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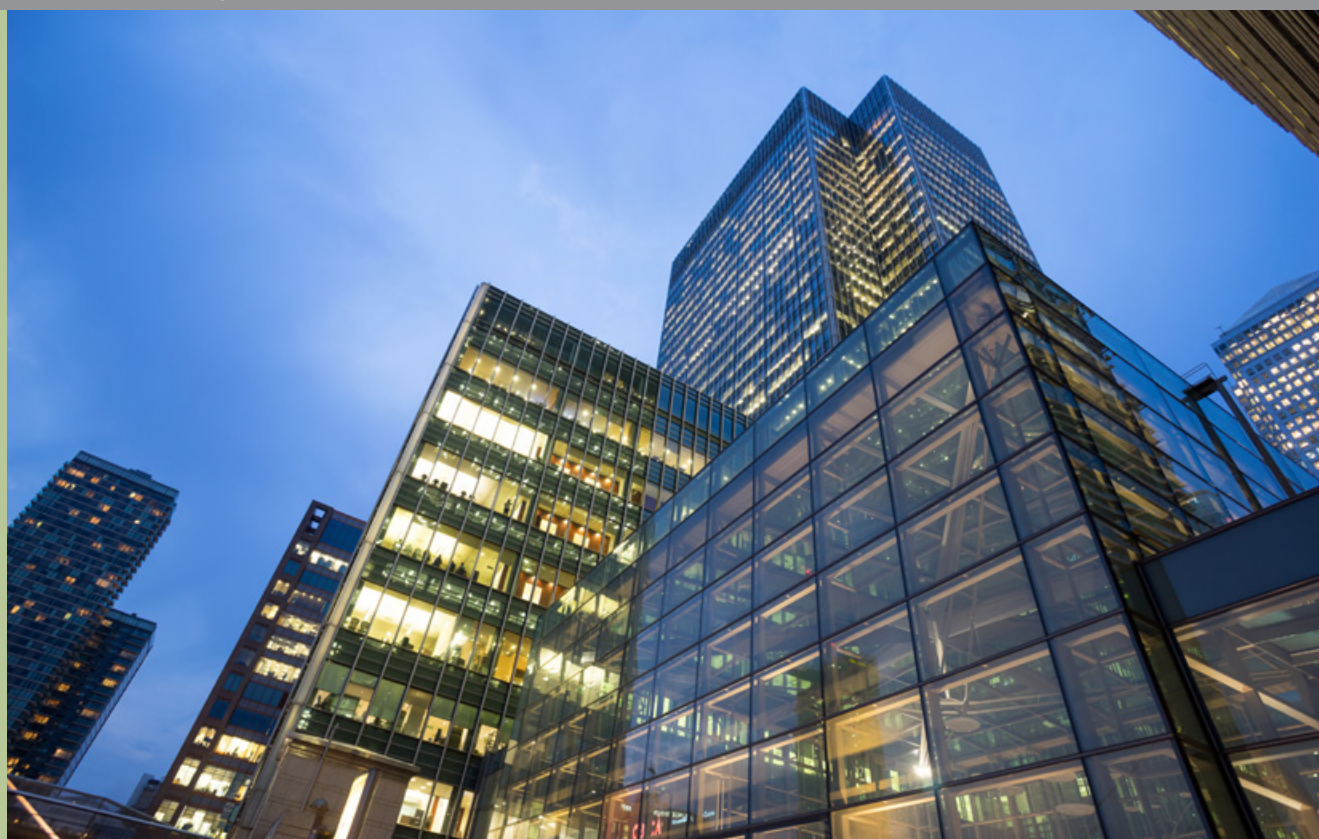


The German Chamber Network

# econet monitor special

## Green Building 绿色建筑特刊

2017 Edition 年刊



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econet china supports German SMEs in the sectors of building, energy and environment that are interested in entering the market, strengthening companies' positioning and ability for exploring business opportunities in China.

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# Foreword

On the occasion of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III), which took place in Quito in October 2016, Germany's Federal Building Minister Barbara Hendricks remarked: "Cities are the key to a sustainable, climate-resilient world." In this regard, the New Urban Agenda adopted at Habitat III is a landmark decision that clearly recognises that the struggle for a sustainable world will be won or lost in cities.

More than half of the world's population is already living in cities. This share will rise to around two thirds by 2050. Cities account for more than 70% of global greenhouse gas (GHG) emissions. By 2030, 70% of China's population will be living in cities and 80% of China's fossil fuels, industrial production, transportation and heating supply will be consumed by more than 160 cities with over a million inhabitants each.

The New Urban Agenda clearly acknowledges these trends and provides political guidance for sustainable urban development over the next two decades. The agenda sets a framework for the inclusive, sustainable development of cities. In addition, the New Urban Agenda is also an important instrument for implementing the 2030 Agenda for Sustainable Development and the Paris Climate Agreement in urban areas.

In Germany we strive for a holistic approach in our strategies for sustainable urbanisation by combining the promotion of energy efficiency and renewable energy with the principles of climate and environment protection and resource efficiency. Several German cities – for example the "Masterplan Communities" that are supported by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) – are preparing concepts to reduce their GHG emissions by 95% and to cut their energy consumption by 50% by 2050. Enhancing energy efficiency in industry and buildings as well as using local renewable energy sources play a major role in achieving these goals.

Germany's ambitious targets are also reflected in its long-term strategy, the Climate Action Plan 2050. The plan charts a course towards an almost climate-neutral building stock. A key component is the gradual further development of energy standards for existing stock undergoing refurbishment. Another important



Source / 图片来源: Bundesregierung / Sandra Steins

**Gunther Adler**  
State Secretary 国务秘书  
German Federal Ministry for the Environment,  
Nature Conservation, Building and Nuclear Safety  
德国联邦环境、自然保护、建筑和核安全部

在2016年10月于厄瓜多尔首都基多举办的联合国住房和城市可持续发展大会(人居三)上,德国联邦建设部部长芭芭拉·亨德里克斯(Barbara Hendricks)提出:"城市对于世界的可持续发展和适应气候变化至关重要。"因此,人居三大会上通过的《新城市议程》是一项具有标志性的决议,它明确指出城市是实现世界未来可持续发展的关键。

目前,世界上有超过一半的人口都居住在城市,到2050年,该比例将上升至三分之二左右。全球超过70%的温室气体排放也来源于城市。就中国而言,到2030年,预计70%的人口将居住在城市,80%的来自化石燃料、工业生产、交通和供热的能源消耗将产生于160多个超过100万人口的大型城市中。

《新城市议程》以城市化发展趋势为依据,为接下来20年的可持续城市发展提出了政策向导。该议程为城市的包容性和可持续发展提供了框架条件。另外,《新城市议程》也是执行2030年联合国可持续发展议程和巴黎气候协议的重要政策工具之一。

在德国,我们一直努力推进节能和新能源利用,遵循气候、环境保护和资源高效利用原则,实践城市可持续发展的综合战略。例如一些德国城市在联邦环境、自然保护、建筑和核安全部(BMUB)的支持下,正在实施"总体规划社区",制定减排方案,计划到2050年将其温室气体排放降低95%、能源消耗降低50%。提高工业和建筑部门能效,利用当地可再生能源,将对上述目标的实现起到重要作用。

德国宏伟的气候减排目标在其长期战略《2050年气候行动计划》中也有体现。该计划正在开发一项具有



aspect is focussing funding on heating systems that are based on renewable energy sources.

Germany is focussed on taking cost-effective and socially sound measures. Therefore, funding is also being considered for new innovations and for helping defray their extra costs where necessary.

The enormous potential for reducing GHG in the building sector is also recognised by the Chinese government in the framework of the Green Building Action Plan of 2013, which embodies targets for energy efficient construction and renovations. The 13th Five-Year Plan further calls for low-carbon urbanisation and aims to enhance the energy efficiency of buildings, improving the quality of building construction and extending the buildings' life spans. Buildings account for nearly one third of the national primary energy consumption in China, and this percentage will continue to rise as the standards of living and rate of urbanisation increase. Consequently, only a significant improvement in energy efficiency, especially in the building sector, will enable China to reach its targets.

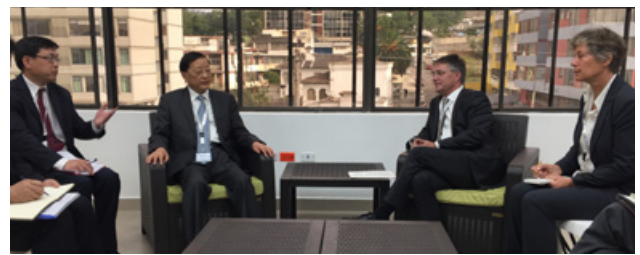
That is why sustainable urbanisation is a central pillar for the development of the Sino-German cooperation. In anticipation of the pressing infrastructural challenges in China, Chancellor Angela Merkel and China's Prime Minister Li Keqiang initiated the Sino-German Urbanisation Partnership in 2013. A Joint Declaration between the BMUB and the Ministry of Housing and Urban-Rural Development (MoHURD) on implementing the Sino-German Urbanisation Partnership forms the basis for the cooperation. The partnership aims to address the various challenges of urbanisation in China and Germany and find solutions to enhance the quality of life in our cities. We are exchanging experiences on climate-resilient, sustainable and integrated approaches to urban development that benefit cities in both countries.

This is not only of interest to China and Germany, but can set an example for countries around the globe, showing them how to support cities in combating climate change and choose a development track that supports sustainable lifestyles. In the end, a well-planned city with a compact, green, intelligently-designed structure, mixed-use neighbourhoods, climate-friendlier buildings, improved public transport and sustainable waste management can reduce an urban area's carbon footprint significantly while providing a better quality of life for its inhabitants.

竞争力的战略以实现“气候中立”建筑群，其中一个重要方面就是逐渐提高既有建筑改造能耗标准，另一方面是出资赞助依靠可再生能源的供热系统。

德国正在努力实施若干兼顾社会平等和经济可行的政策措施。因此，财政补贴也计划支持创新项目，帮助支付其所必需的额外开支。

中国政府于2013年制订的《绿色建筑行动方案》也肯定了建筑行业巨大的减排潜力，其中提出节能建设和改造的专项目标。“十三五”规划中也进一步提到在新型城镇化中坚持低碳设计，旨在提高建筑能效、改善建筑建设质量以及延长建筑的全生命周期。在中国，建筑行业占总一次能源消耗量的近三分之一。随着居住条件的改善和城市化率的上升，这个比例仍将继续上升。因此，中国只有显著提高能效，尤其是建筑行业，才能达到既定目标。



State Secretary Gunther Adler in talks with China's Building Minister Chen Zhenggao in October 2016

2016年10月德国国务秘书Gunther Adler与中国住建部部长陈政高会晤  
Source / 图片来源: BMUB / Matthias Hackstein

可持续城镇化是中德合作的关键领域之一。由于中国面临着日益严峻的基础设施发展的挑战，2013年，德国总理安格拉·默克尔 (Angela Merkel) 和中国国务院总理李克强决定落实关于中德城镇化伙伴关系合作谅解备忘录。德国联邦环境、自然保护、建筑和核安全部 (BMUB) 和中国住房和城乡建设部 (MoHURD) 签署的关于落实中德城镇化伙伴关系合作谅解备忘录为进一步合作打下了坚实基础。该合作伙伴关系项目旨在应对中德两国城镇化进程中面临的诸多挑战，并找到提高城市生活质量的解决方案。我们交流分享各自关于适应气候变化、可持续和综合城市发展的方法，让两国城市都能从中受益。

该项目不仅涉及到中德两国的利益，同时也为世界其他国家提供了范例，向他们展示了城市如何应对气候变化并发展可持续的生活方式。总而言之，一个规划合理的城市包括紧凑、绿色和智能设计的结构，混合用途街区，气候友好型建筑，良好的公共交通和可持续废物处理，以上这些方面能大幅降低城市碳足迹，提高城市居住者的生活质量。

# Green Building

## Developments for Greener Cities in China

### 中国城市绿色发展的新动态

Due to its population size, climate conditions, rapid urban growth, and global economic influence, the future development of China's cities is of particular importance and interest. Many different challenges arise as cities are growing. Problems concerning increasing energy demand and temperatures, pollution as well as flooding rest on fast urbanization and notably affect people's life and living conditions.

The Chinese government has acknowledged the urgency of this problem. Evolving policy frameworks at national level as well as municipal levels address the concerns of fast urban growth and shape a nationwide sustainable development approach. In this context, the government has initiated a wide range of measures in form of pilot programs and initiatives in the field of urban planning and green development. Different causes need different approaches that address problems in urban areas at present as well as potential challenges in the future.

In 2013 President Xi Jinping announced a new national plan to combat flooding and, at the same time, preserve water resources to cope with the issue of water scarcity, which later led to initiation of the so called "sponge city program". In consequence of urbanization, large areas of land are covered with impervious surfaces that do not let water through. This may result in urban water logging, and overflowing of waters and pipes especially during rainy seasons. On the other hand, water scarcity represents an urgent issue in many Chinese cities.

In this regard, the Chinese government invests in water-sensitive urban design. The government selected 30 cities in 2015 and 2016, including Xiamen in the southern Fujian province and Wuhan in Hubei province, that are particularly affected by this problem as testing grounds. For implementing the program, involved cities receive annual subsidies of at least 400 million CNY within three years. This program aims to implementing natural infiltration, purification as well as retention of water through developed permeable grounds that let water through and filter it as well as

中国城市的人口规模、气候条件特殊,城市增长迅速并受到全球经济影响,因此其未来发展至关重要并受到广泛关注。同时城市发展也带来了诸多挑战,比如日益增长的能源需求、温度上升、环境污染和洪涝等问题,进而必将影响人们的生活和居住质量。

中国政府已经意识到了问题的严重性,并制定了国家层面和地方层面的政策框架,旨在解决城市发展过快带来的问题,以实现全国范围内城市的可持续发展。因此,中国政府开展了若干关于城市规划和绿色发展的试点工作。城市发展面临诸多挑战,各项试点有针对性地提出了解决方案。

2013年,国家主席习近平在《中央城镇化工作会议》的讲话中强调了防止洪涝、保护水资源并解决缺水问题,之后发展成为海绵城市试点建设。城市化会导致大量地表由于使用钢筋水泥缺少渗水功能,在雨季将可能会出现城市内涝、排水管道满溢等问题。同时,水资源短缺也是中国许多城市面临的严峻挑战之一。



*Sponge cities as a solution for water scarcity and urban flooding*  
海绵城市建设可作为水资源短缺和城市内涝的一项解决方案  
Source / 图片来源: tupian.hudong.com

于是,中国政府积极促进展开了针对“水敏感”的城市规划工作。2015-2016年间中央政府选取了30个海绵城市建设试点,其中也包括了福建厦门和湖北武汉这类内涝问题较为严重的城市。试点城市将获得中央财政给予的专项资金补助,一定3年,每年至



storage tanks, filtration pools, and wetlands installed all over the cities. The program aims to allow at least 70 percent of rainwater to soak into the grounds instead of flowing into rivers and creeks.

Recently, the Chinese government seeks to attract foreign expertise and investors in this sector for new designs and redevelopment of urban water infrastructure. It is planned that 80 percent of China's cities will have transformed into sponge cities by 2030. For that, suitable technologies and innovation are significant for a successful implementation.

Another example for the government's approach for a more sustainable development of China's cities is Tongzhou. In order to relieve Beijing's overcrowded city center of traffic congestion and population density, the capital's government is planning to relocate major departments to the southeastern suburban district of Tongzhou, along with thousands of civil servants, by the end of 2017. This goes along with the plan for the urbanized region cluster of Beijing-Tianjin-Hebei (or Jing-Jin-Ji) in Northern China.

The new municipal government will be located in Tongzhou, which is also in close proximity to Hebei, the province that surrounds both, Beijing and Tianjin. This would allow the new municipal government to focus on regional development and integration while China's national ministries would remain in the current city center.

More than 300,000 square meters of low-energy buildings are planned to be built within the coming four years. Tongzhou will be developed according to the latest standards in science and technology in order to cut the amount of energy needed for heating and cooling. Thus, the government is aiming to improve each building's energy efficiency to reduce its carbon footprint as well as mitigate other pollution causes, following a passive house concept. For instance, two government office buildings will integrate technologies that could reduce the energy use up to 60 percent compared to conventional buildings. Also, building information technologies will be applied for monitoring the construction schedule and resources. The whole satellite city of Tongzhou is planned to be set up within this framework and to develop energy efficient buildings on a large scale.

The government has recognized that some effects of climate change are inevitable. Building green cities is

少4亿元人民币。海绵城市建设试点旨在实现雨水的自然积存、自然渗透、自然净化,发展可渗透路面、蓄水池、净化池和城市湿地等相关配套设施,保证70%的降雨就地消纳和利用。

近期,中国政府希望引进国际专家和投资,促进市政给排水基础设施方面的设计和创新。到2030年,中国所有城市建成区80%以上的面积达到海绵城市建设目标要求,寻找技术创新解决方案是实现该目标的关键。

北京市通州新城规划是中国城市可持续发展的另一代表案例。为了缓解城区交通拥堵和人口过密的问题,北京市委市政府及其大部分部门将整体搬迁到通州区,将会带动一批公务员外迁,预计2017年底将完成搬迁工作。通州副中心建设也是推进京津冀协同发展的关键任务之一。



*In an effort to reduce pollution and traffic congestion, Beijing's new subcenter of Tongzhou will be built according to energy efficient standards*

为了减少空气污染和缓解交通拥堵,北京城市新副中心通州将遵循节能标准进行建造设计

Source / 图片来源: [perennialrealestate.com](http://perennialrealestate.com)

通州紧邻河北,这会使得新的市政府能更好地促进京津冀地区的一体化协同发展。

政府计划在未来四年内建设超过30万平方米低能耗建筑,工程建设将依据最新科技标准,以降低供热和制冷所需能耗。政府力图按照被动房的理念,提高每个建筑的能效、降低它们的碳足迹、减轻其他污染物排放。例如两座政府办公楼将采用最新技术,比传统建筑节省高达60%的能耗。同时,建筑信息技术检测也将应用于监测施工进度和资源消耗。整个通州新城计划在此框架内进行开发建设,以促进节能建筑的大规模发展。

one way to ease life in urban areas. Concerning climate change, the government will adopt various measures to address the challenge. The National Development and Reform Commission (NRDC), the Ministry of Housing and Urban-Rural Development (MoHURD) and other relevant departments have recently formulated the “Urban Climate Change Adaption Action Plan”. Until 2020, up to 30 selected pilot cities are planned to build and realize economic, social, urban, and industrial development in a climate-resilient manner, of which up to 50 percent of new buildings will implement green building standards.

The cities will be selected according to their vulnerability to climate change and will carry out pilot measures.

If these measures have been proven to be successful, the government plans to establish a climate resilience index which would help other cities to detect and identify their own specific vulnerability to prepare themselves for future climate fluctuations and extreme weather conditions. The plan mainly focuses on assessing urban climate change impacts and the cities' vulnerability and considers, for instance, urban ventilation corridors.

There are many different ongoing projects and programs regarding green urbanization in China. For implementing the idea of green and sustainable cities in China, advanced technologies and services are required. The Chinese government has the ambition to make substantial investments in order to successfully implement energy efficient buildings, water-sensitive urban planning, and the preparation of cities for extreme weather conditions. The question that remains is if the newly launched pilot projects will lead to a comprehensive implementation of measures throughout China and the development of new standards. A country that encounters as many environmental challenges as China has many different obligations. However, to start changing the immediate environment and living space – which for many people is the city – is the right approach for a more sustainable development.



*During the coming years, China will implement projects for a climate resilient urban infrastructure*  
 未来几年中国将实施适应气候变化城市基础设施建设项目  
 Source / 图片来源: [blog.sina.com](http://blog.sina.com)

建设绿色城市是改善城市生活质量的一种途径。政府已经意识到气候变化的影响客观存在,也会采取一系列措施来应对气候变化的挑战。国家发改委、住建部会同有关部门共同制定发布了《城市适应气候变化行动方案》。到2020年,计划建设30个试点城市,以适应气候变化的方式实现经济、社会、城市和工业发展,绿色建筑推广比例达到50%。气候变化脆弱性是此次试点城市的选择依据,相应的措施也会在试点城市实施开展。

如果这些措施证实有效,政府计划设立一套适应气候变化指数,这将有助于其他城市评估确认他们各自的气候脆弱性,为未来的气候变化和可能出现的极端天气条件做好准备。这一计划重点在评估城市气候变化影响和脆弱性,同时关注如城市通风廊道等问题。

目前,中国有若干关于城市绿色发展的项目和方案。为实现绿色和可持续城市的理念,先进的技术服务不可或缺。中国政府有决心大量投资,用来实施节能建筑、水敏感城市设计,并为极端天气条件做好准备。目前还存在的问题是已推出的试点项目中的举措是否以后会在全国各地全面实施,以及新的标准将如何制定。中国面临如此之多的环境问题挑战,任重而道远。然而,着手改变当前的环境和居住空间是实现可持续发展的必要途径。



## Chinese Energy Transition with German Know-How

*A contribution by Susanne Schmelcher, Steffen Joest, Carolin Schenuit, and Liu Yu, Deutsche Energie-Agentur (dena)*

### 借鉴德国技术知识, 推动中国能源转型

来自德国能源署的Susanne Schmelcher, Steffen Joest, Carolin Schenuit和刘瑜的客邀文章

China has been one of the world's fastest-growing countries in recent decades. However, the development has not occurred equally. Instead, it has mounted to disparity in the rural and urban population. This fact puts closing the prosperity gap on top of the political agenda – leading to further increase in energy consumption.

Under the current conditions, this shift will lead to additional energy imports, rising CO<sub>2</sub> emissions and continuing environmental degradation. Natural resources are already constrained and environmental problems have in part reached a critical point. Pictures of smog-covered skylines have been around the world. The Chinese government has understood that consequences are so tangible that business-as-usual can no longer be an option. Taking up the battle, not only national targets have been formulated but also targets at the international level in the context of the Paris Agreement. A future development path has also been outlined through the Energy Development Strategy Action Plan (2014-2020) and the 13th Five-Year Plan for Energy 2016-2020. Overall, it comprises measures to diversify the energy mix in a bid to reduce the reliance on foreign suppliers and coal. The share of renewables, nuclear energy, and natural gas will be increased while the remaining share will be covered by a clean and efficient utilization of coal. Germany can be an important partner in this transformation.

The German Energy Agency (dena) has been working with various bodies of the Chinese national government since 2006 to shape this transition path. Here, the German energy transition (“Energiewende”) serves as a point of reference. Based on experiences gathered in Germany, dena projects in China encompass a broad range of policies, tools, and best practice examples. The overarching goal is to reduce energy demand and enhance the share of renewables. Because energy generation, demand and consumption must be developed as a holistic system, dena's China activities cover all sectors.

#### Power sector

China is the world's biggest user of coal energy, but also the country with the highest dynamics in increas-

近二三十年来, 中国是全球经济发展最快的国家之一。然而, 经济高速发展也拉大了城乡发展差距。缩小城乡贫富差距是当前政策重点之一, 但这同时也意味着进一步增加能源消费。预计到2040年中国的能源需求仍将在当前基础上增长25%。

若当前发展趋势不加改变, 中国将进一步扩大能源进口, 增加二氧化碳排放, 其环境质量将继续恶化, 自然资源消耗加剧。近年来, 中国的大范围雾霾已成为全球关注的问题。值得庆幸的是, 中国政府已经意识到原有高能耗、高污染、高排放的发展模式亟待变革。

为应对气候变化, 中国政府制定了节能减排的政策目标, 签署并批准了《巴黎气候变化协定》。国家颁布了《能源发展战略行动计划(2014-2020年)》以及《能源发展“十三五”规划》为代表的政策规划, 明确了优化能源结构的具体措施, 以减少对煤和能源进口的依赖; 旨在提高可再生能源、核能以及天然气在能源结构中的比例, 并实现煤炭清洁高效利用。在中国能源结构转型过程中, 德国的经验可供借鉴。一如德国, 中国只有提升所有领域的能效, 才能实现能源转型的宏伟目标。

#### 可持续能源转型路径

自2006年以来, 德国能源署(dena)和中国政府多个部委机构开展了提升中国能效方面的合作, 为中方合作伙伴提供德国能源转型(“Energiewende”)的经验借鉴。在已有的德国实践经验基础上, 德国能源署在中国的项目涵盖了政策制定、工具开发以及最佳实践案例等层面, 以期有效地整合能源的生产、需求和供给, 其目标在于减少不同领域的能源需求, 扩大可再生能源利用。

#### 电力部门

中国是全球最大的煤炭消费国, 同时也是可再生能源发展最活跃的国家。水力发电占可再生能源发电份额最大, 风电、光伏发电以及生物质能发电规模增长迅速。与此同时, 电网扩容、跨省联网、电力市场结构及定价机制等问题对可再生能源并网发电造成挑战。发电和输电环节应考虑成本效益, 为此中国决定进一步



ing the share of renewable energies in the overall power mix. There are several challenges linked to this development, for instance the use and extension of grid capacities and inter-provincial connections as well as the general setup of the power market and its price mechanisms. For this reason, the existing rather inflexible system needs to be reformed. This has already been decided and planned by the central government. To consult on possible solutions, dena is part of the German contribution to the international think tank China National Renewable Energy Center (CNREC). Together with experts from China, Denmark, and the US, different approaches and lessons learned from other countries will be adapted to Chinese conditions and with the help of detailed modelling tools specific recommended actions for policy design will be derived. dena started its cooperation with Chinese players in 2014, when a study regarding the grid integration of decentralized PV plants had been realized in cooperation with the Chinese Renewable Energy Society (CRES).

### Industry sector

Reducing emissions in the industry sector is central to the Chinese national strategy as the industry holds the lion's share on energy consumption. Up until now, measures have not shown the necessary success and require more comprehensive strategies. Therefore, a fast and nationwide implementation of energy-efficient low-emission technologies is being targeted. Ensuring that this goal will be reached, dena is pushing this firstly through strategic consultancy at high level and secondly, through advanced pilot projects with role-model character. In cooperation with Chinese governmental bodies and production companies strategies and measures were developed and implemented. For example, dena and Shaanxi Coal and Chemical Industry Group have set up a cooperation agreement with a number of manufacturing companies in energy-intensive fields and implemented a consultancy contract to optimize energy efficiency. In 2016, dena developed a feasibility study on energy efficiency and emissions reduction in the industry on behalf of the Hebei Province Environmental Protection Agency. A selection of the proposed measures is currently being put into practice in pilot projects in Hebei. Starting this year, the National Energy Conservation Center (NECC) and dena hope to implement pilot projects for energy audits and measures in industry and set up an award within the framework of the Sino-German Energy Partnership.

深化电力体制改革,提高系统灵活性。德国能源署作为德国能效、可再生能源和能源系统领域专业职能机构之一,为国家可再生能源中心(CNREC)提供应对电力系统挑战的协助和咨询。通过借鉴其他国家电力体制改革的经验教训,来自德国、美国、丹麦和中国的专家共同展开合作,寻找适合中国国情的政策及工具。

2014年,德国能源署与中国可再生能源学会(CRES)合作开展了分布式光伏发电并网的可行性研究,启动了与中方机构在电力领域的合作。

### 工业部门

工业能耗占中国总能耗的比重最大,因此工业领域减排是中国能源转型战略的关键所在。已推行的减排措施尚未实现应有的效果,政府需要采取更大力度的策略,尽快在全国范围内推行高能效减排技术。



*Participants of the 'Quality Assurance during Construction Workshop' at one of the dena-CSTC Sino-German pilot projects at the Shandong Urban Construction Vocational College in July 2016*

参加dena / CSTC中德示范项目山东城市建设职业学院低能耗实验实训中心项目施工培训, 2016年7月

Source / 图片来源: dena

目前德国能源署一方面为中国主管政府部门提供战略咨询,另一方面与中方合作伙伴共同实施示范项目,旨在促进工业领域的节能减排,通过与中国政府机构和工业企业合作,共同开发和实施节能战略、措施。例如,德国能源署和陕西煤业化工集团有限责任公司签署了针对高能耗企业节能的合作协议。2016年,德国能源署受河北省环保厅委托开展了针对该省工业领域节能减排的可行性研究,提出的一系列建议措施将应用于河北省示范项目的实践中。2017年起,国家节能中心(NECC)和德国能源署有意在中德能源与能效伙伴关系框架下共同开展工业能源审计示范项目,并将进行中德能效奖评选,对先进企业进行宣传。

## Building sector

Projections outline that the today's final energy consumption in the building sector will grow by 20 percent until 2040. The direct use of renewable energies and energy efficiency measures must be promoted. Challenges regarding the implementation of these strategies derive from the existing administrative and economic structures as well as current deficiency in the field of qualified construction specialists and financial incentives. Few controls of already existing ambitious building standards and insufficient construction quality have made their marks in the final overall quality of the building. To start closing the quality gap, dena together with the Chinese Centre of Science and Technology of Construction (CSTC) initiated the Sino-German energy efficiency building project in 2010. It primarily involves initiating pilot projects within a standard that generates energy efficiency savings by an average of 75 percent compared to conventional new buildings in China. It is focusing on quality assurance and know-how transfer in the planning and construction process. Currently, dena and CSTC administer 30 projects of different size, function and technical requirement in 4 different climate zones and 10 provinces. Technologies that directly use renewable energies are applied to all projects. It is only with well-trained specialists, integral planning and quality assurance through the whole process that more energy efficiency in the building sector can be effectively implemented. For successful energy efficiency strategies and the integration of renewable energies, the larger picture must be considered. This being the case, dena has developed a tool for urban district development that follows exactly this objective. The concepts outline a development plan focusing on energy efficiency and usage of local renewable energy resources. But this represents only one aspect of the "Eco-Cities in China" project. Together with the Chinese Society for Urban Studies (CSUS), the think tank of the Chinese Construction Ministry (MoHURD), dena is finding ways of reducing carbon emissions in urban energy systems in a holistic manner. The aim is to enable Chinese municipalities to select, implement and manage technologies in a structured fashion, using the Energy and Climate Protection Management System (EKM) of dena.

Through initiating new projects, dena will also intensely support and consult to further define the path to a Chinese energy transition in 2017. Considering the common tasks of a world energy transition ahead, it is set to be a successful year for Sino-German cooperation.



*Practical demonstration by dena of the proper construction method for crucial details leading to an airtight building in Jinan, Shandong province in July 2016*

被动式建筑关键节点气密性施工方法示范，2016年7月

Source / 图片来源: dena

## 建筑部门

据推测，建筑领域的终端能耗到2040年将在当前基础上继续增长20%。基于这样的建筑能耗发展趋势，天然气和可再生能源利用规模须大幅增长。推动建筑领域可再生能源应用及能效措施势在必行。现有行政管理、经济结构以及能效技术专业人员和资金激励制度的欠缺对可再生能源发展和能效措施的推行造成阻碍。此外，对现有建筑能效标准的实施缺少有力监控，施工质量不足，均导致最终建筑整体质量的缺陷。

为此，德国能源署和住建部科技与发展促进中心（CSTC）2010年共同启动了中德合作被动式低能耗建筑示范项目。德国能源署为示范项目的设计和施工全过程提供质量保证和技术传播，使示范项目的能效比中国常规新建建筑的能效平均提高75%。目前示范项目数量已达30多个，分布于中国四个不同的气候区的10个省份，涉及不同的建筑规模和使用类型。只有通过高水准的能效专业技术人员、一体化设计和全程的质量保证工作才能使高能效建筑切实得以实施。

能效措施及可再生能源一体化应用应着眼于中国城镇化进程的全局。在“中德生态城市”项目框架下，德国能源署开发了旨在提高能效及当地可再生能源利用的可持续城镇发展工具。此外，德国能源署与中国住建部下属机构中国城市科学研究会（CSUS）共同寻求减少城镇能源系统碳排放的整体方案。通过借鉴利用德国能源署为德国城镇开发的能源与气候保护管理体系（EKM），使中国城镇得以系统地选择、实施能效技术。

2017年，通过继续开发和实施新项目，德国能源署将继续为中国的能源转型路径提供支持和咨询。在全球共同应对气候变化、实施能源转型的背景下，中德能效合作将在2017年取得更大的成功。



## Sustainable Support for German Building Expertise in China

### 德国建筑节能经验在中国发展的长期支持

China's economic growth, industrial development as well as its rapid urbanization process during the past years have led to a surge in energy demand. Within the framework of the 13th Five-Year Plan (2016-2020), the Chinese government set the target to reduce energy consumption per unit of GDP by another 15 percent by 2020, focusing on energy efficiency measures. Being responsible for roughly one third of primary energy demand, the Chinese building sector offers great potential for reducing energy consumption. Annually 1 to 1.5 billion square meters of living space are added, whereof one square meter still requires four times more energy for heating and cooling than the European average.

As German companies enjoy an outstanding reputation throughout the world for their high-quality technical products and expertise, particularly in the field of green building and energy efficiency, this provides promising market opportunities for sustainable building technologies and services in China.

Last year, the Energy Efficiency Export Initiative of the Federal Ministry of Economic Affairs and Energy (BMWi) has been merged with the Renewable Energies Export Initiative, another successful programme, to achieve synergy effects. As a result, the activities of German Industry & Commerce (GIC) Greater China in the fields of renewable energies and energy efficiency supported by the BMWi are now implemented within the framework of the new Energy Export Initiative.

Building on measures of previous years, GIC Greater China is implementing activities in the fields of energy efficiency and renewable energies and organizes business trips for German companies to China as well as fact-finding missions for Chinese decision makers to Germany. Business trips, including one-day symposiums, provide German enterprises the opportunity to

过去几年中国的经济增长、工业发展以及快速城镇化进程导致能源需求大幅增加。

在“十三五”规划(2016-2020年)的框架下,中国政府制定了单位GDP能耗累计降15%的目标,重点采取提高能效的措施。建筑行业约占中国总一次能源消耗量的1/3,因此该行业节能潜力巨大,每年总新增居住面积为10到15亿平方米,平均每平方米用于供暖和制冷的能耗相当于欧洲的四倍。

德国凭借全球著称的高质量技术产品和实践经验,尤其是绿色建筑和能效领域,可以为中国在可持续建筑及其相关服务方面提供具有前景的市场机会。

去年,德国联邦经济与能源部的能源效率出口倡议项目与其另一个杰出的项目可再生能源出口倡议合并,以期达到协同效应。因此,德国商会(GIC)大中华区所有由联邦经济与能源部支持的可再生能源和能效方面的工作都在新的能源出口倡议项目框架下进行。

基于多年来的经验,德国商会在可再生能源和能效方面举办了若干活动、为德国企业组织了来华商务考察访问以及为中国决策者组织了赴德考察任务。商务



*The fast growing building sector is responsible for roughly one third of primary energy demand in China*  
不断增长的建筑市场占有了中国近三分之一的一次能源消耗  
Source / 图片来源: gaoloumi.com

explore the business environment and market potential in China and to present their technologies and solutions to Chinese decision makers and stakeholders. Individual business-to-business matchmaking events and company visits are another integral part of the trip. Involved German companies receive a comprehensive target market analysis based on the topic of the programme.

### Energy efficiency in buildings in Southern China

In 2017, GIC Greater China organizes two business trips regarding building energy efficiency to the southern part of China. The business trips will take place in the city of Guangzhou and the Special Administrative Region of Hong Kong in the fourth quarter of this year. Prior to the trips, an information event in Germany will be organized during the third quarter of 2017.

Due to the current industrial shift to more efficient and automated production methods, many production facilities in South China are undergoing a reconstruction and modernization process. The upgrade in production techniques oftentimes also involves structural alterations and energy-efficient refurbishment of industrial buildings. The government provides incentives for energy-saving technologies and innovation particularly in the industrial hub in Southern China in the Pearl River Delta region including the surrounding areas of Guangzhou. Companies are incited to refurbish and modernize their factories as well as erect new buildings that integrate renewable energies as well as energy-saving technologies and building envelopes. This offers market opportunities for German companies in this region of China. The business trip to Guangzhou, the capital city of Guangdong province, will provide support in order to improve the market and sales potential for German energy efficient technologies and services in industrial buildings.

The second business trip will take place in Hong Kong – one of the cities with the highest population density worldwide with approximately 7,000 people per square kilometer, and only one quarter of land area suitable for building. Buildings in Hong Kong are responsible for 70 percent of the metropolis' total energy consumption. Hence, the Buildings Energy Efficiency Ordinance in 2010 and its amendment in 2012 are crucial stepping stones for an improvement in building energy conservation. Since Hong Kong is located in a humid subtropical climate zone, a majority of electricity is consumed in air-conditioning. Thus, it is one of Hong Kong's key interests to find innovative and ener-

考察访问,包括为期一天的研讨会,德国企业可以在此了解中国的商业环境和市场潜力并向中国的决策者和其它利益相关方展示他们的先进技术和解决方案。个性化的B2B对接以及公司拜访也是此次行程不可或缺的一部分。参加访问的德国企业还可以免费获得相应主题的详尽的目标市场分析报告。

### 中国南方的建筑节能

2017年,德国商会将会就中国南方地区建筑节能的主题举办两次商务考察访问活动。两次活动分别于今年第四季度在广州和香港特别行政区进行。在商务考察访问活动之前,将于今年第三季度在德国举办一场相关的主题研讨会。

由于工业效率和自动化生产技术的转型升级,中国南方地区的很多生产设备都正在进行改造和更新。这些生产设备的更新也时常伴随着结构转型和工业建筑的节能改造。政府为珠三角工业基地以及广州周边地区的节能技术和创新提供财政激励。企业因此积极对它们的工厂进行改造更新,并在新建建筑中综合使用可再生能源、节能技术和围护结构。此次对广东省省会广州的商务考察访问将会为在工业建筑节能技术和服务领域的德国企业挖掘更大的市场营销潜力提供支持。



*Business trips include symposiums, business-to-business matchmakings and company visits*

商务考察访问包括研讨会、B2B对接和公司拜访

另一次商务考察活动将于香港特别行政区举办。香港是世界人口密度最高的城市之一,每平方公里居住人口约为7000人,仅有四分之一的土地适合作为建筑用地,然而建筑能耗占特区总能耗的70%。香港特区政府于2010年颁布并于2012年修订的《建筑物能源效益条例》是提高建筑能效的重要举措之一。由于香港位于湿度较大的亚热带气候区,建筑电力消耗的主要来源为空调用电。因此,对于香港来说,建筑节



gy-saving solutions, especially for air-conditioning and ventilation systems.

Furthermore, a fact-finding mission to Germany regarding energy efficiency in buildings is planned for June 2017. Chinese representatives from politics, business, science and administration from the direct-controlled municipality Chongqing as well as from metropolises in the surrounding areas will get the chance to gain practical experience and understanding of German building energy efficiency solutions at first hand, by visiting best-practice projects and leading organisations. The trip also provides an opportunity to exchange information and develop contacts with experts, decision makers and potential suppliers.

For implementing the described programme of activities, GIC Greater China works closely together with the assigned consultants German Asia-Pacific Business Association (OAV) and Baden-Württemberg International (bw-i) in Germany. Furthermore, GIC Greater China builds on synergies and close cooperation with other important players such as Deutsche Energie-Agentur (dena) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), which also accompanies the Sino-German Energy Dialogue and is responsible for implementing its measures.

The target market analyses, the two business trips to China and the fact-finding mission to Germany all bring together relevant stakeholders and offer comprehensive information about the building sector in terms of opportunities for energy efficient solutions for the Chinese market. A technological emphasis is placed on sustainable design, building envelopes, systems for heating, cooling, ventilation, building automation and lighting as well as prefabricated building elements. In addition, the activities focus on heat and power supply through renewable energies.

The linked activities of the Energy Export Initiative provide in-depth knowledge and support to exploit the full potential that lies in the Chinese green building sector. In order to do so, a thorough market preparation, recruitment of qualified personnel as well as suitable market strategies and cooperation partners are key factors for success. As an experienced partner, GIC Greater China supports German companies in this endeavour throughout the coming years, with its access to local stakeholders and building market expertise.

能的重点领域之一在于寻找空调和通风系统的创新节能方案。

另外,德国商会在2017年6月还计划安排了一次以建筑节能效率为主题代表团赴德实地考察,来自直辖市重庆及其周边地区的政府、商务、科技和管理业界代表将有机会访问德国在建筑能效方面优秀实例项目和行业领先机构,获得其解决方案的实际经验和第一手信息。同时,此行将提供与行业专家、决策者和潜在供应商交流与互动的机会。

从项目执行方来讲,德国商会与委派的咨询机构德国亚太商业协会和巴符州经济与科技合作公司紧密合作。除此之外,德国商会还和德国能源署以及德国国际合作机构等组织有多年的项目合作经验,其中包括中德能源对话等项目。



*Hong Kong is one of the cities with the highest population density worldwide – finding energy-saving solutions is extremely urgent*  
香港是世界人口密度最高的城市之一 – 寻找合适的节能方案迫在眉睫  
Source / 图片来源: Andy Yeung / Peta Pixel

目标市场分析报告、两次来华商务代表团以及赴德考察任务,可以把中德在建筑能效领域的利益相关方召集起来,并获得针对中国市场的建筑节能方案的综合信息,其中的技术重点包可持续设计、建筑围护结构、供暖和制冷系统、通风设备、楼宇自动化、照明和装配式建筑构件。此外,活动的重点还包括通过可再生能源的热电供应。

能源出口倡议项目框架下的一系列活动可以提供关于中国绿色建筑行业的深入知识和支持。为了充分挖掘相应市场的潜力,项目在前期阶段就需要进行市场分析和调查、招聘专业人才、运用合适的市场战略以及选取可靠的合作伙伴。德国商会凭借其丰富的经验,愿意在未来竭力为促进中德两国企业在建筑能效领域的交流合作提供长期支持、帮助企业与地方其他利益相关方取得联系并获得最新的市场信息。

## Prefabricated Building for Sustainable Urbanisation in China and Germany

A contribution by Dr. Marie Peters, Sandra Müller, Sandra Retzer, and Liu Xueling, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Liu Meixia, Science Technology and Industrialization Development Center (CSTC)

### 中德装配式建筑促进城市可持续发展

来自德国国际合作机构的Marie Peters博士, Sandra Mueller, Sandra Retzer, 刘雪玲; 住房和城乡建设部科技与产业化发展中心的刘美霞的客邀文章

Cities, as the major producers of greenhouse gas emissions, as the major users of finite raw materials and resources, as the major host of the world's population, and as engines of economic growth are also the places that have the greatest potential of reducing our global footprint and environmental impacts.

Prefabricated buildings are being intensively discussed in China and Germany since they are able to make a genuine contribution to climate mitigation and provide various opportunities to address the development of sustainable cities.

With an increasing and fast urbanisation rate the urge for a sustainable and integrated development of cities as outlined in the New-Type Urbanisation Plan (2014-2020) is especially apparent in China. To share knowledge on how to foster sustainable urbanisation, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of the Federal Republic of Germany (BMUB) and the Ministry of Housing and Urban-Rural Development of the People's Republic of China (MoHURD) mutually exchange on topics such as sustainable and energy-efficient buildings, within the framework of the Sino-German Urbanisation Partnership (SGUP). In June 2016, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has started to implement the SGUP with an office in Beijing and Bonn – focusing on all aspects of sustainable and integrated urbanisation relevant for both countries.

#### With prefabricated building towards sustainable urbanisation

Prefabricated building is becoming more popular globally as it is faster in construction and therefore financially attractive, generating quick rental income. Furthermore, traditional construction methods produce a lot of waste, whereas modern on-site construction can save building materials which – depending on the type – can also be reused in other locations. Various architects are experimenting with prefabricated building techniques as mass construction for modern housing,

城市是温室气体排放的最大制造者,是原材料和资源的主要消耗者,是世界大多数人口的居住地,是经济增长的引擎,同时也是全球减排和减少环境影响潜力最大的地方。近年来,中国和德国都在广泛探讨装配式建筑的发展,因为这种建造方式能够减缓气候变化,促进城市可持续发展。

随着城镇化率的快速增加,城市的综合和可持续发展在中国《新型城镇化规划(2014-2020)》已经有了明确表述。为了充分交换在可持续城市发展方面的经验,德国联邦环境、自然资源、建设和核安全部与中国住房和城乡建设部在中德城镇化伙伴关系(SGUP)项目框架基础上,针对可持续发展、建筑节能等议题交换意见。2016年6月,德国国际合作机构开始实施中德城镇化伙伴关系项目,项目在北京和波恩分别设立了办公室,致力于两国在可持续发展和城镇化发展领域开展活动。



Installation of prefabricated concrete components for the Nantong Longxin Square project in Jiangsu Province, China  
中国南通市龙信广场项目预制混凝土部件安装现场  
Source / 图片来源: CSTC

#### 预制装配式建筑促进可持续城镇化的发展

装配式建筑因其建造速度快而在全球发展迅速,在经济性方面也极具吸引力。此外,传统建造方式产生大量废弃物,而装配式建筑会减少抹灰、木模板等



whereas some architects remain sceptic and perceive prefabricated buildings as a uniform construction method that leaves out creativity and the individual character of buildings. However, the engineering side shows that prefabricated building can offer flexibility, creativity, and innovative construction methods.

### Towards timber-concrete composite structures for prefabricated building

The three most common materials used for prefabricated building are steel, concrete, and wood. Steel structure buildings, for example, have the advantages of seismic performance and a short construction period. It is also claimed by experts that even though the production of steel is highly energy-intensive, it can be reused and is hence more sustainable than concrete. Building with concrete in contrast is also becoming more energy-efficient and has proven to reduce the carbon footprint through innovative approaches such as high-activation grinding, oxygen-enriched combustion and using carbide slag, cement with a low lime saturation factor or geopolymers cement, among others.

Other experts argue that wood as a building material will gain importance during the next years as it stores CO<sub>2</sub>, is a biodegradable, recyclable and renewable resource, and thus further supports sustainability in buildings. Additionally, it brings technical advantages compared to other materials. For example, compared to steel and concrete, timber has benefits due to its light weight and a better ratio of weight to strength. Directly compared to concrete, timber also has a higher traction and in an untreated manner, due to its open porosity, it creates a healthy and comfortable indoor climate as wood regulates the indoor humidity naturally. Also, timber constructions are more resilient to earth quakes, an important factor in particular for China.

In Germany, the building of multi-level timber constructions will become an important field of business, experts argue. Particularly timber-concrete composite structures are an innovative approach, which is currently being used in several new housing projects across Germany. New research focuses on composite structures where the concrete slab is already prefabricated or where both timber and concrete are already connected and brought to the building site in one large unit. The benefits of these two systems include better quality control of the materials and no need for 'wet' components on site during the construction.

许多建筑材料,建材可以在其它地方重新加以利用。各国建筑师竞相尝试采用装配式建筑技术大规模建造现代化住房,而一些建筑师仍对此持怀疑态度,认为装配式建筑的标准化模块抑制了建筑的个性化发展,然而工程实例表明预制装配式建筑能够提供灵活性、创造力和创新的建筑风格。



*A high degree of prefabrication of components ensures planning reliability and profitability (prefabricated timber frame wall)*

高度组合的预制部件确保了规划设计的可靠性和经济性(木制-混凝土混合结构)

Source / 图片来源: Brüninghoff

### 木制-混凝土混合结构的发展

装配式建筑包括装配式混凝土建筑、钢结构建筑、木结构建筑及混合结构建筑。钢结构建筑具有绿色环保、钢材可循环利用、抗震性能优良、施工周期短等诸多优势。尽管钢铁的生产是高耗能的,但一旦成为钢材之后,可以被多次重复利用,因此比混凝土更具有环保性。与钢材相比,混凝土建筑更加节能,已经证明通过一定的方法,能够减少碳排放,例如高活性研磨、富氧化燃烧、电石渣利用、较低的水泥石灰饱和系数或聚合物水泥利用等等。

同时,一些德国专家指出由于木材能够存储二氧化碳,是生物可降解的材料,属于可回收利用的可再生资源,从而可以更好的实现建筑的可持续性。此外,相比于其它材料,木材具有独特的性能优势。例如,与钢铁和混凝土相比,木材拥有更轻的重量和更好的韧性。与混凝土相比,木材也有更高的延展性,由于木材本身的微孔结构,可自然调节室内湿度,创建一个健康、舒适的室内环境。此外,木结构也因其韧性而具有更好的抗震性能,这一点对于木结构建筑在中国的发展至关重要。

在德国,专家认为多层木结构建筑将成为一个重要的发展领域,尤其是木制-混凝土复合结构是一个创新

Additionally, a lot of recent research focuses on cross-laminated timber (CLT), the orthogonal connection of solid-sawn lumber which allows for the durability necessary for high-rise wooden structure buildings. CLT also has a fire prevention function due to carbide processing which separates the inside material in case of a fire. However, timber construction still bears challenges in regards to building legislations and the acceptance among architects and users. In China, even though the need for finding alternative building materials is apparent, the Chinese natural forest resources are limited and like elsewhere challenges regarding fire approval of high-rise constructions remain.

After years of efforts, China has also established a prefabricated building industry base and various technologies and products have already reached international standards. Especially steel and concrete structure systems as well as timber structure systems have been developed along with relevant norms. Informatization is another important factor supporting prefabricated construction in China, especially the Building Information Modeling (BIM) technology needs to be further applied to improve the design, production and construction. Currently, a quality traceability system for prefabricated construction is being introduced by the Science Technology and Industrialization Development Center (CSTC), including the process of purchasing raw materials, production, transportation and installation as well as product quality inspection and evaluation.

### Policies support prefabricated building in Germany and China

Looking at the policy side in Germany, the construction of buildings is mainly based on regional level regulations. However, prefabricated building is increasingly relevant for national policies, especially regarding affordable housing and fast construction methods, i.e., for refugee homes. Relevant actors from the government, industry, and society are working intensively on the development of serial construction in the “Alliance for affordable housing and construction” (Breites Bündnis für bezahlbares Wohnen und Bauen). The aim of the alliance is to jointly improve the prerequisites for the construction and modernisation of living space in good quality and to quickly expand the housing supply in those metropolitan areas with a lack of affordable housing. In addition, a competition for serial housing in Germany will be launched by BMUB in the near future.

的方法,目前已经在德国很多新建项目使用。新的研究更侧重于复合结构,已经预制好的混凝土条板或者连接好的木材-混凝土,以模块化方式运输到建筑施工现场。这两个体系的优势在于不仅能够更好的控制材料质量而且不需要现场“湿”作业。

另外正交胶合木 (CLT) 建筑也是当今研究的热点,通过实木锯材正交组坯,可以建造高层木结构建筑。CLT材料不仅具有极高的强度且绿色环保,自身具备防火功能。CLT的外层做了碳化处理,火灾时可封住内部材料,防止受损。

然而,木结构建筑仍然面临建筑立法和建筑师/用户体验的挑战。在中国,即使寻求替代建材的需求十分迫切,但中国的自然森林资源是有限的,对高层建筑的防火审批,也是木结构建筑发展需要面临的挑战。

经过多年的努力,中国建立了装配式建筑产业基地,各种技术和产品已经达到国际标准,钢铁和混凝土结构以及木材结构体系得到长足发展,并出台了相关标准和规范。信息化是支持装配式建筑的另一个重要因素,尤其是建筑信息模型 (BIM) 技术的应用,改善了设计、生产和施工等环节。以住房和城乡建设部科技与产业化发展中心 (住宅产业化促进中心 CSTC) 牵头的质量追溯系统已投入使用,该系统可以实现装配式建筑部品从原材料购置、生产、运输到安装的全过程跟踪追溯,以及对装配式建筑部品的质量检测、评价与质量追溯。



Refugee home with prefabricated modular timber construction in Lautzenhausen, Germany

德国劳岑豪森难民住房 (木结构建筑)

Source / 图片来源: Pirmin Jung Ingenieure / Holzbau Kappler

### 中德对装配式建筑的政策支持

德国在装配式建筑政策主要基于区域层面,目前装配式建筑越来越多的和国家政策尤其是保障性住房、快速建造房屋相关,例如:难民住房。来自政府、行业和社会的相关行动方正在对“经济适用房和建



Furthermore, Germany is also pushing for sustainable prefabricated building in the framework of the Climate Action Plan 2050. Environmental and climate-friendly building materials and modern building planning shall support climate mitigation measures and reduce the carbon footprint of buildings. Germany will therefore examine whether and to what extent incentives can be created in the future to strengthen the use of sustainable building and insulation materials, life cycle assessment as well as climate protection aspects arising during the production, processing, disposal or recycling of building materials. Prefabricated building offers benefits in this area and is, hence in the focus of future policy measures, especially for flexible intergenerational, barrier-free, and low-income housing that can support housing needs more quickly.

The Chinese government is also strongly promoting the construction of prefabricated building. In 2016, many policies on prefabricated construction have been issued and the market environment for prefabricated building is steadily improving. According to plans from the State Council on “Further strengthening the urban planning and construction management” and “Opinions on further strengthen the construction of urban planning management”, the increased application of prefabricated building shall reduce construction waste and dust pollution, shorten the building period, and improve the project quality.

Furthermore, starting in 2016, 30 percent of all new buildings in the next ten years must be prefabricated. Green buildings and building industrialisation has also been included in the national key research and development plan and more than 212 prefabricated construction technology research and development projects have been completed or are still in progress across China.

Local governments in China are also actively exploring policies on prefabricated construction. For example, more than 40 provinces and cities issued regulations to advance prefabricated construction, including Shanghai, Chongqing, Beijing, Hebei, Zhejiang, and Shenyang. The Beijing government pushes prefab-



*Residential building with prefabricated timber elements in Ulm, Germany*

德国乌尔姆木结构装配式居住建筑

Source / 图片来源: Pirmin Jung Ingenieure / Gapp Objektbau

筑联盟”系列问题进行深入研究。联盟的目的在于共同改善建筑质量和改善居住空间,并快速扩大都市区域的保障性住房的供应。德国环境部将在不久的将来推出装配式建造技术运用于经济适用房建设的竞争机制。

此外,德国在2050年气候行动框架中也明确了要推动可持续装配式建筑发展,同时环境和气候友好型建筑材料和现代化的建筑规划也应当支持气候缓解措施,减少建筑碳排放足迹。德国也在进一步探索如何激励可持续建筑和保温材料的使用,以全生命周期和气候保护的角度去评估建筑材料的生产、加工、处理或回收利用。装配式建筑在这些方面都是十分有益的,可以更快地满足无障碍、保障性住房等需求。

中国政府也在大力推进装配式建筑的发展。2016年,关于装配式建筑的相关政策密集出台,装配式建筑市场环境稳步发展。按照《中共中央国务院关于进一步加强城市规划建设管理工作的若干意见》和《国务院办公厅关于大力发展装配式建筑的指导意见》等政策,都要求大力发展装配式建筑,自2016年开始,中国力争用10年左右的时间,使装配式建筑占新建建筑的比例达到30%,具体目标包括减少建筑垃圾和扬尘污染,缩短建造工期,提升工程质量。绿色建筑和建筑工业化也被列入国家重点研究和发展计划,已经完成或正在研发的装配式建筑技术研发项目共计212余项。

ricated construction in commercial and residential building projects. Similar to the link between affordable housing and prefabrication in Germany, all new affordable housing projects in Beijing need to be prefabricated. Shanghai, for example, requires the rate of prefabricated buildings to be more than 45 percent for projects with a total construction area of more than 30,000 square meters and offers subsidies of 100 CNY per square meter. All these efforts indicate the importance of prefabricated building for future construction – both in Germany and China.

地方政府也在积极探索装配式建筑相关政策,包括上海、重庆、北京、河北、浙江、沈阳等40多个省市出台了有关推进装配式建筑的指导意见。北京市在商业和住宅建设项目大力推广装配式建筑,类似于德国在装配式建筑和保障性住房之间的关联,北京要求所有新建保障性住房项目采用装配式建造技术。上海对于总建筑面积达到3万平方米以上,且预制装配率达到45%及以上的装配式住宅项目,每平方米补贴100元。综上所述,无论在德国还是中国,装配式建筑对于未来建设都是十分重要的。

### Prefabricated Wood Construction in Public Buildings: Good Practice Example Schmutttert-Gymnasium in Germany

One good practice example how prefabricated wood buildings can be used in the public sector is the new campus of the Schmutttert-Gymnasium in Diedorf near Augsburg, Germany – completed in 2015. It is among the largest wooden constructions in Germany and received the Bavarian Energy Prize 2016 and the DGNB (German Sustainable Building Council) Sustainable Building Prize in 2016.

The building achieves the passive house requirements due to several innovative energy-saving technologies: mineral wool insulation of the building envelope and roof, triple-glazing, wood pellet boilers used for heating, ventilation plants to supply the building with fresh air and reduce heating demand, micro sun shielding louvres to block direct sunlight but guide diffused light into the rooms, floor slabs built from a combination of prefabricated wooden elements with concrete to bring reduced fluctuation of the indoor temperature, and PV panels on the roof. With this energy-efficient equipment, the building generates more energy than it consumes and additional costs will be amortised with energy savings over the building's lifespan.



Source / 图片来源: Stefan Müller-Naumann

### 装配式木结构公共建筑案例: 德国Schmutttert中学

本案例展示的是使用装配式木结构的公共建筑, Schmutttert-Gymnasium 中学新校区位于德国奥格斯堡市附近的迪多夫,于2015年完工。它是德国最大的木结构建筑,荣获了2016年巴伐利亚能源奖和DGNB(德国可持续建筑委员会)2016年可持续建筑奖。

建筑由于采用了几项创新节能技术从而达到被动房的要求,例如:外墙和屋面采用岩棉保温,外窗采用三玻两腔玻璃,采用木制颗粒锅炉提供供暖,通风设备为建筑提供新鲜空气同时减少采暖能耗,微型遮阳百叶窗既能遮挡阳光直射又能将漫射光导入房间,楼板为预制木构件加混凝土现浇而成,从而降低室内温度的波动,屋顶安装光伏电池板。这些节能设备的安装,从建筑全生命周期来说,建筑产生的能源多于其消耗的能源,建造的增量成本将由节约的能源来补偿。



Source / 图片来源: Stefan Müller-Naumann

Reference / 来源: Zhang, Ji. 2016: A Prefabricated Wooden School Project in Germany



## econet china: A Platform for Sino-German Cooperation in Sustainability 德中生态商务平台：中德可持续发展领域合作平台

Within the framework of the 13th Five-Year Plan (2016-2020), China released its national plan for sustainable development. By adopting green development strategies, it is aimed to keep improving the eco-environment. Energy saving and environmental protection are areas that will further gain in importance. Also, the demand for innovative environmental technology has been steadily increasing. This applies especially to the Chinese building sector, where energy efficiency and sustainability have become crucial topics.

econet china continues its role as a consulting institution for promoting German greentech as well as an industry platform to bring together all circles of interested partners from business, government, experts, and academia. The econet china team assists German small and medium-sized enterprises in the building sector in strategic positioning and business development by providing a comprehensive range of hands-on and “a la carte” support including the provision of market intelligence, networking and marketing activities, and project coordination. Thanks to our active and supportive industry partners, econet china has been steadily growing and has built up a strong network of green solution providers along the value chain of sustainable urban development and green building.

This year, econet has entered the tenth year of facilitating the Sino-German collaborations in the areas of smart urbanization, energy efficiency, and sustainable development in China and acts as a platform involving public and private stakeholders.

In the context of the BMWi supported Energy Export Initiative programme, the econet greater china team jointly organized three business delegations to China in 2016 together with the German Asia-Pacific Business Association (OAV), eclareon and energiewaechter. The delegations focused on energy efficiency and renewable energy in buildings, for instance under the application of geothermal energy. Each delegation programme consists of a large conference and individual business matchmakings. These events have now become a yearly occasion for leading German solution providers to present themselves, conduct market demand research in China as well as get connected with target industry players for further market entry and business development.

在“十三五”规划(2016-2020年)的框架下,中国创建了若干可持续发展的国家计划,运用绿色发展战略,提升生态文明建设水平。节约能源和环境保护领域仍有大幅发展空间,同时创新环保技术的需求也在稳步提升。这几点在建筑行业中体现尤为明显,能效和可持续发展成为关键议题。

econet china始终发挥着其作为推广德国绿色科技专业咨询机构与行业平台的职能,凝聚商业、政府、专家和学术各个层面的合作伙伴。通过提供包括行业资讯、组织交流和推广活动和项目协调等广泛的定制服务,协助德国建筑行业的中小企业在中国市场的战略定位和业务拓展。凭借各领域合作伙伴的积极支持,econet china逐步建立起可持续城市发展和绿色建筑产业链绿色方案提供商的强大沟通网络。

今年,econet china进入了推动中德在智慧城市、能效和可持续发展领域合作的第十个年头,同时也是促进中德政府和企业间广泛合作的平台。

2016年,在由德国联邦经济与能源部支持的德国能效出口倡议项目背景下,econet china团队分别与德国亚太商业协会,eclareon与energiewaechter合作,在2016年共同组织并接待了三个德国企业代表团访华,代表团访问的主题涉及能效与可再生能源,比如地热能建筑中的应用。每个代表团项目都包括大型的研讨会和商务对接。这些活动每年都为德国本土有意向进入中国市场和寻求业务拓展的优秀企业,创造了技术展示、中国市场需求调研和与行业潜在伙伴对接的重要平台。



Switch-Asia SusBuild Project Training in Yunnan province in 2016  
2016年Switch Asia可持续建筑项目云南培训

econet china还积极参加由德国伍珀塔尔研究所协调的欧盟资助的为期四年的Switch Asia可持续建筑

Coordinated by the Wuppertal Institute, econet has been actively engaged in the EU-funded Switch-Asia SusBuild Project (2016-2019). The kick off conference of the project was held in Chongqing in April 2016 with the presence of over 300 industry practitioners from the Western China regions. A series of training sessions has been co-organized on the topics of cleaner production of building materials and sustainable interior decoration. These training sessions are designated as key modules in the project to build capacity of local authorities, construction, interior installation and decoration companies, share green know-how and practices from Europe as well as foster the Sino-German network in Western China.

As the standing member of the Passive House Alliance (PHA) China, econet has contributed to the working group with a strong network of German experts and solution providers, offered strategic development advice and shared organizational experiences. econet assisted in developing the alliance as an advisory working group for low energy consumption and passive building projects by mobilizing and integrating expertise and solutions amongst the group. The alliance is dedicated to formulating and releasing a technical guide for passive standard buildings of China's hot summer and cold winter regions in the upcoming months and making joint efforts to engage more interested partners to develop economic, healthy, and energy efficient passive building projects.

In January 2017, econet accompanied a Chinese delegation tour to Germany and Switzerland. This delegation trip focused on system integration and application of the precast construction technology. As a leading country in the research and practice of building industrialization, Germany has built up a comprehensive supply chain along architectural design, engineering, production, logistics and installation for more than 60 years. Through visiting leading solution providers and selected projects, the participating Chinese developers, general contractors, and design firms gained a better insight of Germany's advanced know-how in system integration, key components and project experiences in the precast industry. The delegation also took the opportunity to visit the world's leading trade fair for architecture, materials and systems – BAU 2017 in Munich as well as the integrated homes exhibition at the Poing Center. Also, the delegation visited several passive building projects.

As the Chinese economy shifts to a more moderate growth pace, challenges are emerging from numerous fronts ranging from structural adjustments to changes

项目(2016-2019年),启动大会于2016年04月在重庆召开,来自中国西部地区300多位行业代表与会。econet china参与共同组织了建材行业清洁生产 and 可持续室内装修的系列培训。这些培训作为整个项目的重要组成部分,致力于推动在中国西部地区建筑领域的中德交流,提升当地政府机构、施工、室内安装和装修企业的能力水平,分享欧洲绿色技术知识和实践经验。

作为中国被动式建筑联盟的常务理事单位, econet china积极为工作组提供德国相关的专家和技术资源,为联盟的发展献计献策,分享日常运行经验。通过调动与整合各成员单位的经验与解决方案,协力将联盟打造成被动式建筑领域的专业顾问团队。联盟目前正积极编制并计划发布夏热冬冷地区被动式建筑技术指南,并致力于与更多感兴趣的伙伴共同打造满足经济性、健康舒适与节能的被动式建筑项目。



*Passive House Alliance China Annual Meeting in February 2017*  
2017年2月中国被动式建筑联盟年度会议

今年1月份, econet china陪同一批中国代表团考察德国和瑞士,主题主要围绕装配式建筑系统集成和预制建筑技术的应用。作为在建筑工业化研究和实践方面领先的国家,德国在建筑设计、工程、生产、物流和安装的整个产业链拥有超过60年的经验,通过参观当地领先的企业和项目,参与考察的开发商、承建商和设计公司对德国在系统集成、部品部件和项目实践等领域的先进经验有了更全面的认识和理解。代表团同期也参观了在慕尼黑举办的欧洲最大的建筑、材料和系统展BAU,集成房屋展示区Poing中心以及一些具有代表性的被动房项目。

目前中国经济已转向一个温和的发展阶段,社会的整体结构调整到变革都面临着许多挑战。德国企业在进入中国市场和继续发展的进程中也较从前需多一分谨慎。根据德国商会近期发布商业信心调查显示,2016年对德国在华企业来说是“比较艰难”的一年,尽管如此,在华德企仍然对今年中国的整体经济形势持乐观态度。



in society. It is more important than ever for German companies to be prudent when entering and moving forward in the Chinese market. German enterprises in China evaluate the economic situation of 2016 as one of the most difficult within recent years. However, the overall outlook for 2017 is more positive, reflecting the belief of German companies in the Chinese market and its recovery, according to the recently released German Chamber business confidence survey.

Just five years ago, the percentage of green buildings in China only accounted for around 2 percent and it is expected to rise to 50 percent by the year of 2020, according to China's New Urbanization Plan. The opportunities in this ongoing commitment from the central government can be concluded as the following:

- Green building labeling has been more widely required and monitored in compliance with the system.
- Energy is the essence for the development of green buildings, including energy efficiency and the application of renewable energy sources.
- Energy efficient renovation of existing buildings is first to be encouraged in Northern China where the major source of heating is still coal in winter as well as in hot summer and cold winter regions, mostly in Central China and lower reaches of the Yangtze River.
- With the rapid development progress in building industrialization in China, it is planned that prefabricated construction will account for over 50 percent of all new construction, while affordable housing projects will amount to a minimum of 60 percent by 2025. In this context, the prefabrication industry chain is expected to fully upgrade the building quality.
- Public buildings supported by the government (schools, hospitals, museums, etc), indemnificatory apartments, and other public buildings (airport, hotels, office buildings) are obligated to follow the green building standards and to get certified. In addition, the long-term return from energy savings through improved energy efficiency represents a great incentive. The three categories are not only required by the government, but also demonstrate commitment for accelerating green buildings, as they involve operators and long-term beneficiaries of energy cost savings.



Visit of Buggi 50 – the first retrofitted passive tall building in Europe  
访问Buggi 50 – 欧洲第一座改建的高层被动式建筑

五年前,中国绿色建筑占比仅为2%,依据中国新型城镇化规划,到2020年绿色建筑有望占比超过50%。从这项正在实施的规划中总结以下机遇:

- 绿色建筑评价标识正在更全面的开展执行和监测。
- 能源议题是发展绿色建筑的核心,包括提高能源效率和可再生能源的应用。
- 既有建筑节能改造将首先鼓励在中国北方开展,即冬季采暖供热主要依靠煤炭的区域以及长江中下游的夏热冬冷地区。
- 随着中国建筑产业化发展的快速推进,到2025年,装配式建筑占新建建筑的比例将达到50%以上,保障性安居工程采取装配式建造的比例将达到60%。由此,装配式建筑全产业链的发展将促进建筑品质的全面升级。
- 由政府支持的公共建筑(学校、医院、博物馆等)、保障性住房、公共建筑(如机场、酒店、写字楼)必须遵照绿色建筑标准并获得认证。另外,通过提升能源效率所取得的长期节能回报彰显了显著的激励效应。这三类建筑不仅是政府的强制要求,同时也体现了建筑运营商和节约能源成本的长期受益者加快推进绿色建筑的承诺。

## Rebuilding the World – the DGNB's Contribution to the United Nation's Sustainable Development Goals

A contribution by Dr. Anna Braune, Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB)

### 改造世界 — DGNB(德国可持续建筑委员会)助力联合国可持续发展目标

来自德国可持续建筑委员会(DGNB)的Anna Braune博士的客邀文章

On 1 January 2016, the United Nation's landmark 2030 Agenda came into effect. The initiative lays down meaningful goals and targets for the future development of our planet with the aim of changing long-term thinking and thus facilitates life in a world of sustainability. The UN's 17 objectives are called the Sustainable Development Goals (SDGs) and each is broken down into a total of 169 targets. These will be used by the UN and its member states, China among these, to provide development guidelines for the next 15 years. More and more private companies and NGOs orient their sustainability strategies and measures towards the goals as well.

As the leading network of sustainable construction in Europe with activities in more than 30 countries worldwide, the DGNB has also decided to play an active role in supporting the global sustainability goals. A first step was to go through the activities the DGNB has been involved in until now and to compare these to central aspects of the SDGs and its related targets. Future action plans will follow the lead of the SDGs and draw on them as a source of inspiration.

One thing that stands out with many of the SDGs is that implementing them as aspired to by the UN has a strong bearing on the construction industry. The world we are building around us currently accounts for one third of all consumption of global resources and almost one half of global energy use. Buildings generate a third (at least) of global greenhouse gas emissions. As the nation with the highest population in the world, China bears a heavy responsibility in making things better here.

As a comparison between the global sustainability

具有突破性的联合国2030年议程于2016年1月1开始生效。该议程明确的目的是,让人们生活在一个可持续发展的世界成为可能。为了达到这个目的,我们必须改变现有的思维方式,并重新思考和设计世界的下一步发展。2030年议程一共设定了17个可持续发展目标(SDGs),这17个目标又细分为169个分目标。这些目标为联合国及其成员国在未来15年内的发展指明了方向。而且越来越多的私营公司和非政府组织也将SDGs做为各自的可持续发展和经营的指导。

DGNB作为在欧洲范围内引领可持续建筑发展,业务遍及全球30多个国家,全球领先的可持续建筑平台,同样积极支持全球可持续发展目标的推进。作为第一步,DGNB将自己的经营和业务内容依据SDGs及其子目标进行了定位和调整。DGNB会确保未来的业务与SDGs的指针保持一致,并在此基础上进一步发展。

建筑领域对许多SDGs目标的实施和达成有着特殊的重要意义。目前建筑业消耗着三分之一的全球资源,和近一半的全球能源。至少三分之一的全球温室气体排放量来自建筑业。中国作为世界上人口最多的国家,在此起着尤为重要的作用,并担负着更加重要的责任。



DGNB supports the Sustainable Development Goals

DGNB 助力支持全球可持续发展目标

Source / 图片来源: United Nations联合国



goals and the current version of the DGNB System, which is increasingly applied on the Chinese market, shows there already are many overlaps and areas of potential synergy.

### Climate protection

The DGNB wants to contribute to the aim of keeping global warming below 2°C as defined in the Paris Agreement. The reduction goals underscore the urgency with which climate protection measures need to be introduced. They also provide us with an important springboard for making immediate contributions to the SDGs. Existing buildings have huge potential in this respect, partly due to the high levels of consumption already caused by operating properties and the wide-scale use of fossil fuels at present time.

Overall, the DGNB System – itself part of a higher goal to improve sustainability in the world we build around ourselves – makes a direct contribution to SDG 13, which revolves around climate action. One of the aims of the DGNB certification system is to lay down ambitious targets and robust points of reference for carbon emissions when building and operating new or existing buildings. Our current target for energy requirements is to bring them 30 percent below the statutory guideline. This includes embedded energy, which is the energy required to produce building materials in the first place.

As an association, the DGNB also fulfils a more holistic role working alongside its members and its network, which spans many different sectors of society. It plays a key role not only in establishing climate protection goals within the property sector but also in continually spotlighting the importance of such issues on an international level. Working closely in a relationship of trust with producers, investors, building contractors, architects, engineers, construction companies, building operators and tenants plus a variety of other associations and research establishments, helps foster the development and introduction of innovative technologies, new solutions and materials that promote climate protection. The DGNB Akademie helps to share and proliferate know-how held by the DGNB,



*The BASF R&D Centre in Shanghai received a DGNB Pre-Certificate in Silver in 2016  
巴斯夫亚太创新园二期项目于2016年获得DGNB 银级预认证  
Source / 图片来源: BASF巴斯夫*

DGNB系统在中国的规划和建设实践中越正得到来越多应用。而该系统与全球可持续发展的目标之间有着很多的相同和相通的地方。

### 环境气候保护

《巴黎协议》设定了将全球平均温度升幅控制在2°C以内的, 限制全球变暖的控制目标。DGNB也积极行动以推进该目标的达成。减排目标突出了执行气候保护措施的必要性和迫切性, 而这些措施同时也是SDGs的要求。建筑业有着非常巨大的减排空间。其中相当大的原因在于, 建筑运行中巨大的能源消耗, 而当前在整个能源消耗中, 化石能源还占据着绝对的比重。

DGNB系统以促进可持续建筑发展为最终目标, 这与SDGs的第13条“环境气候保护措施”非常地契合。DGNB认证体系为新建和既有建筑都制定了, 既富有挑战性又切实可行的二氧化碳排放量控制目标。而且, 此控制目标贯穿于建筑的建设和运行全过程中。

DGNB有着广泛的会员网络和基础。通过其在国际范围内的影响, DGNB不断地宣传和强调建筑产业对于气候保护目标的重要性。为了支持气候环境保护目标的达成, DGNB与合作伙伴积极合作, 开发和推广新的技术, 以及有创造性的解决方案和材料。这些伙伴中来自不同的领域, 其中有生产商、投资商、建

strengthening awareness of the important role played by climate protection. In China, DGNB has already trained around 300 professionals as experts in sustainable building.

### Resources and consumption

The Earth's natural resources are a precious asset that should be looked after. Whenever resources are used, this has an effect on flora, fauna and humanity. Many resources are already in short supply, and this is increasingly leading to conflict about how they should be shared. The DGNB System promotes sustainable business and the efficient use of all resources. The resources that are specifically needed for buildings – ranging from drinking water to finite materials or energy sources – can be systematically calculated for an individual building, made transparent and thus evaluated.

By looking at carbon footprints, we are able to gauge and understand the impact a building has on our environment. For example land and oceans can be polluted due to soil acidification and over-fertilisation, resulting in forest decline and higher fish mortality.

Apart from actually reducing the use of resources, we also assess when to use renewable energy sources and how to make more efficient use of land. To promote sustainability in the extraction of materials, the DGNB honours the use of wood and natural stone from sustainable forestry and mining. DGNB also promotes construction that reduces environmental hazard, the minimal use of harmful substances, the replacement of building materials with recyclable alternatives, and construction that allows materials to be reclaimed or recycled. Effectively, this is about an overarching principle that resources should be used responsibly in ways that revolve around the concept of recycling. This is in keeping with the idea of a circular economy and is thus already part and parcel of our system. It is also reflected in a variety of the criteria DGNB subscribes to. DGNB plans to keep building on this principle in the future.

### Sustainability in every neighbourhood

When it comes to the buildings that form our environment, it is important that our approach to sustainability does not just look at each building in isolation, separated from its surroundings. This applies to how they are planned, assessed, or both. With the right transportation networks, electric car sharing systems and the infrastructure to match, so much

筑商、建筑师、工程师、承包商、运营商以及研究机构等。DGNB通过DGNB学院,不断推广和交流可持续建筑的经验和知识。这个过程中,环境保护的理念得到了更广泛的传播。至2016年底,在中国已累计有300余位专业人员通过了DGNB的培训和考试,取得了DGNB咨询师的资格。

### 资源与消耗

世界自然资源是珍贵和有限的,必须保护。资源的消耗总是伴随着对动植物界和人类环境的影响。许多资源现在已变得非常紧缺,而由资源分配导致的冲突正也越来越频繁。DGNB系统促进可持续的,经济和有效的资源利用。根据每个建筑的具体情况,其消耗的资源,如水、材料和能源等,会被总结和统计,并最终得到评估,整个过程透明且完善。

除了资源的消耗,酸化或富营养化等污染会导致森林和鱼类死亡等问题,造成对土壤和水体的破坏。而这些污染的可能性也都会被纳入建筑物全生命周期环境影响计算中。

除了减少资源的消耗,利用可再生能源和有效利用的土地也是DGNB系统的评估内容。另外,低毒性和低排放的材料、易于回收的材料以及可拆卸的建筑构件的使用,也是DGNB提倡和鼓励的。由此可见,负责的,根据“循环经济”理念使用资源的原则,已充分融入于DGNB系统中,并会在未来不断得到加强。



*DGNB certification for the Gezhouba Purple County Residence in Shanghai at BAU 2017 trade fair in Munich*  
葛洲坝虹桥紫郡公馆项目认证颁发仪式2017年于慕尼黑国际建筑建材展览会BAU  
Source / 图片来源: DGNB

### 可持续城市发展

建筑物的可持续设计和评估,不应脱离其所在的环境而孤立地进行。在推进城市可持续化发展过程中,



can be done to promote sustainable travel in the long term – and this also ties in with building standards. The DGNB System offers ways to view entire urban districts, commercial districts and centres of manufacturing from a broader perspective. We find it important to assess such aspects as the extent to which actual end-users are involved in decision-making processes, governance issues and the availability of and accessibility to “green spaces” and natural areas – cheek by jowl with buildings.



More than 50 Chinese experts were trained by DGNB at Tsinghua University in December 2016  
2016年12月, 50余位国内专家参加了于清华大学举行的DGNB城区系统培训

Source / 图片来源: Architectural Design & Research Institute of Tsinghua University 清华大学建筑设计研究院

### Health and well-being

To ensure the DGNB certified buildings use non-harmful materials and are fitted to avoid hazardous materials and pollutants to the fullest extent possible, certification involves drafting an exhaustive list of building materials. This list makes it possible to place materials and building items into categories according to their environmental compatibility. To ascertain whether there are harmful substances in the air inside buildings, measurements are taken once construction has been completed. In most cases, ensuring that the air inside buildings is pollutant-free means that harmful materials are not used in the first place.

When we calculate the sustainability of a building, we also assess emissions during the entire life cycle of materials, from initial production to final use. This evaluation includes any potential harm to the environment or people.

### Appeal for more sustainability

The DGNB takes up the challenge of Agenda 2030. The UN's goals for humanity and the Earth lay a foundation for peaceful coexistence, and as an organisation, they provide the DGNB with orientation and inspiration in one. The DGNB will invest its energy in ensuring that these goals are achievable, driven by the aspiration that we can inspire many others to join us on the journey, in Europe, China and other parts of the world.

随着相关的基础和配套设施的完善和提高,其中的建筑物本身的质量也会相应地得到提升。DGNB系统也为城区、商业区和工业园区提供了可持续性评估的工具。在这里,诸如鼓励使用者参与决策、管理和治理的过程,以及开放空间和绿地的使用等问题,都会被纳入评估范围。

### 健康和舒适

使用的材料和构件中,不会含有害物和污染物,作为DGNB认证的一部分,需要为使用的建材编制完整、全面的目录。根据目录,可对使用的材料和构件,依照其对环境的影响进行分级。建筑物室内空气中污染物含量的实际情况,会在完工后经由室内空气质量检测最终确定。大多数情况下,不使用有害的材料,是保证健康的室内空气质量的前提。

通过基于排放的全生命周期计算,从建材生产到建筑物使用寿命结束的整个过程中产生的,对环境和人类产生影响的排放量,会被得到统计。

### 呼吁更多的可持续性

DGNB积极应对2030年议程带来的挑战。联合国此议程的最终目的是让人类在我们的地球上能够和平共处,这也不断指导和激励着DGNB的发展。DGNB正在努力促使这个目标的实现。这需要我们和我们的伙伴共同努力 - 在欧洲在中国,也在世界其他地区。

# Potentials for Low-Carbon-Buildings with Building Integrated Photovoltaics in China

A contribution by Dr. Dirk Schwede, Stuttgart University and energydesign (Shanghai) Co. Ltd.

## 中国应用光伏建筑一体化 (BIPV) 系统的潜力

来自斯图加特大学和energydesign (上海) 有限公司Dirk Schwede博士的客邀文章

Mainly as a result of the German and European energy transformation, China has established more than 60 percent of the photovoltaic module production capacity worldwide (China: 28 MWp / worldwide: 45.7 MWp). However, based on figures of 2014 of Fraunhofer ISE, only about 20 percent of the photovoltaic capacity is currently installed in China.

Building integrated photovoltaic (BIPV) systems have been discussed in China for some time, but compared to the extensive construction activity and the rapidly increasing energy demand in buildings the contributions of BIPV are still insignificant. BIPV would be possible in new buildings and in the retrofitting of the existing building stock.

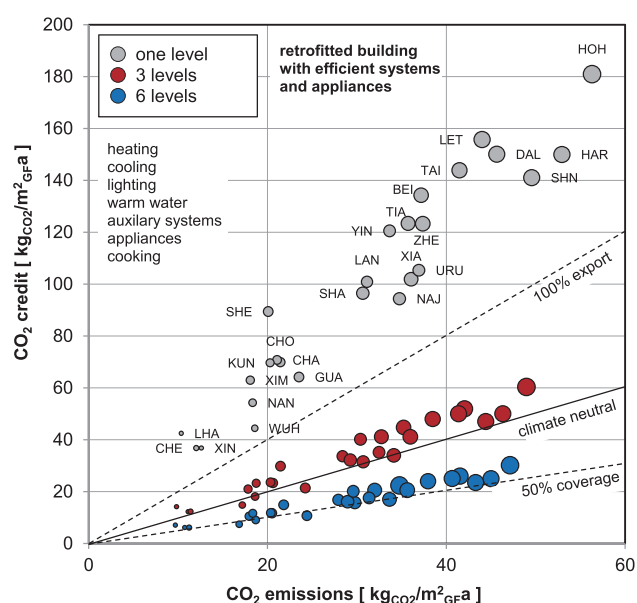
After the successful uptake of energy saving standards in the Chinese construction industry and the rollout of more far reaching energy concepts, for example in projects of GIZ, dena and MoHURD, it is now time to transfer also the experience with PlusEnergy-buildings made in Germany to projects in China. These concepts have to be adapted to local climates as well as market conditions. In theory, feed-in of electricity produced on site is legally and technically possible and feed-in tariffs are available in China.

An investigation of 26 locations in China has been conducted in order to determine specific energy demand profiles at the sites and the potential output of roof-integrated PV systems. Based on energy demand profiles, strategies adapted to different climate zones for energy saving have been developed. The output of the PV systems has been calculated for each location for various system slopes for south orientation. In most locations a higher output can be realized than in Stuttgart, Germany. The highest solar output can be achieved in Lhasa due to high altitude and its clear and sunny climate. Lowest PV output is achieved in Guangzhou, where the major part of the radiation is diffuse due to high humidity levels in the air and the prevailing cloud cover. In summary, heating climates are more suitable for PV power generation than climates with cooling and dehumidification demand. For all locations, a PV system with 15°-slope towards the

由于德国和欧盟能源转型的需求, 中国制造了全球60%的光伏组件(中国: 28兆瓦, 世界总量: 45.7兆瓦)。然而这些光伏组件只有20%被安装于中国本土(数据来源于德国弗劳恩霍夫太阳能系统研究所, 2014)。

在中国, 对于光伏建筑一体化 (BIPV) 系统的讨论已有一段时间, 但是相对于中国目前大量的建筑施工活动和现有建筑不断增长的能耗需求, 光伏建筑一体化的贡献仍然微不足道。而光伏建筑一体化不仅仅能应用在新建建筑中, 也可用来改造现有建筑。

随着中国建筑业不断提出更高的节能标准, 以及越来越成功的推广更高级更广泛的能源概念, 比如德国国际合作机构 (GIZ)、德国能源署 (DENA) 和中国住房和城乡建设部的项目中的案例, 现在是时候将德国产能建筑的概念与经验引进到中国的项目中来。当然考虑到当地的气候和市场条件, 我们还需要对这些理念进行相应的调整。随着中国上网电价 (Feed-in Tariff) 政策的提出, 理论上讲, 将现场生产的电力并网在技术层面与政策层面上均是可行的。

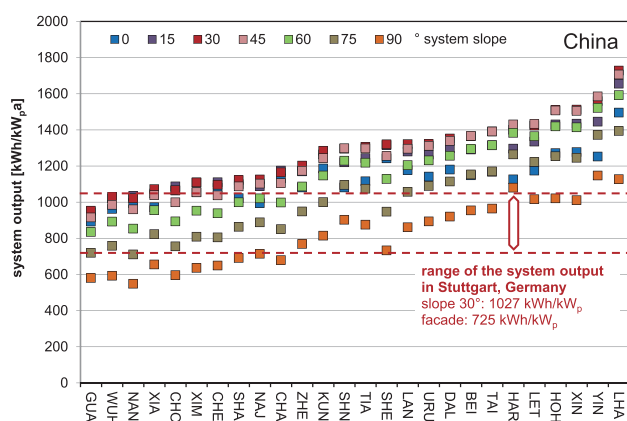


CO<sub>2</sub> emissions and CO<sub>2</sub> credits for buildings with one, three, and six levels (after energy retrofit)

中国26个城市一层、三层和六层建筑能源消耗对应的二氧化碳排放量和光伏系统输出对应的二氧化碳减排量



south performs best. On the other hand, the energy saving concepts are characteristic for the specific location with, for example, increased insulation thickness and 3-pane glazing in the North and moderate insulation thickness and 2-pane sun protection glazing in the South. In all climates building concepts include an airtight building envelope and a mechanical ventilation system for times of conditioning demand and natural ventilation through operable windows in time with moderate outdoor conditions. Ventilation systems are equipped with heat recovery functions in the North and in the West, and heat and moisture recovery in the South and the East. Heating and cooling is generated with decentralized systems of the highest efficiency class.



*Solar systems output of a roof integrated PV system with various roof slopes in 26 locations in China*

不同倾斜角度、屋顶光伏建筑一体化在中国26个城市的产能输出（和同样条件下德国斯图加特作对比）

Balancing the CO<sub>2</sub> emissions from energy consumption (heating, cooling, lighting, hot water, auxiliary energy and appliances) and the CO<sub>2</sub> benefits from PV output, in all climates 3-storey buildings can be carbon-neutral and in 6-storey buildings the CO<sub>2</sub> emissions can be off-set by 50%. If the energy demand for appliances is not included 6-storey buildings can be carbon-neutral in their annual balance.

This investigation shows that BIPV can contribute significantly to a low carbon building stock in all parts of China and under all relevant climatic conditions. Considering typical residential apartment compounds with 5-7 storeys, the necessary energy upgrade combined with PV applications on the roof could result in a nearly carbon neutral building stock (building energy demand without energy use). As it has been shown that the energy demand and the energy generation can be balanced, a supportive political framework, sufficient future-oriented investment and good engineering is needed to realise these potentials for low-carbon-buildings in China's cities.

在中国的某些地区会比其他区域更容易达到光伏系统产电量与用电需求量之间的平衡。为此，我们进行了针对中国不同气候区26个城市的研究，以确定各地点的具体能源需求曲线，以及屋顶光伏建筑一体化系统的潜在能量产出。在研究中，我们根据能源需求曲线调整了适应不同气候区域的节能策略。

我们对每个城市南向光伏板在不同倾角下的系统输出进行了计算（0度代表太阳能板是水平的，90度代表太阳能板是垂直的）。结果显示不同地区光伏系统的产出差距很大，且在大部分城市，光伏系统的产出都比德国斯图加特高。其中光伏系统在拉萨的产出最多，因为拉萨海拔高，天空能见度高并且晴朗。广州光伏系统的产出最少，其原因归咎于由较高的空气湿度和多云带来的大量漫反射。总体上来说，相较于制冷与除湿为主要需求的气候区域，光伏系统更适合于以供暖为主要需求的气候区域。此外，就研究中涉及的所有城市而言，太阳能光伏板朝向南并且有15度倾斜角时能够获得最大的系统产出。

另外，在研究中我们对于中国的不同地区所采用了不同的节能方法。比如北方会增加隔热层厚度，并使用三层玻璃，而南方会采用中度的隔热层厚度，并使用双层防晒玻璃。而针对所有区域的建筑，我们均采用了提高围护结构气密性，在使用空调的情况下采用机械通风，在过渡季节舒适的气候条件下通过外窗或幕墙的开启扇，充分利用自然通风等节能方式。在中国北部和西部地区，通风系统配备热回收功能，在热带和亚热带南部和东部地区，通风系统则配备热湿回收功能。供暖与制冷均采用最高能效级别的分散式系统。

除此之外，本研究对能源消耗（供暖、制冷、照明、热水、家用电器）所对应的二氧化碳排放量和光伏系统输出对应的二氧化碳减排量的平衡关系进行了分析，结果显示在所有气候条件下三层楼建筑能实现碳中和，而六层楼建筑二氧化碳能够实现50%的减排。在不考虑家用电器带来的能源需求的情况下，六层楼建筑也能实现年度碳中和。

研究表明光伏建筑一体化可以在中国所有地区以及相关气候条件下对实现建筑低碳起到重要作用。就中国典型的旧城区五到七层的老式建筑而言，在屋顶安装太阳能光伏板能够使建筑达到零碳排放（建筑本身不需要额外的能源供给）。

本研究证明了建筑能源需求和能源产出可以达到平衡，但同时还需要有效的政策支持，充分面向未来的研究和质量过关的工程，这样才能够充分挖掘中国城市低碳建筑的潜力。

## Upscaling & Mainstreaming Sustainable Building Practices in Western China

A contribution by Dr. Chun Xia-Bauer, Wuppertal Institute for Climate, Environment and Energy

### 中国西部可持续建筑 推广和主流化

来自伍珀塔尔气候、环境与能源研究所夏纯博士的客邀文章

China's unprecedented socio-economic growth drives expansion in the building sector. Meanwhile, building energy consumption has increased by 40 percent since 1990 and accounts for about 30 percent of the final energy consumption in China. Thus, the building sector offers tremendous opportunities for China to pursue a resource efficient and low carbon development. In the last years, the Chinese government has aggressively promoted sustainable building practices. However, in the vast region of western China, the development of sustainable buildings is still at an early stage.

In the period from 2016 to 2019, the EU-funded Switch-Asia "SusBuild" project, led by the Wuppertal Institute for Climate, Environment and Energy, aims to foster sustainable building practices among small and medium-sized enterprises (SMEs) in Chongqing City and Yunnan province with a replication potential for the whole of western China. The project consortium is composed of two national institutes (China Association of Building Energy Efficiency and Beijing University of Civil Engineering and Architecture) and five local partners from both target regions including three governmental think tanks, one industry association, and one bank.

The consortium is supported by the Ministry of Housing and Urban-Rural Development (MoHURD) and their bureaus in the target regions as well as econet china and GIZ. To promote sustainable building practices, the project takes the following integrative approach:

- Building up capacity for and providing technical support to SMEs along the supply chain in the building sector.
- Raising awareness on energy savings among SME users in commercial buildings and improving the technical capacity of facility managers.
- Strengthening the capacity of financial institutions for providing green loans and facilitating access to finance for SMEs in the building sector.

伴随着中国社会经济的快速推进,建筑业和建筑能耗也在快速增长,相比1990年,建筑能耗增长了约40%。目前,建筑能耗占我国全社会终端总能耗的30%左右。因此,建筑业对我国低碳可持续发展至关重要。在过去这些年,中国政府大力推广可持续建筑,也取得了丰硕的成果,尤其在东部地区。然而,在中国的西部广大地区,可持续建筑发展还处于起步阶段。

由欧盟Switch-Asia资助的SusBuild项目旨在调动中国西部重庆市和云南省中小型企业投入可持续建筑产业的积极性,并在中国西部有潜力的其它地区乃至更大的范围进一步推广。项目期为2016—2019年。项目由德国伍珀塔尔气候、环境与能源研究所牵头,项目合作单位包括中国建筑节能协会、北京建筑大学以及五个当地机构(三个政府智库、一个行业协会、和重庆银行)。项目也得到了住房和城乡建设部、云南省住房和城乡建设厅、重庆市城乡建设委员会、econet china、以及德国国际合作机构GIZ的大力支持。



The Switch-Asia SusBuild project kick-off conference in Chongqing took place in April 2016

2016年四月在重庆举行的Switch-Asia SusBuild项目启动会

SusBuild项目采取了综合方法以推动西部可持续建筑发展,主要项目活动包括:

- 对建筑领域供应链中的中小型企业进行发展可持续建筑的能力建设和技术支持;
- 增强中小型企业的节能意识,以及提高商业建筑中物业管理公司的技术能力;



- Providing recommendations of key policies for developing a sustainable building sector to decision makers at both national and local level in China.
- Improving business networks fostering sustainable buildings.

The project has received attention from both national and local government. For instance, the Chief Engineer and Vice Minister of MoHURD, Chen Yiming, took part in the kick-off conference in April 2016, where he acknowledged the importance of the SusBuild project for sustainable building development in western China. After the kick-off, SusBuild implemented a range of activities.

In June 2016, SusBuild hosted a series of trainings and networking events on sustainable building materials and components as well as sustainable interior design for SMEs. Supported by the associate partner econet china, these events not only strengthened the capacity of and network among local SMEs but also encouraged dialogue and match-making between local and European SMEs.

In September 2016, SusBuild organized its first good practice tour to Europe, combining workshops, visits of different projects, and dialogues with European organizations. Participants include stakeholders from both governmental agencies and SME associations.

In addition, in 2016, SusBuild also supported the development of local strategies of promoting green building materials and components and conducted studies on energy performance and policy frameworks for energy efficiency in public and commercial buildings.

2017 will mark another important year for SusBuild. Among others, the project will host training and networking events on green construction and energy service companies (ESCOs) in June and welcome European enterprises to join and share their technology solutions. In order to facilitate SMEs access to finance, the SusBuild team will develop a strategic paper on financing for ESCOs and support match-making with banks. In addition, SusBuild will prepare a handbook on energy management in large commercial buildings. Furthermore, the alliance of promoting sustainable buildings in western Chinese mountainous region will be established.

- 促进金融机构为目标地区建筑领域中小型企业提供绿色信贷, 以及增强企业获得资金的能力;
- 为国家和地方决策层制定关于可持续建筑的重要政策提出建议;
- 建立可持续建筑机构联盟。

该项目得到了国家和地方政府的高度重视。住房和城乡建设部陈宜明总工程师出席了2016年4月举办的项目启动会并致辞肯定了SusBuild项目的重要性。在启动会之后, 项目开展了一系列活动。2016年6月, 项目举办了一系列以可持续建材生产和可持续内部装修为主题的培训和交流。在econet china的支持下, 这些活动不仅加强了地方企业的能力、增进他们的交流, 也促进他们和欧洲中小企业的交流与合作。



*Trainings and networking events encourage dialogue and match-making among local and European SMEs*  
项目的培训和交流促进地方以及中欧企业间对话

2016年9月, 项目组织了第一次欧洲考察。考察期间, 来自重庆和云南省政府机构和行业协会的代表参加了研讨会, 参观了示范项目, 并与欧洲企业和机构就可持续建筑发展进行了一系列对话。另外, 在2016年项目也支持了地方政府起草地方绿色建材推广战略, 并调研了重庆和云南省公共建筑的用能情况以及节能改造政策。

2017年将是项目重要的一年。今年6月, SusBuild项目将举办针对绿色施工和节能服务公司的一系列培训和交流活动, 届时欢迎欧洲企业和机构积极参与和当地企业交流和对接。另外, 为了帮助建筑行业中小企业获得贷款和资金, 项目将提出节能服务公司融资战略建议并组织地方节能服务公司与银行的精准对接。同时, 项目将出版大型商业建筑能源管理手册增强业主和物业管理公司的在节能方面的技术和管理能力。目前, 由项目牵头建立的中国西部山地地区可持续建筑联盟也在紧锣密鼓的筹备当中。

## Fairs & Events 展会与活动

13th International Conference on Green & Energy-Efficient Building & New Technologies and Products Expo  
Beijing, China · 21/03/2017 - 22/03/2017  
第十三届国际绿色建筑与建筑节能大会暨新技术与产品博览会  
北京, 中国 · 2017年3月21日 - 3月22日  
chinagb.net

Clean Energy Expo China 2017  
Beijing, China · 29/03/2017 - 31/03/2017  
中国国际清洁能源博览会  
北京, 中国 · 2017年3月29日 - 3月31日  
www.ceecintl.com

ISH China & CIHE 2017  
China Intl. Trade Fair for Heating, Ventilation, Air-Conditioning, Sanitation & Home Comfort Systems  
Beijing, China · 18/05/2017 - 20/05/2017  
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 · 2017年5月18日 - 5月20日  
ishc-cihe.com

4th China International Energy-saving & Advanced Building Materials Exhibition  
Beijing, China · 24/07/2017 - 26/07/2017  
第四届中国国际建筑节能与绿色建筑技术与装备博览会  
北京, 中国 · 2017年7月24日 - 7月26日  
bj.cibes.com.cn

ISH Shanghai & CIHE 2017  
Shanghai Intl. Trade Fair for Heating, Ventilation & Air-Conditioning  
Shanghai, China · 05/09/2017 - 07/09/2017  
上海国际供热通风空调、城建设备与技术展览会  
上海, 中国 · 2017年9月5日 - 9月7日  
ishc-cihe.com

FENESTRATION BAU China 2017  
Shanghai, China · 07/11/2017 - 10/11/2017  
中国国际门窗幕墙博览会暨中国国际建筑系统及材料博览会  
上海, 中国 · 2017年11月7日 - 11月10日  
www.bauchina.com

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www.china.ahk.de

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### 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  
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jiko-bmub.de

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### Studies & Publications 研究报告与出版物

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adb.org/publications

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Caixin 财新网  
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Environmental Finance 环境金融  
environmental-finance.com

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