



SEMIZENTRAL INTEGRATED SUPPLY AND TREATMENT SYSTEMS FOR FAST-GROWING URBAN REGIONS

SEMIZENTRAL 半集中式系统

为快速发展的城市区域设计的综合供水排污处理系统



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02 View of the skyline of Qingdao | 青岛地平线一瞥



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Providing the population of a fast-growing megacity with an adequate amount of fresh water and a sustainable wastewater treatment is an enormous challenge. One the one hand, the infrastructure for supply and treatment can barely keep up with growth and, on the other hand, local water resources are often limited.

The SEMIZENTRAL approach meets the requirements for flexibility and adaptability of infrastructure systems and sets new standards in the matter of resource efficiency.

对于快速发展的特大城市而言，完善居民给排水设施建设是城市发展建设中一项重大而艰巨的任务。一方面，给排水基础设施几乎很难跟上城市快速发展的步伐，另一方面，在特大城市中普遍存在水资源稀缺的问题。

在灵活性和适应性上，SEMIZENTRAL（半集中式供水排污系统）的理念符合对基础设施系统的最新要求，同时也为资源高效利用树立了新标准。



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

自2009年2月起，苏珊娜·比克博士开始主持达姆施塔特工业大学IWAR研究所跨学科重点项目“SEMIZENTRAL（半集中式供水排污系统）”的科研工作。在接受采访时，她对21世纪快速发展的城市区域的供水排污创新方案作了阐述。

Dr. Bieker, how did SEMIZENTRAL start?

比克博士，SEMIZENTRAL（半集中式供水排污系统）理念从何而来？

Dr. Bieker: Research on the SEMIZENTRAL concept started in 2003 and was led by Prof. Peter Cornel, the head of the Department of Wastewater Technology at the IWAR Institute.

Since then, and in cooperation with partners in Germany and China, we have been investigating a variety of research questions that focus on an integrated infrastructure approach that provides high flexibility, adaptability, and resource efficiency. On the German side, research is funded by the Federal Ministry of Education and Research (BMBF), on the Chinese side by the Ministry of Science and Technology (MoST).

针对SEMIZENTRAL（半集中式供水排污系统）而开展的相关研究始于2003年，由领导IWAR研究所污水处理系的彼得·康奈尔教授发起。自此我们与德国和中国的合作伙伴一起，组织科研攻关，研究多项核心课题，探讨如何开发一个具有高度灵活性、适应性和资源利用效率的集成式基础设施体系。本科研项目由德方的联邦教育研究部和中方的科学技术部共同资助。





What are the advantages of the SEMIZENTRAL approach?

该系统有哪些优点？

Dr. Bieker: Generally, conventional infrastructure systems are centralized systems. With respect to wastewater treatment in China, this means that wastewater from millions of people is collected in one system and transported to the wastewater treatment plant. Shanghai has canals that are as large as underground train tunnels.

The advantages of these centralized systems are the many years of operating experience and, compared to decentralized systems, the operation by professional personnel. However, there are various disadvantages: long lead times for planning and implementation, long periods of under-utilization in which the expansion size is not reached due to oversized capacities, and significant capital lockup. That is why they are not flexible and can only adapt to changing conditions to a very limited extent. In contrast to these centralized systems, decentralized systems consist of small units, for example, on the level of buildings. However, for financial reasons, it has not been possible to operate such systems in a professional way to date. This has excluded them as a serious alternative in densely populated urban areas, due to hygiene problems.

传统的基础设施系统通常为集中式的。中国普遍的污水处理模式是将数以百万居民产生的污水收集后，集中输送至一个污水处理厂进行处理。由于水量巨大，上海的污水管网直径与地铁隧道相当。集中式系统的优点为运行管理经验成熟，并且与分散式系统相较，集中式系统具有更专业的从业人员。但也有一些弊端：如前期规划和建设周期长；由于预留设计余量使系统长期不能满负荷运营；资金周转性差。因此该系统欠缺灵活性，只能十分局限地适应不断变化的边界条件。相对于集中式系统而言还有一种分散为小单位的解决方案，如以楼宇为单位的分散式系统。但到目前为止这种分散式系统由于资金问题都不能做到专业化运营，因此考虑其卫生安全性，不应将其作为高密度城市地区的谨慎选择。

Is this the challenge the research project addresses?

研究项目以此为切入点？

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 efficiently, in terms of resources, by closing material cycles on a small scale.





In addition to the scale of the system, SEMIZENTRAL focuses on the integration of various infrastructure sectors, namely: water, wastewater, waste, and energy. This enables 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 Resource Recovery Center (RRC) and contributes to greenhouse gas reduction.

Thank you very much for this interview.

是的。SEMIZENTRAL（半集中式供水排污系统）是集中式和分散式系统之间的一个折中方式，吸取传统方式的优点并剔除其弊端。也就是说：处理规模“大”得符合需要，以保证处理厂专业化运行管理；同时“小”得恰到好处，以保障区域内部物质流循环和资源的高效利用。

除了考虑系统规模因素之外，SEMIZENTRAL（半集中式供水排污处理系统）主要着眼于对供水、污水、垃圾和能源等各种基础设施领域的整合。这使得各个处理工艺之间相互协调，从而形成资源互补的协同效应，如至少可以减少30%用水量；实现资源再生利用中心的能源自给自足运行以及减少温室气体的排放。

谢谢。

SEMIZENTRAL THE CONCEPT | 方案

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.

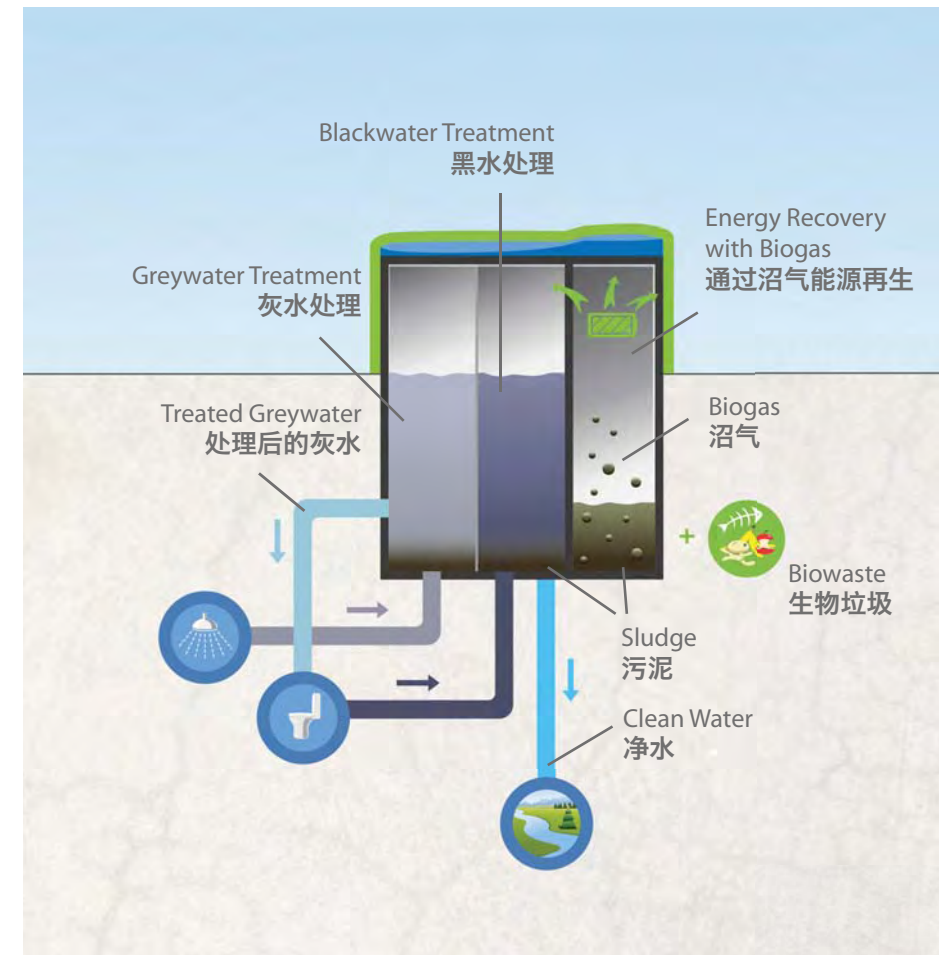
Compared to conventional centralized infrastructure systems for water supply and wastewater treatment, the benefits are the potential for at least a 30-40% reduction in water demand, energy conservation (covering the energy demand of the RRC for wastewater and waste treatment through its own generation of biogas), greatly reduced transport demand, round-the-clock guarantee of water supply with consistent quality, as well as substantial planning and capital cost security.

The approach was presented for the first time to the general public at the Expo 2010 in Shanghai.

SEMIZENTRAL（半集中式供水排污系统）的最大特点是它的综合集成性。传统处理系统对供水、污水处理和废弃物处理进行了严格的区分。

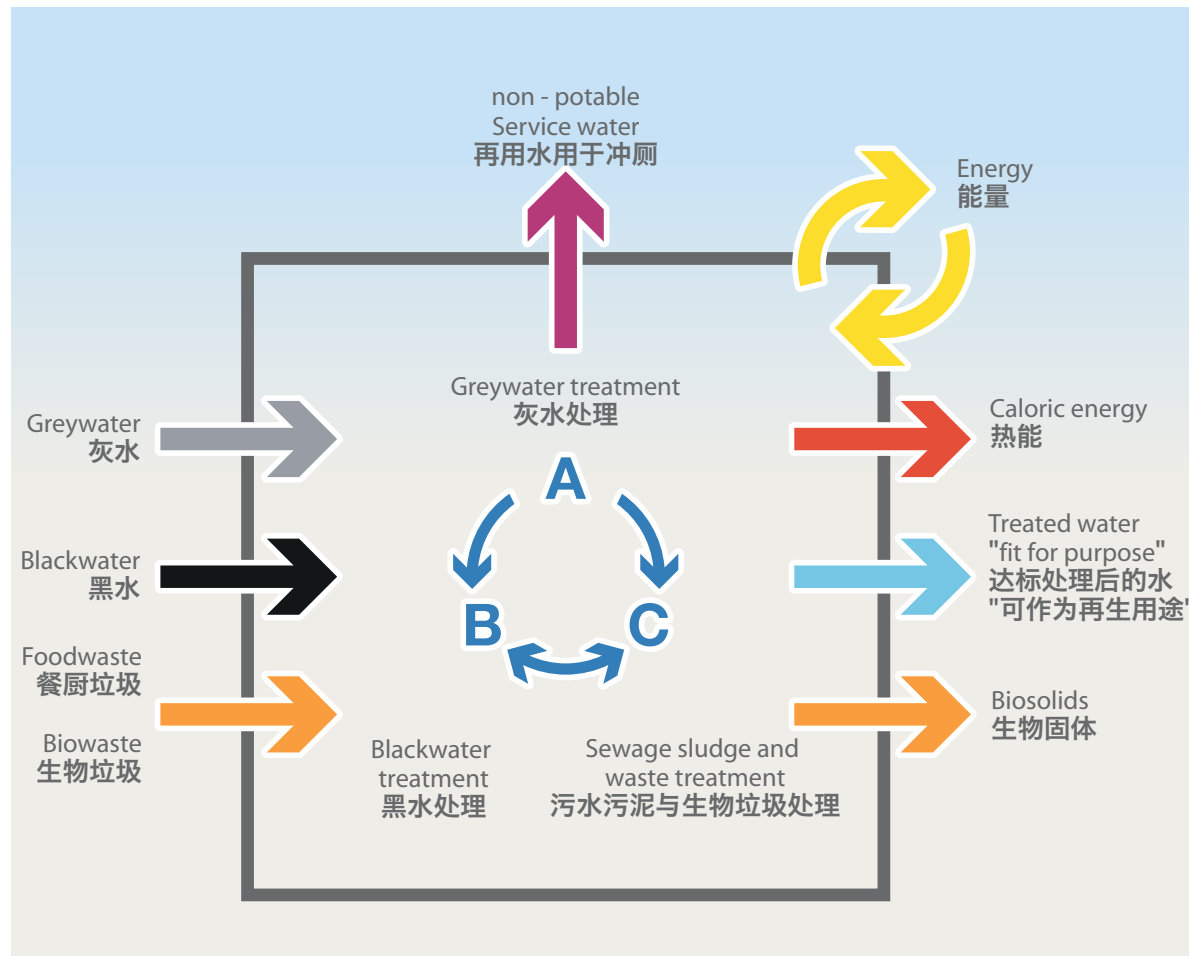
SEMIZENTRAL（半集中式供水排污系统）将这三个处理系统综合集成为一体，并实现了各工艺之间的协调运作，通过协同效应实现了能源自给自足运行。从而减少温室气体的排放。

对比传统的集中式供水排污处理系统，其优势在于具有很大的节约潜力：节水（可节约30%至40%日用水量）；节能（通过沼气产出能源可以满足污水和废弃物处理所需全部能耗）；大大降低了污水与回用再生水等物质流的长途运输需求；能够实现昼夜持续稳定供水；同时保证了出水水质稳定，具有较高的设计安全性。该方案于2010年在上海世博会上第一次公开向公众展示。



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SEMIZENTRAL INTEGRATED APPROACH | 综合集成式处理方案



Semi-centralized supply and treatment systems offer a future-oriented and resource-conserving alternative to conventional centralized systems. They consist of three process units. Module A covers greywater treatment. Wastewater from showers and washing machines is treated and reused as service water for toilet flushing. This reduces daily water consumption by almost one third. In module B, blackwater from toilets and kitchen drains is treated. Module C – the energy center – includes the anaerobic (thermophilic) treatment of biowaste and sewage sludge from modules A and B. The resulting biogas is used for the production of electricity. The generated amount of heat and electricity is, in total, sufficient for all other treatment processes in the RRC.

与传统的集中式基础设施相比，半集中式供水排污处理系统提供了一种面向未来、资源节约型基础设施的新颖思路。该系统由三个不同处理模块组成。模块 A 为灰水处理模块。淋浴和洗衣污水共称为灰水，在此模块进行处理之后，将作为再生水回用于冲厕，由此可以节省约三分之一的生活日用水量。模块 B 处理来自厕所与厨房的污水，也就是黑水。模块 C – 能源中心 – 包括了对生物垃圾和 A、B 模块中产生的污水污泥的（高温）厌氧消化处理。所产生的沼气将用于发电。这部分电能和产生的热能足以平衡资源再生利用中心内所有处理工艺所需能耗，以实现处理中心的自给自足运行。



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At the Expo 2010 in Shanghai, the Department of Waste Water Technology (IWAR, TU Darmstadt) was the only German representative in the Chinese future pavilion URBAN PLANET. The interdisciplinary German-Chinese research approach generated a great deal of interest. Amongst others, the then German Federal President, Dr. Horst Köhler, visited SEMIZENTRAL.

2010年上海世博会上，污水处理系（IWAR研究所，达姆施塔特工业大学）是中国未来城市星球馆中唯一的德国参展者。此跨学科德中合作科研项目的成果引发了参观者极大的兴趣。此外，2010年在位的德意志联邦共和国总统霍斯特·克勒博士也在该馆参观了SEMIZENTRAL（半集中式供水排污系统）。

08 View of the exhibits in the Urban Planet pavilion at the EXPO 2010 in Shanghai | 2010年上海世博会上城市星球馆展品回顾

09 Prof. Peter Cornel (TU Darmstadt, left) and Prof. DAI Xiaohu (Tongji University Shanghai, second from left) in a conversation with the German Federal President Dr. Horst Köhler (right) during his visit to the Expo 2010 in Shanghai |

彼得·康奈尔教授（达姆施塔特工业大学，最左）和戴晓虎教授（上海同济大学，左二）与德国总统霍斯特·科勒博士（最右）在2010年上海世博会展览现场交谈。



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On June 27, 2011, in the presence of Premier Wen Jiabao and Federal Chancellor Dr. 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). This declaration is the basis for the construction of the first semi-centralized RRC in China, in Qingdao.

Investments and operation are provided by the Chinese side. The development company of the World Horticultural Exposition, WHE 2014, in Qingdao, has joined the project as an investor and the operator is the Qingdao Water Group.

On the research side, the Technische Universität Darmstadt, the Tongji University Shanghai, and the Qingdao Technological University are working together. The accompanying research undertaken by the 14 partners is supported by the German Federal Ministry of Education and Research.

2011年6月27日，中国总理温家宝和德国总理安格拉·默克尔博士共同出席并见证《关于开展中德清洁水创新研究合作项目的联合声明》的签字仪式。该声明由中国科学技术部和德意志联邦共和国教育研究部共同签署，从而为在中国青岛建立第一个半集中式资源再生利用中心奠定了基础。

中心的投资建设和经营由中方负责。2014年青岛世界园艺博览会开发公司-青岛世园集团为项目投资方，青岛水务集团为该项目运营商。

科研工作由德国达姆施塔特工业大学、上海同济大学和青岛理工大学共同合作。德国联邦教育研究部为德国十四家研究机构承担的科研工作提供项目科研经费。



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10 Federal Chancellor Dr. Angela Merkel with Prime Minister WEN Jiabao | 德国总理安格拉·默克尔博士与温家宝总理

11 Site of the Resource Recovery Center, Qingdao, in March 2014 | 2014年3月青岛资源再生利用中心施工现场

In addition to the collaboration in research, the semi-centralized RRC is an extremely successful example of German-Chinese cooperation, across and despite of all linguistic and cultural differences.

The participating companies and organizations in both countries have worked in close cooperation on the common realization of the project. Because of its novelty, the project represents a major challenge to the planning process and the coordination of all participants in Germany and China.

A number of well-known German companies have contributed significantly to the technical efficiency of the RRC because they made components available free of charge.

The donated German aggregates and meters (cf. pp. 24-25) were installed and put into operation by experts from the German partner companies and local Chinese experts following completion of the construction work.

项目合作跨越了语言和文化方面的障碍，使得半集中式资源再生利用中心成为中德合作极为成功的一个范例。

为了共同实现此项目，两国的企业与科研机构紧密合作。项目的创新性对德中双方所有项目合作方而言，在设计和协调层面构成了重大挑战。

许多德国知名企业为资源再生利用中心无偿转让了技术成果。德国技术人员会同中国本地技术人员在土建工作完成之后进行了德国捐赠设备（参见24-25页）的安装工作并完成了运行调试。



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The RRC was built in close proximity to the exhibition area of the WHE. The WHE (World Horticulture Exposition) is regarded as the “Olympics” of the horticulture sector. The area surrounding the RRC contains in total, three new residential areas, an office complex, and two hotel complexes. In keeping with SEMIZENTRAL’s approach, greywater and blackwater will be collected and treated separately. The accruing sewage sludge, together with leftovers, will be used to generate energy.

资源再生利用中心紧挨“世界园艺博览会”（世园会）而建，该博览会被誉为园艺界的“奥林匹克盛会”。资源再生利用中心的服务区域包括三个新建住宅区、一个办公建筑群以及两个酒店建筑群，它根据 SEMIZENTRAL（半集中式供水排污系统）的理念对该区域的污水流进行分类收集与处理。所产生的污水污泥与餐厨垃圾一起用于产能。



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13 Exterior view of the Chinese garden in the WHE precinct of Qingdao | 青岛世园会景区内的中国园林外观

14 Official logo of the WHE | 世园会的官方会徽

15 Small lake area in the Chinese garden in the WHE precinct | 世园会景区内中国园林区的小西湖

16 Flower arrangements in the Dutch garden in the WHE precinct | 世园会景区内荷兰园林区的花圃

SEMIZENTRAL CEREMONIAL OPENING ON 27 APRIL 2014

After more than two years of planning and six months of construction, the first semi-centralized RRC worldwide was officially opened on 27 April 2014 by Dr. Georg Schütte, State Secretary in the German Federal Ministry of Education and Research, and WANG Jianxiang, Vice-mayor of the city of Qingdao.

在历时两年多的设计和六个月的施工后，德国联邦教育研究部国务秘书乔治·舒特博士和青岛市副市长王建祥于2014年4月27日宣布，世界上第一个SEMIZENTRAL（半集中式供水排污系统）示范工程正式揭牌投入使用。



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17 State Secretary Dr. Georg Schütte (BMBF) in a conversation with the Vice-mayor of the city of Qingdao, WANG Jianxiang, and Prof. Siegfried WU, Vice-president of the Tongji University Shanghai, and chief planner of the WHE Qingdao 2014

| 国务秘书乔治·舒特博士（德国教研部）与青岛市副市长王建祥和上海同济大学副校长、2014年青岛世园会总规划师吴志强教授交谈 18 From left to right: DING Wei (WHE), WEI Chengjie (Chairman, Qingdao Water Group), Prof. Peter Cornel (TU Darmstadt), Prof. DAI Xiaohu (Tongji University Shanghai), Dr. Susanne Bieker (TU Darmstadt), State Secretary Dr. Georg Schütte (BMBF), XU Jianbo (Director Qingdao University of Technology), Dr. Henning Kocks (Kocks Consult) | 从左至右依次为：

丁伟（世园集团总经理）、魏成吉（青岛水务集团有限公司董事长）、彼得·康奈尔教授（达姆施塔特工业大学）、戴晓虎教授（上海同济大学）、苏珊娜·比克博士（达姆施塔特工业大学）、国务秘书乔治·舒特博士（德国教研部）、徐剑波（青岛理工大学校长）、亨宁·考克斯博士（德国考克斯工程咨询有限公司） 19 Vice-mayor WANG Jianxiang and State Secretary Dr. Georg Schütte (BMBF) at the unveiling of the entrance panel | 青岛市副市长王建祥和德国教研部国务秘书乔治·舒特博士一起为中心揭牌



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20 From left to right: DING Wei (WHE), Prof. DAI Xiaohu (Tongji University Shanghai), Prof. BI Xuejun (Qingdao University of Technology), LI Gang (MoST), Undersecretary Reinhold Ollig (BMBF), Dr. SHEN Weimin (Kocks Consult), WEI Chengjie (Qingdao Water Group), WANG Jianxiang (Vice-mayor of the city of Qingdao), Undersecretary Christian Jörgens (BMBF), Prof. Siegfried WU (Vice President Tongji University Shanghai), senior government official Christian Stertz (BMBF), Prof. Peter Corneli (TU Darmstadt), State Secretary Dr. Georg Schütte (BMBF), Ministerial Director Volker Rieke (BMBF), Prof. Hans Jürgen Prömel (President of the TU Darmstadt), Ralf Marohn (Far Eastern Consulting), Rudolf Scharping (RSBK), Peter Stamm (WILO), Friedrich Barth (GWP), Julia Kundermann (German Embassy Beijing), Dr. Susanne Bieker (TU Darmstadt), Marion | 从左至右依次为: 丁伟 (世园集团总经理)、戴晓虎教授 (上海同济大学)、毕学军教授 (青岛理工大学)、李刚 (中国科技部)、赖因霍尔德·欧利希处长 (德国教研部)、沈伟民博士 (德国考克思工程咨询公司)、魏成吉 (青岛水务集团有限公司)、王建祥 (青岛市委副书记)、克里斯蒂安·蕨根斯处长 (德国教研部)、吴志强教授 (上海同济大学副校长)、克里斯蒂安·施特尔茨博士 (德国教研部行政专员)、彼得·康奈尔教授 (达姆施塔特工业大学)、国务秘书乔治·舒特博士 (德国教研部)、福尔克尔·里克处长 (德国教研部)、汉斯·于尔根·普鲁尔梅尔教授 (达姆施塔特工业大学校长)、拉尔夫·马论 (东源咨询公司)、鲁道夫·沙尔平 (鲁道夫·沙尔平战略咨询交流公司)、彼得·施塔姆 (威乐集团)、福瑞迪希·巴尔特 (德国水工业联合会)、尤莉亚·孔德尔曼 (德国驻北京大使馆)、苏珊娜·比克博士 (达姆施塔特工业大学)、玛丽昂·施泰因贝格 (德国教研部)

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Following the official opening ceremony in the administration building of the WHE concern, the training room in the RRC (cf. p. 28) was officially opened by State Secretary Dr. Georg Schütte, Prof. Peter Cornel (TU Darmstadt), and Prof. DAI Xiaohu (Tongji University Shanghai).

在世园大厦举行盛大开幕仪式后，德国教育研究部国务秘书乔治·舒特博士、彼得·康奈尔教授（达姆施塔特工业大学）和戴晓虎教授（上海同济大学）又来到资源再生利用中心的培训中心（参见28页），为其开幕剪彩。



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21 In the foreground: State Secretary Dr. Georg Schütte (BMBF), Prof. Peter Cornel (TU Darmstadt), Prof. DAI Xiaohu (Tongji University Shanghai) | 前景：国务秘书乔治·舒特博士（德国教研部）、彼得·康乃尔教授（达姆施塔特工业大学）、戴晓虎教授（上海同济大学） 22 From left to right: Prof. Peter Cornel (TU Darmstadt), Artist Susanna Neunast, State Secretary Dr. Georg Schütte (BMBF) | 从左至右依次为：彼得·康乃尔教授（达姆施塔特工业大学）、女艺术家苏珊娜·纽纳斯特、国务秘书乔治·舒特博士（德国教研部）

SEMIZENTRAL IMPRESSIONS OF THE OPENING | 开幕式印象



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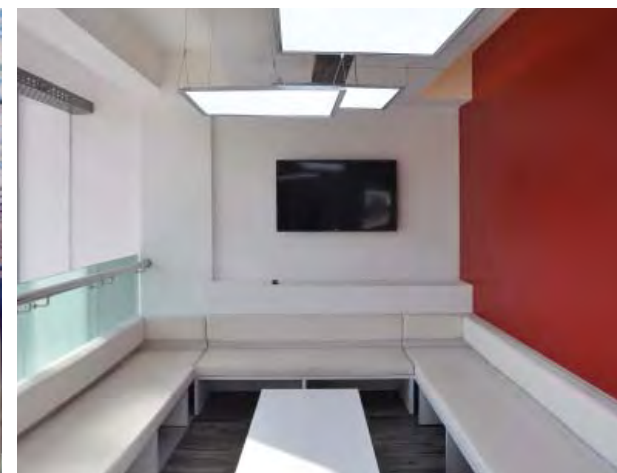
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23 From left to right: Alexander Coelius (COSALUX), State Secretary Dr. Georg Schütte (BMBF), Dr. Susanne Bieker (TU Darmstadt) | 从左至右依次为：亚历山大·克流思 (COSALUX)、国务秘书乔治·舒特博士 (德国教研部)、苏珊娜·比克博士 (达姆施塔特工业大学)

24 Training Room in the Resource Recovery Center | 资源再生利用中心培训中心

25 Sponsor wall with information cards in the Resource Recovery Center | 资源再生利用中心内的赞助商信息卡墙

26 Prof. Dai Xiaohu in an interview with a Chinese television channel | 戴晓虎教授接受中国电视台的采访

27 Lounge area in the training room of the Resource Recovery Center | 资源再生利用中心培训中心的休息区

SEMIZENTRAL TOUR THROUGH THE RRC | 参观资源再生利用中心



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Despite the rain in Qingdao, the mood of all those present was very good.

尽管青岛飘着霏霏细雨，但所有在场嘉宾心情极佳。



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28 From left to right: Peter Stamm (WILO), Dr. Matthias Kautt (project leader for the BMBF in Karlsruhe), ZHU Enhui (WILO) | 左至右依次为：彼得·施塔姆（威乐集团）、马蒂亚斯·考特博士（德国教研部卡尔斯鲁尔项目办）、朱恩惠（音译）（威乐集团） 29 From left to right: Dr. Volker Zang (Bilfinger Water Technologies), State Secretary Dr. Georg Schütte (BMBF), Dr. SHEN Weimin (Kocks Consult), Dr. Henning Kocks (Kocks Consult) | 从左至右依次为：福尔克尔·臧博士（贝尔芬格水处理技术有限公司）、国务秘书乔治·舒特博士（德国教研部）、沈伟民博士（德国考克思工程咨询公司）、亨宁·考克思博士（德国考克思工程咨询有限公司） 30 In the foreground, from left to right: Prof. Siegfried WU (Tongji University Shanghai), WANG Jianxiang (Vice-mayor of the city of Qingdao), und DING Wei (WHE) | 前面从左至右依次为：吴志强教授（上海同济大学）、青岛市副市长王建祥和丁伟总经理（世园集团）

State Secretary Dr. Georg Schütte during the tour with representatives of the sponsors who made German high-tech products available for free for this unique plant.

国务秘书乔治·舒特博士在赞助商代表的陪同下进行参观，赞助商们为这座世界上第一座该类型的基础设施提供了德国高精尖技术的产品。



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31 Klaus-Hasso Heller (AERZEN) in a conversation with State Secretary Dr. Georg Schütte (BMBF) | 克劳斯·哈索·黑勒博士（艾岑集团）与国务秘书乔治·舒特博士（德国教研部）亲切交谈

32 From left to right: Peter Stamm (WILO), State Secretary Dr. Georg Schütte (BMBF), Prof. Peter Cornel (TU Darmstadt) | 从左至右依次为：彼得·施塔姆（威乐集团）、国务秘书乔治·舒特博士（德国教研部）、彼得·康乃尔教授（达姆施塔特工业大学）

33 From left to right: Prof. Peter Cornel (TU Darmstadt), State Secretary Dr. Georg Schütte (BMBF), Hans Joerg Heckmann (Microdyn-Nadir) | 从左至右依次为：彼得·康奈尔（达姆施塔特工业大学）、国务秘书乔治·舒特博士（德国教研部）、汉斯·约尔格·黑克曼（德国迈纳德有限公司）

SEMIZENTRAL A PROJECT OF MANY PARTNERS | 众星云集的合作项目



Prof. Peter Cornel
Institute IWAR, TU Darmstadt
彼得·康奈尔教授
IWAR研究所, 达姆施塔特工业大学



Prof. Martin Wagner
Institute IWAR, TU Darmstadt
马丁·瓦格纳教授
IWAR研究所, 达姆施塔特工业大学

Prof. Peter Cornel is the “conceptual father” of the SEMIZENTRAL approach. Together with his team, he leads the joint research group that includes partners from science and industry. What is so special, is the realization of the project on an industrial scale. This became possible through more than 30 years of partnership with the Tongji University Shanghai, whereby Prof. Martin Wagner, a member of the team, acted as the liaison for this work during the entire period. This has provided the basis for forming a consortium of 14 partners who will now support the operation scientifically. The project demonstrates that such landmark cooperation between research institutions and private enterprises makes it possible to meet future challenges of supplying and treating water in cities.

彼得·康奈尔教授是SEMIZENTRAL（半集中式供水排污系统）理念的精神之父。他与其团队领导着这一由学术界和工业界组成的科研联盟。这一理念在从诞生至科研再至实际生产规模的建设，整个过程的艰辛是其他科研项目无法比拟。正是得益于与上海同济大学存在着超过三十年的合作经验，以及马丁·瓦格纳教授对SEMIZENTRAL（半集中式供水排污系统）这一由十四个合作伙伴组成科研联盟的全程指导，才使得项目取得了巨大成功。该项目展示了通过科研机构和企业之间的这种开创性的合作方式可以克服并解决未来城市供排水方面所面临的挑战。





Prof. DAI Xiaohu
(Tongji University Shanghai)
Head of the planning team in China
戴晓虎教授（上海同济大学）
中方项目团队总负责人



Prof. CHEN Hongbin
(Tongji University Shanghai)
Coordinator of the planning team in China
陈洪斌教授（上海同济大学）
中方项目团队协调员



Prof. BI Xuejun
(Qingdao Technological University)
Head of the planning team in Qingdao
毕学军教授（青岛理工大学）
青岛中方项目团队负责人



With respect to SEMIZENTRAL research, numerous scientists at respected universities in Darmstadt, Shanghai, and Qingdao have been cooperating since 2003. The highest recognition that this Chinese-German partnership has received, to date, was the acknowledgement at the EXPO 2010 in Shanghai, that the research provides a trend-setting solution for future cities. The first RRC worldwide implemented as part of the WHE 2014 in Qingdao, represents a further milestone for German-Chinese cooperation.

SEMIZENTRAL（半集中式供水排污系统）研究合作始于2003年，众多来自达姆施塔特、上海和青岛的知名大学教授共同参与了科研合作。

这一研究项目在2010年上海世博会上作为未来城市供水排污方面的前瞻性解决方案被公开展览，这次展出是该项目德中亲密合作目前为止所得到的最高荣誉。

在青岛世界园艺博览会中所展示的世界首个半集中式资源再生利用中心是中德合作又一个重要的里程碑。

SEMIZENTRAL

A PROJECT OF MANY PARTNERS | 众星云集的合作项目

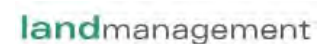
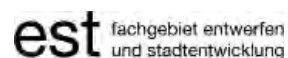


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01 TU DARMSTADT, INSTITUTE IWAR, WASTEWATER TECHNOLOGY AND WATER REUSE | 达姆施塔特工业大学, IWAR研究所, 污水处理系 02 TU DARMSTADT, INSTITUTE OF CONSTRUCTION TECHNOLOGIES AND MANAGEMENT | 达姆施塔特工业大学, 工程运行管理研究所
03 ISOE – INSTITUTE FOR SOCIAL-ECOLOGICAL RESEARCH | ISOE—社会生态研究所 04 TU DARMSTADT, FACHGEBIET ENTWERFEN UND STADTENTWICKLUNG | 达姆施塔特工业大学, 设计与城市规划系
05 TU DARMSTADT, CHAIR OF LANDMANAGEMENT | 达姆施塔特工业大学, 土地管理系 06 EMSCHER WASSERTECHNIK GMBH | EMSCHER水务技术有限公司



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01 M+P GRUPPE | M+P集团 02 KOCKS CONSULTING GMBH | KOCKS 德国考克斯工程咨询有限公司 03 BILFINGER WATER TECHNOLOGIES GMBH | 贝尔芬格水处理技术有限公司
04 ENDRESS+HAUSER | 恩德斯豪斯有限公司 05 COSALUX GMBH | COSALUX有限公司 06 FAR EASTERN CONSULTING | 东源咨询公司
07 HEYL NEOMERIS | HEYL NEOMERIS创新水处理技术经销有限公司 08 GUMMERSBACH ENVIRONMENTAL COMPUTING CENTER/FACHHOCHSCHULE KÖLN | 科隆应用技术大学GUMMERSBACH环境计算中心

SEMIZENTRAL OUR SPONSORS | 我们的赞助商



Six sponsors have contributed decisive support for the realization of the SEMI-ZENTRAL concept. Their great commitment and invaluable know-how made it possible to provide the semi-centralized RRC facility with state-of-the-art technology. It incorporates many trend-setting components supplied by the sponsors that had to be brought together and coordinated with high precision during the planning phase. This high-quality equipment makes it possible to validate the SEMIZENTRAL approach on a large, industrially realistic scale and will contribute to its future propagation.

六位赞助商为实现SEMIZENTRAL（半集中式供水排污系统）的理念提供了巨大而关键的支持。他们极强的事业心以及珍贵的专业技术知识，使半集中式资源再生利用中心配备了高精尖的技术设备。资源再生利用中心中安装了数量众多由赞助商研发部门为本项目提供的，具有技术前瞻性的设备和组件，并根据设计工作实现了对该项目的高度匹配。资源再生利用中心的高品质设备不但使得SEMIZENTRAL（半集中式供水排污系统）理念变为现实，而且对该理念的优化与扩展应用做出了巨大的贡献。



AERZEN blowers and compressors supply industrial facilities worldwide with gaseous media. Experience collected in 150 years of company history is reflected in their innovative mechanical engineering. Their range of products includes rotary lobe compressors, positive displacement blowers, turbo blowers, screw compressors, and gas meters. AERZEN's blowers, compressors, and gas meters are quality controlled and certified according to DIN EN ISO 9001. The spectrum covers standard products as well as customized special-purpose solutions. In addition, AERZEN's after-sales service offers a complete range of services, from all-inclusive maintenance contracts to repair and modernization of existing plants.

在世界范围内，几乎所有工业设备均使用AERZEN（艾岑）生产制造的鼓风机和压缩机，用以提供气体介质。极具创新性的AERZEN工艺技术，得益于公司150年的经验历史。产品范围包括旋转活塞压缩机、旋转活塞风机、涡轮风机、螺杆压缩机及气量表。AERZEN风机、压缩机及气量表多符合DIN EN ISO 9001质量标准和受到认证。供货范围极为灵活，除了标准产品之外，还可以按照客户需求提供特定解决方案。此外，AERZEN的售后服务部门提供全面的售后服务 - 包括订货产品的全面维护或现有设备的维修和现代化改造。



No industrial process without automation. No automation without actuators. Actuators are the decisive components for the safe and economical transport of gases, liquids, sludges and granules through the pipes of industrial plants. In every plant and in every industrial process, the various energy and material flows develop individually and as novelties. Optimal control demands a flexible and modular concept that can, on the one hand, provide customized responses to specific requirements and, on the other hand, offer maximum reliability and safety. This is exactly the AUMA concept: Solutions for a world in motion.

没有任何一种工业过程可以脱离自动化控制，没有任何一种自动化控制可以脱离电动执行器。电动执行器是保障工业设备中气体、液体、浆料与颗粒物管道输送过程的物流安全性和经济性的核心部件。每台工业设备、每一个工业流程中的能量循环和物质循环均是全新而独特的。优秀的控制系统需要为其提供灵活的、模块化的方案，一方面，需按照具体的特殊要求进行量身打造，另一方面，需要提供并保障其可靠性和安全性运转。而这恰恰是AUMA（欧玛）公司的理念 - 为运转中的世界提供解决方案。



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 and sewage disposal. 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. The Wilo Group supports the innovative and future-oriented SEMIZENTRAL project of the Technische Universität Darmstadt in Qingdao, China, with its products.

威乐集团 (WILO) 是专为建筑工程以及供水和污水处理系统提供水泵和水泵系统的制造商之一，它在全球范围内处于领先地位。威乐集团始终着眼于未来，斥巨资进行研究与开发，并将自身定位逐步从零部件供应商发展为系统供应商。国际上威乐是高科技水泵的代名词。威乐集团以其产品为达姆施塔特工业大学具有创新性的、面向未来的半集中式供水排污处理系统项目提供了极大的支持。该项目是2014年中国青岛世界园艺博览会的一个重大项目。



For several decades, the BinderGroup in Germany has been manufacturing gas meters and related products for use in wastewater treatment plants. VACOMASS® is a unique modular system, based on building blocks, for the air distribution and control in aeration tanks.

Only the precise calibration of the air flow meter in the CAMASS®-calibration technique and the system integration in the air distribution system guarantees the optimal interaction of the system components. The main advantages for the operator are the high process stability and the reduction of energy costs. The thermic COMBIMASS® gas meter and the COMBIMASS® gas analyzer can be used to monitor and control the formation of gas in purification plants. Mobile and stationary analysis tools identify the typical components in the gas.

几十年以来，冰德集团 (Binder Group) 在德国生产用于污水处理厂的气体流量计和其他相关产品。VACOMASS® 是按模块化原理进行设计的一种独特的模块化系统，它专用于生物处理池中的气体分配和调整。只有在CAMASS®标定中心对空气测控装置进行整体标定工作，才能保证系统组件的性能最优化。对于运营方而言，其主要优点是高运行稳定性，并能够减少能耗成本。COMBIMASS® 热式流量计和 COMBIMASS® 气体分析仪可用于对所产生的废气进行监控和调整。移动和固定的分析仪器测定气体中的典型组成。



For more than 25 years, OTT has had a passion for quality and efficiency in biological wastewater treatment. The company manufactures fine bubble tube diffusers as well as the modular AirRex® piping system. OTT also develops and installs high-performance aeration systems for municipal and industrial wastewater processing. With its HE® program, OTT offers customers comprehensive options for sustainable energy savings and optimization of aeration systems in their wastewater treatment plants.

25 年来 OTT 集团始终致力于提高污水生物处理的质量和效率。其在德国的生产基地生产制造微小气泡的膜式管道曝气管，以及模块化的 AirRex® 管道系统。此外，OTT 集团为市政污水和工业废水处理厂开发和制造高质量的曝气系统。通过 HE® 程序我们可为我们的极为注重效率的客户提供给为污水处理厂节能降耗以及优化曝气系统效率的各种方案。



LAR Process Analysers AG is a leading supplier of online analyzers for the determination of important sum parameters in water like TOC, COD, BOD, TNb, TP and toxicity. A patented sample withdrawal system, as well as product add-ons and relevant services are also part of the product range offered by LAR AG. The analyzers are deployed in industrial and municipal wastewater technology, process monitoring, and pure water analysis for condensation water and pharmaceutical water (HPW, WFI). The LAR AG online-analyzers help to control industrial plants and to optimize processes. Due to the steadily increasing significance of environmental protection, their technological market leadership – made in Berlin – ensures their participation in the water resources market in the future.

拉尔分析仪器公司 (LAR AG) 是世界领先水质在线分析仪器开发者及制造企业，旗下产品涵盖水中多项参数（如TOC、COD、BOD、TNb、TP及水中毒性等）的测量。拉尔分析仪器被广泛应用于工业废水、生活污水、过程控制、冷凝水及制药用水超纯分析 (HPW、WFI) 等领域。拉尔分析仪器公司在提供优质分析仪器的同时，也提供具有专利的采样系统、产品配件及相关技术服务。拉尔分析仪器公司的在线分析仪器协助用户进行过程控制优化及工业系统的控制工作。随着环境保护日益重视，拉尔分析仪器公司希望借此契机成为水质测量领域的领导者。-柏林制造-未来水资源保护领域的积极参与者

The artist Susanna Neunast has occupied herself for many years with the topic “water”. She captures the fascination and beauty of water to make it emotionally accessible and, with her photos, creates an unexpected view of this apparently well-known element. With Susanna Neunast’s installations in and around the RRC, water becomes part of the building.

A large, reflecting water surface – a central element of the facade – draws the attention of visitors to the uniqueness of the building from afar.

When visitors enter the building, they become part of the moving water surface.

The RRC lobby becomes a spatial installation with the visitor in the center. In the installation, which consists of water photos and numerous mirrors that simulate a moving water surface, viewers become part of the water. The reflections of the water photos and of the visitors merge to form a new entity.

艺术家苏珊娜·纽纳斯特多年从事关于“水”的创作。她将水这个众所周知的元素以另一种角度呈现在她的摄影作品中，使其散发出潜藏的魅力并使人们得到强烈的情感体验。

在苏珊娜·纽纳斯特为资源再生利用中心的设计中，水成为该建筑的一部分。以大型反光的水面作为外墙主体彰显了这座建筑的与众不同。访客一旦进入楼内即成为波动水面的一部分。

入口处以访客为中心的区域构成了一个独特的空间。水面摄影及大量镜面的组合模拟了水面波动的效果，并使访客成为水的一部分。水面摄影的反射与访客的镜像融合成为一个新的整体。



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34 Facade of the Resource Recovery Center Qingdao: Installation created by Susanna Neunast | 青岛资源再生利用中心外立面：艺术装饰由苏珊娜·纽纳斯特设计

35 Lobby of the Resource Recovery Center: Spatial installation created by Susanna Neunast | 资源再生利用中心入口区域：空间艺术装饰由苏珊娜·纽纳斯特设计



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The training room serves to explain the SEMIZENTRAL approach to interested visitors and experts, to provide insights into the operation of the RRC, as well to implement training in the fields of water-, wastewater- and waste technologies. The BMBF has financed the equipment in the training room.

在培训中心，对SEMIZENTRAL（半集中式供水排污系统）感兴趣的访客与专家可以获取更多该系统理念的详细信息，并了解资源再生利用中心的运行情况。在培训中心内，还可以针对供水、污水处理与废弃物处理技术领域进行专业培训。德国教研部承担了整个培训中心的建设费用。



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SEMIZENTRAL is an innovative infrastructural approach to water supply and disposal, designed to improve the resource efficiency of cities of the future and, thereby, the quality of life in these cities. However, not only technical solutions are needed to achieve this goal. The operation of new, efficient, and innovative systems also represents a substantial task. Thus, highly qualified employees are also essential. SEMIZENTRAL responded to this challenge with its multimedia training room in the RRC Qingdao. It provides, on the one hand, apprenticeship and in-service training and, on the other hand, serves to consolidate German-Chinese cooperation.

（半集中式供水排污系统）是针对供排水基础设施的一项创新理念，旨在改善未来城市的资源利用效率，从而显著提高城市生活质量。然而，对此不仅需要技术方案，新的高效和创新系统的运行管理同样也成为一件极为重要的任务。为迎接这一挑战，高素质人才的培养是重中之重。SEMIZENTRAL（半集中式供水排污系统）在青岛世园资源再生利用中心为此设立了多媒体培训中心，它一方面被用于培训和进修，另一方面也将为中德合作的不断深入做贡献。

To make the RRC accessible, a virtual 3D model was realized. Visitors can learn interactively about the concept and process technology of the RRC. A rotating 3-D model of the RRC serves as a navigation tool that offers visitors views from various perspectives. There are also filter functions that can reduce the number of selected items. In this way, the visitor accesses specific information on individual processes as well as the applied technologies, including those supplied by the project sponsors.

为了使用户对半集中式资源再生利用中心有身临其境的真实感受，资源再生利用中心可以通过虚拟的三维模型方式进行展示。通过交互方式用户可以获得赞助方和研究合作伙伴为建成半集中式资源再生利用中心所做出的贡献等相关项目资讯。半集中式资源再生利用中心的三维模型可以用作导航元件，通过旋转它可以为用户提供各种视角。应用程序提供各种过滤功能，以便减少选项的数量，对赞助方为处理工艺所提供的技术设备可进行具有针对性的查询。



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Page 1: Simon Gehrmann;
Page 2: Dreamstime (Image ID: 16773023);
Page 3: iStockphoto (Image ID: 40816026);
Pages 4/5: IWAR, Wastewater Technologies and Water Reuse;
Pages 6/7, 11 (Figure 11), 14 to 19 and 29: COSALUX;
Pages 8/9: SEMIZENTRAL;
Page 10: DAI Xiaohu (Tongji University Shanghai);
Page 11 (Figure 10): Bundesregierung/Guido Bergmann;
Page 12: TU Darmstadt;
Page 13: Dreamstime (Image IDs: 39741274, 39742295, 3974257613),
Logo: Official Website World Horticultural Exposition (<http://www.qingdaoexpo2014.org>);
Page 20: IWAR, Wastewater Technologies and Water Reuse;
Page 21: Tongji University Shanghai/ Qingdao University of Technology;
Page 26: Susanna Neunast (Figure 34), Simon Gehrmann (Figure 35);
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IMPRESSUM

Publisher:

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Text and Editing:

Dr. Susanne Bieker, Susanna Neunast

Design:

www.cosalux.com

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出版说明

出版人:

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设计:

www.cosalux.com

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