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Energy comparison based design review of 100 MWp QASPP and crest

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KEYWORDS

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PV Cleaning

ABSTRACT

Energy needs of the world can be achieved by considering photovoltaic (PV) energy as a large-scale source that has been proved by recent growth in production of PV modules and decrement in their prices. Deserts are in demand for the purpose of energy generation through PV, began utilized by countries too. This article scrutinizes the issue of offbeat energy generation by contrasting the two 100 MW PV power plants analogous in location, environment and installed equipment. Irregularity of performance is conducted and assessed by plane of array (POA), annual deterioration rate, inter row spacing, PV cleaning frequency, equipment losses, temperature and other factors. Actual monthly generation differences of a year are examined considering deterioration rate and vice versa for the two in sight. Inter row spacing and POA are emphasized with sun path plots and eclipse diagrams for maximizing the energy yield. Any discrepancy of these parameters during design stage prompted with pecuniary loss that ramified over the life cycle of the project. While a meliorated design impacted a USD 0.85 million financial saving with supplement of energy output.

1. Introduction

Middle East is encouraging whole world with financial investment in solar energy for trimming electricity prices and to develop green energy technologies. A sinking 86% rate in price of solar modules have been observed during 2010 to 2017 [1] with exuding 0.03 USD as levelled cost of electricity (LCOE) [2]. The renewable energy forecast study of International Energy Agency (IEA) figures out that India, Japan, China and United States will attain 580GW, 157 GW, 149 GW, 45 GW installation till 2024 respectively [3]. The photovoltaic (PV) contriver trying to deracinate maximum energy generation at commercial level by utilizing availed land and roofs [4]. Different circumstances pop up with fallout from maximum energy yields from installed capacity [5-6]. Grid connected design of PV power plants are embedded with the extraordinary power losses [6]. Optimal PV design needs special supervision as solar irradiance can be controlled by the nature only unlike others such as heat and radioactive energy. According to commercial demand, PV system designers are intended to enhance performance ratio (PR), getting converged maximal solution of topographic map of invested area for PV installation [7].

Solar irradiance is diversified against polar bisection of earth planet. Therefore, global horizontal irradiance (GHI) differs for the same rated PV plants installed at both ends of the polar bisection of the earth; giving different energy [8-9]. For an example, Europe has larger shadow effects as compared to Asia thus needs larger area for PV installation (more PV modules) for achieving energy output of Asian PV plants [10]. The major aspect of PV installation is the area with plenty of solar irradiance [11-12]. Thus, the countries having lower cost of land with suitable solar irradiance level are beneficial for investment point of view in VLS PV system installation [13]. With optimized PV design such areas can yield tremendous energy [14] with economic benefits with lower ground cover ratio (*GCR*). Deserts have lower land cost, thus consideration of *GCR* makes them as suitable for VLS PV plant installation; many of them found in the world too [15-16].

Generally, two PV plants located next to each other with same rated capacity and installed equipment in the desert should have to generate same energy.

Same could not be said for the two largest (100 MWp capacity) commercial PV plants beside each other for Pakistan desert. Commercial VLS PV plants with identical environment has never been correlated. Such correlation is required for developing country like Pakistan boosting up generated energy with economy. This article correlates the output energy mismatch of two solar PV plants beside each other in the Cholistan desert, Bahawalpur Pakistan. Eventually, results prospects change in design. This article discusses the factors effecting the PV plant generation in detail, optimally endorsed with plant location to regale PV designers about plane of array (POA), sun plots and *GCR*.

This article is a major contribution in the field of VLS PV power plants by interpreting a contrast in energy volume of 100MWp solar power plants of Pakistan located next to each other [17].

All the site-based parameters impacting on the energy yield are studied discerningly with annual energy output for 3 years i.e. 2017 to 2019. Additionally, inter row spacing, POA and *GCR* of the two are discussed and fiscal losses are calculated. For future research scope, optimal parametric discussion has been done at the end.

2. Solar trending in Pakistan

Naturally Pakistan is gifted with global horizontal irradiance level of 1500 kWh/m2 covering 90% of the country as shown in Fig. 1 [18]. Energy harvesting from fossil fuels is the major cause of average temperature rise globally. Thus, renewable energy trend can be observed in energy harvesting around the globe. Almost 194 countries agreed to decrees the rising rate of carbon emission in Paris 2015 with United Nations Framework Convocation on Climate Change (UNFCCC). The statement of agreement was; ‘Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change’ [19]. Likewise, in Asian countries, Pakistan also promises to encourage renewable energy harvesting give his share in carbon emission reduction. Currently, a share of 47% is given by Pakistan through his renewable energy sector and most likely it will grow gigantically [20]. Pakistan has adopted renewable energy and wind power plants has been operational in Sindh province [21-22]. After wind power installation Government of Punjab starts exploring VLS PV solar power Potential in Pakistan and Quaid-e-Azam Solar Park (QASP) is the contribution of these efforts. The operational capacity of QASP is 400 MW with 100 MW in construction stage and expected to reach at 1000 MW (original approved capacity) plus 350MW (under approval) in upcoming years. The VLS PV Solar power plants of Pakistan has listed in table 1. This article discusses the phase 1 and phase 2 solar PV power plants listed in table 1 i.e., 100 MWp Quaid-e-Azam Solar Power Plant (QASPP) and 100 MWp Crest Energy power plant. Quaid-e-Azam Solar Power Park is favourable for researchers to study the environmental impacts of solar PV plants as four plants of 100 MW capacity are located very close to each other as shown in Fig. 2.

3. Factors effecting solar generation

The most important factor for any solar PV power plant is its location because our globe has diversified solar irradiance level. In the case of adjacent located solar PV power plants temperature, humidity, sky covering, rainfall and dust are in analogy due to same environmental zone.

Thus, the remaining factors of consideration for comparison are listed and discussed in detail.

1. PV module technology
2. PV Pitch (inter row spacing)
3. POA for modules
4. Generation devaluing factor of module (GDF)
5. Cleaning delay of PV modules
6. Balance of system (BoS) losses.
7. Revamping losses of MV & HV.
8. Non-Projected missed volume.

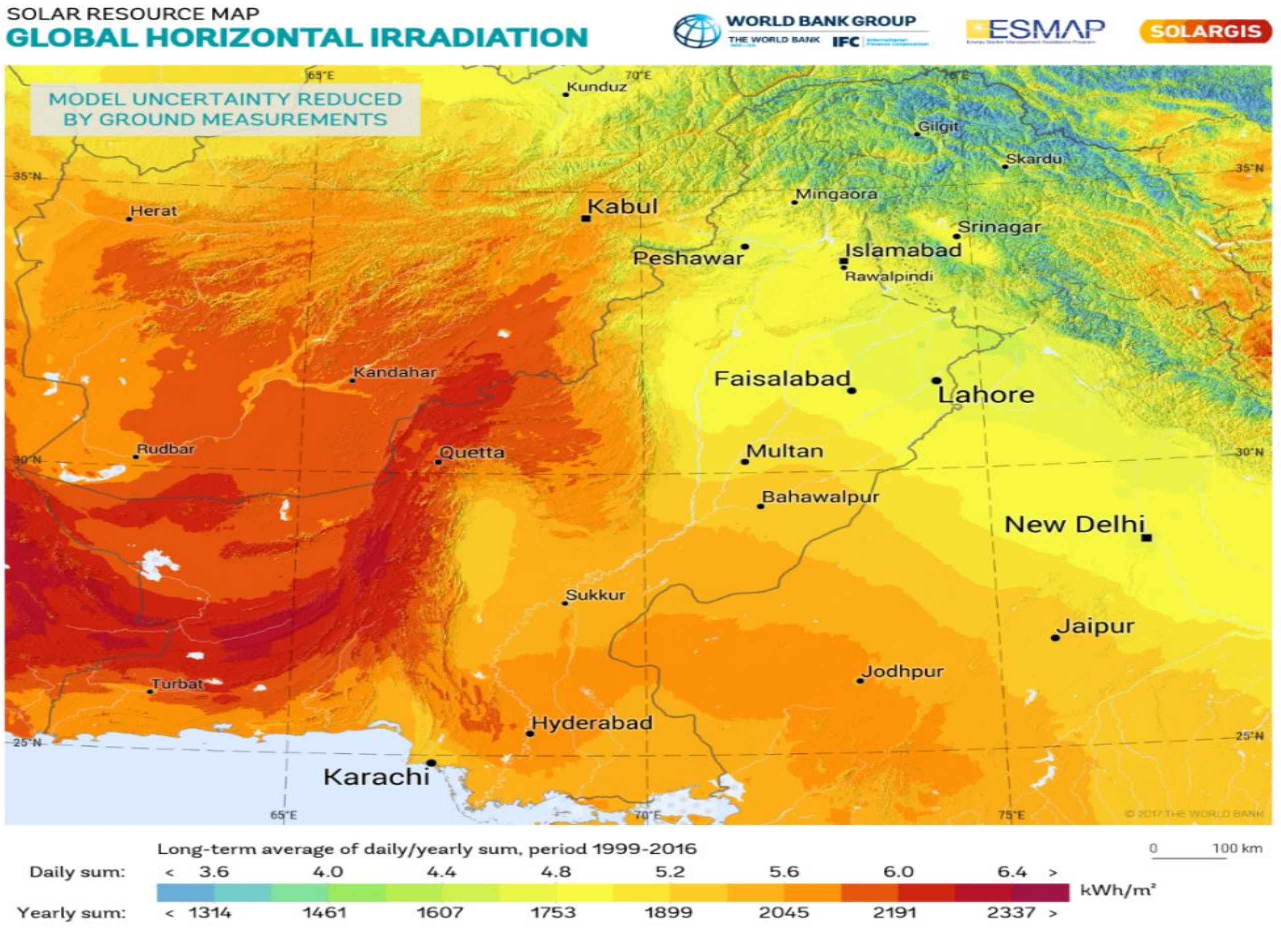


Fig. 1. Global horizontal irradiance map of Pakistan [18]

Fig. 2. Location of 100MW solar power plants in Bahawalpur, Pakistan

Table 1

Details of large scale PV power plants in Pakistan

S. No.	Name of power plant	Capacity (MW)	Location	Status
1	Quaid-e-Azam Solar Power Plant (QASPP)	100	QA Solar Park Bahawalpur, Punjab	Operational
2	Crest Energy Solar Power Plant	100	QA Solar Park Bahawalpur, Punjab	Operational
3	Best Green Energy Power Plant	100	QA Solar Park Bahawalpur, Punjab	Operational
4	Apollo Solar Power Plant	100	QA Solar Park Bahawalpur, Punjab	Operational
5	Zorlu Energy Solar Power	100	QA Solar Park Bahawalpur, Punjab	Under construction
5	Oursun Solar Power Limited (OPL)	50	Gharo, District Thatta, Sindh	Operational
6	Gharo Solar Power Limited (GSPL)	50	Gharo, District Thatta, Sindh	Operational
7	Harappa Solar Power	18	Sahiwal, Punjab	Operational
8	Fauji Cement	12.5	Attock, Punjab	Operational
9	Aj Solar Power	12	Adhikot, Khushab Punjab	Operational
10	ENI Solar Power	10	Sehwan, Dadu, Sindh	Operational

3.1 PV Module Technology

Ample amount of PV technologies is available for installation at utility level. Silicon based ploy and mono crystalline, amorphous silicon (a-Si, CdTe, CIGS) thin film technology is trendier due to their PR. A newly available technology in PV world is concentrated (CPV) and organic PV (OPV). In comparison, crystalline modules almost captured 85% of the PV cosmos. Space contrasting of crystalline PV and thin film PV results in 4.5-5 acers/MW or 7-8 m^2/kWp and 9-10 acers/MW or 10-15 m^2/kWp respectively. Table 2 shows a comparison of common PV technologies [23].

Table 2

Comparison of PV module technology

Items	Si (Mono)	Si (Poly)	Thin Film
PR	Highest PR (18-22%)	Lower PR (14-18%)	Least PR (10-12%)
Fabrication apt for	By individual crystal	By integrated crystal	Layered structure of PV
Area requirement	Minimum	Moderate	Large
Per unit energy	High; large Si molecules	High due to Si fusing	Low; lower Si molecules
Shaded PR	Less	Less	Mediate
Gap of V_{oc} and V_{mp}	15-20%	15-20%	15-20%
Temperature coefficient	Large	Large	Minute (better)

3.2 PV Pitch

Inter row spacing of the two PV arrays is also called PV pitch, if not properly designed cause financial loss in terms of lower generated energy due to shading of front array on the array at back. This phenomenon is also called inter array shading and majorly depends upon the selected site location latitude. During design stage of PV power plant site selection must agrees with the installed capacity and lower pitch value and repugnant loss. The objective function of maximum annual energy production must have convergence of feasible solution [24]. The dependability of inter row spacing of two PV arrays are shown in Fig. 3 [17], Where d is pitch of the array, b is displacement of array/inter row spacing, β is POA,l is Module length and α is Solar elevation.

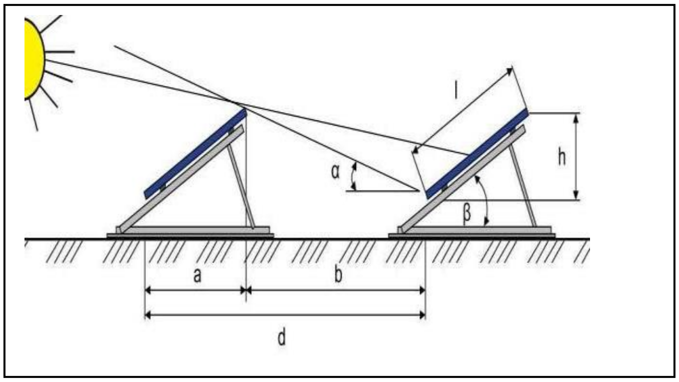


Fig. 3. PV inter row spacing exploration [17]

3.3 Plane of Array

The angle between horizontal ground and PV module is known called POA or commonly known as tilt/inclination angle. Sloped surface of PV modules is incident with diffused, beam and reflected radiations collectively called global irradiance. The POA is principal element for maximum incidence with solar irradiance. It is a site dependent parameter due to the diversified sun path during one year. This objective function must be converged in feasible solution range for maximized yield [25]. When objective function of pitch and POA are correlated, it can be seen that POA is important as covered area of land depends upon both pitch and POA. If not designed stochastically project will have financial loss in terms of extra land requirement, length of cable with large electrical losses.

The tilt angle trending analysis head towards expensiveness between 10^o to 40^o due to requirement of array support strength and labour cost [26].

On the other hand, decreased slope of PV module will have negative impact on *GCR* in conjunction of inter array shading power loss. The most common pragmatism about PV tilt angle of modules in a region is approximation to the latitude of the region. However, it should be considered in calibration of sun chart of the selected region [27].

3.4 Generation Devaluing Factor (GDF)

It is a nature's norm that everything losses its value after some time. Thus the PV modules also get devalued after being in operation. The rate of devaluation is called generation devaluing factor (GDF) or simply degradation factor (DF). Catastrophic power degradation is not experienced in Solar PV modules [28]. The devaluing process is comprised of two different stage.

1. Accelerated degradation usually in first year of operation (1-4%) [29].
2. Definite degradation after 1 year (0.5-1%)

GDF impacts the energy generation capability of the PV modules directly over its life cycle. Every purchaser add a clause in power purchase agreement (PPA) for GDF of the project for its life cycle. The GDF must be limited to the level mentioned before for productive operation and maintenance (O&M). The GDF for QASPP is 0.83% for each year and for crest energy is 0.75%

3.5 Cleaning Gap of PV Module

All the deserts of Pakistan have one thing common in them that is dusty hovers during sun hours causing aggregation of sand on the modules and dew in night. The resultant of both factors becomes nasty for the modules efficiency by choking the sun rays in severe cases. Hence PV cleaning is required for reliable PR. Wet cleaning commonly called washing is older but effective method. Early morning cleaning is beneficial and cost effective. when irradiance level is below 150 kWh/m^2 with demineralized water at maximum pressure of 500 psi at the nozzle [30]. However, PV cleaning in Pakistan deserts may face a problem of water scarcity resulting in larger cleaning gap. Optimal PV cleaning gap is popular among researchers at present. The literature review suggest the cleaning gap of 20 days in general (varies site to site) when output power sand accumulation becomes 5% or 100µg/m3 respectively. Hence, cleaning gap of 15 days is preferred to maximize generation and PR.

3.6 Balance of System

The balance of system comprises of all the electrical equipment of the Solar PV plant causing losses excluding PV modules. The major equipment are cables, switches, structure, MPPT inverter, transformer, battery, combiner boxes, fuses, relays and meters. Efficient operation and maintenance, cost, space constants drives BoS with different configuration and can be manipulated by the designer [31].

3.7 MV and HV Transformation Losses

As per voltage specifications of Pakistan, DC voltage of 1000 V is converted to 315 V AC and further stepped up to 33 kV (medium voltage range MV) by the means of 1MVA transformer. The AC power feeder of 33 kV rating is combined in MV switchgear room. The MV switchgear losses are comprised of DC and AC cables, switching and transformation losses. Before dispatch to national grid, AC power goes through transformation to 132 kV level causing HV losses. After that added an energy metering loss and transferred to grid.

3.8 Non Projected misses Volume (NPMV)

It is important to consider the number hours of outage of the means to transfer generated energy to utility (HV circuit outage) when correlating VLS PV plants. In case of transmission network unavailability while generation is available at all times. Such type of loss is called NPMV due to fault, curtailment or scheduled maintenance in Pakistan PPA agreement. The PPA have clause of claiming such losses by providing the proof of generation availability.

4. Comparison of generated energy

Section III discuss the factors effecting the generation of VLS PV plants. A comparison of generated energy of QASPP and Crest Energy is made in this section. The monthly energy curve of 3 years i.e. 2017 to 2019, for both power plants is shown in Figs. 4-6. It can be clearly seen that generation of 100 MWp Crest Energy solar power plant is higher than 100 MWp Quaid-e-Azam solar power plant. Thus, logics are given in support of higher energy of Crest power plant in further sections.

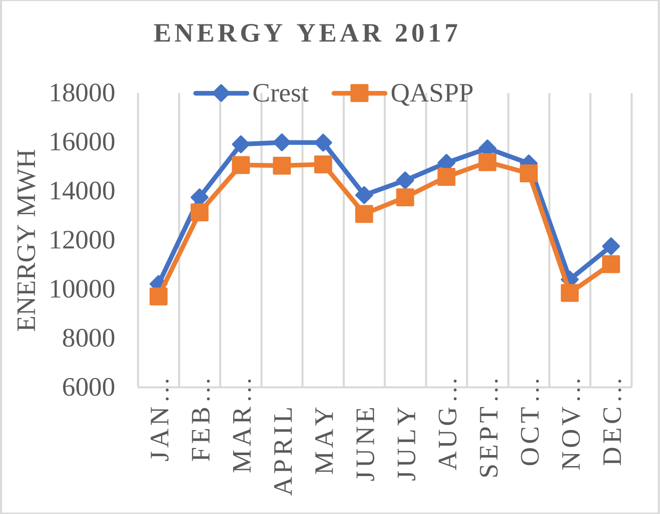


Fig. 4. Crest VS QASPP energy generated in year 2017

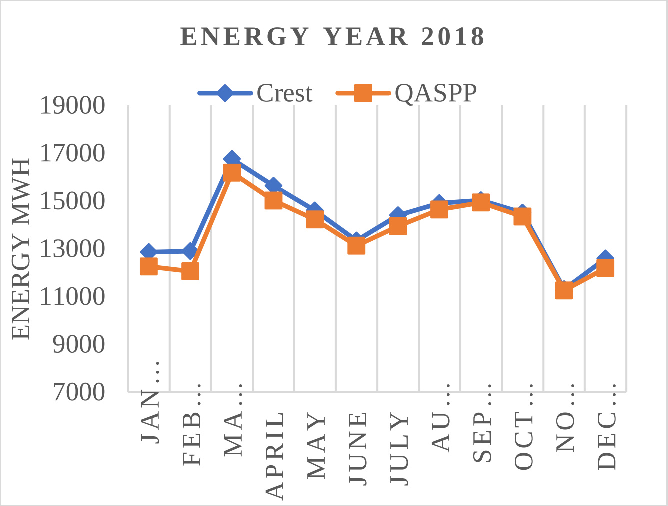


Fig. 5. Crest VS QASPP energy generated in year 2018

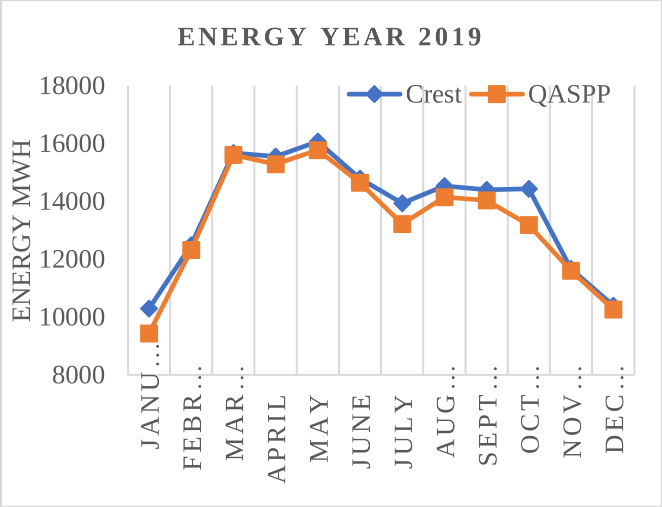


Fig. 6. Crest VS QASPP energy generated in year 2019

5. Logics for difference in energy yield

The logics behind the energy yield of the two power plants is given in this section by claiming the factors considered in section 3.

5.1 PV Module Technology

A 255 W JA Solar (made in China) has been installed in QASPP while crest energy utilizes 250 W Trina solar (made in China) of same technology i.e., poly crystalline PV. As per data sheet of above mentioned PV modules the PV cell structure consists 60 cells with 3 bus bar (BB). The temperature loss of JA Solar and Trina Solar is 0.45%/°C and 0.41%/°C respectively. Thus, the JA solar module will waste 0.04% of output on every degree rise in temperature above 25°C.

5.2 PV Pitch

The angular distance of earth poles against its equator plays major role in case of inter array shading and PV pitch. This angular distance is diversified for each location of the site. The area for this purpose must have sufficient space as per rated capacity installation with acceptable pitch to maximize the generation. The area of QASPP is 1.41 km^2 and Crest Energy is 1.71 km^2 as shown in the Fig. 7. This means that QASPP has installed 100MW in lesser area as compared to Crest energy power plant because inter array spacing and pitch is lower. The Figs. 8 and 9 shows the site inter array spacing of 3 m and 3.8 m of QASPP and crest energy respectively. Per MW area of QASPP and crest energy is 3.5 acre/MW and 4.42 acre/MW respectively.

Fig. 7. PV Area measurements of QASPP VS Crest Energy

5.3 PV Array POA

The POA of QASPP is found 28° and for crest it is 25°. In both power plant modules are facing south. A difference of 3 degree set up the reduced inter array shading, eliciting more energy. As *GCR* major depends upon PV POA thus resulting in a reduced *GCR* and PV area of the module can be calculated as. Where *APV* + *L* is the area of PV modules and land whereas A_c, N_c, N_m are area of cell, number of cell and number of modules respectively.

$$GCR = A_{pv} / \left(A_{pv} + L \right) \qquad (1)$$

$$Apv = A_c \times N_c \times N_m \qquad (2)$$

5.4 QASPP GCR calculations

As per data sheet of JA Solar module of poly crystalline technology (255 W), the specification of its dimensions are 156 mm ×156 mm [32], thus the covered PV area with array spacing is 1146000 m^2. The calculated *GCR* for QASPP is 41.6%.

Fig. 8. QASPP PV area inter array spacing

Fig. 9. Crest energy PV area inter array spacing

5.5 Crest energy GCR Calculations

As per data sheet of Trina Solar module of poly crystalline technology (250 W), the specification of its dimensions are 156 mm ×156 mm [33], thus the covered PV area with array spacing is 1789000 m^2. The calculated *GCR* for Crest energy is 33.65% with more consumption of 26.8% more land.

5.6 Generation Devaluing Factor (GDF)

GDF is an important factor in current case of comparison, one point to be taken into account for calculations is the Commercial Operation Date (COD). The COD gap is 1 year, the GDF must be considered twice for the Crest energy for year 2017 to normalize the effect of COD gap. According to Fig. 4 to 6 the devaluation factor effect lies below 0.75% due to competent O&M team at plant.

For QA Solar, between August and December the GDF is considered double and once for other months. The reason is that for starting year of operation no degradation is considered i.e., from 2015 July to 2016 July, rest will apply once. On the other side GDF for seventh month of 2017 is considered due to 1 year of operation from COD. Fig. 10 will describe it clearly as it been used further for analysis.

5.7 PV Cleaning Gap

The PV cleaning Gap is most important for the PR of the power plant. As per site weather conditions the cleaning gap is two times a month for both plants, while a rainfall record greater than 5mm is considered as one cleaning cycle. Hopefully, all the standard operating procedure (SOP) of PV cleaning are followed by the O&M teams [34].

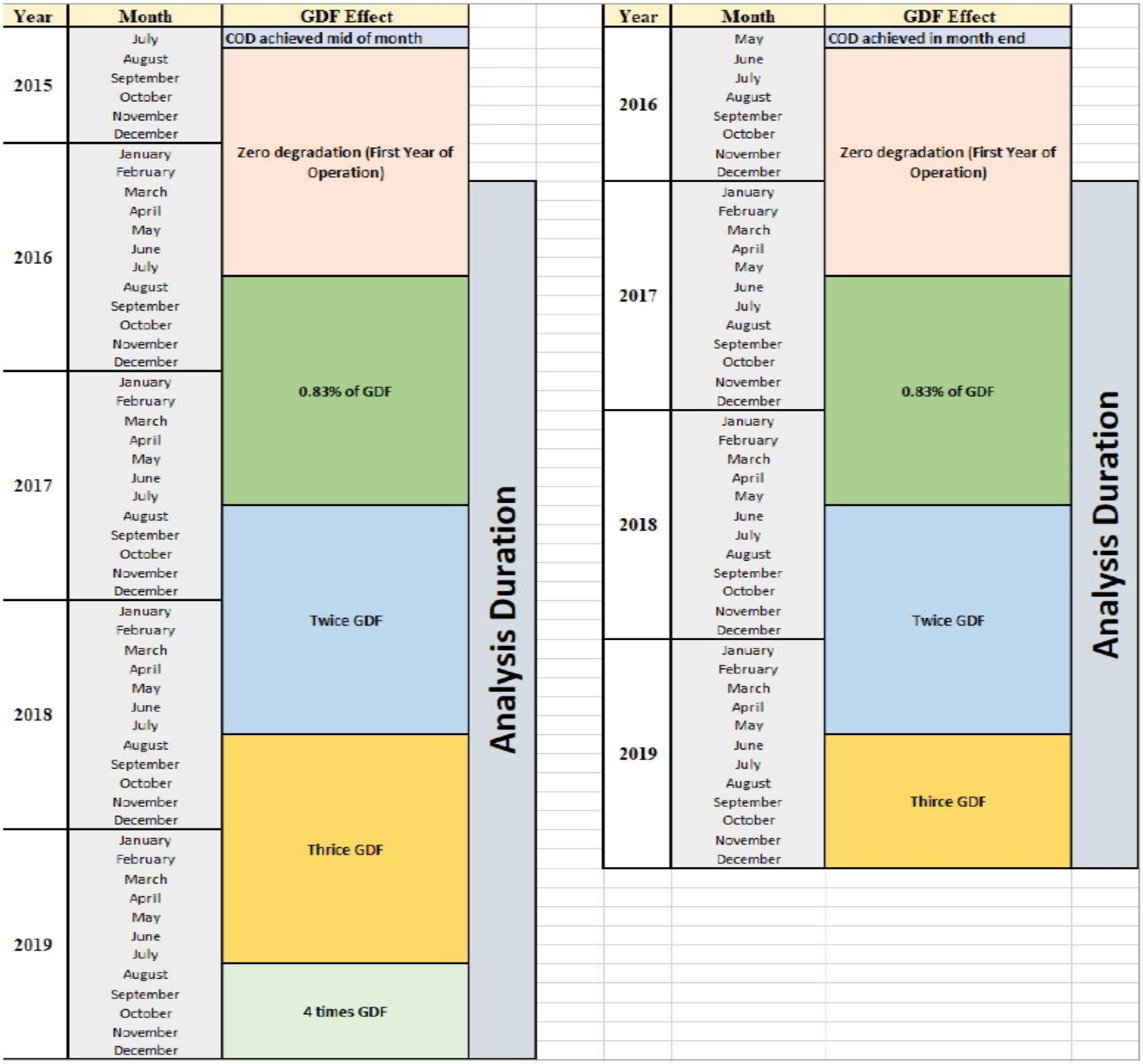
5.8 BoS for MV and HV System

The QASPP and Crest energy utilizing centralized inverter technology. The AC power is stepped up to 33 kV and transferred to 33 kV switchgear room by 20 MV feeders. Then two bus with piece wise is utilized to dispatch up to 132 kV through 100 MVA transformation. As both plants use the same topology thus BoS is same for the two.

5.9 Non-Projected Missed Volume

The units of electrical energy not delivered to grid due to the following restraint.

1. Grid outage (faults)
2. Restrain of exported energy
3. Dispatch Curtailments.
4. Circuit unavailability



Year	Month	GDF Effect	
2015	July	COD achieved mid of month	
	August	Zero degradation (First Year of Operation)	
	September		
	October		
	November		
	December		
2016	January		
	February		
	March		Analysis Duration
	April		
	May		
	June		
	July		
	August	0.83% of GDF	
	September		
	October		
	November		
	December		
2017	January		
	February		
	March		
	April		
	May		
	June		
	July		
	August	Twice GDF	
	September		
	October		
	November		
	December		
2018	January		
	February		
	March		
	April		
	May		
	June		
	July		
	August	Thrice GDF	
	September		
	October		
	November		
	December		
2019	January		
	February		
	March		
	April		
	May		
	June		
	July		
	August	4 times GDF	
	September		
	October		
	November		
	December		

Year	Month	GDF Effect	
2016	May	COD achieved in month end	
	June	Zero degradation (First Year of Operation)	
	July		
	August		
	September		
	October		
	November		
	December		
2017	January		Analysis Duration
	February		
	March		
	April		
	May		
	June	0.83% of GDF	
	July		
	August		
	September		
	October		
	November		
	December		
2018	January		
	February		
	March		
	April		
	May		
	June	Twice GDF	
	July		
	August		
	September		
	October		
	November		
	December		
2019	January		
	February		
	March		
	April		
	May		
	June	Thirce GDF	
	July		
	August		
	September		
	October		
	November		
	December		

Fig. 10. Analysis duration of QASPP and Crest

Many such situations exist in running plant that NPMV occurs. Both of the under-observation plants are adjacent and export energy to same circuit. 132kV double circuit transmission line serves both the grids and connected to Bahawalpur Lal Sunhara substation. The grid interconnection scheme [17] of Quaid-e-Azam solar park is shown in Fig. 11. During analysis and as per provided record of NPMV from crest energy and QASPP, it can be said that the both have very less NPMV. The NPMV clause is agreed by both parties in EPA.

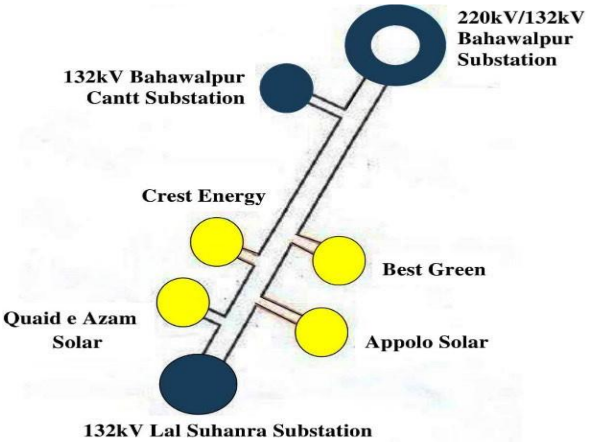


Fig. 11. Grid interconnection of QASPP & Crest [17]

6. Monthly generation accounting factors

The GDF rate for both the power plants energies as per agreement is shown in Fig. 12 and it can be clearly seen that gap between becomes closer for the month of August, September, October, November and February. The average of 4.5% GDF rate is calculated for all the years i.e., 2017 to 2019.

The difference in energy percentage was observed highest for January and December as shown in Fig. 12, because of sun's low horizon and causing longer shadows as shown in Fig. 13 at site location [18]. With consideration of GDF rate the energy effect of 6.65 GWh and 7.5 GWh for QASPP and crest respectively, clearly mentioning that Crest plant producing more power. Thus, it has been concluded that the design has to be reviewed for the POA of the arrays and to minimize the inter array shading effect during morning, evening times and winter season especially. With larger POA or tilt of module *GCR* will increase and shading will be minimized. As QASPP had utilized lesser area with higher *GCR*, resulting in a lower energy yield. It is already discussed in above sections that *GCR* for crest energy is lower than QASPP, thus producing higher energy.

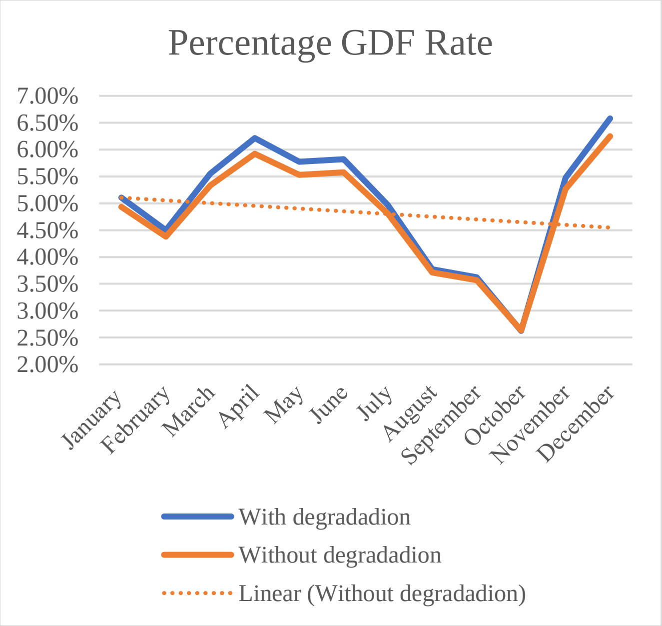


Fig. 12. Percentage GDF rate of QASPP & Crest energy

7. Modified proposal

As every power plant have extension feasibilities too, as per approved design of government of respective country. QASPP and Crest energy has been allotted 500 acre (2023.42 km^2) and can be utilized for the extension purpose or improving the energy yield with fixed tilt PV modules.

An optimized inter array gap calculation of the site is needed to increase the energy yield through the existing PV area. For such exploration of shading of arrays, sun chart of site location is given in Figs. 13-14.

The Fig. 13 shows the shading effect existence above 5 degrees at site location from the existing one can be considered for the mentioned time and days. The sun rays elevated angle is 12 degrees (given at sun chart) for period between 8:00 to 16:00 hours. Thus, we have to set POA to 12 degrees at that time. According to data sheets of installed modules the dimensions are 3.3 m or 1.65 m^2 for the existing twin row installation. In this case PV plant becomes infeasible for energy production during sunrise and set times. For this shading correction, azimuth angle corrections are required by ensuring no shade at mid of the day and ignore little shades in the morning and late evening. The calculated azimuth angle for the site location is 125° and 235° by 180°. Hence the 55° is considered for the calculations of inter array shading effect.

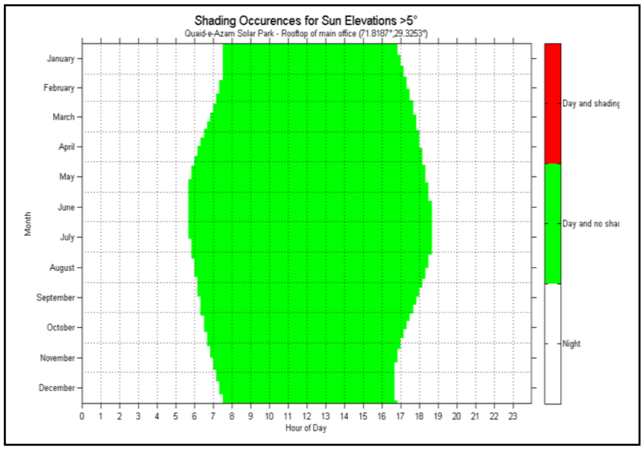


Fig. 13. Shadow effect of QASPP and Crest energy [18]

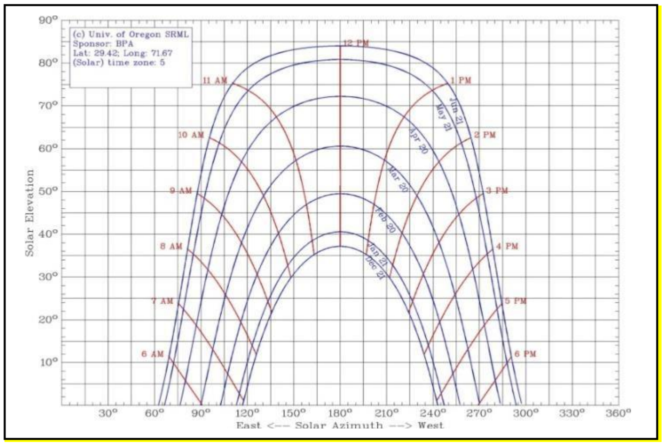


Fig. 14. Sun chart of site location (Bahawalpur) [17]

7.1 Minimum Inter Array Gap for Crest Energy

Considering H_t as difference in height, ξ as the POA and Lm length of onsite installed module and Rm as number of modules in one row, the inter array spacing of 1.39m can be calculated by Eqs. 3 and 4.

$$H_t = Sin\xi + L_m \times R_m \tag{3}$$

$$L_{r-R} = H_t \ / \ tan\ \delta \tag{4}$$

Where LR-R is the spacing in brackets installed and δ as elevated angle from module facing edge. The final corrected azimuth is given by Eq. 5.

$$L_{r-R} = L_{r-R} \times Cos\ \delta \tag{5}$$

Using $\delta \cong 55°$ the value of minim inter row gap for crest energy is 3.76 m which sufficient to yield maximized energy from the installation.

7.2 Minimum inter array gap of QASPP

This is important to note that QASPP and Crest energy only differ in POA of the module. For the $\xi \cong 28°$ from Eqs. 3 to 5, we will get the inter row gap of 4.15 m. Contrasting QASPP and Crest Energy calculated gap with actual site values, the difference of gap for QASPP is 1.15 m with angle of 28°. Which is the reason of lower generation share from QASPP to Bahawalpur energy sector.

Whenever due to devaluation of modules extension will be required to maintain its agreed PR in EPA with government of Pakistan, the extension can be done with 4.15 m inter array gap with the same tilt. But expense of such extension has to bear by the client or the EPC team, thus modification is required in 100 MW rated capacity of PV plant.

7.2 Importance of inter gap in immobile PV plants

Objective of this article is maximization of energy yield of VLS PV systems that has been investigated in may early studies of PV plants installation. All of them considers main parameters of incident energy from sun and environmental effects of PV. This article has major emphasis on the design parameters of PV plant that are interconnected with grids. Thus, the stagnant PV plants can also be explored under the following parameters.

1. Land vacuity of country
2. Annual production
3. Financial perception of PV plants

The annual production can be increased by increasing *GCR* and lowering the self-shading of PV arrays. While on the other side such parametric changes in PV plants will introduce the extra amount of land use and cable losses. In case of limited vacuity, designer has to made objective function by considering the constraints of land vacuity, rated capacity, constant POA angle and irradiance level as per site and maximize the production.

According to the calculations it can be seen that there is a difference of 4.001% annual energy difference in QASPP energy due to 0.8m lesser inter array gap then Crest energy. If the gap of QASPP is set to calculated gap, i.e. 4.15 m, QASPP can compensated the loss of PKR 119 million/year.

8. Conclusion

This paper deals with the comparative analysis of two 100 MWp PV power plants located in Cholistan desert Bahawalpur Pakistan. The calculation based on the actual energy production of both power plants, calumniate the difference in tilt angle of arrays and inter array gap. A 4% of annual average energy difference is spotted which is nearly 6.6GWh loss per annum.

A difference of 1.15m in inter array gap for QASPP is spotted, while the optimized gap is 4.15 m. The assumption of equal BoS is made due to same EPC Chinese team and equipment utilized. A frugality of USD 0.78 million per annum will be recoded in upcoming Zorlu energy power plant if appropriate and modified design is approved by government of Pakistan. The adjustment of *GCR*, land use and output energy from PV plants with modified design has to be made in future works.

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