

# High Performance Office Building a Low-Carbon Cities Initiative

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## ABSTRACT

The advanced technology involve in green/sustainable building systems is a platform to conveniently transform a cities road map for low carbon initiatives as office buildings might crave the road in save 2.9 GtCO<sub>2</sub>e, with a range of 2.5–3.3 GtCO<sub>2</sub>e, through the combined efforts of design and management initiatives, direct contribution to closing the emissions gap, lays the foundation for future action by encouraging reporting of emissions. Major initiatives of cities and regions are already delivering commitments that should result in emission reductions even higher. Through a literal case study of United Nations Environment Programme (UNEP) and the cities of Johor Bahru and Pasir Gudang both in Malaysia, low carbon imitative respectively, with relationship to office buildings. The outcome is a low carbon cities initiative for Abuja Nigeria. This initiative is to assist policies makers as guidance for establish a framework that will ensure carbon reduction in Abuja.

**Keywords:** High Performance, Office-Building, Low-Carbon, Cities, Abuja

## I. INTRODUCTION

There is no universally applicable definition of a low-carbon city. There are two reasons for this. First, cities differ in their initial carbon endowments. Cities engaged in energy-intensive heavy industry, or those in colder, northern provinces requiring a lot of heating, will start with higher absolute carbon intensities than cities focusing on service and non-energy-intensive industries or those in moderate climates with less need for heating or cooling. Second, the essence of most cities is to provide economic opportunities and quality of life for its citizens and not simply focus on carbon reductions. Actions that compromise on this fundamental fact risk undermining a city's long-term sustainability. Current pledges and commitments are not sufficient to keep the average rise in global temperature below 2 degree Celsius compared to preindustrial levels: the associated "gap" in required emissions reductions is not closing. [1], reported that the gap in 2020, defined as the difference between global emission levels consistent with the 2 °C target and the emission levels expected if country pledge cases are implemented, is between 8–10 GtCO<sub>2</sub>e. While, [2], indicates that the emission gap in 2020 has remained unchanged if the basis is the least cost scenario starting

with reductions in 2010. This research reveals that there are many economically attractive opportunities to increase energy efficiency and stimulate renewable energy investment, which would in turn improve the economic competitiveness, energy security and carbon intensity of Johor Bahru and Pasir Gudang as expressed by [3]. The scale of the opportunities demonstrates that accounting for climate change in urban planning can be attractive in commercial terms, above and beyond the immense benefits of reducing the future impacts of climate change. On the one hand a continuation of business as usual trends in Johor Bahru and Pasir Gudang will see energy use rise by 79.4%, total energy bills by 139.9% and carbon emissions by 83.8% by 2025. While on the other hand, Johor Bahru and Pasir Gudang could reduce their energy bills by RM 2.56 billion (US\$ 0.77 billion) and their carbon emissions by 24.2% through investments that would pay for themselves in 1.3 years.

Therefore, definitions of a low-carbon city should above all focus on how cities change their carbon emission trajectories independent of their initial carbon endowments, but in ways that do not compromise economic development and livability.

## II. BACKGROUND

Quantifying the emission reduction contribution these initiatives can (or are likely to) make is now critically important to understanding their overall impact on international climate mitigation efforts. By demonstrating what is already being achieved through these initiatives, such analysis could also play an important role in encouraging national governments to pledge more ambitious commitments through the international negotiations. In this report, we present a quantitative assessment of the total GHG emissions mitigation impact in 2020 of current important non-state climate action.

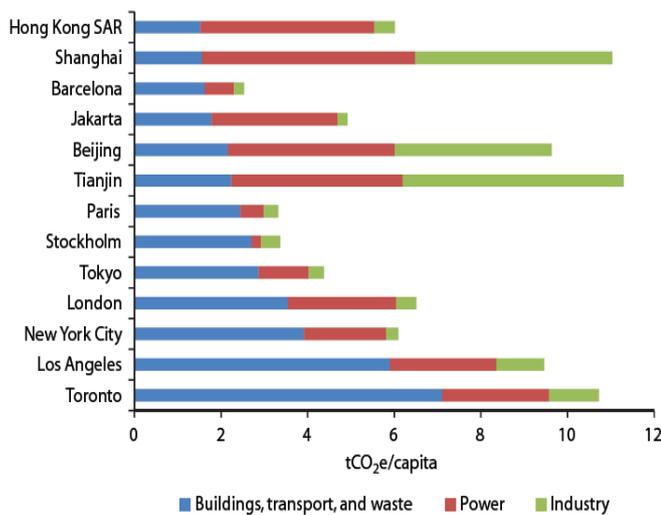


Figure 1: Per Capita Carbon Emissions of Selected Cities Sources: World Bank 2010

### A. Non-state initiatives

A non-state climate initiative is the name given to the set of initiatives that are driven by other actors than central governments: cities, regions, companies, NGOs, etc. The aims and activities of initiatives range from high level political or technical dialogue to concrete mitigation objectives and actions. There is a wide variety of initiatives across many sectors. These initiatives often deliver emission reductions on a short term – in many cases ahead of government action. The carbon footprint of a building or infrastructure is the total amount of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases emitted over the life cycle of that building, expressed as kilograms of CO<sub>2</sub> equivalents.

The carbon footprint for buildings includes embodied carbon and operational carbon. The embodied carbons of

a building are from the CO<sub>2</sub> produced during the manufacture of materials, their transport and assembly on site, maintenance and replacement, disassembly and decomposition [4]. All these boils down to the building life cycle **Construction Emissions** arising from construction processes **Operating Emissions** arising from the use of a building **Maintenance Emissions** arising from keeping a building in good repair **Demolition Emissions** arising from eventual disassembly or demolition. In summary 80% -90% of emissions from a building occurred during the operational stage, i.e. energy used for running the building.

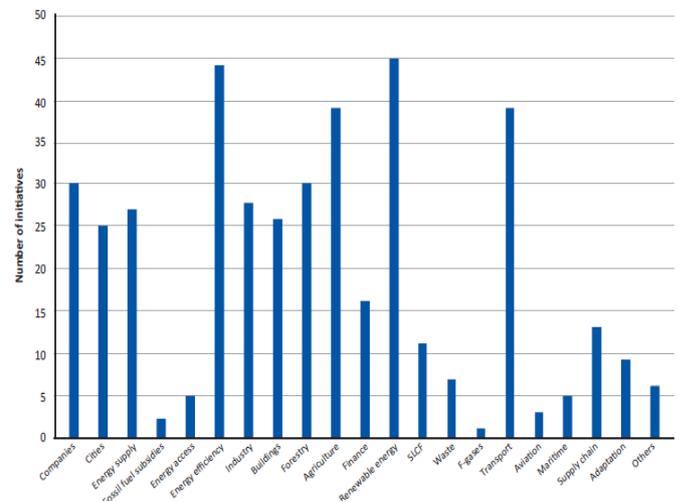


Figure 2: Number of initiatives by thematic focus. Many initiatives have more than one thematic focus source [5]

## III. PROBLEMS STATEMENT

Cities are uniquely positioned to take meaningful action against climate change through the built environment, as they have jurisdiction over certain building regulations, issue construction permits and are more politically agile to pass and implement progressive policies. The World Green Building Council's Sustainable Cities Initiative (SCI) facilitates interactions between national green building councils and cities around the world, with the aim to create partnerships and collaborations that leverage synergies to rapidly accelerate the uptake of green building. [6]. A project of SCI, in partnership with C40 Cities Climate Leadership Group and other local government networks, is underway, to develop Green Building City Market Briefs for key cities around the globe. The aim is to provide a snapshot of the green building industry and policies in each city. These short

briefs will develop a compendium for policy best practices and a roadmap for market transformation at the local level. [7].

The first step in offering guidance on a low-carbon transition is to have a common understanding of the current carbon footprint of the city in particular and to articulate a shared vision of what would constitute low-carbon growth. So high performance office buildings would serve as a model for low-carbon growth to share what would constitute low-carbon growth in the Nigeria scenario most especially Abuja city as it is the new capital city under development [8 & 9].

#### IV. METHOD

Through a literal case study of United Nations Environment Programme (UNEP), this was discussed in the findings from [1, 2 & 5] and the cities of Johor Bahru and Pasir Gudang both in Malaysia, low carbon imitative respectively, with relationship to office buildings. The research was conducted in two stages.

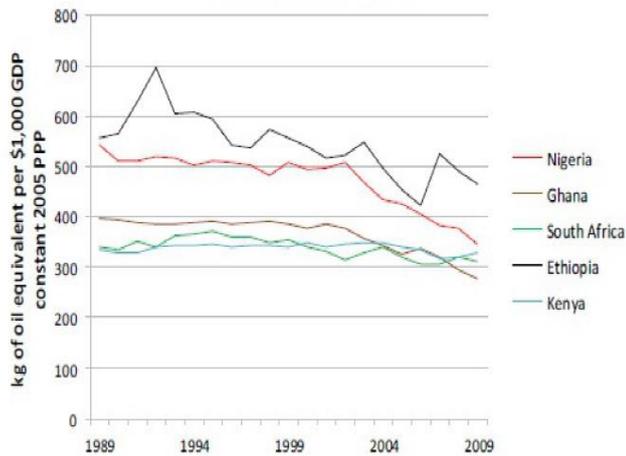
#### V. RESULT

Africa, with 20% of the Earth's landmass and a little over 15% of its population, currently contributes fewer than 4% of global greenhouse gas emissions (compared with 24%, 18%, 14% & 6% respectively for China, USA, European Union and India [10]. This Studies, however, shown that the continent could be the most severely affected by global warming in acknowledgement, the African Ministerial Conference on the Environment (AMCEN), established in December 1985 following a conference of African ministers of environment in Egypt, was mandated to advocate for environmental protection in the continent, and to ensure that basic human needs are met in a sustainable manner [5]. Table 1 shows that C40 cities as a network of the world's megacities committed to taking action that reduces global GHG emissions established that Cement Sustainability Initiative (CSI) and caring for climate would enhance a low-carbon cities initiative, this initiatives is also supported by the tropical forest alliance as shown in table 1. In Figure three (3) it shows that Nigeria is the second largest emitters in African after South Africa, but

this is in terms of energy use between 1989-2009 among selected countries and economics in kg of oil equivalent per USD 1,000 GDP with a constant 2005 PPP 2012 as expressed by [10]

TABLE 1  
QUANTIFIED INITIATIVES FOR EMISSION REDUCTION IMPACT ADOPTED [5]

	<b>Company Initiatives</b>
Business Environmental Leadership Council (BELC)	BELC is the largest U.S.-based group of corporations. Companies adopt voluntary emission reduction targets and innovative programs in energy, carbon sequestration and waste management.
Cement Sustainability Initiative (CSI)	CSI is an alliance of 25 leading companies in the global cement industry created under the WBCSD. Participants commit to developing a climate change mitigation strategy setting reduction targets for CO2 and reporting annually on their progress.
Caring for Climate	Caring for Climate is an initiative aimed at advancing the role of business in addressing climate change. Participants commit to set voluntary targets to improve energy efficiency and to reduce their carbon footprint
	City and Region Initiatives
C40	C40 cities are a network of the world's megacities committed to taking action that reduces global GHG emissions.
	Sectorial Initiative
Tropical Forest Alliance	The Tropical Forest Alliance – along with two related initiatives – supports private sector members to engage with governments, civil society leaders and other businesses worldwide, to achieve a reduction in the deforestation of tropical forest. Its partners take voluntary actions, individually and in combination, to reduce the tropical deforestation associated with the sourcing of commodities, such as palm oil, soy, beef, paper and pulp



**Figure 3 :** Energy use 1989-2009: selected countries and economics 2012 adopted from

## VI. DISCUSSION

The implementation of high performance buildings requires a deep understanding of all issues on carbon emissions from all processes from planning, design, construction and operations. Evidence from our research suggests that a high performance building is not necessarily one which costs more to build, but it should certainly be more cost effective to operate. From the literature review so far a frame work can be develop through Identify suitable designated area for the application of High performance buildings in Abuja, Authorities can Give full cooperation, technical support and commitment towards the implementation of the project; Provide access to available information related to carbon emissions required to be achieved by high performance buildings Appoint dedicated staffs as focal persons to facilitate the implementation of the project; and Incorporate and implement high performance building action plan in the planning and development of low carbon townships [11]. Energy, domestic and commercial buildings is one targeted area for low carbon measures from literature [6]: this shows that high performance office buildings could possibly assist in establishing a framework for a low-carbon cities initiative for Abuja city in Nigeria as it is a developing city with many phases still under development.

<b>Energy</b>	Retrofitting coal generation (6045 MW), wind generation (450 MW), solar PV (450 MW), solar PV (900 MW)
<b>Domestic</b>	Air conditioners – energy efficiency standards; banning incandescent light bulbs; biomass boilers; entertainment appliances – standby; fuel switching (coal to LPG, cow-dung cake to LPG); green building standards; kitchen appliances – energy efficiency standards; raising thermostat 1°C; retrofitting with mineral wool and fibreglass urethane; setting LED targets; solar lamps for outdoor lighting; solar photovoltaic panels with and without FIT; solar water heaters with and without FIT; turning off lights; washing machines – energy efficiency standards; water heaters – energy efficiency standards.
<b>Commercial buildings</b>	Air conditioners – energy efficiency standards; banning incandescent light bulbs; computers – energy management; copiers – energy management; elevators and escalators – energy efficiency standards; green building standards; monitors – energy management; printers – energy management; raising thermostat 1°C; retrofitting with mineral wool and fibreglass urethane; setting LED targets; solar photovoltaic panels with and without a feed-in tariff (FIT); turning off lights.

**Figure 4 :** List of Low Carbon Measures Consider [6]

## VII. CONCLUSION

We can ensure we're designing for net carbon emission reductions. Reductions in carbon emissions of materials have an immediate benefit, while the carbon reductions through operations accrue over a long period of time. To minimize severe climate change, the goal is to reduce the total quantity of greenhouse gasses getting into the atmosphere as quickly as possible, therefore reducing embodied carbon of building materials has an important role. Designing for reuse and deconstruction; using alternative materials; using products with higher recycled content and reclaimed product all of which are reacted to designing high performance buildings.

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