Temperature Characteristics NOCT: Nominal Operation Cell Temperature	
Nominal Operating Cell Temp. 45OC (2OC	. 45°C (+/- 2°C)
Nominal Module Operating Temp (NMOT)	41°C (+/-3°C)
Temperature Coefficient of Voc	- 0.26 % / °C
Temp coefficient of Pmax	-0.36% / °C
Temperature Coefficient of Isc	- 0.04 % / °C
Operating Temperature	-40 °C ~ +85°C

Inverter technical data

AC(Grid-connected)	
Apparent power	33kVA
Rated power	30kW
Rated voltage	400V
Rated current	43A
Voltage range	360V - 440V
Rated frequency	50/60Hz
Frequency range	45~55/55~65Hz
THDi	＜3%
PF	0.8lagging~0.8leading
AC connection	3/N/PE
AC(Off-grid)	
Apparent power	33kVA
Rated power	30kW
Rated voltage	400V
Rated current	437A
Rated frequency	50/60Hz
THDu	≤2%linear
Overload capability	110%-10 mins 120%-1 min
DC (battery and PV)	
Max PV Open-circuit voltage	1000 VDC
Recommended PV power	45kWp
PV MPPT voltage range	480VDC-800VDC
Recommended nominal battery voltage	420V
Battery voltage range	352-600V*
Max. charge/discharge power	33kW
Max. charge/discharge current	93A

SOLAR SYSTEM SIZING CALCULATION FOR THE EMPLOYEE CARE CENTER BUILDING IN THE PORT OF RICHARDS BAY

Disclaimer: The following calculations were based on information made available from the following documents:

1. *Solar PV System sizing calculation Employee care Center Haroun Cmments (002)*
2. *General Specifications For Solar System – Employee Care Center (003)*

Where required, reference is made to the aforementioned documents and/or assumptions are made.

Given:

Energy consumption	***Kilowatt***	***Period***
Average Active Power	*19.093 kW*	*14 hours*
Average Apparent Power	*26.324 kW*	*14 hours*
Average Reactive Power	*18.122 kW*	*14 hours*
Average Power Factor	*0.72*	*14 hours*

Step 1: Determining the Load Consumption

Total Power = 19.093 kW

Operating hours in a day = 14 hrs

$$Total\ Energy\ Consumption\ = Total\ Power\ (kW)\ x\ operation\ hours\ ina\ day\ (hrs)$$

$$267.4\ kWh/day$$

Step 2: Solar Panel Selection

Total Power per day = 19.093 kW

Total energy required per day = 267.4 kWh

$$Total\ Power\ required\ from\ solar\ panel\ (kW) = \frac{Total\ energy\ required\ from\ solar\ panel\ (kWh)}{effective\ sunshine\ hours\ \ x\ system\ efficiency}$$

Where,

Total energy required from solar panel = 267.4 kWh

Effective sunshine hours in Durban, South Africa = 3.9 hrs (Solar Basics ! - EcoTrades)

System efficiency (n_s) = $n_\beta \; x \; n_i \; x \; n_{oth}$

$n_\beta - Battery\ efficiency\ (assume\ 90\%)$

$n_i - inverter\ efficiency\ (assume\ 95\%)$

$n_{oth} - other\ components\ (charge\ controller, cables\ etc.\ assumer\ 85\%)$

(180) Solar System Calculation For Home / DOD/ Safety Factor l Solar System Calculation @CircuitInfo - YouTube

System efficiency = 0.72 (*Solar PV System sizing calculation Employee care Center Haroun Cmments (002)*)

Thus,

$$Total\ Power\ required\ from\ solar\ panel\ (kW) = \frac{267.4\ (kWh)}{3.9\ hrs\ x\ 0.72}$$

= 95227 W

= 95.23 kW = 96 kW

Choosing a 550 W panel – largest rated readily available in South Africa from tier 1 manufacturers

$$Number\ of\ panels = \frac{Total\ Power\ required\ from\ solar\ panel\ (W)}{Panel\ capacity\ (W)}$$

$Number\ of\ panels = \frac{9600\ (W)}{550 (W)}$ = 175 panels

Raw data needs to be verified in order to accurately calculate the PV system components required for this site

Step 3: Battery Selection

$$Total\ required\ battery\ capacity\ (Ah) = \frac{Total\ energy\ required\ per\ day\ \ (kWh)\ x\ 3}{battery\ voltage\ x\ depth\ of\ discharge\ x\ battery\ efficiency}$$

the total energy required per day (kWh) is multiplied by 3 to cater for a backup supply in the event of a cloudy / rainy day. In other words, the battery should be sized in such a way that it can supply power for up to three times the required energy per day.

Solar PV System sizing calculation Employee care Center Haroun Cmments (002). Days of autonomy = 3

$$Total\ required\ battery\ capacity\ (Ah) = \frac{Total\ energy\ required\ per\ day\ \ (Wh)\ x\ 3}{\underbrace{battery\ voltage}\ x\ \underbrace{depth\ of\ discharge}\ x\ \underbrace{battery\ efficiency}}$$

53 V from General Specs. No battery on the market is rated at 53 V. I have chosen 12 V

DoD is = 90% from the General Specs.

Battery efficiency from Step 2 of THIS document is assumed to be 90%

$$Total\ required\ battery\ capacity\ (Ah) = \frac{267400\ x\ 3\ (Wh)}{12V\ x\ 0.9\ x\ 0.9} = 82\ 530.9\ \text{Ah}$$

Therefore , $Number\ of\ batteries\ required = \frac{Total\ required\ baterry\ capacity\ (includign\ backup) - (Ah)}{Battery\ Capacity\ (Ah)}$

Using a 12 V 200Ah battery

$$Number\ of\ batteries\ reuqired = \frac{82\ 531\ (Ah)}{200\ Ah} = 413\ batteries\ required$$

Step 4: Inverter Selection

$$Required\ Inverter\ Power) = \frac{Total\ energy\ required\ per\ day\ \ (Wh)\ x\ \ Safety\ factor}{\underbrace{Inverter\ efficiency\ (98.8\%)}}$$

Inverter efficiency is = 98.8% from the General Specs.

Safey factor = 1.25 (According to NEC Inverter Should be 25% - 30% High)

[(180) Solar System Calculation For Home / DOD/ Safety Factor l]

$$Required\ Inverter\ Power) = \frac{267400\ x\ 1.25}{0.988} = 338\ 309.7\ \text{Watts} = 339\ \text{kW}$$

There is no inverter sized at 339 KW, thus, 3 x 125 kW string inverters can be used

Step 5: Charge Controller Selection

$$Charge\ Controller\ Current\ = \frac{Total\ Solar\ Panel\ power\ (W)}{Battery\ Bank\ voltage\ (V)}$$

$$Charge\ Controller\ Current\ = \frac{96000\ (W)}{12\ (V)} = \ 8000\ A$$

Summary

1. **Load Calculation = 267.4 kWh**
2. **Solar Panel Selection = 175 x 550 W panels**
3. **Battery selection = 413 x 12V 200Ah batteries**
4. **Inverter Size = 1x 25 kW inverter**
5. **Charge controller = 8000 A – There is no charge controller this size.**

Conclusion:

Based on the date supplied, the design did not seem feasible or practical, using standard methods of Photovoltaic (PV) system design calculations.

The possible error could be that the total average power of 19.063 kW is actually the total load consumption = 19.063 kWh. If this is the case, then the total power = 19.063/14= 1.363 kW.

In this case, the PV system design or the Employee Care Center is as Follows:

1. **Load Calculation = 19.063 kWh**
2. **Solar Panel Selection = 13 x 550 W panels**
3. **Battery selection = 10 x 12V 200Ah batteries**
4. **Inverter Size = 1 x 25 kW inverters**
5. **Charge controller = 565A – There is no charge controller this size.**

Further personal R&D required to determine the correct sizing of the charge controller.

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END OF REPORT