



Green Office Method to Low Carbon Office: A Pathway for Thailand's Sustainable Future

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Abstract

The Green Office Thailand has become an important mechanism for promoting environmentally responsible practices within organizations, such as reducing resource consumption and generating waste. However, in the context of global climate change and increasing pressure to reduce greenhouse gas emissions, organizations are expected to move beyond general environmental management toward more measurable and data-driven carbon reduction strategies. This study examines the role of the Green Office method as a pathway toward the development of Low-Carbon Offices in Thailand. The paper describes the principles of the Thailand Green Office standard, analyzes the concept of Low Carbon Office (LCO) buildings, and explores practical approaches for transitioning from conventional Green Office practices to carbon-oriented office management. Key strategies include carbon footprint assessment, the adoption of energy-efficient building systems, integration of renewable energy technologies such as rooftop solar photovoltaic systems, and the use of smart building technologies for energy monitoring and optimization. In addition, organizational factors such as leadership commitment, employee engagement, sustainable procurement, and behavioral change are identified as essential components in achieving long-term sustainability. The study also highlights future operational strategies, including digital building management, carbon credit mechanisms, circular economy practices, and nature-based solutions. The findings suggest that the transformation from Green Office to LCO represents a significant step toward strengthening organizational sustainability and supporting Thailand's national climate goals. By integrating technological innovation with sustainable organizational culture, offices in Thailand can significantly reduce environmental impacts while improving operational efficiency and contributing to the country's transition toward a low-carbon economy.

Keywords: Green Office, Low Carbon Office, Carbon footprint, Thailand, Building energy efficiency, Sustainability

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1. Introduction to the Green Office Standard of Thailand

The concept of a Green Office in Thailand has been promoted primarily by the Department

of Environmental Quality Promotion (DEQP), operating under the Ministry of Natural Resources and Environment. The initiative aims to encourage both public and private organizations to operate in a more

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environmentally responsible manner by reducing resource consumption, minimizing waste, and improving environmental management practices within office environments [1].

The Thailand Green Office Standard, commonly known as G-Green or G-Office certification, provides a structured framework for evaluating and improving environmental performance in offices [2]. The certification system categorizes organizations into three levels: G-Gold (Excellent), G-Silver (Very Good), and G-Bronze (Good). These levels serve as benchmarks that motivate organizations to progressively enhance their environmental practices and performance [3].

The Green Office framework evaluates offices across several key categories. These include organizational management, which emphasizes the establishment of clear environmental policies and leadership commitment from executive levels, and internal auditing, which involves regular monitoring and self-assessment of resource consumption and environmental performance [4]. Another important component is resource and energy management, focusing on improving efficiency in electricity, water, and paper usage to reduce operational environmental impacts [5].

In addition, the standard emphasizes waste management, particularly through the implementation of the 3Rs principle: Reduce, Reuse, and Recycle to minimize waste sent to landfills and ensure proper segregation, including the safe handling of hazardous waste [6]. Offices are also encouraged to adopt green procurement practices, prioritizing the purchase of environmentally friendly products and services, such as those carrying eco-labels [7, 8].

Furthermore, the framework includes indoor environmental quality, which addresses factors such as air quality, lighting, and noise levels to ensure a healthy and safe workplace environment [9, 10].

Another critical element of the standard is continuous improvement, which involves environmental awareness training for employees, regular performance monitoring, and ongoing reporting of environmental outcomes [11]. Through these mechanisms, organizations are encouraged to develop a culture of environmental responsibility among staff and management.

In the broader national context, the Green Office initiative aligns with Thailand's strategic environmental and energy policies, including the *Thailand Integrated Energy Blueprint* (TIEB). Rather than focusing solely on resource conservation, the initiative reflects a shift toward a more holistic sustainability model that integrates environmental protection, social responsibility, and economic efficiency [12]. . As global attention increasingly focuses on climate change mitigation, the Green Office standard is also evolving. While the existing framework emphasizes environmental management processes and resource efficiency, there is a growing expectation for offices to transform into low-carbon organizations, placing greater emphasis on measurable greenhouse gas reduction and carbon-equivalent metrics [13].

2. Principle of Low-Carbon Office Building

A Low Carbon Office (LCO) building refers to an office building designed and operated to minimize greenhouse gas (GHG) emissions throughout its entire lifecycle from construction and operation to maintenance and eventual decommissioning [14]. Unlike a conventional green office that mainly emphasizes environmental management practices, a LCO focuses on quantifiable carbon reduction and the concept of carbon balance, where organizations measure and manage their emissions using data-driven approaches [15, 16].

One of the most important principles of a low-carbon office building is energy efficiency, which forms the first pillar of carbon reduction. In tropical climates such as Thailand, energy consumption in office buildings is dominated by cooling demand. Air-conditioning systems typically account for approximately 60–70% of total energy consumption. Therefore, optimizing the building envelope, including insulation, shading devices, and high-performance glazing, helps reduce heat gain and lower the cooling load [17,18]. Additionally, high-efficiency HVAC systems, such as Variable Refrigerant Flow (VRF) air-conditioning, together with LED lighting and smart controls such as motion sensors, significantly improve overall energy performance [19].

Another key principle is passive building design, which aims to reduce energy demand by

utilizing natural environmental conditions. Strategies such as natural ventilation, daylighting, building orientation, shading devices (e.g., overhangs and louvers), and insulated glass help reduce reliance on mechanical cooling and artificial lighting [20]. These passive strategies are particularly important in tropical regions where solar heat gain is a major contributor to building energy consumption.

In addition to improving efficiency, LCO buildings integrate renewable energy systems to reduce dependence on grid electricity. A common solution is the installation of rooftop Solar Photovoltaic (Solar PV) systems, which generate clean electricity directly from sunlight [21]. The integration of renewable energy transforms buildings from purely energy-consuming structures into partially energy-generating systems, thereby lowering operational carbon emissions [22]. A fundamental component of the LCO concept is the carbon accounting framework, where organizations calculate their greenhouse gas emissions based on energy consumption and emission factors. This carbon equation allows organizations to quantify emissions from electricity use, fuel consumption, and other operational activities, enabling them to track progress toward carbon reduction targets [23].

Furthermore, LCO buildings also consider the distinction between operational carbon and embodied carbon. Operational carbon refers to emissions produced during building use, such as electricity consumption for lighting, cooling, and equipment. In contrast, embodied carbon represents the emissions associated with the production, transportation, and construction of building materials. Consequently, material selection plays a significant role in reducing lifecycle emissions. Examples include the use of low-carbon materials, recycled steel, and locally sourced natural materials such as bamboo or clay, which generally require less energy to produce and transport [24]. Finally, water conservation strategies also contribute to sustainable office design. The installation of low-flow plumbing fixtures and rainwater harvesting systems for landscape irrigation helps reduce water consumption and the energy associated with water supply and treatment.

Overall, the transition from a Green Office to a LCO represents a shift from qualitative environmental management toward

quantitative carbon reduction strategies [14]. By integrating passive design, energy-efficient systems, renewable energy technologies, low-carbon materials, and resource conservation measures, low-carbon office buildings can significantly reduce greenhouse gas emissions and support broader climate mitigation goals [15].

3. Implementation of Green Office in Thailand toward a Low-Carbon Office

The transition from a Green Office to a LCO in Thailand requires the following steps:

1. Reducing the quantity of GHG emissions

Organizations should practice beyond general environmental management toward quantifiable greenhouse gas (GHG) reduction strategies [25]. While the Green Office framework focuses on improving operational practices and resource efficiency, the LCO approach emphasizes data-driven management, carbon accounting, and measurable emission reductions across organizational activities [15].

2. Carbon footprint assessment

A critical step in this transition is the assessment of organizational carbon footprints. Many Thai organizations apply the Carbon Footprint for Organization (CFO) methodology developed by the Thailand Greenhouse Gas Management Organization (TGO). This framework enables offices to calculate and verify their annual greenhouse gas emissions from activities such as electricity consumption, fuel use, waste management, and transportation [23]. By quantifying emissions, organizations can identify major emission sources and establish effective reduction strategies [15].

3. Digitalization of building management systems

Another important element is the digitalization of building management systems. Modern offices increasingly integrate smart building technologies, including Internet of Things (IoT) devices, smart meters, and Building Management Systems (BMS), to monitor and control energy consumption in real time. These technologies allow lighting, air-conditioning, and other building systems to adjust automatically according to occupancy patterns. Real-time monitoring also helps identify abnormal energy consumption or “energy

leaks,” enabling immediate corrective action and improving overall energy efficiency [26].

4. Retrofitting and upgrading building systems to improve environmental performance

In Thailand, many office buildings are existing structures (brownfield buildings) rather than newly constructed facilities. Brownfields are the result of changes in the functional use of the area and represent a huge environmental problem and a barrier to the spatial development of municipalities. Therefore, implementation strategies often focus on retrofitting and upgrading building systems to improve environmental performance. Examples include replacing outdated refrigerants such as R-22 with alternatives that have a lower Global Warming Potential (GWP), upgrading conventional air-conditioning systems to more energy-efficient technologies such as Variable Refrigerant Flow (VRF), and installing advanced energy monitoring equipment [19].

5. Green Procurement

Another essential aspect of implementation is the integration of green procurement practices. Organizations are encouraged to select products and services with low environmental impacts throughout their lifecycle. This includes choosing energy-efficient office equipment, environmentally friendly cleaning chemicals, and eco-labeled products. Such procurement policies help reduce indirect emissions associated with supply chains [7,8].

6. Behavioral Change

In addition to technological and managerial improvements, behavioral change among employees plays a significant role in achieving low-carbon objectives. Many organizations apply behavioral science approaches, such as “nudge” strategies, to encourage environmentally responsible habits [27]. These initiatives may include promoting the use of

stairs instead of elevators, setting air-conditioning temperatures at 25–26 °C, encouraging digital workflows to reduce paper consumption, and providing environmental awareness training programs for staff [28].

7. Innovative Waste Management

Furthermore, some organizations in Thailand have implemented innovative waste management initiatives to support carbon reduction. Programs based on the concept of “Zero Waste to Landfill” aim to eliminate waste-related emissions through recycling, composting, and material recovery systems [6]. For instance, projects developed by organizations such as Kasikornbank demonstrate how office complexes can utilize food waste shredders to produce fertilizer and establish plastic upcycling platforms to reduce landfill waste [6].

Overall, the implementation of LCO practices in Thailand represents a transition from simple resource conservation to *integrated carbon management*. Integrated Carbon Management (ICM) is a holistic framework that integrates carbon accounting, operational efficiency, and emissions reduction technology. Organizations need to establish clear boundaries, identify all their emission sources, collect reliable data, and utilize verified emission factors to calculate their carbon footprint accurately. Greenly and similar platforms increasingly automate these processes, reducing complexity while improving accuracy. By combining carbon footprint assessment, smart building technologies, retrofitting strategies, sustainable procurement, waste reduction initiatives, and behavioral change programs, organizations can significantly reduce greenhouse gas emissions while improving operational efficiency and supporting national climate mitigation goals [25]. Figure 1 shows the steps of carbon footprint measurement and calculation.



Figure 1. Carbon footprint measurement and calculation.

4. Sustainable Organization toward Green Office

A sustainable organization refers to an organization that integrates environmental responsibility into its core values, management systems, and daily operations. In the context of a Green Office, sustainability is not merely a technical or engineering challenge; rather, it is largely a cultural and organizational transformation. Successful implementation requires that environmental principles become embedded within the organization's corporate system ensuring that sustainability practices are continuously maintained rather than treated as temporary projects [3].

One of the most critical factors in building a sustainable organization is leadership commitment and governance. Strong support from top management provides the strategic direction, policy framework, and financial resources necessary to implement environmental initiatives. In many organizations, particularly small and medium-sized enterprises (SMEs) in Thailand, top-down leadership commitment has been identified as one of the most significant predictors of success in Green Office programs [29]. When senior management actively supports environmental policies and allocates budgets for sustainability initiatives, employees are more likely to participate and align their work practices with organizational sustainability goals.

At the same time, sustainability also requires active employee participation. Many organizations establish internal "Green Teams" or designate "Green Champions" within different departments to promote environmental awareness and encourage sustainable practices across the workplace. These teams help foster a bottom-up culture of sustainability, where employees feel a sense of ownership and responsibility for environmental initiatives [30].

Achieving a sustainable, climate-resilient organization requires systemic shifts across several core areas, such as accelerating clean energy and boosting climate resilience [31]. Another important aspect is the integration of sustainability into Environmental, Social, and Governance (ESG) frameworks. Increasingly, organizations align their Green Office practices with international sustainability reporting standards such as the Global Reporting Initiative (GRI). In Thailand, ESG reporting has

also become increasingly relevant for companies listed on the Stock Exchange of Thailand (SET), encouraging organizations to incorporate environmental management into their broader corporate governance and transparency practices [32].

In addition to structural and governance measures, behavioral strategies play a key role in promoting sustainable workplace practices. Many organizations apply principles from behavioral economics, particularly "nudge" strategies, to encourage environmentally responsible behaviors without imposing strict regulations [27]. Examples include setting default printer settings to double-sided printing, implementing thermostat controls that maintain air-conditioning temperatures at approximately 25°C, and designing office layouts that encourage the use of stairs instead of elevators (Rattanawit, 2019). These subtle interventions help reduce energy and resource consumption while maintaining employee comfort and productivity.

Furthermore, sustainable organizations often extend environmental responsibility beyond internal operations by promoting stakeholder engagement. This includes encouraging suppliers and business partners to adopt environmentally friendly practices and comply with green procurement standards. Such collaboration can create a broader "green network" effect, where sustainability principles are integrated throughout the entire value chain [7,8].

Finally, many organizations align their sustainability strategies with global frameworks such as the United Nations Sustainable Development Goals (SDGs) [32] (Chansomsak & Seggerman, 2022). By linking Green Office initiatives to these international sustainability objectives, organizations can strengthen their corporate reputation, enhance social responsibility, and attract environmentally conscious employees and stakeholders.

Overall, developing a sustainable organization toward a Green Office requires a comprehensive approach that integrates leadership commitment, employee engagement, ESG reporting, behavioral strategies, and stakeholder collaboration. Through these mechanisms, sustainability becomes an integral part of organizational culture and long-term operational strategy.

5. Recommendation for Future Operation

In the current complex global economy, sustainability has become a critical necessity that can be promoted with a shift towards renewable energy sources, the promotion of circular economies, and the pursuit of equitable and inclusive growth [33]. To support the long-term transition toward Low-Carbon Offices and a broader low-carbon economy in Thailand, organizations and policymakers must adopt more advanced strategies that integrate technology, policy support, and sustainable operational practices [14]. Future operations should move beyond basic resource efficiency toward innovative, data-driven, and systemic solutions that reduce greenhouse gas emissions while enhancing organizational resilience and environmental performance [25].

One important strategy is the adoption of advanced digital technologies in building management. Emerging concepts such as digital twins, virtual replicas of physical buildings, allow organizations to simulate energy consumption patterns and evaluate potential efficiency improvements before implementing them in real-world environments. Combined with Property Technology (PropTech) solutions, artificial intelligence (AI), and Internet of Things (IoT) sensors, building systems can automatically optimize lighting, air-conditioning, and other energy loads based on real-time occupancy data and weather conditions [26]. These technologies significantly improve operational efficiency and reduce unnecessary energy consumption.

Since retrofitting legacy infrastructure involves high capital expenditure, it presents a severe financial problem for SMEs in Thailand, so there should be an expansion of policy to address it, such as:

Green financing instruments, which are specialized financial tools used to channel capital toward environmentally sustainable projects, such as renewable energy, clean transport, and climate adaptation. These instruments help align financial assistance with low-carbon projects, fostering environmental benefits and sustainability goals [34]. Common instruments include:

Green Bonds: Debt securities issued by governments, banks, or corporations where the proceeds are strictly earmarked for environmental projects.

Green Loans: Lending facilities provided by financial institutions directly to borrowers to develop or overhaul business processes so they yield positive environmental benefits

Sustainability-Linked Loans & Bonds: Instruments where the terms (like interest rates) are tied to the borrower's achievement of predetermined sustainability performance targets or key performance indicators (KPIs) [35].

Another key recommendation is the expansion of carbon offsetting and carbon credit mechanisms. Organizations can participate in national carbon reduction programs such as the Thailand Voluntary Emission Reduction Program (T-VER), developed by the Thailand Greenhouse Gas Management Organization (TGO) (Thailand Greenhouse Gas Management Organization, 2024). Through this program, organizations can compensate for unavoidable emissions by supporting verified carbon reduction projects, thereby contributing to national climate mitigation goals [23].

In addition, offices should move toward decentralized and renewable energy systems. The development of micro-grids, where clusters of buildings share locally generated renewable energy, can reduce dependence on centralized electricity grids and improve energy security [21]. Integrating rooftop solar systems and shared energy storage solutions enables office districts to operate more efficiently and sustainably [22].

Operational strategies should also include flexible workplace models. The adoption of hybrid work arrangements, including remote or flexible working schedules, can reduce the overall demand for office space, commuting-related emissions, and energy consumption within buildings. This approach reflects the growing recognition that organizational carbon reduction can also be achieved through changes in work patterns and operational structures [28, 36]. Furthermore, organizations should adopt circular economy principles to reduce resource consumption and waste generation. Initiatives such as “Zero Waste to Landfill” aim to eliminate waste disposal through recycling, reuse, and material recovery systems. By

redesigning procurement practices and waste management processes, offices can significantly reduce emissions associated with waste treatment and landfill disposal [6].

Government policy also plays a critical role in accelerating this transition. Financial incentives, such as tax reductions, subsidies, or low-interest loans, can encourage building owners to retrofit aging buildings with energy-efficient technologies and renewable energy systems[28]. In addition, policymakers should work toward standard harmonization, aligning Thailand's Green Office and sustainability frameworks with international building standards such as LEED and TREES [32]. Such alignment would enhance international credibility and facilitate global collaboration in sustainable development [32].

Finally, future operations should also incorporate nature-based solutions (NbS) to address urban environmental challenges. Strategies such as rooftop gardens, green walls, and urban vegetation help reduce the urban heat island effect, improve air quality, and contribute to carbon sequestration within urban environments. These approaches complement technological solutions by integrating ecological processes into urban infrastructure.

Overall, achieving a low-carbon future for office operations in Thailand requires a comprehensive approach that combines technological innovation, policy support, organizational transformation, and environmental stewardship[14]. By adopting digital technologies, carbon markets, decentralized energy systems, circular economy practices, and nature-based solutions, Thai organizations can significantly accelerate their progress toward sustainable and climate-resilient office environments [25].

6. Conclusion

Thailand is currently at a critical turning point in its pursuit of sustainable development. The implementation of the Green Office standard has played an important role in raising environmental awareness and promoting resource conservation within organizations across the country. Through initiatives such as the G-Green certification, thousands of organizations have begun adopting environmentally responsible practices, helping to create a foundation for sustainable workplace

management. However, in the context of global climate change and increasing carbon constraints, these efforts must evolve beyond basic environmental compliance. The transition from Green Offices to LCOs represents the next phase of Thailand's sustainability journey. While the existing framework has successfully encouraged behavioral change and improved operational efficiency in many organizations, achieving deeper climate goals requires a shift toward quantitative carbon management and measurable emission reductions. This includes the adoption of carbon accounting systems, energy-efficient building technologies, renewable energy integration, and data-driven monitoring systems that enable organizations to track and reduce their greenhouse gas emissions more effectively. This transformation is closely aligned with Thailand's national development strategy, particularly the BCG Economy Model, which integrates Bio Economy, Circular Economy, and Green Economy principles to support sustainable economic growth. The transition to LCOs also contributes directly to Thailand's commitment to achieving carbon neutrality by 2050, requiring organizations to move from qualitative environmental management toward structured carbon reduction strategies. To reach these ambitious goals, a combination of structural, technological, and cultural changes is necessary. Offices must integrate passive architectural design strategies, energy-efficient building systems, and renewable energy technologies with advanced digital monitoring tools such as smart energy management systems. At the same time, fostering a strong organizational culture of sustainability remains essential to ensure long-term behavioral change among employees and stakeholders. Furthermore, collaboration between the public and private sectors will play a crucial role in accelerating this transition. Government policies, financial incentives, and regulatory frameworks should support innovation and encourage organizations to adopt low-carbon technologies and practices. At the same time, businesses must demonstrate agility and leadership by integrating sustainability into their core strategies and operations.

By combining innovative technologies, sustainable design principles, and a strong culture of environmental responsibility, Thailand has the potential to significantly

reduce the environmental impact of its office sector. Such efforts will not only lower operational costs and improve energy efficiency but also position Thailand as a regional leader in sustainable urban development and climate resilience within the ASEAN region. Ultimately, moving from compliance-driven Green Offices toward innovation-driven LCOs will be a key factor in achieving Thailand's long-term sustainability and net-zero ambitions.

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