

DEVELOPMENT OF SMART ENERGY AREAS IN IBADAN, NIGERIA: PROSPECTS AND CHALLENGES.

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Overview

Highlights.

- Concept models of Global Smart Cities and Smart Energy Systems were reviewed.
- A definition of Smart Energy Town (SET) is given in the Nigeria context.
- Objectives and driving forces of current Smart Energy Towns projects were determined.
- Gaps and barriers to building Smart Energy Towns in Nigeria were investigated.
- Action recommendations for various stakeholders are put forward.

Abstract.

The confluence of challenges bedevilling the Nigerian economy in the areas of Power and Socioeconomic indicators, belies an increasing need for the development and strategic deployment of both Smart Cities and Smart Energy Systems along with an eye on employment creation. The confluence of these three concepts lead to the realisation of Smart Energy Cities (SECs) Model which has emerged in recent years as a viable alternative and possible solution to the rising urbanisation problem. However, there is still very limited practical deployments of this concept as it relates to a developing country like Nigeria. With serious challenges of urbanization and energy, Nigeria can serve as a testbed case study to further deepen the understanding of this concepts and practices, as not only a rapidly developing country but also one with ideal conditions and natural endowments to be harnessed. This paper aims to bring to the fore, new concepts of Smart Energy Cities transitioning to Smart Energy Towns (SET) using the Urban Renewal Model, according to recent theoretical progress and Nigeria's practical need for SECs and SETs. First, we reviewed the connotations of Smart City, Smart Energy Systems, and Smart Energy City, and then derive a definition of SET according to Nigeria's national conditions. Second, we investigate the likely economic and social impact of SET projects in Nigeria, and identify the gaps and barriers to development SET as compared with the definition. Finally, from the view of four stakeholders, comprising (i) Nigeria's Federal Government, (ii) International Organization, (iii) Oyo State Government, and (iv) Private Enterprises, we put forward some possible plan of action recommendations for the development of Nigeria's SET. The main findings are that compared with SECs, SETs emphasize the importance of overall planning of Energy and Urbanization, as well as promoting business model innovations to support integrated economic development. The main barriers to the development of SET in Nigeria lies in the lack of coordinated planning and support of a sustained policy focus by governments, as well as the lack of sufficient funds and capacity of local enterprises to birth these mega projects. Once these teething problems are sorted, it will strengthen investment drive and further encourage practical business models suitable for each state and sub-region to promote the development of SECs and SETs in Nigeria.

Keywords: Urban Renewal, Smart City, Smart Energy Town, Conceptual Policy Analysis and Barrier Analysis.

Methods

Conceptual Policy Analysis and Barrier Analysis. Two methods analysis are adopted-Conceptual Policy Analysis (CPA) and Barrier Analysis (BA). The conceptual policy analysis deals with the review of the connotations of Smart City, Smart Energy Systems, and Smart Energy City, and then derive a definition of SET according to Nigeria's national conditions. On the other hand, BA deals with the identification of barriers to smart energy development, which is important in designing actionable plans towards SETs. Following from Razmjoo et al, (2021), we identified some barriers based on a systemic literature review and the understanding of the study environment. These barriers are categorised into five dimensions-governance, economic, social, technology, and environment. Each of these barriers are investigated along micro and macro indicators and their impact could be moderated or eliminated to foster the development of SET in Ibadan. Through internal validation process like frequency of occurrence in the literature, we assigned weight to each of the barriers and evaluate the likely economic and social benefits of SET projects when barriers are removed.

Results

From the identified gaps we proposed a comprehensive Policy regime centred around Urban Renewal which not only addresses the present identified shortcomings associated with shanties, slums and inefficient old Cities and Towns but guides transition to SECs/SETs by providing much needed incentives and a conducive environment for their emergence. Starting with the above proposed SEC Model, the buildings and by extension the Housing Estate(s) will have absolutely no need for neither generators nor electricity from the national grid lines as they are designed to generate more than enough of their electricity needs and even be equipped to sell excess electricity thus generated to the national grid. This is more so because even with our best national estimate of 12GW – 25GW of power generation and distribution in the next twenty years, and assuming all goes according to plan, the country would still not have generated and distributed enough power to satisfy the ever-growing demand for electricity, put at 45GW - 75GW. The energy thus saved from the national grid as well as the extra being generated and sent back to the grid can then be diverted to power other critical health and related institutions as well as Research and Manufacturing concerns long starved of steady power.

We eliminate the associated costs of generator acquisition and maintenance as well as drastically reduce our carbon footprints as well as eliminate ozone depleting gases like CFC and GHG. Each energy efficient modern three-bedroom can be delivered fully built and as a fully serviced-flat, that is, completely furnished at the total cost of N8.5m (\$18,000) to N9.5m (\$20,000). This price is set to drop rather than increase once the Project takes-off due to the various government incentives to be harnessed. This SEC/SET will leverage on the modern rail transport and improved road network in Ibadan. We adopt affordable energy efficient Housing and Transport as foundational core of SEC/SET upon which other key components like adequate water and electricity supply, Sanitation, including solid waste management, Robust IT connectivity and digitalization can be reliably built on. We propose rapid deployment of Energy Efficient Housing Schemes across the State, which will serve as a form of urban renewal measure as well as a means of ensuring affordable and energy efficient Housing.

Conclusions and Recommendations

From our assessment of smart solutions, it is observed that it can be integrated into the five verticals of Housing, Water, Waste, Energy and Transport which showed common themes. Benefits of smart city solutions: Smart solutions across the verticals optimise resources through better information on where resources are being consumed. This information enables better monitoring and management on the part of the utility and also enables consumers to make more informed use of resources, and lower their consumption. This in turn reduces utility operating costs and extends the operating life of existing infrastructure. Smart technologies also provide opportunities for new services to citizens. Our proposed SECs/SETs solutions are an innovative combination of physical and digital projects which are associated with low carbon economies due to their low carbon footprints. Smart city solutions apply digital technologies to address social, environmental and economic goals. Smart city solutions can combine physical and digital infrastructure or can be based on digital infrastructure alone. Smart city solutions are by nature propelled by disruptive technologies which require system wide deployment to yield the most benefits. Existing processes and systems will need to change radically. Furthermore, successful deployment will require continuous, deep and extensive collaboration between multiple actors in value chain. This will be facilitated by appropriate Policies put in place to encourage needed change.

RECOMMENDATIONS FOR GOVERNMENTS AT ALL LEVELS.

We recommend that Governments consider the following areas:

- The five verticals studied in this report are fundamentally material to our society and economy, and Governments have an enabling role. Government should collaborate with Cities, Businesses, and the Academia to help form a vision encapsulated in needed Urban Renewal Policy, of how Cities and the five verticals will benefit from smart city solutions. Relevant Departments and Regulators in each of the five verticals should commit to this vision and a roadmap for deployment. This would give both Service and Real Sectors of Industry, much needed clarity on what is expected and help to address the demands of the envisioned and emerging SEC/SET market.
- Cities need help to develop capability in leading and facilitating collaboration with industry, academia and citizens because deploying solutions requires collaboration between different actors in the value chain. There is a role for government and its agencies in convening multiple stakeholders.
- Large scale trials of whole systems should be implemented, with a focus on business models and deployment, rather than just technology.
- Cities and utilities need to find ways to make it easier to deploy innovative products and services. Cities should look for ways to attract capital and create organisational structures which have the authority and capacity to deliver innovative programmes.