

把握可持续发展主流——从政策到实践

Making Sustainability Mainstream: From Policy through to Practice

撰文 Chris Twinn 奥雅纳工程顾问公司董事、可持续发展高级顾问

0 简介

中国正处在发展的关键时期，是否按照西方依赖资源的高消耗道路走向繁荣？或者中国应该去寻找另一条通向繁荣的道路，而直接改为对环境影响较小的社会发展，从而避免对资源的过度开发？

中国的目标是明确的。他们明白，如果中国继续保持繁荣增长，必须设法降低其对不断消耗自然资源的依赖和日益增加的环境影响。不幸的是，就建筑业而言，我们在当地看到的是中国极大程度上参照西方的常规方法进行建设，并造成一些高度依赖资源消耗和高污染排放的遗留问题。

1 发展方向

第十二个五年计划中就发展方向列出了一些明确的指标，使中国整个社会的发展目标越来越明确。但目前来看，建筑业对国家发展方向的贡献是完全不清楚的，不仅短期的方向不够明确，长期的方向也同样缺乏。那么，现在的建筑业应该怎样发展并向未来迈进呢？

显然，找到一条适合中国的特殊发展路线和具体解决方案，需要快速改变的现状以及13亿人口的规模意味着这个答案将需要非常适合中国。但答案并不是现成的，需要借鉴许多来自世界各地的经验和思想而得出。

西方的某些国家已经认识到需要改变其发展的模式。最新的理解是将人类利用资源和排放废弃物总量作为一个整体，与自然界提供的资源储量和处理废弃物的能力联系起来。将自然界资源储量除以世界人口总数（世界人均资源占有量），告诉我们建筑环境所允许的资源使用和排放总量，从而为我们提供了一个清晰的目标，这就是未来所谓“生态时代”的涵义。对大多数西方国家而言，这将意味着未来的资源用量比目前至少减少80%。设定时间表和机制以实现这一削减已经在某些国家和地区开展起来。经过试验，已经得出一些帮助减小所需规模的经验及其教训，也清楚地认识到一个强有力的国家监管机制的必要性。这个机制必须要精心构建，使其经自由市场经济模式产生，从而实现长期的有效削减成本的想法和创意。但同时它也必须强大到足以避免一般常规市场单纯追求短期经济利益的弊端，而是要一直与长期社会、环境目标相结合。

中国已经迅速认识到利用这种想法是提高其庞大的劳动力技能的关键，从而实现未来所需的社区。

2 现状

低碳建筑的发展已经有了一个良好的开端。适用于新建公共建筑的节能强制性标准GB50189 - 2005的发布，旨在相比20世纪80年代典型无管制建造，对可预见的、规范的能源使用量减少50%。2010年更新的房屋JGJ26&134设计标准规定了不同气候区新建住宅的能源使用效率，同时专门针对中国建筑市场需求的三星级的环境评估方法已经出台。然而从其他地方的经验表明，这些只是第一个最基本的步骤。其他国家现在不断出台新的方案，以持续改进能源法规。例如，英国允许每3年减少25%的能源

0 Introduction

China is at a key junction in its development. Does it follow the West's path to prosperity dependant on high resource consumption? Alternatively, does China seek an alternative prosperity path that avoids much of this high resource exploitation, and instead go directly towards a low environmental impact society?

The aims from the Chinese Government are clear. They understand that if China is to maintain its prosperity growth it must seek to reduce its dependence on ever depleting natural resources and ever increasing environmental impacts. Unfortunately, as far as construction industry is concerned, what we see being delivered on sites across China is following much of the conventional Western approach and creating a legacy of dependence on high resource consumption and high pollution emissions.

1 Direction of travel

The 12th Five Year Plan sets out some clear indicators for the desired direction of travel for Chinese society as a whole is becoming clear. But for the construction industry's contribution to this national direction, the objectives are not at all clear. This lack of clarity is both for the short term and the long term. What should the construction industry be delivering now and forward into the future?

What is clear is the need to develop a China specific road map and China specific set of solutions. The rate of rapid change needed and the scale defined by the population of 1.3 billion people means the answers will need to be very specific to China. The answers do not come ready made, but will need to be formulated by drawing on an amalgamation that includes experience and thinking from many sources from around the world.

Some parts of the West have already recognised the need to change their model of prosperity growth. The emerging understanding relates mankind's sum total of resource use and waste emissions to the overall physical capacity of the natural world to provide and handling these. Dividing this natural capacity between the number of people worldwide gives us a clear target for the permissible resource use and emissions for our built environment. This is what is meant by a future 'Ecological Age'. For much of the West this would involve at least an 80% reduction compared with current use. Setting timelines and the framework to achieve this level of reductions has started in certain countries. Experience is being generated on what helps to deliver the scale of reduction needed and lessons learnt on what does not. Also clearly identified has been the need for a strong national regulatory framework. This framework has to be carefully structured to allow the free market economy to generate ideas and innovation to achieve these long term reductions in a cost effectively way. But likewise it has to be strong enough to avoid the normal market default of focusing solely on seeking short term economic benefits instead of a combining this with long term social and environmental objectives.

China has been quick to realise that harnessing this kind of thinking is key to up-skilling their vast workforce potential to deliver the communities needed for the future.

2 Progress so far

There has been a good start towards low carbon buildings. The publishing of the mandatory GB50189-2005 energy standard for new public buildings aims to cut by 50% the predicted 'regulated' energy use when compared with a typical 1980s unregulated building. The 2010 updated housing JGJ26 & 134 design standards defines energy efficiency of new residential buildings for various climate zones. The 3-Star Environmental Assessment Method has been introduced specifically tailored for the needs of the Chinese construction market.

消耗,使得新建筑物在2020年之前达到零碳排放。像美国LEED、中国三星这样的环境评估方法越来越多地被看成是可持续性的延伸,而不是使建筑业可以从了解新国家标准的领先典范。

中国大约规划了250个新的生态城市,并且到目前为止,已知的跟踪记录都非常混乱。黄柏塬等生态项目刚刚开始实行就失败了。上海崇明岛的东滩生态城仍然停留在图纸上。天津生态城已在实施中,但现在正被质疑是否真的要建立一个“生态”城市。许多诸如此类的问题涉及到对未来中国生态城市应该怎样发展没有任何正式规划,以及对生态城未来如何演变与如何引进市场资金同样也没有正式规划。

如果我们从更深的层次来看东滩生态城项目,我们会发现它试图把最新的理念应用到城市设计中去,未来将证明它已经为今后几十年的需求做好准备。它包括了一个主要通过减少能源需求来实现零碳排放的规划,并要求尽可能消除对汽车的依赖,将所有交通都转换为无污染、非化石能源的动力驱动型,同时强调公建、住宅和工作场所相整合。实现这一切的基础是一种将地球有限资源公平分配的资源利用模式。

然而五年前开始计划生态城时,在当时的中国来说实在太过超前,特别是建筑行业的经验和能力与达到高环保标准的要求不匹配,中国只是处在学习如何实施这些标准的开始阶段。有趣的是,东滩项目说明很多事物都有一个成长曲线,不只是在建筑行业的技术方面,同时也在立法者制定法案,投资者对投资回报的理解,当地市政当局的核查过程,基础设施服务供应商的贡献,以及接下来的营销和运营方面都有一个成长曲线。此外,我们不应忽视这样一个事实,即欧洲可能正开始实施这些标准,但它已经投入了25年来逐步发展所获得的知识、技术规范、建筑产品和实施经验。正因为有了这段学习期,现在它才可以开始推行像英国生态城这样的计划。

由于当时上海市委书记的过早下台而失去了政策上的支持赞助,东滩生态城市计划于是迅速地陷于停顿。尽管如此,该项目还是提供了大量的反馈意见,例如,关于中国需要提高其建筑行业和设计机构的技术能力,以实现未来所需的高环保标准。

有趣的是,英国生态城计划在环境方面,已经有非常明确的技术规范要求要求在运作中实现碳排放量为零。然而这一生态城概念的一个关键组成部分是如果开发商希望在他的开发项目中使用生态城的标签以吸引投资者,就要制定一套完整规范的标准,然后不折不扣地在开发中实行。

细究更近的天津生态城市概念,可以很清楚看出在这方面的开发汲取了东滩的经验教训。为推广生态城市的意识,天津做出了非常大的努力,大牌投资者和高调业主都想要参与到项目中来。它加强了许多利益相关者之间的良好合作关系以确保项目的运营,这也达成了指标原则和设计标准体系。总体而言,它已清楚地表明了在中国一部分的政治家、市政领导和投资者对“走向绿色”有着极大的热情。但它是否要营造一个生态城市——顾名思义即是一个与地球做到生态平衡的城市?从更深的层次来讲,似乎坚持生态城市原则和计划运行的方式之间有着显著的差别。看来,绝大多数的天津生态城的建筑物有望达到最适当的生态环境标准。事实上,这部分已经使得所有新建筑的标准黯然失色。例如第12个五年计划指出,中国所有新建筑都应以超过GB50189-2005标准的15%以上为目标。看来天津并没有比这做到更好。因此,天津正在建设的并不比中国的任何新建筑好多少,这很难反映出中国选择走的路线。所以,天津生态城真的如它宣称是生态的典范吗?

放眼中国的版图,我们看到许多新的城市,城镇和城市扩张都按照

However, experience from elsewhere indicates that these are just modest first steps. Other countries now have rolling programmes of continual improvements to energy regulations. So for example, the UK is reducing allowable energy targets by 25% every 3 years with the aim of reaching zero carbon for new buildings before 2020. Increasingly, environmental assessment methods like US' LEED or the Chinese 3-Star are then seen as an introduction to sustainability, not the leading exemplars from which the construction industry can learn what new national standards are coming.

China has plans for some 250 new Eco-Cities. So far the delivery track record for these has been very mixed. Eco-projects like Huangbaiyu have failed once they started on site. Dongtan Eco-City on Shanghai's Chongming Island remains on the drawing board. Tianjin EcoCity is moving onto site but is now raising questions as to whether it is really going to deliver an 'Ecological' city. Many of these issues relate to the absence of any formal expectations of what a future Chinese Eco-City should be, how it will evolve in future and engages with market funding.

If we look in a little more depth at Dongtan Eco-city, it sought to bring the very latest thinking on how to design cities, such that it would be future proofed ready for the needs of many decades ahead. It included a roadmap to zero carbon with a major focus on energy demand reduction. It sought to largely eliminate the need for cars and it switched all transport to pollution free non-fossil power sources. It addressed social, residential and workplace integration. Underlying all of this was a model of resource use that related to a fair share of the planet's finite resources.

However, when planned some five years ago it was arguably too far ahead of its time for China at that time. In particular there was a mismatch between the construction industry's experience and ability to deliver the high environmental standards sought. China is only at the start of a process of learning how to implement such standards. Interestingly, Dongtan illustrated there was a learning curve, not just for the technical side of the construction industry, but also for the lawyers drawing up contracts, the funders understanding of investment returns, the local municipality's verification processes, the infrastructure service providers' contribution, as well as the downstream marketing and operational aspects. Also we should not overlook the fact that Europe might be starting to implement these standards but it has taken the past 25 years of progressively developing the knowledge, technical specifications, building products and the implementation experience. It is only after this learning that it can now start rolling out, for example, the UK's Eco-Town's programme.

For Dongtan Eco-city proposals effectively ground to a halt once it lost its political sponsorship as a result of the then Shanghai Party Secretary being prematurely removed from his position. Nonetheless the project has provided large amounts of feedback on where China needs to up-skill its construction industry and institutions to deliver the high environmental standards needed for the future.

Interestingly, the UK's Eco-Towns programme has a very clear technical specification requiring, among other environmental aspects, zero carbon emissions in operation. A key component of this Eco-Towns concept is that if a developer wants the right to use the Eco-Town label for his development to attract investors, then the fully defined set of standard should be expected and then fully delivered in the completed development.

Examining the more recent Tianjin Eco-city concept it is clear this development has learnt some of these lessons. Tianjin has done great things for raising the awareness of Eco-Cities. It has shown that big name investors and high profile occupiers want to be associated with Eco-Cities. It has forged excellent partnerships between the many stakeholders that are needed to ensure delivery. It has also formalised the principle of indicators and metrics being included in the design. Overall it has clearly illustrated that there is a great enthusiasm for 'going green' in China on the part of politicians, municipal leaders and investors. But is it going to deliver an Ecological City—namely a city that is ecologically in balance with the planet? If one digs deeper there appears to be a significant difference between the principle of Eco-City principles and what it intends to deliver. It seems that the vast majority of the Tianjin Eco-City buildings are expected to achieve very modest environmental standards. In fact, it is in part already being eclipsed by standards required of all new buildings. For example the 12th Five Year Plan directs that all new buildings across China to target 15% better than the GB50189-2005 standard. It seems Tianjin is targeting no more than this. So, by the time Tianjin is constructed it will be no better than any new building everywhere across China. This hardly reflects where China is hoping to get to. So is Tianjin Eco-City really the Ecological exemplar it is claimed?

生态城市的标准进行规划，所有都自称是世界上最好的环保标准。但是相反，我们看到的是钢铁格网和宽阔道路大行其道，日益繁荣所带来的越来越多的汽车将道路变得更加闭塞。我们本来能够方便地步行或骑自行车，却被道路、平整的地块和封闭的组团阻断。我们看到一个居住密度的“游戏”正在上演，加高建筑物的高度去达到更高容积率的目标，但忽视了社区设施与建筑物应当便于到达的需要。我们也看到高档住宅以空置为主，不是为住家而是作为投资的广泛问题。我们看到新建的建筑物在能源消耗性能上往往比现有建筑物更差。这些社区会符合中国未来的长远目标吗？前面描述的问题，反映了中国建设开发过程中非常有必要提高技术能力，为成为生态时代的新范例做好准备。

设想中都不能出现的实施水平，在施工现场也不会发生。有一个这样的例子是在上海世博会城市最佳实践区的零碳示范建筑。建筑师Bill Dunster和他的Zedfactory公司在英国已成功地运作了许多零碳项目。他被要求为世博会设计一个基于他原来在伦敦西南部贝丁顿生态村的项目蓝本的类似的示范建筑。他借助相当丰富的经验完成了概念阶段设计、详细设计，此后工地监督的职责被移交给当地设计院和没有运作此类项目经验的承包商。因此，在建筑完成后也不能以预想的被动式模式运作。

最初的设计理念是为了解决冬季对传统采暖系统的依赖，并减少夏季约80%的制冷能耗。在冬季，建筑将只使用内部热量收益和冬季太阳热收益来保持温暖。夏季，房间外部较高的比热容材质表面（热惰性）产生被动的散热效果，并充分利用住户的适应能力以保持舒适。

在寒冷的天气，室内热量的获得来自住户、低耗能照明和电器。建筑的围护结构设计性能使得室内热量收益水平与户外热损失的水平相匹配。因此，需要特定的设计考量、现场安装的关注和现场核查测试，来避免通过隔热层出现热桥，同时确保较高的围护结构气密性。房间的热惰性的表面作为一个被动的热回收设备以吸收房间处于热收益高峰期多余的热量，然后重新释放出柔和的辐射热进入处在内部热量低收益期的房间。

在炎热的天气，使用外部出挑减少太阳能热量的获得，另外缓冲区与客房之间的阳光间大小适当的窗户和高屋顶、墙体保温隔热层也减少了太阳热量的进入。房间的热惰性通过吸收高峰期的热量达到大面积的被动辐射降温。天花板悬挂有低能耗的风扇，以加快房间的空气流动给居住者提供额外的降温效果。围护结构的气密性对减少湿热的室外空气向内的渗透，具有特别重要的意义。可再生电能由建筑使用的光伏板和微型风力涡轮机生产。为了让发电量足够全年使用，减少建筑系统及其设备的能源需求就显得尤为重要。专家提出了许多减少电力需求的建议。其中风力通风帽不需要电力供应就可以为整个建筑提供了新鲜的空气，将室外空气捕捉摄入通风帽，通过热回收换热器进入建筑，然后将新鲜空气输送到各个房间。该通风帽也从各个房间中抽出浑浊的空气，通过热回收换热器将这些空气排放到室外。这种类型的热回收通风帽已经在英国成功使用多年。在上海世博会中他们对其进行了改进，通过热交换器也可以恢复空气中的水分，这使它们能够降低夏季室内湿度，并增加房间在冬季的湿度。

不幸的是，现在建造的与普通建筑拥有一样多的空调和用一样多的电。如裸露的混凝土天花板可以提供自然冷却和热回收功能，这样的被动节能设计都不起作用，因为它们基本上被天花板上安装的设备所覆盖。建筑围护结构的气密性也未实现，所以预期的湿度控制功能无法实现。安装在屋脊线下面的微型风力涡轮机，同样被风屏蔽和不能按照预期工作。屋顶安装的风力通风帽没有专门调整以适应当地的风速，所以也没有实现预期的功能。这个项目说明成功运作的范例非常少，零碳建筑不仅仅需要一



上海世博会零碳馆夜景

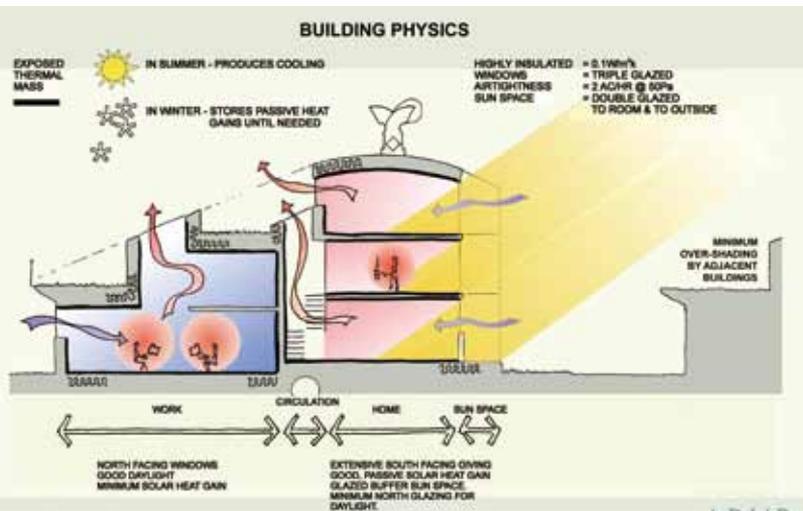
As we look wider across China we see many new cities, city quarters and urban extensions being planned as Eco-Cities, all claiming to be the world's best environmental standards. But instead we see grid-iron large road layouts that will become grid-locked as the increasing prosperity brings more cars onto the roads. We see the ability to easily walk or cycle, blocked by the roads, proscribed landscaping and enclosed block compounds. We see a residential density 'game' being played using building height to satisfy occupancy density targets, but overlooking the need for shorter distances between buildings to community amenities. We also see the widespread problem of predominately unoccupied up-market homes as investments instead of homes for people. We see the energy consumption performance of the completed buildings too often being worst than existing buildings. Are these communities that accord with the long term vision of China's future? Much of the previously described issues reflect the need to up-skill so much of the construction development process in China ready for a new paradigm of the Ecological Age.

Not delivering on the expectations is also not happening at the construction site implementation level. One example of this is the Zero Carbon demonstrator building at the Shanghai Expo Urban Best Practice Area. The architect, Bill Dunster and his Zedfactory practice have successfully delivered numerous zero carbon projects in the UK. He was asked to design a similar demonstrator for the Expo based on his original BedZED prototype project in southwest London. After bringing his considerable experience to bear for the concept stage design, the detailed design and site supervision were handed over to Local Design Institutes and contractors with no experience of delivering this kind of project. As a result the completed building can't operate in the passive way intended.

The original design concept was to avoid the need for conventional heating system in winter and reduce summer cooling by about 80%. In winter the building is intended to stay warm using only internal heat gains and winter solar heat gains. For summer, room exposed high thermal capacity surfaces (thermal mass) provide passive cooling effects, and the occupant comfort adaptation abilities fully exploited.

During cold weather indoor heat gains are emitted from occupants, low energy lighting and electrical appliances. The building envelope design performance was selected to match the level of heat loss to outdoors against these levels of indoor heat gains. Particular design care, site installation care and site verification testing is needed to avoid thermal bridging through the insulation and to ensure a high level of envelope air-tightness. Room thermal mass surfaces act as a passive heat recovery device – absorbing heat during periods of excess room heat gains and then re-emitting gentle radiant heat back into the room during periods of low internal heat gains.

During hot weather solar heat gains are excluded using external overhangs, sunspaces as buffers separate from occupied rooms, modest sized windows and high levels of roof and wall thermal insulation. The room thermal mass provides large areas of passive radiant cooling by absorbed peak period heat gains. Ceiling suspended low energy fans provided additional cooling effects by increasing room air movement onto the occupants. The envelope air-tightness is of particular importance to reduce the infiltration of hot humid outdoor air.



英国零碳住宅 (BedZED building)

个概念设计，它还需要那些已经完成零碳项目建设人的经验，来帮助提高楼宇供应链在整个过程中的运作技术能力。

所以需要问，中国得到真正有益的建议了吗？事实上从来都不缺乏提建议的人。中国所面临的挑战是选择从西方获得哪条建议，即哪条是有关中国未来资源不足的建议，而哪条建议实际上是在鼓吹当前西方的高资源消耗。对于中国来说，这一决定是困难的，因为这两套建议都提供了与“低碳”、“零碳”、“生态城市”、“可持续发展的建筑”相同或类似的标签。这是一个不幸的事实，许多西方国家仍然继续在增加资源消耗的路线上，但很乐意用中国想听到的任何标签包装其建议。因此，我们必须问——中国得到真正需要的建议了吗？

3 前进的道路

这些问题的解决方案可归结为以下4点：

(1) 标准运作的验证（以及效果反馈）

当涉及到最终产品的质量时，允许最初的愿望被忽略是历史的默许。然而，西方的品牌可以为其产品的质量带来内在的升值。事实上，大多数中国的年轻一代都十分满意这一级别的产品质量。

另一方面，房地产的开发和建筑业往往宣扬大规划与大建筑的传统方法，但却未能达到预期目标，甚至最基本的技术标准都达不到。研究表明目前很多强制性的国家建筑标准都没有实现。来自世界各国的经验表明，这种情况往往出现在由本国建造业承建的项目中。这主要是因为建造业规模大，零散又难以控制供应链。但社会未来的需要意味着这一点必须改变。社会和投资者的期望将上升，因为他们开始期待其投资的全部好处。事实上，由于资金回报拮据使这在未来将变得至关重要。所有这一切都需要非常具体的法规和执行方式使整个供应链提高其产品的质量。这也需要整个供应链的态度的变化，使每个人都得到他们所期望的，而不是“视而不见”。

与验证直接相关的是利用反馈信息。成功而快速的可持续型城市化挑战正迅速地得到反馈，并据此查看预想的进程是否按部就班地进行。只有借助反馈信息可以对规章和程序有效地作出调整。事实上，由于现场验收过程非常不规范，从建筑运作中得到性能反馈的机制就更加难以实现，会出现很多意想不到的后果。经验表明，在实际运作的建筑中，能源使用和二氧化碳排放量可以很容易达到设计师预测值的两倍。就中国整个国家的水平来说，二氧化碳排放量在考量中具有更高的优先性，那么切实了解究竟每个新的政策和法规如何执行显得至关重要。所有称建筑是“低碳”的

Renewable electricity is generated on the building using photovoltaic panels and micro-wind turbines. To allow this amount of electricity to be sufficient for year round energy use, it is particularly important to reduce the energy demand of the building systems and its fitout. Many electricity demand reduction features were proposed. Among these are the wind powered ventilation cowls which required no electricity to provided fresh air throughout the building. The cowls captured intake outside air, passed the air through a heat recovery exchanger, and then duct the fresh air to the rooms. The cowls also extracted air from the rooms, passed this air through the heat recovery exchanger, before discharging the air to outdoors. This type of heat recovery wind cowl has seen many years of successful operating in the UK. They were enhanced for the Shanghai Expo by using heat exchangers that also recovered moisture from the air. This allowed them to reduce the room humidity in summer and increase room humidity in winter.

Unfortunately, what was constructed has as much air-conditioning as a normal building and will have as much electricity consumption as a normal building. The passive design features like exposed concrete ceilings to provide natural cooling and heat recovery features, do not function because they are largely covered up by ceiling mounted equipment. The building envelope airtightness has not been achieved, so the intended reduction in humidity control is unable to work. The micro-wind turbines are installed below the roof ridge lines, and so are shielded from the wind and do not work as intended. The roof mounted wind powered ventilation cowls have not been tailored for the local wind speeds and so do not function as intended.

This project illustrates that the delivery of proper exemplars of very low and zero carbon buildings needs more than just a concept design. It also needs the experience of those people who have been involved in completed zero carbon projects to help up-skill the construction supply chain all the way through the process into the operation of the completed buildings.

So the question has to be asked – is China getting the advice that will really help? There is no shortage of people willing to give advice. The challenge for China is deciding which advice it gets from the West actually relates to the low resource future that China wants, and which advice in reality propagates the West’s current high resource consumption. For China this decision is difficult because both sets of advice are offered with the same labels of ‘low carbon’, ‘zero carbon’, ‘Eco-cities’, ‘sustainable buildings’, or similar. It is an unfortunate fact that much of the West is continuing on the path of increased resource consumption, but is quite happy to package its advice with any label China wants to hear. So the question has to be asked – is China getting the advice it really needs?

3 The way forward

The solutions to so many of these issues can be grouped under four headings:

1) Verification of delivery standards (and acting on feedback)

There is a historical tacit acceptance of the initial aspirations being allowed to slip when it comes to the quality of the end product. However there is an inherent appreciation for the delivered quality that Western branding can bring. Indeed there is a whole new Chinese younger generation who are expecting this level of delivery quality.



上海世博会零碳馆室内



建筑外部表皮空气泄露



空调机阻挡被动式节能屋顶



上海世博会零碳馆

频繁发言往往没什么意义，因为它们没有实际的数据和事实根据。

因此，标准运作的验证在每一个项目中都已成为至关重要的部分。此外，对于那些自称为典范的项目，无论低碳、可持续发展，还是零碳排放、生态城市等，应该做到强制性的全面监控，并公开发布建筑建成后的运作性能，以及验证已开始实施的技术标准。经验表明，这其中附带的一个好处是，设计师和政府官员可以开始为他们的项目提出更现实的要求！

(2) 明确定义技术标准

整个中国的新开发项目都自称是“低碳”，但什么是低碳？如果更加仔细地检查大多数开发项目，会发现比现有建筑更高的碳排放量！此外，预测几乎总是低估建筑投入使用的实际碳排放量！这是怎样发生的？答案是缺乏碳排放量预测的明确标准。国家标准GB50189-2005定义了任何非住宅建筑应该达到的最低标准。然而当被检查出问题时，大多数已提高性能参考标准却声称是按照1980年的低效率建设，而不是现行国家标准规定的最低水平。于是问题在于，GB50189-2005国家标准只考虑了建筑物的部分能源使用。它一般包括空调能耗和一些照明能耗，却不包括任何其他形式的能耗，如使用升降机、外部照明、电源插头、设备能源的使用，以及许多其他“不受监管”的能源使用。因此，如果一个开发项目号称“优于GB标准50%”，实际上意味着建筑节省的总能量大大低于50%。

到目前为止，需要更加清晰对目前“低碳”要求的依据，否则它会

On the other hand building developments and the construction industry tend to propagate the historical approach with the vast majority of buildings and masterplans not attaining the original aspirations or even the basic technical standards. Research has identifying that much of the current mandatory national building standards are not being achieved. Experience from other countries around the world has shown that this has often the case for their own construction industries. This is largely because the construction industries are large, fragmented and have difficult to control supply chains. But society's future needs mean this is required to change. Expectations from society and from funders will rise as they start wanting the full benefits of their investment. Indeed as funding returns become tighter in future this will become essential. All of this then requires very specific regulations and enforcement to get the whole supply chain to lift its standards of delivery. It also requires a change of attitude throughout the supply chain so that everyone expects delivery of what was asked for, instead of 'turning a blind eye'.

Directly related to verification is using feedback. The challenge for successful rapid sustainable urbanisation is getting fast feedback to understand if the intended progress is on course. Only with this feedback can adjustments to regulations and procedures be made effectively. Currently this does not normally happen. Indeed, with the very weak processes for checking site standards delivery, there is even weaker processes for getting feedback on operating building performance. The opportunities for unintended consequences are enormous. Experience indicates that actual building energy use in operation and carbon emissions can easily be double that of the designer's predictions. As carbon emissions become an ever higher priority for China at a national level, the need to understand exactly how each new policy and regulation is performing is essential. The all too frequent statements saying that a building is 'low carbon' too often mean nothing

迅速成为被公众忽略的毫无价值的声明。节能和低碳声明明确规定其基础的起源，还应该说明它们是设计中的“预测值”还是在建筑投入使用的“测量值”。

(3) 为在未来迅速完善这些标准，明确规划发展路线

中国的高速发展在世界上是独一无二的，如此之快，也就暴露出自身的问题，因为教训的汲取没有足够快的速度，以至于难以避免不必要的失误和意想不到的后果在全国蔓延。

对于碳减排，世界上迅速提高实施标准的那些地方已经得出了很多经验教训和反馈信息，例如，英国迅速对所有新建建筑实行零碳标准。这说明需要先进的“探路者”或行业典范能够考察、学习和完善如何向前迈下一步，它也必须让业界花时间来集中精力减少实施新工艺和新技术的成本。

中国的生态城市计划为成为这样的典范提供了一个千载难逢的机会。然而，这是一个宽泛的机会，因为生态城“绿色建筑”的定义仅仅是遵守“十二五规划”对所有新建楼宇规定的最低碳排放标准。因此，其不能为这个行业的其他人提前探路。这也是一种讽刺，在中国生态城市的定义已经失去了它生态的原意而只是作为一种市场营销的标签使用。事实上要实现2020年脱碳国内生产总值达到40%~45%的国家目标，这些生态城市建筑甚至完全不满足这个标准。

对于建筑行业而言，一条更为透明的未来发展路线是必要的，使它逐步提高脱碳做准备。经验表明，如果有了一个明确的发展路线，将有业内人士希望成为典范，并成为先进的“探路者”，他们的付出会更多，同时也会吸引前沿投资者和领导支持。只有了解到未来这些将成为更广泛的行业标准，然后对其更好地利用，为之后将成为人人都要遵守的标准做好准备。

(4) 提高整个供应链的技术能力

前面谈到的大多数是涉及建造业的管理方式的转变，而一个管理变革的关键要素是为供应链中的每一个人提供他们所需要的新技能。这方面的知识已经可以从具有许多国外低碳甚至零碳项目的人的工作经验中得出。现在我们面临的挑战是如何将这些知识转化和整合到中国的整个供应链中来。因此，我们需要知道为什么西方设计师只提供战略性和概念性的建议。如果这些顾问们提供低碳和零碳开发非常实际的经验，他们需要了解从实际操作反馈而来的经验，直接参与到落实项目的所有过程。如果要实现期望的结果，这些反馈经验和概念性的建议一样重要。事实上，如果把世界最好的经验集成在一起，形成一个专属中国的特有运作方式，直接参与到每天的详细设计和工程监理是必要的，同时通过建筑的运作过程与西方设计师共同工作，然后进行经验总结并广泛地在中国推广。

不过，建造业的技能提高任重而道远。制定法律合同中，诸如土地建设权、建筑及其部件采购方面的问题，也需要提高技能。用法律术语定义那些以公平合理用语表达的内容，包括基本的技术术语，也是一种技能，同时创新项目也需要不断提高技能。同样，对市政官员来说，重要的是他们能够将可持续发展的愿望转换成书面定义术语，这样开发商和投资者充分了解什么是必要的，同时公众也可以在竣工交付时做出评价。公众将越来越多地期望广告上的可持续性、低碳、低资源利用和低污染，可以真正地在未来的社区里实现。那么，现在是该到提高技能的时候了。

4 面临的挑战

前面所说的是为实现可持续发展社区我们要面临的挑战。这表示有一个进一步的问题，即在日常的基础上限制建造业的能力以保证可持续发

because they are not quantified and not based on facts.

So verification of delivery standards has to become essential on every project. In addition, for those projects claiming to be exemplars, be it low carbon, sustainability, zero carbon, Eco-Cities, etc., it should be mandatory to fully monitor and publicly publish the operational performance of the finished buildings as well as verifying that the technical standards have been delivered. Experience shows that a side benefit of this is that designers and officials then start making more realistic claims for their projects!

2) Clearly defined technical standards

Everywhere across China new developments are claiming to be 'low carbon'. But what is low carbon? For most developments examined more closely this actually means higher carbon emissions than already existing developments! In addition the predictions almost invariably underestimate the actual carbon emissions of the finished operational buildings! How does this happen?

The answer is a lack of clarity of what standards are being used for the carbon predictions. The national standard is GB50189-2005 which defines the minimum standard any non-residential building should target. Yet when examined, most claims of improved performance reference back to a nominal 1980's poor efficiency building, not the minimum stipulated in the current national standard.

Then there is the issue that the GB50189-2005 national standard only considers a part of the energy use of a building. It generally includes the air-conditioning energy and some of the lighting. It does not include any of the other energy uses like lifts, external lighting, plug power, fitout energy use, and many other 'un-regulated' energy uses. So if a development claims a "50% improvement better than GB standard", in reality, this means substantially less than 50% saving for the total energy uses of the building.

Thus far more clarity is needed on the basis of the 'low carbon' claims being currently made. Otherwise it will rapidly become a worthless statement the public will ignore. Energy and carbon statement should clearly state the origin of their baseline. They should also state whether they are 'predictions' for the design or 'measured' from the finished building in use.

3) Clear forward road map for rapid standards improvements

China is unique in the world in the sense that its development is happening so very fast. Moving so fast can create its own problems because lessons are not learnt quickly enough to avoid unnecessary mistakes and unintended consequences being propagated across the whole country.

For carbon emission reductions there are lessons and feedback from elsewhere in the world where there has been rapidly improving standards implemented. Take for example the UK's rapid acceleration towards zero carbon for all new-build. This identified the need for advanced 'pathfinder' exemplars for the industry to be able to examine, learn and refine how to take the next big steps forward. It was also essential to allow the industry to spend time focusing on reducing the cost of implementing the new technologies and techniques.

China's Eco-Cities programme offer a golden opportunity to act as such exemplars. However this is a lot opportunity because the definition of Eco-City 'Green Buildings' is simply compliance with the minimum carbon emission standards as directed by the 12th Five Year Plan for all new buildings. Therefore they cannot act as pathfinders in advance of the rest of the industry. It is also a shame that the definition of Eco-City in China has lost its Ecological origins and is being used simply as a marketing label. Indeed, given the national goal of de-carboning GDP by 40-45% for 2020, it is unfortunate that these Eco-Cities buildings do not even meeting this standard.

For the construction industry, a far more transparent Road-Map into the future is needed to allow it to prepare for the step-changes in carbon performance needed. Experience shows that with a Road-Map in place, there will be those in the industry who wish to become exemplars and to become the advanced 'pathfinders' Their costs will be higher, but they will attract the leading edge investors and leading municipality support. Knowing that these are the standards to come in future the wider industry can then better use these as preparation ready for the standards subsequently becoming mandatory for everyone.

4) Up-skilling of the whole supply chain

Much of what I have talked about related to managing change within the Construction

展。直觉告诉我们，可持续发展是代价昂贵的。这一点以能源价格相对便宜的事实也可以理解。但事实是，我们为能源消耗所支付的金额不包括使用能源的间接成本，不包括后代继续使用化石燃料而产生的高碳排放量对环境的影响，也不包括换用可再生能源的投资成本以及高峰期需求相关的成本。这一切都意味着能源成本的投资回报不足以鼓励投资于改善能源效率和低碳生活方式。

但全球范围内也有正在寻求可持续性成本减少，同时又能保证正常使用的例子，这也是由于近期的全球经济危机所推动的。与建筑开发商密切合作的综合设计团队和他们的供应链正在设计新的“A”级写字楼，成本比传统设计减少高达20%。这涉及到对未来资讯科技及照明从根本上的反思，如何装修，并大大减少了空调的使用。他们实现了较高的环保性能，仅仅通过使用简单的包层方案、被动式设计，包括结构的热惯性，整体上减少了建筑材料的使用数量。因此，相对于更多关注新的可持续发展技术，这种方法更看重减少建筑的需求。总体而言，这会减少材料的使用量，降低对环境的影响，同时也降低了成本。

5 结语

中国处在其发展的一个非常令人兴奋的阶段，它拥有足够的财富、繁荣和理念使得它现在可以决定自己未来的方向，并以世界上绝无仅有的速度在高速发展，这意味着现在的决定能够让中国远在其他国家之前就进入全面意义上的生态时代，即自然界承载能力范围内持续稳定的繁荣。关键是制定适当的政策、法律、建筑业和观念框架，以确保所有利益相关者为我们的子孙后代建立可持续发展的社区作出贡献。（译/张岩，校/吴春花）

（注：文章所有图片资料均来自Arup公司）

Industry. A key element of managing change is providing the new skills needed for everyone in the supply chain. This knowledge is already available from those who have hands-on experience of delivering many very low and zero carbon abroad. The challenge is transferring and integrating that knowledge throughout the supply chain here in China.

So it has to be asked why Western designers only offer strategy and concept advice. If these advisors have real experience of delivering very low carbon and zero carbon developments, they would know from practical feedback experience that being directly involved in taking projects all the way through into implementation on site and is just as important as the conceptual advice if the intended end results are to be achieved. Indeed, direct involvement in the day to day detailed design and site delivery is imperative if the best of world experience is to be moulded together to form a specifically Chinese way of delivery. It is working side by side with Western designers all the

way through the building delivery process, which then allows that combined experience to be taken and replicated across the wider Chinese.

But up-skilling the construction sector goes far wider. The issue of formulating legal contracts, for land building rights or for procuring the building and their components, also needs up-skilling. Defining in legal terms what should be delivered in fair and reasonable words that include basic technical terms is a skill that these innovative projects have had to develop. Similarly, for municipality officials, it is important for them to be able to convert their sustainability aspirations into written defined terms such that developers and investors fully understand what is needed and that public judgement will be made at delivery completion. It is the public who will increasingly expect that the rhetoric on sustainability, on low carbon, on low resource use and low pollution, is actually being delivered in their new communities. Now is the time to put in place the skills needed to deliver this.

4 Challenges ahead

Previously described are from experience the key challenges for delivering sustainable communities. That said there is one further issue that on a day to day basis curtails the Construction Industry's ability to deliver sustainability. This is the perception that sustainability is expensive. This is reinforced by the fact that energy is relatively cheap. It is a fact that the amount paid for energy bills does not include the indirect costs related to using that energy. They do not include the environmental impact on future generations of continued fossil fuel carbon emissions. They do not include the investment costs for switching energy generation to renewables. They do not include the costs related to the high peak demands. All this means energy cost paybacks are not available for encouraging investment in energy efficiency and low carbon lifestyle behavioural change.

But there are examples worldwide that are now seeking to make sustainability cost less than business-as-usual. This is driven by a context of the recent global economic crisis. Integrated design teams working closely with building developers and their supply chains are designing new 'A' grade office buildings that cost as much as 20% less than conventional designs. This involves fundamentally review of the future of IT and lighting, how to fit-out, and dramatically reduced HVAC capacities. They achieve high environmental performance using simpler cladding solutions, passive design – including the thermal inertia of the structure, and overall reducing the amount of building materials used. So instead of focusing just on new sustainability technologies, this approach focuses on reducing building demands. Overall this reduces the amount of material used, reduces the environmental impact, as well as reducing the cost.

5 To conclude

China is at a very exciting stage in its development. It has the wealth, prosperity and understanding that it can now decide its own future direction. It is developing at a speed the world has never seen before. This means decisions it makes now could allow China could achieve the full meaning of the Ecological Age – prosperity within the capacity of the natural planet – long before other countries. The key is formulating the appropriate policy, legislative, construction industry and perceptions framework to ensure all stakeholders contribute towards delivering sustainable communities for our future generations. 



作者简介

Chris Twinn，英国皇家艺术协会资深会员，英国皇家建筑师学会荣誉院士，英国屋宇设备工程师学会资深会员，英国能源学会会员，英国认证工程师，荣誉理学士。

Chris Twinn是可持续发展方面的专家同时也是奥雅纳公司董事，职权范围包括奥雅纳除了在上海和伦敦的办事处的全球性的经营。克里斯在设计和建造方面拥有超过30年的经验，并已连续6年参与中国项目的工作。他专门研究设计和项目运营中建筑的可持续性，及其资源使用、社会和财政方面的重要课题，也在对环境敏感的建筑结构设计和系统设计方面有着深入的研究，使他在这个领域作为顶尖人物而被众人所知。项目包括贝丁顿零能源发展计划（贝丁顿生态村），世界上第一个城市碳中性项目；金斯潘住宅，在第一个完成的零碳建筑，获得了英国的新可持续住宅守则的6级评价和三星绿色明天零能源住宅，东亚第一个获得LEED®白金认证的项目。