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A Perspective on TAIPEI 101's Decision to Upgrade Recertification to LEED O+M v4 | 台北101升级认证LEED v4 O+M的决策观点



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蔡清徽女士于2015年7月加入台北101(台北金融大楼股份有限公司), 担任大楼事业处总经理。蔡总经理拥有美国康乃尔大学建筑学士及美国哈佛大学设计学院建筑硕士, 她二十余年跨领域的职业生涯涵盖了建筑设计、不动产投资暨管理、自有商办大楼管理等专业经验。蔡女士是台北101 LEED v4再认证的专案负责人, 成功带领多学科的专业团队取得LEED v4白金级(营运管理)再认证。在加入台北101以前, 她曾是AIG南山人寿房地产投资暨管理职场企划部的副总。



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周德宇先生于2015年十二月始担任台北101(台北金融大楼股份有限公司)董事长。周董事长自1996年起担任台湾政治大学财政学系专任副教授。身为经济学者, 周博士拥有二十余年产业组织、创新研究、公私合作的丰富多元经验。他尤其专精大数据研究在计划评估及政策制订方面的应用。他丰富的顾问工作经验对象涵盖了私人企业、政府机构单位、国际非政府组织。周董事长曾担任台湾金控的董事, 他持有美国维吉尼亚理工大学的经济学博士学位。

Abstract | 摘要

The sheer size and complexity of a building like TAIPEI 101, along with the international nature of the project and newness of LEED v4, can present particular challenges to project teams. Notwithstanding this, TAIPEI 101 is in many ways representative of all multi-tenant office buildings, as are the plurality of LEED O+M projects, and therefore the success of this particular building offers a relevant case study for buildings of this type. The paper illustrates key issues for the project team relating to the increased stringency of the new system. Readers will benefit from the perspective of the project owner to understand the impact and change in management brought about by the practical differences between LEED v2009 O+M and v4. Aside from the technical aspects of LEED v4 O+M in detail, this paper will analyze the business benefits to TAIPEI 101 and the importance of tenant interaction in LEED v4 O+M certification.

Keywords: LEED, Supertall

就台北101如此庞大复杂的量体和国际化的属性来说, 参与全新的LEED v4 升级认证对专案团队而言可谓是一项挑战。即便如此, 台北101在许多方面都是多租户办公建筑的代 表, 尤其在LEED营运管理认证上, 它的成功案例可作为此同类型外租大楼的相关案例参考。本论文阐述了专案团队因新系统严格度增加所面临的关键议题。读者亦可从业主的视角了解LEED 2009 O+M升级至v4的标准差异带来的管理措施上的影响和变化, 从而有所收获。除了讨论LEED v4 O+M的技术细节以外, 论文也着手分析台北101在此过程的商业利益以及LEED v4 O+M 认证过程中租户参与的重要性。

关键词: 领先能源与环境设计、超高层建筑

Introduction

Built in 2005, TAIPEI 101, the world's tallest building until 2010, marks the skyline of Taipei with unrivalled height. Standing as the icon and landmark of Taiwan, TAIPEI 101 receives a daily influx of international and domestic tourists. More than just a building, TAIPEI 101 resonates with the sentiments of Taiwanese people. Built upon years of memorable events ranging from New Years fireworks and the mid-year Run-Up Race to slogans running on LED screens, TAIPEI 101 always portrays the spirit of Taiwan and aims to demonstrate exemplary performance commensurate to her fame (Figure 1).

The building complex is comprised of a five-story mall and an office tower measuring 101 stories with tenancy in 66 floors. The tower offers 181,225 M2 of leasable Grade-A office space with a current occupancy of 96.36% and projected occupancy of 98% in 2016. The major tenants include the Taiwan Stock Exchange, multinational financial institutions, accounting firms, and burgeoning internet and software innovation enterprises. On the top floors, the Tower features 3 famous restaurants boasting panoramic views as well as menus to satisfy the most selective gastronomes. From its first construction,

引言

台北 101 于 2005 年落成, 并保有全球最高大楼头衔直到 2010 年, 为台北市的天际线点缀一抹无人能及的高度。台北 101 作为昂然挺立于台湾的图腾与地标, 每天涌入大量国内外游客。台北 101 不仅只是一栋建筑物, 也是与台湾人感性共鸣的存在。多年来累积无数难忘回忆, 包括新年烟火、国际登高赛及顶冠LED 电视墙 的标语, 让台北 101 不断刻划出台湾精神, 展现出与其盛名相符的卓越表现 (图1)。

台北 101 是由 5 层楼商场及 101 层楼的塔楼所组成, 承租户分布于其中的 66 层楼。塔楼提供可供租赁的甲级办公面积 达181,225 M2, 目前承租率为96.36%, 预计 2016 年可达 98%。主要承租户包括台湾证券交易所、多间跨国金融事务 所、会计师事务所, 以及蓬勃发展的网路 及软体新创企业。最顶楼主打 3 间知名 餐厅, 以放眼环绕全市的景色和美味餐点 为招牌, 满足最挑嘴的美食家。自建造伊 始, 台北101 即不断创下从工程奇观到 全球最高速电梯等多项纪录, 现在更又 创下另一项纪录: 以90分高分通过LEED 白金级再认证, 成为第一宗美国以外 LEED v4白金级运营与维护的超高层建筑, 同时也是台湾首宗LEED v4白金级的建筑 (图2)。



Figure 1. TAIPEI 101, icon and landmark of Taiwan (Source: TAIPEI 101)
图1. 台北101是台湾的地标和代表 (来源: 台北101)

TAIPEI 101 has set many records, from engineering marvels to the world's fastest elevators. To set another new record, it has been awarded a 90-point high score in June 2016 for LEED re-certification, making it the first LEED v4 Platinum OM skyscraper ex-US and the first LEED v4 Platinum in Taiwan (Figure 2).

It is no wonder the management takes upon its shoulders to apply for LEED (Leadership in Energy and Environmental Design) certification first in 2010 and again for recertification in 2015. Though the tower of TAIPEI 101 was not originally designed as LEED certified construction, it embraces all the essence of green building design.

To name a few green design highlights – the curtain wall glass panels are double glazed low-emissivity in nature, which is meant to reduce heat absorption but admit daylight. Rain water is captured and stored in B5 tanks for re-use; garbage chute system is installed to save elevator rides for waste-delivery. Meanwhile, the building-wide “Energy Management and Control System (EMCS)” monitors and provides automation of equipment including air-conditioning, power, illumination, and water supply through more than 100,000 installed detecting sensors. The system also ensures optimum energy-performance at all times.

In 2010, with the company delivering steady profit backed by >70% tenant occupancy, the management team decided to kick off the daunting task of applying for LEED Existing Building Operation & Maintenance (EB:OM) with the US Green Building Council (USGBC).

This is to commit the entire tower building to a minimum of five years down the path of leadership to support environmental sustainability. The LEED process ensures that TAIPEI 101 will establish a baseline for energy efficiency, and as we quickly refine our skills, it will become the industry benchmark. The first certification is a huge challenge; for the sheer size and complexity of a building like TAIPEI 101, any new measures had to be carried out system-wide. The company poured in resources to install hardware that was not originally there. To begin with, building-wide metering for collecting pertinent data was applied, followed by installation of water saving faucets and toilet flushes, LED bulbs in common areas, and A/C inverters, etc. Drafted and implemented policies include the “Green

2010 年, 台北 101 管理团队肩挑起重任, 率先申请 LEED (能源与环境设计先锋奖) 认证, 并于 2015 年申请再认证。虽然台北 101 大楼并非依 LEED 兴建的建筑物, 但其建筑设计仍保有绿色建筑的精髓。

举例而言, 绿色设计重点包括帷幕玻璃窗采用低辐射特性(low-e)的双层玻璃, 用于降低吸热并可让光线透入; 雨水经大楼露台的收集贮存在B5 水箱供重复利用; 安装垃圾投递系统, 让人无需搭乘电梯就能丢弃垃圾。整栋建筑的「能源管理及控制系统 (EMCS)」能监控和自动开关各种设备, 透过安装100,000 个以上的侦测感知器以管理空调、电力、照明、供水等, 此系统可确保随时都能发挥最高的节能效益。

2010 年, 公司于出租率超过 70% 稳定收益之际, 管理团队决心挑战向美国绿色建筑委员会(USGBC)申请 LEED 既有建筑运营与维护 (EB:OM)。本项认证规定整栋建筑必须在未来五年期间内保持环境永续的先导地位。LEED 申请程序不仅让台北 101 建立能源效率基准, 并在迅速精进管理技巧之后, 能成为业界领先标杆。2010年首次的认证是一项重大挑战, 有鉴于台北 101 是一栋巨大又复杂的建筑物, 因此任何新措施必须是系统化全面执行。本公司在当时投入资源装设兴建时未规划的硬体设备。首先是收集必要资料安装于全栋的电子计量器, 其次是安装省水水龙头及马桶、公共区域改装 LED 灯泡、空调变频器等; 另外也起草执行各项政策, 包括「绿色装修手册」、「租户手册」和「绿色租约」提供所有租户, 同时推动实施绿色环保教育、认养社区公园等措施。

五年后于2015年申请铂金级再认证之际, 需要依当年承诺的事项, 公布过去五年



Figure 2. TAIPEI 101 decides to recertify with LEED v4 in 2015 (Source: TAIPEI 101)
图2. 台北101于2015年决定申请LEED再认证 (来源: 台北101)

Fit-out Handbook” and “Green Lease” for all tenants, Green-on education, adoption of a neighborhood park, and so on and so forth.

The process of re-certification, five years after the first certification using the Platinum standard, mainly challenges the integrity of the team to deliver past five-year records as first committed. Any company which sets out to do only the first LEED EB:OM for publicity purposes would not have voluntarily subjected itself to the re-certification process for it is only at this stage that the record card is exhibited and the Platinum certificate scrutinized.

For the purpose of this recertification, a new consultant was appointed to the task of auditing and cross-examination. Weighing more importantly was the interpretation and dialogue ability of the consultant with USGBC personnel, for we were dealing with a revised and upgraded version of LEED v4. The process has been very tedious, as the nature of business warrants, filled with many checks and balances working on technical calculations. The more interesting aspect of this journey lies in the back-and-forth discussion of the concept and intent behind some scrupulous and seemingly high-threshold requirements. We submit 3 CIRs (Credit Interpretation Rulings) to seek approval on discrepancies in article stipulations, namely rainwater capture, drinking water innovation, and E-waste. Approvals were readily secured and the entire application submitted in mid-April 2016. TAIPEI 101 is in many ways representative of all multi-tenant office buildings, and therefore the success of our building should offer a relatable case study for all leased buildings.

LEED's Goals and Benefits

When TAIPEI 101 first achieved LEED Platinum certification as an existing building in 2011, we knew it was the beginning of a new leadership role, a new relationship with our tenants, and a new definition of standard practice. For an existing building, green is not just an adjective used to describe a noun in a single point in time; green is a verb, reflecting continuous action to maintain and improve the environmental performance of the building and how it's operated. For LEED O+M, this is ensured by a five-year recertification requirement with an ongoing performance period for prerequisites and credits from one certification to the next. This requirement verifies the progress of sustainability goals and ensures green practices are being properly implemented after initial certification (Crea 2015).

To involve oneself into the iterative process of LEED certification tests the team's desire to go green and individual abilities to pinpoint problems as well as provide solutions across the board. It is important to bear the big picture in mind for it is easy to be bogged down by details and get swamped with tedious calculations. It is also critical to keep track of time and begin with the end in mind – to stay above water yet dive deep where needed – so that bottom lines in the form of deliverables are met by respective sub-groups.

From the outset, LEED is an honorable title and certification to obtain. We are often asked, “What are the benefits of LEED?” Had we not been backed up by solid numbers, we would find it hard not to draw our answers only from Corporate Social Responsibility (CSR) aspects constantly.

LEED is designed to address environmental challenges while responding to the needs of a competitive market. Certification demonstrates leadership, innovation, environmental stewardship, and social responsibility (USGBC 2013).

An integrated team can develop goals that lay a strong foundation for achievement. By looking at the building's location, orientation, massing and occupant use patterns, ways to reduce the loads and environmental harms of each system can be devised. The project goals should reflect organizational values and operational realities as well as sustainability targets supported by major stakeholders. This will ensure buy-ins and ongoing support by stakeholders. There are two types of goals attainable through LEED (USGBC 2013):

Environmental Goals

- Energy Signature – an analysis of measured energy use in relation to seasonal fluctuations in temperature.
- Energy Benchmark – compare the building's energy use against recognized standards, such as ENERGY STAR score.
- Site Analysis – define opportunities for improving and preserving ecological integrity of the site.

Organizational Goals

- Corporate Social Responsibility Report – align organizational goals and priorities with LEED credits.
- Organizational Annual Metrics – for example, GHG (greenhouse gas emission metrics) and waste recycling from operations.

的表现。若单为行销宣传的目的而申请 LEED，就不太可能自愿挑战再认证；因为，在此阶段必须缴出与铂金级认证相媲美的营运成绩单。

为了这次再认证的公信力，台北101特地聘请了新顾问团队协助，处理稽核与资料查验的工作。由于 LEED v4 是修订后的更新版本，因此我们格外着重顾问团队与 USGBC 的审查人员，针对条款的诠释及沟通的能力。申请资料预备的程序一如其业务本质，非常繁琐，充满许多查核重复验算的比重。在过程较有趣的层面，是针对某些乍看似高门槛的细节要求，进行概念与意图的来回讨论。我们针对与条款的差异之处总共提交了 3 份 CIR（积分辨读裁定）寻求批核，主要有雨水收集、饮水创新及电子废弃物。经顺利取得批核之后，便于2016年 4 月中旬提出完整的申请。台北101在许多方面，可比是外租商办大楼的代表，因此本建筑的成功案例，值得其他同类型商办大楼作为案例仿效。

LEED 目标及效益

台北 101 于 2011 年以既有建筑资格首次获得 LEED 铂金级认证时，我们就已认知到这是全新领导地位的开端、与承租户发展全新关系的起点，以及重新定义标准作业的开始。对既有建筑来说，「绿色」不单仅是某一时间点的形容词，而是持续的维护和改进建筑环境效能与营运模式的动词。对 LEED O+M 而言，这指的是为期五年的要求、依颁布的认证标准，持续符合先决条件，至下次认证前所累计的积分。这种要求可确认永续发展目标的推进，也确保认证后绿色管理的实施。

再次投入 LEED 认证的过程，是考验整个团队走向绿化的决心，也是挑战个别成员辨别问题症结的能力，可否跨部门跨领域合作找出解决方案的能力。团队成员必须将整体目标放在心中，以免被繁复的细节拖着走，或陷入枯燥的计算泥沼中；另外也要注意期限时间，保持头脑清醒，以免为因兼具综观与微观视野——排除障碍让个别小组能顺利达标缴件。

LEED 从一开始就是一项殊荣的认证。经常有人问我们：「LEED 有什么好处？」幸好我们有坚实数据作为后盾，否则就只能从企业社会责任（CSR）角度作答。

LEED 的目标旨在解决环境挑战，同时因应市场竞争的需求。认证代表领导地位、创新、环境管理和社会责任。

有一支跨领域人才的团队，才能打下好的基础。考量建筑的地点、方位、量体和住户使用模式，就能找出降低各功能系统的负载及环境冲击的方法。此外，专案目标应反映组织价值和营运现实面，以及为

- Shareholders' or stakeholders' concerns – involve them and gain their support.

The above goals, once achieved, reap long term benefits. The tangible result from LEED 2010 is the reduction in water usage by at least 70% compared to previous years. The savings in electricity are measured by EUI (energy usage index). Despite increasing occupancy TAIPEI 101 still managed to decrease energy consumption by 25% EUI from 2007 to 2015 in the course of 8 years. Thanks to the metering and monitoring system already in place, the management team is able to set a target in energy or water reduction yearly, and work towards it by engaging our tenants periodically. A projected figure of annual reduction, say 2%, is set at the beginning of the year and we track MoM/ YoY to reach the target at yearend. Our waste recycle rate reached 77% in 2015, a feat gaining much recognition from industry and peers. All these records strengthen TAIPEI 101 as a green leader, which in turn reap us even more intangible benefit (Figure 3).

LEED-certified buildings in general are designed to deliver the following benefits:

- Lowered operating costs and increased asset value
- Reduced waste sent to landfill
- Energy and water conservation
- More healthful and productive environments for occupants
- Reductions in greenhouse gas emissions

A Challenge to Integrative Thinking and Management

To meet human needs without compromising our baseline target, green building operations require dedication and buy-in from all levels of building and tenant management. So, a successful operation requires collaboration, integrative thinking, and a strong team, each of which has a clearly defined role and responsibility.

In the first LEED certification undertaken by TAIPEI 101, the hard-set experts of Engineering, Operation and Maintenance (EOM) team exhaustively explores ways to reduce energy consumption, which includes replacing fixtures to reduce both energy and water consumption. The onward result tracking is made possible by means of building-wide meter installations on critical equipment. With these expenditures, satisfying results are achieved, making future savings limited.

This distinctive challenge in re-certification calls for thinking out-of-the-box and on multi-tracks, as there seems to be scarce opportunities to save energy the traditional way. In the beginning sessions, various professional discipline groups brainstorm together to tackle the challenge from a bigger context, so as to identify possible solutions and assign project owners who then coordinate among two or more departments.

The v4 list of new requirements proves to be a helpful guide in pointing to a new area of investigation, incidentally the "Cooling Tower Water Recycling Project," to effectively reduce

主要利害关系人支持的永续发展目标。LEED 可达成的目标可分成两类：

环境目标

- 能源特征-分析能源用量测量值与季节性温度波动的对比关系。
- 能源基准-将建筑的能源用量与公认标准比较，如能源之星计分。
- 场址分析-定义改进和保持场所生态完整性的可能性。

组织目标

- 企业社会责任报告-依照 LEED 积分调整组织目标与优先顺序。
- 组织年度指标-如 GHG (温室气体排放指标) 及营运废弃物回收。
- 股东或利害关系人考量-让他们参与并取得支持。

一旦达成上述目标即可转化成长期效益。LEED 2010 的具体成果为用水量较前年减少 70% 以上。若以 EUI (能源用量指数) 计量用电量的节约幅度，则从 2007 年到 2015 年的 8 年之间尽管台北 101 承租率上升，仍能设法将耗电量降低 25% EUI。由于早已装设计量和监控系统，因此管理团队得以设定年度节能或节水目标，并与承租户定期合作共同努力。每年年初会设定年度预计节约数字 (如 2%)，之后将以前年同月 (MoM) 或前年同期 (YoY) 的方式追踪，以期在年底达成目标。2015 年的废弃物回收率达 77%，这种成绩受到业界及同业一致肯定；种种佳绩让台北 101 坐稳绿色领导宝座，进而转换为更多的无形效益 (图 3)。

LEED 认证建筑通常采用具备下列效益的设计：

- 降低营运成本及提升资产价值
- 减少不可回收的废弃物量
- 节约能源及水
- 对承租户更为健康及更具生产力的环境
- 减少温室气体排放

迈向整合性思考与管理的挑战

要满足人性需求的目的，又不至于损及获利目标，绿色建筑营运需要建物与租户管理团队全心全意投入，亦即成功营运需要协力合作、整合性思考，以及清楚界定成员角色与责任的坚强团队。

在台北 101 第一次的 LEED 认证中，工程营运与维护团队 (EOM) 的硬体专家竭尽全力找出降低耗电量的方法，包括更新

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Power Consumption (KWH)	95.8mil	96 mil	91.09mil	90.53mil	85.1mil	86.5mil	84.74mil	84.68mil	86.40mil
Using Area (M ²)	318,372	339,707	344,059	346,395	351,929	360,095	368,772	374,303	374,243
EUI	301	283	265	261	242	240	230	226	231
Compare With previous year		-6.1%	-6.3%	-1.3%	-7.5%	-0.7%	-4.3%	-1.5%	2.21%

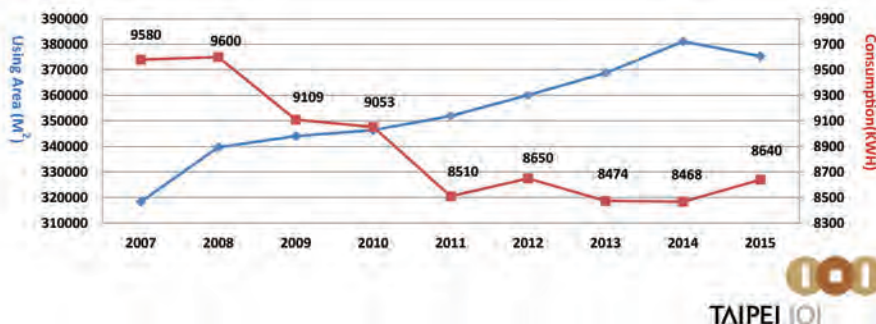


Figure 3. Upward occupancy trend vs. downward EUI curve (Source: TAIPEI 101)
图3. 攀升的进驻率对比下滑的能源消耗指标 (来源: 台北101)



Figure 4. Pump with variable frequency mode (Source: TAIPEI 101)
图4. 空调泵加装变频器节能 (来源: 台北101)

water usage (Figure 4). While water is relatively cheap compared to electricity fees, such cost-saving possibilities should not be overlooked, as A/C cooling towers consume by and large the majority of water resources on-site. With this measure, water could now be recycled as many as 10 times before bleed-off. This is made possible with the introduction of appropriate purification agents to keep the water quality within standard. TAIPEI 101's water recycle performance is excellent by the highest Platinum standard. In the past, water quality falls under the purview of the Engineering and Operation Management team. Now the solution enhancement is readily adopted by a multi-discipline team to achieve concrete results (Figure 5).

The new upgraded LEED version also broadens the perspective in that LEED EB:OM is not all about energy savings and life-cycle costs. It helps individuals to see their roles in light of the community at large. When the concept of Advance Demand Response (ADR) was first introduced, it was not out of cost saving consideration, but rather to align with

the spirit of CSR (Figure 6). We were among the early birds to sign an ADR memorandum with Taipower. The idea behind ADR is to reduce the power usage by 10% at peak loading times so as to help ease the pressure off the power grid. Since presently we cannot actually reduce the demands on our side at peak loading, in lieu we use our own power generators to fill in the 10% gap in supply. This has proven to be actually more economical and cost-effective while we continue to strive towards greater energy-saving.

In the long run, the LEED leaders continue to think in terms of integration for creative solutions, and they manage from a flexible organizational structure whereby the division lines between disciplines are no longer solid barriers but perforated.

Moving from Hard Sets to Soft Skills

As stated before, the idea of EB:OM is not to make building owners spend big money

Maximum Concentrations for Parameters in Condenser water 冷却水最大浓度参数	
Ca (as CaCO ₃) 钙 (即碳酸钙)	1000 ppm
Total alkalinity 总碱度	1000 ppm
SiO ₂ 二氧化硅	100 ppm
Cl 氯	250 ppm
Conductivity 传导性	2000 US/cm

Figure 5. LEED Platinum Standard for Recycled Water Quality (Source: TAIPEI 101)
图5. LEED铂金级的水循环回收的品质标准 (来源: 台北101)



Figure 6. Advance Demand Response (Source: TAIPEI 101)
图6. 需量反应控制器 (来源: 台北101)

设备器材以降低耗电量及用水量。另外,也透过在全栋建筑的重要设备上安装计量器,以持续进行成果追踪;以上支出换来令人满意的成果,但也无形间限制了未来节约的幅度和方法。

有鉴于传统节能的方法用罄,因此重新认证的新得分点,需要跳脱框架多元的思考。一开始,不同专业领域的成员齐聚在一起脑力激荡,试图扩大范畴思考,找出可能的解决方案,并指派专案负责人协调跨二个部门以上的专案项目。

LEED v4 的新要求的确指引一些新方向。例如「冷却水塔水循环回收专案」能有效节省用水(图4)。虽然水费相对较电费低廉,但空调冷却塔消耗台北 101 大量的水资源,不容忽视节约机会。经由这新措施,排放以前能循环回收高达 10 次。实际做法是采用适合的净化剂将水的品质保持在标准范围内。依照最高的铂金级标准判断,台北 101 的水循环回收效能属于杰出等级。在过去,冷却水品质是由大楼的空调团队负责,新的升级解决方案,则改为由跨组的水资源及空调团队缔造绩效(图5)。

升级版的 LEED 的范畴也进一步扩大,LEED EB:OM 不再仅限于节能与生命周期成本,更能协助个别人士自省发掘自己在群体中的角色。首次推出需量反应(ADR)的概念时,其背后的考量并非节省成本,而是向 CSR 的精神看齐(图6)。我们抢先他人一步与台电签署 ADR 备忘录;ADR 的概念是在尖峰负载时间降低 10% 的耗电量,以利减轻电力网路的压力。虽目前尚无法实际减少尖峰负载的需求,我们以自有发电机填补供电的 10% 落差;这种做法经过证明实际上更为经济有效,且也允与我们空间能继续精进节能管理。

长期来说,LEED 的先导者会不断以整合性思考追求创新解决方案,并以弹性的组织架构管理让各专业领域间融会交流,不再壁垒分明。

从硬体到软体技巧

如前所述,EB:OM 的概念不是要建筑业主花费巨资在整修或升级上,而是在既有基础上改进。不单只是仰赖智慧型新设备,而是从管理政策着手。只要一看「先决条件」的类别表,就能发现认证的「必要」项目包括水、能源及空调效能的最低门槛、全建筑的用水及用电计量,以及多项重要管理政策。表中的各大项类别皆有相对应的管理政策或措施。图表二说明 LEED EB:OM 的基础要素,以及管理政策的重要性(图7)。

	Category 类别	Credit Name 积分名称
1	Prerequisites 先决条件	<ul style="list-style-type: none"> • Site Management Policy 场址管理政策 • Indoor Water Use Reduction 室内用水减量 • Building-Level Water Metering 全栋用水量 • Energy Efficiency Best Management Practices 能源效率最佳管理 • Minimum Energy Performance 最低耗能效能 • Building-Level Energy Metering 全栋能源计量 • Fundamental Refrigerant Management 基础冷媒管理 • Ongoing Purchasing and Waste Policy 营运采购及废弃物政策 • Facility Maintenance and Renovation Policy 设施维护及装修政策 • Minimum Indoor Air Quality Performance 最低室内空气品质效能 • Environmental Tobacco smoke Control 大楼全栋禁烟 • Green Cleaning Policy 绿色清洁政策
2	Location and Transportation 地点及运输	• Alternative Transportation 替代运输方式
3	Sustainable Sites 永续场址	• Site Management Policy 场址管理政策
4	Water Efficiency 水效率	• Indoor Water Use Reduction 室内用水减量
5	Energy and Atmosphere 能源和大气	<ul style="list-style-type: none"> • Energy Efficiency Best Management Practices 能源效率最佳管理做法 • (suggested) Demand Response (建议) 需求回应
6	Materials and Resources 材料及资源	<ul style="list-style-type: none"> • Ongoing Purchasing and Waste Policy 营运采购及废弃物政策 • Facility Maintenance and Renovation Policy 设施维护及装修政策
7	Indoor Environmental Quality 室内环境品质	<ul style="list-style-type: none"> • Environmental Tobacco Smoke Control 大楼全栋禁烟 • Green Cleaning Policy 绿色清洁政策
8	Innovation 创新	
9	Regional Priority 区域优先顺序	

Figure 7. LEED Credit Requirement of Metering (in blue) and Management Policies (Source: TAIPEI 101)
图7. LEED计量设备(蓝字)和管理政策的积分要求 (来源: 台北101)

on refurbishing or upgrading, but to make improvements on the given outset. It is designed not to solely rely on smart and new equipment but to dwell on building management policies. Glancing at the category chart under “Prerequisite,” one notes the “must-have” items for certification, which includes minimum thresholds for water, energy and air performance; building-level water and energy metering; and several key policies. Moving down the chart, each category has a corresponding management policy or strategy provision in governance. This illustration reveals the fundamental elements of LEED EB:OM and the importance of getting management policies in place (Figure 7).

In addition to the above listed policies, there are a few more policies in place and a myriad of improvement plans and surveys (a v4 distinctive is “site improvement plan”) to ensure Platinum standard operation and management are in place for sustainable operation (Figure 8).

Stakeholder Engagement is Key to Ongoing Success

As USGBC is expecting to progressively lift the LEED threshold requirement upward, the Innovation Category becomes a channel to collect best practices and ideas from industry players. These ideas could become a requirement for LEED tomorrow. TAIPEI 101 has submitted “Green Building

Education Program” as an innovation credit entry, and “Occupant Engagement” as a pilot credit entry. These 2 entries engage our stakeholders; one external stakeholders (visitors who are interested in TAIPEI 101’s green endeavors) and one internal stakeholders.

External Stakeholders Engagement – Green Building Education Program

The Green Building Education Program targets visitors who are in support of green

除了上列政策外，另有规范其他政策及众多改善计画与调查（v4 的特色为「场址改善计画」），以确保落实铂金级的标准于营运管理面，朝向永续经营的方向前进（图8）。

利害关系人参与，是持续成功的关键

预料美国绿色建筑委员会将持续提升 LEED 门槛的要求，因此「创新得分」将成为从业界搜集最佳做法与想法的管道。这类新点子或许会成为未来 LEED 的要求。台北 101 已分别针对创意积分项目和先导积分项目提出「绿建筑教育计划」及「租户参与」。这两个项目能增加利害关系人的参与度：其中一项针对外部利害关系人（对台北101绿色实践有兴趣的访客），另一项则针对内部利害关系人。

外部利害关系人参与——绿建筑教育计划

绿建筑教育计划锁定的对象是支持绿建筑的访客。非营利组织、企业集团、学校和一般大众皆可透过下列管道，报名参加台北101的教育计划。

绿色智慧专案

立基于各界公认的认证，我们制作了专属网页（<http://www.taipei101greenon.com.tw/>）；此网页连结至手机可下载的APP程式，提供绿色行动相关的资讯给一般大众参考。本专案的七大面向包括（图9）：

- 节能
- 空气品质之提升



Figure 8. Waste handling process (Source: TAIPEI 101)
图8. 废弃物回收程序 (来源: 台北101)



Figure 9. Green On Project (Source: TAIPEI 101)
图9. 绿色教育专案 (来源: 台北101)

building. Non-Profit organizations, business groups, schools and the public at large can access TAIPEI 101's Education program by the following channels:

Green On Smartphone Project

Built on the foundation of acclaimed certifications, we have created a dedicated webpage (<http://www.taipei101greenon.com.tw/>) which is also linked to an App to view these initiatives made available to general public. The seven major dimensions of the project are (Figure 9):

- Energy Saving
- Better air quality
- Material recycling
- Friendly with the environment
- More green space
- Promote eco-education
- Commitment by tenants

Green Corner Education Program

A space in the lobby called Green Corner is dedicated to raise public awareness of LEED certification. This place becomes the showcase for the tower's LEED achievement,



Figure 10. Education Signage Program and Green Tour (Source: TAIPEI 101)
图10. 教育标志与绿导览专案 (来源: 台北101)

whereby a green wall featuring indigenous Taiwanese plants, as well as the Green On Project QR code, begins the Green Education. The three LCD screens display an animated film introducing the building features and highlights of v4 certification. It was first created and shown for the LEED Award Ceremony in July 2016 and subsequently included in the Green Education (Figure 10).

Green Tour

Green Tours are available to the public at advance request. The tour takes visitor groups of 20–30 people through the backend service functions of TAIPEI 101. In 2015, we conducted tours to organizations, groups, and schools with a total visitor count of 1,025 people. These green education tours help visitors to learn how green operations are actually carried out within the building and to instill green awareness for sustainable environment to a young audience.

Internal Stakeholders Engagement – Occupant Engagement Policy

Monthly Newsletter

A monthly newsletter is distributed to tenants to disseminate tower news, event updates, and most importantly, the tower electricity consumption as compared to last month. This newsletter also features articles on power and water savings, as well as tips on how to do so.

Greenhouse Gas Inventory (GHG)

Since the start of 2011, TAIPEI 101 has taken a greenhouse gas inventory so as to observe and analyze in detail the classification and ratio of gas emissions based on the Green House Gas Inventory Report, certified by a third party, in compliance with ISO 14064-1:2006.

Environment Awareness Seminars

Every quarter to half-year, a seminar related to environmental conservation or protection is held (Figure 11).



Figure 11. Environment Awareness Seminars (Source: TAIPEI 101)
图11. 环境意识讲座 (来源: 台北101)

- 材料回收
- 友善环境
- 绿色空间扩增
- 环保教育之提倡
- 租户之委身参与

「绿色角落」教育计划

大厅将设置一区称为「绿色角落」, 专为民众介绍 LEED 认证。此空间将成为大楼 LEED 成就的展示空间, 一面完整的植栽墙专门介绍台湾原生植栽, 亦展示「绿色智慧专案」的成果, 以QR符号扫描后可经手机下载, 开启本区的教育导览。透过三座 LCD 萤幕展出动画影片浏览建筑特征以及 LEED v4 的再认证特色。此影片初次在2016年七月的认证颁奖典礼播放, 尔后成为例行绿色教育的材料 (图10)。

绿色导览

绿色导览可供大众预约安排参访。约 20–30 人的团体经由导览路线可深入台北 101 的后场服务区域。单2015 年, 我们所执行的绿色导览(对象为机关、团体及学校), 总数达 1,025 人次。绿色导览有助于访客了解绿建筑营运的实际操作面, 提升民众(尤其年轻孩童)对于环境永续的觉察力。

内部利害关系人参与——租户参与政策

每月电子报

向租户派送每月电子报以传达大楼新闻、活动新闻, 以及最重要的前月大楼耗电量比较; 本电子报亦刊登节能和省水的专栏文章, 以及相关诀窍做法。

温室气体排放量清册 (GHG)

自2011 年起, 台北101 开始执行温室气体排放量计算, 根据「温室气体排放量报告」所载, 详细观察并分析温室气体排放量的分类及比例, 并依照ISO 14064-1:2006 由第三方认证。

环境意识研讨会

每季到每半年举行一次环境保育或保护的相关研讨会 (图11)。

承租户舒适度调查

除了日常与服务中心的沟通与回馈以外, 台北101大楼的租户于每年第3 季可填写满意度调查表反应意见; 租户服务中心亦每月按时提供水电费帐单, 以及大楼活动邀请函给租户。



Figure 12. Tenant team at Run-Up (Source: TAIPEI 101)
图12. 租户队参加登高赛（来源：台北101）

Occupant Comfort Survey

At Q3 every year, TAIPEI 101 tenants get to fill out survey forms in addition to day-to-day feedback correspondence with the Service Center. The Service Center also delivers monthly utility bills and tower event invitations to tenants.

Mapping with Corporate Social Responsibility (CSR) Report

On the side of intangible benefits, the windfall on CSR is immense. LEED has become a critical component in TAIPEI 101's CSR report. This report is made accessible to the public via our website. Way before the signing of the Paris Agreement and COP21, TAIPEI 101 has decisively taken strides to establish our presence in environmental sustainability CSR through LEED certification. Known as the Tallest Green Building, we are a prominent purchaser of Taiwanese local green energy. One thing leads to another, and a right decision reaps many favorable outcomes. Up to this point, TAIPEI 101 has received many awards and recognitions; Diamond Level Green Building Certificate, Global Perspective Annual CSR award, Taipower Award on Green Energy, and the 2016 CTBUH Performance Award are a few awards of many won by TAIPEI 101. These Green CSR achievements give us much publicity, become stepping stones to many key partnering relationships, and further spur reeling development in CSR. Some past CSR events are as follows:

CSR Report

2015 marks the third time for TAIPEI 101 to publish an annual corporate social responsibility report. This CSR report

provides detailed disclosures of our efforts and achievements in economic, social and environmental aspects. Beginning in 2016, CSR reports will undergo assurance which is not required of but voluntarily undertaken by the management.

Green Power

TAIPEI 101 also participates in the "Green Power Good Power" plan, which was initiated by Ministry of Economic Affairs in July 2014. TAIPEI 101 bought 1.01 million kWh of green electricity in 2015 and 2016.

Earth Hour

Since 2009, TAIPEI 101 has participated in the "Earth Hour" event to turn off the lights for one hour under the global initiative by the World Wildlife Fund (WWF). The goal is to raise public awareness for carbon reduction, energy savings, and climate change.

TAIPEI 101 International Run-Up

Since 2005, TAIPEI 101 has been organizing annual international run-up races to promote sports and exercise. Since 2015 we have joined the Tower Running World Association to be among the world towers hosting global run-up races (Figure 12).

Diamond Level certification

In 2013, TAIPEI 101 received "Diamond Level" certification awarded by the Architecture and Building Research Institute. In the same year, we also received the "Energy Conservation and Carbon Reduction Action Emblem" awarded by the Environmental Protection Administration. This certificate has been renewed in 2016 and will last for 3 years.

对观企业社会责任 (Corporate Social Responsibility, CSR) 报告

CSR 的附加无形效益非常广大。LEED 已成为台北 101 CSR 报告的必备要素，此报告透过网站供大众参阅。早在COP21与巴黎协定签订前，台北 101 已经决定透过 LEED 认证迈向环境永续 CSR 的道路；身为最高绿色建筑的台北 101，已是购买台湾本地绿能的重要客户。正确的决策，往往能连接获许多有利的成果：台北101 至今已获颁许多奖项及认证，包括2016年世界高层建筑与都市人居学会全球卓越绩效奖(2016 CTBUH Performance Award)、钻石级绿建筑证书、远见杂志年度CSR 奖、台电绿能奖等一连串的奖项。如此众多的绿色 CSR 成就让我们获得大量公关曝光，成为建立与重要的合作伙伴的基石，一同成为 CSR 绵密发展的动力。以下举例说明过往举办的 CSR 活动：

CSR 报告

2015 年是台北 101 第三次出版发表年度企业社会责任报告。本 CSR 报告详细揭露台北 101 在经济、社会及环境方面等努力与成就。自2016年起，CSR报告将进行查核确信，纯粹自愿性而非主管机关所要求。

绿电

台北 101 另外参与经济部在 2014 年 7 月发起的「Green Power Good Power」自发性绿色电价计划。2015 年及 2016 年，台北 101 已购买 101 万 kWh 的电力。

Earth Hour (地球一小时)

自 2009 年起，台北 101 参与世界自然基金会 (WWF) 发起的全球「Earth Hour」(地球一小时) 活动，在活动中关灯一小时。活动目标是激起大众对减碳、节能和环境变迁的认知意识。

台北 101 国际登高赛

自 2005 年起，台北 101 开始举办年度国际登高赛以推广运动；我们也在同年度加入世界登高协会，与全球各地其他高塔一同举办登高赛 (图12)。

钻石级认证

2013 年，台北 101 获颁建筑研究所「钻石级」认证，另外也获颁环保署「节能减碳行动标章」，后者更于 2016 年续颁效期 3 年之标章。

台湾企业永续奖-气候领袖奖

这项广泛涵盖不同层面的 CSR 奖项，代表台北 101 过去对气候领袖的贡献与成就获得肯定 (图13)。



Figure 13. Taiwan Corporate Sustainability Award – Climate Leadership (Source: TAIPEI 101)
图13. 台湾企业永续奖 (来源: 台北101)

Taiwan Corporate Sustainability Award – Climate Leadership

This is a prolific CSR award to recognize TAIPEI 101's past contribution and achievement in climate leadership (Figure 13).

MoU signing with Sky Restaurants in Local Food and Fair Trade Support

In 2015, we were among the first building owners to sign a memorandum with our sky restaurants to use fair-trade goods and local farming ingredients in support of social enterprises. By committing to use local produce, we alleviate poverty, support local agriculture and reduce carbon food prints on food purchase (Figure 14).

"Love-Fair" Charity Event

TAIPEI 101 works with KPMG Taiwan on the "Love-Fair" annual charity event. Many CSR counterparts of TAIPEI 101 tenants are invited to join the auction to bid for selected luxury goods donated by our mall tenants. This event draws at least a thousand participants each year and raise over NT\$ 1 million on average to donate to various social welfare organizations.



Figure 14. MoU signing with sky restaurants in support of fair trade and social enterprises (Source: TAIPEI 101)
图14. 支持公平贸易和社企产品,与高空餐厅签署合作备忘录 (来源: 台北101)

Conclusion

TAIPEI 101's experience of LEED O+M recertification is invaluable in that the process offers an excellent opportunity to review sustainability programs and goals, which is particularly important in the context of a rapidly evolving landscape of green building standards, competitor achievement, and stakeholder expectations. Not only does it give building teams an opportunity to evaluate new initiatives, but it also provides new tools to demonstrate actual performance levels in step with new iterations of LEED to a level of detail and independently verified rigor that is hard to beat by other certifications (Crea 2015).

LEED is an ongoing commitment, not just a one-time accomplishment, and those who recognize this are the leaders of the next phase of the green building movement. TAIPEI 101 is one of these leaders and is setting an example for others to learn from.

与景观餐厅就支持本地食材与公平贸易签订备忘录

2015 年, 台北 101 率先与景观餐厅签订备忘录, 支持社会企业并采用公平贸易货物与本地生产农作物。透过致力采用当地农产品, 达到扶贫、支持本地农业与降低食材采购的食物碳足迹 (图14)。

「爱-市集」公益活动

台北 101 与 KPMG 台湾所合作举办「爱-市集」年度公益活动。台北 101 租户的 CSR 部门皆受邀参加, 义卖竞标商场租户所捐出的多项精选高级商品。本活动每年吸引上千名参加者, 平均募集超过 1 百万台币捐给多个社会福利组织机构。

结论

台北 101 在重新认证 LEED O+M 获得了宝贵经验; 在过程中, 让我们可回顾并审视永续计划与目标, 比较日新月异的绿色建筑标准、竞争者成就和利害关系人的期望。这不仅让建筑团队有机会评估新行动企划, 也能利用新工具展示实际绩效水准, 追上新版 LEED 的脚步, 缔造其他认证无法迨及的独立严谨高度。

LEED 并非昙花一现的成就, 而是持续不断的实践承诺。下一阶段的绿色建筑运动领导者, 无不拥抱此认知点。台北 101 已成为绿色领导标杆, 将致力持续成为他人学习的榜样。

References:

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