Site Description-UNHCR Sub-Office Dadaab

1. General Site Description

UNHCR Sub-Office Dadaab compound is located in Dadaab town, Garissa County, Kenya at approximately 107.2 km from Garissa town. The sub-office lies at coordinates 0.047778N, 40.310556E.

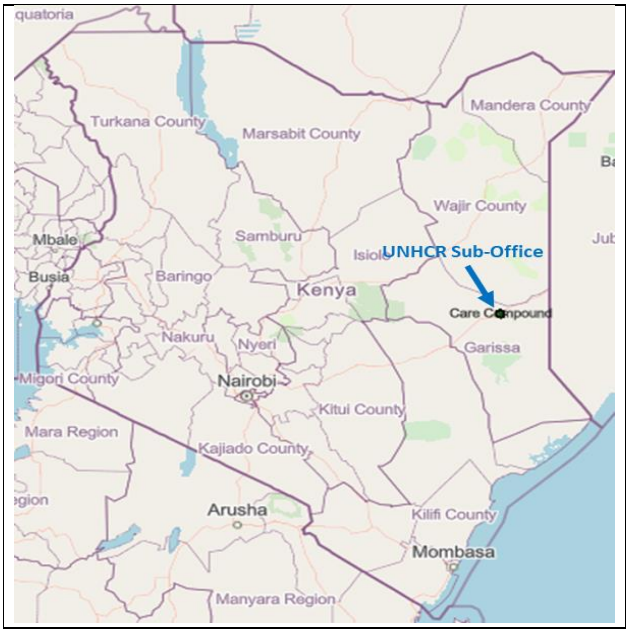

Figure 1: Site Location

The compound supports UNHCR Sub-Office Dadaab staff and consists of mainly offices and accommodation facilities of permanent staff, in addition to supporting recreational and infrastructure components as indicated in the table below.

Table 1: Compound Functional Units

Functional Unit	Facility	
Office:	Concrete Offices: 84 Container Offices: 8	
Housing:	Residential houses:>142 Prefab Houses: 18	Guest Houses: Block G & M (12)
Compound:	**General Facilities:** - Bunkers (2) - Pumzika Cafeteria - Clinic - Tukul 1 (Furniture Storage) - Conference Rooms - Dog Yard	- Laundry - Tukul 2 (TV Room) - Workshop - Gymnasium - Tennis Court - Staff Cafeteria - Litter Incinerator

2. Site map of UNHCR Sub-Office Dadaab Compound

Figure 2: UNHCR Dadaab Layout

Key

	Humanitarian Hub Perimeter
	UNHCR Compound Perimeter
	Proposed PV Field

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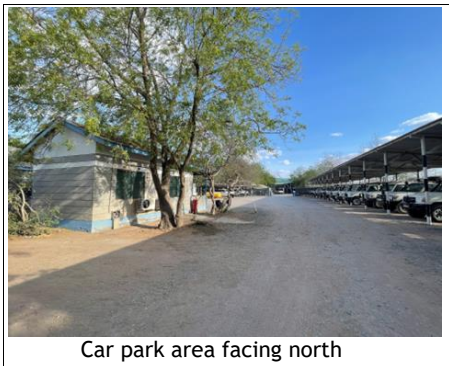
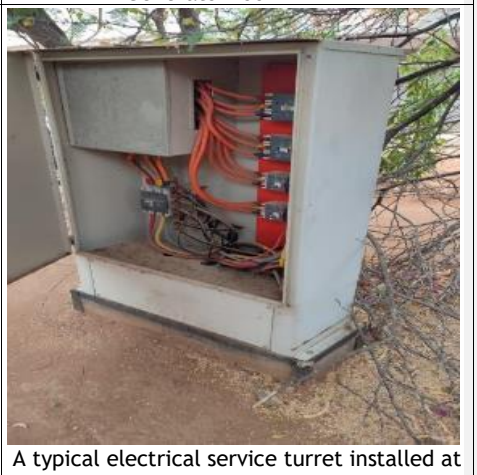
3. Pictures of UNHCR Sub-Office Dadaab Compound



Car park area facing north

Generator room

Road and Ablution Block (to be demolished)



A typical electrical service turret installed at the facility. A total of 7 turrets have been installed but not all necessarily tap power from the LV room.

Hut houses in the genset area (to be demolished)

Generator area facing north

4. Existing infrastructure

UHNCR Sub-Office Dadaab is fully dependent on diesel generators for electrical power supply. There are five generators on site. Generator 1 and Generator 2 are utilized for electricity production at the facility each rated **500kVA (440kW)**. The generator operation is such that they operate in a 12-hour cycle; one from 6am-6pm and the other from 6pm-6am. Generator 3 and Generator 4 are left as back-ups during maintenance of the two main generators while generator 5 has been decommissioned. The maintenance of the two main generators is done in 250 run-hours intervals. The technical specifications are provided in Table 2~~Table 2~~

Table 2: Technical Specifications of Installed Generators

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Parameter	Unit	Generator 1	Generator 2	Generator 3	Generator 4
Manufacturer		Caterpillar (NI) Ltd	Caterpillar (NI) Ltd	FG Wilson	FG Wilson
Model		P550-3	P550-3	P450ES	P450ES
Year of manufacturing		01/10/20219	01/10/20219	2012	2012
Year of installation		2020-02	2020-02	2015	2015
Rated power	kVA	500	500	450	450
Rated voltage	V	415-240	415-240	415-240	415-240
Rated frequency	Hz	50	50	50	50
Rated current (prime)	A	696	696	626	626
Rated power factor		0.80	0.80	0.80	0.80
Parameter	**Unit**	**Generator 1**	**Generator 2**	**Generator 3**	**Generator 4**
Number of phases		3	3	3	3
Cables per phase		1	1	1	1
Avg. load	kW	233	222	-	-
Total hours worked per day	h/d	12	12	N/A	N/A
Yearly working hours	h	4 380	4 380	N/A	N/A
Total working days per year	d/yr	365	365	N/A	N/A
Total cumulated working hours	hours	17 901	17 775	-	-
Days from installation	days	4 yrs	4 yrs	-	-
Remaining lifetime	hours	3yr	3 yrs	-	-
Maintenance interval	run hours	250	250	-	-
Shift		Day	Night	-	-
Efficiency	%	25	25	25	25
Diesel caloric value	MJ/ kg	45.5	45.5	45.5	45.5
Diesel density	kg/L	0.846	0.846	0.846	0.846

A picture of the installed generators is presented in Figure 3~~Figure 3~~ indicating generator 1 to generator 4.

Figure 3: Installed Generators

Power Distribution Network

Electrical power from the generators is transmitted via 185mm^2 4-core electrical cables to the switch room which hosts the automatic transfer switch (ATS). The ATS enables selection of generators to ensure only one runs at a time. From the switch room, the power is transmitted via underground cables to the low voltage (LV) room where it is supplied to various sections through the use of electrical service turrets. The main distribution single line diagram is shown in Figure 4~~Figure 4~~.

Table 3: Power line start and termination points~~Table 3: Power line start and termination points~~ shows the start and termination of the power lines from the service turrets to the electrical loads. The single line diagrams for the various turrets at the facility are as indicated in Appendix A.

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Table 3: Power line start and termination points

Start Point	Termination Points	
Turret 1	Office Blocks (37-57)	• IT Block
Turret 2	• Turret 3	• Kitchen, Staff Mess, Tukul, Night Radio
Turret 3	• Pumzika • Block B Houses	• Guest houses (M Block)
Turret 4	• D1-D4 Houses • New House • Block B (B7-B12)	• Security Lighting Turret • Prefab, A6, A7, Store, Mosque, Workshop
Turret 5	• Turret 6 • Turret 7 • Block E Houses	• UNICEF Prefabs • UNHCR Clinic • IOM • Water Pump/Borehole
Turret 6	• Residential Houses (H, J & I)	• Dispensary
Turret 7	• Prefabs F7-F12, F13-F18 • K16-K20, K11-K15	• K1-K5, K6-K10, H10-H11, H5-H6 • H3-H4 • Security/Ground Lighting
Police Post	• Supplies electricity to the police post	

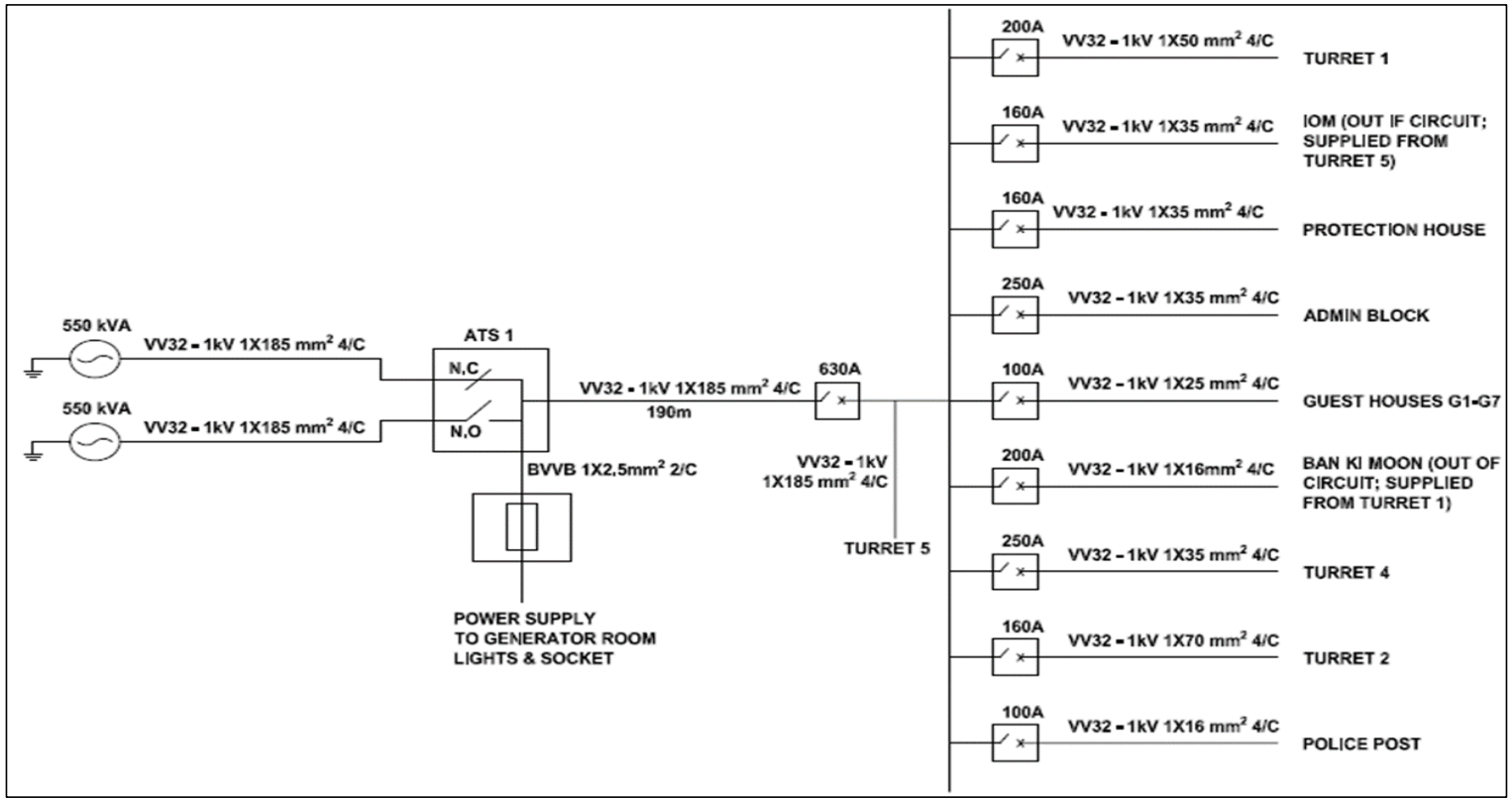

Figure 4: Main Power Distribution Network

Electrical Loads.

The main electrical loads at the facility include;

- ❖ Lighting Systems
- ❖ Plug Loads
- ❖ Air Conditioning Systems

The total electrical load demand by the appliances installed at the facility is approximately **914.35 kW**. Figure 5~~Figure 5~~ provides the composition of the various electrical loads at the facility. Notably, **plug loads** form the largest composition at **50%**, followed by the **air conditioning systems** at **46%**. The **lighting systems** contribute to the lowest load at **4%** of the total electrical loads.

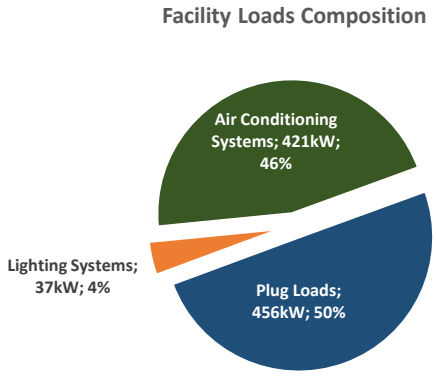

Figure 5: Facility Electrical Loads Composition

Table 4: Average Power on Weekday, during the Weekend and the weekly average

Hour	Weekday Average Power [kW]	Weekend Average Power [kW]	Average Power [kW]
0	126.96	137.10	132.03
1	119.46	129.17	124.32
2	112.30	125.30	118.80
3	113.40	121.62	117.51
4	112.48	120.46	116.47
5	115.70	116.46	116.08
6	115.64	99.61	107.63
7	135.92	100.49	118.20
8	149.61	107.79	128.70
9	175.51	116.55	146.03
10	198.23	122.24	160.23
11	206.36	137.23	171.80
12	207.35	146.74	177.04
13	214.25	156.86	185.55
14	224.33	160.72	192.52
15	221.84	162.86	192.35

16	214.82	161.34	188.08
17	201.05	160.68	180.86
18	184.61	169.61	177.11
19	194.06	185.73	189.90
20	188.31	184.07	186.19
21	175.42	173.65	174.53
22	160.94	163.60	162.27
23	141.28	155.21	148.25

Forecasted Monthly Energy Profile

For the demand in the future, a monthly profile has been estimated incorporating seasonality variations with the environmental factors such as temperature considered. From the forecast, the average monthly demand is **121,928 kWh**. The forecasted monthly energy profile is as depicted in **Error! Reference source not found.**.

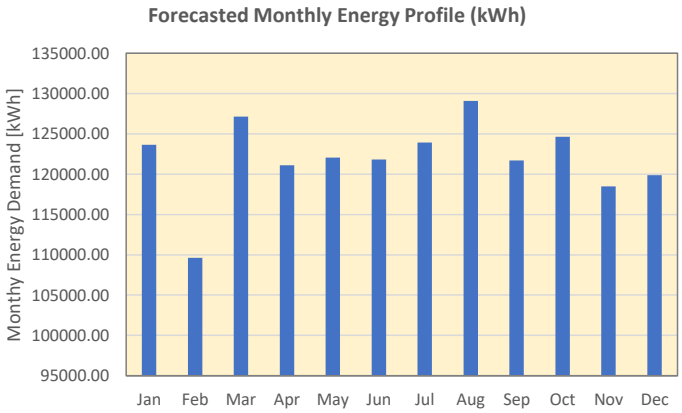

Figure 6: Forecasted Monthly Energy Profile [HOMER Pro]

The values of the above energy profile presented as numerical values are in the **Error! Reference source not found.** below.

Table 5: Forecasted Monthly Energy Demand [HOMER Pro]

Month	Days	Average Daily Demand (kW)	Duration (Hrs)	Monthly Energy Demand (kWh)
Jan	31	166.19	24	123,645.36
Feb	28	163.15	24	109,636.80
Mar	31	170.9	24	127,149.60
Apr	30	168.22	24	121,118.40
May	31	164.04	24	122,045.76
Jun	30	169.2	24	121,824.00
Jul	31	166.56	24	123,920.64
Aug	31	173.52	24	129,098.88
Sep	30	169.04	24	121,708.80
Oct	31	167.53	24	124,642.32
Nov	30	164.55	24	118,476.00
Dec	31	161.12	24	119,873.28
Average	**30**	**167**	**24**	**121,928.00**

5. Information on existing supply contract

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The diesel generators are serviced by the UNHCR maintenance technicians. The two main 500 kVA generators are serviced after 250 hours of operation.

The generators use an average of 43,402 litres of diesel fuel every month. The average fuel price in 2023 was 1.16 US$ per litre.

6. Forecast energy demand

There is no plan for the government to push for downsizing of the operation, as was the case in 2021, and although there could be some increase in the number of staff in the complex, the operation does not foresee a massive upscale. The renewable energy fraction specified for the compound is limited by the available space, however, the bidder must design the system so that it is able to integrate additional UNHCR generators, if necessary, at a later stage.

7. Size of plot and availability of land

The UNHCR Sub-Office Dadaab compound occupies a surface area of **125,048 m^2**. The compound is covered with trees with most of the roofs ruled out due to shading and fragmentation. The areas approved for installation include a space of land in the Peace Wings Japan Compound ("PJW Compound"), and the area south west of the current Generator shed ("Genset Area") for ground mount systems, and the Supply and carport spaces, as seen in Figure 7~~Figure 7~~.

Figure 7: Helioscope Overlay for solar systems installation.

Due to the limitation of the land space, the bidder is expected to use the provided areas as listed in Table 6~~Table 6~~ **Error! Not a valid bookmark self-reference.**to undertake the project sizing and simulation for the maximum plant performance.

Table 6: Description of the areas designated for solar system installation

LOCATION	AREA (m^2)	SOLAR PV MOUNTING	DESCRIPTION	SHAPE
Care Compound	1,200	Ground-mounted	The area is located at Care Compound next to Pumzika Cafeteria. There are a number of trees near the area acting as a habitat for birds.	Rectangular
Genset Area	2,562	Ground-mounted	The are is mainly covered by trees and other vegetation including the juliflora plant. There are also has 9 concrete huts that are so far not in use. The trees will be cut while the huts will be demolished to provide space for installation of the solar PV system. The area is adjacent to a road used by UNHCR vehicles in accessing various points of the compound.	Irregular

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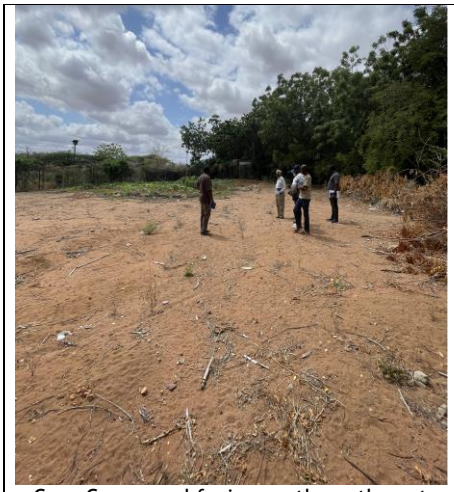
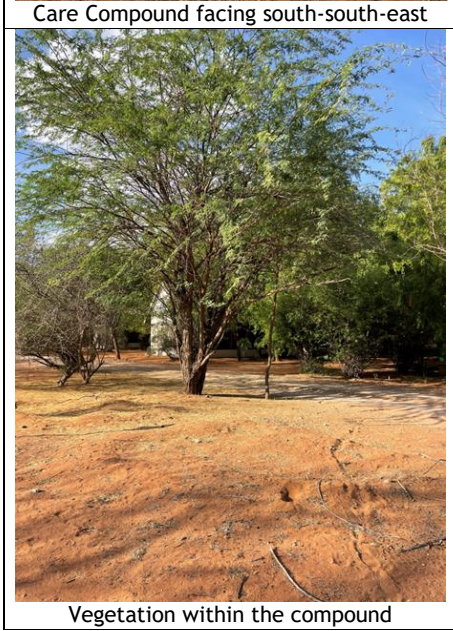
8. Vegetation/ shading

The compound is covered by fully grown trees which cause a lot of shading on the existing buildings. The area further boasts of the invasive Prosopis juliflora plant (Mathenge tree) that would require regular pruning in the areas where the solar systems will be ground-mount.



Care Compound facing south-south-east

Care Compound facing north-west



Vegetation within the compound

Vegetation within the compound

9. Ground conditions

The geotechnical analysis done on the soil revealed that the proposed sites are covered with **loose sandy soils**. The soils are well defined and drained hence have good load bearing (from **100 to 150 kN per square meter**) properties and will be able to support the ground-mount Solar PV system. Figure 8: Facility Geotechnical Soil Analysis~~Figure 8: Facility Geotechnical Soil Analysis~~ shows the geotechnical soil analysis activity carried out at the facility. The geotechnical analysis carried out was up to 1.5m of the soil which indicated a mono-strata profile composed of red sandy soils. With the area characterized by wind speeds averaging at **3.35 m/s** (source: NASA), the loose soil particles can be easily carried leading to soiling of the solar PV panels. The soils are well defined thus flooding does not occur within the UNHCR Sub-Office Dadaab compound. It is important to take note that flooding occurs in areas outside the UN-Compound and may have effect on the transportation of materials to site. Heaviest rainfalls are experienced in the months of March, April, November and December.

Excavation at proposed site

Loose Sand Soil - Banana Farm

Figure 8: Facility Geotechnical Soil Analysis

10. Additional Information

The soils are well defined thus flooding does not occur within the UNHCR Sub-Office Dadaab compound. It is important to take note that flooding occurs in areas outside the UN-Compound and may have an effect on the transportation of materials to site. Heaviest rainfalls are experienced in the months of March, April, November, and December.