

**BEFORE THE  
PUBLIC SERVICE COMMISSION  
OF MARYLAND**

**IN THE MATTER OF THE APPLICATION OF  
CHERRYWOOD SOLAR I, LLC FOR A  
CERTIFICATE OF PUBLIC CONVENIENCE  
AND NECESSITY TO CONSTRUCT A 202 MW  
SOLAR PHOTOVOLTAIC GENERATING  
FACILITY IN CAROLINE COUNTY,  
MARYLAND**

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**CASE NO: 9477**

**DIRECT TESTIMONY AND EXHIBITS  
OF  
KEVIN H. ZHONG**

**ON BEHALF OF THE STAFF  
OF THE  
PUBLIC SERVICE COMMISSION OF MARYLAND**

**NOVEMBER 13, 2018**

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## **INTRODUCTION**

**Q. Please state your name and business address.**

A. My name is Kevin H. Zhong. My business address is 6 St. Paul Street, Baltimore, Maryland 21202.

**Q. What is your occupation?**

A. I am employed by the Public Service Commission of Maryland (“Commission”) as an Engineer in the Commission’s Engineering Division.

**Q. Please describe your educational background and professional experience.**

A. I hold a Master of Science degree in Chemical Engineering from the Ohio State University and a Master of Science degree in Technical Management from the Johns Hopkins University. Before joining the Maryland Public Service Commission, I had more than ten years of experience in process engineering and managing the construction of air pollution control equipment for process and power plants.

**Q. Have you previously testified before the Commission?**

A. Yes. I have previously testified before the Maryland Public Service Commission in Case Number 9353, *In the Matter of Annual Performance Reports on Electric Service Reliability*, which examines electric company reliability performance under COMAR 20.50.12 on August 9, 2016 , July 25, 2017, July 27 and August 28, 2018. I prepared direct testimony in the Delmarva Power & Light base rate case (No. 9455). I testified on Pepco’s public purpose Microgrid proposal, in Case No. 9361, and also on Rule Making Session 63 on June 20, 2018 and September 18, 2018.

**Q. What is the purpose of your testimony?**

A. The purpose of this testimony is to make a recommendation regarding the effect that the project (the “Project”) proposed by Cherrywood Solar I, LLC (“Cherrywood” or the “Company”) will have on the reliability and stability of the

electric system in the State of Maryland. Reliability and stability are two factors the Commission is required to consider prior to issuing a Certificate of Public Convenience and Necessity (“CPCN”) pursuant to §§ 7-207 and 7-208 of the Public Utilities Article of the Annotated Code of Maryland.

### **CONCLUSIONS AND RECOMMENDATIONS**

**Q. Please summarize your conclusions.**

A. After reading the testimony of the Company’s witnesses and performing my own analysis, I am recommending that the Commission:

- (1) Grant a CPCN to Cherrywood for a 202 MW solar generating plant for which Cherrywood applied, conditioned upon completion of the Facilities Study for the PJM Interconnection, LLC (“PJM”) queue AB2-037; and
- (2) Require the filing of a request for CPCN amendment with the Commission for any generation capacity in excess of 202 MW; and
- (3) Require the signed Interconnection Service Agreement (“ISA”) executed by Cherrywood, PJM and Delmarva Power & Light (“DPL”) be filed with the Commission prior to the commencement of construction; and
- (4) Require that Cherrywood, its successors and assigns, provide sixty (60) days written notice to the Commission of any non-wholesale electricity sale to a Maryland retail electric customer and comply with all regulations regarding such sale including obtaining any requisite ISA and retail supplier approval(s) prior to delivering electricity into the respective distribution systems of Maryland electric companies; and
- (5) Require that Cherrywood, its successors and assigns, provide written notice of any change in ownership of all, or any portion of the Project, at least thirty (30) days prior to the closing date of any sale to a third party. The written notice should include, but not be limited to, identifying the third party providing contact information to receive any Commission inquiries, the proposed effective date of any change in ownership, and providing documentation that demonstrates the capability of the prospective owner to

operate and maintain the Project to perform in accordance with any CPCN issued in this proceeding; and

- (6) Include any additional conditions proposed by the other State agencies having jurisdiction in this proceeding.

### **TESTIMONY**

**Q. Who is the applicant in this case?**

A. Cherrywood is the applicant requesting a CPCN in this case.

**Q. Please describe the Project identified in the application.**

Cherrywood has proposed a 202 MW solar powered generating facility to be located on an approximately 1,074 acre parcel located in Caroline County, Maryland. The Project property is part of a total Limit of Construction that measures approximately 1,723 acres, currently for agricultural uses with the zoning code Rural (R). Cherrywood is designed to be built with photovoltaic solar modules, which will be installed on a pile-driven, post-supported racking system, which will continuously rotate around a horizontal axis to follow or track the sun throughout the day, which will maximize the electricity generated by the modules. It should be noted that the Project was submitted to PJM Interconnection, LLC (“PJM”) to study with a 212.5 MW Maximum Facility Output (“MFO”). The actual design nominal output of the Project is 202 MW which was reduced in the CPCN application.<sup>1</sup> If the Commission decides to grant Cherrywood a CPCN at 202 MW, then based on the result of the remaining PJM studies, Cherrywood may elect to request a CPCN amendment be granted for a 212.5 MW facility. The Company will also comply with conditions imposed by other State agencies and local jurisdictions.

**Q. Please describe the process by which generators are connected to the regional transmission system.**

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<sup>1</sup> See Exhibit, Response to Staff Data Request (“DR”) No. 1-6.

The Regional Transmission Organization responsible for assessing transmission system reliability and stability in Maryland is PJM. A potential interconnection customer, such as the Project, must comply with the PJM Open Access Transmission Tariff (“OATT”), as approved by the Federal Energy Regulatory Commission (“FERC”), and must become a PJM member. PJM organizes generation interconnection requests into clusters, or queues, for the purpose of identifying required transmission system improvements. Upon the receipt of an interconnection request, PJM conducts sequential studies, provided the potential customer meets certain requirements to retain its queue position. The studies are dependent on other projects within the geographical area. The studies performed by PJM are the Feasibility Study, the Impact Study, and the Facilities Study. The studies are intended to determine what system enhancements are necessary to accommodate the interconnecting generator and maintain the reliability and stability of the transmission system. PJM and the Transmission Owner, in this case DPL, require the Project to assume the financial responsibility for any upgrades to the distribution or transmission system. DPL retail electric customers will not have any role, obligation, responsibility or cost in interconnection of the Project to the PJM or DPL electric systems.

**Q. How will the Project be connected to the PJM transmission system?**

The interconnection to the local grid would be undertaken by tapping into the 230 kV transmission system through a new DPL-built substation. To ensure safety and reliability of the electric system, DPL will be constructing protection equipment, including recloser and communications equipment that will allow DPL to isolate the Project in order to address operational events adversely impacting the electric system. The Project will be responsible for all costs of the interconnection upgrades identified in the interconnection studies. DPL customers will not bear responsibility for any costs or work associated with the upgrades. The design and construction of all facilities to complete the interconnection would be the responsibility of the FERC regulated transmission segment of DPL. In addition, the Project will be required to install telemetering

and telemetry equipment to provide revenue metering and real-time data to PJM in accordance with the OATT, and to design and install relaying and metering to comply with DPL transmission standards.

**Q. Please describe the Feasibility Study.**

- A. Computer modeling of the electric system is used by PJM to evaluate the feasibility of new generation with respect to compliance with the Regional Reliability Council, Reliability First, of the North American Electric Reliability Council (“NERC”) reliability and stability criteria. Short circuit calculations are performed to ensure that circuit breaker capacities are not exceeded. This report identifies direct connection requirements and network impacts. PJM has completed a Feasibility Study for Cherrywood, and PJM has issued a Feasibility Report for a 212.5 MW MFO generating facility.

**Q. Please describe the System Impact Study.**

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the Project to the PJM network at a location specified by the Project owners. The System Impact Study is a continuation of the Feasibility Study with the inclusion of more detailed analysis. Capacity Resources<sup>2</sup> are evaluated for load deliverability and generation deliverability. Load deliverability is a measure of the ability to transfer power to the load in a particular sub-area. Generation deliverability is a measure of the ability to export generation from a sub-area. Reliability and stability are evaluated for critical contingencies. Short circuit calculations are performed, taking into consideration all elements of the regional plan, to ensure that circuit breaker capacities are not exceeded.

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<sup>2</sup> A capacity resource has the right to schedule both capacity and energy deliveries at a point of interconnection into PJM markets, pursuant to a bilateral contract or through participation in the PJM capacity market. A capacity resource can provide both capacity and energy to load serving entities to meet their load obligation, pursuant to the PJM Reliability Assurance Agreement that is binding on all PJM members.

**Q. What are the interconnection and transmission network upgrade facilities and costs identified in the Feasibility and System Impact Studies?**

A. Neither the Feasibility Study nor the System Impact Study identified a need for any new transmission system reinforcements or transmission network upgrades. PJM completed a System Impact Study for Cherrywood, and PJM issued a System Impact Study Report for a 212.5 MW MFO generating facility. The estimated cost of facilities required for attachment of the Project to the DPL system is a new substation costing approximately \$6,491,000<sup>3</sup>, all of which will be paid by the Project.

**Q. Please describe the Facilities Study.**

A. In general any generator seeking to interconnect to the PJM transmission system would be required to complete the Feasibility and Impact studies, and for a Facilities study, the applicant will be required to execute a Facilities Study Agreement (“FSA”). By executing the FSA the Applicant retains the assigned priority in the PJM queues. The FSA will provide the estimated cost responsibility and estimated completion date for the study. The FSA may also define reasonable milestone dates that the proposed project must meet to retain its queue position while PJM is completing the Generation or Transmission Interconnection Facilities Study. The Applicant informed Staff that the FSA has been executed.<sup>4</sup>

**Q. What is the current status and queue position of the Project?**

A. As explained above, the Facilities Study is in progress. The PJM website listed the Project’s interconnection request, and indicated an estimated in-service date of October 31, 2019. However, at the time of this testimony, the Facilities Study has

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<sup>3</sup> Generation Interconnection System Impact Study Report for PJM Generation Interconnection Request Queue Position AB2-037, April 2017, page 3.

<sup>4</sup> See Exhibit, Response to Staff DR No. 2-1.



been repeatedly delayed.<sup>5</sup> The estimated in-service time period may not be realistic due to the remaining PJM studies and DPL construction schedules.

**Q. Please describe the agreements that may be executed upon completion of the PJM studies.**

A. Upon completion of the studies, if a project owner desires to continue with the project, an ISA or Wholesale Market Participant Agreement (“WMPA”) is tendered among the project, PJM, and the Transmission Owner and filed with the FERC. Finally, if the project is to be connected to transmission facilities, PJM executes a Construction Services Agreement (“CSA”) between the project and the Transmission Owner. As stated previously in my testimony, if a project is to be connected to transmission facilities, PJM executes a CSA between the project and the Transmission Owner.

**Q. Can you explain what is meant by a Capacity Injection Right (“CIR”)?**

A. The CIRs are awarded to a project based on satisfactory completion of milestones and requirements contained in the various agreements. CIRs allow the project to participate in PJM as a capacity resource. The class average for panel solar farms is limited to 38 percent of their maximum MW output. The reduction is due to variable output resulting from the weather, season, and time of day, etc. Because this is a tracking system, the project’s capacity factor could be higher than 38 percent. Using the MFO of 212.5 MW as studied by PJM, at 38 percent the CIR of Cherrywood will be 80.75 MW.<sup>6</sup>

**Q. Why is the stability analysis important for new projects seeking to interconnect in PJM?**

A. Stability is a measure of the transmission’s system ability to recover from changes to its normal operation. Large or sudden changes in load or generation output can have significant impacts on transmission system operations resulting in voltage

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<sup>5</sup> See Exhibit, Response to Staff DR Nos. 2-2, 3-1

<sup>6</sup> See Exhibit, Response to Staff DR No. 1-6

collapse or cascading outages. Stability Analysis takes into consideration the response of the generator to requests for changes in real (MWs) and reactive power (MVARs) output. According to PJM Manual 14A: New Services Request Process, "For Generation Interconnection Requests a threshold of 20 MW is considered when determining if a stability Analysis is required on a generic basis".<sup>7</sup>

**Q. Have the effects of the Project on the reliability and stability of the electric system in Maryland been determined?**

A. Prior to operation, Cherrywood will be required to comply with DPL's interconnection requirements and the requisite facility upgrades specified in the ISA. The Project's compliance with this agreement would assure no adverse impact to the reliability and stability of the electric transmission system since both DPL and PJM will be parties to the ISA. At the time of this testimony, an ISA has not yet been executed. The Applicant indicated that a target date for execution of ISA and CSA is January 15, 2019.<sup>8</sup> Additionally, the Code of Maryland Regulations ("COMAR") 20.50.02.02: Acceptable Standards requires compliance with IEEE Standard 1547-2003 and Amendment 1-2014; or the latest revision version. The Applicant has confirmed that their design will comply with IEEE 1547-2018: IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.<sup>9</sup>

**Q. Why are you recommending CPCN conditions regarding reliability and transmission system stability?**

A. The Facilities Study should be completed. Additionally, the ISA is a crucial document for maintaining the safety, reliability, and stability of the electric transmission system. The ISA should be required as a condition of any issuance

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<sup>7</sup> PJM Manual 14A, Revision: 24, Effective Date: 07/26/2018, page 27

<sup>8</sup> See Exhibit, Response to Staff DR No. 3-2

<sup>9</sup> See Exhibit, Response to Staff DR No. 3-5.

of a CPCN and be filed with this Commission prior to starting any construction activities.

## **CONCLUSIONS**

**Q. What are your conclusions regarding this Project?**

A. Renewable energy projects, such as solar and wind farms, have been promoted and mandated by many states. State Renewable Portfolio Standards (“RPS”) require suppliers to utilize renewable resources to serve an increasing percentage of total demand or pay an alternative compliance fee. Maryland’s RPS target is 25% by 2020, with 2.5% being supplied by solar generation. The Project would contribute toward meeting this goal. Compliance with an ISA is critical for maintaining the reliability and stability of the electric system. Therefore, the ISA has also been referenced in the proposed CPCN conditions for approval of the Project.

**Q. What is your recommendation in this matter?**

A. Staff recommends that the Commission grant a CPCN to Cherrywood for a 202 MW solar generating facility, but only after the PJM Facilities study for queue AB2-037 is completed. Staff recommends that the Commission include the following conditions if the Commission authorizes the Project:

- (1) Require the filing of a request for CPCN amendment with the Commission for any generation capacity in excess of 202 MW; and
- (2) Require the signed ISA executed by Cherrywood, PJM and DPL be filed with the Commission prior to the commencement of construction; and
- (3) Require that Cherrywood, its successors and assigns, provide sixty (60) days written notice to the Commission of any non-wholesale electricity sale to a Maryland retail electric customer and comply with all regulations regarding such sale including obtaining any requisite ISA and retail supplier approval(s) prior to delivering electricity into the respective systems of Maryland electric companies; and

- (4) Require that Cherrywood, its successors and assigns, provide written notice of any change in ownership of all, or any portion of the Project, at least thirty (30) days prior to the closing date of any sale to a third party. The written notice should include, but not be limited to identifying the third party, providing contract information to receive any Commission inquiries, the proposed effective date of any change in ownership and providing documentation that demonstrates the capability of the prospective owner to operate and maintain the Project to perform in accordance with any CPCN issued in this proceeding; and
- (5) Include any additional conditions proposed by the other State agencies having jurisdiction in this proceeding.

**Q. Does this conclude your testimony?**

**A. Yes.**

**EXHIBITS**

Data Request responses

**Item No.: STAFFDR1-6**

Information provided on pages 2 of the PJM System Impact Study Report indicated “212.5 MW (80.75 MWC)”, from which Staff calculated a 38% capacity factor. Please explain why this factor exceeds the “DC Capacity Factor” and “AC Capacity Factor”, found on Table 8a, on page 34 of the ERD.

**RESPONSE:**

Reference to “212.5 MW (80.75 MWC)” in the PJM System Impact Study Report describes the MW of Energy and Capacity rights associated with the AB2-037 queue position and cannot be used to determine a project capacity factor. The capacity rights associated with AB2-037 are based on a PJM-approved class average for solar photovoltaic facilities of 38% and does not directly relate with the project capacity factor, which is a function of a number of design variables that are subject to change within the limitations of the permitted impacts. Another way to interpret the referenced PJM System Impact Study energy and capacity numbers is that regardless of the ultimate project capacity factor, AB2-037 will be responsible for the cost of transmission system impacts associated with 212.5 MW of energy and 80.75 MW of capacity rights.

On a related note, after receipt of the PJM System Impact Study Report, Cherrywood exercised its rights under the PJM Tariff to reduce the project capacity to 202 MW (76.7 MWC) prior to the start of the Facilities Study. This adjustment was made with prior approval from PJM. The current queue position on the PJM website reflects this reduced capacity. Please see the details for AB2-037 on the PJM interconnection queue website at <https://www.pjm.com/planning/services-requests/interconnection-queues.aspx>

**Item No.: STAFFDR1-9**

Please describe the role, responsibilities, scope of work, and costs being borne by DPL and Cherrywood for the interconnection of the proposed project to the DPL electric system.

**RESPONSE:**

Per the PJM tariff, upon execution of an ISA and CSA, the Applicant will be required to provide funds to PJM based on the amount of network and facility upgrade costs required for interconnection of the Cherrywood project to DPL's system. DPL would then utilize those funds to design, procure, and construct the network upgrades and facilities identified in the ISA and CSA. In compliance with the PJM tariff, all costs associated with the network and facilities upgrades to DPL's transmission system in order to interconnect the Cherrywood project are borne by the Applicant.

**Item No.: STAFFDR1-10**

Please provide an update regarding the current status, or in the alternative, all fully executed agreement(s) between the PJM and the Interconnection Customer identified in the interconnection application and the various PJM studies that would allow the proposed solar project to participate in PJM wholesale markets in calendar 2018. In responding, please identify and provide all necessary agreements, such as the fully executed Interconnection Service Agreement (ISA), Wholesale Market Participants Agreement (WMPA), and the Construction Services Agreement (CSA) between PJM, DPL and Cherrywood, and identify any State or Federal regulatory approvals that are required prior to commercial operation. If any required agreements identified in this request are not currently available, please provide an estimated date by which the outstanding Is will be filed in this proceeding.

**RESPONSE:**

The Applicant is currently in the Facilities Study phase of the PJM interconnection process. The study is conducted by DPL and has been significantly delayed by a backlog at DPL and it is not clear exactly when the Facilities Study will be completed. Cherrywood estimates that the ISA and CSA will be executed by September of 2018.

State and Federal regulatory approvals required prior to commercial operation are included in Table 1 on page 18 of the Environmental Review Document included with the Applicant's Petition for a CPCN from the Commission.



**Item No.: STAFFDR 2-1.**

Has the Company signed a Facilities Study Agreement with PJM?

**RESPONSE:**

Yes.

**Item No.: STAFFDR2-2**

What is the estimated return date of the Facilities Study from PJM?

**RESPONSE:**

August 2018. The study is more than 1 year late due to personnel constraints at DP&L.

**Item No.: STAFFDR2-3**

Will the current footprint of the proposed project site accommodate expansion to 212.5 MW as is being studied by PJM Generation Queue Position AB2-037?

**RESPONSE:**

The PJM queue position for AB2-037 is for a Maximum Facility Output of 202 MWac. The current footprint of the proposed project site will accommodate such a project size.

**Item No.: STAFFDR3-1**

Following up on the response to Staff DR No. 2-2, please provide an update on the status of PJM Facilities Study, Queue AB2-037.

**RESPONSE:** Cherrywood Solar I, LLC has no update from PJM Interconnection, LLC (PJM) or Delmarva Power and Light Company (DPL). The Facilities Study is approximately 18 months late.

**Item No.: STAFFDR3-2**

Following up on the response to Staff DR No. 1-10, please provide an updated estimate of the date for execution of ISA/CSA.

**RESPONSE:** The Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA) will be executed within 60 days of receiving the facilities study. However, it remains unclear when PJM Interconnection, LLC (PJM) or Delmarva Power and Light Company (DPL) will provide the Facilities Study. This notwithstanding, Cherrywood Solar I, LLC estimates that the execution of the ISA and CSA will occur on or about January 15, 2019.

**Item No.: STAFFDR3-5**

Please describe any design specs that the Company has revised in order to be in compliance with IEEE 1547-2018.

**RESPONSE:** Inverter procurement specifications will be in compliance with IEEE 1547-2018.