

# FINANCIAL SUSTAINABILITY STRATEGY FOR KALOBYEI ADVISORY LOCAL PHYSICAL DEVELOPMENT PLAN

KALOBYEI INTEGRATED SOCIO ECONOMIC DEVELOPMENT  
PROGRAMME, TURKANA COUNTY, KENYA





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.....  
In collaboration with  
Turkana County Government



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the People of Japan

## EXECUTIVE SUMMARY

The financial sustainability strategy here presented aims at supporting the implementation of the “Advisory Local Physical Development Plan” developed by UN-Habitat, which provides a long-term and integrative Spatial Plan to guide appropriate development for the Kalobeyei refugee settlement in Turkana, Kenya.

Turkana has been handling a large refugee influx for the last thirty years - UNHCR has supported the government in providing shelter and services to approximately 180,000 refugees. The main refugee camp, Kakuma, has been expanding over the last years, which has led to the proposal of Kalobeyei in 2016 to act as a new site to host a total of 60,000 people.

In the last years, there has been an increased consensus over the fact that refugee response needs to embrace a more long-term approach that avoids unsustainable practices with recurrent investments being done in temporary infrastructure that is long standing. The spatial plan for Kalobeyei New Settlement thereby departs from traditional refugee camps and emergency planning approaches, towards an incremental development methodology that provides improved strategies to achieve a more durable, sustainable, mixed-used and socially

integrated human settlement. In this regard, the financial strategy aims at supporting the implementation of the durable infrastructure in the spatial plan from a long-term perspective until 2050.

It provides an approximate number of investments necessary to build durable infrastructure, and presents the costs for its maintenance in the long-run. Additionally, it offers a cost benefit analysis between different qualities of infrastructure and the different costs associated for investment and maintenance between the different quality standard. In this regard, the financial strategy shows that higher standards of infrastructure can have a very positive implementing impact in reducing maintenance costs in the long- run.

Additionally, the plan also offers an analysis of existing economic activities in the region and how the increased infrastructure provision could catalyse productivity and developing the main economic sectors to climb on the value chain process. This can have a resultant positive impact in revenue generation in Turkana which is essential for ultimately, supporting revenue generation by the Local Government thereby securing the maintenance and additional investments in infrastructure.



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## 01

**INTRODUCTION: A REFUGEE SETTLEMENT  
AS AN OPPORTUNITY FOR TURKANA**

For the last thirty years, shelter and services were provided to approximately 180,000 refugees in Kakuma camp by Turkana County Government, with the support of UNHCR. The surge in population was a result of three expansion camps being built in addition to the initial camp. All four camps suffer from increasing stresses on infrastructure services and local resources and are subjected to growing tensions between host and refugee communities. In 2016, this led to the proposal of a new settlement, the Kalobeyei New Settlement, roughly 13 km away from Kakuma, which aims to host 60,000 inhabitants, integrating both hosts and refugees.

UN-Habitat, in collaboration with UNHCR and Turkana County Government, has developed an “Advisory Local Physical Development Plan” for implementation of the new Kalobeyei New Settlement, which provides a long-term and integrative Spatial Plan to guide appropriate development on the site. This Advisory Development Plan shifts away from traditional refugee camps and emergency planning approaches, towards an incremental development methodology that provides improved strategies to achieve a more durable, sustainable, mixed-used and socially integrated human settlement.

The Spatial Plan highlights the consensus that conventional refugee camps are largely environmentally unsustainable practices, both economically and socially. Although the current humanitarian aid response focuses on temporary solutions, refugee camps often result into sites needing eventual long-term development support. Per ECHO (European Civil Protection and Humanitarian Aid Operations), the average international age of an active refugee camp is an average of 25 years and growing.

Planning is most effective when accompanied by realistic financial implementation strategies. This report provides a financial and economic perspective to compliment UN-Habitat’s “Advisory Local Physical Development Plan” for the new Kalobeyei New Settlement, which will contribute to the long-term sustainable investments for the settlement.

Finding means for financial sustainability of investments in the context of the new Kalobeyei New Settlement is currently challenging. The existing economics of the county appear to be hindered by the lack of appropriate infrastructure,

preventing municipalities from being able to absorb new refugee populations. Concurrently, the constant influx of refugee populations further lessens the county’s capacity to recover local infrastructure to normal working levels.

The increased refugee population can however be seized as an economic opportunity rather than an obstacle. This can be achieved by shifting the financial focus from temporary aid to investments that are tied to more strategic regional development. This would in turn positively affect the livelihoods of both the refugee and host communities in the long-term and additionally decrease social tensions.

This report aims to contribute to the financial sustainability of the Kalobeyei New Settlement in two ways –

- a) Providing a detailed Financial Sustainability Strategy, which aims to support a realistic implementation strategy for the Spatial Plan;
- b) Providing economic development proposals for improvement of future revenue generation for both refugee and the host communities.

Chapters 2 to 5 consist of the Financial Sustainability Strategy, listing the total number of the necessary investments for infrastructure and maintenance costs for the new plan to host 60,000 refugees by 2020. The strategy also provides detailed estimates for different infrastructure standards, aiming to support decision making regarding the cost efficiency of infrastructural investments as well as considering the demands of the expected population growth by 2050.

Chapter 6 details the economic development proposals for the Kalobeyei new settlement. To increase the financial sustainability of the Spatial Plan, economic development needs to be robust to increase revenues among both refugee and host communities. Aligned with the overall objectives of the Spatial Plan to implement durable solutions for Kalobeyei, increased revenues and strengthened municipal finance can decrease dependency on international humanitarian assistance in the long run and strengthen development of the region in the long-term.

# 02

## CONTEXT: KALOBYEI AS AN OPPORTUNITY FOR INVESTMENTS IN TURKANA

### 2.1 Turkana: Challenges and opportunities for the region

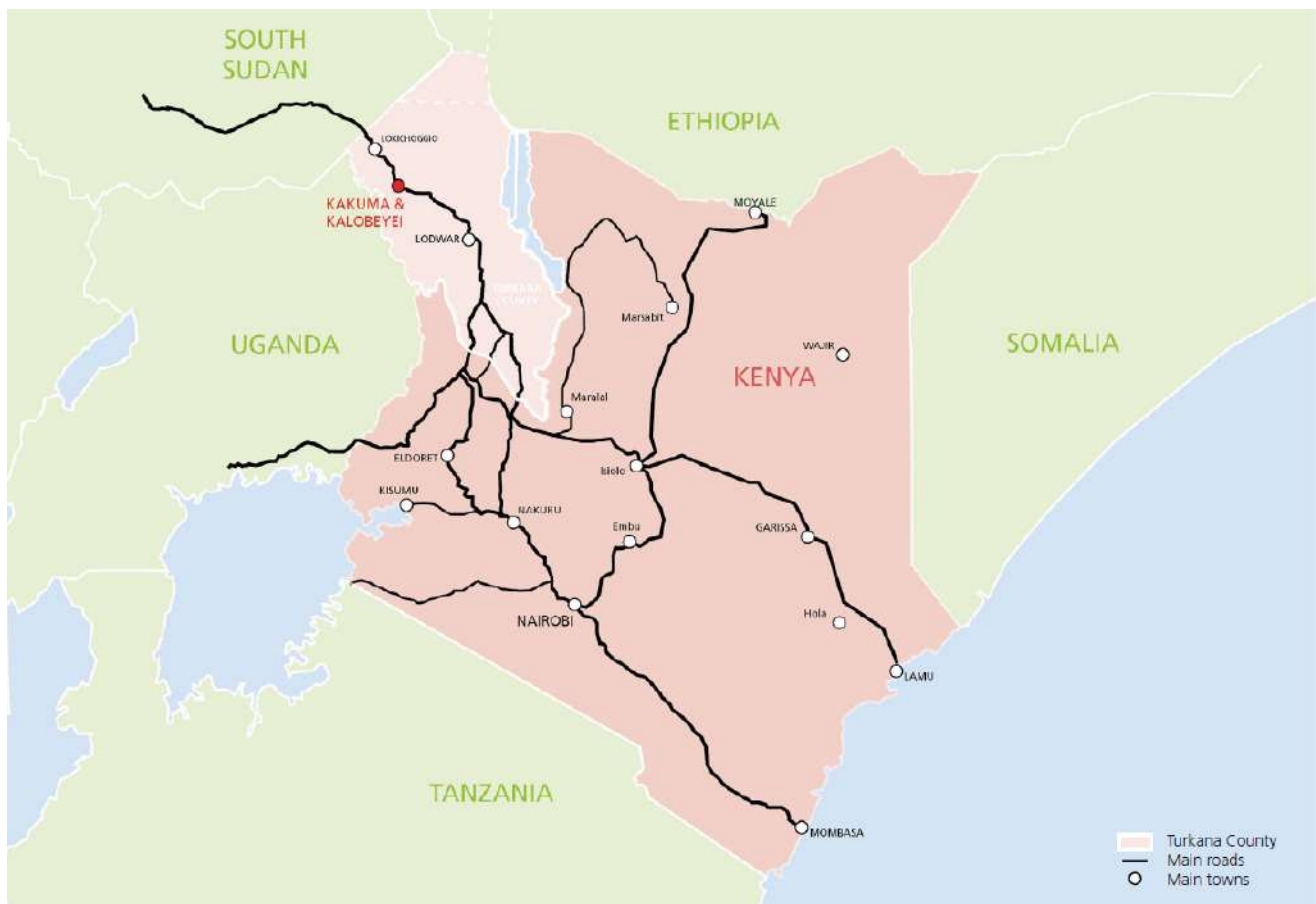
The site of the Kalobeyei New Settlement, identified for the implementation of the “Kalobeyei Settlement Advisory Local Physical Development Plan”, is situated within Turkana County, in North-Western Kenya, bordering Uganda to the North-West, South Sudan to the North and Ethiopia to the North-East.

Turkana is a vast county with a low population density. This is partly due to the economic structure of the region being based largely on livestock and pastoralism. The county is hosts to a population of 1,427,797 and is the second largest county in the country, encompassing an area of 77,000 km<sup>2</sup> (UN-Habitat, 2017). The average population density is 12 persons per km<sup>2</sup>, with many parts of the county having a

density lower than 1 person per km<sup>2</sup> (World Bank, 2017). The main urban centers are Lodwar, the capital with a population of 48,316 (2009), followed by Kakuma and Lokichogio.

Turkana county is one of the most impoverished and marginalized counties in Kenya, with a distinct lack of proper infrastructure and basic services. The transportation and connectivity both by air and road are poor, pushing up transportation costs considerably. Only one of the main national road arteries passing through the county, the Kitale-Lodwar-Lokichogio-Juba Highway (A1) is in good condition. The overall road network in Turkana is considerably underdeveloped when compared to the rest of the country, with a road density 3.4 times lower than the national average (World Bank, 2016). 91% of the county road network is unpaved and the only airport, located in Lokichogio, is currently under reconstruction. Furthermore, of the 22 existing airstrips, only one (at Lodwar) is tarmacked.

Figure 1: Localization of Turkana County



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

One of the main challenges in the region is access to water due to the scarce rainfall and limited sources. Although there are some companies providing water supplies in main urban centers, 39% of Turkana residents depend on unimproved sources of water - ponds, dams, lakes, rivers, water vendors, etc. This percentage is higher in rural areas, where more than half of the population (61%) rely on unimproved water sources (Turkana County Government, 2016). Scarce rainfall causes high rates of evaporation and general shortage of natural water sources. Apart from Lake Turkana and the two main rivers of Turkwel and Kerio, other natural water sources are only seasonal.

Access to energy is another main challenge for the region. Electricity access in Turkana is below 20%, much lower than the national average of approximately 60% (World Bank, 2016). The county currently only provides an electricity network that serves main towns and urban centers. Only a low coverage is made available within interior towns. Despite Turkana county's many challenges, there is increasing attention given to the region, largely driven by recent developments. With recent discovery of oil reserves in the region, there is great potential to generate revenue for the county, encouraging developments and increased investments. Per the new Petroleum Bill, the Turkana County would preserve 20% of the oil revenue (Daily Nation, 2018).

The implementation of project LAPSSSET (Lamu Port and Lamu-Southern Sudan-Ethiopia Transport Corridor), a regional infrastructure mega-project, will contribute greatly to the improved overall transport connectivity within Turkana. LAPSSSET would become Kenya's second major transport corridor, connecting to both South Sudanese and Ethiopian borders. What makes the project particularly relevant to Turkana is the plan for upgrading Kitale-Lodwar-Lokichoggio-Juba Highway (A1), implementation of a new railway line and other energy projects that would complement the commercialization of the new oil pipeline constructions.

In addition to the recent development changes, Turkana has also been the focus of attention for its development efforts to accommodate the rise of refugee populations in the region. Since 1992, Turkana has been hosting up to 180,000 refugees, which have been sheltered predominantly in Kakuma camp (World Bank, 2016). Since the camp's inception roughly thirty years ago, it has grown into a main urban and economic center of the region. Since the refugee influx is expected to increase, particularly with the establishment of the Kalobeyi new settlement, investments towards humanitarian assistance are expected to rise as well.

## 2.2 Kakuma: lessons learnt and a new approach

Since its inception in 1992, Kakuma camp has had a significant impact in the region. The population of the camp has also been growing exponentially since then, with a current estimated density of 12,000-13,000 persons per square kilometer, 1,000 more than the overall density of Turkana County.

The camp has also since become a main commercial center in the region, providing access to goods and services to both refugee and host communities in the region as well as access to new economic and employment opportunities. The economic potential of Kakuma has also progressed significantly, with an increase by 3.4% of the GRP Gross Regional Product, underlining the evidence and health of the informal and robust trade between both communities. Nevertheless, there is still more potential for further economic development to be seized. For instance, capitalizing on the rise of densities, investments and the development of infrastructure effectively could create further economic development opportunities for camp and the region.

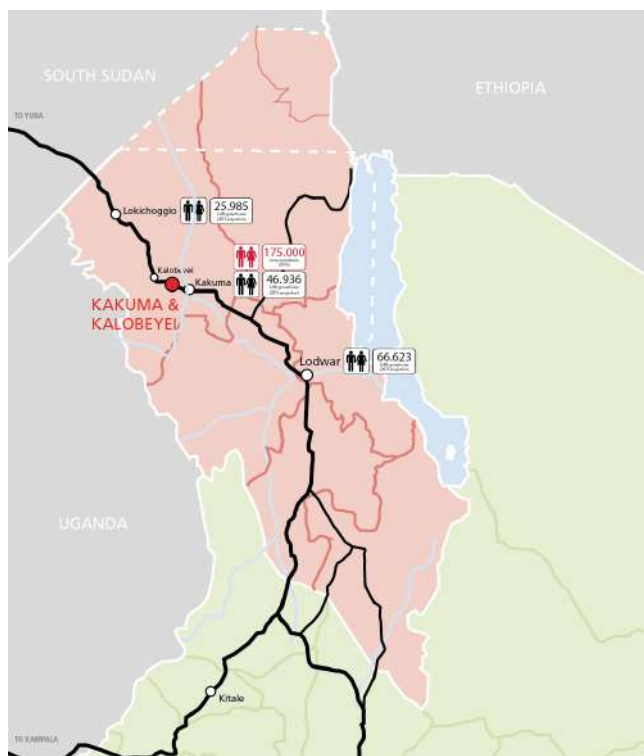
The presence of Kakuma Camp has also significantly improved accessibility to services in the area, mainly with the increased local and international assistance and its positioning as urban center. For instance, 36% of Kakuma refugee community has access to solar energy, while only 14% from the host community have accessibility. And while only 15% of the refugee community does not have access any type of sanitation facilities, the lack of access rises to 60% among the host community (UN-Habitat). Kakuma camp is also equipped with sufficient education and medical facilities, greatly surpassing the level of provision in the remainder of the county. As per the latest data for Turkana County, the ratio of doctors to inhabitants for host communities is only 1:70,000 and that of teachers to students (secondary school) is 1:180 (World Bank, 2016).

Seizing the economic development potential of the region can be imperative in reducing conflicts and tensions over inequality between refugee and host communities. During focus group discussions, host community members have described their tensions with the increasing refugee community in regards to sharing access to resources, particularly access to community land for the practice of pastoralism and cattle grazing.

The rapid refugee influx into Kakuma over the years has resulted in mainly unplanned and informal development. The refugee population also tends to fluctuate significantly, depending on level of security and political context within their countries of origin either discouraging or encouraging their repatriation. To plan effectively, this fluctuation should be taken into consideration by providing growth flexibility. Emphasis should also be placed on integration between refugee and host communities to achieve greater socio-economic prosperity.

## 2.3 Kalobeyei: A new site for a refugee settlement

**Figure 2:** Localization of the site for Kalobeyei

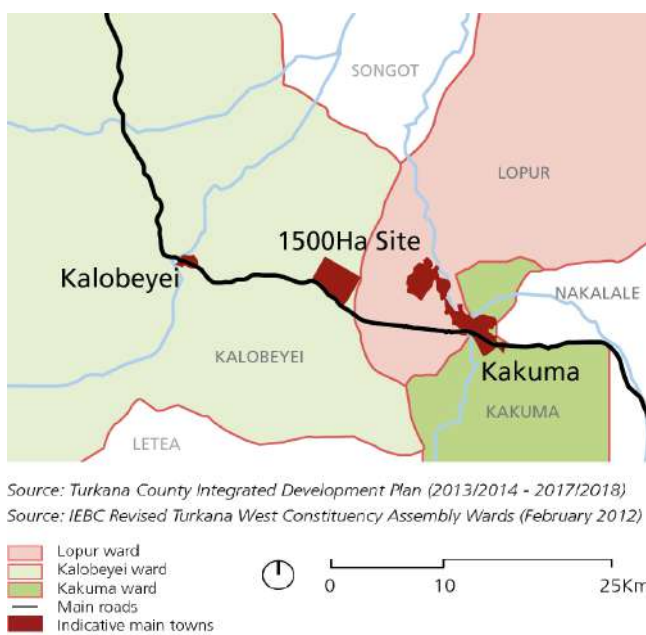


Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

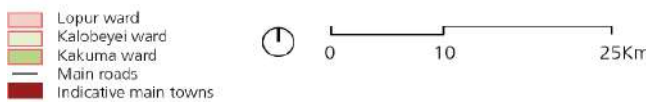
The site for the Kalobeyei New Settlement, identified for the implementation of the “Kalobeyei Settlement Advisory Local Physical Development Plan”, is a total of 1,500 hectares, and is expected to host 60,000 refugees and locals by 2020.

The site is situated roughly 13 km away from Kakuma Camp and is near Kalobeyei town (12km away), which serves as another main urban center within the region. Originally designated as community land, commonplace in Turkana county due to pastoralist culture, a terms of engagement agreement by the Turkana County Government has allowed for the land to be managed also by the Department of Refugee Affairs and UNHCR.

**Figure 3:** Main centers next to Kalobeyei site



Source: Turkana County Integrated Development Plan (2013/2014 - 2017/2018)  
Source: IEBC Revised Turkana West Constituency Assembly Wards (February 2012)



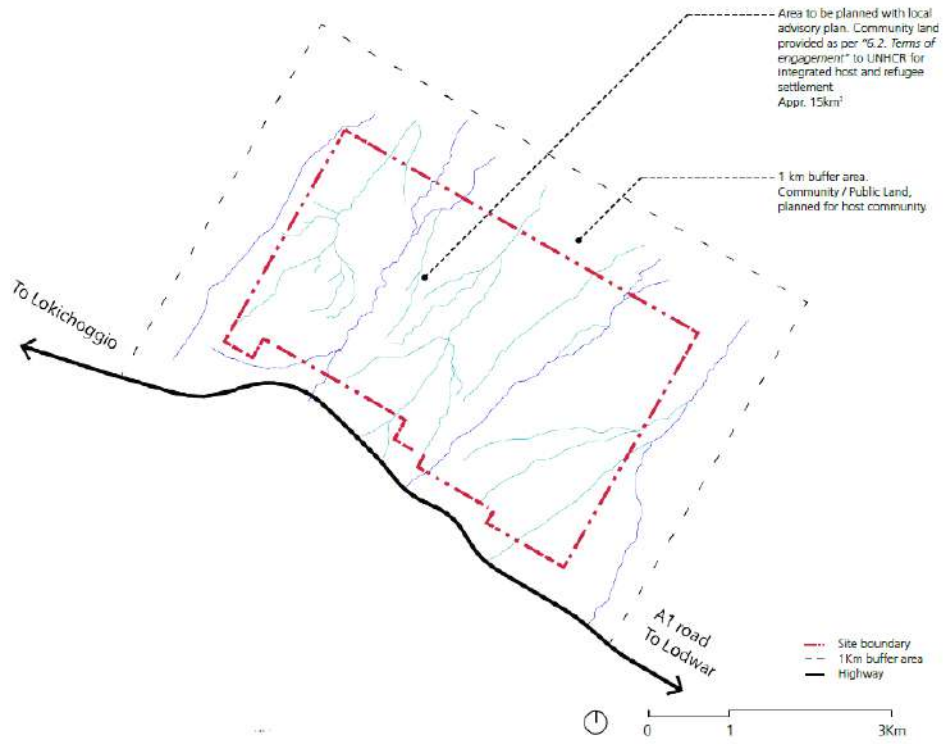
Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

The site, as shown in Figure 4, borders the A1 Road (Kitale-Lodwar-Lokichoggio-Juba Highway) to the South. The Spatial Plan takes into consideration the development of the highway as part of the LAPSSSET Corridor strategy, which will be an important asset to the development of the settlement.

Several river basins exist within the site (Figure 5), which serve as assets given the significant challenge of water scarcity within the region. There are four main river beds running through and adjacent to the site and the watersheds are predominantly dry throughout most of the year however short and heavy rainfall occurs in April and October, often causing flash floods. Given these circumstances, it is essential to implement storm water harvesting strategies to tackle both drought and flash floods.

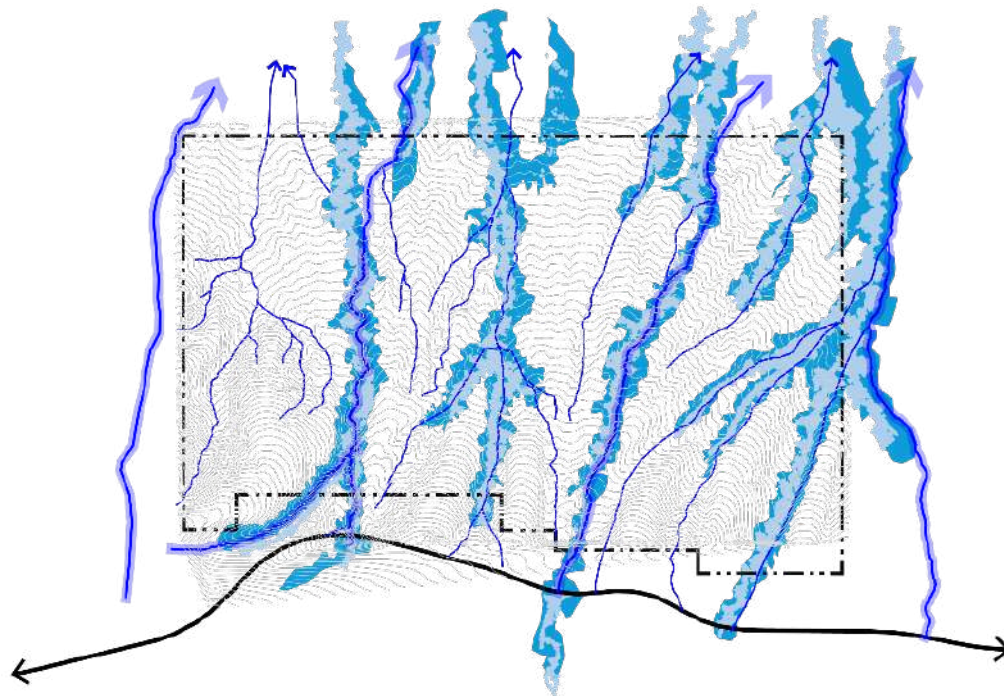


**Figure 4:** Location of the A1 highway in relation to Kalobeyi site



Source: UN-Habitat, Kalobeyi Settlement, Local Advisory Physical Development Plan

**Figure 5:** River basins crossing the site of Kalobeyi



Source: UN-Habitat, Kalobeyi Settlement, Local Advisory Physical Development Plan



# 03

## THE PLAN: “KALOBEYEI SETTLEMENT ADVISORY LOCAL PHYSICAL PLAN”

### 3.1 General guiding principles of the Spatial Plan

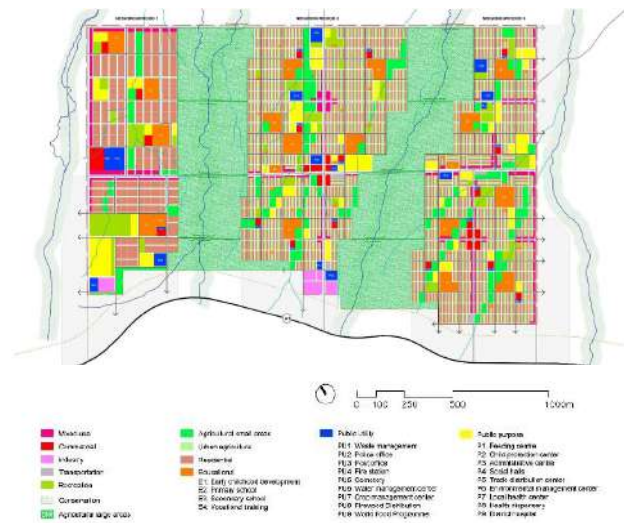
With the goal of creating a long-term and sustainable human settlement for 60,000 host and refugee residents, the Spatial Plan delivers a mixed-use strategy, combining infrastructures for residential, commercial, educational and public use and detailing the projects required therein. With the Spatial Plan effectively promoting value creation and the agglomeration of economies, this will result in a solid economic development for the long-term.

The spatial plan is developed in accordance to UN-Habitat’s 5 neighborhood planning principles:

- 1 Adequate space for streets and an efficient street network**  
The street network should occupy at least 30 per cent of the land and at least 18 km of street length per km<sup>2</sup>.
- 2 High density.**  
At least 15,000 people per km<sup>2</sup>, that is 150 people/ha or 61 people/acre.
- 3 Mixed land-use.**  
At least 40 percent of floor space should be allocated for economic use in any neighbourhood.
- 4 Social mix.**  
The availability of houses in different price ranges and tenures in any given neighbourhood to accommodate different incomes; 20 to 50 per cent of the residential floor area should be for low cost housing; and each tenure type should be not more than 50 per cent of the total.
- 5 Limited land-use specialization.**  
This is to limit single function blocks or neighbourhoods; single function blocks should cover less than 10 percent of any neighbourhood.

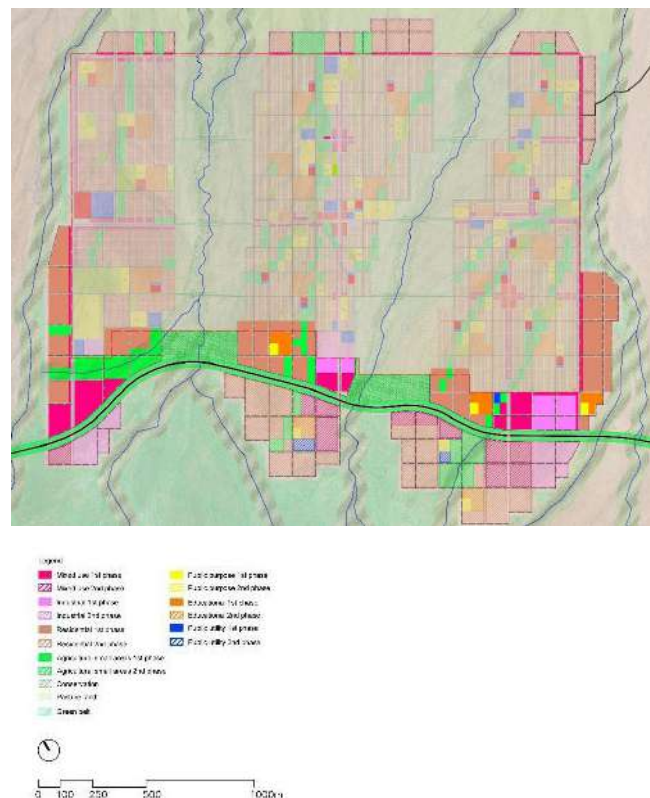
The mixed-use strategy consists of a land-use breakdown (summarized in Figure 6), which allocates 18% for residential, 19% for transportation, 41% for agriculture, 5% of public facilities, 3% of recreation and 2% for commercial. The breakdown is then slightly adjusted in consideration of the variation of needs within each neighbourhood such as land-use dedicated to large scale agriculture or inter-neighbourhood transportation possibilities.

Figure 6: Land use plan for Kalobeyei



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

Figure 7: Future extension to plan for population growth



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

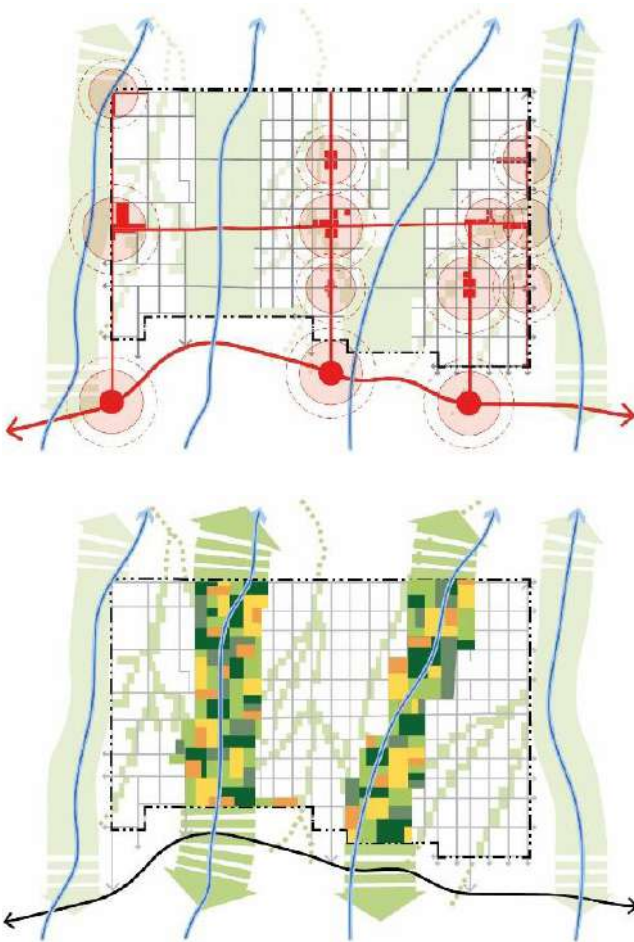
In anticipation for the expected population increase after 2020, the Spatial Plan also delivers a strategy for accommodation of future additional residents. For example, the residential areas have allowances for the expected density increase and the road arteries can be extended within the site (Figure 7). Developmental control measures are also put in place to avoid unplanned and informal growth around the river basins, which are not habitable due to flood risks.

The Spatial Plan also identifies areas with good potential for economic activity, commercial growth and linkages to transport infrastructure, encouraging the creation and good health of future economic and commercial nodes. These nodes are also connected to smaller neighbourhood scale markets, businesses and kiosks.

The Spatial Plan also encourages agricultural practices and horticulture as potential livelihood options. Within the land use breakdown, three agricultural practices are contemplated – large scale, medium scale and urban agricultural projects. Large scale agricultural plots are located along river basins, utilizing seasonal flooding for irrigation potential. These plots are situated between neighborhoods and far from built areas. Medium scale agriculture plots serve to act as green spaces for activities, such as sports locations and communal spaces. Lastly, urban agricultural plots are located within residential blocks, encouraging residences to contribute greater to self-subsistence, and acting to foster community bonding.

To encourage social mixing between refugee and host community members, the Spatial Plan also promotes increasing access and opportunities for host community members within the first phase, equalizing the priority usually given to refugees in this context. The long-term housing strategy recommends facilitating equitable access to plots and housing, ensuring good maintenance of public interests.

**Figure 8: Planning for the creation of economic and agricultural nodes**



Source: UN-Habitat, Kalobeyi Settlement, Local Advisory Physical Development Plan

## 3.2 Infrastructure

The Spatial Plan has identified the needs for infrastructure provision in 5 main areas - roads, housing, water and sanitation, electricity and community facilities. These needs are based on the service provision objectives for both the refugee and host communities, a collective projected population of 60,000. Initial infrastructure provision will follow UNHCR guidelines, which are transitional. Overtime, the aim will be towards the long-term provision of durable solutions to ensure the sustainability of the settlement.

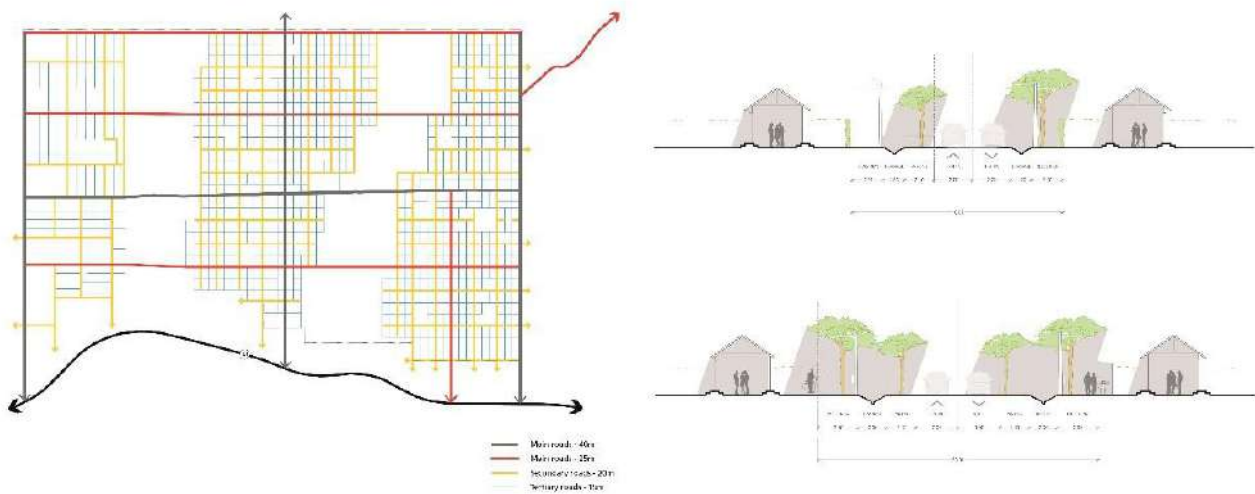
### 3.2.1 Roads

The Spatial Plan proposes a road network system consisting of four types of roads - arterial, primary, secondary and tertiary. The total road area is 56.22 Ha, which would include 19,589m for arterial streets, 12,070m for primary roads, 71,197m for secondary roads and 98,968m for tertiary roads. The roads also vary in widths based on type, arterial streets measuring 40m, primary roads measuring 25m, secondary roads measuring 20m and tertiary roads measuring 15m. The arterial roads would be tarmacked and the remainder would use gravel. The different road types will also vary in functions, which is detailed in Table 1. above.

**Table 1:** Information on the different types of roads

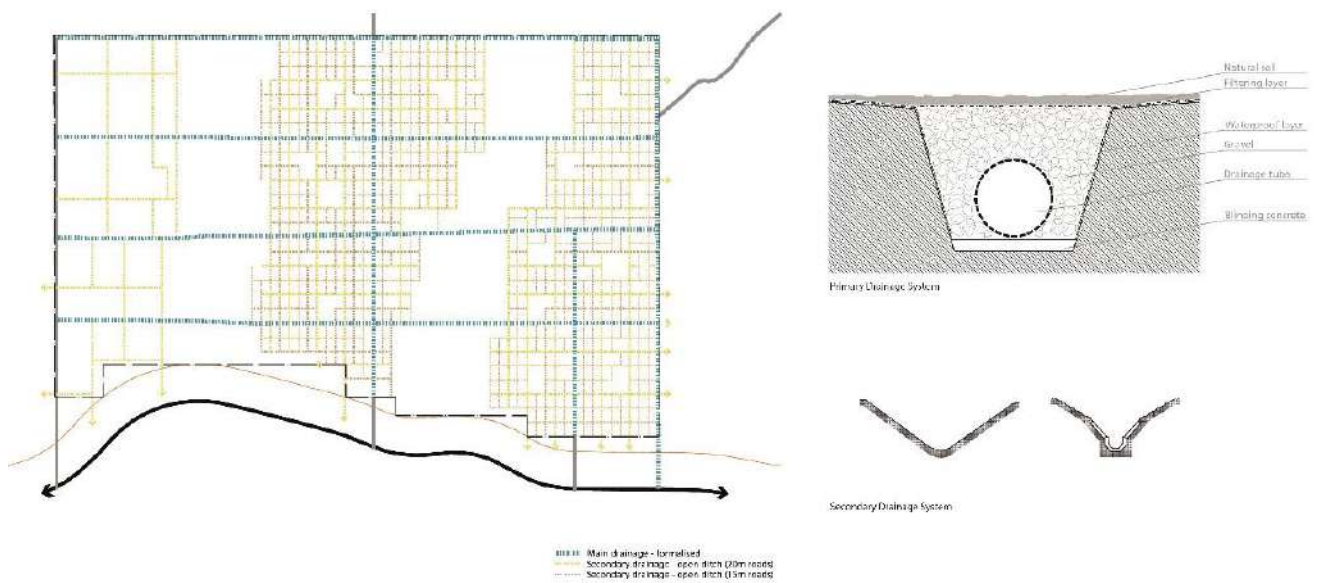
Road Type	Area	Function	Details
Arterial Streets	40m wide*19589m long	Provide connection to main areas such as from the North to South of the settlement.	Four lanes for vehicular traffic (two ways), parking plots, drainage system, cycle lanes, sidewalks and commercial stalls on both sides
Primary roads	25m wide*12.070m long	Provide main connections between three different neighbourhoods in the settlement.	Four lanes for vehicular traffic (two ways), parking plots, drainage system and sidewalks on both sides
Secondary roads	20m wide*71.197m long	Provide connections between different areas within each neighbourhood.	Two lanes for vehicular traffic (one or two ways), parking plots, drainage system and sidewalks on both sides
Tertiary roads	15m wide*98.968m long	Facilitate access to smaller and different plots in the settlement.	Two lanes for vehicular traffic (one or two ways), parking plots on one side, drainage system and sidewalks closer to the plots on both sides

**Figure 9:** Road system network for Kalobeyei



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

**Figure 10:** Drainage system in Kalobeyei with two system examples



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan



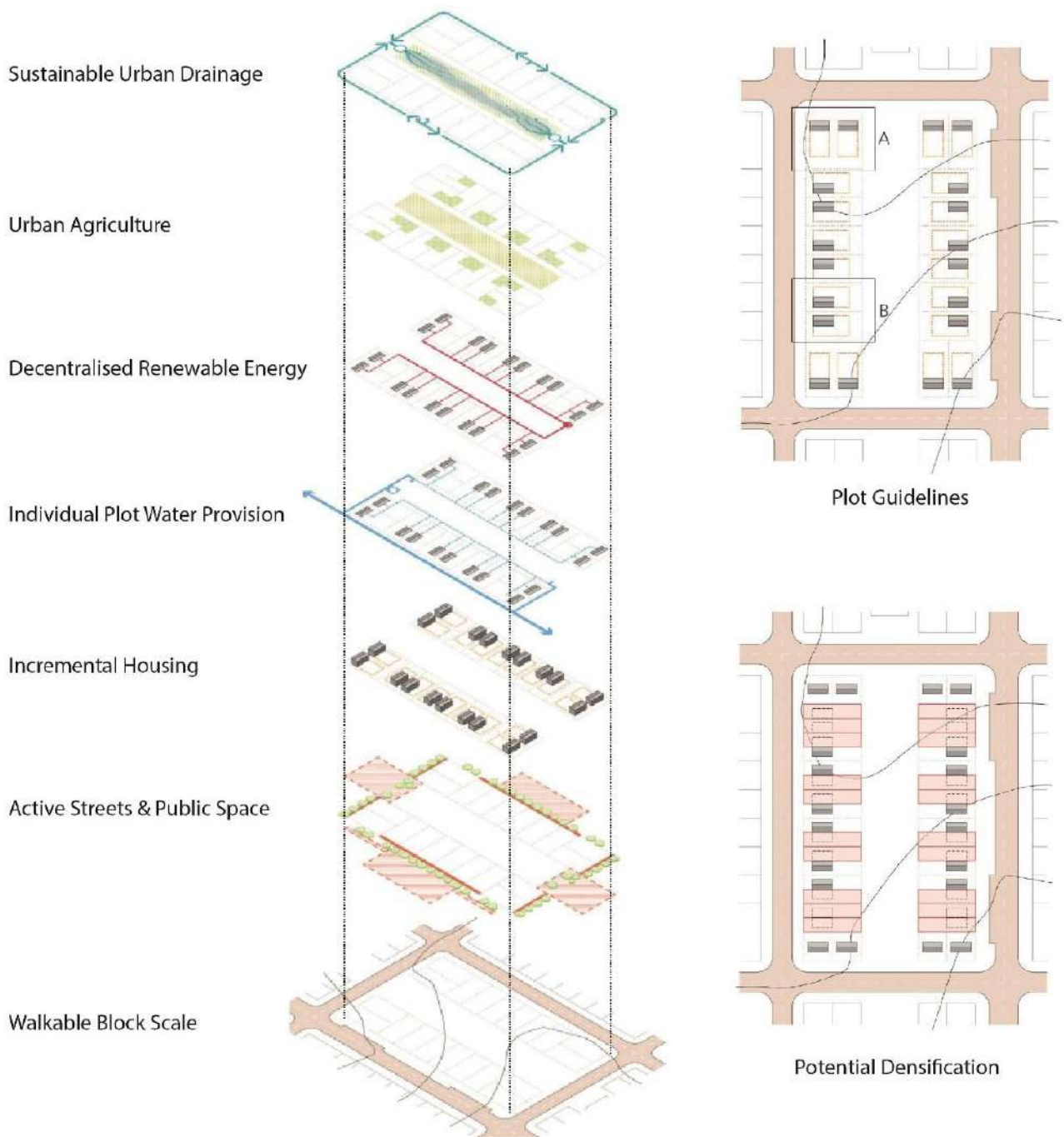
The Spatial Plan also proposes the use of two different types of drainage systems for different street scales. For main arterial streets and primary roads, using a wider ditch and gravel drainage system and a lower cost, open ditch drainage system for the remaining roads Figure 10. The main formalized drainage will be filled with big stones, permitting for the filtration of runoff, which will then be incorporated into the primary flow of water within the settlement. The secondary drainage comprises of a v-shaped channel section that directs the runoff into a secondary flow of water within the settlement.

Street lighting infrastructure would be implemented along the arterial streets and primary roads to increase safety and utility. The street lamps would utilize solar-powered technology and are proposed to be set 30m apart.

### 3.2.2 Housing

To ensure more durable and appropriate spatial demands of the expected population growth long-term, the Spatial Plan proposes a model for incremental housing. The housing will be provided for both refugee and host community members, enabling better integration and social mixing.

**Figure 11:** Housing prototype and plot design for the Kalobeyei site



Incremental housing is also a more sustainable housing model in terms of investments. It offers a more needs-based and long-term approach, encouraging revenues and enabling financial effectiveness in the future. In the initial emergency phase, shelters would be built and could incrementally be upgraded during the following phases. The incremental strategy also offers greater adaptation possibilities, which will be particularly relevant when catering to a growing population, changing needs and cultural differences.

The residential blocks would be designated within a 200m<sup>2</sup> area, with 20 housing units per block. Each block would have direct street access and assigned green spaces for urban agriculture. The layout of a block is designed to allow for future densification should the need arise. The capacity of each housing unit is a maximum of 5 people. 12,000 housing units will need to be provided to house the projected population of 60,000 residents, amounting to a total residential area of 269.22 Ha.

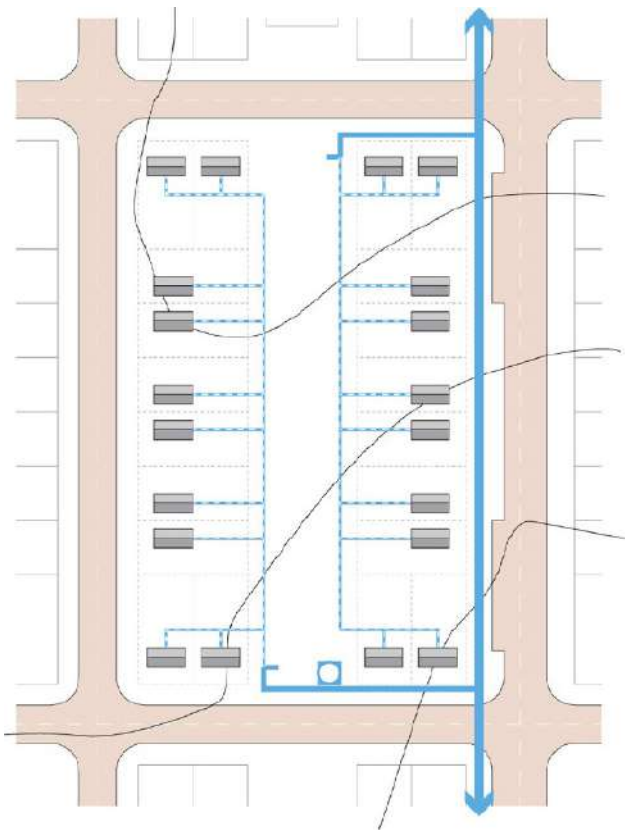
### 3.2.3 Water and Sanitation

An effective water provision scheme is a fundamental priority due to the semi-arid environment with scarce access natural water resources in Turkana County. The water provision scheme envisioned in the Spatial Plan aims to provide communal collection points in the first phase and transition to individual connection for individual collection in the long-run.

The proposed sewer system will vary depending on the development phase. In the emergency phase, a series of shared pit latrines are implemented at a block level. The sludge can be recycled and used for agricultural purposes. In the long-term, it is recommended to review this temporary strategy and upgrade the system to a Ventilated Improved Pit latrine (VIP). Feasibility should be evaluated after the emergency phase.

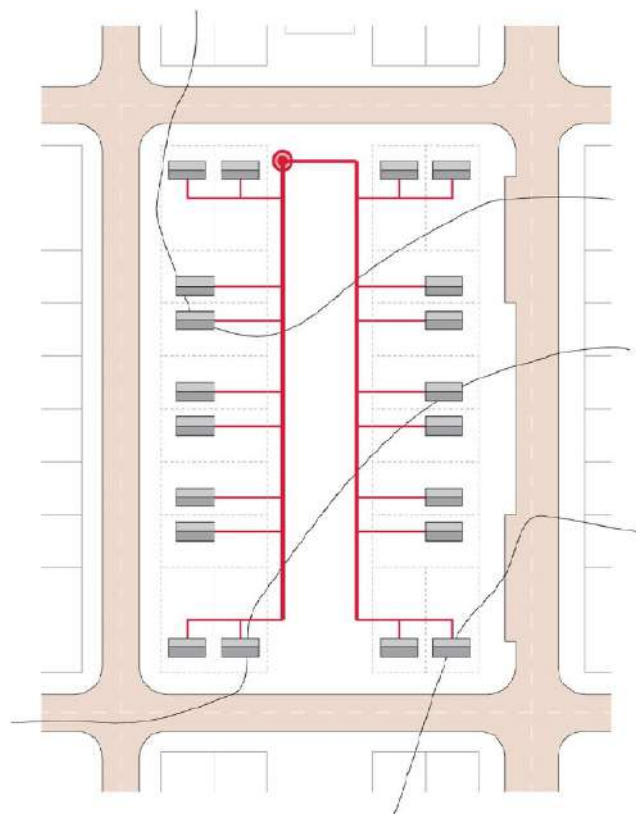
In the emergency phase, it is proposed to implement 1 pit latrine at the block level, serving a total of 10 people. In the later phase, a system of double pit latrines at block level will be provided.

**Figure 12:** Water provision for Kalobeyei according to the Spatial Plan



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

**Figure 13:** Strategy for the provision of sanitation facilities in Kalobeyei



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

### 3.2.4 Electricity

The Spatial Plan proposes a decentralized solar energy system at the household level to compensate for the lack of a power grid in the region. This system would ideally be developed with the potential to become a formalized electricity system. To reflect this objective, the proposed system would have a capacity of 600W, covering basic household electricity needs for lighting and mobile-phone charging, as well as other additional home appliances (e.g. kettle, microwave, television, etc.).

### 3.2.5 Community facilities

The Spatial Plan proposes infrastructure for three types of community facilities - education facilities, health facilities and public facilities.

Education facilities will consist of 25 early childhood development centers, 13 primary schools, 3 three secondary schools and 3 three vocational training centers will also be implemented within the site. On the neighbourhood scale, there will be 1 primary school and 3 kindergartens, providing for 5000 students as well as 1 large secondary school, providing for 2000 students.

Kindergartens will be located on small residential streets within predominantly residential land use areas to ensure the safety of the young children and a proximity to their homes. Primary schools will be centrally located within each mega-

block on secondary roads, while remaining at a safe distance away from any major transport arteries. To provide additional space for sport/leisure and agricultural training, all primary schools will be situated adjacent to the green corridor.

Health facilities will consist of 1 district hospital, 3 health centers and 6 health dispensaries. District hospitals will serve as the coordinating and referral centers for smaller units. They will provide comprehensive medical and surgical services and will be managed by medical superintendents. Dispensaries will be the lowest level of health care provision and will be predominantly run and managed by nurses. The dispensaries will provide outpatient services for simple ailments and refer more serious cases to one of the 3 health centers. Health centers will be in the second order of operating health facilities and will be run by a clinical officer.

Additional public facilities proposed for the site follow the standards and provisions outlined in both the Kenya Physical Planning Guide and UNHCR's Emergency Handbook. This will include the provision for three police offices, four post offices, three fire stations, three cemeteries, one water management center, three firewood distribution centers, one crop management center, one world food program office, two feeding centers, eight child protection centers, four administrative centers, 16 social halls, seven trade distribution centers, one environmental management center, one site market and 18 neighborhood markets.

**Figure 14:** Education facilities in the Kalobeyei site



Source: UN-Habitat, Kalobeyei Settlement, Local Advisory Physical Development Plan

# 04 METHODOLOGY

The Financial Sustainability Strategy combines estimations for the upfront capital investments required, referred to in this document as Capital Investment Costs and the operation costs, referred to in this document as Maintenance Costs. Capital Investment Costs are fixed one-time expenditures used for building, construction, purchase of land, buying equipment, etc. Maintenance Costs are long-term operation and management costs including facility maintenance and staff payroll.

## 4.1 Capital Investment Costs

The estimation model for the Capital Investment Costs (Figure 15), accounts for the building of five main types of infrastructure - housing, water and sanitation, streets, electricity and community facilities.

To determine the most accurate infrastructure costs and justification for the context of Kalobeyei, the estimations for unit costs are based on information retrieved from the Kalobeyei New Settlement and other existing projects within the region or relevant contexts. Prices in this document were converted into US dollars in instances where other currencies were listed in information provided. The prices were also adjusted to inflation.

These unit costs are multiplied to the total needed quantities as established by the Kalobeyei New Settlement Advisory Local Physical Development Plan. Total costs estimated cover the completion of the first phase of the Kalobeyei New Settlement, with a designated timeframe until 2020. The capital investment plan also accounts for a progressive forecasted population growth until 2050.

Further details of the model for estimation on capital investments costs is covered in the following sections.

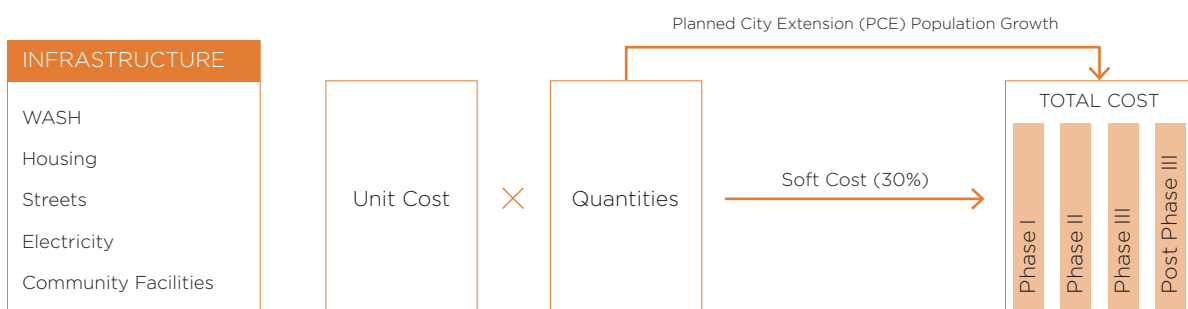
### a. Unit Costs

Unit cost refers to the cost incurred by the stakeholder to produce, store and sell one unit of a product, including all fixed costs and all variable costs involved in production. Unit costs estimates were retrieved from sources including past infrastructure projects by the Kenyan government, as well as projects in Kenya and other Sub-Saharan countries from international and donor organizations such as UNHCR, World Bank, African Development Bank, International Committee of the Red Cross, United States Agency for International Development, etc. This included reports and publications as well as personal interviews with donor agencies. CAPEX unit costs are usually determined by the type and scale of the building area. OPEX unit costs are usually calculated as a percentage from the capital investment, which is invested annually for maintenance. Unit cost prices have also included inflation in Kenya to account for the varying dates of the source information from which the unit cost was retrieved.

### b. Quantities

The quantities for each type of infrastructure accounted derives from the planning proposals provided within the “Kalobeyei Settlement Advisory Local Physical Plan.” This means that costs can change depending on decisions and further specifications of the infrastructure planned for the site.

**Figure 15:** Methodology for the estimation of the Financial Plan





### c. Phases and Population

The financial sustainability strategy has been developed based on a demographic prognosis of the forecasted population growth (Graph 4). The Financial Plan has accounted for the total investment required for the completion of the Spatial Plan by the end of the first, second, third and fourth phase, which are defined in the following timeframes: Emergency Phase (Phase 1, 2016-2020), Transitional Phase (Phase 2, 2021-2025), Self-Sufficient Phase (Phase 3, 2026-2030) and Developmental Phase (Phase 4, 2021-2050).

The demographic assumption is based on the the Kenyan average annual growth of 2.6% (World Bank). Per this assumption the population in Kalobeyei will grow from 60,000 by the end of 2020, to 129,590 129 by 2050. The total costs under all the phases are calculated as the present value at year 2017. Inflation will need to be further considered when attracting investments in the following years.

### c. Soft Costs

Soft cost is a construction industry term for an expense item that is not considered a direct construction cost. Soft costs differ from hard costs in both labor and materials as they are generally not considered to be exclusively related to physical construction. They are rather commonly perceived to entail non-construction costs such as taxes, marketing expenses, interest payments, and finance charges.

Cost estimations for Kalobeyei account for an additional 30% of soft costs. This allows a buffer for expenses including project management, technical fees and construction loans, licenses, building permits, etc.

**Table 2: Quality and infrastructure provision difference between low, medium and high standard**

Segment	Sub-segment	Lower Standard	Plan Standard	Higher Standard
Housing	Temporary Shelter			
	Housing Upgrade	Low	Average	High
Wash	Water Connection Prototype	Community	Individual	Individual
	Sanitation and Shared Users	1 basic single latrine per 2 household	1 VIP per household	2 Bio toilet per household
	System	Dry system	Dry system	Wet system including pour-flush, septic tank, small bore sewer, and sewer connection
Street	Road material	Regravelling for all roads	Tarmac for arterial streets, regravelling for the rest	Tarmac for the arterial streets and primary roads, regravelling for secondary and tertiary roads
	Drainage Type	Open Ditch for all roads	Mainformalized normal standard for arterial streets, open ditch for the rest	Mainformalized higher standards for arterial streets, mainformalized normal standard for primary roads, open ditch for secondary and tertiary roads
	Distance between Streets Lighting	30 metres	20 metres	10 metres
Electricity	Energy Source and Capacity	300watt per household by solar system	600watt per household by solar system	Grid introduced from Turkwel
	Community Facilities Education, Health, Public Purpose			

Source: UN-Habitat

## 4.2 Three different infrastructure investment standards

Apart from the Spatial Plan, the Financial Plan discusses two additional cost scenarios. As mentioned earlier in this document, this provides scenarios for a lower and a higher construction standard. The aim is to allow comparison of expenditures across various standards, identifying possible cost-saving opportunities, as well as contributing to the decision process in envisioning a sustainable human settlement.

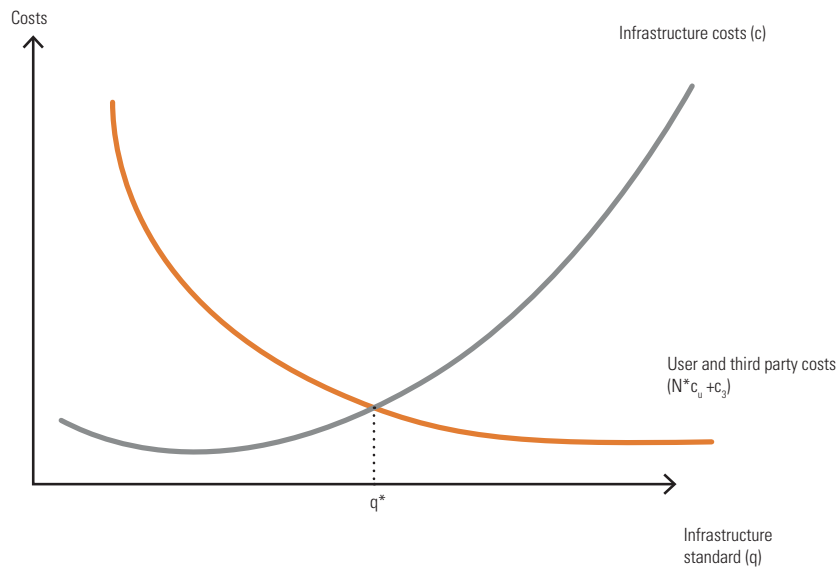
The differences in terms of quality and infrastructure provision between low, medium and high standards are detailed in Table 2. The medium standard is referred as "Plan Standard," as it comprises the infrastructure provision proposed in the "Kalobeyei Settlement Advisory Local Physical Plan." The lower standard, lists cost estimates for lower quality and fewer infrastructural provisions. This means accounting for lower quality housing, shared water and sanitation facilities, the gravelling of all roads and only 300-watt solar panel system per household. The higher standard in turn accounts for high quality housing, individual water and sanitation facilities, the paving of more roads and the introduction of a grid-electricity connection.

### 4.3 Maintenance Costs

Maintenance unit costs are often calculated as a percentage from the capital investment, with annual supporting investments. In the financial sustainability strategy, the maintenance costs follow all necessary assumptions applied for estimating capital investments, including quantities, population growth, and soft costs. The maintenance costs estimate also assumes the forecasted infrastructure needs of each year, accommodating population growth, will be completed within the designated time frame.

The maintenance estimations also generate a progressive analysis across lower, medium and higher standards. According to academic research and industry practice, when quality of infrastructure is higher, the total operational cost generated is lower in the long-term (Graph 1). The Financial Plan provides estimates of the maintenance costs based on accounting which reflects this economic consideration. The aim is to also facilitate the decision-making process for quality standards in the settlement, ideally finding a balance between cost-effectiveness and durability to reach financially sustainable solutions.

**Graph 1:** Infrastructure Investment Costs and Maintenance Cost relative to Infrastructure standard



Source: *Transportation Infrastructure Investment: Options for Efficiency, International Transport Forum, 2008*

# 05

## OVERVIEW OF THE RESULTS OF THE CAPITAL AND OPERATIONAL FINANCIAL PLAN

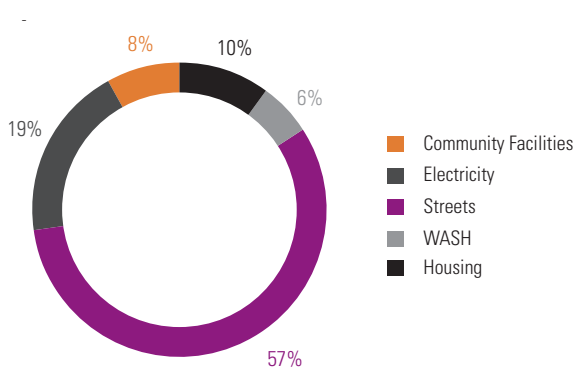
### 5.1 Total costs of the Spatial Plan until 2020

Based on UN-Habitat calculations, the needed upfront investments in infrastructure for implementation of the Kalobeyei New Settlement Advisory Local Spatial Plan, is total of **236,140,944.92 USD**. This investment would allow the provision of services for a population of 60,000 by the year 2020. The total cost accounts exclusively for the capital investment needed to build the infrastructure, excluding maintenance and labor costs.

This amount represents an investment of **3,963 USD per capita**, which translates into 19,678 USD per household. Accounting for the direct services associated with household provisions, consisting of shelter, electricity and water and sanitation provision, the investment needed is **1,053 USD per capita** and 5,269 USD per household.

In regards to the composition of costs (Graph 2), the construction of streets will account for the majority, utilizing 57% of the needed investments. Electricity infrastructure costs follow at 19% and housing at 10%. Community facilities including education, health and school facilities account for 8% accounts for 6%, utilizing the lowest amount of the total investment.

**Graph 2:** Composition of the total upfront capital investment by 2020



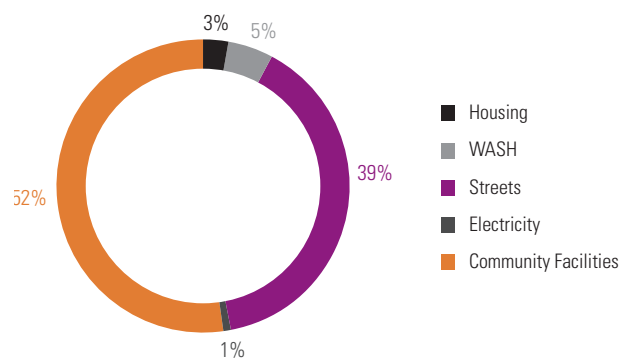
Source: UN-Habitat

In addition, the maintenance cost accounting from the year 2017 to 2021<sup>1</sup> is a total of **109,518,514.37 USD**. To provide a better understanding of each annual cost, the annual cost for 2021 for example is estimated at 35,623,878.81 USD.

The composition of maintenance costs (Graph 3) differs significantly from the composition of the capital investment. In this case, community facilities account for a clear majority of the costs, utilizing 52% of total investments<sup>2</sup>. In terms of services provided within community facilities, the primary costs are attributed to labor, which accounts for 81%. Education accounts for 50% while maintenance of the community facilities accounts for 15%. The remaining composition of maintenance costs consists of streets, accounting for 39%, water and sanitation accounting for 5% and housing accounting for 5%.

In terms of type of services community facilities<sup>3</sup> costs are driven by education facilities, which account for 50%. On the other hand, in terms of type of costs, while maintenance of the facilities account for 15% of the costs, the main costs are attributed to labor costs that represent 81%. The breakdown of costs (Graph 3) is followed by streets (39%), water and sanitation (5%) and housing (3%).

**Graph 3:** Composition of the annual maintenance costs for 2021



Source: UN-Habitat

<sup>1</sup> It was accounted until year 2021 to consider the maintenance costs for 2020, which is the date of completion of the Kalobeyei Plan to provide services for 60,000 people.

<sup>2</sup> Other services are hospitals (25%) and public facilities (25%)

<sup>3</sup>

## 5.2 Investment curves for capital and maintenance costs until 2050

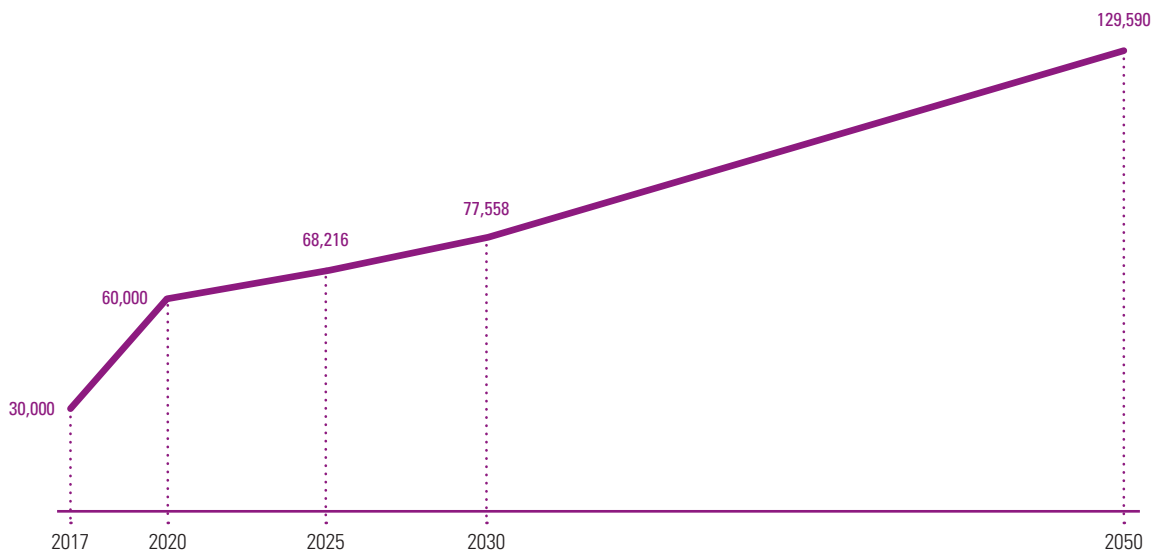
To account for the increasing infrastructure needs after 2020, derived from expected population growth, UN-Habitat has developed an investment scenario until 2050. The population growth is estimated based on the average Kenyan annual growth rate of 2.6%, provided by World Bank. The population of 60,000 in 2020 is expected to grow to 129,590 by 2050 (Graph 4).

Per UN-Habitat estimations, this population growth will result into an additional increased upfront investment need of **272,706,917 USD** in comparison to 2020. This translates into an additional investment of 27,158,127 USD in housing, 17,279,483 USD for water and sanitation, 50,880,421 USD for electricity, 156,199,520 USD in streets and 21,189,365 USD in community facilities.

The total capital investment needed until 2050 is **508,847,861.95 USD**. Following Graph 6, the investment curve is downward sloping with 46% of the total investment being carried out in the three first years until 2020. The remaining 54% of the investment will be carried out during a time span of 30 years from 2020 to 2050. Consequently, annual investment needs decrease from 120,1M USD in 2017 to a range from 6M to 12M from 2020 to 2050.

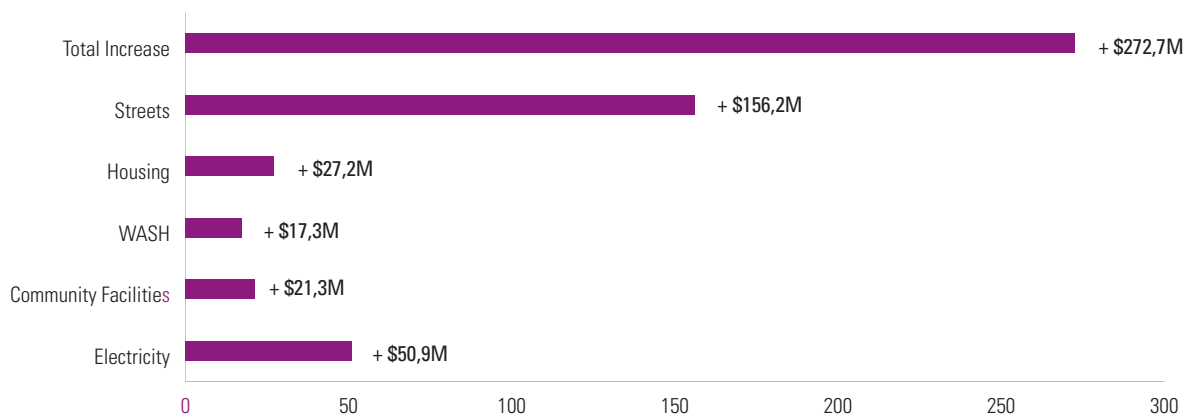
The investment curve for the maintenance costs on the other hand, is upward sloping (Graph 7). This has two principal reasons, the first being the depreciation of infrastructure and the second being a consequent increase in the costs, following an increase in the number of infrastructure over the years in parallel to the population growth. The downward slope of the curve means that 4% of the investment is carried out by 2020, and 96% of the investment is concentrated between 2020 to 2050.

**Graph 4:** Population growth estimation of Kalobeyei (2017-2050)



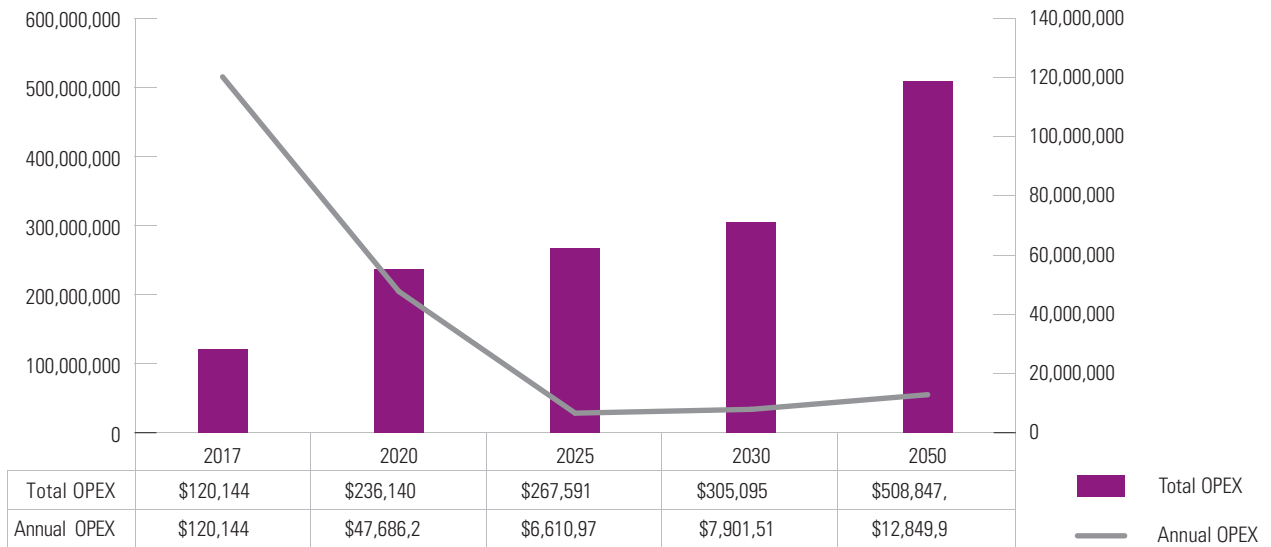
Source: UN-Habitat

**Graph 5:** Increased upfront capital investment until 2050



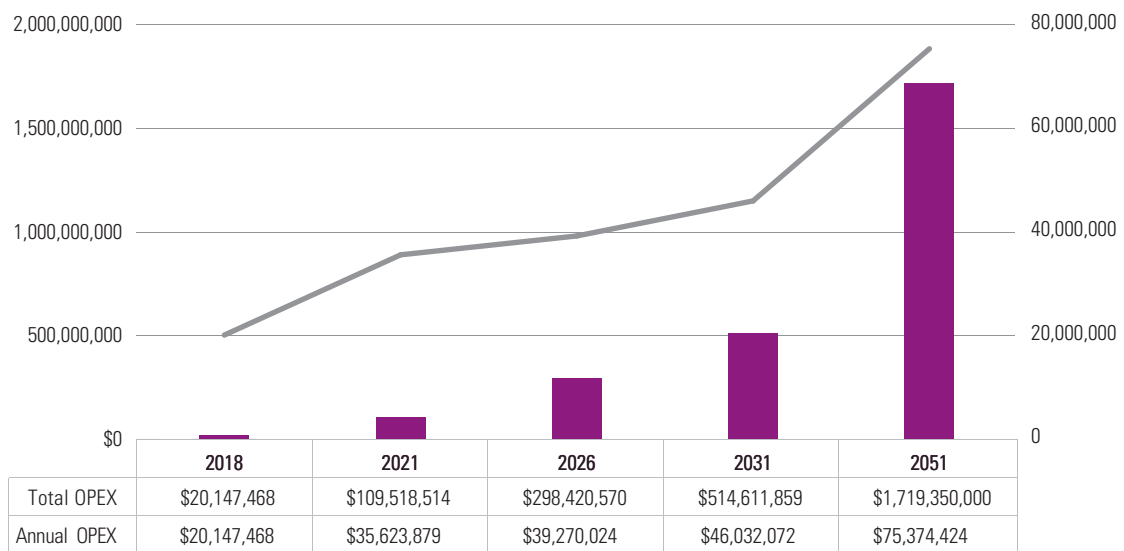
Source: UN-Habitat

**Graph 6:** Investment curve for the upfront capital investment needed from 2017 to 2050



Source: UN-Habitat

**Graph 7:** Investment curve for maintenance investment from 2018 to 2051



Source: UN-Habitat

This means that the annual costs become more expensive over time. While the annual maintenance of 2018, the first year of the implementation of the Spatial Plan, is of 20,1M USD, the annual maintenance costs between 2021 and 2051 ranges from 39M USD to 75M USD.

### 5.3. Cost-benefit analysis of the infrastructure

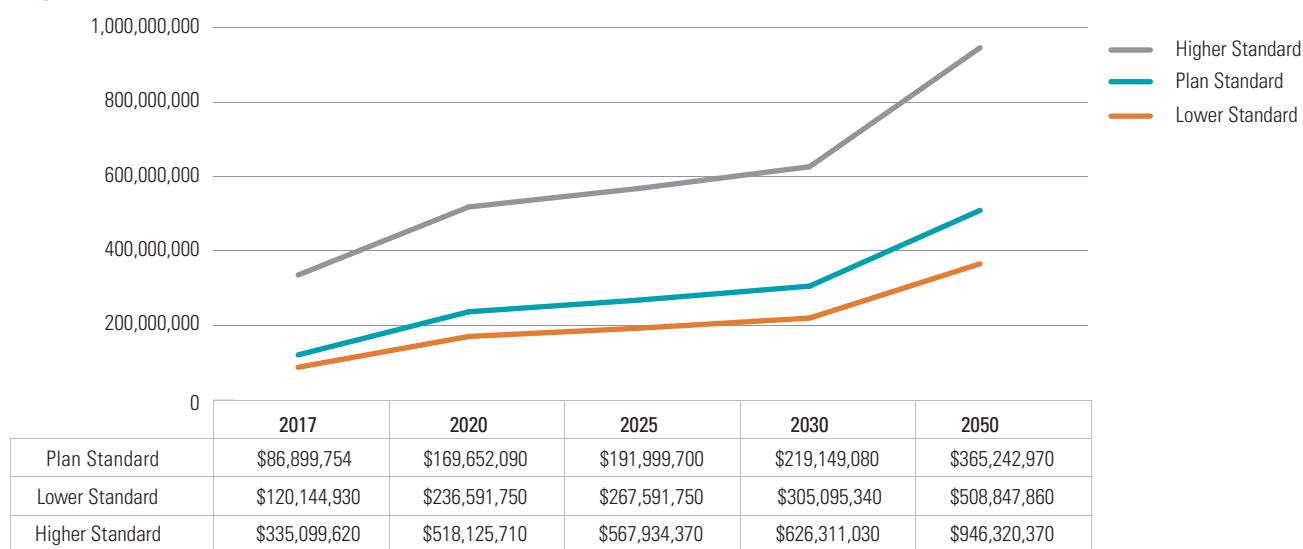
UN-Habitat has developed a cost benefit analysis between three different investment scenarios, which were based on three different infrastructure standards. The analysis should be assisting in the decision-making process for the provision of infrastructure in Kalobeyei.

Table 3: Infrastructure provision under the three different standards

	Lower Standard	Plan Standard	Higher Standard
Housing	Low	Paper Tube Structure/ Timber Frame Module/ Compressed Earth Bricks (CEB)	High
Wash	<ul style="list-style-type: none"> <li>Communal connection</li> <li>1 basic pit latrine per 2 household</li> <li>Dry system</li> </ul>	<ul style="list-style-type: none"> <li>Individual connection</li> <li>1 VIP per household</li> <li>Dry system</li> </ul>	<ul style="list-style-type: none"> <li>Individual connection</li> <li>2 Bio toilet per household</li> <li>Wet system</li> </ul>
Street	<ul style="list-style-type: none"> <li>All streets gravelled with open ditch</li> <li>30 metres between solar streetlight</li> </ul>	<ul style="list-style-type: none"> <li>Arterial streets - tarmac and main formalized drainage</li> <li>Rest - graveled with open ditch</li> <li>20 metres between solar street light</li> </ul>	<ul style="list-style-type: none"> <li>Arterial streets - tarmac and better main formalized drainage</li> <li>Primary roads - tarmac and main formalized drainage</li> <li>Rest - graveled with open ditch</li> <li>10 metres between solar street ligh</li> </ul>
Electricity	Solar system - 300watt per household	Solar system - 600watt per household	Grid introduced from Turkwel

Source: UN-Habitat

Graph 8: Comparison of the capital upfront investment among low, medium and high standard



Source: UN-Habitat

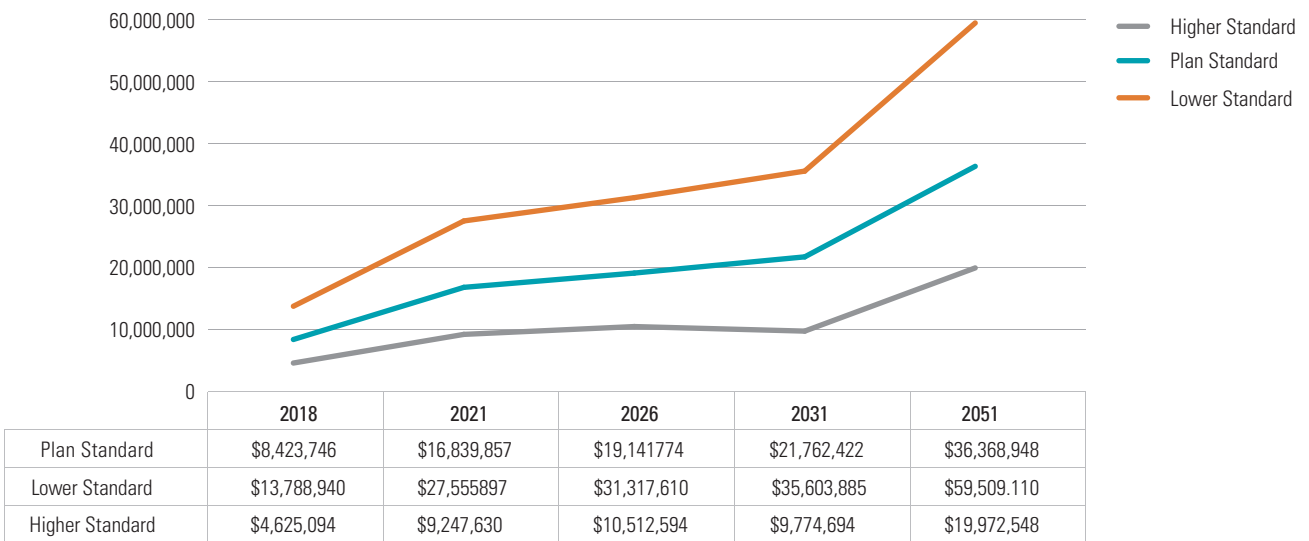
The three standards, detailed in Table 3, range from low, medium and high depending on the durability and quality of infrastructure. The medium standard, referred to in the table as Spatial Plan Standard, corresponds to the infrastructure requirements specified in the Kalobeyei New Settlement Advisory Local Physical Development Plan.

With regards to Capital Upfront Investment, shown in Graph 8, a lower infrastructure standard would cost 28% less than the Kalobeyei New Settlement Advisory Local Physical Development Plan, saving a total of 143M USD. A high infrastructure standard would elevate the cost to 86% more than the Spatial Plan standard, translating into an increased capital investment of 348M USD. A high infrastructure standard corresponds to durable infrastructure typical of a standard urban settlement, including electricity grid connection, individual household water connection, individual sanitation system, high standard housing and significantly more tarmac-paved roads.

It is important to note that health care standards are not displayed under infrastructure provision standards. The total number of healthcare facilities - dispensaries, centers and hospitals were tabulated based on increasing population growth such as recommendations within the contexts of unique humanitarian projects. This will be further expanded within the Annex.

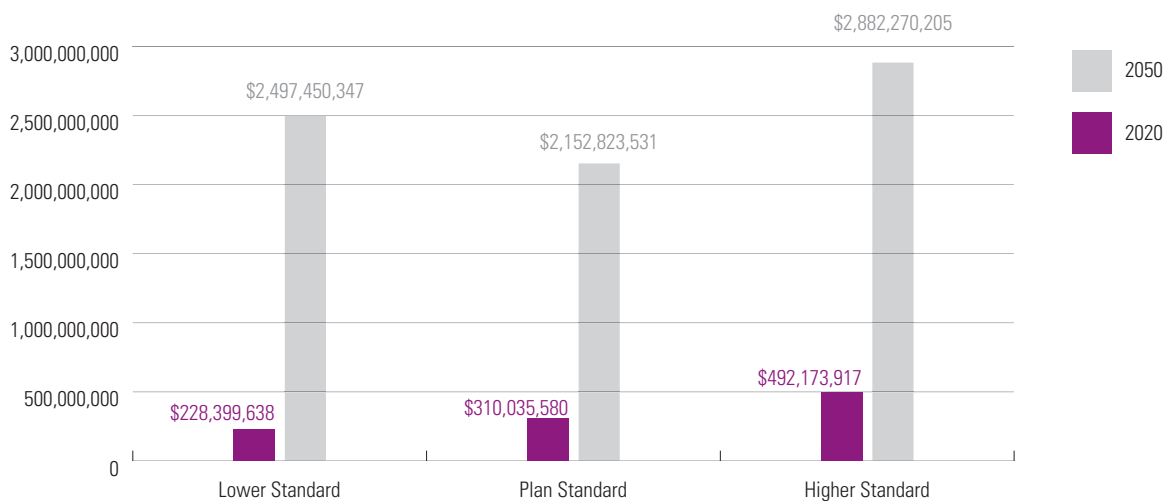
Graph 9 shows that over time, the maintenance costs in differing infrastructure standards switch. The long-term costs grow higher for lower standard infrastructure and lower for higher standard infrastructure, clearly indicating the economic benefits of investing in high quality infrastructure in the initial stage. Per UN-Habitat’s estimations, the implementation of lower standard infrastructure investment would have an increased maintenance cost by 2050 of 30% compared to the Spatial Plan standard. This would amount to an increased total cost of 498M USD. However, implementation of a higher standard infrastructure would save maintenance costs by 50%, amounting to a total saving of 395M USD.

**Graph 9:** Estimates of annual maintenance costs (Housing, WASH and Streets) for low, medium and high standard



Source: UN-Habitat

**Graph 10:** Total capital investment and maintenance costs in 2020 and 2050 under low, medium and high standard\*



\* This graph accounts for maintenance costs for all types of infrastructure including community facilities and electricity

Source: UN-Habitat

It is important to note that these calculations were based solely on the maintenance costs of streets, housing and water and sanitation. This is because community facilities maintain a singular quality standard in the model (it does not change with alternate standards) and electricity costs in the higher standard infrastructure (which would include connection to the main power grid) are too high, thereby driving the high standards costs disproportionately high.

When observing capital investment and maintenance costs, (Graph 10), it can be acknowledged that maintenance is the main driver of the costs of the site until 2050, suggesting that precedent should be given to its consideration in the financial planning of the site. While the total amount for capital investment required until 2050 is of 508M

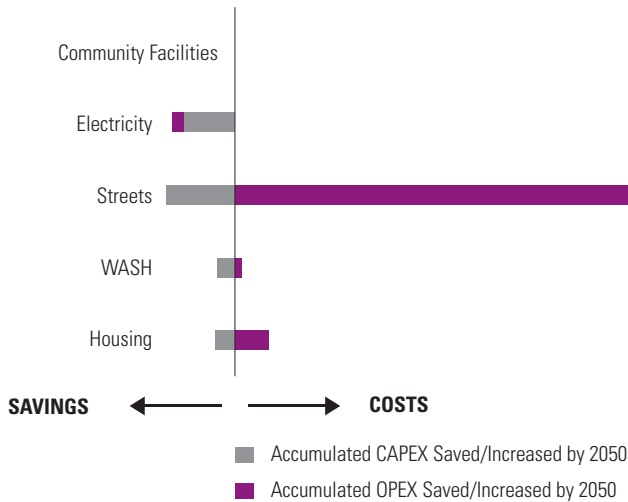
USD, maintenance increases a total cost of 2,2 B<sup>4</sup> USD. Although capital investment costs represent over the 74% of the investment in the first years until 2020, from 2021, maintenance costs account for 81% of the annual investments needed.

Furthermore, when combining both costs, both the lowest and the highest standards are costlier than the Plan standard. The lower standard is 16% more costly than the costs in the Spatial Plan and the high standard is 34% more costly.

4 "B" means billions and it stands for thousands of millions



**Graph 11: Lower standard: Capital and maintenance costs saved/increased by 2050**

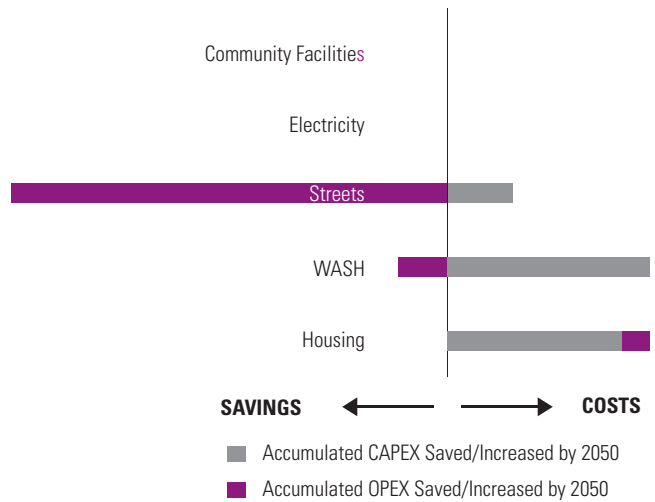


Source: UN-Habitat

It is important to note that maintenance costs account for electricity and community facilities, driving up the costs for the higher standard significantly. When controlling for electricity and community facilities, the added costs of maintenance and capital investment for the higher standard until 2050 is slightly cheaper (3.3%) than the Spatial Plan.

The benefits of investing in higher quality infrastructure to reduce maintenance costs becomes more evident when looking at the accumulated capital and maintenance costs for each infrastructure component. As shown in Graph 11 and

**Graph 12: Higher standard: Capital and maintenance costs saved/increased by 2050**



Source: UN-Habitat

Graph 12, the economic benefit of high quality infrastructure is particularly evident in the case of streets. Within a lower standard, as shown in Graph 11, capital investments for streets are saved by 43%, whereas maintenance costs increase by 94%. Capital investments for electricity are also saved by 37%. In the case of a higher standard, as shown in Graph 12, while capital investment costs for streets increase by 30%, there is a saving of 23% in maintenance costs. Capital Investment costs for WASH represent a significant increase of 37%.

## 06

## LOCAL ECONOMIC DEVELOPMENT

### 6.1 Creating a financially sustainable settlement

The creation of a financial sustainability strategy appears as a major challenge in the case of building and maintaining a new settlement when accounting for maintenance costs in the long-term.

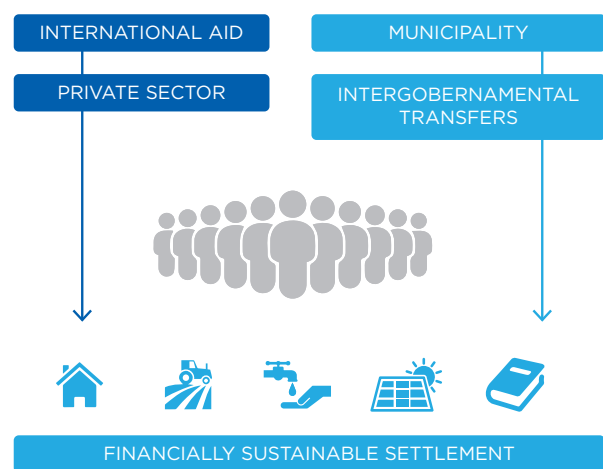
In this regard, economic development, such as increasing potential employment opportunities and revenue generation, proves to be the main strategy necessary to ensure sustainability of the Spatial Plan. Economic development becomes the conditioning factor to progressively engage the public sector (national, county and municipal) and private sector in taking financial ownership of the settlement in the future.

Since the international aid sector is the principal provider of refugee assistance, as shown in Figure 6, a financial model which would sustain the settlement must include a strategy to attract investments from other actors, namely from the private and public sector. The strategy would also Spatial Plan for the gradual decrease in dependence on international aid, while the private and public sector provisions would increase and subsequently gain importance.

In the circumstance where the private sector would play the leading role in financing the settlement, it would be important to tie infrastructure investments of the settlement with regional economic development strategies of Turkana County. The county has already been gaining momentum with significant developments currently underway and the additional support would further encourage financial sustainability. Some of the current developments include the recent discovery and exploitation of oil sources as well as the development of a national transport corridor, which will become one of the primary arteries connecting Kenya to South Sudan, Ethiopia and Uganda.

There are various ways of cooperating with the private sector. One example could include the establishment of public-private partnerships (PPP) for the delivery of key services and infrastructure. In this regard, increasing the revenues for both refugee and host populations will be essential. This can be achieved by creating employment opportunities through economic development strategies.

**Graph 13:** Percentage of transfers and own-source revenues in the different counties

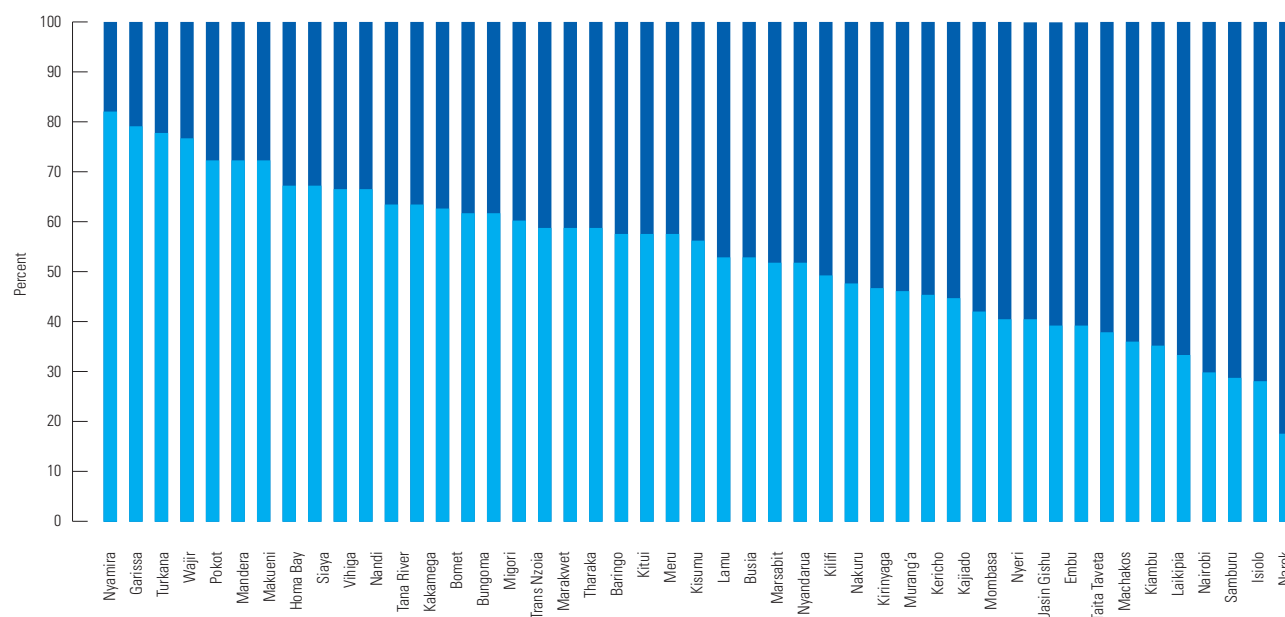


Source: UN-Habitat

Due to the recent structural reform in Kenya, which supports the devolution of responsibilities and power to local governments, the pressure on service delivery has become the responsibility of counties, often with low-own source revenues (World Bank, 2012). This is especially true in the case of Turkana County, which has one of the lowest percentages of own-source revenues nationwide (Graph 13). The public sector in county already faces many challenges regarding financing infrastructure and service provision. The influx of refugees further increases demands, which adds to the existing financial stress of the sector.

Turkana County is encouraged to seize the opportunity of increased investments and economic development in the region, using it to enhance its own-source revenue generation and improve the management of the county's finance. For example, raising local government taxes and fees, engaging in public-private partnerships as well as enhancing credit worthiness to apply for further loans and bonds. As cited in section 2.1 Turkana: Challenges and opportunities for the region, the county is likely retained a percentage of approximately 20% of revenue from the newly discovered oil resource. In addition, a new formula derived from the Commission of Revenue Allocation establishes national equitable share transfers. This will further increase the advantages to Turkana County, seeing an overall rise in national transfers.

**Graph 14:** Financial Scheme for the Implementation of the Plan



Source: UN-Habitat

Although management and reform are essential for increasing own-source revenues, these are not the only necessary conditions. Economic development is a triggering factor for employment opportunities, fundamental to increasing citizens’ incomes (Graph 14). This factor will also be essential to increasing own-source revenues as well as the implementation of finance mechanisms such as fees, taxes or land-based finance.

In the context of Turkana County, where arriving refugees are unemployed and often without financial security, increasing economic development is a fundamental factor for the financial sustainability of the Spatial Plan. It is thus critical that investments for refugee assistance in the region aim to strategically activate economic development and employment generation. In the following section, the Spatial Plan elaborates on different strategic proposals for the case of Kalobeyei.

**Figure 17:** Economic development, municipal finance and the financial sustainability of the Plan



Source: UN-Habitat

## 6.2 High-tech agriculture for the future of Kalobeyei and Turkana

Agriculture is a main economic sector in Kenya generating over 26% of the total GDP. Within the agricultural sector, employment accounts for 20%, labour force accounts for 75% and export revenues account for 50% (Deloitte, 2017). The main agricultural products for export are tea, accounting for 22.79% of total exports, cut flowers for 13.48%, coffee for 4.52%, and legumes for 2.91% (Atlas of economic complexity, 2018). In fact, Kenya is the 4th largest exporter of cut flowers accounting for 7% of the world’s exports (2013) (UN Comtrade, 2014).

Nevertheless, Kenya has yet to optimize the full potential of its agriculture sector as it primarily depends on rain fed agriculture, resulting in huge variability of production by region due to rainfall inconsistency (Muraya, 2017). In addition, a large portion of the country is not used for agricultural production due to its arid and semi-arid conditions. Expanding agricultural production into these arid and semi-arid areas, such as Turkana County, would reduce regional disparities and simultaneously increase business opportunities and productivity within the agricultural sector.

In the case of Turkana County, there are significant benefits in promoting agriculture in the region, such as addressing the pressing issue of food security. Typically, local agriculture has been a very limited source of food for the community and aid agency allocations managed by the World Food Programme are the primary source of food provision, supplying the refugee population exclusively. In addition to the massive influx in the refugee population, the depletion of water sources adds further strain on food security. The need to feed over 250,000 people present in the Kalobeyei area ensures a “captive market” which could be secured in part by an agreement with the WFP (World Food Programme). The pressing issue of water availability is an additional limitation to the development of large-scale agriculture in the area and remains to be addressed. The existing sources are heavily dependent on rainfall, reservoirs and an aquifer, serving only in a limited capacity for larger scale projects. Despite this, the context of Kalobeyei does still offer a good opportunity for investment into larger scale irrigation project and could later also serve as pilot example for the rest of the country to replicate.

Counties throughout Kenya are in need for investments of irrigation infrastructure. Within the 9.2 million hectares of agricultural land in Kenya, only 54,000 hectares are currently well irrigated (International Trade Centre, 2016). There are however significant opportunities for public-private partnerships to implement innovation irrigation projects for arid and semi-arid regions, which could also then be scaled up nationwide. For example, recycling waste water or desalination with solar energy, which has already proved successful in other arid regions in Australia, India and the state of Israel. With Turkana county being one of the most impoverished counties in Kenya, being also one of the counties in most need of adequate water management infrastructures and water supply source investments, the costing of a water dam is not included within the costing scope of the Kalobeyei New Settlement spatial plan. The dam project would have proven too costly in the context of Kalobeyei New Settlement’s total costs as a county level infrastructure investment. Regarding the Spatial Plan, agricultural plots are strategically located near waterbeds, and irrigation channels.

Further limitations to the development of large-scale agriculture in the area are the lack of energy and good connectivity. Thanks to recent technical progress however, drylands and arid areas offer the opportunity to establish solar energy plants. These plants can provide renewable, cheap energy and compensate for the energy-intensive process of water irrigation. Development of the LAPSSSET corridor also offers a great opportunity, as the A1 Kitale-Lodwar-Lokichogio-Juba Highway is set to become one of the main transport hubs of the country connecting Kenya with Ethiopia, South Sudan and Uganda.

An advantage of the Kalobeyei New Settlement is the provision of agricultural land secured by the Spatial Plan. There are 617,54ha provided for agricultural use from which 439,64ha are designated for large-scale agriculture, 177,93ha for medium scale or urban agriculture. Agricultural projects would also require a large labour force, of which the Kalobeyei New Settlement would encompass in the long term.

### 6.3 Meat and livestock products

Livestock production in Turkana County is currently run by nomadic pastoralists, whom are scattered within the country. Livestock is a major economic activity in the county, being one of the primary forms of income for most households (Oxfam, 2015). This sector has a high potential to grow, especially in regards to the forecasted refugee population growth, which in turn would increase the intra-county domestic demand. Per Oxfam (2015), the high concentration of people in Kakuma refugee camp has turned the camp into the largest meat and livestock market center in the Turkana County, indicating increased demands in the sector. Given that the Kalobeyei New Settlement population is projected to increase to 60,000 by 2020 and 129,590 by 2050, the settlement would significantly increase the current additional “captive market”.

There are however different factors significantly constraining the current meat production market for internal and external consumption including the limited number of slaughter facilities, lack of freezers and no modern butchery facilities. High transportation costs also significantly deter exports outside of the county.

Meat production systems can however be enhanced in several ways. For example, slaughterhouse facilities can be equipped with cooling systems, which would allow pastoralists to slaughter their animals and be less vulnerable to loss of cattle during harsh droughts. These measures should be accompanied by refrigerated transportation to deliver the meat to internal as well as external markets. This could also create a marketing strategy for a brand name promoting a fair-trade quality position and advocating for the creation of job opportunities for the refugee population.

Kalobeyei has the potential to become a main market hub for meat production in Turkana. Given its proximity to transport routes as well as to Kakuma camp being only 12 km away, makes the site easily accessible. Considering that investments could enable access to electricity in the area, the site also presents itself as an adequate area to host slaughter facilities where pastoralists can sell their meat to generate income. Additional livelihood opportunities from meat transportation can also be created.

## 6.4 Moving along the value-chain: Leather and derived products

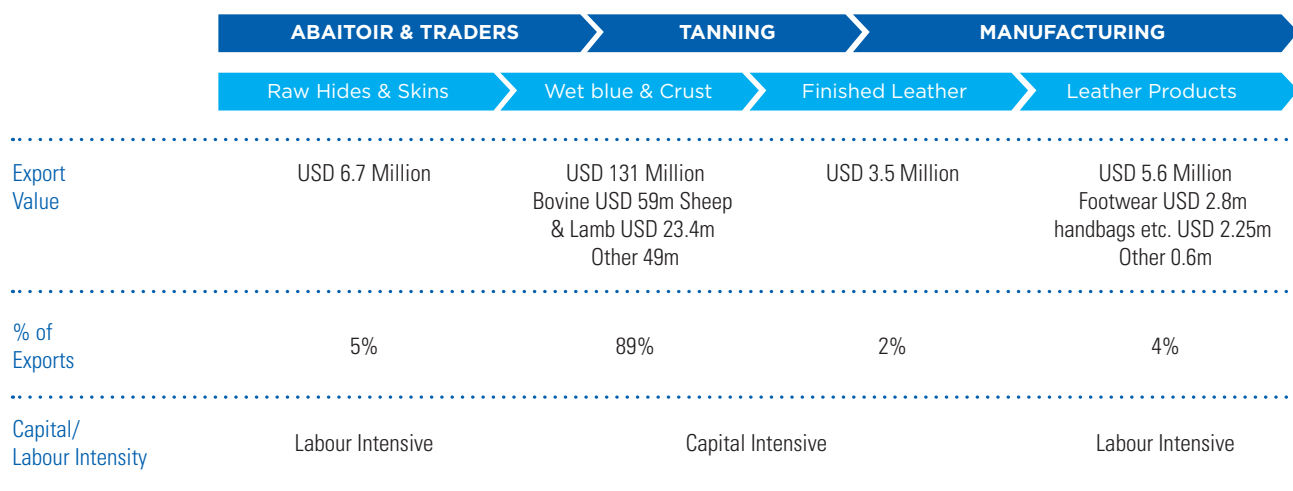
Other potential economic activities within the livestock value chain could be the production of leather and leather end products. The value chain of leather products consists of raw hides and skins, tanning and manufacturing of leather products. The process of tanning includes wet blue and crust production as well as the production of final leather. In Kenya, 89% of the leather production activities are concentrated in the production of semi-processed tanned wet blue and some crust leather (World Bank, 2015). In 2013, per UN Comtrade, wet blue and crust accounted for 89% of total leather exports in Kenya, while whole finished leather products only accounted for approximately 6%. (World Bank, 2015). Production is also significantly concentrated in exports, which account for approximately 90% of the leather products.

The Kalobeyei area could capitalize on the existing livestock economic activity as well as the production of raw hides and skins. Although this activity is not the most significant

in Kenya in terms of number of exports, it is a labor-intensive industry that can generate an increased number of employment opportunities. Concurrently, it is a sector that is less dependent on energy and water, in comparison to the other phases of the value chain making it suitable for this context.

Raw hides and skins can be sold to tanneries, which are located across the country and have a significant presence in Nairobi, Athi River and Nijru Market (World Bank, 2015). This initiative could become a joint effort with tanneries interested in having better quality raw hide and skins, which could then become certified with a fair-trade qualification. This economic activity would also benefit most from being developed similarly to a large livestock production as well as the availability of a large labour force. Improvement of transportation and energy infrastructure in Kalobeyei area would need to be taken into consideration to provide the appropriate conditions for investment in processing industries of raw hide and skins as well as economic development in the area in general.

**Figure 18:** Value chain of leather products in Kenya



Source: UN-Habitat

## 07

## CONCLUSIONS AND RECOMMENDATIONS

The financial sustainability strategy for Kalobeyei states that the building of infrastructures detailed in the “Kalobeyei New Settlement Advisory Local Physical Development Plan” until 2020, providing services for 60,000 people, will cost near a total of **236,140,944.92 USD**. This translates into an investment of **3,963 USD per capita** and **19,678 USD per household**. Accounting for the direct services associated with household provision - shelter, electricity, water and sanitation, the investment needed is of **1,053 USD per capita** and **5,269 USD per household**.

This number however increases when accounting for the projected population growth within the site, forecasted to reach 129,590 people by 2050. The increase in population will lead to an increase in demand for built infrastructure and expanding basic services. This would translate into a total upfront investment of **508,847,861.95 USD**, needed by 2050. This results in an increase of **272M USD**, relative to the investment needed by 2020.

Taking into consideration maintenance costs will be essential for the financial sustainability strategy of the settlement. In fact, maintenance costs will be the highest cost of the Spatial Plan until 2050. While the total amount for capital investment required until 2050 is **508M USD**, maintenance increases the total costs to **2,2B USD**. Capital investment costs represent over the 74% of the investment in the first years until 2020 and from 2021 onwards, maintenance costs account for 81% of the annual investment needed.

The Financial Plan presented has also shown the economic benefits of investing in a higher quality infrastructure, as low infrastructure presents higher maintenance costs in the long-term. From the three different standards, the lower infrastructure standard has 30% higher maintenance costs, while the savings of the capital investments are only of 28%. The highest infrastructure standard, despite presenting elevated upfront investment costs would ultimately result in significant savings within the maintenance costs for streets.

The amount of investments required in the long-run for both capital investments and maintenance highlight the importance of the financial sustainability strategy. In this regard, this report has advocated for the economic development of the area and highlighted the fundamental role it plays in the sustainability of the Spatial Plan for both refugee and the host communities. Economic development is the condition to enhance the sustainability of the Spatial Plan and engage the private and public sector in contributing to the investments needed.

A high-tech agriculture strategy, based on innovative irrigation, has been proposed herein to enhance employment generation and increase irrigation based agriculture in the country. The strategy can also help address the pressing issue of food security in the region. In addition, the Spatial Plan also suggests to enhance the livestock sector by boosting existing activities and increase growth in the livestock value-chain by suggesting skin, rawhide and leather production on a national scale.

These measures combined would not only contribute to the livelihoods of refugees, they would also help create employment opportunities both for both refugee and the host communities, contributing to the overall development of the new settlement as well as Turkana County. Existing international investments in the area addressing the refugee influx provide the opportunity to further expand developments in the region, including the development of the LAPSET corridor as well as oil revenue generation.

# 08

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## 09

## ANNEX

## 9.1. Annex 1: Detailed analysis of the Financial Plan

### 9.1.1 Housing

#### a. Assumptions

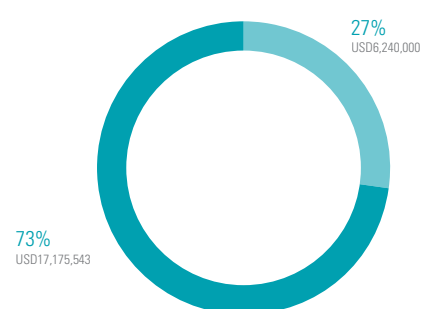
Regarding capital investment costs for housing, cost estimates are based on information provided by the UN-Habitat team, currently working on the development of a housing upgrading prototype. Temporary housing units cost 400 USD. The housing upgrading prototype for the Spatial Plan has not been determined yet, however cost estimates of an average standard are 1,100 USD per unit. This has been calculated based on UN-Habitat statements indicating that capital investment costs of prototypes currently under discussion, range between 600 and 5,000 USD. The low standard of upgrading has a unit cost of 600 USD and the high standard has a cost of 5,000 USD. Under both standards, quantity of housing and unit costs remains the same.

Maintenance cost estimates for housing are based on information provided by UNHCR. It is indicated that maintenance costs will take up 6% of the capital investment, annually. The estimates in this Financial Plan have not accounted for maintenance costs of temporary shelters, as they are only intended to be used for a limited period.

#### b. Capital Investment Costs

Total capital investment costs for housing in the Spatial Plan is estimated at 23,415,543 USD until 2020. The number totals the costs of building 12,000 temporary shelters and 12,000 housing upgrading units. Regarding the cost breakdown, 27% (6,240,000 USD) need to be invested in temporary shelters and 73% (17,175,543 USD) in the housing upgrade (Graph 14).

**Graph 15:** Breakdown of Housing Capital Investment Costs for the Spatial Plan by 2020



Source: UN-Habitat

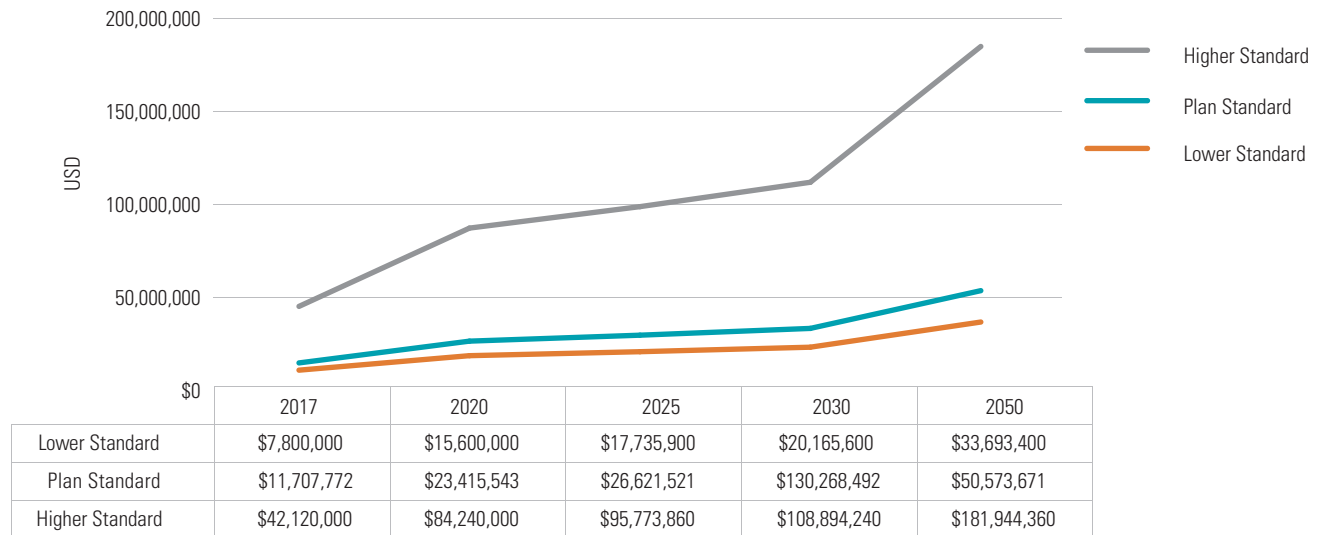
**Table 4:** Assumptions and unit costs for low, medium and high housing quality standards investments

Standard	Quality	Quantity	Unit Cost
Plan	Average	12,000 temporary housing units and 12,000 upgrading units	Housing upgrade: 1,101 USD T-Shelter: 400 USD
Low	Low	12,000 temporary housing units and 12,000 upgrading units	Housing upgrade: 600 T-Shelter: 400 USD
High	High	12,000 temporary housing units and 12,000 upgrading units	Housing upgrade: 5,000 USD T-Shelter: 400 USD

Source: UN-Habitat

To accommodate the forecasted population growth, Graph 15 presents the total Capital Investment Cost required until 2050. The “Kalobeyei Settlement Advisory Local Physical Plan,” herein referred to as “Spatial Plan Standard” presents a needed investment of 50,573,671 USD by 2050. On the other hand, the costs by 2050 of the lower standard would be a total of 33,693,400 USD and 181,944,360 USD for the higher standard.

**Graph 16:** Housing Capital Investment Costs for low, medium and high standard by 2050



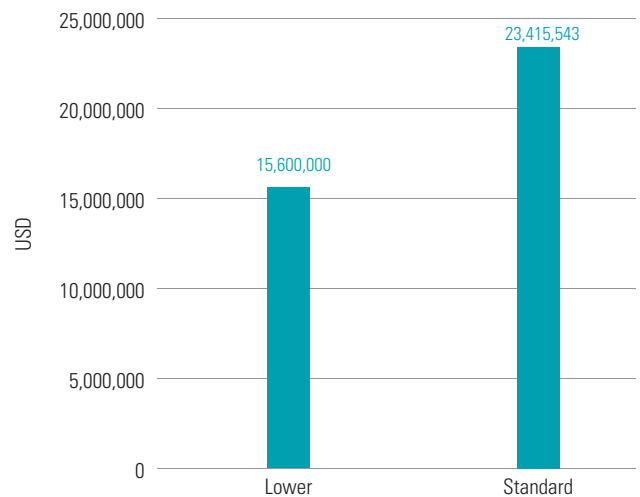
Source: UN-Habitat

When examining the comparison of capital investments between housing standards by 2020 (Graph 16), the total costs of a lower standard are 15,600,000 USD and 84,240,000 USD for the higher standard. This means that by 2020, a lower standard would save 33% in costs in the Spatial Plan. In contrast, the higher standard would cost 260%.

### C. Maintenance Costs

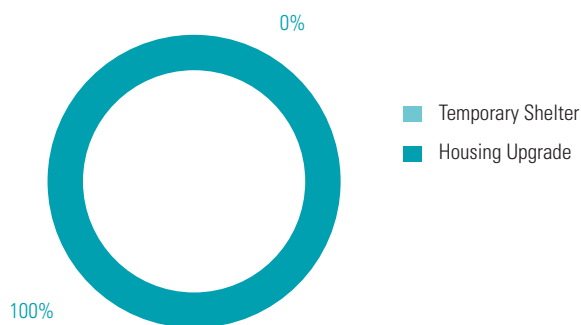
To implement the Spatial Plan by 2020, the annual maintenance investment for housing is estimated at 1,030,533 USD, based on the assumptions made in section B) Capital Investment Costs. Also, stated in section B, no maintenance costs were accounted for temporary shelters, as they are only intended for a limited period. The maintenance costs for housing upgrades will thus account for 100% of total housing maintenance costs (Graph 17).

**Graph 17:** Comparison of Housing Capital Costs for low, medium and high quality standards by 2020



Source: UN-Habitat

**Graph 18:** Breakdown of Housing Maintenance Costs for the Spatial Plan by 2020

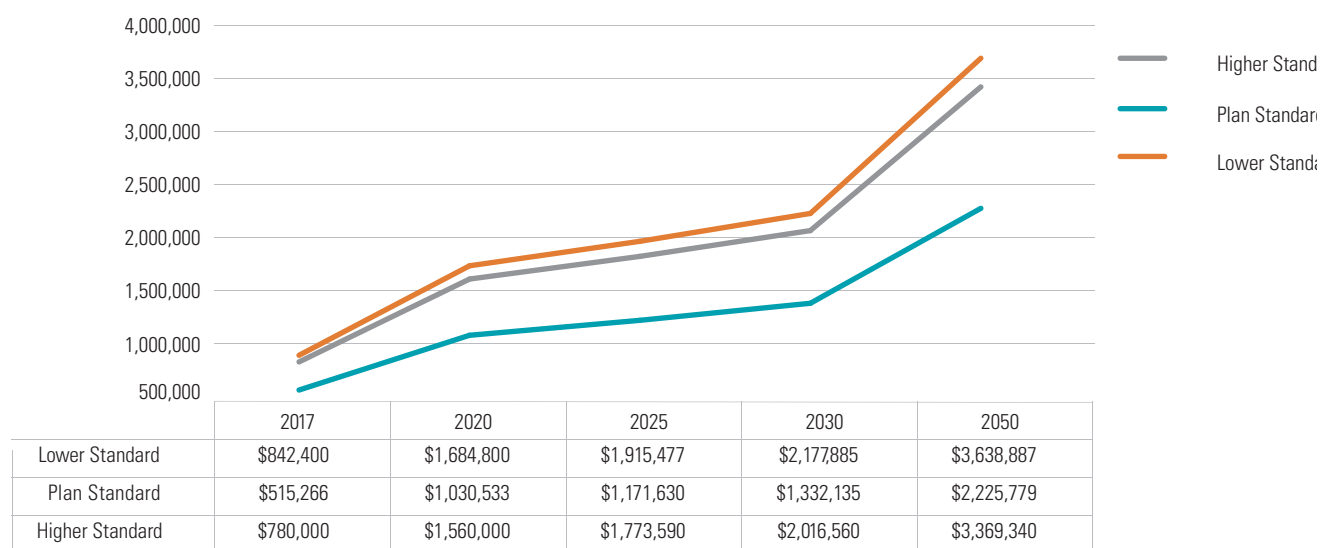


Source: UN-Habitat

Regarding the accumulated costs by 2050, the annual Maintenance Cost required for the Spatial Plan in 2050 is 2,225,779 USD compared to the 1,030,533 USD needed in 2020. This indicates a steadily positive increase in the annual maintenance costs (Graph 18). By 2050, the costs of the lower standard will amount to 3,638,887 USD and costs of the higher standard will amount to 3,369,340 USD.

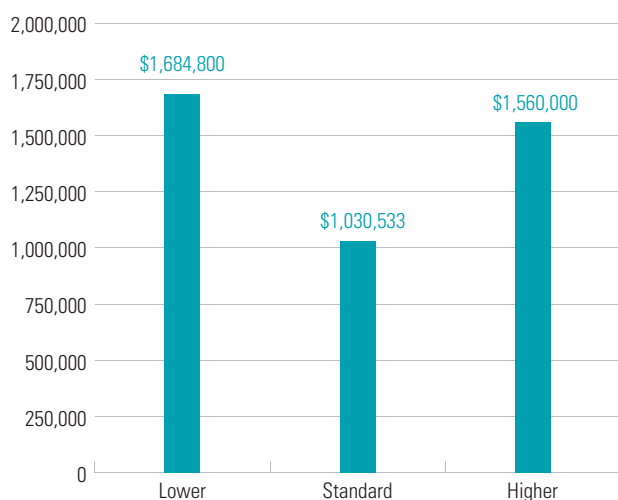
Comparing the maintenance costs by 2020 across the low, medium and high standards (Graph 19), the low housing standard would imply a 63% (1,684,800 USD) increase of maintenance costs in the Spatial Plan. This is due to the high frequency of repair and replacements. By contrast, the higher standard would imply a 51% (1,560,000 USD) increase in maintenance costs, mainly attributed to the high capital investment.

**Graph 19:** Housing annual Maintenance Costs for low, medium and high standard by 2050



Source: UN-Habitat

**Graph 20:** Comparison of Housing Maintenance Costs for low, medium and high quality standards by 2020



Source: UN-Habitat

## 9.1.2 Water and Sanitation

### a. Assumptions

Regarding capital investment costs, unit cost estimates for water and sanitation were derived from plural sources, including data from the Kenyan Water and Sanitation for the Urban Poor organization and the Water Research Commission of South Africa and India.

There are three different standards concerning water and sanitation, differing in quality and quantity of service provision provided in the Financial Plan (Table 5). The estimations account for individual household water connections and one VIP latrine per household. It should be noted that this type of service provision is only accounted for in the final phase of the Spatial Plan, while the emergency and transitional phases account for lower quality levels in services provision.

The lowest quality of service provision would consist of communal water connection points and one basic single latrine per two households. Finally, the highest standard would consist of an individual household water connection and two Bio toilets per household.

**Table 5: Assumptions and unit capital investment costs for low, medium and high water and sanitation quality standards investments**

Standard	Water	Sanitation
Plan	Individual household connection	1 VIP toilet per household (474 USD per unit)
Low	Communal connection points	2 basic single latrine per 2 household (300 USD per unit)
High	Individual household connection	2 bio toilets per household (1,063 USD per unit)

Source: UN-Habitat

Unit costs of sanitation facilities differ between quality standards of service provision. The unit costs for sanitation facilities are as follows: 474 USD per unit for VIP pit latrines, 300 USD for a basic model of pit latrines and 1,063 USD for bio toilets.

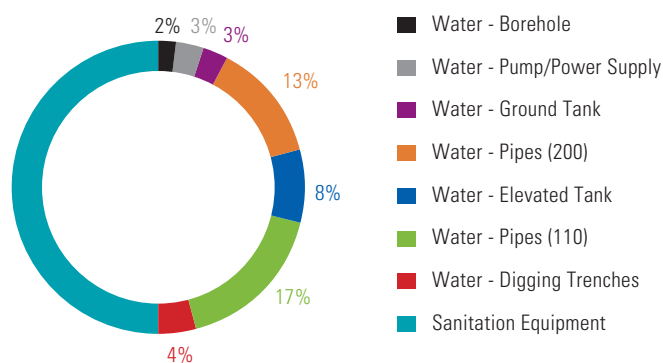
Water service provision only differs in quantities between the quality standards. For each standard, there is the same number of boreholes (eight), solar pump (eight), ground tanks (eight), elevated tanks (17), and pipes of 200 ml (46,055 m). The standards differ only in the quantities of 100 ml pipes, which are the final connection to households. The Spatial Plan and the higher standard account for individual household water connections, using the 100ml pipes, constituting a total of 170,165 m of pipes<sup>5</sup>.

Maintenance costs estimates are based on data provided by IRC Wash as well as the Kenyan Ministry of Water and Irrigation. A basic pit latrine costs 1.8 USD per person per year, a VIP (Ventilated Improved Pit) latrine costs 13.5 USD per person per year and a bio toilet is maintenance free. The annual maintenance costs for other water provision infrastructure, which includes boreholes, pipes, solar pumping systems, ground tanks and digging trenches, are calculated at 10% of the investment cost. This is will be based on the lifespan of the installation and the likelihood that the installation will need replacement during its lifetime.

### b. Capital Investment Costs

The total water and sanitation Capital Investment for the implementation of the Spatial Plan by 2020 is estimated at 14,918,659 USD. The costs breakdown (Graph 20) constitutes of 50% in sanitation facilities (7,397,471 USD) and 50% in water connection. The costs breakdown for water connection infrastructure are: pipes of 110 ml accounting for 17% (2,452,033 USD), pipes of 200 ml accounting for 13% (1,990,921 USD), elevated tanks accounting for 8% (1,224,666 USD), dug trenches accounting for 4% (588,711 USD), solar pumps accounting for 3% (475, 206 USD), ground tanks also accounting for 3% (475,206 USD) and boreholes accounting for 2% (314,445 USD).

**Graph 21: Breakdown of Water and Sanitation Capital Investment Costs for the Spatial Plan by 2020**



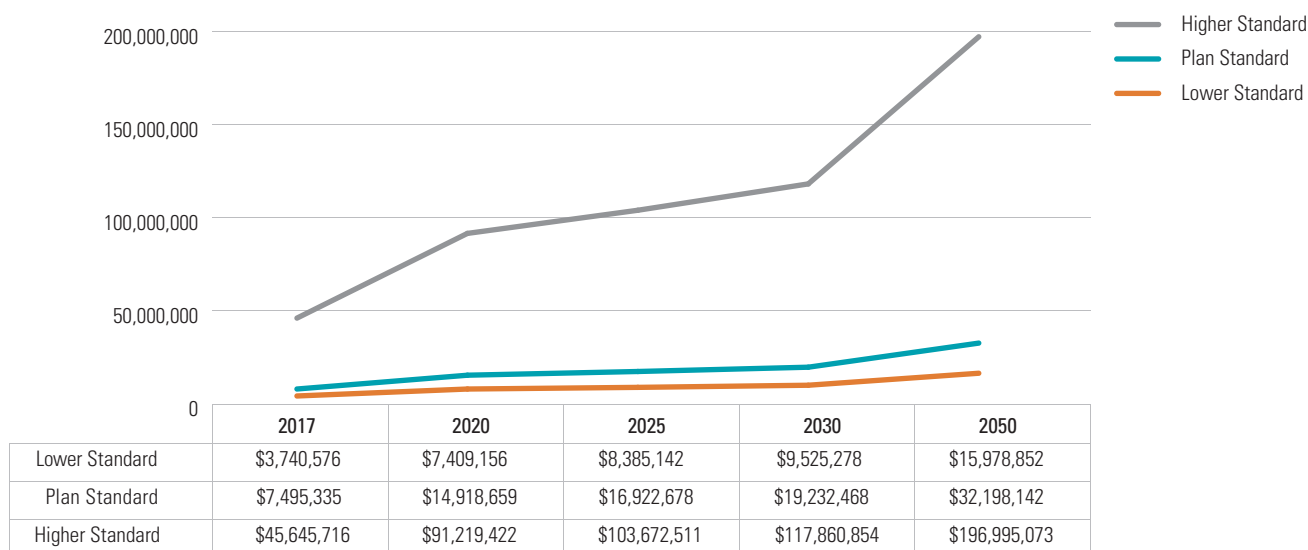
Source: UN-Habitat

With the consideration of the projected population growth until 2050, the Plan would have a total capital investment cost of 32,198,142 USD (Graph 21). The lower standard would cost 15,978,852 USD and the higher standard 196,995,073 USD.

When comparing the capital investment costs of the Spatial Plan to the different standards (Graph 22), by 2020 the lower standard would equate to a cost saving of 50% compared to the Spatial Plan, costing 7,409,156 USD. In contrast, the high standard would equate to a 511% increase, costing 91,219,422 USD.

<sup>5</sup> This number derives from the quantities combined of tertiary (98,968 m) and secondary (71,197 m) roads combined. The meters are retrieved the road provision envisioned in the Spatial Plan.

**Graph 22:** Water and Sanitation Capital Investments Costs for low, medium and high standard by 2050

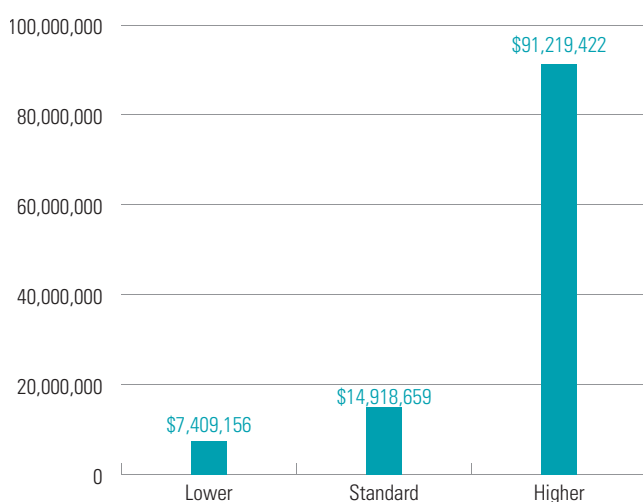


Source: UN-Habitat

**c. Maintenance Costs**

Concerning maintenance costs for water and sanitation, annual costs of the Spatial Plan by 2020 is estimated at 1,803,141 USD. Sanitation infrastructure takes over most the costs comprising of 58%. For water provision the maintenance costs are significantly driven by pipes:13% for 110ml and 11% for 200ml.

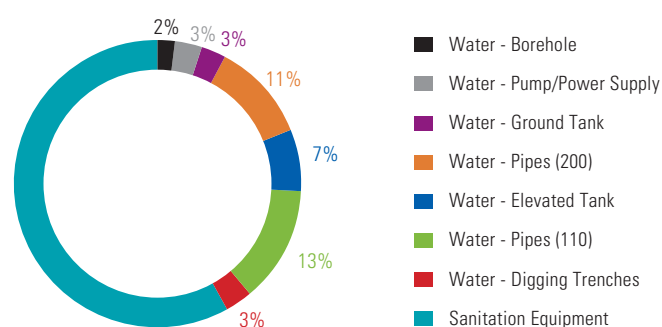
**Graph 23:** Comparison of Water and Sanitation Capital Investment Costs for low, medium and high quality standards by 2020



Source: UN-Habitat

Accounting for projected population growth for 2050, the annual Maintenance Cost required for the Plan by the same year is 3,892,116 USD as opposed to 1,803,141 USD in 2020. This indicates a steady increase of the annual maintenance costs. By 2050 the annual maintenance cost is 4,165,726 USD for the lower standard and 4,178,763 USD for the higher standard.

**Graph 24:** Breakdown of Water and Sanitation Capital Investment Costs for the Spatial Plan by 2020



Source: UN-Habitat

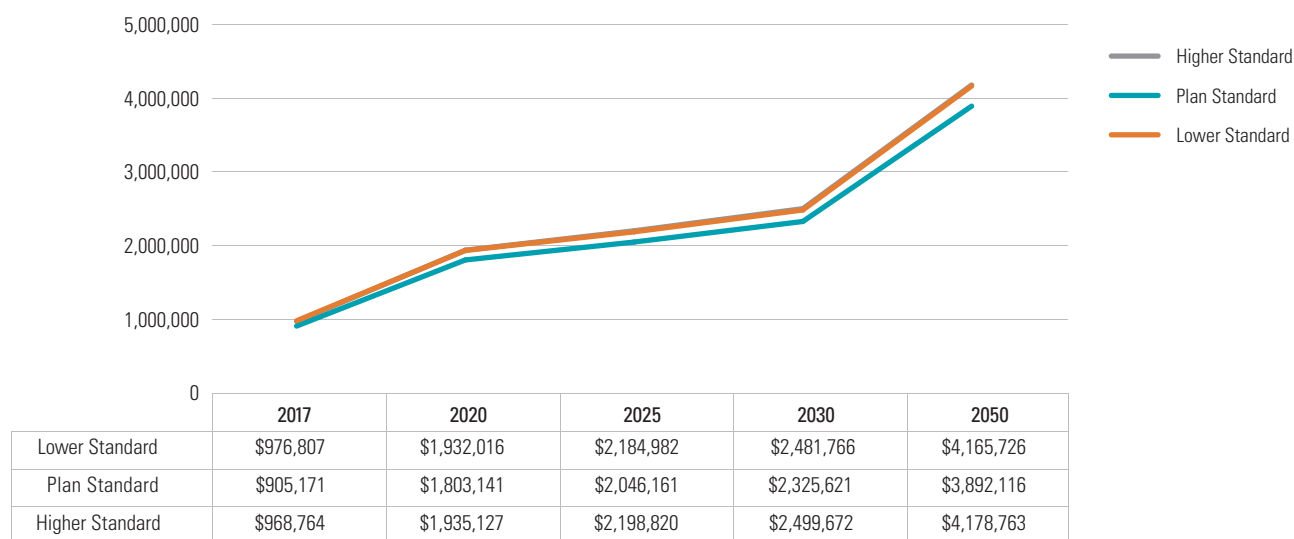
It can be observed in Graph 25 that by 2020, both the lower and the higher standard present higher maintenance costs than the Plan. The lower standard implies a 8% increase in maintenance costs (1,932,016 USD) while the higher standard presents a 7% increase (1,935,127 USD).

**9.1.3 Roads**

**a. Assumptions**

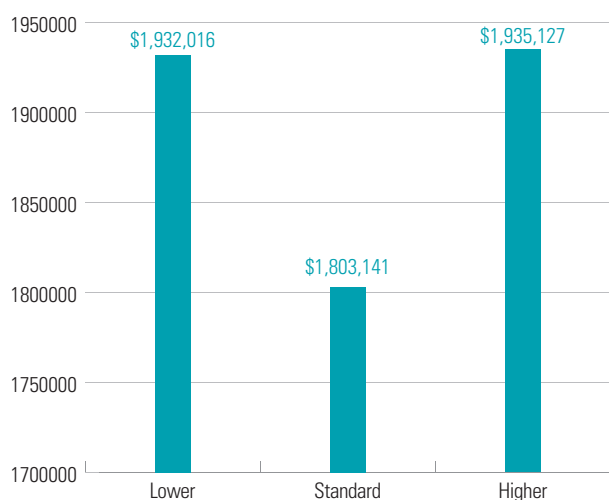
Cost estimates for streets include road material, the drainage systems and street lighting. Calculations are based in the road system proposed in the Spatial Plan, which includes arterial, primary, secondary and tertiary roads. This amounts to a total road area of 56.22 Ha.

**Graph 25:** Water and Sanitation annual Maintenance Costs for low, medium and high standard by 2050



Source: UN-Habitat

**Graph 26:** Comparison of Water and Sanitation Maintenance Costs for low, medium and high quality standards by 2020



Source: UN-Habitat

As shown in Table 6, calculations for the Spatial Plan account for the construction of arterial streets in tarmac and gravelling for the rest, street lighting every 20 m in primary and arterial roads, a normal main formalized drainage system for arterial streets and an open ditch drainage system for the remainder.

Calculations for the low standard on the other hand, include the gravelling of the whole street network, street lighting every 30m and an open ditch drainage system for the whole street network. Finally, the calculations for the high standard includes tarmac for all arterial streets and primary roads, street lighting every 10 m and a main formalized higher drainage standard for secondary and tertiary roads.

**Table 6:** Assumptions for Streets for low, medium and high standards

Standard	Road material	Street lighting	Drainage
Plan	Tarmac for arterial streets	Street lighting every 20m	Main formalized normal standard drainage for arterial streets, open ditch for the rest
Low	Regravelling for all streets	Street lighting every 30m	Open ditch drainage for all streets
High	Tarmac for arterial streets and primary roads	Street lighting every 10m	Main formalized higher standard drainage for secondary and tertiary roads

Source: UN-Habitat



**Table 7:** Unit capital investment costs assumptions for Streets for low, medium and high standards

Unit cost	Road material	Street lighting	Drainage
	<ul style="list-style-type: none"> <li>Tarmac: 108.76 USD x 1m long and 3m wide</li> <li>Gravelling: 9.60 USD x 1m long and 3m wide</li> </ul>	<ul style="list-style-type: none"> <li>316 USD per unit</li> </ul>	<ul style="list-style-type: none"> <li>Open ditch: 22.9 USD per m</li> <li>Main formalized (normal): 338.2 USD per m</li> <li>Main formalized (high standard): 764 USD</li> </ul>

Source: UN-Habitat

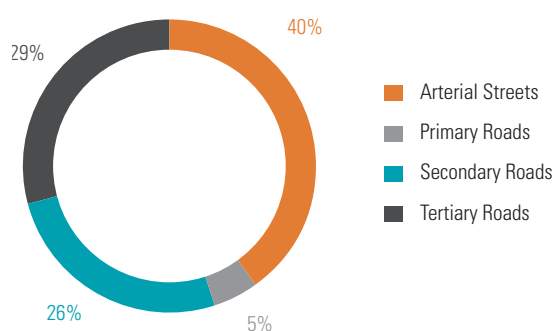
Unit costs assumptions were mainly based on World Bank and African Development Bank projects as well as data retrieved from WHO (World Health Organization). As shown in Table 7, tarmac roads cost 120 USD per m and gravelling costs 14 USD per m. Street lighting accounted in these calculations correspond to a solar street lighting system of 2\*14W, which has a unit cost of 407 USD per unit. Additionally, an open ditch drainage costs 27 USD per m, a normal main formalized system costs 435 USD per m and a high main formalized system costs 764 USD per m.

Concerning maintenance costs, streets have a periodic maintenance cost every 5 years, costing 16,013 USD/km/lane/time, for unpaved roads, and 91,545 USD/km/lane/time for paved roads. Routine maintenance costs are estimated at 2% of capital costs for the year following full rehabilitation, rising to 3% in Year 3, 4% in Year 4 and 5% in Year 5. The cycle repeats after each periodic maintenance.

Drainage is assumed to have a maintenance cost amounting to 8% of the capital cost for both drainage types. The annual maintenance for street lighting is 42 USD per bulb and it should be noted that each street light unit has 2 bulbs.

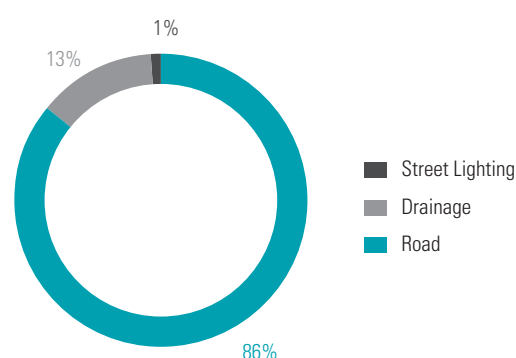
#### b. Capital Investment Costs

In accordance to the Spatial Plan, the total Street Capital Investment by 2020 is estimated at 134,673,784 USD. In terms of street type, arterial streets account for the highest costs, with a total estimation of 53,710,066 USD (40%), following by tertiary roads with 38,465,598 USD (29%), secondary roads with 35,760,434 USD (26%) and primary roads with 6,737,687 USD (5%) (Graph 26).

**Graph 27:** Breakdown of Streets Capital Investment Costs for the Spatial Plan by 2020 by type of road

Source: UN-Habitat

When considering the type of infrastructure, the material of the streets account for 86% of the costs (116,362,044.06 USD), drainage for 13% (17,473,809 USD) and street lighting for 1% (837,931.41 USD) (Graph 27).

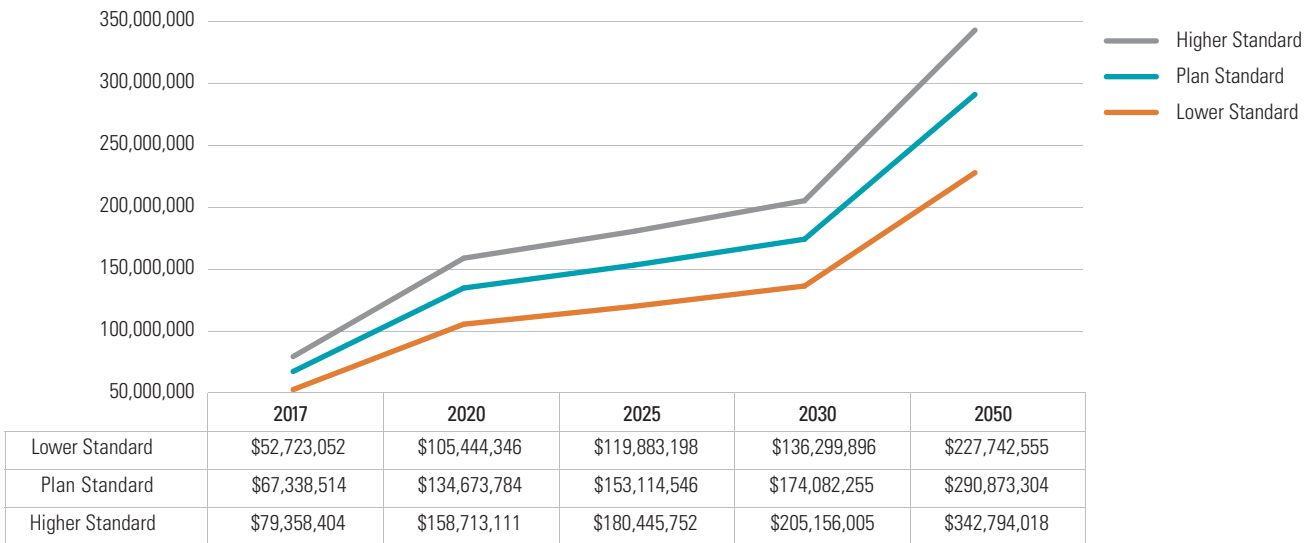
**Graph 28:** Breakdown of Streets Capital Investment Costs for the Spatial Plan by 2020 by type of infrastructure

Source: UN-Habitat

To accommodate the forecasted population growth, Graph 27 also presents the total Capital Investment Cost required until 2050 under each of the three scenarios. By the end of 2050, the cost under the Spatial Plan would amount to 290,873,304 USD, 227,742,555 USD under the lower standard and 342,794,018 USD under the higher standard.

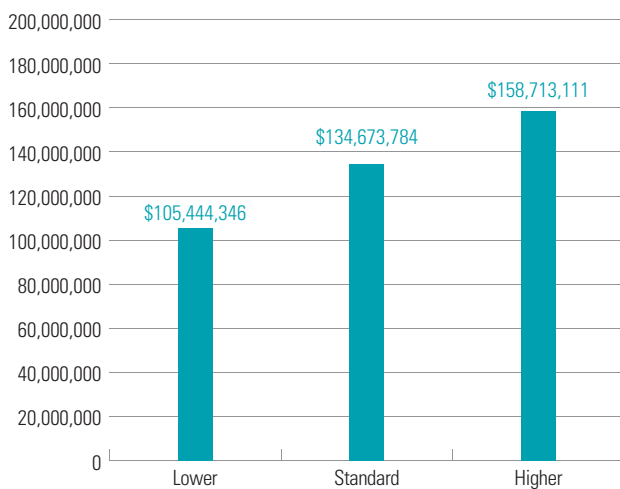
When comparing the costs by 2020 between the Spatial Plan, the lower standard and the higher standard, the lower standard proves less 22% less expensive than the Spatial Plan (105,444,346 USD), while the higher standard is 18% more expensive (158,713,111 USD).

**Graph 29: Streets Capital Investment Costs for low, medium and high standard by 2050**



Source: UN-Habitat

**Graph 30: Comparison of Water and Sanitation Maintenance Costs for low, medium and high quality standards by 2020**

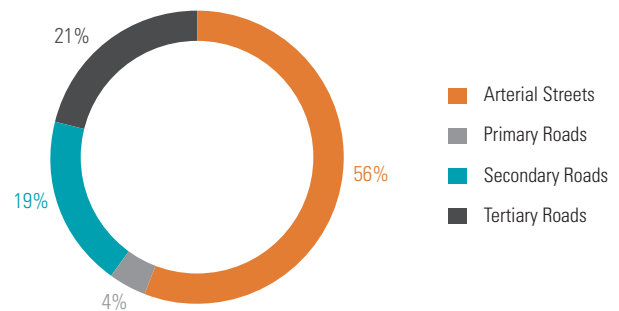


Source: UN-Habitat

**b. Maintenance Costs**

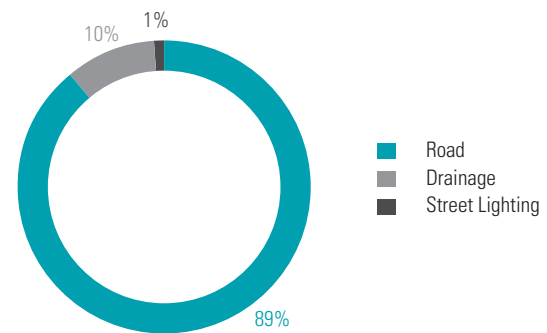
Based on the assumptions named above in section B) Capital Investment Costs, the annual Maintenance Investment for implementing the road network by 2020 according to the Spatial Plan, is estimated at 14,006,183 USD. In terms of the type of roads (Graph 30), arterial streets account for 56% of the costs (7,769,306 USD), tertiary roads account for 21%(2,905,272 USD), secondary roads account for 19%(2,711,748 USD) and primary roads accounting for 4%(619,858 USD). In terms of types of infrastructure (Graph 31), the costs are divided as 89% for roads (12,434,063.23 USD), 10% for drainage (1,397,904.70 USD) and 1% for street lighting (174,215 USD).

**Graph 31: Breakdown of Streets Maintenance Costs for the Spatial Plan by 2020 by type of street**

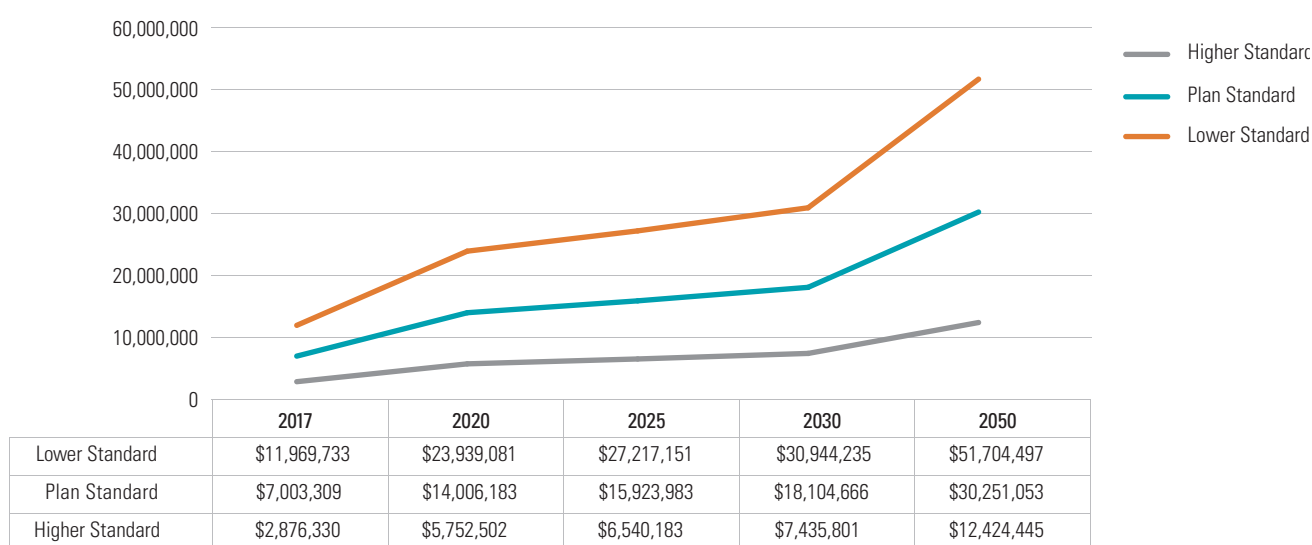


Source: UN-Habitat

**Graph 32: Breakdown of Streets Maintenance Costs for the Spatial Plan by 2020 by type of infrastructure**



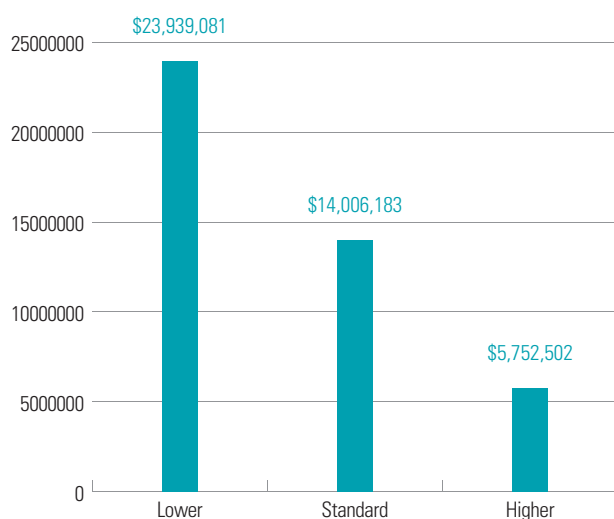
Source: UN-Habitat

**Graph 33:** Streets annual Maintenance Costs for low, medium and high standard by 2050

Source: UN-Habitat

Considering the projected population growth by 2050, the annual Maintenance Cost required by that year would amount to 30,251,053 USD for the Spatial Plan standard, 51,704,497 USD for the lower standard and 12,424,445 USD for the higher standard (Graph 32). Graph 31 also indicates the steady increase in maintenance cost across the years.

Comparing Maintenance Costs by 2020 across low, medium and high standard (Graph 33), it is estimated that a lower standard would result in a 71% increase of the annual maintenance costs (23,939,081 USD) by 2020 and a higher standard would result in a saving of 59% (5,752,502 USD).

**Graph 34:** Comparison of Street Maintenance Costs for low, medium and high quality standards by 2020

Source: UN-Habitat

## 9.1.4 Electricity

### a. Assumptions

Capital Investment cost assumptions for electricity are based on previous Kenyan construction projects. The investment study calculates the electricity costs of the Spatial Plan accounting for the use of solar panel system at the household level with a capacity of 600W. Typically this capacity covers the basic household electricity needs for lighting, device charging and the use of a kettle, microwave, TV, etc.

When comparing the higher and lower standard, the lower accounts for the same household solar panel system only with a lower capacity of 300W. The highest standard accounts for a connection from the main national grid. The Financial Plan accounts for only 2 different possibilities for connecting to the national grid<sup>6</sup>, the first being Kakuma, roughly 35 km away and the second being Town of Turkwel, roughly 185 km away.

When considering maintenance costs for electricity, the maintenance cost for a solar panel system is 5% over the total capital expenditure. This 5% is comprised of regular maintenance, accounting for 1% and life expectancy (25 years), accounting for 4%.

For a national grid connection, maintenance and energy losses during the 40-year lifespan of the connection (based on a medium capacity connection with two circuits, each with 3190 MW ratings) amounts to 85,536 USD per km annually in overhead line costs.

<sup>6</sup> The calculations for the capital costs for expanding the national grid are detailed in Annex 1

**Table 8:** Unit capital investment costs assumptions for Electricity for low, medium and high standards

Standard	Service Provision	Unit Cost
Plan	Solar panel at a household level 600W	2,400.00 USD per unit
Low	Solar panel at a household level 300W	1,200.00 USD per unit
High	National grid introduced from 1) Turkwel (185 km) or 2) Kakuma Town (35km)	157,053,252 USD from Kakuma Town and 164,688,960 USD from for 60,000 people

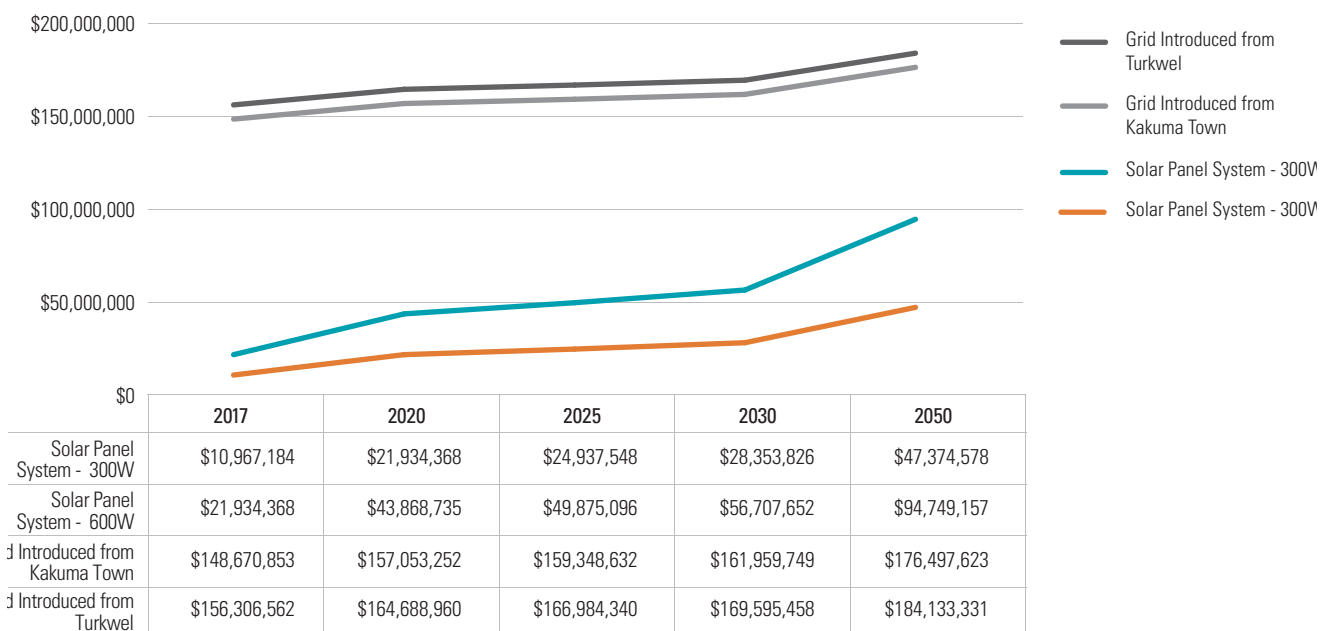
Source: UN-Habitat

**b. Capital Investment Costs**

The total Capital Investment for r electricity provision per the Spatial Plan is estimated at 43,868,735 USD by 2020, accounting for a capacity of 600W per household using a solar panel system.

Considering the projected population growth, the investments required for implementation of the Spatial Plan would be 94,749,157 USD by 2050. The lower standard, with a capacity of 300W would cost 47,374,578 USD and the higher standard, connecting to a national grid, would either cost 176,497,623 USD (from Kakuma town) or 184,133,331 USD (from Turkwel) (Graph 34).

**Graph 35:** Electricity Capital Investment Costs for low, medium and high standard by 2050

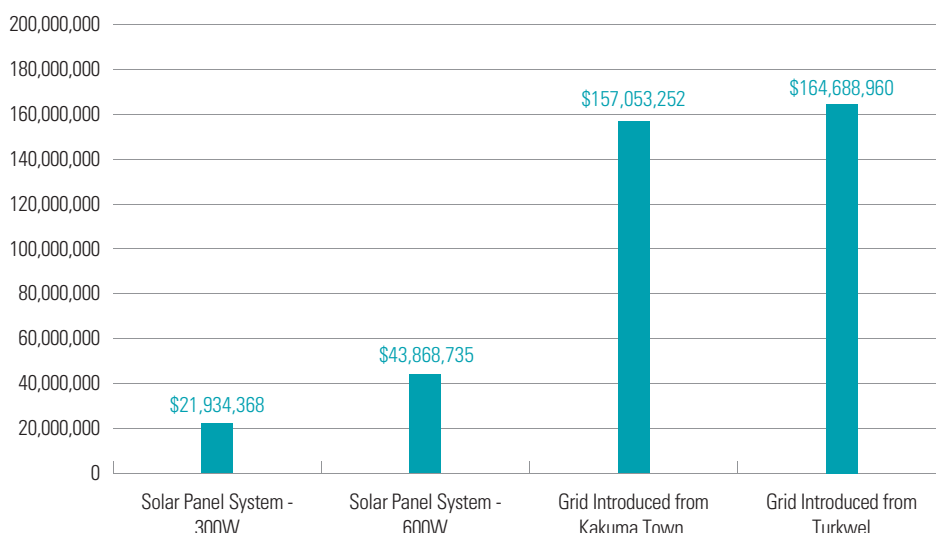


Source: UN-Habitat

When comparing the projected costs between the low and high standards for 2020, the lower standard, which accounts for the use of a solar panel system with a 300W capacity, would imply a 50% decrease in the costs (21,934,368 USD). By contrast, the higher standard, which accounts for the connection to a national grid, would increase capital investment costs to 258% (if connected to Kakuma town) or 275% (if connected to Turkwel) (Graph 35).

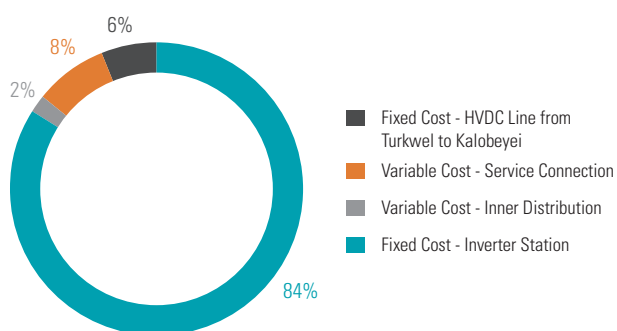
For an improved understanding of the capital investment need for national grid system, Graph 36 breaks down costs into fixed and variable. Fixed costs are the necessary costs for connecting Kalobyei to the national grid and variable costs refer to the costs of infrastructure for electricity distribution to each household as well as service connection. Fixed costs represent 90% and variable costs represent 10% (Graph 36). The investment for fixed costs would amount to 148,220,064.28 USD.

**Graph 36:** Electricity capital Investment costs for low, medium and high standard by 2020



Source: UN-Habitat

**Graph 37:** Breakdown of capital investment costs of a national electricity grid system



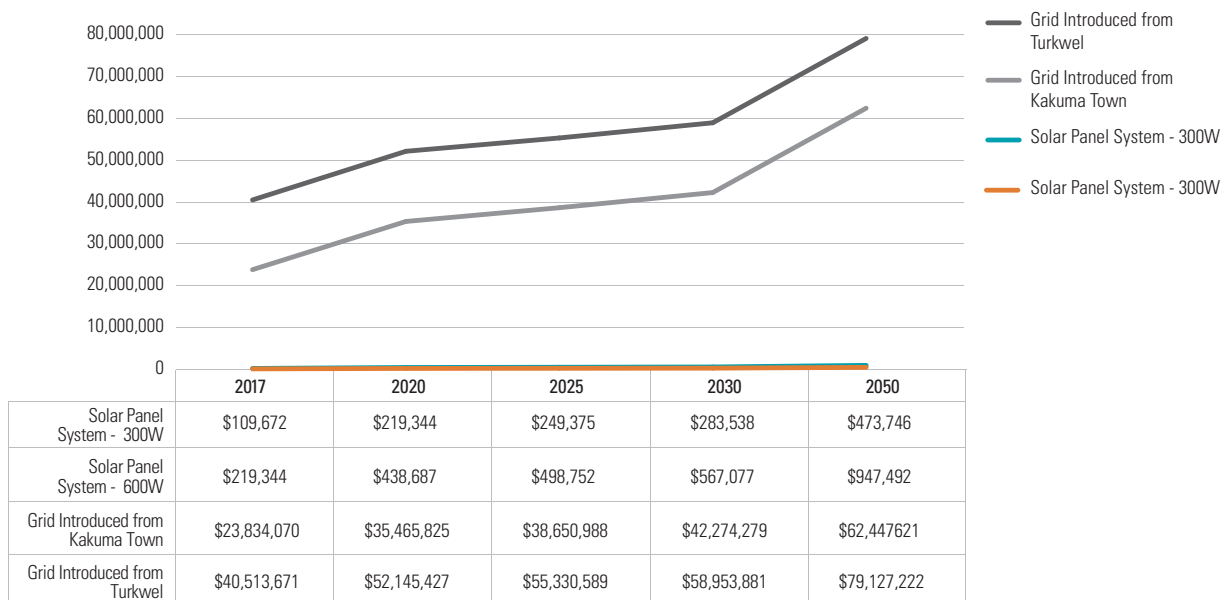
Source: UN-Habitat

*c. Maintenance Costs*

The annual maintenance cost for the implementation of electricity provision using the solar panel system with a 600W capacity per household is estimated at 438,687 USD by 2020.

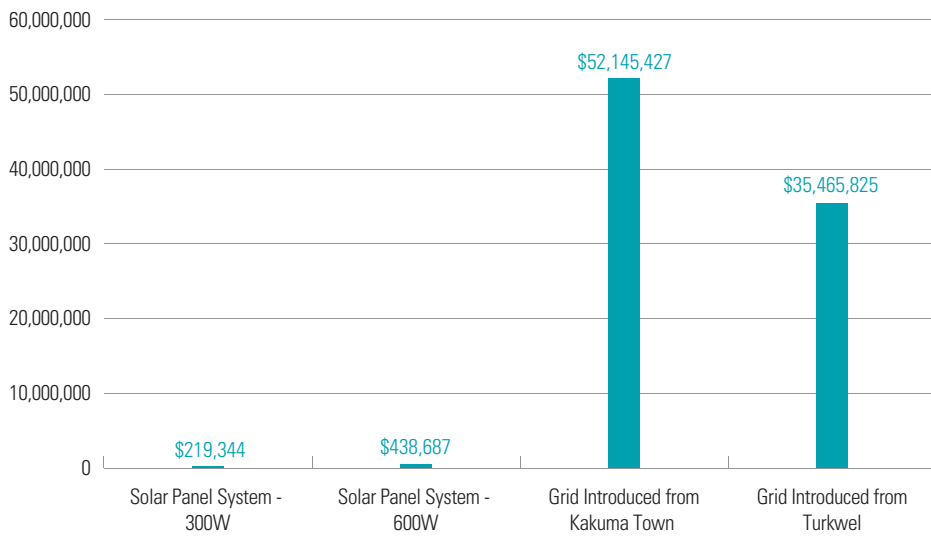
Considering the projected population growth, the investments required for implementation of electricity provision according to the Spatial Plan would be 947,492 USD by 2050. The implementation of a solar household system with the lower capacity of 300W would cost 473,746 USD and a national grid electricity system would cost 62,447,621 USD (if connected to Kakuma Town) and 79,127,222 USD (if connected to Turkwel) and Graph 37 shows the steady overall annual increase of costs.

**Graph 38:** Electricity annual Maintenance Costs for low, medium and high standard by 2050



Source: UN-Habitat

**Graph 39:** Electricity maintenance costs for low, medium and high standard by 2020

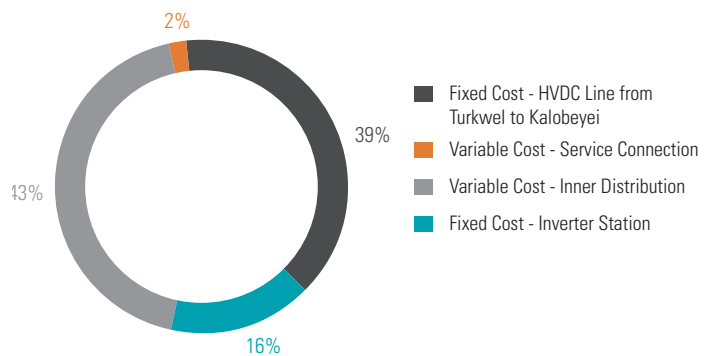


Source: UN-Habitat

When comparing projected investments needed by 2020 for electricity provision in the Spatial Plan to the lower and higher standards, the lower standard, which accounts for the use of a solar panel system with a 300W capacity, would imply a 50% decrease in the costs (219,344 USD). By contrast, the higher standard, which accounts for the connection to a national grid, would surpass the investment stated in the Spatial Plan by 80 times (35,465,825 USD from Kakuma Town and 52,145,427 USD from Turkwel).

The electricity system connected to the main national grid has a high investment cost in maintenance. However, this can be a strategic investment considering Kalobeyi's future needs for local economic development, especially since national grid equipment is an enabling condition for many industrial activities. For an improved understanding of the maintenance costs, see the cost breakdown in Graph 39.

**Graph 40:** Breakdown of maintenance investment costs of a national electricity grid system



Source: UN-Habitat



The maintenance costs for a grid system connected to Turkwel are divided between fixed and variable costs. While the fixed costs represent 55% of the total maintenance costs, variable costs account for 45%. Variable costs correspond mainly to the inner distribution of electricity into each household (43%). A grid system connected to Kakuma for industrial use only would have a maintenance cost of 23,465,441.99 USD.

### 9.1.5 Community Facilities

#### a. Assumptions

To provide for 60,000 inhabitants and reflect the projected population growth, assumptions for quantities of community facilities (including education, health and public facilities), following the UNHCR emergency handbook, are all based on the Spatial Plan. Unit costs assumptions for capital investments however, are based on different sources. Regarding health, unit costs are based on data provided by the IRC as well as reference to sampled construction firms. Building costs for public facilities are based on data provided by UNHCR. Building costs for education facilities are based on data provided by DFID, focusing on assumed costs in Kenya and Sub-Saharan Africa specifically.

Maintenance costs of community facilities consist of facility maintenance and labor. Facility maintenance, employment and salary assumptions are based on World Bank projects within Africa, data provided by the International Committee of the Red Cross as well as average salaries in Kenya (in related occupations).

Facility maintenance for offices and classrooms are assumed to be 2% of capital investment cost. Depreciation is accounted for health facilities, both for general maintenance and for the equipment. Labor costs are accounted by different occupations (e.g. teachers, doctors, and administration staff), different skill levels (e.g. head, above average, average, below average) and employee origin (e.g. host or refugee community member refugees).

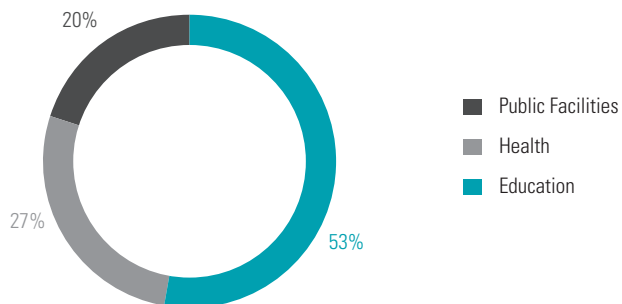
An additional assumption within community facilities infrastructure is that healthcare standards are not measured as part of the costing forecasts. Due to the often-unpredictable nature of the unique humanitarian-development project, the primary assumptions for healthcare standards follow that of the first emergency phase in the Plan. This phase measures quantity provision of healthcare facilities and encourages an increase in numbers. In future phases, a cost-benefit analysis can be conducted to improve the costs of healthcare standards, in turn providing forecasts for worthy investments for the future.

**Table 9:** Unit capital investment costs assumptions for community facilities including education, health and public facilities

Standard	Education	Health	Public Facilities
	<ul style="list-style-type: none"> <li>132 USD per built square metre</li> <li>2,497 USD for furniture per classroom</li> </ul>	<ul style="list-style-type: none"> <li>1 hospital, 3 health centers and 6 health dispensaries</li> </ul>	<ul style="list-style-type: none"> <li>3 police offices, 4 post offices, 3 fire stations, 3 cemeteries, 1 water management center, 3 fire wood distribution center, 1 World Food Programme office, 2 feeding centers, 8 child protection centers, 4 administrative centers, 16 social halls, 1 environmental management center, 1 site market and 18 neighbourhood market</li> </ul>
	<ul style="list-style-type: none"> <li>25 early childhood development centers, 13 primary schools, 3 secondary schools and 3 vocational training centers (5,000 students for secondary schools)</li> </ul>	<ul style="list-style-type: none"> <li>331,570 USD for a health dispensary</li> <li>340,467 USD for a health centre</li> <li>995,231 USD for a district hospital</li> </ul>	<ul style="list-style-type: none"> <li>Building and equipment 291 USD per square meter</li> <li>Warehouse 145 USD per square meter</li> </ul>

Source: UN-Habitat

**Graph 41:** Breakdown of community facilities capital investment costs by type of infrastructure (education, health and public facilities)



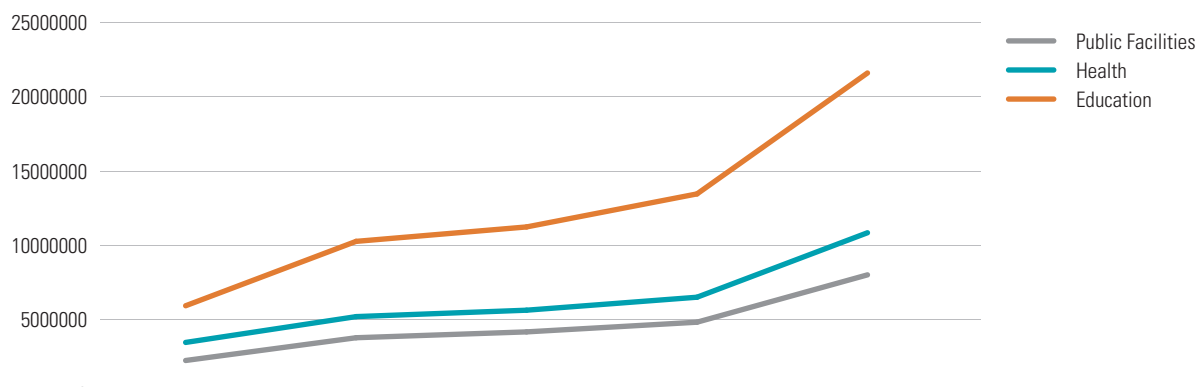
Source: UN-Habitat

**b. Capital Investment Costs**

The total Community Facility Capital Investment is estimated at 19,264,223 USD. Education has the highest cost, accounting for 53% of the total cost (10,268,412 USD), health accounting for 27% of the costs (5,207,868) and public facilities for 20% (3,787,943.92 USD).

Accounting for the projected population growth by 2050, the total amount of investment needed for community facilities is 40,453,589 USD. This includes 21,591,056 USD for education, 10,846,776 USD for health and 8,015,757 USD for public facilities.

**Graph 42:** Community Facilities Capital Investment Costs by 2050 for education, health and public facilities

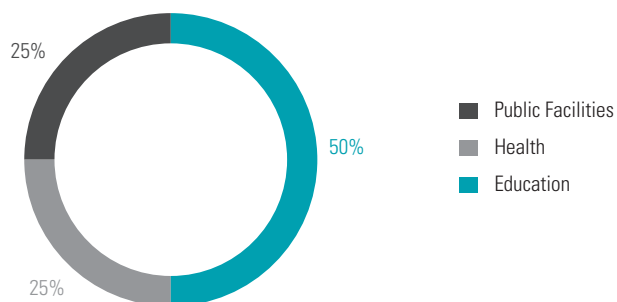


Source: UN-Habitat

**C. Maintenance Costs**

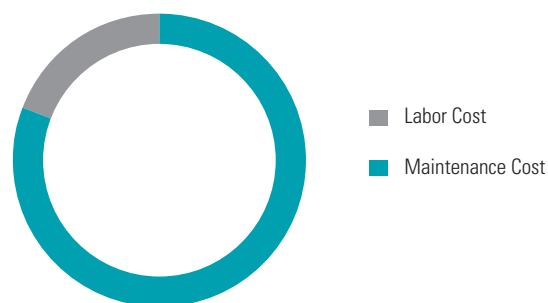
The annual maintenance costs for community facilities by 2020 is estimated at 18,345,334 USD. Education accounts for 50% of the maintenance costs (9,175,828 USD), followed by health and public facilities, which account for 25% respectively (4,568,004 USD for health and 4,601,502 USD for public facilities) (Graph 42).

**Graph 43:** Breakdown of capital investment costs by 2020 for education, health and public facilities



Source: UN-Habitat

**Graph 44:** Breakdown of capital investment costs by 2020 by maintenance or labor costs



Source: UN-Habitat

Labor costs account for up 81% of the total maintenance costs, while maintenance costs of the facilities account for 19% (Graph 43).

The annual maintenance cost required by 2050 is 38,057,985 USD in total. Education accounts for 19,234,340 USD health accounts for 9,331,440 USD and public facilities for 9,492,206 USD. Graph 44 indicates the steady annual increase in costs over time.

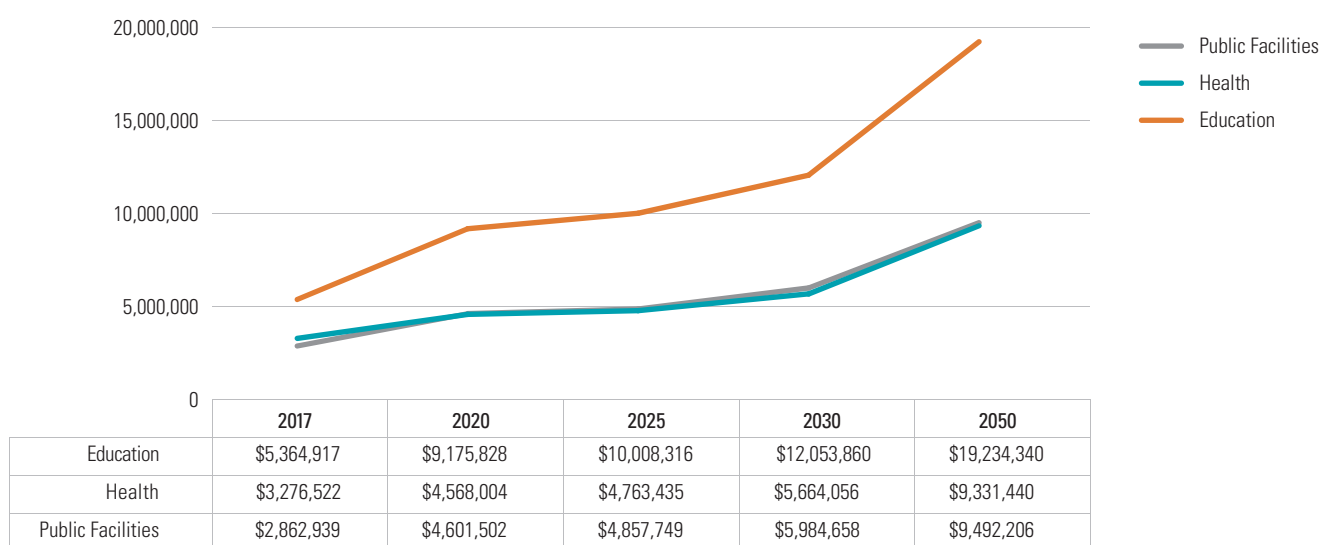
### 9.2 Annex 2: Calculations for the expansion of the national grid

Energy provision from the existing national grid system is proposed as one of the alternatives of electricity infrastructure for the settlement Per World Bank’s research in Sub-Saharan Africa, the total cost of the grid system is estimated as follows:

The unit costs under the grid system includes a fixed cost and variable costs. The fixed cost accounts for the HVDC line (high voltage, direct current) from substation to site, costing 39,157 USD per km and inverter stations costing 106,543,684 USD each. The variable cost increases with the growth of population with an inner distribution of 11,731 USD per km, and service connection of 877 USD per connection. In terms of quantities, per the Kenya 132KV – 500 KV Electricity Transmission Network Plan, two options are recommended in the Capital Investment Plan:

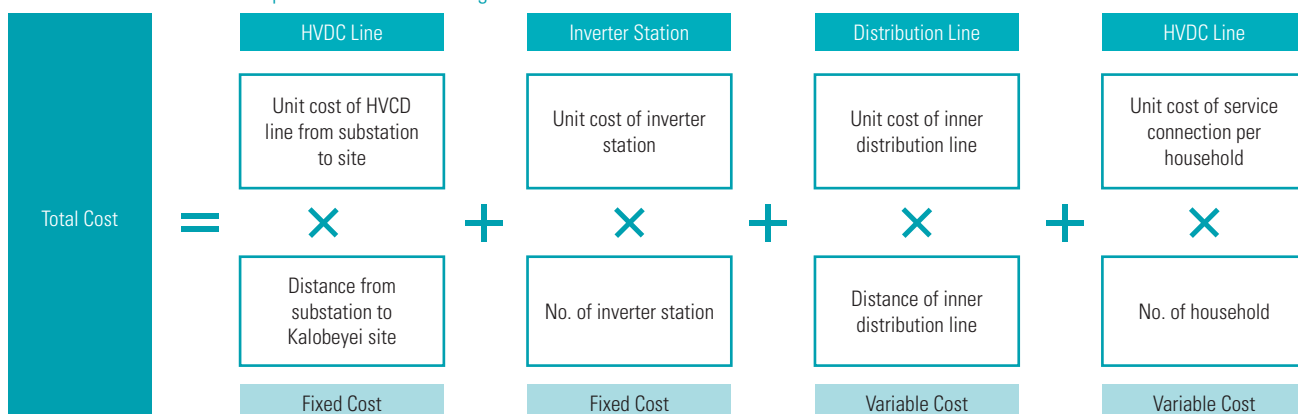
- **Option 1:** Electricity introduced from Turkwel being the nearest substation at the provincial level with roughly 185 km from the Kalobeyei site.
- **Option 2:** Electricity introduced from Kakuma town, being the nearest substation at the county level with roughly 35 km distance from the Kalobeyei site. (Per an expert interviewed, it has a capacity of 33,000 KV driven by diesel fuel, which can cover the whole of Kakuma including Kalobeyei. A plan for Kalobeyei could capitalize on this existing infrastructure within a formal electricity strategy.)

**Graph 45:** Community Facilities annual Maintenance Costs by 2050 for education, health and public facilities



Source: UN-Habitat

### Annex 1: Calculation of the expansion of the national grid



Source: UN-Habitat

# FINANCIAL SUSTAINABILITY STRATEGY FOR KALOBYEI ADVISORY LOCAL PHYSICAL DEVELOPMENT PLAN

KALOBYEI INTEGRATED SOCIO ECONOMIC DEVELOPMENT  
PROGRAMME, TURKANA COUNTY, KENYA

HS/014/19E

**UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME**

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