How is this done?

The SEMIZENTRAL approach combines the traditionally separated sectors of water, wastewater, waste, and energy. Before being treated in the supply and treatment center, wastewater streams (so-called grey water and black water) are collected separately. Sewage sludge is co-treated with organic waste to produce biogas which in turn is used for energy generation.

Why Qingdao?

In organizing the WHE, the megacity in the eastern province of Shandong underlines its claims to realize “green” growth. Qingdao with its 8 million inhabitants faces significant water scarcity. To date, only one seventh of the water amount that is regarded as Chinese average is available to the city’s inhabitants. This is the reason the city council as well as private developers invest heavily in trend-setting infrastructure systems.

What does WHE 2014 stand for and what is SEMIZENTRAL doing there?

The World Horticultural Exposition 2014 (WHE) takes place in Qingdao from April to October 2014.

The WHE is organized by the Qingdao Municipal Government and the Executive Committee of 2014 Qingdao International Horticultural Exposition. The Chinese minister Mr. Wan Gang (MoST), with the participation of all research partners and sponsors, will inaugurate the WHE, regarded as the “Olympics of Horticulture”, and the SEMIZENTRAL supply and treatment center on April 25, 2014. The organizers expect about 12 million visitors at the WHE, which presents the current worldwide trends and technologies in the horticulture sector.

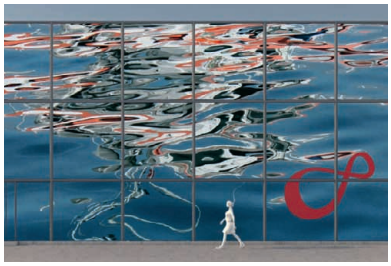
In the course of the WHE, two residential areas and a WHE village as well as two hotel complexes for a total of about 12,000 inhabitants are established. In this context, within 6 months, the semicentralized STC Qingdao was constructed as the worldwide first reference plant. The STC will collect and treat the settlement area’s wastewater according to the SEMIZENTRAL approach. The purposes of the plant are wastewater treatment, production of service water, and the generation of biogas for energy.

Who is responsible for the artistic design of the STC façade?

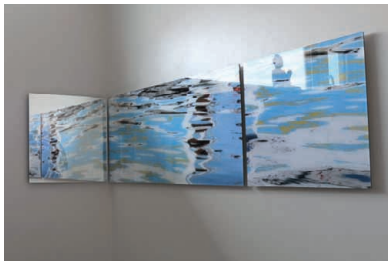
The German artist Susanna Neunast has developed an expansive art installation that decorates the outer façade of the entrance building as well as parts of the interior. She uncovers the extraordinary in the seemingly ordinary medium water. That’s how Susanne Neunast captures the fascination and beauty of water to make it emotionally accessible, and she communicates unexpected perspectives of perception. Beside the artistic installation, the STC lobby welcomes its visitors with especially developed, well-founded professional visual information installations on the plant and the semicentralized approach.

4. WHE in Qingdao

5. Ministerialdirektor Dr. Karl Eugen Huthmacher (BMBF) at the STC consruction side in Qingdao, March 2014



6. Art installation façade – Susanna Neunast



7. Art installtion interior – Susanna Neunast

Who are the cooperation partners?

During the approximately three years of planning and operational attendance of the semicentralized STC Qingdao, 14 partners from Germany, the Tongji University Shanghai and the Qingdao Technological University worked together in a cooperative consortium. The TU Darmstadt maintains a partnership of more than 30 years with its Chinese partners.

Who finances the semicentralized STC Qingdao?

Investment as well as operating costs are paid for by the WHE development company. The German Federal Ministry of Education and Research (BMFT) financed the joint research group's scientific support during implementation. MoSt supports the Chinese universities in research. The Chair of Wastewater Technology, Institut IWAR, of the TU Darmstadt heads the joint research project.

The following supporters and sponsors have made important material contributions towards the realization of the SEMIZENTRAL approach. Our sincere thanks go to:

Wilo SE (pumps and mixing devices)
Aerzner Maschinenfabrik GmbH (blowers)
Auma Riester GmbH & Co.KG (gearboxes for valves)
OTT System GmbH & Co.KG (aeration elements)
Binder GmbH (valves and electronic control devices for aeration)
LAR Process Analyzers AG (measuring technique)

From the development departments of these institutions and companies originate a multitude of innovative components and machinery. They are now part of the STC facilities with its state-of-the-art technology. The sponsors' great commitment and extensive know-how have played a decisive role in the high-quality layout and thus the realization of the worldwide first semicentralized supply and treatment center in Qingdao.

GEFÖRDERT VOM Bundesministerium für Bildung und Forschung

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SEMIZENTRAL GERMANY

TECHNISCHE UNIVERSITÄT DARMSTADT

IWAR Wastewater Technology

SEMIZENTRAL

Integrated supply and treatment systems for fast-growing regions

1. 3D model of the Qingdao STC

Background

In many Chinese cities, as in many growing cities in newly-industrialized and developing countries, local water resources are insufficient to supply the population with clean drinking water. This results in a pressing need for action in the affected cities. The SEMIZENTRAL approach meets the requirements for flexibility and adaptability of infrastructure systems and sets new standards in the matter of resource efficiency.

2. View of the skyline of Qingdao

Dr. Bieker, how did SEMIZENTRAL start?

Dr. Bieker: Research on the SEMIZENTRAL idea started in 2003, led by Prof. Peter Cornel, head of the Chair of Wastewater Technology at the Institut IWAR. Since then, investigations regarding different research aspects have been and are stilled carried out together with partners from Germany and China, always focusing on an integrated infrastructure approach with high flexibility, adaptability, and resource efficiency. On the German side, research is funded by the Federal Ministry of Education and Research (BMFT), on the Chinese side by the Ministry of Science and Technology (MoST).

What are the advantages of the SEMIZENTRAL approach?

Dr. Bieker: Generally, conventional infrastructure systems are centralized systems. With respect to wastewater treatment in China, this means, wastewater from millions of people is collected in one system and transported to the wastewater treatment plant. In Shanghai, there are sewers with diameter the size of train tunnels. The advantages of these centralized systems are the many years of operating experience and professional operation. However, there are various disadvantages: long lead times for planning and implementation, long periods of under-utilization, high capital lockup and therefore a high path dependency. That is why they are not flexible and only adaptable to changing conditions to a very limited extent. In contrast to these centralized systems there are decentralized systems, forming small units, on building level for example. However, so far, it is not possible to operate such systems in a professional way, excluding them as a serious alternative in densely populated urban areas due to hygiene problems.

Is this the challenge the research project addresses?

Dr. Bieker: Yes. SEMIZENTRAL occupies a position between centralized and decentralized. It eliminates the drawbacks of the classical approaches and combines their benefits. In other words: We are “as large as necessary” to enable professional operation and “as small as possible” to work resource-efficient by closing material cycles on a small scale.

What is the focus of SEMIZENTRAL?

Dr. Bieker: In addition to the scale of the system, SEMIZENTRAL focuses on the integration of the infrastructure sectors water, wastewater, waste, and energy. This enables the interaction and coordination between the sectors and creates synergy effects, such as the reduction in water demand by 30% and more. It also facilitates the energy-autarkic operation of the supply and treatment center and contributes to greenhouse gas reduction.

Thank you very much for this interview.

3. Dr. Susanne Bieker, TU Darmstadt/IWAR

Since 2009, Dr. Susanne Bieker heads the interdisciplinary research focus SEMIZENTRAL at the Institut IWAR of TU Darmstadt. In this interview she explains the innovative supply and treatment approach for fast-growing urban areas in the 21st century.

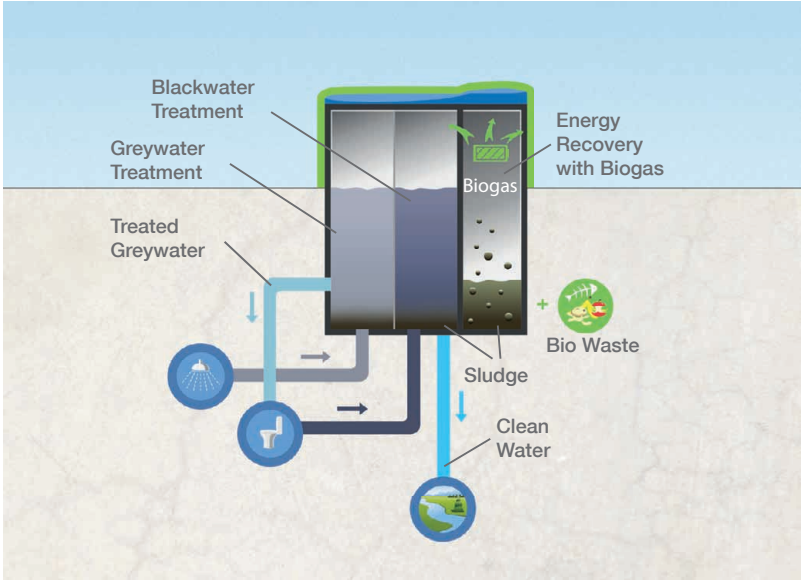
The concept

The unique characteristic of SEMIZENTRAL is its integrated approach. Conventional systems focus on the strict separation of water supply, wastewater treatment, and waste treatment. In contrast, SEMIZENTRAL integrates these sectors into a holistic approach. It enables the coordination between the sectors, creating synergy effects such as energy-autarkic operation and the reduction of greenhouse gases.

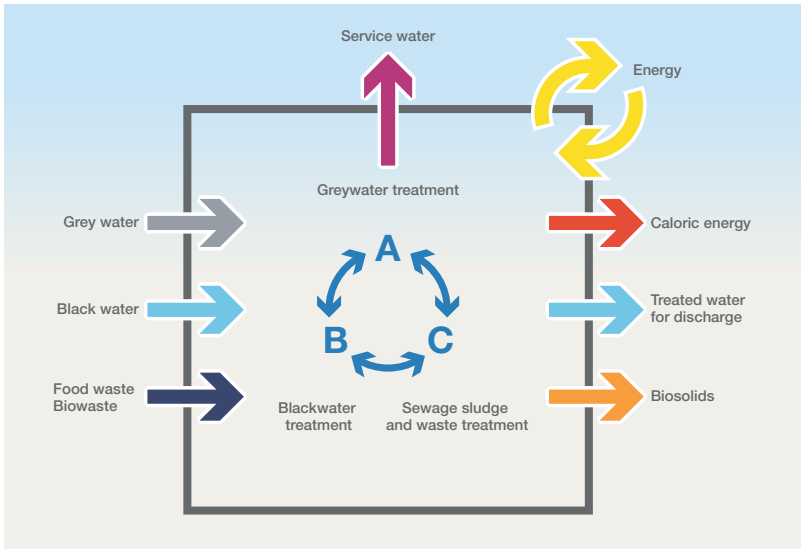
Compared to conventional infrastructure systems, the benefits are the potential for 30-40% or more reduction in water use, no external energy demand for wastewater and waste treatment, greatly reduced transport demand, around-the-clock guarantee of water supply with consistent quality, high planning security. The same applies to wastewater and waste.

Integrated approach

Semicentralized supply and treatment systems offer a future-oriented and resource-conserving alternative to conventional centralized infrastructure systems. Module A covers greywater treatment. Wastewater from showers and washing machines is treated and reused as service water for toilet flushing. This way, the daily water consumption is reduced by almost one third. In module B, black water is treated. Module C – the energy center – includes the anaerobic (thermophilic) treatment of biowaste and sewage sludge. The emerging biogas is used for the production of electricity. The generated energy supplies all other treatment processes and enables an energy-autarkic operation of the STC.



4. Visualization of a supply and treatment center (STC)



5. Functional scheme of a semicentralized supply and treatment **system**

Water and energy for Qingdao

On June 28, 2011, in the presence of Premier Wen Jiabao and Federal Chancellor Angela Merkel, a joint declaration on the research and innovation program “Clean Water” was signed by the Chinese Ministry of Science and Technology (MoST) and the German Federal Ministry of Education and Research (BMBF).

As part of this program, the WHE, together with a Chinese-German team, built an environment-friendly semicentralized supply and treatment center for about 12,000 people near the premises of the International Horticultural Exhibition.

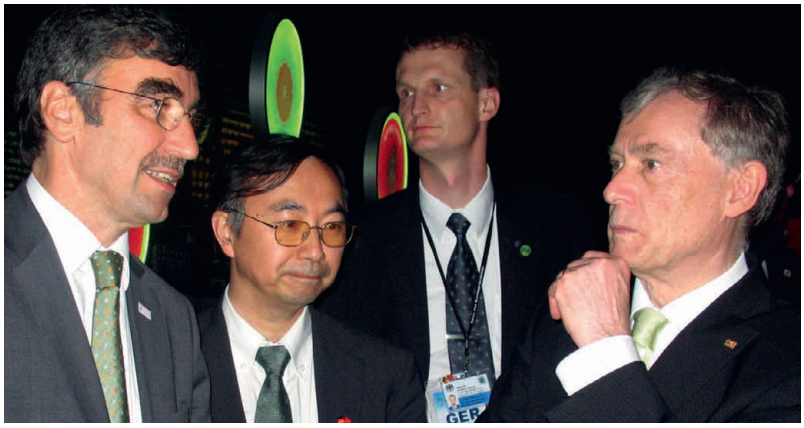
The STC was designed by Tongji Design Institute in cooperation with Kocks Consult GmbH, with participation and consulting by the renowned universities from Darmstadt (TU Darmstadt), Shanghai (Tongji University) and Qingdao (Qingdao Technology University) as well as further German and Chinese partners from industry with outstanding technical experience and innovative technology.

Since 2004, the SEMIZENTRAL research has been financed by the German Federal Ministry of Education and Research (BMBF) and the Chinese Ministry of Science and Technology (MoST). In addition, in 2011, the project succeeded in adding the organizers of the World Horticulture Exposition as investors and operators. Besides the implementation of the worldwide first STC, a showcase for vacuum technology has been realized in the ShiYuan building on the WHE site.

6. Ministerialdirektor Dr. Huthmacher visiting the STEC construction site, March 2014

7. STC construction site, Qingdao, March 2014

Shanghai EXPO 2010



8. Prof. Cornel (TU Darmstadt, li.) and Prof. Dai (Tongji University, second from left) in a conversation with the German Federal President Köhler (right) during his visit at the EXPO **Shanghai 2010**

10. View of the Botanical Pavilion at the WHE 2014

9. View of the central exhibit of the Urban Planet Pavilion: media show “Planet Earth”

11. View of the exhibits in the Urban Planet Pavilion at the EXPO Shanghai 2010

A SEMIZENTRAL STC for the WHE 2014

The WHE (World Horticulture Exposition) is regarded as the “Olympics” of the horticulture sector. From April to October, 2014, the organizers expect more than 12 million people to visit the WHE 2014 in Qingdao. On this occasion, for the first time ever, a semicentralized supply and treatment center (STC) has been deployed with ongoing scientific support and research. The center is designed for two residential areas, a WHE village and two hotel complexes, serving a total of 12,000 people. The STC will collect and treat the arising wastewater streams according to the SEMIZENTRAL approach.

SEMIZENTRAL – a project of many partners

Prof. Dr.-Ing. Peter Cornel is the "father" of the SEMIZENTRAL approach. Together with his team he leads the joint research group including partners from science and industry. What is so special is the realization of the project in industrial scale, scientifically accompanied by 14 partners over three years.

This became possible through more than 30 years of partnership with the Tongji University Shanghai. Prof. Dr.-Ing. Martin Wagner was the person in charge to accompany this work during the whole time. This trend-setting cooperation between research institutions and private enterprises will enable us to meet the challenges of water supply in future cities.

The project is jointly managed by the renowned universities Technische Universität Darmstadt,
Tongji University Shanghai and Qingdao Technology University. In this context, numerous scientists have been working together in various SEMIZENTRAL sub-projects since 2003.

The first highlight of the Chinese-German partnership was the recognition of the joint research as a trend-setting solution for future cities at the EXPO 2010 in Shanghai. The newest highlight of the research cooperation is the implementation of the worldwide first semicentralized STC at the WHE 2014 in Qingdao, the center being regarded as an outstanding milestone of Chinese-German research and development cooperation.

TECHNISCHE UNIVERSITÄT DARMSTADT

12. Prof. Dr.-Ing. Peter Cornel Institut IWAR

13. Prof. Dr.-Ing. Martin Wagner Institut IWAR

14. Prof. Bi Xuejun (TU Qingdao), head of the local planning team

15. Prof. Chen Hongbin (Tongji University), coordinator of the planning team

16. Dai Xiaohu (Tongji University), head of the planning team China

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TECHNISCHE UNIVERSITÄT DARMSTADT
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COSALUX

Far Eastern Consulting

HEYL NEOMERIS

Fachhochschule Köln
Cologne University of Applied Sciences

Gummersbach Environmental Computing Center GECO

SEMIZENTRAL and its important sponsors

There are six sponsors, which contributed decisive support to the SEMIZENTRAL idea. Their great commitment and invaluable know-how made it possible to provide the facilities with state-of-the-art technology, supplying components and machinery from several areas of supply and treatment systems technology.
One of the objectives of the close cooperation over three years is to optimize the operation of the Qingdao STC for the future. There are many components supplied by the sponsors that had to be coordinated and brought together with high precision during the planning phase. They guarantee the energy efficiency of the STC and provide, for example, measuring data that helps to further optimize the SEMIZENTRAL approach und its future propagation.

AERZEN

AERZEN blowers and compressors supply industrial facilities worldwide with gaseous media. The experience of 150 years of company history is reflected in their innovative mechanical engineering. Their range of products include rotary lobe compressors, positive displacement blowers, turbo blowers, screw compressors, and gas meters, quality controlled and certified according DIN EN ISO 9001. The spectrum covers standard products as well as customized special-purpose solutions.

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wilo

The Wilo Group is one of the world's leading manufacturers of pumps and pump systems for heating, ventilation and air conditioning as well as water supply, sewage disposal and wastewater treatment. Moving with the times has always been the Wilo way. With a firm focus on the future, the company is heavily involved in research and development and increasingly markets itself as a system supplier rather than a manufacturer of individual products. In the international pumps market, Wilo is synonymous with high-tech solutions.

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OTT GROUP

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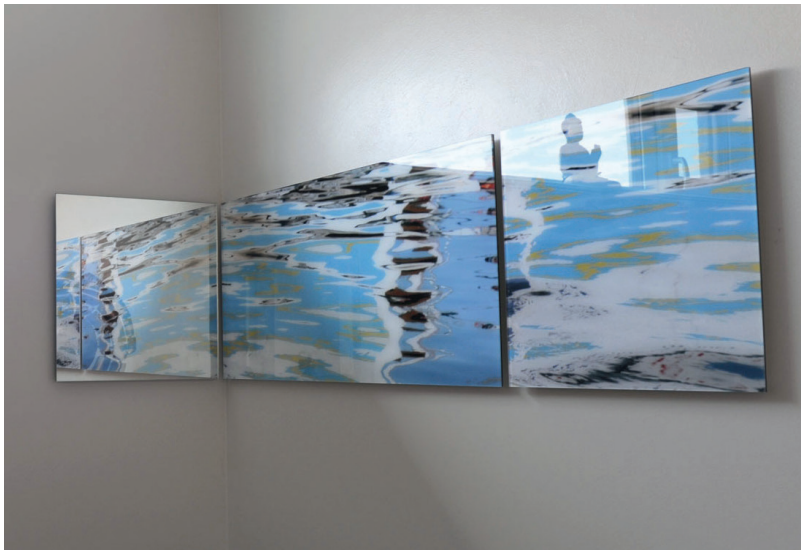
LAR PROCESS ANALYSERS AG

LAR Process Analysers AG is a leading supplier of online analyzers for the determination of sum parameters in water. Applications are industrial and municipal wastewater, process monitoring and pure water analysis. The online-analyzers help to control industrial plants and optimize processes. Due to the steadily increasing significance of environmental protection, their technological market leadership secures their participation in the future market of water resources.

17. Façade of the Qingdao STC: Art installation by Susanna Neunast

SEMIZENTRAL offers unexpected perspectives

Visitors of the semicentralized STC in Qingdao get a favorable first impression when looking at the artistically designed façade. Expansive art installations by Susanna Neunast capture the fascination and beauty of water to make it emotionally accessible. Inside, the STC lobby welcomes its visitors with well-founded professional information. Here as well, art installations uncover the extraordinary in the seemingly ordinary medium water. Susanna Neunast's large-size photo images of water surfaces appear like paintings, combined with mirrors. The visitor becomes part of a moving art installation, and to him, the artist's works opens unexpected perspectives in the interplay between art and science.

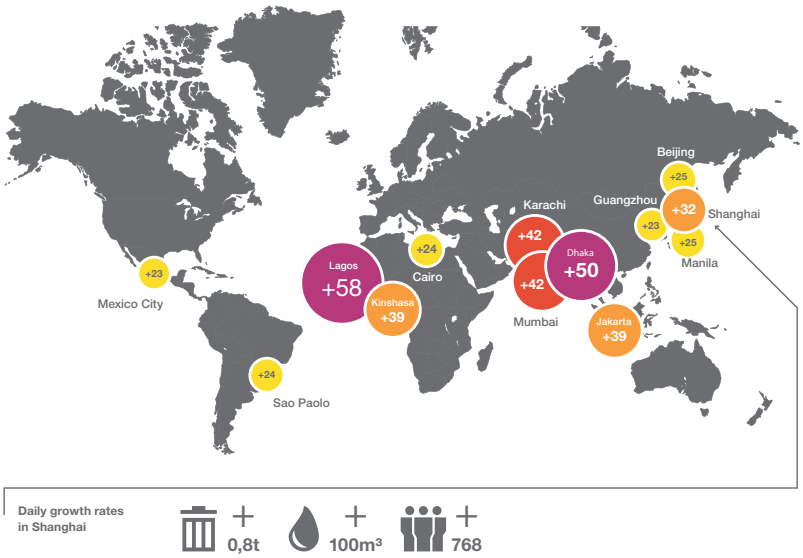


18. Art installation of the STC interior by Susanna Neunast

Prospects with SEMIZENTRAL

In the 21st century, there is an enormous need for action regarding infrastructure planning and development in fast-growing metropolitan areas. Worldwide, urban growth involves an increasing consumption of basic resources, resulting in serious consequences for infrastructure, water supply as well as the treatment and disposal of wastewater and solid wastes.

IDue to insufficient or non-existent treating facilities for wastewater and waste it is not only the quality of life that is impaired in many regions in the world. The environment, as well, is at serious risk. Resource-efficient concepts are needed. The SEMIZENTRAL approach is such a concept – resource-efficient via the application of state-of-the art technologies, and flexible enough to meet the challenges the world will face in the future.



19. Urban growth and associated resource requirements: persons per hour (source: Bieker 2009, adapted by Burdett and Rhode 2007)

20. The STC in the virtual app

SEMIZENTRAL virtual app

To make the STC visually accessible, a virtual 3D model was realized. In an interactive way the visitor learns about the contributions of sponsors and research partners towards the realization of the STC. A 3D model of the STC serves as a navigation tool offering visitors rotating views and different perspectives. There are also filter functions for reducing the number of selected items. In this way, the visitor gets specific information on individual processes as well as the technologies supplied by the sponsors.

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