

# GRADUATION PLAN

**CAMILLE C.S. GBAGUIDI**

Graduation studio Architectural Engineering  
2021-2022

THE ROLE OF EMERGENT AND DEVELOPING COUNTRIES  
IN THE 21st CENTURY

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**A VISION FOR SUSTAINABLE HOUSING  
DEVELOPMENT IN BENIN**

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Personal Information	
Name	Camille Charlotte Sessito Gbaguidi
Student number	5393620

Studio	
Name/Theme	Architectural Engineering, 1 million homes, Harvest
Main mentor	Ir. Annebregje Snijders
Second mentor	Ir. Paddy Tomesen
Third mentor	Ir. Christien Janssen
Argumentation of choice of the studio	The aE Studio allows me to combine the design-heavy background from my architecture studies at the Savannah College of Art and Design (Savannah, Georgia) and the more technical oriented program of TU Delft. Additionally, it allows focusing on real-world problems in a context of my choosing and a context that I am very passionate about.

**A VISION FOR SUSTAINABLE HOUSING DEVELOPMENT IN BENIN**

<b>Graduation project</b>	
Title of the graduation project	<b>A vision for sustainable housing development in Benin</b>
<b>Goal</b>	
Location	West Africa, Benin, Abomey-Calavi
<b>Problem statement</b>	
<p><b>Priorities for housing architecture and Urban development in Africa</b></p> <p>Developing and emerging countries possess a unique role in housing in the 21st century. They should be the focus of discussion because they will experience the highest growth rates in the coming decades and are often at the beginning or in the process of massive urbanisation. Almost all developing and emerging countries are geographically located in tropical climates (Central America, Caribbean, Southeast Asia, Sub-Saharan Africa, the Indian sub-continent). In these countries alone, the population will double by 2030 (Institut de la Francophonie pour le Développement Durable, 2015). They should be high on the list of priorities for achieving global sustainability goals. For Africa, UN-Habitat predicts that population and urbanisation rates will increase by more than 50% by 2040. This also means that the number of urban dwellings will triple from 400 million to 1.26 billion by 2050 (UN Habitat, 2014). In sub-Saharan Africa, 80% of those buildings are not yet built, compared to 30% in Europe. Therefore, greater attention should be paid to how construction is done there.</p> <p><b>Relevance</b></p> <p>In Benin, cities are becoming more and more the focal point of the population. From 1955 to 2020, the population in urban areas has risen from 7% to 48% (Worldometer,2021). The increasing urbanisation directly follows the rising demand for land and real estate considerations that occurs due to the economic importance of Cotonou. Land (often privately owned) is parcelled out and then sold to developers. Often, complete urban development only takes place after the buildings have been erected. Land use plans and qualified development plans with overriding objectives do not exist. Against this backdrop and the increasing demand, the government of Benin has decided to build 20,000 new homes across the country in the next five years (Bénin Révélé, 2016). These new homes are planned to be located in the periphery of existing cities to allow their extension and favour the creation of new neighbourhoods and new cities. For my master thesis, I using this action plan as an occasion. In my view, it represents an opportunity to positively and sustainably influence housing construction in Benin and strengthen the countries architectural identity.</p> <p>With the continuously rising temperatures due to climate change and already elevated outdoor temperatures, the current housing situation in Sub-Saharan regions is battling elevated indoor temperatures. They strongly affect the thermal comfort and, generally speaking, the well-being of people. With the rapid growth of West African cities and the shortage of currently available housing stock, builders and developers focus on quantity rather than quality (Choplin, 2020). Many housing projects that are being built do not consider the specific climate conditions in Benin. Too often follow the occidental low-income housing model (Plattenbau, HLM) and battle temperature variations with mechanical cooling systems and standard universal amenities. The needed urban infrastructure to supply these new dwellings with the necessary services is expansive and takes time to build. The existing networks are overloaded, and water and electricity supply interruptions are commonplace, even in the cities. Proper waste disposal and garbage collection are mainly non-existent, and landfills are the final waste destination.</p> <p><b>Goal</b></p> <p>Therefore, a sustainable building approach in hot and humid climates is not only a way to have a positive impact on the environment, but instead, it is a fundamental mean that allows to lower energy use, lower long-term costs of use while improving the thermal comfort and quality of air (de Schiller and Evans, 1998).</p>	

To be sustainable in Benin means to design the built environment with nature. Therefore the implementation of passive design strategies at various scales will also increase the spaces attractiveness, comfort levels and allow for more urban activities. Additionally, it forms the first milestone and fundamental base necessary to envision a future of neighbourhoods that live in self-sufficiency, in autonomy.

### Research question

**Which passive design strategies are suitable for regulating the indoor climate in housing projects in Benin?**

#### Sub-questions

1. What are the climate characteristics in the coastal region of Benin?
2. What is the current housing situation?
3. Which passive design strategies can be used to cool neighborhoods and houses in Benin?

### Design assignment

The design assignment for the graduation project is to develop an autonomous residential building, neighbourhood. An exemplary project that minimizes the need for mechanical building infrastructure and urban utilities through passive design strategies while using renewable energies and water storing infrastructure to ensure a continuous supply of electricity and water. A modern beninese sustainable building typology that will improve the quality of life and solidify the beninese architectural identity on a long term bases. The decisions made in Benin today will impact the country's development in the coming decades.

### Process

### Method description

**Generally speaking, the methodology is focused on the relationship between climate, person and building.** The climate variables are defined through the help of meteorological data sets. Then the current situation in housing in our chosen context is documented through means of field research, photo documentation and interviews. The last section of the research is structured as a guide that determines appropriate design strategies at different scales for the specific Beninese climate, following the architectural design strategy guide *Sun, Wind & Light* by DeKay and Brown, 2014.

### Literature and general practical preference

Main literature references:

- *Sun, Wind & Light - architectural design strategies* by Mark DeKay & G.Z. Brown
- *Tropenbau - Building in the Tropics* by Georg Lippsmeier

Main practical precedents:

- Kere Architecture, Atelier Masoni, Studio Mumbai, Tropical Space etc.

### Reflection

My graduation project embraces two of the main guiding topics of the studio (1 million homes and Harvest). I am tackling the 1 million homes challenge (a number coming from the housing goals in the Netherlands) and applying it to the current goals in Benin. In addition, I am looking for sustainable building solutions and therefore making use of local natural resources to improve indoor climate while favouring the local development of the building industry, and therefore the economy is essential. Within the architectural track of the TU Delft master program, I believe this project is quite feasible and allows me to bring my part in the architectural discourse to the TU Delft Global Initiative by working on a concrete solution for a global problem within a specific context.

# GRADUATION PLAN DIAGRAM

## The role of emerging and developing countries in the 21st century A VISION FOR SUSTAINABLE HOUSING DEVELOPMENT IN BENIN

