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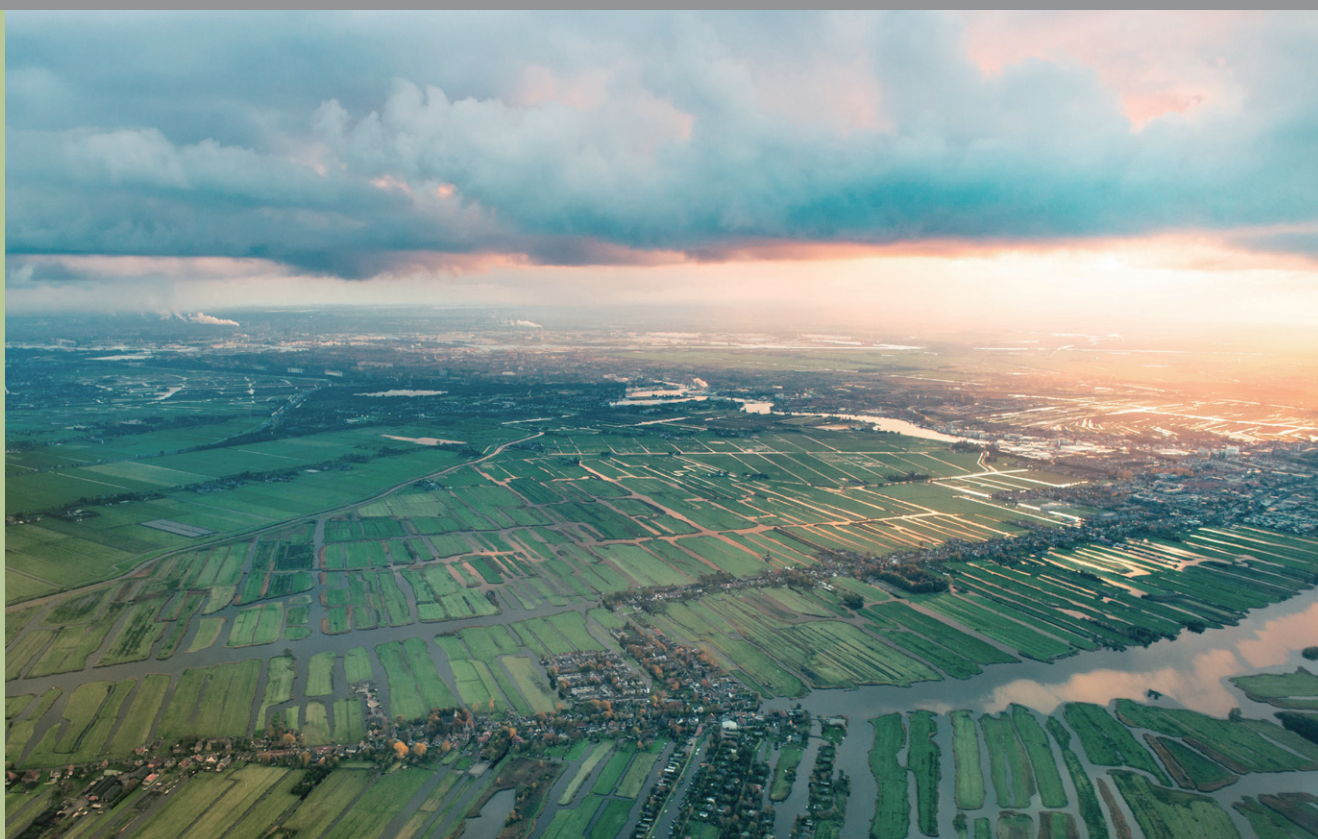


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## Green Markets & Climate Challenge

December 2017 12月刊



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## In Focus

### Xiongan New Area – A Future Solution for Jing-Jin-Ji Regional Development 雄安新区 — 京津冀发展之困的未来解决方案

In April 2017, China announced a plan to create the national-level new area Xiongan, which is located about 100 km southwest of downtown Beijing and will span the counties Xiongxian, Rongcheng, and Anxin. The area is also home to Baiyangdian, the largest plain water wetland in Northern China. The initial concept of the new area will cover 100 sq km, aiming at expansion to 200 sq km in the medium-term and about 2,000 sq km in the long-term with an estimated population of 2 to 2.5 million.

So far 19 national-level new areas in China were officially announced. All of them have been established in different development phases in peripheral regions of first-tier or second-tier cities, across the country. According to a circular issued by the Communist Party and the State Council, the decision of setting up Xiongan New Area was described as “a strategy crucial for a millennium to come”. In contrast with other national-level new areas, Xiongan was attached with a nation-wide significance, similar to Shenzhen Special Economic Zone established in the 1980s and Shanghai Pudong New Area launched in the 1990s. Shenzhen was developed from a fishing village to a dynamic cosmopolitan city in a time span of about 40 years. Pudong New District of Shanghai was just a wetland area 30 years ago. In the meantime, it has emerged as one of the most important financial centers in China.

By the end of 2016, the residential population of Beijing has reached 21.7 million. The vast population growth caused so-called “urban diseases” including resources shortage, capacity limitation, traffic congestion and rapidly rising housing prices. However, in the 13th Five-Year Plan (2016-2020), a strict control of the population scale in Beijing was proposed with a cap of 23 million until 2020. The concept of Xiongan New Area is expected to phase out some of Beijing’s non-capital functions, explore a new model of optimized development in densely populated areas, and restructure the urban layout in the Beijing-Tianjin-Hebei region (Jing-Jin-Ji). The frequently-mentioned non-capital functions specifically refer to Beijing’s municipal administrative organs, public institutions, science &

2017年4月,中共中央、国务院决定在雄安设立国家级新区,位置在北京西南方向距离市中心110公里左右,规划范围涉及河北省雄县、容城、安新3个县以及周边部分区域。同时,被誉为“华北明珠”的白洋淀就位于雄安新区核心。雄安新区规划建设以特定区域为起步区先行开发,起步区面积约100平方公里,中期发展区面积约200平方公里,远期控制区面积约2000平方公里,将承载200万至250万人口。

迄今为止,中国一共设立了19个国家级新区,分布在全国各个省市的一线或二线城市周边地区,发展程度各不相同。国务院印发通知中提到,雄安是千年大计、国家大事,不同于一般意义上的新区,是继深圳经济特区和上海浦东新区之后又一具有全国意义的新区。深圳在20世纪80年代曾是一个小渔村,40年左右的时间发展成为一个极具活力的大都市,上海的浦东新区在20世纪90年代还是一块未开发的湿地,30年左右的时间发展成为中国最为重要的金融中心之一。



*A strict control of the population scale in Beijing was proposed with a cap of 23 million until 2020*

“十三五”规划中划定了北京至2020年不得超过2300万的人口红线

截止至2016年底,北京市的常住人口已达2170万,大规模的人口增长带来了一系列的“城市病”,诸如资源短缺、承载力达到上限、交通拥堵和房价过快上涨。然而,在“十三五”规划(2016-2020年)中划定了北京至2020年不得超过2300万的人口红线。雄安的建设就旨在疏解北京的非首都功能,探索人口密集

technology parks, state-owned and private enterprise headquarters, hospitals, financial institutions as well as colleges and research institutes. In an urban planning context, polycentric-cluster spatial structure indicates that a spatial entity consists of multiple clusters, fulfilling the basic demands of urban working and living. This concept is attached with great importance to Xiongan, which could be of help to improve the efficiency and quality of urban life and thus will make the city more resilient for future development. It is considered as a feasible solution for the much-criticized, outward, disordered urban sprawl mode.

The selection of Xiongan New Area's location was conducted through extensive field investigation, research and workshops by government officials and various experts. Certain advantages were identified such as geographical location, ecological environment, transportation accessibility, resources, and environmental capacity as well as low land development level and population density. The distance from Xiongan to Beijing and Tianjin in both directions is around 110 km, forming a spatial triangle. Currently, many highways and railways are passing through the planned area, which provides a good basis for building the planned "half-hour rapid transport circle" together with Beijing and Tianjin. The wetland Baiyangdian is essential for conserving water of the North China Plain and possesses excellent landscape conditions. Xiongan New Area is described as a "blank paper" due to almost no factories and a very low population density of currently only 660 residents per sq km, while the population density of Beijing central districts has reached 24,000 residents per sq km. All of the mentioned factors have offered favorable prerequisites for the future urban and industrial agglomeration.

The President of China, Xi Jinping stressed that Xiongan should be built into a world-leading, modern, green and smart area with beautiful environment, high-tech industries, and efficient transport. The vision cannot be realized without the support of high-end innovative scientific research as well as industrial and personnel resources. In addition, sufficient infrastructure construction and public services, such as rail transit, 5G wireless telecommunications network, municipal facilities, education and health care are vital to guarantee the benign development of the new urban area.

Environmental and ecological conservation is another key factor to ensure the living quality of Xiongan's residents. According to the Chinese evaluation standards, the water quality of some lake zones of Baiyangdian is

地区的都市发展新模式,重组京津冀地区的城市格局,媒体频繁提到的“非首都功能”具体包括北京市属行政事业单位、科技园、央企国企及其他在京总部企业、央属及市属医院、金融机构、大学及科研机构。城市规划的概念中,多中心组团式布局是指一个空间单位中涵盖多个组团,每个单一组团都能满足居民的日常工作和生活的基本需要。专家指出,雄安的规划将采取多中心组团式布局,以提高城市生活的效率和质量,并让城市的发展更富有弹性,该空间布局方式被看作是阻止北京进一步“摊大饼”式无序扩张的一项有效解决方案。



*Xiongan forms a spatial triangle with Beijing and Tianjin*  
 雄安与北京和天津在空间上形成一个等边三角形

Source / 图片来源: perspectives.pictet.com

雄安的选址是基于政府官员和多个行业专家广泛的现场调研、研究和论证确定的,该地区区位优势明显、交通便捷通畅、生态环境优良、资源环境承载力较强,现有开发程度较低,发展空间充裕,具备高起点高标准开发建设的基本条件,并且相隔北京和天津均为110公里左右,空间上形成一个等边三角形。目前,有多条高速公路和铁路经过该地区,为未来与北京和天津形成“半小时交通圈”打造了良好的基础条件。白洋淀湿地对于华北平原涵养水源的功能,并为新区的发展提供了优质的景观条件。另外,雄安新区开发程度极低,几乎没有任何工厂,且当前人口密度很低,即30km<sup>2</sup>的启动区上仅为660人每平方公里,相比之下北京的人口密度为24,000人每平方公里,因此官方对雄安新区的评价是“如同一张白纸”,以上所提到的各种要素为雄安未来的城市发展和产业集聚提供了有利的先决条件。

习近平总书记提出,雄安新区应建成国际一流、绿色、现代、智慧城市,生活环境优良、高新产业集聚、交通便捷。该目标的实现需要创新型高端科技研究产业和人才的引入,以及相应配套基础设施的建设,比如轨道交通、5G无线网络、市政设施、教育、医疗等,这些都是保证新城新区的良性发展的必要条件。



currently still rated as unfit for direct human contact. Hence, water governance has been put as one of the top priorities in Xiongan New Area's overall development. Moreover, demography planning must be in accordance with the environment bearing capacity. In the comprehensive plan of Xiongan, it is stated that the proportion of green land and water will be no less than 70 percent.

Furthermore, noticeable change happened to the real estate market in Xiongan. In order to stabilize prices and curb speculations, a series of measures have been implemented. The sale of houses has been restricted and both illegal constructions and illicit real estate agencies have been shut down. According to high-level officials from the Chinese Ministry of Housing and Urban-Rural Development (MOHURD), there will be a fundamental paradigm shift in local land finance policies. The land tenure revenue will be abandoned with the replacement of raising local tax incomes and sharing land value-added incomes. Land tenure will not be owned by real estate developers but shared by the government and citizens. It serves as a possible solution to restrain the exorbitant growth of housing prices usually experienced in national key development areas.

The Comprehensive Plan on Beijing City (2016-2035) published in September 2017, added a new chapter to the urban planning for Xiongan New Area. Beijing's "wings" – Xiongan in the southwest and the new sub-center of Tongzhou District located in southeast Beijing – are aimed to undertake non-capital functions. The local-level planning system of Xiongan in the Chinese context can be summarized as "1+3+54": "1" stands for a comprehensive plan for the whole area, "3" stands for a regulatory plan for the starting area of 100 sq km, a regulatory detailed plan for the smaller initial area of 30 sq km, as well as Baiyangdian ecological environment governance and protection plan, "54" stands for 22 specialized plans and 32 significant research projects.

同时,环境与生态保护是保障未来新区居民生活质量的另一重要议题,根据中国《地表水环境质量标准》评级,目前白洋淀的水质根据水质评测显示仍有部分区域有四类和五类水,即不适合人体直接接触的级别,因此水质的整治是新区的发展建设最应着力的工作重点之一,人口的发展应与环境承载力相协调,在新发布的雄安新区总体规划中,明确规划新区的蓝绿比,即城市水域与绿地的总体空间占比不得低于70%。

此外,另一项关于雄安的重大变化发生在房地产市场,从宣布设立雄安新区的消息伊始,所有关于房地产的交易都被当地有关部门紧急叫停,并且一切非法建设项目和二手房交易也被全面禁止。中华人民共和国住房和城乡建设部的官员表示,雄安新区将会实行土地财政政策改革,未来将不搞土地财政,财政收入主要来自税收收入和土地增值收益,土地使用权将不再归房地产开发商所有,而以股份的形式分属于政府和居民。这种改革思路有望抑制以往国家重点开发新区普遍存在的房价过快上升的大趋势。

2017年9月发布的《北京城市总体规划(2016年-2035年)》还新增单独章节,对支持河北雄安新区规划建设作出安排,北京城市副中心通州和河北雄安新区将形成北京新的两翼,拓展京津冀区域发展新空间。权威消息透露,雄安的整个规划体系可概括为"1+3+54": "1"是指雄安新区总体规划;"3"是指起步区控制性规划、启动区控制性详细规划和白洋



*Baiyangdian is the largest plain water wetland in Northern China*

白洋淀是华北地区最大的淡水湖湿地

Source / 图片来源: i2.sinaimg.cn

In comparison with other new area planning, Xiongan serves as a test field for new innovative development models. Key concepts such as city-industry integration, ecological greening, reform and innovation were frequently stressed by experts from the key planning institute China Academy of Urban Planning and Design (CAUPD). An international consulting competition for the urban design has been conducted from June to September 2017. In total 12 design teams were selected out of 183 teams to proceed to the final round of on-site consulting with local government officials and experts and to submit their comprehensive concept planning for an area of 198 sq km. German architecture and planning offices were also involved in the process such as OBERMEYER, SBA, ISA, Atelier Dreiseitl and others.

However, the ambitious plan for Xiongan also aroused the attention of critics. Current local economic conditions in the Hebei Province are not attractive for high-tech industry and talent agglomeration. Since the announcement of Jing-Jin-Ji cluster development in 2014, Hebei has improved substantially in the fields of transportation, medical care, and education, but the implementation of a balanced and coordinated development of regional economy still has a long way to go. The imbalance between Beijing and neighboring cities constrains the progress of integrated development of the Jing-Jin-Ji region. The industry cultivation and operation are considered as a major challenge for Xiongan in the long term. For the planners, multi-dimensional coordination is also seen as a tough challenge, since the complexity of Xiongan planning is not comparable with new town planning in the conventional sense. Moreover, against the mainstream of rising housing prices in almost all developed regions in China, it remains to be seen, whether reform on land finance policies will turn out to be effective.

Nevertheless, the planning and construction work of Xiongan New Area is proceeding systematically and gradually. If all visions are becoming reality, Xiongan's new development paradigm will be of great significance as a leading example to ease the "urban diseases" of population- and economic-intensive metropolises in China.

淀生态环境治理和保护规划；“54”是指22个专项规划和32个重大课题研究。

雄安新区将充分汲取其它国家级新城新区的规划经验并将努力尝试试验创新型发展模式。中国城市规划设计研究院的专家反复提到在新区建设中要践行产城融合、生态绿色、改革创新的理念。为了借鉴世界其他国家的先进规划经验，雄安新区城市设计国际咨询于2017年6月至9月举行，总共183支设计团队参赛，其中包括国际、国内著名公司组成的设计联合体67个，主办方将根据专家的意见，从这些报名机构中筛选12支设计团队。入选团队对198km<sup>2</sup>的起步区提交城市设计方案，这其中也包括若干德国建筑规划事务所如欧博迈亚、SBA、意厦、戴水道等。

然而，对于雄安这项伟大计划也不乏质疑之声。目前河北省的整体经济发展状况相对落后，对于高新技术产业和人才的吸引力不够。京津冀协同发展的概念早在2014年就已提出，河北在交通、医疗和教育方面有长足的进步，但对于实现协同发展的整体目标来说仍然差距较大。北京和周边城市的发展不均衡制约了京津冀协同发展的进一步推进。对于雄安来说，面临的挑战并非建设，更多的是后续的产业培育和运营。因此，雄安新区作为非首都功能的承接地，所面临挑战的复杂性比常规性国家级新区高很多，也给规划师们带来了前所未有的挑战。再者经济发达地区房价上涨是当前中国的主流趋势，雄安新区土地财政改革是否卓有成效让我们拭目以待。

无论如何，目前雄安新区的规划建设工作正在有条不紊地开展当中，如果对于新区的发展设想都能全面实现的话，那无疑雄安模式将为中国人口密度高、经济发达地区的“城市病”的缓解树立新的发展范式。



*Xiongan serves as a test field for new innovative development models*

雄安新区将充分汲取其它国家级新城新区的创新型发展模式

Source / 图片来源: n.sinaimg.cn



# Building



## Germany's Green Roofs offer Lesson on Climate Change Adaptation

*A contribution by Dongfang Zhang*

### 高温和暴雨中, 让我们谈谈绿色屋顶吧

来自张东方的客邀文章

Heatwaves and heavy rains have hit China in the summer of 2017, with Shanghai seeing its hottest weather for 145 years and rainstorms, floods and landslips killing at least 156 people across five provinces in southern China. Climate change and the El Niño effect are being blamed for both phenomena. Urbanisation and poor city-planning have also worsened these problems. Heat is absorbed by concrete surfaces and roads during the day and then radiated at night, which prevents temperatures from falling. Paved surfaces can also increase rainwater run-off, worsening the risk of flooding.

Green roofs offer a solution to these problems because they absorb rainwater and reduce radiant surfaces, helping to cool buildings internally and reduce the need for air-conditioning. As a pioneer in the research and construction of green roofs, Germany offers lessons that could be applied in China, says Zhao Dingguo, senior agronomist at Shanghai Institute of Agricultural Sciences and an expert on green roof technology.

#### Rainwater management

China is already experimenting with “sponge cities” to mitigate heavy rainfall and recycle water by adding green spaces, integrating ponds and filtration pools into city landscapes and laying permeable road surfaces so that 70 percent of rainfall is absorbed or re-used. A project to remodel 16 districts in major cities such as Wuhan and Chongqing began in 2015 at a cost of 600 million CNY (90 million USD) for each area.

More widespread use of green roofs beyond these schemes could have a big impact. Researchers Michael Richter and Wolfgang Dickhaut of HafenCity University in Hamburg are part of a team monitoring the German city's green roofs. They reported soils over six centimetres thick retain 60 percent of rainfall, while those that are 50 centimetres retain more than

高温和暴雨无疑是2017年夏天中国最热的话题之一。上海打破了145年的最高气温记录,而此前南方的暴雨更是造成五个省至少156人死亡。

气候变化和厄尔尼诺现象被认为是推高气温和降水量的原因,而城市热岛效应也与夜间城市气温的居高不下关系密切。

积极推进城镇化的中国政府正在试图推行海绵城市的概念,使其成为城市对抗强降水的新手段。已经有30个城市加入海绵城市建设试点项目,目标是通过增加绿地面积,改造下水系统,将70%的降雨就地消纳和利用。

而在建设海绵城市的诸多手段中,绿色屋顶是一种一举两得的技术,可以同时达到滞蓄雨水和改善热岛效应的双重功能。而作为绿色屋顶的积极研究和推广者,德国的经验对中国有重要的参考价值。

#### 隔热又蓄雨的绿色屋顶

绿色屋顶是一种高技术含量的屋顶建设技术,需要在防水的建筑屋顶铺设土壤等介质以种植植物,有些绿色屋顶还需要完善的排水和灌溉系统。据德国气象服务站(Deutscher Wetterdienst)2015年的研究报告《打造可持续性发展的城市空间》(Urbane Räume nachhaltig gestalten),不同的建筑结构以及绿化面积大小会影响到温度,以市中心建筑为例,百分百绿化率的绿色屋顶可降低地表附近气温将近1.5度。

绿色屋顶也有助于雨水管理:一部分雨水保留在屋顶植被当中,而不是排入下水管,而后通过蒸发实现自我循环;极端天气时,一部分雨水滞蓄在植被中,而后才慢慢流出,减缓极端天气的瞬时冲击,排解排水系统的压力。

90 percent. Rainfall typically seeps from the soil mat over four hours later so heavy rainfall enters drainage systems gradually.



*Green roofs can protect buildings from extreme heat and heavy rain, helping to keep them cooler and reduce run-off*

*滯蓄雨水还能降低地面温度——一举两得的绿色屋顶能在中国流行吗？德国的成功经验值得参考*

Source / 图片来源: Gerhard Bulyga / pixelio.de

### The German model

The country's expanse of green roofs has increased rapidly. Germany had 86 million square metres in 2014, with new additions of roughly eight million square metres a year, according to the European Federation of Green Roof and Wall Associations. Today, this has risen to between 100 and 150 million square metres, the German Roof Gardens Association estimates. "Growth has been particularly fast recently as part of the response to climate change," says Wolfgang Ansel, an official with the association. A mixture of federal and local laws, backed by supportive subsidies, and punitive higher taxes on run-off from conventional roofs has driven the growth.

The first wave of green roofs appeared in the 1960s, followed by research into waterproofing technologies in the 1970s, and into environmental impacts in the 1980s, when local governments also started to issue supportive policies. But it was only with the passing of federal laws that green roofs started to be built on a large scale, says Goya Ngan, a Canadian landscape architect and expert on Germany's green roof policies. He credits the 1992 UN Earth Summit's Local Agenda 21 initiative, and EU directives, with shaping sustainable development strategies for European nations, and Germany's legislation.

German federal law demands that each state produce a landscape plan, and federal nature conservation

汉堡港口城市大学 (HafenCity Universität Hamburg) 从2014年到2017年对汉堡绿色屋顶策略对雨水管理产生的影响进行了跟踪研究。研究人员马歇尔·李希特 (Michael Richter) 和沃尔夫冈·迪克号特 (Wolfgang Dickhaut) 在为国际绿色屋顶协会 (International Green Roof Association) 撰文时指出:种植土超过6厘米的粗放型绿色屋顶 (extensive green roof) 可以保留60%的降雨,而生长介质超过50厘米的密集型绿色屋顶 (intensive green roof) 雨水保留量超过90%。从雨水降落到雨水溢流,也就是雨水滞蓄的平均时间为277分钟。

### 绿色屋顶在德国:从鼓励到强制

早在上个世纪60年代,德国就出现了绿色屋顶的建设潮流,70年代研究防水技术和材料,80年代研究其生态效应,不同的地方政府也开始出台政策支持绿色屋顶。

但真正促使德国绿色屋顶政策得到大范围制定和执行的,是联邦法律。加拿大景观建筑师戈雅·尼安 (Goya Ngan) 在其研究报告《绿色屋顶政策:鼓励可持续性设计的手段》(Green Roof Policies: Tools for Encouraging Sustainable Design) 中指出,1992年联合国地球峰会 (1992 UN Earth Summit) 召开,由此产生的21世纪议程 (Local Agenda 21) 催生了欧洲许多国家一系列可持续发展战略,而欧盟关于生态环境的指令也影响到了德国联邦法律,从而影响到了地方绿色屋顶政策。

如今,很多德国城市都有绿色屋顶支持政策,包括财政补贴,减少雨水费,或制定地方法规等。从2014年到2019年,汉堡市环境和能源局将推出价值300万欧元的绿色屋顶资助项目。

支持政策带来了绿色屋顶的大发展。据欧洲绿色屋顶联合会 (European Federation of Green Roof and Wall Associations, 以下简称EFB) 2015年白皮书 (2015 White Paper),德国2014年有8600万平方米绿色屋顶,并以每年800万平方米的速度在增长。

此外,德国建筑绿化专业联合会 (Fachvereinigung Bauwerksbegrünung e.V. 简称FBB) 2016年针对绿色屋顶发展政策,对人口超过1万居民的1488个德国城市进行问卷调查的结果为:存在直接补贴的城市为6%,减少雨水费的城市为79%,而有着绿色屋顶建设计划的为51%,较2014年有11%的增幅。



laws stipulate compensation for environmental damage in greenfield developments, which can be "paid" by installing green infrastructure, according to a 2011 report in Solutions Journal by German and US-based researchers. "Munich and Stuttgart have become examples of what can be done," says Ansel. Munich has required green roofs on new buildings since 1996. Germany's eighth largest city, Essen, has recently ruled that all new buildings and restoration work in its city centre must have green roofs.

Private householders also pay heavier taxes on conventional roofs, based on estimates of how much storm water run-off will enter local drainage systems. For instance, in Hamburg the tax on a roof with five centimetres of planted soil is half that of an ordinary roof.

Out of 1,488 German urban areas with more than 10,000 people, 79 percent have financial incentives for reducing storm water run-off according to a 2016 survey by Germany's Association of Green Building Companies. Six percent of them offer subsidies to install green roofs, and 51 percent have drawn up green roof building plans, an 11 percent rise on 2014.



An example of a green roof in Germany  
德国的绿色屋顶

Source / 图片来源: efb-greenroof

### Obstacles ahead

However, there are significant barriers facing the spread of green roofs globally, the most important being the lack of high-quality, lightweight systems suitable for different climates and ecosystems, as the European Federation of Green Roof and Wall Associations pointed out in a 2015 white paper.

德国屋顶园艺联合会 (Deutscher Dachgärtner Verband e.V. 以下简称DDV) 负责人沃尔夫冈·安泽尔 (Wolfgang Ansel) 在采访中说: "我估计德国现在有1亿到1.5亿平方米的绿色屋顶, 最近其作为应对气候变化的举措发展尤其迅猛。"

一些城市甚至开始强制新建筑配备绿色屋顶。早在1996年, 绿色屋顶建设在慕尼黑就成为义务。"慕尼黑和斯图加特都已成为城市绿色屋顶的样本。" 安泽尔说。而最近, 德国第八大城市埃森 (Essen) 也在讨论, 在其市中心规定新建、改建、翻修建筑须建成绿色屋顶。

### 成本和效益的衡量

绿色屋顶的推广仍存在障碍, 主要集中在标准和成本两个方面。

在世界范围内, EFB在2015年白皮书中指出, 绿色屋顶缺乏一个高质量的轻量系统, 以适应各地不同的气候和生物多样性。

而在德国, 有景观发展和建设研究会 (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. 简称FLL) 这样的专业机构负责制定发布绿色屋顶的技术指标和指南。

另一个障碍就是高成本。绿色屋顶的成本包括一次性成本, 即安装成本, 和续生成本, 即维护和灌溉。收益也包括一次性收益和长期收益。其中一次性收益包括节省了安装雨水管理设备的费用, 或者更低的雨水费。在西方很多国家都有雨水费一说, 即对建筑的不渗水面积进行收费。不同城市收费标准不一, 以汉堡为例, 种植土大于5厘米的绿色屋顶的雨水费是同等面积普通屋顶的一半。长期收益包括使用寿命长, 能让房产升值, 维护绿色屋顶也创造了就业岗位, 更不用说节能和环境的好处。

不过, 在这个成本和收益的公式里, 主要问题是: 其一, 高成本发生在前, 收益远远发生在后, 其二, 收益难以量化。

汉堡市的绿色屋顶政策报告中, 有一份绿色屋顶和砾石屋顶的成本对照: 按300m<sup>2</sup>来算, 前者第一年的初期成本为9437欧元, 是后者的三倍多, 但40年后二者的长期成本已经持平。而如果算上补贴, 绿色屋顶40年周期的成本优势可达到5098欧元。

Another barrier is high up-front installation costs. In Hamburg, green roofing costs three times more than a gravel alternative although costs equalise over a 40-year period. However, add in subsidies and the green roof is cheaper.

Early adopters have paid the most. Switzerland's first modern green roofs, built in the 1990s, averaged 20 USD per square foot ( $1 \text{ m}^2 = 10,8 \text{ ft}^2$ ) more than an ordinary roof. In Zurich today, competition and economies of scale mean the cost premium is only 3 USD per square foot, according to engineering and environmental consultancy firm Arup.

### Next steps in China

Zhao says China has experimented with green roofs before, with some showpiece roofs dating back 40 years in Beijing and Shanghai. Green roofs are spreading thanks to more light-weight projects that use less soil. Zhao's own research is focused on developing and popularising these lightweight systems.

According to a report in Beijing's Legal Daily newspaper, the municipal government started to promote green roofs in 2005, and the city now has over two million square metres of them, though there is still a need for more funding and greater awareness.

However, unclear ownership of roofs on many residential buildings is also a major problem, notes Zhao in an article in the China Building and Waterproofing journal. To remedy this, the government needs to take a lead in promoting green roofs through legislation and additional funding, says Zhao.

Although there is still no legislative support for the promotion of green roofs, there has been some government funding: 800,000 square metres of Beijing's two million square metres green roofs had government funding. Green roofs were encouraged to improve air quality for the 2008 Beijing Olympics, and were used on many of the temporary international pavilions for the 2010 World Expo in Shanghai.

And with higher temperatures and heavier rains expected in the decades ahead, it is hoped that efforts to develop green roofs, together with the "sponge city" projects already underway, will develop further.

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根据建筑环境咨询公司ARUP今年的一份报告则显示,越早进入这个市场,绿色屋顶成本劣势越小。报告提到:瑞士的第一批现代绿色屋顶始于上个世纪90年代,其当时高于一般屋顶的成本为20美元/ $\text{ft}^2$  ( $1 \text{ m}^2 = 10,8 \text{ ft}^2$ )。而今在苏黎世,因为竞争和规模经济,其高出一般屋顶的成本仅为3美元/ $\text{ft}^2$ 。

### 如何在中国推动绿色屋顶?

很多西方国家都会来德国学习绿色屋顶的技术和推广政策。而上海市农科院高级农艺师赵定国也认为德国的经验和教训值得借鉴。他从1999年开始从事轻型屋顶绿化技术研究和推广。

其实中国城市很早就尝试屋顶绿化了,北京、上海都有一些历史超过40年的知名屋顶花园,而真正推动了绿色屋顶发展的是(使用种植土较少的)轻型屋顶绿化方案的提出,赵定国介绍道。

据《法制晚报》报道,北京市政府从2005年起开始推广屋顶绿化,至今全市屋顶绿化面积超过了200万平方米。

不过,总的来说资金以及观念普及都是绿色屋顶进一步推广需要解决的问题,而中国城市大量多业主商品房的复杂产权状况也是绿色屋顶推广的障碍,赵定国在一篇发表于《中国建筑防水》杂志的文章中指出。

至于中国该如何推广绿色屋顶,赵定国认为,一是政府先行。他特别指出:德国汉堡的屋顶绿化受到到访的美国芝加哥市长的关注,而后芝加哥市政厅建设率先做了屋顶绿化。二是政府资助,三是法律推进。

在采访中他表示,绿色屋顶的推广目前还没有专门的法律支持,但前两条中国已经在参考,例如“2008年北京奥运会对空气质量的要求,推动了城市重视屋顶绿化;2010年上海世博会,许多外国展馆展出屋顶绿化和外立面绿化,推动了政府补贴屋顶绿化的决心。”另外,在北京的200多万平方米绿色屋顶中,有约80万平方米得到了政府资助。

也许,气候变化背景下越来越频繁的高温和暴雨,以及正在试点的“海绵城市”概念,会成为绿色屋顶在中国发展的新的契机。

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# Energy

## Industry Energy Efficiency and Renewable Energy – German Business Delegation to China

### 能源解决方案出口倡议计划下的德国能源效率与可再生能源企业代表团

During 14-16 November 2017, AHK Greater China Shanghai and Baden-Württemberg International jointly organized a business delegation on behalf of the Federal Ministry for Economic Affairs and Energy, in the framework of the German Energy Solutions Initiative. Focusing on industrial energy efficiency, including self-sufficiency with renewable energies, over 80 participants joined in the Sino-German Technology Forum that took place on November 14. Eight German companies specializing in industry energy efficiency presented their technologies and services, alongside presentations of senior experts from Germany and China in this field.

The developments in the area of energy efficiency in China began several years ago: The "Energy Saving Act" has been already enacted in 1997, but did not provide the individual government units with clear responsibilities for enforcement. As a result, the positive effects ultimately remained weak at that point in time. After the Act has been renewed in 2007, it laid the legal foundation for energy-saving measures in the 11th Five-Year Plan for the period of 2006 to 2010. In this context, the responsibilities of the government were defined and energy-intensive products were banned. It also penalized energy-wasting companies and created incentives for energy efficient behavior. In a further effort, the "Measures for the Implementation of Energy Efficiency in Industry" came into force in June 2016.

The German government has been closely involved in the global dissemination and transfer of technologies for energy efficiency and renewable energies under the framework of its export initiatives. The program in China aims to showcase German products, technologies, systems and service providers in the field of renewable energies and energy efficiency in the industry with the great opportunity to introduce a range of solutions and know-how to the Chinese market and its key industry players, design institutes and developers.

2017年11月14 - 16日期间,德国工商大会上海代表处德中生态商务平台 (econet china) 与巴登符腾堡国际经济和科学合作有限公司受德国联邦经济与能源部的委托,携手组织了一个以工业能效为核心的商业代表团,其中包括利用可再生能源进行能源自给在出口倡议计划框架下的德国制造能源解决方案。11月14日,来自德国的八家可再生能源企业、德中可再生能源业界专家作为主讲嘉宾与80多位中德来宾进行了密切的交流。



*Representatives of eight German companies joined the business delegation to China under the German Energy Solutions Initiative*  
八家德国企业的代表参加了此次能源解决方案出口倡议计划下的商业代表团

中国能源效率领域的发展起步早:1997年颁布了“节能法”,但并未赋予各单位明确的执法责任,其积极影响还是比较薄弱。2007年节能法被更新,十一节节能法律措施出台。此外,对执行单位的责任给出了界定,高耗能产品被禁止,惩罚浪费能源的企业,并为节能行为制定激励措施。2016年6月“工业节能管理办法”生效。

德国政府一直在能源解决方案/德国制造出口倡议的框架下,密切参与全球能效和可再生能源技术的推广和转让。该计划旨在把行业内可再生能源和能源效率领域的德国产品,技术,系统和服务提供商引进中国市场,介绍给重要行业参与者,设计机构和开发人员。

Daniel Eckmann, head of econet china at AHK Greater China Shanghai, opened the one-day conference with a warm welcome to the business delegation and all participants. Katja Lison, project manager at Baden-Württemberg International then gave a detailed introduction of the Energy Solutions Initiative, the targets of the German energy transition "Energiewende", the application of renewable energies in Germany and also the German companies of the delegation.

Eight companies from Germany in the field of energy efficiency and renewable energy participated in the delegation and introduced their products and services to the Chinese audience:

Markus Diem of Drees & Sommer Engineering Consulting was the first to give a speech and shared the benefits of starting energy conservation planning as early as possible. Energy efficiency is an important part of the planning and design process as well as operational procedures. Subsequently, William Ou, general manager of Caesar Air Compressor, introduced an advanced energy saving technology for an air compressor system.

In the following presentation, Sven Jensen of Duerr-Cyplan illustrated an innovative process for extracting energy from waste – a method called organic rankine process (ORP). The related technology has already become cost-effective and combined power and waste heat can recover previously lost energy. As this area is still at an early stage, China is interested in international cooperation to further develop this technology under new market conditions.

Moreover, the company Arqum gave an overview of the current challenges facing industrial energy efficiency and how they can be dealt with. Qin Dengke provided insights into the energy efficient solutions of Wilo and pointed out the significance and opportunities of energy efficiency. In IS Predict's corporate presentation, Johannes Vizethum introduced a powerful algorithm based self-learning and adaptive software tool that can improve the energy efficiency of various industrial sectors. Bosheng Yao of AAA Energy Efficiency Solutions illustrated a detailed mathematical analysis of the pump optimization theory.

During the final company presentation, Bernhard Rill showed Gustav Klein's latest achievements in the field of simulation tests and energy storage solutions for battery packs of electric cars. So-called new energy

德中生态商务平台负责人Daniel Eckmann先生在会议开幕式上对商务代表团和所有与会者表示热烈的欢迎。巴登符腾堡州项目经理Katja Lison详细介绍了出口计划,德国“能源转型”的目标,德国可再生能源的使用以及介绍了代表团中的德国公司。



*The exchange between Chinese and German stakeholders during the conference was described as beneficial*  
会议期间中德双方利益相关者的交流被认为是非常有帮助的

来自德国的八家工业能效和可再生能源领域企业依次介绍了自己的先进技术及产品。

迪索工程咨询(上海)有限公司的Markus Diem先生第一个发起了演讲,分享了尽早开始节能规划的好处,能源效率是规划和设计过程以及运营运营中的重要组成部分;凯撒空压机(上海)有限公司欧志球先生介绍了空压系统节能改造。杜尔Cyplan公司的Sven Jensen先生介绍了一种从废物中提取能源的新颖创新工艺,这个过程叫做有机朗肯过程,因为这项技术已经变成了成本效益。热电联产和废热回收相结合,可以恢复以前损失的能源。这个能源回收领域还是非常新的,中国会愿意感兴趣合作,以便在新的市场环境下进一步发展这项技术。

Arqum GmbH为大家讲解了目前的工业能效面临的问题和如何通过已知途径减少的可能性;威乐公司的秦登科先生带来了威乐的能源效率解决方案,也指出了能源效率的重要性;在IS Predict的企业介绍中,Johannes Vizethum先生介绍了一种基于强大算法的自学习和自适应软件工具,可以提高行业各个部门的能源效率;AAA公司的姚柏生先生对水泵优化理论进行了非常详细的数学分析。

Bernhard Rill在演讲中深入Gustav Klein的最新成果:测试模拟与电动汽车电池组的储能解决方案。新能源汽车的话题目前在中国是一个绝对的热门市场,特别是在测试和仿真以及变频和变频器领域,Gustav Klein期望有很多机会能够把他的创新产



vehicles are very topical at the moment in China and an absolute growth market. Especially in the field of testing and simulation, as well as frequency conversion and converters, the German company expects promising business opportunities. Particularly interesting was the solution in collaboration with Smart, in which even new and unsold car batteries are used as temporary energy storage solutions.

In addition, the China-German Energy Partnership was presented by GIZ with an overview of current business models and trends regarding energy storage technologies and markets, optimized energy efficiency solutions for industrial plants, as well as energy transition as a perspective for economic growth and promotion of energy efficiency in the Chinese industry.

Within the two days after the conference, the delegation companies participated in individual on-site visits to stakeholders in the Chinese market such as Shanghai SBC Green Building Energy Service, China Baowu Steel Group Corporation, Shanghai Goldwind Energy Technology, Shenzhen Institute of Building Research and Capitaland, in order to explore further business cooperation opportunities.

Overall, the participants gave a very positive feedback. Especially the organization of the program activities and the support of AHK Greater China Shanghai were evaluated very positively. The goal of the business delegation trip, to give the German participants the opportunity to establish relevant contacts, meet potential business partners and find out about the framework conditions, and opportunities for cooperation in the Chinese market, has been considered in the program's design from the beginning. In the individually prepared business-to-business meetings, the participating German companies were able to discuss ways of establishing collaborations with potential business partners in China. The exchange with other market players during the conference was also described as beneficial.

Due to the further opening up and growth of the Chinese market in the field of industry energy efficiency, it still offers interesting opportunities for German companies in some areas. The Chinese partners repeatedly expressed the wish to continue to receive more companies in the future and have promised their willingness to support the organization of activities and initiation of business talks.

品放在这个增长市场上。非常希望与Smart合作,把电池存储解决方案在即使是新的和未售出的汽车上使用。

另外,来自于中德两国多个专家也在大会做了主题发言,来自德国国际合作机构的中德能源合作伙伴介绍了关于出口倡议能源,能源存储技术和市场 - 目前的商业模式和趋势,工业厂房能效优化解决方案,在中国企业内的能源转型视角的经济增长和促进能源效率。

在接下来的两天内,代表团对与潜在的德国合作伙伴进行了一对一的现场考察,如上海斯宾茨建筑节能技术有限公司,中国宝武集团,上海金风能源科技有限公司,深圳市建筑科学研究院 (IBR),凯德集团等进一步探讨商业合作机会。

总之,与会者给予了非常积极的反馈。尤其对项目的组织和德国商会上海代表处的支持得到了非常积极的评价。这次代表团访华目的是让德国参与者有机会建立相关联系,会见潜在的商业合作伙伴,了解在中国市场的框架条件以及寻找合作的机会,这一直是项目规划设计的一部分,从一开始就考虑和实施。在一对一的企业对接交流中,参与的德国公司能够与潜在商业伙伴讨论建立业务的方式。会议期间与其他市场参与者的交流也被认为是非常有帮助的。



*German experts introduced the industrial energy efficiency sector in Germany and the current developments and trends for renewable energies*

德国专家介绍了德国工业能效领域和可再生能源的最新发展趋势

由于中国市场在行业能效领域的开放和发展,尽管德国公司在中国经济总体低迷,但这仍然为德国企业在一些地区提供了巨大的机遇。中方的合作伙伴多次向德国商会上海代表处表示希望未来能够继续接收更多的公司,并承诺愿意帮助组织项目和开展商务谈判。

# Environment



## Aquaponics – New Prospects for the Aquaculture Sector

### 养耕共生 — 水产养殖业的新前景

The world's population is growing rapidly, with a rise to 10 billion by 2056, according to estimates of the United Nations. With such a large increase, finding new solutions to nutrition shortages is more urgent than ever. Fish offer an important supply of protein, and compared to other sources of animal protein it is climate-friendly – a pound of fish has about one-seventh of the carbon footprint of a pound of beef. Even so, natural ecosystems such as oceans and inland waters cannot meet the rising demand. Unsustainable fishing already affects 30 percent of the ocean's wild fish populations. The Chinese government has implemented measures in order to protect maritime wildlife. For example, the central province of Hubei will, by August 2018, ban fishing in 79 nature reserves in order to restore the ecosystem of the Yangtze River. Furthermore, with a duration of three and a half months, this year's annual fishing ban in the South China Sea represented the longest since the introduction of this practice. New forms of agriculture can alleviate the pressure on ecosystems, while generating greater output.

#### Intensive aquaculture

Aquaculture, raising aquatic animals such as fish in tanks, is an attractive alternative to conventional fishing. According to the Food and Agriculture Organization of the United Nations (FAO), it is one of the fastest growing areas of agriculture, with half of fish production now coming from farms. 60 percent of all global aquaculture production can be found in China. However, many forms of aquaculture in the Middle Kingdom operate on a small scale, without the implementation of sustainable practices. Farmers are often without appropriate training, leading to unsustainable business practices, such as the overuse of antibiotics. In addition, water contaminated with fish waste, left-over fish feed, and medicine, is frequently released back into waterways instead of being treated at appropriate facilities.

Fish meal, the most common feed used in aquaculture, is mainly made out of small species for example

世界人口正在迅速增长，联合国预计到2056年全球总人口数将达到100亿，而随之而来的营养供给短缺问题亟待解决。鱼类产品是一种气候友好型的蛋白质来源，相比其他肉类而言，生产一英磅的鱼肉的碳足迹约于同等重量牛肉的七分之一。尽管如此，自然水源如海洋、内陆湖河中的鱼类仍无法满足日益增长的食材需求量。不可持续性捕鱼方式已经影响到海洋中30%的野生鱼类种群的生存。中国政府部门已对保护海洋生物采取了相关措施，比如，为修复长江生态系统，湖北省将于2018年8月前对79个自然保护区颁布捕鱼禁令。另外，南方今年的休渔期长达三个半月，为史上最严最长。创新型农业能为生态系统减负并创收。



*Small low-valued fish are turned into feed for aquaculture*

小型低值鱼作为水产养殖业饲料

Source / 图片来源: Zhu Li / Greenpeace

#### 集约化水产养殖

水产养殖是常规捕鱼很好的替代方式，如养鱼池喂养。联合国粮食及农业组织（FAO）表示水产养殖业发展很快，其供应量占鱼类产品总量的一半。中国水产养殖业的规模居全球之首，占全球产量的60%，但这个行业中却充斥着大量的小型鱼场，而且大多缺乏规范。水产养殖户们大多未接受过专业培训，从而造成养殖方式不当，例如抗生素使用过量；鱼类废弃物、鱼饲料残留物和药物未经过妥当处理就重新进入自然水体中。



sardines, leading to overfishing of those fish and unwanted side-effects in the marine ecosystems. China is the largest importer of fish meal, accounting for about one-third of the total trade, putting more pressure on Chinese marine ecosystems. Even though aquaculture can be a useful model to provide more food for a growing world population, the unsustainable practice found in Chinese aquaculture farms tend to contribute further to exploitative practices and environmental degradation. But with the right setup, aquaculture has the potential to reduce environmental pressure and provide a fast regrowing, low-carbon source of animal protein.

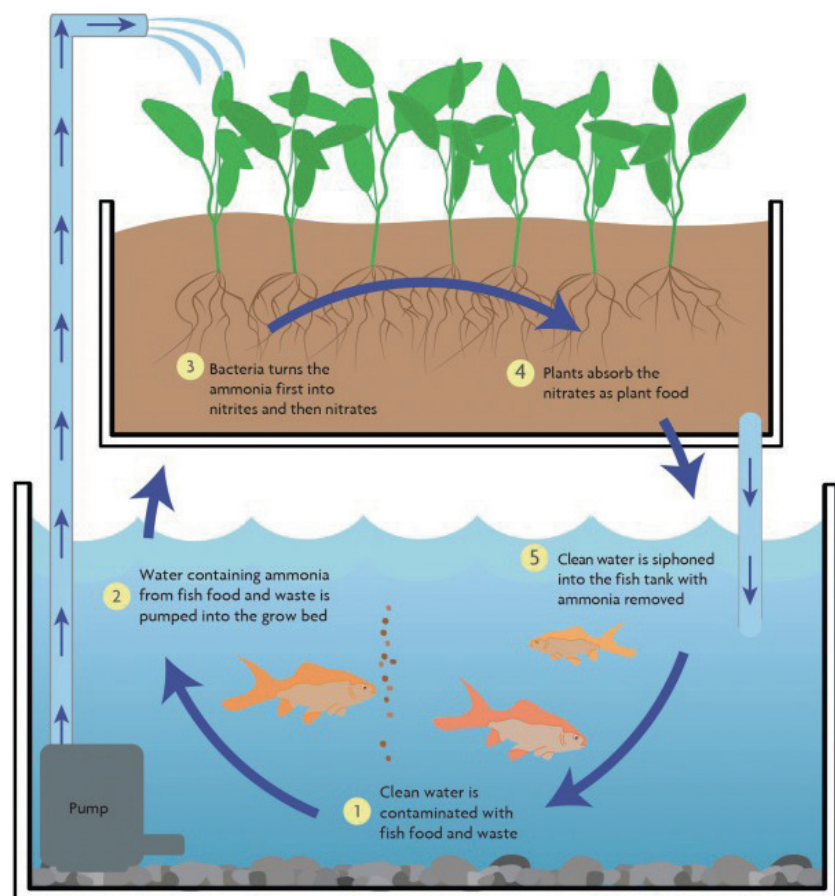
### Aquaponics and sustainable aquaculture

Aquaponics represents an alternative food-production system, combining aquaculture with hydroponics, the cultivation of plants in a soil-free environment, to create a symbiotic environment. The complementary needs of fish and plants are used to create a closed circulation unit, eliminating the drawbacks of each individually, thereby conserving resources. The ammonia of the fish-waste-filled water is, with the help of nitrifying bacteria, converted into nitrates. These provide an organic source of food for the plants, which in return naturally filter the water for the fish. The water, evaporated by the plants, is regained and condensed back into liquid through “cold traps” in the air-conditioner and then returned back to the fish tank. Additionally, the  $\text{CO}_2$  exhaled by the fish is absorbed by the plants and turned into  $\text{O}_2$ . Through this closed-loop system the daily need for fresh water can be reduced to less than three percent of the total volume. Aquaponics only uses one-tenth of the water that soil-based gardening requires. Furthermore, the plants are not grown in soil, but in long tubes with water constantly flowing through them. This soilless environment prevents pathogens from entering the system, making drug use generally unnecessary. In addition, if the system is powered by renewable power sources, aquaponics can run

鱼粉作为饲料在水产养殖业被广泛应用,主要由像沙丁鱼一类的原料粉碎加工制成,但由此带来的过度捕捞会给海洋生态环境造成不良的副作用。中国是鱼粉进口最大国,占全球总交易的1/3,因此给中国的海洋生态系统带来了更多的压力。尽管水产养殖模式能够为日益增长的人口提供更多的食物,然而中国该行业的农场不可持续的运营方式会导致资源过度利用和环境退化。如果水产养殖业能采用正确的方式,则在减缓环境压力和提高快速可再生、低碳动物蛋白质来源两方面有很大潜力。

### 养耕共生和水产养殖业的可持续发展

养耕共生是一种新型的复合生产体系,它把水产养殖与水耕栽培这两种原本完全不同的农耕技术,通过巧妙的生态设计,达到科学的协同共生,从而实现养鱼不换水而无水质忧患,种菜不施肥而正常成长的生态共生效应。鱼和植物的需求互补,形成一个闭环系统,并能消除各自的弊端,实现资源优化。养鱼池中的氨气经过硝化细菌的处理成为硝酸盐,它们可成为植物的有机养料,并对养鱼池里的水有过滤作用。植物产生的水蒸汽,经过空气调节系统的冷却重新凝结



The Aquaponics Cycle

养耕共生循环

Source / 图片来源: Jillian Helvey / aquaponichowto.com

almost emission free. Through all these advantages aquaponics achieves a sustainable and climate-friendly system of food production.

The interaction of water, land and resource optimization while minimizing waste was already known and used in ancient China. The dyke-pond system, a practice in which multiple species of fish were cultivated in deep ponds with vegetable and tree crops being grown around the ponds, utilizing the nutrient-rich fish water, was practiced for centuries.

In an aquaponic system, fish such as the tilapia, catfish, and carp are grown jointly with different vegetables, for instance tomatoes, lettuce, basil, bell pepper and chili. Aquaponics respond to the challenges of the 21st century by providing healthy, local and sustainable food produced in a resource efficient way. Additionally, aquaponic systems are very versatile. This system can be used in areas that are too dry for conventional agriculture, or areas with poor soil that are unsuitable for farming. Moreover, aquaponic farms are not bound by size, and they can be set up in a wide variety of sizes, from single-barrel installations to large-scale farms. The fact that this system enables the production of large amounts of food in a small area makes it suitable for urban farming as well. Due to this wide range of applicability, aquaponics offers the possibility to grow food where it will be consumed, helping to reduce transport costs.

### The Tomatofish

The EU funded INAPRO project, developed at the Leibniz-Institute of Freshwater Ecology and Inland Fisheries, is a good example of a pioneering aquaponic project. Focusing on the production of tomatoes, it is also referred to as the “Tomatofish” project. With only 200 liters of water, it managed to produce up to two kilograms of tomatoes and one kilogram of fish. In conventional cultivation, producing one kilogram of tomatoes consumes 184 liters of water. Environmentally friendly INAPRO aquaponic facilities operate not just in Germany, but also at a site in Shouguang, Shandong Province, south of Beijing. At the Shouguang facility, mushrooms are integrated into the aquaponics system. But Tomatofish facilities are not the only form of aquaponics to be found in China: other commercial aquaponic farms have been established as well, demonstrating the technical and financial feasibility of the system. Nonetheless, the market potential for sustainable aquaculture in China has so far remained largely unexploited and leaves room for further investments.

成为液态水并被养鱼池再次利用。另外鱼呼吸产生的CO<sub>2</sub>也会通过植物的光合作用转化为O<sub>2</sub>。养耕共生系统的每日新增水量少于系统总流量的3%，植物生长的水需求量仅为传统土壤种植1/10。同时，该系统中植物生长在有流水的长试管中。脱离土壤栽培的方式阻止了病菌进入系统，因此也无需使用农药。整个系统由可再生能源供应，运行过程中几乎没有任何温室气体的排放。养耕共生具有多种优势，是一种可持续的气候友好型复合生产体系。通过水土相互作用实现资源优化的方式在中国古代就已经被人们熟知并长期实践，即稻田养鱼，就是把不同物种的鱼类置于深水池塘中，利用池塘中的养分在周围种植蔬菜或者树木。养耕共生系统里，罗非鱼、鲶鱼和鲤鱼等鱼类可和番茄、莴苣、罗勒、灯笼椒和红辣椒等植物一起培养，是应对世纪难题提供健康、本地和可持续食物的资源节约型解决方案。同时该系统还具有广泛的适用性，可用于无法进行常规农业的干燥地区或土质条件较差不适合发展农业的地区，且不受大小的限制，从单体容器到大规模农场化应用均可应用。而且，该体系单位占地面积小、植物产量高的特点还适用于城市农耕，并可布局在邻近食材消费地区，节省交通运输成本。



*In an aquaponic system, fish such as the tilapia, catfish, and carp are grown jointly with different vegetables, for instance tomatoes, lettuce, basil, bell pepper and chili*

养耕共生系统里，罗非鱼、鲶鱼和鲤鱼等鱼类可和番茄、莴苣、罗勒、灯笼椒和红辣椒等植物一起培养

Source / 图片来源: Ryan Somma

### “番茄鱼”项目

德国莱布尼兹淡水生态与内陆渔业研究所发起的欧盟FP7“鱼菜共生系统 (INAPRO)”项目是养耕共生项目的一个优秀实践案例，由于所种植的植物为番茄，又被称为“番茄鱼”项目。该项目可用200公升水种植2公斤番茄并饲养1公斤鱼，采用常规农耕方法种植1公斤番茄则需184公升水。INAPRO项目不仅在德国实施示范，也落户于山东省寿光市，并在寿光的试点中增添了蘑菇种植。“番茄鱼”项目并不是中国唯一的养耕共生模式，还有其他商业运作项目，这也证实了该系统在技术和经济层面的可行性。因此，中国的可持续养耕共生产业的市场发展潜力巨大，投资前景可期。



# Politics

## China is Sorting its Waste and Recycling Sector 中国正在对垃圾回收处理行业进行整顿

In order to save money and resources, it has been a lucrative business for China to buy trash from around the world and extract the raw materials. It is cheaper and takes less effort to recycle certain materials, such as copper, iron, paper, and plastic, than to newly produce them. In the case of steel, for example, re-processing of materials can save up to 40 percent of energy. The lower quality of some of China's raw materials, and therefore lower suitability for recycling, additionally made waste imports attractive.

The synergy of China's need for raw materials and the world's demand of exporting waste, over the years transformed into a billion-dollar business. China is the world's largest importer of multiple types of waste. According to the Ministry of Environmental Protection, the country imported about 56 percent of the world's total solid waste output in 2016. Between 1995 and 2016, Chinese imports of waste grew tenfold, from 4.5 to 45 million tons. Last year alone, China imported 7.3 million tons of plastic waste, worth 3.7 billion USD, of which Europe accounted for 1.6 million tons. But not just European nations have greatly taken the opportunity of sending their waste to China. The main export commodity from the United States to China – with an export volume of 5.6 billion USD in 2016 – is waste. However, with China's transformation to a consumer society, the basis of this business model fades and the market situation is set to change.

On July 18th, China notified the World Trade Organization (WTO) that it would take emergency measures to prohibit 24 kinds of solid waste by the end of 2017. These include the imports of household plastic waste (e.g. PET, PE, PVC, PS), vanadium slag, unsorted waste paper, and waste textile raw materials. Furthermore, the State Council announced that imports of solid waste, which can be replaced by domestic resources, will end by 2019. In the strive for better protection of the environment, China seeks to minimize the environmental damage caused by low-quality waste imports, poor recycling practices, and small-scale operations, which are currently still omnipresent in the East Asian nation. In addition, China sees an opportunity

为了节约资金和资源，中国一直在做垃圾进口的生意，从中提取原材料，某些原材料的回收再利用的成本低于生产成本，例如铜、铁、纸和塑料等。就钢铁而言，废钢材再利用相比炼钢可节约高达40%的能耗。中国某些本地原材料品质较差，不利于循环利用，从而为垃圾进口生意提供了市场机会。



*Between 1995 and 2016 Chinese imports of waste grew tenfold, from 4.5 to 45 million tons*

1995年至2016年间，中国垃圾进口量翻了十倍，即从450万吨增长至4500万吨

Source / 图片来源: Bernd Sterzl / pixelio.de

中国对原材料的巨大需求和世界其他国家的垃圾出口的需求在过去的的时间里演变成了一桩数百亿元的大生意，中国成为世界上最大的垃圾进口国。根据环保部提供的信息，中国在2016年进口了全世界56%的固体废弃物，1995年至2016年间，中国垃圾进口量翻了十倍，即从450万吨增长至4500万吨。去年，中国进口了730万吨塑料垃圾，总价值37亿美元，其中160万吨来自欧洲。此外，美国去年对华各类垃圾出口总额高达56亿美元，成为其主要出口产品。然而，随着中国逐渐转变为消费型社会，这种商业模式的基础正在动摇，市场状况即将发生重大改变。

2017年7月18日，中国正式通知世界贸易组织（WTO），表示今年底开始将不再接收外来垃圾，禁止进口4类24种固体废物，包括生活来源废塑料（例如PET, PE, PVC, PS）、钒渣、未经分拣的废纸和废纺织原料等高污染固体废物。同时，国务院印发通知，将在2019年年底以前停止进口国内可以替代的固体废物。中国正在积极采取更为严厉的环保举措，努力解

to strengthen its domestic solid waste management, placing greater importance on waste sorting and the development of its own domestic recovery system for recyclable materials.

Ahead of the WTO notification, the Chinese government approved a new action plan, also referred to as the National Sword, which is aimed at tackling the illegal importation of solid waste. Various authorities related to the management of imported solid waste – for instance in the field of commerce, environmental protection and customs – will share information across their systems to strengthen monitoring. A one-month-long round of inspections for waste import reprocessing enterprises has been conducted in July by 60 teams in 22 regions and cities. Furthermore, China's customs conducted several rounds of rigorous proceedings on illegal import of waste. This led to the arrest of 259 suspects for importing 303,000 tons of waste. Already in 2013, the so-called Green Fence operation provided more aggressive inspections, aiming at improving the quality of imported waste. In order to ensure that the new measures will be followed, controls on imported waste will be intensified and severe punishments will be imposed on the reselling or illegal processing of imported waste. Uncertainties in explicit details as well as questions of enforcement rigor remain and already caused a disruption in the global recycling markets. Domestic as well as international enterprises of the waste and recycling sector are taking the announcements seriously.

Meanwhile, China's own waste output has increased steadily and has risen to more than 520,000 tons a day. The most common practice of waste management is landfilling and incineration. According to the Chinese government, there are up to seven billion tons of waste buried around the country's major cities. In order to strengthen the waste-to-energy sector, the incineration practice will be further increased. Data from the National Development and Reform Commission (NDRC) stated that the capacity of incineration plants will rise from 31 percent of the total garbage output from 2015 to 54 percent by 2020. Therefore, the world's largest waste-to-energy incineration plant, with a capacity of 5,000 tons a day, is currently built in the city of Shenzhen, located in the south Chinese Guangdong province. Additionally, China experiments with alternative sustainable disposal methods. For example, in a facility in the northeastern coastal province of Shandong, where 15 tons of kitchen waste a day are eaten by 300 metric tons of cockroaches.

决目前普遍存在的废物进口质量低、循环再生方式落后和小规模作坊运作等问题,力求促进固体废弃物管理、垃圾分类和循环再生系统产业的发展。

在中国向WTO递交通知之前,中国政府批复了打击走私“国门利剑2017”联合专项行动,重点之一是针对“洋垃圾”的走私违法活动,开展专项打击和集中整治。固体废物进口管理的相关行政部门,例如商贸、环保和海关,将会加强信息互通和监管整治行动。今年7月,环保部派出了60个工作组对22个省市的进口废物加工利用企业开展了为期一个月的专项督查。此外,中国海关总署今年还进行了若干轮集中督查行动,共打击了259起非法垃圾进口案件,总重量达30.3万吨。早在2013年的“绿篱”专项行动就是针对加强固体废物监管、打击洋垃圾走私开展的。进口废物的管控将会更为严格,非法交易和加工将面临严重的处罚,以此确保工作的顺利开展。尽管具体实施细节还有待确认,该通知已经引进了全球回收业市场的震动以及国际和本土企业的高度重视。



*China's customs conducted several rounds of rigorous inspections on illegal import of waste in 2017, which led to the arrest of 259 suspects*  
中国海关总署在2017年进行了若干轮集中督查行动,共打击了259起非法垃圾进口案件

Source / 图片来源: Natalie Behring / Greenpeace

同时,中国的垃圾产量稳步上升,已多达52万吨每天,国内最为常见的垃圾处理方法即填埋和焚烧。根据中国政府给出的数据,共有70亿吨的垃圾填埋在主要城市周边。为了促进垃圾焚烧发电行业的发展,政府将会鼓励以焚烧的方式处理垃圾。国家发改委表示垃圾焚烧电站的消纳能力将大幅提高,2015年占总垃圾比例31%,预计到2020年将达54%。因此,在深圳正在修建一座日处理量为5000吨的垃圾焚烧电站,建成后规模将为世界最大。中国还在研发其他可持续垃圾处理技术,例如,山东章丘环卫中心的蟑螂车间,利用300吨的蟑螂每天可处理15吨的厨余垃圾。



Beijing's strategy is not just limited to sustainable disposal methods but also seeks to improve reprocessing materials. The domestic recycling rate is supposed to reach at least 35 percent of all waste output by 2020. The State Council issued a plan in March of this year to make sorting of domestic waste compulsory. Already 43 cities have been instructed to implement waste-sorting systems and more will follow. Additionally, to cope with the growing waste problem, the government pledged to spend 252 billion CNY (36.7 billion USD) until 2020.

In order to successfully undertake these commitments, Beijing must reform and regulate the country's recycling industry, which still is highly decentralized and poorly regulated, with professional services only accounting for up to 20 percent of the total waste recovery. A lot of reprocessing plants in China are family-owned businesses with limited government oversight, failing to comply with waste processing criteria, and causing harm to the air, water and soil. Moreover, recycling providers often discard unrecyclable waste into landfills or bodies of water, or simply have it informally incinerated.

Another challenge is waste sorting, which is largely ineffective due to the lack of sustained public participation. All stages of the process need to be addressed and made public to ensure residents are willing to sort their waste, and that their efforts are not in vain. Average practice in most Chinese cities does not give much incentive to citizens to reduce and sort waste, since the same fees apply to all the households, no matter how much garbage is produced. Since 2012 the south Chinese city of Guangzhou seeks to implement a different system: garbage fees are charged based on the produced amount, encouraging households to limit their waste output. So far, the implementation of this new system has not been successful, but a new draft of the regulation, believed to eradicate some flaws, is currently being reviewed.

With every development step, China will focus more on its domestic challenges and has by now reached a level of wealth which does not require the import of many types of foreign garbage anymore. Although domestic waste output has been increasing steadily, production from recycled materials, such as steel or aluminum is still comparatively low. As such, recycling and waste processing are industries with huge growth potential in China, in particular for foreign technologies and expertise. Greater effort in waste handling and recycling could drastically cut emissions, reduce waste, and produce more affordable commodities.

北京的政策不仅限于垃圾的可持续处理,同时也包括材料的循环再加工方面。到2020年,国内再生利用率至少要达到全部垃圾产量的35%。今年三月国务院出台了一项方案,实施生活垃圾强制分类,已有43个城市实施了垃圾分类系统,之后会推广到更多城市。此外,为了处理日益严重的垃圾问题,政府承诺到2020年将投入2520亿元人民币(367亿美元)。



*Many reprocessing plants in China are still family-owned businesses with limited government oversight*

中国很多回收处理厂都是以家族作坊式运营,缺乏政府监管

Source / 图片来源: S. Flint / pixelio.de

为了成功履行这些承诺,北京必须对全国的垃圾回收行业进行改革和规范,目前该行业仍高度分散、缺乏管理,专业服务只涵盖垃圾回收总量的20%。中国很多回收处理厂都是以家族作坊式运营,缺乏政府监管,这种类型的处理厂大都不遵守废物处理标准,会对空气、水和土壤造成危害。而且,回收商通常会将不可回收垃圾直接填埋或丢弃到水体中,或者将其不规范地焚烧。

另一挑战是垃圾分类,由于缺乏持续的公众参与,它在很大程度上无法有效推行。这一过程的每个阶段都需要妥善处理并公开透明,以保证居民看到自己的努力不是白费,他们才有意愿去进行垃圾分类。从大多数中国城市的实际情况来看,政府并没有激励居民减少或分类垃圾,因为无论产生多少垃圾,每家每户收费都是一样的。2012年以来,广州市试行垃圾计量收费制度,鼓励居民控制他们的垃圾产出。到目前为止,这一政策的实施效果并不理想,现在广州正在审议一项新的管理条例草案,以弥补之前的不足。

随着经济社会的发展,中国已达到了一定的财富水平,不必再依靠垃圾进口,会更注重应对国内的挑战。虽然生活垃圾的产出持续增长,但如钢铁或铝这样的回收材料的产量仍相对较低。因此,回收和垃圾处理行业在中国具有巨大增长潜力,特别是对国外技术和专业知识引进仍有很大需求。加大垃圾处理和回收的力度,可以大幅度减少排放、减少浪费、生产更多物美价廉的商品。

## New Clean Energy Buying Option in China: Green Electricity Certificates

A contribution by Hong Miao, Alex Perera and Min Yuan, World Resources Institute

### 中国清洁能源采购新渠道：绿色电力证书

来自世界资源研究所的苗红, Alex Perera和袁敏的客邀文章

Businesses and other organizations in China have a new option for buying renewable energy, thanks to a voluntary trading platform for Green Electricity Certificates (GEC) launched in the summer of 2017. These certificates allow companies to claim the environmental benefits associated with renewable energy generation, even if the electricity from a renewable power plant does not feed directly into the company's facilities. Still in its early stages, China's GECs program is one step in a larger reform of national energy markets aimed at offering more ways for large energy buyers to purchase renewable energy at scale.

As of September 20, China's GEC trading platform had issued 8 million certificates, corresponding to 8 billion kilowatt hours (kWh) of on-grid wind and solar electricity, equivalent to what Beijing's residents consume in five months. This initial phase includes certificates only for onshore wind power and ground solar photovoltaic (PV) projects. Once renewable energy developers sell their Renewable Energy Certificates (RECs) on the voluntary market, the corresponding power is no longer subsidized by the government. So far, less than 1 percent of issued certificates have been sold. 1,552 individuals have purchased 1,900 GECs and 46 businesses and organizations have bought 19,097 GECs. While the number of GECs purchased is still small, it is a market worth tracking as it evolves.

#### Reforming China's Renewable Energy Subsidies

China's Green Electricity Certificates program is part of a government push to reform subsidies for renewable energy development. In the past decade, subsidies have supported rapid growth in China's renewable industry. But the current subsidy mechanism is dependent on fees collected from customers. Because electricity demand is flattening in China, the subsidy fund is shrinking and can no longer support the scale of investment in renewable energy needed to meet China's goals. If there is no improvement in the current subsidy mechanism, by 2020, the cumulative renewable energy subsidy funding gap could reach an estimated 200 billion CNY (about 30 million USD). Rather than spending long time obtaining public subsidies, developers are hoping that over time, the GEC

2017年7月,全国绿色电力证书自愿认购交易正式启动,为企业和其他机构开辟了全新的清洁能源采购渠道。虽然绿色电力证书认购单位的电力消耗并非直接由可再生能源电站供应,但是公司可以宣称通过绿色电力采购而获得了环保效益。中国的绿色电力证书项目刚刚起步,旨在促进能源市场更大的变革,为大型能源买家规模化采购可再生能源提供多元化的购买方式。

截止至9月20日,中国绿色电力证书认购交易平台共核发了800万张证书,相当于80亿千瓦时的上网电量,约等于北京市居民5个月的生活用电量总和。绿色电力证书认购初期,只有陆上风电和光伏地面电站两类项目可以申请绿证。企业出售可再生能源绿色电力证书后,相应的发电量不再享受国家补贴。迄今为止,1,552位个人购买了1,900张绿色电力证书,46个企业或机构购买了19,097张绿色电力证书,证书交易量占核发量的比重不足1%。目前绿色电力证书购买量还很小,其市场发展仍值得关注。



*Still in its early stages, China's Green Electricity Certificates program is one step in a larger reform of national energy markets aimed at offering more ways for large energy buyers to purchase renewable energy. 中国的绿色电力证书项目刚刚起步,旨在促进能源市场更大的变革,为大型能源买家规模化采购可再生能源提供多元化的购买方式*

Source / 图片来源: Danish Wind Industry Association / flickr.com

#### 推进中国可再生能源补贴改革

中国的绿色电力证书项目是政府推动可再生能源补贴机制改革的一部分。过去的一段时间里,补贴政策支持了中国可再生能源产业的快速发展。目前的可再生能源补贴资金主要来源于向消费者征收的电力附加费,由于近年来电力需求趋于平稳,所征收的电力附加费不足以支撑可再生能源规模的快速扩大,并且资金缺口日渐扩大。如果不对目前的补贴机制进行调整,到2020年我国可再生能源补贴缺口累计将超



market will become stronger and less risky, leading to lower financing risk, lower project costs and cheaper renewable power for all consumers.

While the GEC market is currently very small, the Chinese government is evaluating policies to strengthen it over time. A new renewable portfolio standard to mandate that energy portfolios include a certain amount of renewable power is expected in place in early 2018. This would require power producers, grid companies or provincial governments to promote renewable power generation and consumption, boosting GEC demand.

China's GEC program is still in its early stages, but there are several indicators to be observed in the coming months:

- Is the number of buyers growing?
- Are buyers increasing their purchases of GECs over time?
- Is the revenue generated by GEC purchasing helping new projects get built?
- How do companies rate the program for accessibility and credibility?

### Collaborations for Clean Energy Buying in China

Collaboration among power producers, companies and other energy players is essential for the growth of China's renewable energy. In June 2017, the Green Electricity Consumption Cooperative Organization (GECCO) launched with the support from ten leading Chinese and international organizations. GECCO has already enrolled 68 member companies and organizations. The 2017 Renewable Energy Buyers Alliance Summit in California gathered representatives from large multinational companies that have extensive operations and supply chains in China, and many of these companies joined working sessions on China to explore the best options for purchasing large-scale wind and solar power.

Large energy buyers in China can engage with organizations including WRI, as they launch pilot programs for green power purchasing and look to a forthcoming guidebook for recommendations on how companies can purchase renewable energy in China's energy market.

*This article was first published on the website of the World Resources Institute: [www.wri.org](http://www.wri.org)*

2000亿元(约3000万美元)。与其花费较长的周期等待政府的补贴,可再生能源开发商们更希望未来的绿色电力证书市场能够更为稳健、风险更低,从而降低项目的财务风险和开发成本,为消费者提供更低价的可再生能源。



*While the Green Electricity Certificates market is currently very small, the Chinese government is evaluating policies to strengthen it over time*  
目前绿色电力证书市场规模很小,中国政府正在对政策进行评估,以促进其长远发展

目前绿色电力证书市场规模很小,中国政府正在对政策进行评估,以促进其长远发展。讨论多时的可再生能源配额制有望在2018年初出台,该政策将对可再生能源的比例提出强制目标。这就要求发电企业、电网公司和省级政府积极促进可再生能源电力的生产和消费。这一政策的出台也将会提高绿色电力证书的需求。

中国绿色电力证书项目仍在起步阶段,以下几项指标有待观察:

- 购买者数量有无增加?
- 购买总量有无增加?
- 售卖绿色电力证书所获收益是否用于新项目投资?
- 可再生能源买家如何评价绿色电力证书项目的可获得性和可信度?

### 促进清洁能源采购项目在中国的合作

电力生产商、可再生能源买家和其他能源利益相关方的合作对中国可再生能源的发展至关重要。2017年6月,10个中外组织合作发起并成立了绿色电力消费合作组织(GECCO),GECCO至今已有68家会员单位。2017年9月,可再生能源买家联盟峰会在美国加利福尼亚州举行,会上有许多大型跨国公司代表出席,他们在中国有广泛的运营网络和供应链,这些企业探讨了在中国大规模采购风电和光伏电力的最佳途径。

在中国的大型能源买家可与包括WRI在内的多个机构展开合作,这些机构共同开展绿色电力认购试点项目,并将出版指导手册,为企业如何在中国购买可再生能源电力提供建议。

本文首次刊登于世界资源研究所的网站:[www.wri.org](http://www.wri.org)

## Fairs & Events 展会与活动

China Clean Energy Week 2018  
Beijing, China 25.03.2018 - 31.03.2018  
2018中国国际清洁能源科技推广周  
北京, 中国 · 2018年3月25日 - 3月31日  
www.chinacleanenergyweek.cn

Energy Storage China 2018  
Beijing, China 27.03.2018 - 29.03.2018  
第五届中国国际储能峰会暨中国国际储能技术与应用展览会  
北京, 中国 · 2018年3月27日 - 3月29日  
escexpo.cn

14th International Conference on Green and Energy-Efficient  
Building & New Technologies and Products Expo  
Zhuhai, China 02.04.2018 - 03.04.2018  
第十四届国际绿色建筑与建筑节能大会暨新技术与产品博览会  
珠海, 中国 · 2018年4月2日 - 4月3日  
chinagb.net

BBS 2018 – 6th China International Bioenergy and  
Biomass Utilization Summit  
Shanghai, China 12.04.2018 - 13.04.2018  
第六届中国(国际)生物质能源与生物质利用高峰论坛  
上海, 中国 · 2018年4月12日 - 4月13日  
bbs-summit.com

IE expo China 2018  
Shanghai, 03.05.2018 - 05.05.2018  
中国环博会  
上海, 中国 · 2018年5月3日 - 5月5日  
ie-expo.com

ISH China & CIHE 2018  
China International Trade Fair for Heating, Ventilation,  
Air-Conditioning, Sanitation & Home Comfort Systems  
Beijing, China 22.05.2018 - 24.05.2018  
中国国际供热通风空调、卫浴及舒适家居系统展览会  
北京, 中国 · 2018年5月23日 - 5月24日  
ishc-cihe.com

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#### 参考网站:

www.china.ahk.de

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Econet Monitor 相关内容参考和引用了下列网站(不完全列表):

### Green Technologies & Energy 绿色科技及能源

ESCO Committee of China Energy Conservation Association  
中国节能协会节能服务产业委员会  
emca.cn

Alternative Energy 替代能源网  
alternative-energy-news.info

China Energy Web 中国能源网  
china5e.com

China Greentech Initiative 中国绿色科技  
china-greentech.com

China Renewable Energy Society (CRES) 中国可再生能源学会  
cres.org.cn

China Renewable Energy Centre 国家可再生能源中心  
cnrec.org.cn

German Energy Agency 德国能源署  
dena.de

German Federal Ministry for Economic Affairs and Energy  
(BMWi) 德国联邦经济和能源部  
bmwi.de

Energy Efficiency Export Initiative 能效出口倡议  
efficiency-from-germany.info

Renewable Energies Export Initiative 出口计划网  
export-erneuerbare.de

Europe-China Clean Energy Centre 中欧清洁能源中心  
ec2.org.cn/en

RETech 回收技术  
retech-germany.net

Renewable Energy World 可再生能源世界研讨会暨博览会  
renewableenergyworld.com

Renewables International 国际可再生能源  
renewablesinternational.net

### Environment 环境

German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)  
德国联邦环境、自然保护、建设和反应堆安全部  
bmub.bund.de

Federal Agency for Nature Conservation 联邦自然保护局  
bfn.de

Sustainable China 可持续发展的中国  
nachhaltiges-china.de

Federal Environmental Agency 德国联邦环境局  
umweltbundesamt.de

The Guardian 卫报  
guardian.co.uk/environment

### Climate Protection & CDM 气候保护与清洁发展机制

CDM in China 中国清洁发展机制  
cdm.ccchina.gov.cn

China Climate Change Info-Net 中国气候变化信息网  
en.ccchina.gov.cn

Chinese Renewable Energy Industries Association (CREIA)  
中国可再生能源行业协会  
creia.net

Climate Focus 气候聚焦  
climatefocus.com

Climate Works Foundation 气候工作基金会  
climateworks.org

CO2 Trade 二氧化碳交易  
co2-handel.de

German Emissions Trading Authority  
德国温室气体排放量交易处  
dehst.de

United Nations – CDM 联合国-清洁发展机制  
cdm.unfccc.int

JIKO BMUB 德国联邦环境部 联合履约处  
jiko-bmub.de

KfW Carbon Fund 德国复兴信贷银行碳基金  
kfw.de/carbonfund

### Studies & Publications 研究报告与出版物

Asian Development Bank 亚洲开发银行  
adb.org/publications

Economist Intelligence Unit 经济学人智库  
eiu.com

International Energy Agency 国际能源机构  
iea.org/publications

World Bank - East Asia & Pacific 世界银行-东亚及太平洋地区  
blogs.worldbank.org/eastasiapacific

### Economy, Finance & Law 经济、金融与法律

Germany Trade & Invest 德国联邦外贸与投资署  
gtai.de

Caijing 财经网  
english.caijing.com.cn

Caixin 财新网  
English.caixin.com.cn

Eco-Business 生态商务  
eco-business.com

Environmental Finance 环境金融  
environmental-finance.com

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