

# Lund vs Casablanca

Dave McGinnis  
2-November-2015

<https://ess-ics.atlassian.net/wiki/display/ESSSC/European+Spallation+Source+Solar+Concept>

# Lund - Casablanca Comparison

- In the comparison,
  - Assumed that one would build a duplicate ESS in Casablanca
  - Limit the solar field to 22.75 MW of peak electrical power on clear day on the summer solstice.
- To produce 22.75 MW of peak power on the summer solstice
  - The Casablanca site would require 7.5% less solar panels as compared to Lund.
- **For these comparable fields, the electrical energy yield of Lund would be 58% of yield produced at Casablanca.**
- Major differences - (please see Solar Power Density on slide 5)
  - Direct sunshine in summer - Casablanca about 6% brighter sun
  - Summer cloud cover - Casablanca < 5%; Lund > 30%
  - Winter sun elevation - Casablanca 1.8x more direct sunlight than Lund in January
  - Winter cloud cover - Casablanca < 15%; Lund > 55%

# Analysis Application

- ESS Solar Calculator Web Application at:
  - <https://aig.esss.lu.se:8443/SolarCalculatorGWT/>
- Uses
  - global irradiation data on a horizontal surface
  - from the European Commision Joint Research Centre Institute for Energy and Transport
  - <http://re.jrc.ec.europa.eu/pvgis/download/download.htm>
- Two data sets are used in the ESS Solar Calculator
  - **CLASSIC** - Data from the original PVGIS solar radiation data set, based on ground station data from 1981-1990
  - **CMSAF** - Solar radiation data based on satellite data retrieval. This data set is based on satellite data from 1998 to 2011 and covers most of Europe as well as Africa.

# Summary Parameters

## Lund

Parameter	Value	Unit
Latitude	55.741	deg
Longitude	13.263	deg
DataBase	CMSAF	
Field Area	22.548	Hectares
Field Utilization Factor	70	%
Panel Inclination Angle	10	deg
Panel Electrical <u>Eff</u> at 25C	17	%
Electrical Transmission Efficiency	95	%
Panel Electrical De-rating	0.0048	/degC
Start Day for Cold Panel	1	
Stop Day for Cold Panel	365	
Hot Panel Temperature	80	degC
Cold Panel Temperature	25	degC
Panel Area	16.027	Hectares
Peak Day	172	
Shadow on Peak Day	0	%
Shadow Winter Solstice	25.697	%
Shadow on Vernal Equinox	0	%
Shadow on Autumnal Equinox	0	%
Peak Electrical Power on Peak Day	22.75	MW
Electrical Energy on Peak Day	6.278	MW-day
Yearly Electrical Energy	3.392	MW-Yr
Yearly Hot Thermal Energy	0.008	MW-Yr

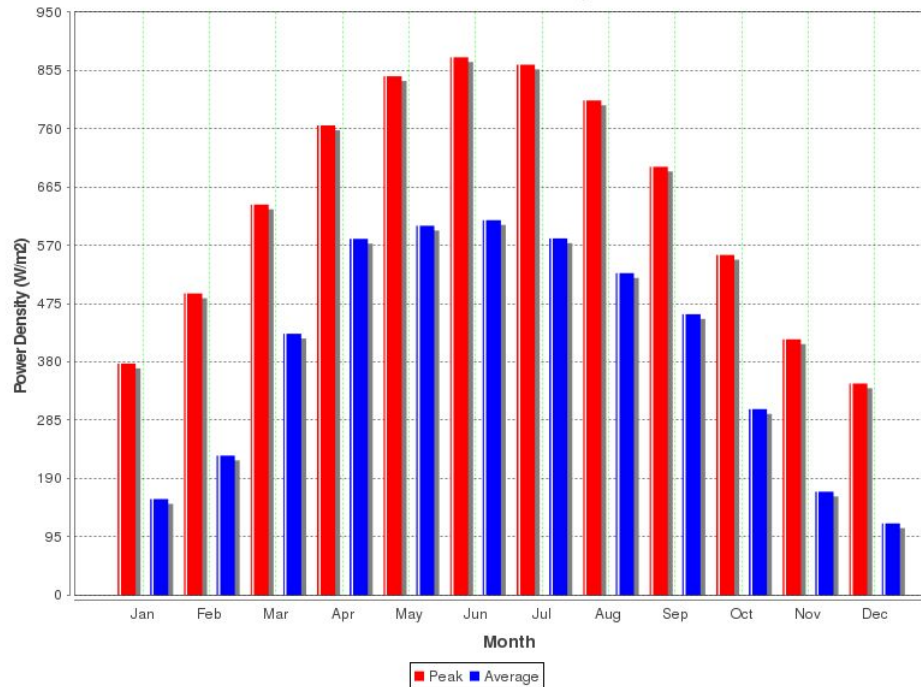
## Casablanca

Parameter	Value	Unit
Latitude	33.533	deg
Longitude	-7.583	deg
DataBase	CMSAF	
Field Area	20.861	Hectares
Field Utilization Factor	70	%
Panel Inclination Angle	10	deg
Panel Electrical <u>Eff</u> at 25C	17	%
Electrical Transmission Efficiency	95	%
Panel Electrical De-rating	0.0048	/degC
Start Day for Cold Panel	1	
Stop Day for Cold Panel	365	
Hot Panel Temperature	80	degC
Cold Panel Temperature	25	degC
Panel Area	14.828	Hectares
Peak Day	172	
Shadow on Peak Day	0	%
Shadow Winter Solstice	0	%
Shadow on Vernal Equinox	0	%
Shadow on Autumnal Equinox	0	%
Peak Electrical Power on Peak Day	22.75	MW
Electrical Energy on Peak Day	7.429	MW-day
Yearly Electrical Energy	5.797	MW-Yr
Yearly Hot Thermal Energy	0.054	MW-Yr

# Solar Power Density

Lund

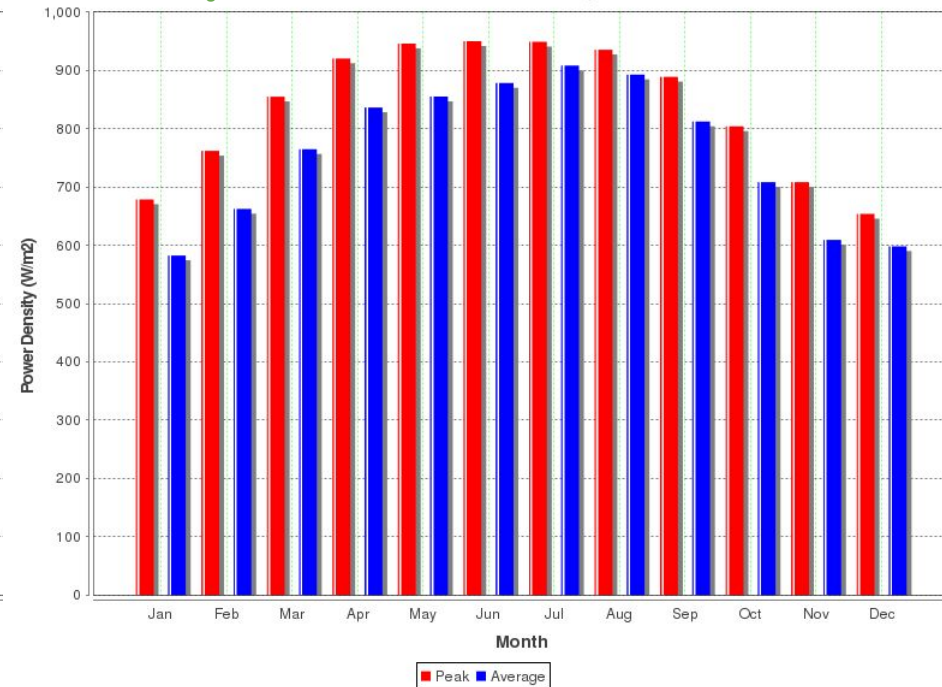
Solar Power Density



Casablanca

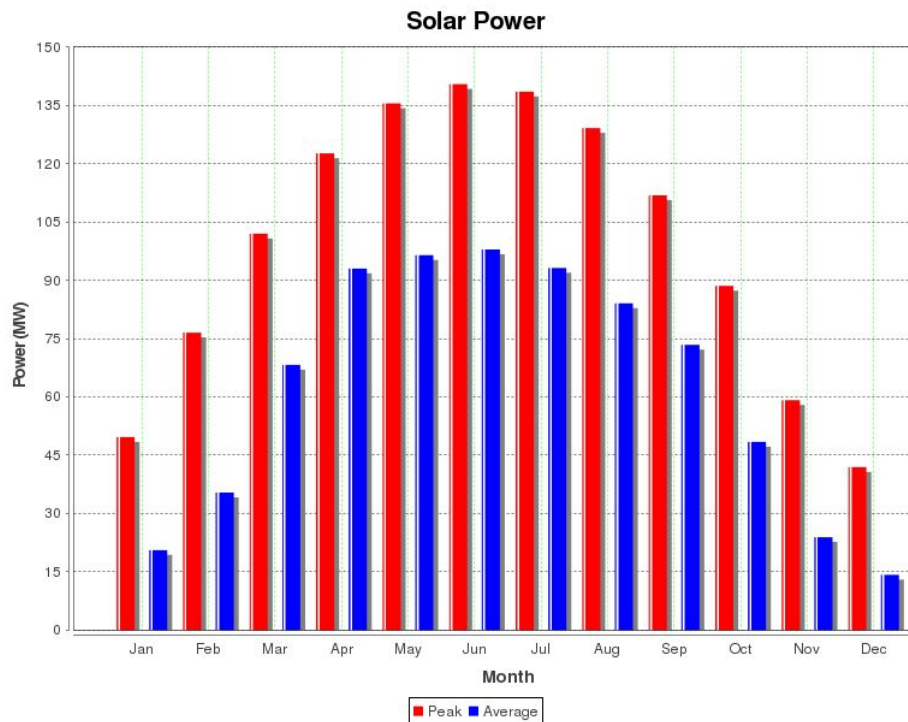
Note: Change in Scale

Solar Power Density

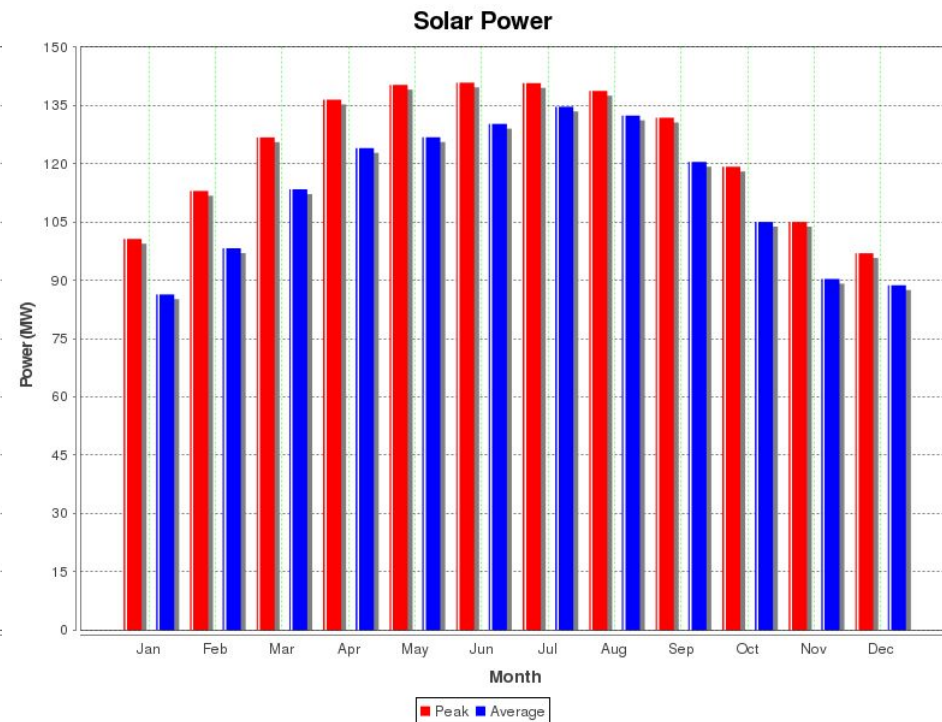


# Solar Power

Lund



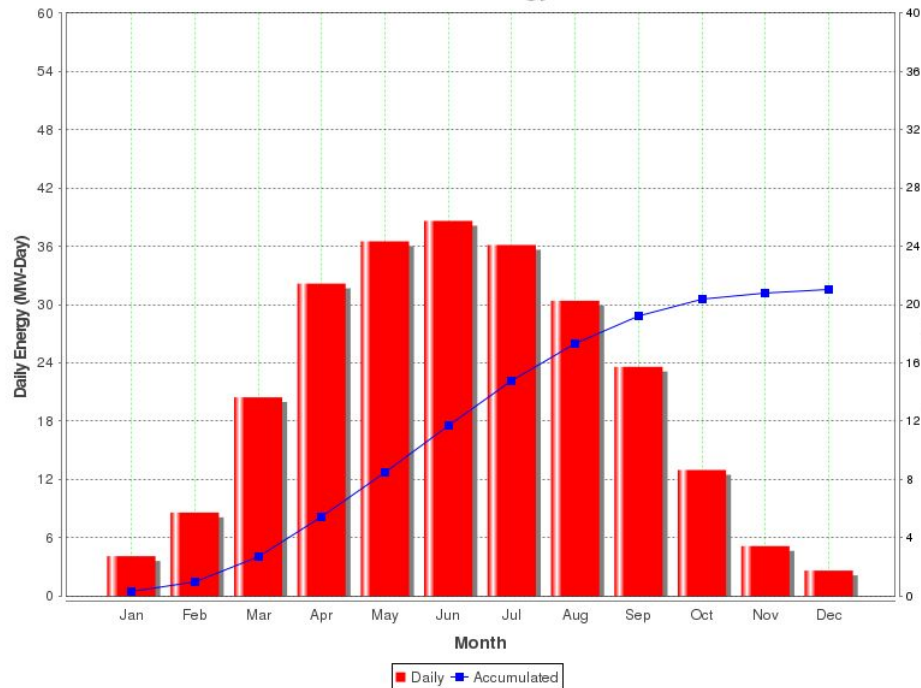
Casablanca



# Solar Energy

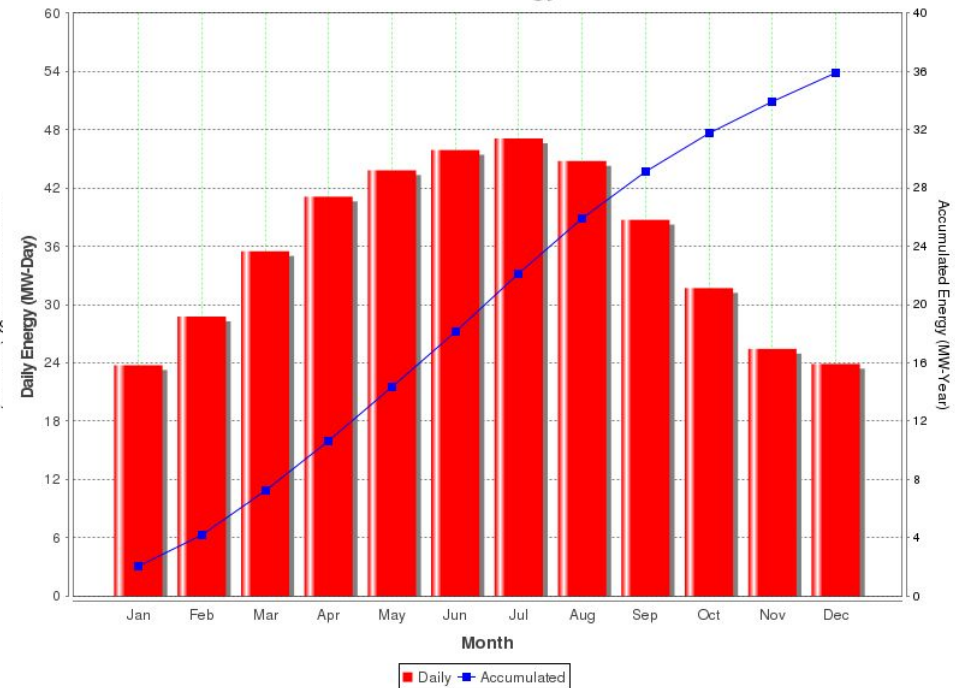
Lund

Solar Energy



Casablanca

Solar Energy

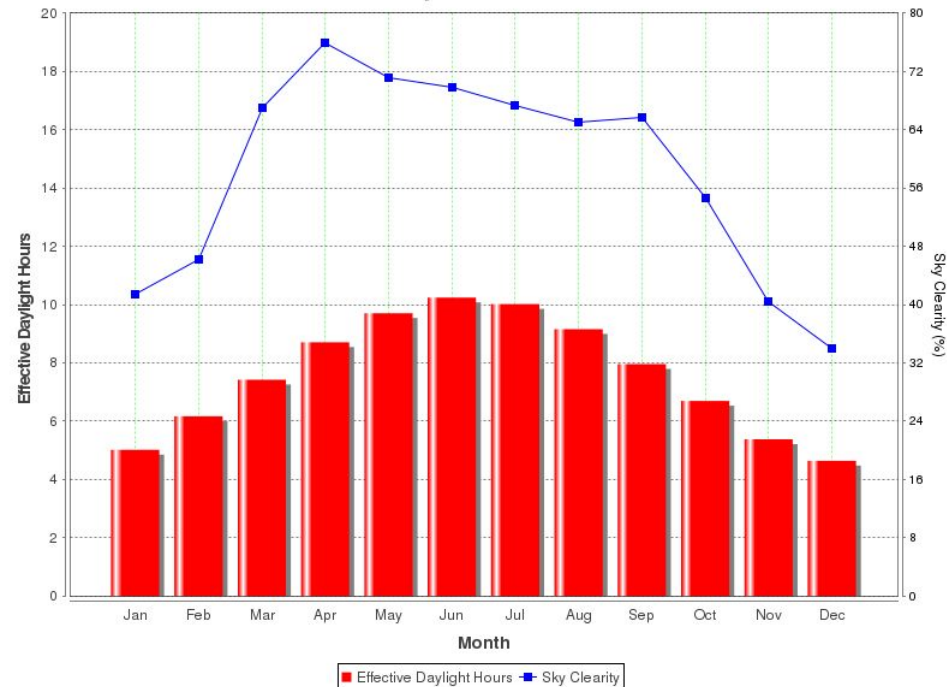




# Sky Conditions

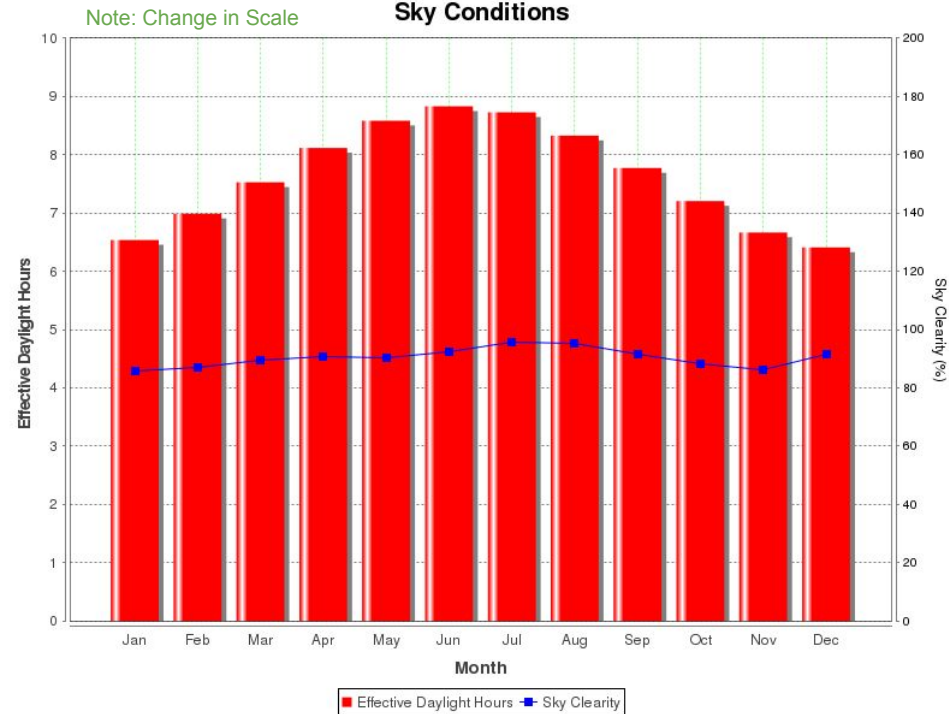
## Lund

Sky Conditions



## Casablanca

Sky Conditions

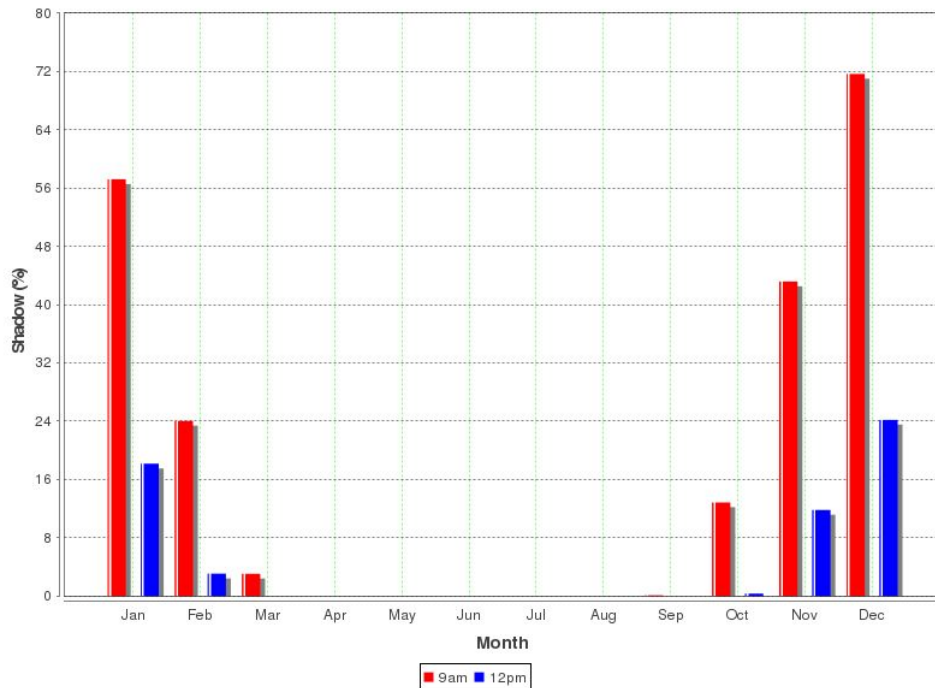




# Solar Panel Shadow

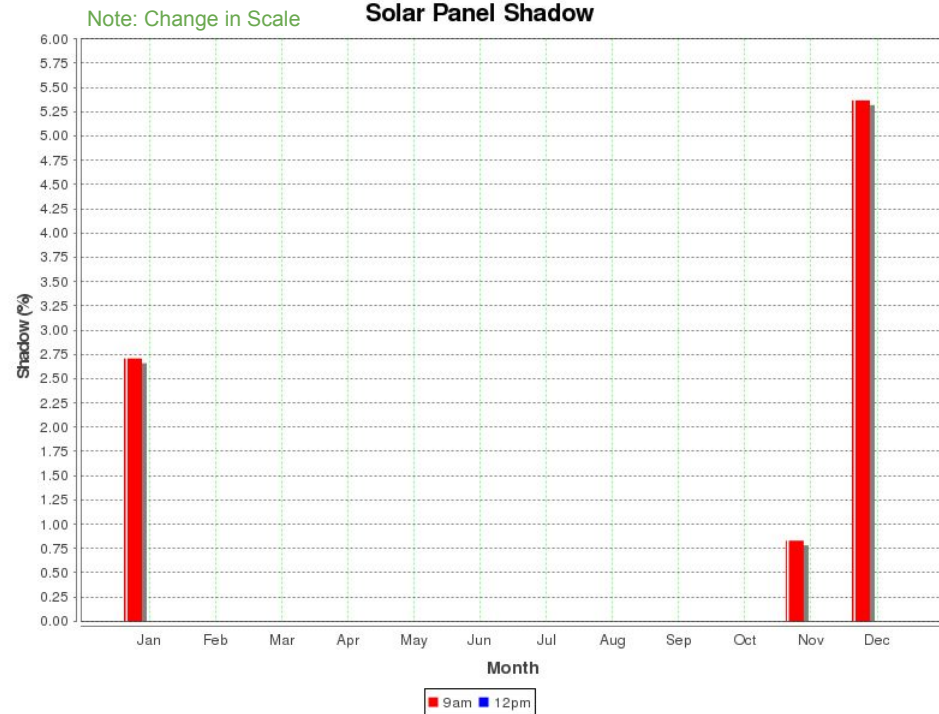
## Lund

Solar Panel Shadow



## Casablanca

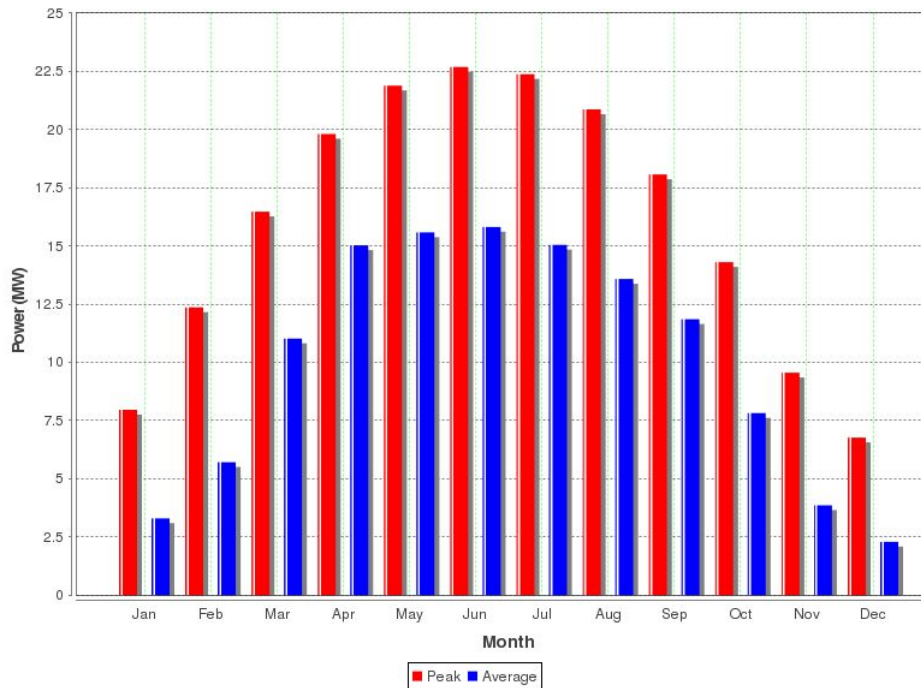
Solar Panel Shadow



# Electrical Power

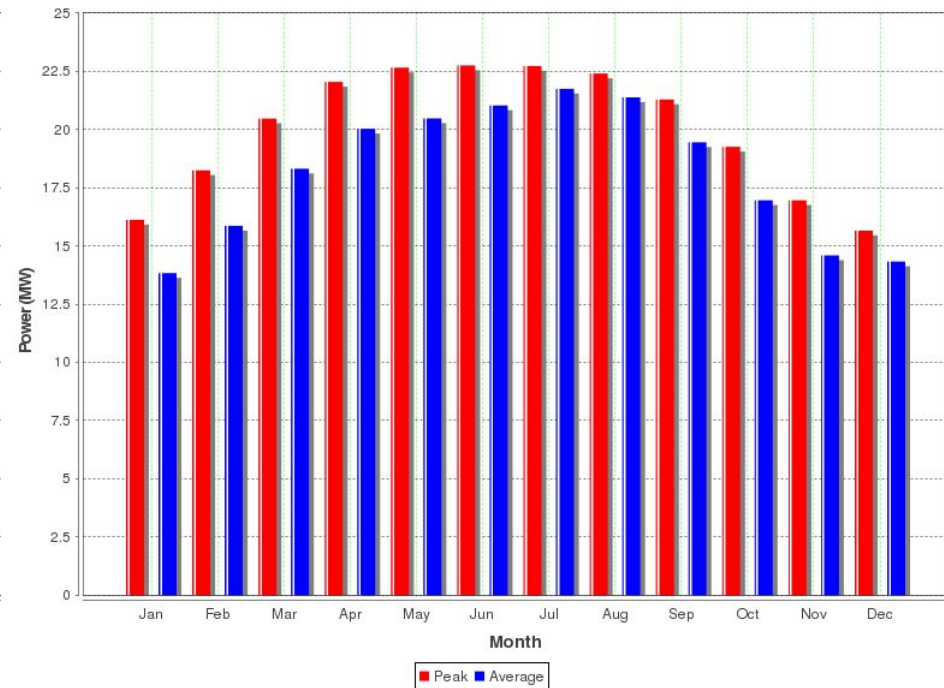
Lund

Electrical Power



Casablanca

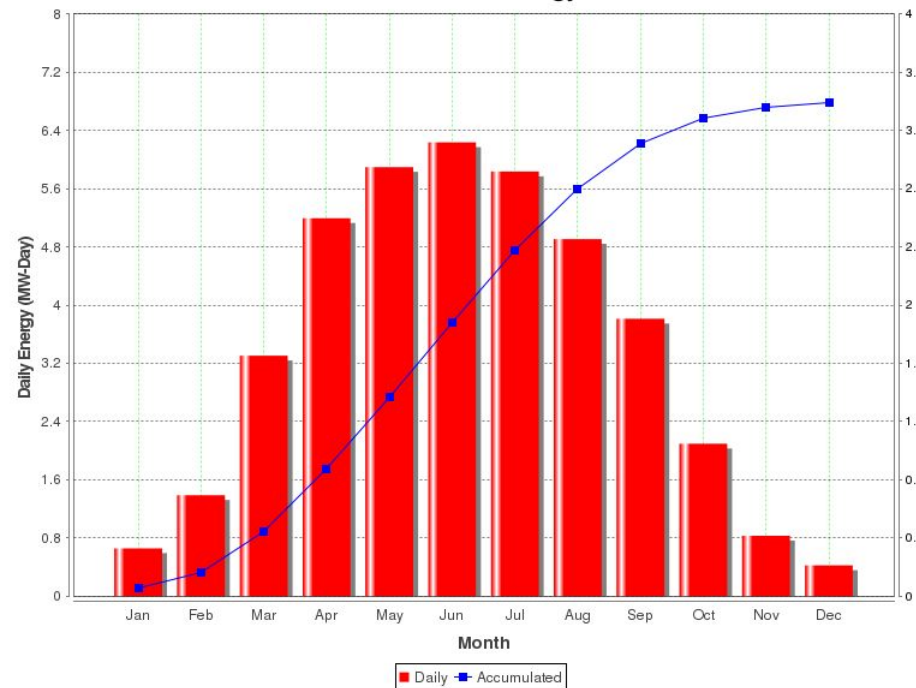
Electrical Power



# Electrical Energy

## Lund

### Electrical Energy



## Casablanca

Note: Change in Scale

### Electrical Energy

