APPENDIX V

Energy Generation Technical Memorandum

JVR Energy Park – Energy Generation Technical Memorandum

To: County of San Diego Planning & Development Services

Date: June 11, 2021

This JVR Energy Park Project (Proposed Project) technical memorandum has been generated in response to comments received on the Draft Environmental Impact Report (EIR). This memorandum explains and substantiates the energy production of the Proposed Project, as revised.

Brief Summary of Project Changes

The Proposed Project in the Final EIR has been revised in several ways that affect its ability to produce electricity. The Community Buffer Alternative has also been revised to include these revisions, as described below:

- Increase the setbacks from Old Highway 80 and Jacumba Community Park, which results in a reduction in the solar facility of approximately 20 acres. The Community Buffer Alternative also incorporates the increased setbacks, resulting in an additional 19-acre reduction from the original Proposed Project.
- Change of photovoltaic (PV) module type from mono-facial (single sided) to bi-facial for all PV modules for the Proposed Project. Bi-facial modules can generate electricity on both sides of the module resulting in increased electricity production capacity. A bi-facial module generates electricity from direct and diffuse sunlight on the top of the module, and reflected sunlight off the ground from the bottom of the module. (See https://www.solarreviews.com/blog/bifacial-solar-panels.)
- Utilize improved PV module technology that would increase module wattage from 385 watts to approximately 540 watts (approximately 40% increase).

90 Megawatt Power Capacity

The purpose of the Proposed Project is to construct a 90 megawatt (MW) alternating current (AC) power capacity solar facility. With the revisions to the Proposed Project and the Community Buffer Alternative, it is reasonable to ask how the revised Proposed Project and revised Community Buffer Alternative can maintain the required power capacity to the grid. Specifically, the Proposed Project in the Final EIR has been reduced from 643 acres to 623 acres. This 20-acre reduction represents a 3.1% decrease in the development footprint. The revised Community Buffer Alternative has been reduced to 604 acres, which is a 6.1% decrease compared to the original Proposed Project. The discussion below provides an explanation as to how a reduced footprint solar facility can maintain a 90 MW of power capacity.

First, a PV module's power capacity is rated based on its ability to generate electricity in a lab setting that simulates summer conditions at noon with no clouds. Real world conditions very rarely allow a solar module to generate at peak performance. The output of a solar facility is dependent on the availability and angle of the sun. Cloud cover also reduces output. Therefore, a solar facility developer typically designs the facility to have a higher power capacity on-site relative to the MW power capacity that can be delivered to the grid. This is done because a solar facility's power produced on site changes over the course of the year when the sun is at different altitudes in the sky. In addition, PV modules degrade over time which means they produce less energy with the same amount of sunlight.

In order to ensure a solar project can meet a specified amount of energy over the term of a contract, a ratio between the amount of power capacity the facility has versus how much power a solar facility's equipment can transfer to the grid must be evaluated. The industry-standard ratio of power capacity of the facility relative to how much power a facility can transfer to the grid ranges from 1.2 to 1.4. A facility's actual ratio will depend on the geographic features, location, array orientation, and scale of the solar facility. Accordingly, utility-scale solar facilities are sized approximately 20% to 40% larger than the target power capacity to be transferred to the grid to ensure that the system can meet its power output to the grid.

Second, technological improvements related to the use of bi-facial modules and increased module wattage allows a solar facility to generate a similar amount of electricity in a smaller footprint. Bi-facial technology is expected to increase energy production from a solar module by between 5% to 20% or more relative to mono-facial PV modules, depending on location and geographic features.

Further, for clarification, a solar facility's power capacity (nameplate capacity) is different than the amount of electricity that a facility will produce. The power generated by a solar facility over a year is measured in megawatt hours per year (MWh/yr). The MWh/yr that a facility will generate depends upon site conditions, the facility footprint, and technology utilized.

Table 1, below, compares the power capacity and the amount of electricity that would be produced based on the size of the Proposed Project footprint and the Community Buffer Alternative (both as revised).

TABLE 1. COMPARISON OF PROPOSED PROJECT AND COMMUNITY BUFFER ALTERNATIVE

	Acres	Power Capacity to the Grid (AC nameplate)	Approximate Onsite Power Capacity (Direct Current, DC capacity)	Power Capacity to the Grid/Onsite Power Capacity Ratio (DC/AC ratio)	MWh/yr
Revised Proposed Project in Final EIR	623	90 MW	115.18 MW	1.28	Approx. 283,000
Revised Community Buffer Alternative in Final EIR	604	90 MW	110.57 MW	1.23	Approx. 267,000

As demonstrated in Table 1, above, a reduction in acreage under either the Proposed Project or the Community Buffer Alternative can still maintain power capacity to the grid at 90 MW AC because there is sufficient acreage to maintain a gross module wattage (DC capacity) to gross inverter nameplate rating (AC capacity) ratio of at least 1.2 to 1.4.[1] The gross inverter nameplate capacity (AC Capacity) has been calculated based on the gross module wattage (DC capacity) that spans the acreage such that the ratio falls in an industry-standard efficient design range for a solar facility. The amount of energy produced was calculated using a proprietary photovoltaic software, named PVsyst, developed by University of Geneva, and commonly used in the industry as a standard for calculating energy or electricity (in MWh) produced by solar photovoltaic plants.

As a cross-check to the information provided in Table 1, above, the anticipated energy produced by a solar facility can also be calculated through publicly available software, called PV Watts, using the given power capacity to the grid (AC) and power capacity generated from the solar array onsite (DC). The PVWatts

[1] The Proposed Project will not inject more than 90 MW AC into the grid.

Calculator is an interactive web application developed by the National Renewable Energy Laboratory (NREL) that allows installers and manufacturers to easily develop estimates of the performance of potential PV installations at specific location.[2] PV Watts reports for the revised Proposed Project and Community Buffer Alternative are provided in Appendix A of this memorandum. These results represent an approximate calculation of the energy produced where each report also states the variance in electricity produced, based on this specific location. The reports were simulated using mono-facial modules, which do not absorb light from the rear side to boost production, because the PVWatts program does not allow for bi-facial module analysis. However, Table 1, above takes into account an increase in power generation due to the incorporation of bi-facial PV modules.

A Substantial Reduction of Solar Facility Acreage Causes A Proportional Reduction in Power Capacity to Transfer to the Grid

It is reasonable to ask whether a more significant reduction in the solar facility acreage could be made while maintaining the 90 MW capacity to the grid (AC nameplate capacity). When considering minor reductions in acreage, like that proposed by the Community Buffer Alternative, it is possible to optimize design characteristics such as increasing module wattage (from 385W to approximately 540W) to maintain a sufficient number of PV modules that add up to the power capacity onsite. This is done without reducing the number of inverter/transformer platforms (i.e., the machines that convert the DC electricity generated by the PV modules to AC electricity for transfer to the grid) to maintain the 90 MW (AC) which results in an efficient ratio of DC capacity to AC capacity of the solar facility.

When considering more significant reductions in acreage, however, the number of PV modules and inverters must be reduced because there is insufficient space to accommodate them in the development footprint while maintaining the industry-standard 1.2 to 1.4 DC/AC ratio. The reduction in PV modules and inverters would in turn proportionally reduce the ability to transfer 90 MW (AC capacity) to the grid.

Both the revised Proposed Project and the revised Community Buffer Alternative include 25 inverter/transformer platforms to convert the power generated by the PV modules and to meet the 90 MW AC nameplate capacity. If approved, the Proposed Project would provide renewable energy to customers in the cities of San Diego, Chula Vista, La Mesa, Imperial Beach and Encinitas through a 20-year term Power Purchase Agreement (PPA) with San Diego Community Power (SDCP), a Community Choice Aggregation program partnered with San Diego Gas & Electric. The PPA requires an annual guaranteed energy production amount, which in turn requires the solar facility to be 90 MW AC and to produce approximately 260,000 MWh/yr to reasonably achieve the guaranteed energy production amount. (San Diego Community Power, Staff Report to Board of Directors at 2 (May 27, 2021), available at

[2] See https://openei.org/wiki/PVWatts.

https://sdcommunitypower.org/wp-content/uploads/2020/12/00.-Agenda-Packet-v4.pdf.) Both the Proposed Project and the Community Buffer Alternative would be able to the meet the obligations of the PPA.

If the Proposed Project acreage was more substantially reduced below 604 acres, however, then the number of PV modules and inverter/transformer platforms would also need to be reduced because the Community Buffer Alternative is very close to the minimum 1.2 DC/AC ratio. For example, a 20% reduction in acreage could be expected to reduce AC nameplate capacity by approximately 20%. Accordingly, further reductions in project size would result in a proportional decrease in the power capacity onsite and the capacity of the solar facility to transfer power to the grid, and the PPA obligations described above would not be able to be achieved.

Regards,

Jeff Greinke, PE

EVP, Operations

Appendix A – Comparison Using PV Watts

Appendix B – Curriculum vitae for Jeff Greinke, PE

Appendix A

COMPARISON OF PROPOSED PROJECT AND COMMUNITY BUFFER ALTERNATIVE USING PV WATTS

	Acres	Power Capacity to the Grid (AC nameplate)	Approximate Onsite Power Capacity (DC)	Power Capacity to the Grid/Onsite Power Capacity Ratio (DC/AC ratio)	MWh/yr
Revised Proposed Project in Final EIR	623	90 MW	115.18 MW	1.28	265, 523
Revised Community Buffer Alternative in Final EIR	604	90 MW	110.57 MW	1.23	257,189

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at https://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

265,523,200 kWh/Year*

System output may range from 253,441,894 to 268,125,327 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	[redacted]
January	4.88	14,502,594	[redacted]
February	5.81	15,759,346	
March	7.77	22,774,438	
April	9.52	25,938,686	
May	10.73	29,476,930	
June	11.43	29,941,710	
July	10.23	28,154,786	
August	9.51	25,938,424	
September	8.61	23,066,982	
October	7.22	20,822,488	
November	5.46	15,574,787	
December	4.48	13,571,831	
Annual	**7.97**	**265,523,002**	[redacted]

Location and Station Identification

Requested Location	32.63,-116.13
Weather Data Source	Lat, Lon: 32.61, -116.14 1.5 mi
Latitude	32.61° N
Longitude	116.14° W

PV System Specifications *(Commercial)*

DC System Size	115182 kW
Module Type	Premium
Array Type	1-Axis Backtracking
Array Tilt	0°
Array Azimuth	180°
System Losses	11.42%
Inverter Efficiency	99%
DC to AC Size Ratio	1.28
Ground Coverage Ratio	0.38

[redacted]

Performance Metrics

Capacity Factor	26.3%

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

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The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

257,189,232 kWh/Year*

System output may range from 245,487,122 to 259,709,686 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	[redacted]
January	4.88	13,921,759	[redacted]
February	5.81	15,130,345	
March	7.77	22,077,248	
April	9.52	25,474,886	
May	10.73	28,735,216	
June	11.43	29,364,350	
July	10.23	27,390,228	
August	9.51	24,960,464	
September	8.61	22,161,692	
October	7.22	19,993,304	
November	5.46	14,951,740	
December	4.48	13,027,867	
Annual	**7.97**	**257,189,099**	[redacted]

Location and Station Identification

Requested Location	32.63,-116.13
Weather Data Source	Lat, Lon: 32.61, -116.14 1.5 mi
Latitude	32.61° N
Longitude	116.14° W

PV System Specifications *(Commercial)*

DC System Size	110575 kW
Module Type	Premium
Array Type	1-Axis Backtracking
Array Tilt	0°
Array Azimuth	180°
System Losses	11.42%
Inverter Efficiency	99%
DC to AC Size Ratio	1.22
Ground Coverage Ratio	0.38

[redacted]

Performance Metrics

Capacity Factor	26.6%

Appendix B

CURRICULUM VITAE FOR JEFF GREINKE, PE

Jeff Greinke, P.E.

22 Arriate St • Rancho Mission Viejo, CA • 92694 • 949-742-4851
jeff.greinke@gmail.com

SUMMARY OF QUALIFICATIONS

Mr. Greinke has more than 20 years of work experience in renewables, combined cycle, cogeneration power projects, as well as an array of multiple infrastructure projects throughout the United States: Seven years in electrical engineering, and thirteen years in department and project engineering and management. As an Engineering Manager on a diverse set of projects in the United States, Jeff has led multi-disciplinary engineering and construction teams in the development and successful execution of complex projects. Jeff led the engineering, supply chain, and construction disciplines in developing and delivering, in turn, drives his projects towards delivery of cost and schedule certainty. Currently Jeff is serving as Vice President of EPC for renewables.

EMPLOYMENT EXPERIENCE:

Vice President, Engineering, Procurement, and Construction, Baywa r.e. Renewable Energy, Irvine, CA

- Responsible for developing strategic partnerships with multiple engineering, equipment and construction firms which helped drive the success of the projects.
- Responsible for the evaluation of EPC bids and the selection process of EPCs for utility scale solar project.
- Managed a substantial EPC staff in development and execution of utility scale solar projects.
- Responsible for actively communicating with the executive team for the necessary staffing requirements of the EPC teams.
- Provide strategic leadership and guidance for the overall organization and EPC teams.
- Ensure procedures, systems and processes are updated and followed by the organization.

Technology and Project Development Manager, Fluor Corp., Aliso Viejo, CA

- **Market Leadership** responsibilities included development of Fluor's go to market strategy for renewables globally. Additional responsibilities were to assign engineering personnel to be subject matter experts in the renewables market and train them on the most recent technologies in the power field.
- **Client Development** responsibilities include meeting with existing and potential clients globally within all of Fluor's business lines and providing a clear and concise direction of Fluor's Power business line capabilities. Based on these globally meetings and presentation; clients provided their direction for their power strategy which in turn led to future work for Fluor.
- **Project Development** responsibilities included all aspects of executing a contract and front-end engineering to be turned over to the detailed engineering team for completion of the projects.
- **Leadership** responsibilities included working with the sales team as the technical expert in helping drive additional work with existing and new clients as well as other business lines within Fluor.

Jeff Greinke, P.E.

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Engineering Manager, Fluor Corp., Aliso Viejo, CA

- **Market Leadership** responsibilities included development of Fluor's go to market strategy for renewables domestically. Additional responsibilities were to ensure that Fluor personnel were well versed on the latest as it pertains to the technology in the market.
- **Client Development** responsibilities include technical development of renewables and gas-fueled proposal. Along with the development of the proposal, Jeff assisted in supporting sales with interviews and presentations to secure future work.
- **Engineering Management** responsibilities included all aspects of engineering execution including front-end and detailed process design and plant commissioning. Other responsibilities also included successful execution of all of the engineering work on the project. This would include budget, schedule and quality responsibility. As engineering manager, Mr. Greinke was responsibility to insure proper communication and coordination between the engineering disciplines, so that they function as a unified team. It consisted of developing the work processes and inter discipline alignment sessions to catalyze effective inter discipline communication. It was also tasked with bringing a project perspective to the engineering team to insure the overall project objectives are well understood and communicated to the entire team.
- **Leadership** responsibilities included working with all disciplines of the engineering team to address day to day engineering items and ensure everyone on the team works to the common goal of the project which was to execute the work on schedule and under budget.

Engineering Practice Director, Westin Engineering Inc., Santa Ana, CA

- **Regional Market Leadership** responsibilities include development of a three year Strategic Business Plan and Annual Business Plans as a part of the practice management team, development of new service (business) lines, and development of strategies to strengthen the Company's position within the market place.
- **Client Development** responsibilities include development and execution of target account plans with an emphasis on building relationships within the Client organization. Within the account planning process develop and execute specific project capture plans for sole source award or RFP award. When necessary, lead the RFP/RFQ proposal teams through proposal development and selection interviews. Emphasis is always placed on aligning the team and proposal response with the client's needs and organizational structure.
- **Project Management** responsibilities include a collaborative approach with the client, building strong communications, maintain project plans with a focus on maintaining schedule to insure earned value matches expenditures, insure quality assurance and scheduling controls are maintained and adhered too, maintain formal risk management controls to insure all parties are aware of issues that could impact the project negatively.
- **Leadership** responsibilities include working closely with the management team for day to day management of the region, participation in financial management and workload management activities, cultivate and mentor staff in a culture of excellence. Responsible for the direction and guidance of business development, financial management, and project execution within the region.

Director of Engineering, DLT&V Systems Engineering, Irvine & Oceanside, CA

- Responsible for developing strategic partnerships with multiple engineering firms which helped grow the overall revenue of the company.
- Responsible for marketing and business development, which involved evaluating Request for Proposals (RFP) and developing client proposals.
- Managed many industrial clients concurrently in the water/wastewater, manufacturing, and power industries throughout the Southwestern United States.
- Managed a substantial engineering staff in development of electrical and instrumentation drawings, specifications, and calculations.
- Managed a substantial programming staff in development of Programmable Logic Controllers (PLC), Human Machine Interface (HMI), Operator Interface Terminal (OIT), and SCADA systems.
- Prepared assessment reports, preliminary designs, master plans, electrical single-line diagrams, P&ID development, electric schematics and control system architecture development.
- Supervised the work of large staff of CADD operators, technicians and others assisting in specific assignment and checking calculations, sketches and layouts of other Engineers or Designers.
- Prepared and issued control strategies, electrical and instrument specifications, datasheets, calculations and other construction documents on multiple multi-million dollar projects.
- Provided construction services including shop drawing reviews, factory and field acceptance test witnessing on multiple multi-million dollar projects.
- Primarily responsible for securing and negotiating for additional office space to expand the California operations.
- Managed day to day operations in multiple offices throughout Southern California.

EI&C Engineer, Carollo Engineers, Fountain Valley, CA.

- Prepared assessment reports, preliminary designs, master plans, electrical single-line diagrams, P&ID development, electric schematics and control system architecture development.
- Supervised the work of CADD operators, technicians and others assisting in specific assignment and checking calculations, sketches and layouts of other Engineers or Designers.
- Prepared and issued control strategies, electrical and instrument specifications, datasheets, calculations and other construction documents.
- Provided electrical power studies utilizing ETAP PowerStation and Microsoft Access application software. Studies include performing detailed modeling, power system studies (load flow, short-circuit, transient stability, motor starting), and protective device coordination.
- Undertook field assignments & provided technical information and data to design.
- Coordinated information flow between design and other project groups.
- Initiated equipment quotation and purchase requests and prepared bid summaries.
- Provided construction services including shop drawing reviews, factory and field acceptance test witnessing.

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Electrical Engineer, Operation Technology, Inc., Irvine, CA.

- Development of software specifications for development of ETAP PowerStation software.
- Tested upgrades and enhancements of software.
- Prepared electrical power system analysis proposals and business development activities.
- Prepared electrical power studies utilizing ETAP PowerStation and Microsoft Access application software. Studies include performing detailed modeling, power system studies (load flow, short-circuit, transient stability, motor starting), and protective device coordination.
- Led the engineering and software design efforts for generator governor and exciter modeling.
- Provided ETAP PowerStation training class to software users.

Associate Design Engineer, Duke/Fluor Daniel, Aliso Viejo, CA

- Development of specifications, detailed design and drawing production, equipment bid evaluations, procurement of related materials, preparation of subcontract scope of work, and construction support.
- Provided equipment inspections for compliance with design specifications, project requirements, the National Electric Code (NEC), and ANSI standards.
- Prepared detailed engineering calculations, including, but not limited to, equipment and feeder sizing, voltage drop, and cable pulling) power system studies, and protective relay coordination.

EDUCATION:

California Polytechnic State University, San Luis Obispo
Bachelor of Science in Electrical Engineering, Concentration - Power

PROFESSIONAL:

Licensed Professional Electrical Engineer, California No. E 17700
Licensed Professional Electrical Engineer, Texas No. 105633
Licensed Professional Electrical Engineer, Arizona No. 53324
Registered Professional Engineering - National Council of Examiners for Engineering and Surveying (NCEES)