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Johanna Tolksdorf (TU Darmstadt), **Susanne Bieker** (GIZ), **Peter Cornel** (TU Darmstadt)
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ABSTRACT

SEMIZENTRAL is an integrated, district-related infrastructure approach that has been developed for fast-growing cities, in order to meet their challenges in regard to the supply of water and the treatment of biowaste and wastewater. SEMIZENTRAL is characterised by high resource efficiency. In Qingdao (People's Republic of China), the SEMIZENTRAL Resource Recovery Centre (RRC) has been implemented for the first time worldwide, in full-scale. Water being reused for toilet flushing and irrigation is derived from greywater and blackwater from the catchment area of the RRC. Due to the integration of food waste into the anaerobic sludge treatment, the production of biogas and electricity within the RRC is increased, thus enabling an energy self-sufficient operation. The effects of source separation of wastewater and the integration of food waste on process design, energy balance, and discharged nutrient loads are evaluated. Water reuse can save energy, compared to alternative water resources. The discharged nutrient load from the wastewater treatment to the receiving water bodies decreases considerably. Nevertheless, the effort required for wastewater treatment increases.

Keywords: *urban water reuse; integrated infrastructure systems; energy efficiency*

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1. INTRODUCTION

Urbanisation is a challenging trend for infrastructure in the 21st century. UN (2014) forecasts predict that the urban population will increase to 6.3 billion people (66% of the world's population) by 2050. Currently, urban growth mainly occurs in emerging and developing countries in Asia, Africa, and South America. The strong dynamic of urban growth results in challenges for the implementation of water and waste infrastructures in cities. Shanghai is a rapidly changing city. The megacity grows by 580,000 inhabitants per year (UN 2014). The water demand is approximately 132 L/(C·d). Thus, every year, the supply of additional 77,000 m^3 tap water per day is required, and an equal amount of wastewater has to be treated. The extreme population dynamic contrasts with the long planning and depreciation horizon of conventional water infrastructure systems (≥ 50 years for sewer systems). Consequently, significant planning and investment risks exist.

Another challenge is the availability of local water resources. In areas with a high population density, water resources are often overexploited. The groundwater table in Beijing, for example, has fallen more than 10 m since 1986 (Sun et al. 2014). Deficiencies in wastewater treatment lead to an increasing pollution of surface water bodies. Desalination of seawater (in coastal areas), or long-distance water conveyance, are potential solutions but are questionable in terms of energy demand and ecological principles.

Hence, in fast-growing urban areas, new approaches for water infrastructures are required. Besides the need for a greater resource efficiency, infrastructures must grow at the same rate that a city grows.

2. THE SEMIZENTRAL APPROACH

SEMIZENTRAL is an alternative infrastructure approach that deals with the challenges of fast-growing urban areas. Key elements of SEMIZENTRAL are the system size, between central and decentral, the district-wise realisation, and high resource efficiency.

The infrastructure of the water, wastewater, biowaste, and energy sectors are integrated into one system. Treated and disinfected wastewater is used for purposes that do not require drinking water quality (e.g., toilet flushing, irrigation). In addition, the energy potential of wastewater and solid waste is used. Biogas from co-digestion of sewage sludge and biowaste is used for heat and electricity production. SEMIZENTRAL is therefore a more resource-efficient system compared to conventional, usually centralised systems.

Water reuse is more efficient when applied to small systems because the shorter distances between the first user, treatment, and second user lower the energy demand for water conveyance. Moreover, within small systems, the potential for heat recovery from wastewater is higher than in large systems, due to the higher temperature level. Professional operation is important to ensure high product quality (hygienically safe service water). Thus, for economic reasons, a minimal system size is required. This results in a scale ranging between central (entire city) and decentral (single building). In the context of China's fast-growing urban areas, a system size between 30,000 and 100,000 capita is recommended. This size allows for the district-wise realisation of the infrastructure system. Whenever a new district is developed, a so-called Resource Recovery Centre (RRC) can be built for this particular district that treats wastewater and biowaste and produces service water (cf. Figure 1). Forecasts are only required for the currently developed district but not for the entire city. Thus, planning and investment risks are reduced, compared to a centralised system where the development of the whole city has to be taken into account. With the district-wise, demand-related infrastructure system, the RRC can reach full capacity faster as compared to centralised treatment plants with a long-term development capacity. A flexible adaptation to the actual development of a city is therefore possible. Moreover, the knowledge gained from previous realisations can be considered for the implementation of new projects. SEMIZENTRAL is open to any process technology: treatment technologies are chosen according to the reuse-purpose (Bieker et al. 2010, Bieker 2015, Tolksdorf et al. 2015 a, b).

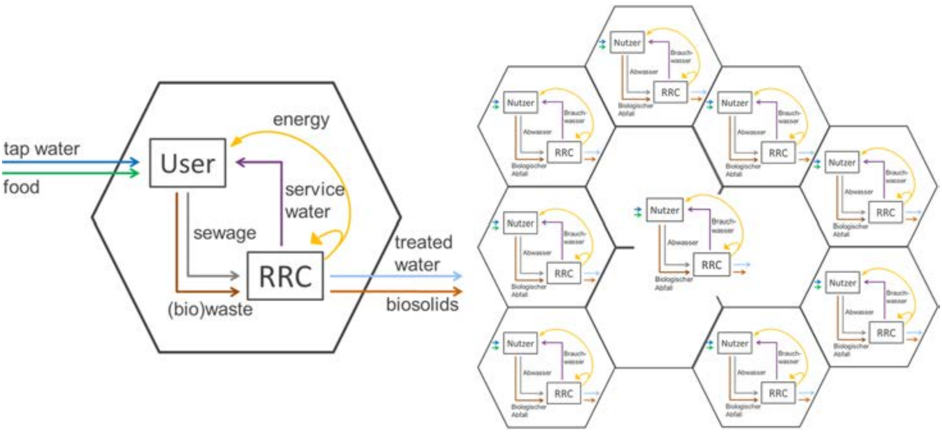


Figure 1: Material and energy flow in a city district (left). District-wise realisation of infrastructure (right) (Tolksdorf et al. 2015b)

3. IMPLEMENTATION

3.1 Project Background and Location

The first full-scale Resource Recovery Centre (RRC) has been realised in the coastal city of Qingdao (China), in the context of the World Horticultural Exposition 2014. Qingdao's population grows yearly by 130,000 people (UN 2014). Supplying water for the city's growing population and industries is a challenge, such that, in 2013, a seawater desalination plant with a capacity of 100,000 m^3/d was commissioned.

The implementation of the first full-scale RRC is embedded in the joint declaration of the research and innovation programme "Clean Water", signed by the Chinese Ministry of Science and Technology (MoST) and the German Federal Ministry of Education and Research (BMBF) in June 2011.

The Qingdao RRC is a reference, full-scale plant aimed at verifying and demonstrating the SEMIZENTRAL concept, and it is also a showcase for potential future customers. All of the required investments were made by a Chinese investor. The design was carried out by Chinese design institutes in close cooperation with the Chinese-German research team (financed by BMBF and MoST). The RRC is operated by a Chinese operator and with initial support from the Chinese-German research team.

Figure 2: Resource Recovery Centre in Qingdao (right) and its catchment area (left)

The catchment area of the RRC (cf. Figure 2) consists of two housing areas and the so-called ShiYuan Village (ShiYuan: short form of World Horticultural Exposition in Chinese). Two hotel complexes are located in the north; to the south, there are offices, canteens, another hotel, and guest houses. The RRC is located close to two hotels. A further housing area is planned nearby. In total, the RRC's capacity is 12,000 population equivalents, based on 100 gCOD/(C·d).

3.2 Dimensioning Basis

Greywater (from showers, wash basins, and washing machines) and blackwater (from toilets and kitchen sinks) are collected separately within the catchment area. The specific greywater flow in Qingdao is approximately 41 L/(C·d) and approximately 68 L/(C·d) for blackwater (Bi 2004). The total amount of wastewater in accordance with the statistical data for specific water consumption in Qingdao was 110.6 L/(C·d) in 2012 (China Statistics Press, 2013). For the design of the RRC, a higher specific greywater amount was assumed, because of the connection with hotels and guest houses. The water demand in hotels ranges between 150 and 300 L/(bed·d); hence, the average specific greywater generation in the catchment area of the RRC is calculated at 60 L/(C·d). Inhabitant-specific pollutant loads are calculated according to the Chinese standard for the design of wastewater treatment plants (GB 50101-2005) and distributed, according to Bi (2004), to grey- and blackwater. The influent concentrations are given in Figure 3.

Grey- and blackwater separation is planned. Compared to the reuse of treated wastewater as a whole, where the wastewater source includes faecal matter, the reuse of treated greywater might find greater acceptance. However, the investors were concerned about the acceptance. Thus, it was decided that service water would be supplied to the ShiYuan village for toilet flushing only. Blackwater is reused for irrigation following treatment and disinfection.

The SEMIZENTRAL approach includes the co-treatment of household biowaste and sewage sludge in the RRC. Through the use of anaerobic treatment, the amount of waste transported out of the city is reduced considerably. The generated biogas is used to produce electricity and heat, enabling the computational self-sufficiency of the RRC. Residual biosolids can be used for landscaping or soil improvement.

In China, the separate collection of household biowaste is not yet a common practice and therefore, greater efforts are required to introduce such a concept to the population. Additionally, at the actual location of the RRC in Qingdao, low amounts of household biowaste are generated, because of the high proportion of offices, hotels, and guest houses. To compensate for this, food waste from restaurants and canteens in the ShiYuan village and the surrounding area is co-digested with sewage sludge.

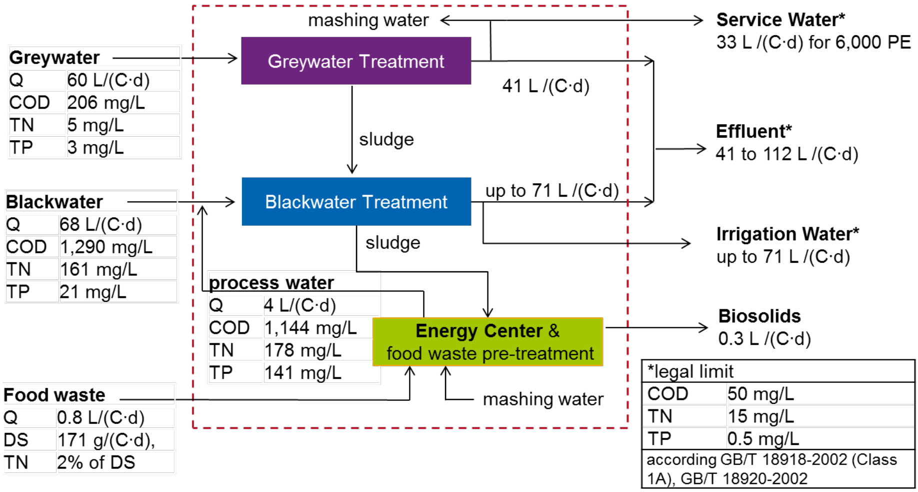


Figure 3: Basic design of the Qingdao ShiYuan Resource Recovery Centre

3.3 Process Technology

The process technology of the RRC in Qingdao and its design criteria have been described in Tolksdorf et al. (2015a, b, 2016) and are summarised here.

Greywater and blackwater treatment: Grey- and blackwater are treated with a membrane bioreactor (MBR) (cf. Figure 4). Both water flows are reused after treatment; the presence of a membrane filtration is a further barrier against pathogens (in addition to the chlorine disinfection).

For greywater, the nitrogen concentration at the influent is lower than the maximum permitted effluent concentration (cf. Figure 3). Therefore, carbon removal is sufficient and nitrification/denitrification is not required. Although the required sludge age (SRT) for carbon removal is only 4 to 5 days, the designed SRT is 25 days because of the reduced membrane fouling processes (Melin et al. 2007, Meda et al. 2012). Detergents containing phosphorus are still in use in Chinese households; thus, simultaneous phosphorus removal had to be designed.

Compared to the overall household wastewater, the nitrogen influent concentration of blackwater is high and the C/N ratio low. Thus, by calculation, an external organic carbon dosage is necessary to meet the effluent standard for TN (15 mg/L). A combination of pre-denitrification and post-denitrification has been chosen. If required, acetic acid can be dosed. The acid capacity might be insufficient because of the required high P-precipitation and nitrification; in this case, a base dosage is possible.

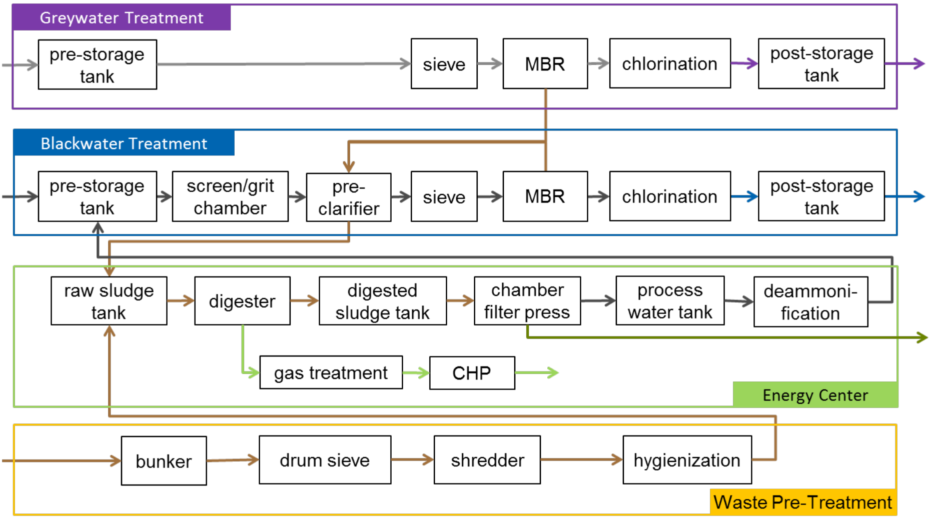


Figure 4: Process scheme of the RRC (Tolksdorf et al. 2015b, 2016)

Waste pre-treatment: The waste delivery takes place in the courtyard of the RRC, to minimise the impact on the neighbourhood from noise and odour emissions. The food waste is transported from the bunker via spiral pumps to a drum sieve, which removes impurities such as plastics. Next, the waste is shredded and homogenized, and treated greywater is used to dilute the waste down to 7% dry solid (DS) content. Following disinfection (70°C for 1 hour), the pre-treated food waste is pumped into the raw sludge storage tank, where it is mixed with the sewage sludge. To date, existing Chinese standards do not require disinfection, but the process design was oriented towards the European hygiene regulation standards (EC No 1774/2002).

Energy Centre: Biogas production, treatment, and usage are located in the Energy Centre. The biogas production takes place in two parallel, rectangular, thermophilically operated digesters with an HRT of 20 days. The organic load is approximately 2.0 gVS/(m^3·d) but can vary considerably, depending on the amount and composition of the co-digested food waste. Although usage of the digested sludge (biosolids) is intended, in addition to the standards for usage (CJ/T 309-2009 and GB 4284-84, GB 8172-87), the regulation for landfill deposition has to be fulfilled (DS ≥ 40 %). Thus, the sludge is dewatered by a chamber filter press. In accordance with the environmental impact analysis, the biosolids have to be transported to a composting plant. The sludge water (process water) is pre-treated by deammonification prior to discharge to the blackwater module, to reduce the demand for oxygen and acetic acid. The process water has to be cooled from 55°C to the optimal process temperature of 32–40°C.

Biogas is pre-treated by filters and desulfurization. With a combined heat and power plant, or boiler, electricity and/or heat are produced, which are used for processes in the RRC.

4. SOURCE SEPARATION AND FOOD WASTE INTEGRATION

To evaluate the efficiency of source separation and integration of food waste, the wastewater and sludge treatment in the RRC in Qingdao was compared with the treatment processes in a conventional system with the boundary conditions of the RRC in Qingdao (total wastewater flow, loads, plant specifics such as process technology and parameters; see also Tolksdorf et al. 2016). The only differences with the SEMIZENTRAL system is the co-substrate, which is not included in the conventional system, and that greywater and blackwater are not separated.

The plant-specific optimal energy demand is calculated with the boundary conditions of the RRC in Qingdao. For example, the energy demand of pumps is calculated with the flow rate and the corresponding discharge head of the pumps of the RRC in Qingdao.

4.1 Dimensioning and Nutrient Removal

Grey- and blackwater separation affected both the nutrient ratio and the concentration levels. Greywater consists of the less polluted wastewater stream from showers, wash basins, and washing machines. The nutrients (N, P) content in greywater is relatively low, resulting in a high C/N ratio. Blackwater, in contrast, includes the more polluted household wastewater streams with the major proportion of nutrients. The process water from sludge dewatering is discharged into the blackwater module. Process

water has a high nitrogen concentration, and a low C/N ratio. The nitrogen content in process water is increased by the additional load that originates from the food waste. The pre-treatment by deammonification allows for a reduction of the nitrogen return load. Thus, compared to the conventional system without co-substrate, the nitrogen return load is only slightly higher (cf. Table 1) but, nonetheless, increases the oxygen demand in the blackwater module.

In comparison with total wastewater (greywater + blackwater) in the conventional system, the C/N ratio in blackwater is about 10% lower and the TN influent concentration 45% higher. Because the same effluent standard applies (15 mg/L TN), the required nitrogen elimination rate of the blackwater module is 90%, but 81% for total wastewater. Thus, 15% more nitrate has to be denitrified during blackwater treatment, requiring 40% higher acetic acid dosage. As a consequence, the excess sludge production and required activated sludge tank volume increase, compared to the conventional system (cf. Table 1). Because more nitrate is denitrified, less TN is discharged to the receiving water body. Furthermore, due to water reuse, the discharged water flow is reduced and, with it, the discharged pollutant load. Thus, the discharged TN load is reduced by 39 to 94%, depending on the actual reuse rate. The same applies to the discharged TP load: depending on the water recycling rate, 14 to 69% less is discharged to the receiving water body. For polluted or sensitive water bodies, this can help considerably to improve water quality.

Table 1: Data from design calculation for wastewater, greywater, blackwater treatment

	Conventional System	**RRC Qingdao**		**Difference RRC/Conv. Syst.**
		GW	**BW**	
C/N ratio influent aeration basin	6.1	38.6	5.5	
TN load to aeration basin[g/(C·d)]	10.5	0.3	10.7	+5 %
COD dosage [kg COD/d]	202	–	287	+42 %
Qair [Nm³/d]	627	52	638	+10 %
Required Volume [m³]	800	199	755	+19 %
Discharged N load [g/(C·d)]	1.8	0.1	0–1[1]	39 to 94 % less
Discharged P Load [mg/(C·d)]	42	13	0–23[1]	14 to 69 % less

[1] depending on the proportion of reused treated blackwater (0–100 %)

4.2 Energy

The actual electricity demand of the RRC is the subject of further research within the current project and might differ as a function of the actual operating conditions (e.g., utilisation rate of the RRC). Figure 5 shows the plant-specific optimal value for the energy demand of the in-house RRC treating greywater, blackwater, and biowaste, in comparison to an open air conventional system treating only wastewater.

Blackwater treatment requires the highest proportion of the total electricity demand of the RRC, followed by exhaust air purification and the greywater module.

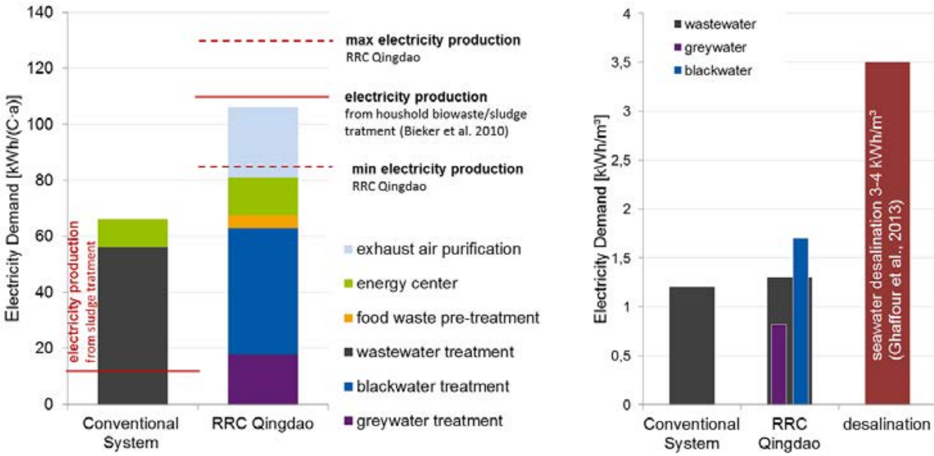


Figure 5: Calculated specific energy demand (based on Tolksdorf et al. 2016)

Wastewater treatment and service water production: The aeration demand for biological processes and, therefore, the energy demand for aeration is 10% higher in the RRC, compared to the conventional system. More energy is also required for mixing, because of the larger activated sludge tank volume (cf. Table 1). Additional electricity consumers in the RRC (compared to the conventional system) are the effluent pumps for service water supply. Hence, the sum of the energy demand for grey- and blackwater modules is 8% higher than that for the total wastewater treatment (cf. Figure 5).

Xiao et al. (2014) reported 0.5 kWh/m³ as the average energy demand of Chinese municipal MBRs built after 2010, with a range between 0.4–0.6 kWh/m³. This is considerably lower than what is needed in the RRC (greywater: 0.8 kWh/m³, blackwater: 1.8 kWh/m³) or for the calculated conventional system (1.2 kWh/m³), but also compared to other studies: Krzeminski et al. (2012) determined 0.8–1.1 kWh/m³ for full-scale MBRs in the Netherlands; Barillon et al. (2013) reported a range from 0.8–2.4 kWh/m³ for six MBRs in USA, Spain, and France. The boundary conditions have to be considered for the comparison with literature data. In China, municipal wastewater often has low organic and nutrient influent concentrations e.g., TN 40 mg/L (Qiu et al. 2010). In contrast, the influent concentration for the conventional system calculated in this study is higher, e.g., 88 mg/L TN. Thus, the load-dependent energy demand (mainly for biological aeration and mixing of anoxic zones) might be related to a specific lower flow, which results in a higher flow-specific energy demand, compared to the Chinese literature data.

Sludge treatment and integration of food waste: The food waste pre-treatment requires 6% of the total electricity demand of the RRC. Due to the additional co-substrate, the energy demand of the energy centre increases by 35%, compared to the conventional system, whilst the biogas and electricity production is approximately eight times higher (cf. Figure 5). For the electricity production in the RRC, a range was calculated; depending on the amount of co-treated food waste, its quality, and the usable proportion of the biogas, an energy self-sufficient operation of the RRC is possible, despite the higher energy demand.

The exhaust air fans are the largest electricity consumer. Thus, in future similar projects, measures to reduce the exhaust airflow could potentially increase the overall energy efficiency of the RRC. Possible measures are the encapsulation of odour and moisture emission sources.

4.3 Energy Savings due to Service Water Supply

Compared to seawater desalination, the volume-specific energy demand for grey- and blackwater treatment is considerably lower (cf. Figure 5, right) and, therefore, the substitution of potable water with reused water not requiring potable water quality is more energy efficient.

With the assumed water volumes in the catchment area of the RRC Qingdao ShiYuan, 210 kWh/(C·a) are needed for raw water treatment by desalination and wastewater treatment in the RRC (cf. Figure 6). In a conventional system (scenario A in Figure 6), 310 kWh/(C·a) are required for these processes; by reusing the effluent of the conventional wastewater treatment plant (WWTP) for irrigation, the electricity demand

in the conventional system can be reduced to 229 kWh/(C·a) (cf. Figure 6, scenario B). Thus, using service water for toilet flushing saves 10% of the energy required for tap water production (cf. Figure 6) and 8% in the overall system (water production, wastewater treatment), assuming that irrigation water in the conventional system is also reused water (scenario B). If irrigation water has to be produced by desalination, 32% of the electric energy would be saved by water reuse in the SEMIZENTRAL system. The energy demand for tap water and wastewater conveyance was not taken into consideration, but is probably higher in conventional systems because of the longer transport distances.

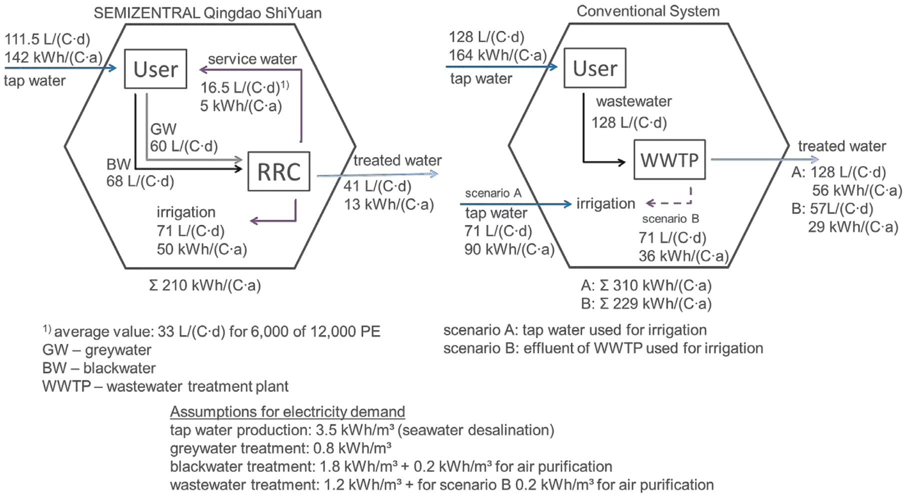


Figure 6: Specific electricity demand for raw water treatment and wastewater treatment – comparison of SEMIZENTRAL Qingdao ShiYuan and a conventional system

In Qingdao ShiYuan, service water produced from greywater is used only in hotels and office buildings. Reuse in households is also possible, which would mean a higher reuse rate. Based on the amounts of water from households (inhabitants), 15% of the electricity needed for water production and wastewater treatment could be saved by water reuse for toilet flushing within the SEMIZENTRAL system (and under the boundary conditions in Qingdao ShiYuan; cf. Figure 7).

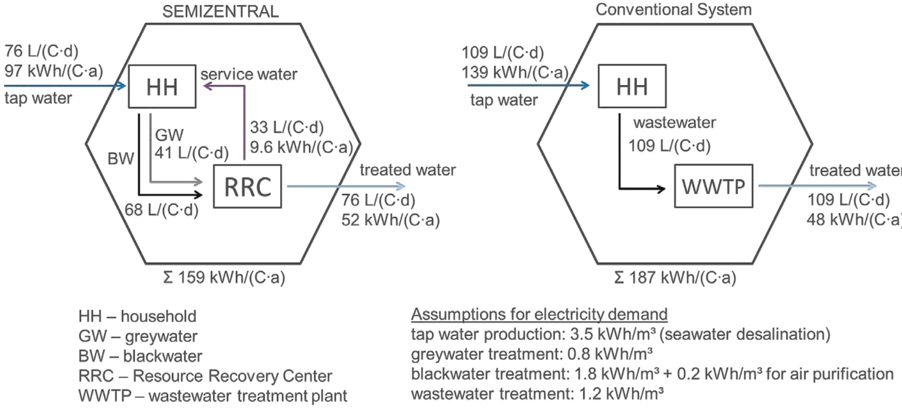
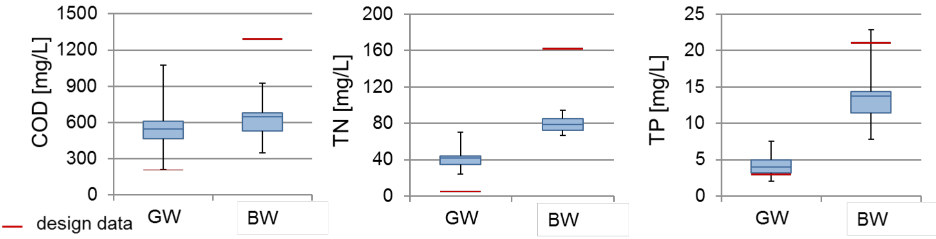


Figure 7: Specific electricity demand of raw water and wastewater treatment for water supply and disposal for households

5. INITIAL RESULTS OF COMMISSIONING AND OPERATION

5.1 Wastewater Characteristics

Figure 8 shows the influent concentration of greywater and blackwater measured (with Hach cell tests) in 24-h composite samples taken from the pre-storage tank. There are notable differences between estimated design data and the actually measured influent concentrations: greywater is considerably more concentrated; blackwater, in contrast, has approximately half the expected concentration of COD and TN. The reasons for these discrepancies still have to be investigated. Apart from misuse, the possibility of misconnections also exists. For example, for some buildings, it has already been determined that kitchen wastewater (planned to be discharged as blackwater) is actually drained to the greywater sewer. For blackwater, in particular, there is also the possibility of higher specific water consumption, leading to dilution. The possible reasons will be considered in more detail in the ongoing project, to draw conclusions for future planning.



n	39	24	36	22	39	26
Median	545 mg/L	645 mg/L	42 mg/L	79 mg/L	4 mg/L	14 mg/L
Design Data	206 mg/L	1290 mg/L	5 mg/L	162 mg/L	3 mg/L	21 mg/L

Figure 8: Influent concentration (from Jun. 15 to Sep. 15) to the full-scale RRC (box-whisker diagram), compared to design data

5.2 Commissioning of Grey- and Blackwater Modules

The greywater module was commissioned first. Seed sludge from a municipal wastewater treatment plant was used after sieving (to remove fibrous substances). The greywater module was designed for carbon removal, but because of the higher nitrogen influent concentration, nitrification and denitrification are required to meet the effluent standard. The design SRT is 25 days; therefore, establishing nitrification is not a problem. The aeration basin consists of two consecutive chambers (each with a mixer and an independent aeration grid). Hence, it is possible to operate the greywater treatment as pre-denitrification. The recycling of nitrate by the return sludge is adequate. To date, the influent flow (200–400 m^3/d) is lower than the design capacity. Under these conditions, operation of the greywater module is stable and the effluent standard can be achieved.

The module that was commissioned next was that for blackwater treatment. The MBR consists of two lines, but at present, only one line is in operation because this is sufficient for the current influent flow (approximately 400 m^3/d). The pre-clarification is bypassed because of the lower influent flow; moreover, the sludge digestion is not yet in operation. The excess sludge from the MBRs is aerobically stabilised and can be disposed of safely.

Because of the lower nitrogen influent concentration in blackwater, the treatment efforts are reduced significantly: with the design influent TN concentration of 162 mg/L (and effluent standard 15 mg/L), 91% reduction is required. The actual influent concentration of 79 mg/L requires, for the same effluent standard, only 81% elimination rate for nitrogen. The currently calculated COD/TN ratio is 8.2 and thus, close to the value calculated from the design values (8.0). Moreover, there is currently no N return load from the sludge treatment. For these reasons, acetic acid for denitrification usually does not have to be dosed to reach the effluent standard for TN.

6. CONCLUSION

SEMIZENTRAL, an infrastructure approach for fast-growing urban areas, has been implemented for the first time in full-scale in Qingdao, China. Greywater and blackwater is collected in separate sewer systems and treated in a Resource Recovery Centre with a capacity of 12,000 population equivalents. Treated greywater is reused as service water for toilet flushing, and treated blackwater for irrigation. Accordingly, a two-fold water reuse scheme is realised. Food waste from nearby areas is co-digested with sewage sludge; the produced biogas is used to generate the required electricity and heat for the operation of the RRC. The greywater and blackwater treatments have been commissioned successfully. Compared to a conventional system (with the same flow and loads), and given the boundary conditions of the location in Qingdao, the integration of food waste and the source separation has the following effects:

- 8% higher electricity demand for wastewater treatment
- 10–15% lower energy demand for the sum of wastewater treatment and tap water production (by desalination), due to water reuse
- 42% higher COD dosage for denitrification
- 39–94% lower discharged TN load
- 14–69% lower discharged TP load

Depending on the amount and quality of co-digested food waste, an energy self-sufficient operation of the RRC is computationally possible. With regard to the energy mix in China, which includes a high proportion of fossil fuel, the energy savings and the energy self-sufficient operation reduce greenhouse gas emissions.

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WATER, SOIL AND WASTE
DRESDEN
NEXUS
CONFERENCE

ABOUT UNU-FLORES

MISSION

"Advancing a Nexus Approach to the sustainable management of environmental resources"

In line with the general mission of UNU to foster sustainable development, UNU-FLORES aims to contribute to the resolution of pressing challenges to the sustainable use and integrated management of environmental resources, such as water, soil, and waste. UNU-FLORES strives to advance the development of integrated management strategies that take into consideration the impact of global change on the sustainable use of the environmental resources. To this end, the Institute engages in research, teaching, advanced training, capacity development, and dissemination of knowledge.

VISION

UNU-FLORES acts at the forefront of initiatives promoting a Nexus Approach to the sustainable management of water, soil, and waste. The Institute supports the overall mission of UNU as a think tank for the United Nations and its member states, in particular addressing the needs of developing countries and emerging economies. In this role, UNU-FLORES aspires to become an internationally recognised hub and intellectual focal point promoting integrated management strategies.

ORGANISATIONAL STRUCTURE

The organisation of UNU-FLORES into five academic units – three core scientific units (Water Resources Management (WRM), Waste Management (WM), and Soil and Land Use Management (SLM)), supported by two cross-cutting units (System Flux Analysis Considering Global Change Assessment (SFA) and Capacity Development and Governance (CDG)) – supports the think tank function of the Institute.

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ABOUT DRESDEN NEXUS CONFERENCE

As a hub for initiatives on the Nexus Approach, UNU-FLORES is not only committed to strengthening its own network but also to providing an international platform to foster cooperation and networking amongst all actors working on or with the Nexus Approach to managing environmental resources. That platform is the biennial Dresden Nexus Conference (DNC).

Every two years UNU-FLORES organises a DNC, welcoming scholars, politicians, and practitioners from all regions of the world to meet and discuss the most recent and innovative initiatives on a Nexus Approach to the management of environmental resources.

DNC2015: Global Change, Sustainable Development Goals, and Nexus Approach

Building on the outcomes of the 2013 "International Kick-Off Workshop on Advancing a Nexus Approach to the Sustainable Management of Water, Soil and Waste", UNU-FLORES organised the inaugural Dresden Nexus Conference (DNC). From 25 to 27 March 2015 representatives from academia, politics, and civil society assembled in Dresden under the theme "Global Change, Sustainable Development Goals and Nexus Approach". Working together with co-organisers, TU Dresden and IOER, in 2014 UNU-FLORES solicited applications from numerous renowned academic institutions from around the world. Categorised under three key themes – climate change, urbanisation, and population growth – 18 sessions were selected for the first DNC. Comprising of a comprehensive selection of the diverse initiatives on the Nexus Approach, sessions were convened by UN entities, international research organisations, universities, and non-governmental organisations.

In parallel with the organisational activities of the DNC2015, UNU-FLORES arranged for the drafting and distribution of nine position papers to help build and consolidate the background knowledge of the three topics covered during the conference.

www.dresden-nexus-conference.org