Technical and Economic Performance of 1MW Grid-connected PV system in Saudi Arabia

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ABSTRACT
In this paper, a feasibility study has been done utilizing real time solar irradiance data for a 1MW grid-connected PV system in Qassim region in the middle of Saudi Arabia. The analysis has been done using both technical and economic indicators. Technical performance indicators are; Yield Factor, Capacity Factor and Performance Ratio. Economic indicators are; Levelized cost of energy and simple payback time. The simulation results show high energy productivity, and both technical and economic indicators are high compared with similar systems in different countries. Also, the greenhouse gas emission reduction has been estimated. The prices of PV modules and balance of system components are up to date. The analysis results proved the viability of the proposed system supposing there is no any governmental incentives or grants which could make big difference.

**Keywords** - photovoltaic; PV; Solar Energy; PV grid-connected; Levelized cost of energy; GHG

Abbreviations:
- BIPV: Building Integrated PV system
- BOS: Balance of System
- CF: Capacity Factor
- DGPV: Distributed Generation PV
- ECRA: Electricity & Cogeneration Regulatory Authority
- GHG: Greenhouse Gas
- IEA: International Energy Agency
- K.A.CARE: King Abdullah City for Atomic and Renewable Energy
- LCC: Life cycle cost
- LCOE: Levelized cost of energy
- MPPT: Maximum Power Point Tracking
- NEEP: National Energy Efficiency Program
- NOCT: Nominal Operating Cell Temperature
- PR: Performance Ratio
- PV: photovoltaic
- PW: Present worth
- SAMA: Saudi Arabian Monetary Agency
- SEEC: Saudi Energy Efficiency Centre
- SPBT: Simple payback time
- STC: Standard Test Condition
- YF: Yield Factor

Symbols:
- $A$: Area of the PV array
- $C_{\text{capital}}$: The capital cost
- $C_{\text{O&M}}$: The operation and maintenance cost
- $C_{\text{salvage}}$: The salvage value
- $d$: Discount rate
- $E_A$: Energy delivered by the PV array
- $E_{\text{grid}}$: Energy injected to the grid
- $G_{\text{STC}}$: Amount of irradiance at STC
- $G_t$: Global solar irradiance on the plane of PV array
- $i$: Inflation rate
- $K_t$: Clearness index
- $T_a$: Ambient temperature
- $T_c$: Module cell temperature
- $T_r$: Reference temperature = 25°C
- $\alpha_p$: Temperature coefficient of module efficiency
- $\eta_{\text{inv}}$: Inverter efficiency
- $\eta_p$: Average efficiency of PV array
- $\eta_r$: Efficiency of PV module at reference temperature
- $\lambda_c$: Power conditioning losses
- $\lambda_m$: Miscellaneous losses of PV array
- $\Sigma G_t$: Accumulative irradiance on the plane of PV array within certain period

I. INTRODUCTION
The importance of photovoltaic (PV) systems has increased with the rapid growth of solar cells industry over the current and past decades. This is due to the fact that PV systems are clean, environment friendly, and secured energy source. However, the drawback of PV systems is the high capital cost as compared to conventional energy systems.

The photovoltaic systems can be classified into two types: Standalone PV system and Grid-connected PV system. Standalone PV system operates independent of the grid and is used to power individual load with batteries storage, while the grid-connected PV system directly feeds the generated power into the grid without batteries storage. Grid-connected PV systems can be divided
into two types: Building Integrated PV system (BIPV) and Distributed Generation PV (DGPV) system. BIPV systems usually supply a specific load and inject the excess energy to the grid. On the other hand, the DGPV systems inject the whole produced energy to the grid without feeding any local load [1].

PV system size and performance strongly depend on metrological variables such as solar Irradiance, wind speed, ambient temperature. Therefore, to optimize a PV system, extensive studies related to the effect of metrological variables have to be done [2]. The importance of the metrological data in sizing PV systems lies in the fact that the PV modules output energy strongly depends on the available solar energy and the ambient temperature. Although extreme high temperatures may degrade the performance of some types of photovoltaic modules.

Saudi Arabia has very good conditions for the development of photovoltaic systems due to possessing high daily solar irradiance and sunny days over the year. This indicates that photovoltaic technologies would perform well at any location in Saudi Arabia.

Cost of power from large scale photovoltaic installations reduced to 75% in the last decade [3]. In Germany, the cost fell from over 40 ct/kWh in 2005 to 9ct/kWh in 2014. Even lower prices have been reported in sunnier regions of the world, since a fact that the PV modules output energy strongly depends on the available solar energy and the ambient temperature. Although extreme high temperatures may degrade the performance of some types of photovoltaic modules.

The main objective of this paper is to study the viability of 1MW grid-connected photovoltaic system in Qassim region. Qassim region is located in the center of Saudi Arabia about 350 km northwest of Riyadh, the capital as shown in Figure 1. Qassim region lies between latitudes 24°41’N and 27°19’N and longitudes 41°38’ E and 44°50’ E, which is in the solar belt, and the elevation is 600-750 m above the sea level. The climatic condition of Qassim region is a typical desert climate, known for its cold, rainy winters, and for its hot and sometimes balmy summers, with low humidity and dusty sometimes. The average daily solar irradiance in Qassim is 6.13 kWh/m2/day and has a long daily duration of sunshine [5]. Figure 2 shows the average annual sum of global horizontal irradiance in Saudi Arabia [6]. Therefore, the use of PV systems in Qassim region has a very good potential.

In this paper, a technical and economic analysis for evaluating the feasibility of 1 MW grid-connected PV system in Qassim region has been presented based on both technical and economic indicators. Technical performance indicators are Yield Factor, Capacity Factor and Performance Ratio while, economic indicators are Levelized cost of energy and simple payback time. This work is based on one-minute meteorological data provided by King Abdullah City for Atomic and Renewable Energy (K.A.CARE) recorded by the meteorological station hosted in Qassim University. Finally, a comparison of the obtained results with similar PV grid-connected systems in different countries will be presented.

II. SOLAR ENERGY POTENTIAL IN QASSIM REGION

A real one-minute meteorological data for the last two years recorded by the meteorological station in Qassim University. The recorded data was global horizontal irradiance, direct normal irradiance, diffuse irradiance, ambient temperature, humidity, atmospheric pressure and wind speed. Figure 3 shows a sample of recorded solar irradiance for one day. Figures 2 and 3 indicate that Qassim region is a promised region for solar energy applications, but the average of ambient temperature which reaches 37° C in summer would reduce the overall efficiency of PV system, as an increase in cell temperature by 1° C decreases PV module’s power by 0.5-0.6% [7]. This means the expected output power of PV modules will be lower than mentioned in their data sheets because, the PV modules are being tested at 25°C.

III. BOUNDARIES OF THIS STUDY

Along with solar radiation, other factors which may affect this study are: type of PV technology deployed, Fixed or with sun tracker, tilt and azimuth angles of PV modules, inverter efficiency, utilizing the Maximum Power Point Tracking system (MPPT) or not. Further, economical parameters such as interest rate, discount rate, inflation rate prevalent and projected in Saudi Arabia, percentage of debt to the initial capital cost of the whole project also plays critical role.

This study will be based on the following:

i. The PV technology is mono crystalline silicon, ground-mounted modules, fixed tilt angle equals to location latitude, south facing azimuth angle.
ii. Inverter equipped with MPPT system.
iii. The economic parameters as provided by the Saudi Arabian Monetary Agency (SAMA) in 2015 [8].
iv. The percentage of debt of the capital cost is (0%), and there is no any Incentives or grants.
v. The life time of project is 25 years.

IV. MATHEMATICAL MODEL OF GRID-CONNECTED PV SYSTEM

Figure 4 shows a typical PV grid-connected system consisting of a PV array, inverter and a connection to the grid. So the mathematical model of the PV grid-connected system will combine both models of PV array and the inverter. The
The instantaneous output power of a PV array depends on the global solar irradiance on the plane of PV array; \( G_t \), and the ambient temperature; \( T_c \). The influences of these two parameters on the cell characteristics are shown in Figure 5, where the open circuit voltage increases logarithmically by increasing the solar irradiance and the short circuit current increases linearly as shown in Figure 5a, while the main effect of increasing in cell temperature is on open circuit voltage, which decreases linearly with the cell temperature and the short-circuit current increases slightly with the increase of the cell temperature as shown in Figure 5b. Thus, the cell efficiency will drop [9]. This frequent change in the cell characteristic leads to frequent change in the position of maximum power point as shown in Figure 6. So, for achieving the maximum output power from the PV array, an inverter equipped with MPPT system is preferred. Therefore, the assumption in this model is that the PV array only generates power at the maximum power point on the I-V curve [10].

\[
\eta_{pe} = \eta_r \left[ 1 - \alpha_p \left( T_c - T_r \right) \right] 
\]

where \( \eta_r \) is the PV module efficiency at reference temperature \( T_r \), and \( \alpha_p \) is the temperature coefficient for module efficiency. \( T_c \) is related to the mean ambient temperature. \( T_a \) as following [10], [11]:

![Fig. 1: Location of Qassim Region in the middle of Saudi Arabia](image)

![Fig. 2: The Average annual sum of global horizontal irradiance in Saudi Arabia](image)

![Fig. 3: Sample of recorded solar irradiance data on August 10, 2014](image)

![Fig. 4: Block diagram of grid-connected PV system](image)

![Fig. 5: Influence of irradiation and cell temperature on PV cell characteristics.](image)

(a) solar radiation effect, (b) cell temperature effect.

![Fig. 6: Position of the maximum power point on I-V characteristic of PV cell](image)
The replacement of count rate (d).

The capacity factor (CF) and the performance ratio are the key indicators to evaluate the energy performance of a PV system. These indicators include the total energy yield, the yield factor, the capacity factor, the performance ratio, and the levelized cost of energy. These technical indicators help in comparison between similar PV systems to determine which works better. On the other hand, the economic indicators are the levelized cost of energy and the simple payback time.

The total energy yield is the total amount of energy that is injected into the grid. The yield factor (YF) measures the productivity of a PV array under certain weather condition, and it is defined as the annual, monthly, or daily net AC energy output of the system divided by the peak power of the installed PV array at standard test condition (STC) and it is given by [12]:

\[ YF = \frac{E_{grid}}{E_{array}} \]  

Where \( E_{grid} \) is the actual amount of PV energy delivered to the grid in a given period divided by the theoretical amount according to STC data of the modules [13]. It is independent of location and system size and indicates the overall effect of losses on the array's nominal power due to: inverter inefficiency, wiring mismatch, other losses when converting from d.c. to a.c. power, PV module temperature, incomplete use of irradiance, soiling or snow, system down-time, and component failures [14], [15].

Performance ratio (PR) is defined as the actual amount of PV energy delivered to the grid in a given period divided by the theoretical amount according to STC data of the modules [13]. It is independent of location and system size and indicates the overall effect of losses on the array's nominal power due to: inverter inefficiency, wiring mismatch, other losses when converting from d.c. to a.c. power, PV module temperature, incomplete use of irradiance, soiling or snow, system down-time, and component failures [14], [15].

\[ PR = YF \cdot \frac{G_{STC}}{\sum G_i} \]  

The levelized cost of energy (LCOE) is the average cost of energy produced ($/kWh) over the life time of project, i.e., the life cycle cost (LCC) of project divided by the expected output of energy during the project life time. LCC is the sum of all costs associated with an energy delivery system over its lifetime in today’s money, taking into account the time value of money [9]. The purpose of using the LCC is to bring back costs that are anticipated in the future to present day costs by discounting, i.e., by calculating how much would have to be invested at a market discount rate [9].

The levelized cost of energy can be calculated by

\[ LCC = C_{capital} \cdot \frac{\sum C_{D&M} \cdot \sum C_{replacement} - C_{salvage}}{} \]  

The capital cost (\( C_{capital} \)) of a project includes the initial expense for equipment, the system design, engineering, and installation. This cost is always considered as a single payment occurring in the initial year of the project. The operation and maintenance cost (\( C_{O&M} \)) is the sum of all yearly scheduled operation and maintenance costs. Replacement cost is the sum of all spare parts and equipment replacement cost anticipated over the life of the project, for example the replacement of inverter after 15 years. The salvage value (\( C_{salvage} \)) of a project is its value in the end of the life cycle period. All these anticipated costs should be discounted to their present worth taking into account inflation rate (i) and discount rate (d). The present worth (PW) for any future cost is given by [9]:

\[ PW_n = \frac{c(1+i)^n - 1}{(1+d)^n} \]

where (n) is the number of years.

After calculating the life cycle cost, the levelized cost of energy can be calculated by
dividing the life cycle cost of project by the expected output energy during the project life time as follows [17]:

\[ LCOE = \frac{LCC}{E_{grid}} \]  

The simple payback time (SPBT) is one of the most requested measures of a renewable energy system’s economic feasibility. Simple payback time determines the number of years for the energy savings from a renewable energy system to offset the initial cost of the investment and given by [18]:

\[ \text{SPBT (year)} = \frac{(E_{grid}/\text{Kwh/year}) \times \text{Value$($/KWh)} - \text{C_{Initial}\$/year}}{\text{Initial Cost$/year}} \]  

These technical indicators shown in Eqns. 5, 7 and 8 and economic indicators shown in Eqns. 11 and 12 are the performance indicators usually used for determining the viability of renewable energy systems.

VI. DETAILS OF THE GRID-CONNECTED PV SYSTEM UNDER INVESTIGATION

A. The grid-connected PV system

Figure 7 shows the complete system which consists of 4764 unit of PV modules. The PV modules are mono crystalline, manufactured by SunPower. Its maximum efficiency reaches 16.9% at STC and falls to 14.5% due to the temperature effect in summer in Qassim region, the complete electrical data are shown in Table 1. The PV array is divided into four groups, each group connected to one inverter of 250 kW equipped with MPPT system manufactured by China power, its maximum efficiency reaches to 97.7% as shown in Figure 8 [21]. In addition to that, one step-up transformer is used for connecting to grid. The miscellaneous and power conditioning losses are estimated to be 2.0% and 1.5% respectively. All PV modules are ground-mounted, tilt angle equals to location latitude (26.3°) and azimuth angle equals zero. The area of land needed for installation the complete system is estimated at 11,000 m² according to [19].

Table 1. Electrical Data of PV module SPR-210-BLK [20]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Power (+/-5%)</td>
<td>210 W</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>40.0 V</td>
</tr>
<tr>
<td>Rated Current</td>
<td>5.25 A</td>
</tr>
<tr>
<td>Open Circuit Voltage</td>
<td>47.7 V</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>5.75 A</td>
</tr>
<tr>
<td>Efficiency</td>
<td>16.9%</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>-0.38 %</td>
</tr>
<tr>
<td>Measured at (STC): irradiance</td>
<td>1000 W/m²</td>
</tr>
<tr>
<td>air mass 1.5g, cell Temp. 25 °C</td>
<td></td>
</tr>
</tbody>
</table>

B. Location and weather data

The suggested location is near Qassim University at Longitude 43.75° E and Latitude 26.35° N. The weather and solar irradiance data are recorded for one year by a meteorological station located in Qassim University for period 6/1/2013 - 5/1/2015. The weather and solar irradiance data calculated from one minute recorded values are shown in appendix. The annual average irradiance of recorded readings is in good agreement with previously reported data shown in Figure 2, which makes these recent readings more reliable.

C. Financial and economic data

This study focuses on the investment cost of solar PV power plants. This includes costs for PV modules and inverters as well as the Balance of System cost (BOS) which includes: installation, mounting, DC cabling, switch gear, grid connection, transformer, infrastructure development, planning and documentation.

The current international price of PV modules for mono-si type is between (0.56-0.67) $/Wp as stated by the Energy trend website [22], while the international price of inverters is between (0.11-0.13) $/Wp as stated in the recent report prepared by Fraunhofer-Institute for Solar Energy Systems for Current and Future Cost of Photovoltaics [3]. In this study, the highest price will be chosen to be in safe side for both PV modules and inverters. The BOS cost and O&M cost as estimated in the report prepared by Fraunhofer-Institute for Solar Energy Systems (ISE) for Current and Future Cost of Photovoltaics [3]. The considered costs are illustrated in Table 2. The interest and inflation rates are 2% and 2.2% respectively as published by SAMA on its website [8], and the discount rate is estimated at 4.5%. In this study we assume no debt as a part of the capital cost, the life period of project is 25 years which is equal to the life cycle of PV modules. The life period of inverters is 15 years and the salvage value is 20% of capital cost.

![Fig. 7: Complete PV grid-connected system](image-url)
A. F. Almarshoud. Int. Journal of Engineering Research and Application

VII. RESULTS AND DISCUSSION

A. Technical analysis

The simulation results show that, the total energy injected to the grid is 2025.6 MWh/year as shown in Table 3. Figure 9 shows the average monthly energy supplied to the grid. The total energy supplied to the grid during the life time of project (25 years) is 42978.9 MWh assuming the energy yield decreases by 1% annually due to degradation in the rated output power of PV modules.

The annual YF is 2024.7, this means that the PV system in this location under this weather condition can produce its rated power for 2024.7 times during one year. The monthly YF is in the range from 153.73 to 184.52 as shown in Figure 10. The YF of system under investigation is considered high comparing with similar PV grid-connected systems worldwide, for example; 1163 in Ghana[13], 1696.6 in Oman [16], 1861-1922.7 in Kuwait [7], 400–1300 in Germany, 450–1400 in Italy and 470–1230 in Japan [14].

CF For the system under investigation is 23.1%. This value of CF is reasonable comparing with similar PV grid-connected systems worldwide, for example; 13.2 in Ghana [13], 19.64 in Oman [16], 21.6-22.5 in Kuwait [7] and 14-24 in USA [23]. The annual PR for the PV system under investigation is 84.27% and monthly PR in the range from 80.26% to 89.11% as shown in Figure 11.

Table 3. Summary results of performance indicators.

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual energy yield</td>
<td>2025.6 MWh</td>
</tr>
<tr>
<td>Annual capacity factor</td>
<td>23.1 %</td>
</tr>
<tr>
<td>Annual yield factor</td>
<td>2024.7</td>
</tr>
<tr>
<td>Annual performance ratio</td>
<td>84.27 %</td>
</tr>
<tr>
<td>Levelized cost of energy</td>
<td>0.0359 $/kWh</td>
</tr>
<tr>
<td>Simple payback time</td>
<td>13.7 year</td>
</tr>
<tr>
<td>Annual GHG emission reduction</td>
<td>1755 tCO₂</td>
</tr>
</tbody>
</table>

B. Economic Analysis

The LCOE calculation is done in actual prices of the reference year 2015 for PV modules according to Energy trend website[22], and 2014 for other BOS components are according to the report prepared by Fraunhofer-Institute for Solar Energy Systems [3]. The LCOE for the system under investigation is 0.0359 $/kWh. This value is encouraging value in comparison to other reported values in 2015 in some different countries, for example; .051-.09 in Brazil, .053-.09 in China, .061- 0.1 in France, .051-.069 in Morocco, .049-.076 in Spain and .047-.076 in USA [3]. It is worth to mention that the method of LCOE is suitable to compare the cost of energy produced in PV systems of different generation and cost structures. But it is not suitable for determining the financial viability of a specific PV system. For that, a financing calculation must be done taking into account all revenues and expenditures on the basis of a cash flow model.

The SPBT depends on the price of exported electricity to the grid, for the system under investigation it is 13.7 years on the base of 0.0533 $/kWh which is equivalent to the new tariff of electricity in Saudi Arabia for residential sector.

![Fig. 8: Variation of Inverter's efficiency with loading](image)

![Fig. 9: Monthly average of energy injected to grid](image)
C. Environmental effect

As a result of utilizing the system under investigation in Qassim region, the estimated greenhouse gas GHG emission reduction is about 1755 tons of CO$_2$ annually. This quantity of GHG emission is equivalent to 4080 barrels of crude oil, or 754,137 liters of gasoline could be saved from burning for energy production annually, or equivalent to 161 Hectares of forest for absorbing the emitted CO$_2$.

VIII. CONCLUSION

In this paper, a feasibility study has been performed for a 1MW PV grid-connected system in Qassim region in the middle of Saudi Arabia depending on real solar irradiance data. The simulation results showed high energy productivity and the performance indicators; Yield factor, Capacity factor and Performance ratio are high comparing with similar systems in some different countries. Economic analysis has been done using the LCOE and SPBT as the two most important economic indicators. The LCOE was 0.0359 $/kWh which is less than the electricity tariff in Saudi Arabia. The SPBT was 13.7 years if the electricity sold with an export rate of 0.0533 $/kWh which is equal to the tariff of electricity in Saudi Arabia for residential sector. Also the GHG emission reduction has been estimated at 1755 tons of CO$_2$ annually. The prices of PV modules and other components of BOS are according to prices of year 2015. This study was done supposing that there is no any governmental incentives or grants which could make big difference.

In light of the positive results of this study, there are three crucial requirements for the progress of PV competitiveness in Saudi Arabia: The creation of a comprehensive series of laws and regulations providing the basis for renewable systems feeding into the public network, development of feed-in-tariff mechanism and providing good incentive for renewable systems through greenhouse gas abatement.

The final and most important conclusion derived from the study presented here is that the Saudi Arabia market possesses huge potential for investment in solar energy application.

ACKNOWLEDGEMENTS

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[8]. Saudi Arabian Monetary Agency (SAMA), http://www.sama.gov.sa/en-
/Pages/default.aspx


[22]. Energy Trend: http://pv.energytrend.com/


Appendix

Monthly mean daily weather data and solar irradiance values calculated from one minute recorded values.

<table>
<thead>
<tr>
<th>Month</th>
<th>Ambient Temp. °C</th>
<th>Relative humidity %</th>
<th>Global radiation (horizontal) kWh/m²/d</th>
<th>Global radiation (Tilted) kWh/m²/d</th>
<th>Atm. pressure kPa</th>
<th>Wind speed m/s</th>
<th>Clearness Index (Kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>14.2</td>
<td>44.6</td>
<td>4.30</td>
<td>5.82</td>
<td>94.2</td>
<td>2.4</td>
<td>0.66</td>
</tr>
<tr>
<td>February</td>
<td>17.0</td>
<td>30.8</td>
<td>5.43</td>
<td>6.77</td>
<td>93.9</td>
<td>2.6</td>
<td>0.65</td>
</tr>
<tr>
<td>March</td>
<td>21.9</td>
<td>33.8</td>
<td>6.07</td>
<td>6.70</td>
<td>93.7</td>
<td>2.5</td>
<td>0.58</td>
</tr>
<tr>
<td>April</td>
<td>28.2</td>
<td>22.1</td>
<td>5.95</td>
<td>5.89</td>
<td>93.7</td>
<td>2.9</td>
<td>0.61</td>
</tr>
<tr>
<td>May</td>
<td>31.9</td>
<td>15.5</td>
<td>7.03</td>
<td>6.47</td>
<td>93.5</td>
<td>2.7</td>
<td>0.64</td>
</tr>
<tr>
<td>June</td>
<td>34.3</td>
<td>11.2</td>
<td>8.18</td>
<td>7.18</td>
<td>93.1</td>
<td>2.7</td>
<td>0.72</td>
</tr>
<tr>
<td>July</td>
<td>36.2</td>
<td>11.1</td>
<td>8.16</td>
<td>7.29</td>
<td>92.9</td>
<td>2.6</td>
<td>0.75</td>
</tr>
<tr>
<td>August</td>
<td>36.5</td>
<td>11.5</td>
<td>7.54</td>
<td>7.24</td>
<td>93.0</td>
<td>2.5</td>
<td>0.71</td>
</tr>
<tr>
<td>September</td>
<td>33.7</td>
<td>13.3</td>
<td>6.70</td>
<td>7.11</td>
<td>93.4</td>
<td>2.4</td>
<td>0.69</td>
</tr>
<tr>
<td>October</td>
<td>28.0</td>
<td>19.3</td>
<td>5.67</td>
<td>6.79</td>
<td>93.8</td>
<td>2.7</td>
<td>0.66</td>
</tr>
<tr>
<td>November</td>
<td>20.2</td>
<td>41.3</td>
<td>4.46</td>
<td>5.87</td>
<td>94.0</td>
<td>2.5</td>
<td>0.62</td>
</tr>
<tr>
<td>December</td>
<td>15.8</td>
<td>44.1</td>
<td>4.03</td>
<td>5.61</td>
<td>94.3</td>
<td>2.4</td>
<td>0.60</td>
</tr>
<tr>
<td>Annual (Avg)</td>
<td>26.5</td>
<td>24.9</td>
<td>6.13</td>
<td>6.56</td>
<td>93.6</td>
<td>2.6</td>
<td>0.66</td>
</tr>
</tbody>
</table>