BEFORE THE IDAHO PUBLIC UTILITIES COMMISSION

IN THE MATTER OF IDAHO POWER COMPANY'S APPLICATION FOR APPROVAL OF NEW TARIFF SCHEDULE 63, A COMMUNITY SOLAR PILOT PROGRAM.	)	CASE NO. IPC-E-16-14

IDAHO POWER COMPANY

DIRECT TESTIMONY

OF

DAVID M. ANGELL

Q. Please state your name and business address.

A. My name is Dave Angell. My business address is 1221 West Idaho Street, Boise, Idaho.

Q. By whom are you employed and in what capacity?

A. I am employed by Idaho Power Company ("Idaho Power" or "Company") as the Planning Manager in the Customer Operations Engineering and Construction Department.

Q. Please describe your educational background.

A. I graduated in 1984 and 1986 from the University of Idaho, Moscow, Idaho, receiving a Bachelor of Science Degree and Master of Engineering Degree in Electrical Engineering, respectively. I have provided electrical engineering instruction for both the University of Idaho and Boise State University. Most recently I instructed power system analysis at Boise State University during the 2009 spring semester.

Q. Please describe your work experience with Idaho Power.

A. From 1986 to 1996, I was employed by Idaho Power as an engineer in both communications and protection systems. In 1996, I became the Engineering Leader of System Protection and Communications. I held this position until 2004, when I transferred to Transmission and Distribution Planning. During the fall of 2006, I accepted

the positions of System Planning Leader and Manager of Delivery Planning. I have been managing Idaho Power's load research, interconnected-transmission system, sub-transmission, and distribution planning since 2006.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to describe the construction and operational aspects of the Company's proposed Community Solar Pilot Program ("Program").

Q. How is your testimony organized?

A. My testimony is organized as follows:

(1) I provide an overview of the project and the selected location.

(2) I discuss the request for bid ("RFB") issued for the construction of the solar array and the results.

(3) I describe the interconnection process and cost to connect the solar array to Idaho Power's grid.

(4) I discuss the expected energy production of the facility and the line losses applied to that energy.

(5) I describe the operational benefits and the operational learning objectives of the Program.

I. Community Solar Project Overview

Q. Please summarize the proposed project.

A. The Company is proposing to build a 500 kilowatt ("kW") single-axis tracking solar array in southeast Boise that will offer Idaho Power customers in Idaho the opportunity to buy electricity from a local solar array. Based on the current timeline and contingent upon Commission approval, the Company plans to have the facility built and operational no later than June of 2017.

Q. Why did the Company choose to build the Solar array in Boise?

A. The Company considered multiple locations around its service territory and evaluated each site based on price, current infrastructure, permitting, constructability, access, and general impacts. Ultimately, the land adjacent to Idaho Power's Boise Bench substation was chosen to be most suitable for the pilot project.

Q. What factors drove the decision to build at the Boise Bench substation?

A. The Company evaluated each location based on the factors described above to determine which location would result in the lowest cost imposed upon the project. The location adjacent to the Boise Bench substation is owned by the Company, is fairly flat, has limited potential for other use, is zoned for industrial, is in close

proximity to the engineering staff, and is adjacent to two distribution circuits for interconnection and a substation with significant communications infrastructure. This location minimizes the project cost by eliminating a land purchase and grading, has reduced permit requirements, requires minimal distribution circuit upgrades, and minimizes engineer and technician travel and communications infrastructure.

Q. What permits are required for the construction of this solar array?

A. Idaho Power will be responsible for securing the following permits: (1) Federal Aviation Administration ("FAA") written approval regarding potential reflectivity and (2) a Boise City Conditional Use Permit. The FAA application is currently pending. The Company will file for the Conditional Use Permit through the City of Boise.

The selected contractor has discussed permitting requirements with the City of Boise and they believe that they will need the following permits: (1) Boise City Building Permit, Solar, for projects greater than $100,000 and 2) Boise City Electrical Permit, Solar, wiring cost greater than $10,000.

II. RFB Process and Results

Q. Please give a high-level overview of the Company's RFB process.

A. On February 1, 2016, the Company sent an RFB to a selection of 12 potential bidders for the design, procurement, and construction of a 500 kW single-axis tracking solar photovoltaic PV system to be built in Boise, Idaho on land owned by Idaho Power. The RFB included detailed technical specifications and special conditions that each bidder had to incorporate into their bid proposal. The Company also requested that the respondents provide two bid alternates along with their base bid. The Company's first alternate bid was for the design, procurement, and construction of a 500 kW fixed-panel system. The second alternate bid was for a full site build out of the base bid.

Q. How did the Company select the 12 bidders for the RFB?

A. The Company began compiling a list of contractors and solar PV installers by consulting with Idaho Power employees who had relevant in-field experience. The Company also included one bidder because of awareness through their participation in Idaho Power's long-term planning process. The Company then verified that all of the companies on the list were either Idaho based, or had an Idaho presence. The 12 companies that received the RFB met this condition.

Q. What were the results of the RFB?

A. Idaho Power held a mandatory pre-bid meeting on February 18, 2016, in which nine of the 12 bidders attended. The RFB bids were due on March 16, 2016. Of the nine eligible bidders, the Company received a total of five bids, however, only four of those bids were deemed complete according to the specifications in the RFB documents.

Q. How was the successful contractor chosen?

A. Following the issuance of the RFB, an internal team conducted a thorough evaluation of each of the bids. The team specifically reviewed the proposed equipment to ensure it conformed to Idaho Power's technical specifications. Next, the team analyzed each bid based upon energy cost and a risk assessment of each company to determine which bid resulted in the least-cost and least-risk to Idaho Power, shareholders, and customers.

Q. What is the cost of the solar array?

A. The cost estimate provided by the selected contractor is $1,158,769.

Q. Generally describe the equipment to be installed at the site.

A. Based upon the technical specifications in the RFB, the successful contractor has proposed to install 1,800 Hanwha Q-cells 320 watt solar modules mounted on Array Technologies single-axis tracking mount. The Hanwha Q-cells are German-engineered 72-cell solar panels which

have won a number of performance competitions in real world testing for kilowatt-hour ("kWh") generation versus capacity installed. Array Technologies is the industry leader in small to large utility scale tracked mounting systems. According to the manufacturer, the system requires zero scheduled maintenance. The selected contractor has proposed to use SolarEdge SE33.3k-US inverters for the project. The SolarEdge system utilizes power optimizers for every pair of modules in the array. This allows each module in the array to perform efficiently. Any shade impacts or soiling between modules are limited to only the modules directly affected. According to the information provided by the selected contractor, another advantage of the SolarEdge system is that they require less wiring compared to string inverters which reduces wire losses within the array. The inverters come standard with a 12-year warranty. The optimizers allow for module-level monitoring. This simplifies operations and maintenance expense by pinpointing any trouble spots and allows for confirmation at a glance that the array is performing to full expectations. Module-level monitoring can reduce costly maintenance work by displaying the exact location of a failure in real-time.

Q. Has the Company issued a notice to proceed to the selected contractor?

A. No. The Company will not issue a notice to proceed until the Company receives an Idaho Public Utilities Commission ("Commission") order approving the pilot Program, as well as sufficient program enrollment. In his testimony, Mr. Pengilly discusses the conditions upon which the Company will proceed with the project.

Q. When does the Company anticipate commercial operation of the community solar project?

A. In the RFB, the Company requested that substantial completion of the project occur by May 24, 2017 with a final completion date of June 7, 2017. As indicated above, the Company will not issue a notice to proceed prior to receiving a Commission order; the date of such order may impact the completion dates identified in the RFB.

III. Interconnection

Q. Please describe the interconnection process.

A. Every generation facility that wants to connect to Idaho Power's system must submit an interconnection request consistent with Idaho Power's Open Access Transmission Tariff filed with the Federal Energy Regulatory Commission. The request is studied to determine what, if any, facilities are reasonably required by good utility practices and the National Electric Safety Code to

interconnect and allow the delivery of energy from the generation facility to the Company's system.

Q. Did the proposed solar array have to go through the interconnection process?

A. Yes. Even though the proposed project will be an Idaho Power-owned resource, the Company had to follow the required steps for the interconnection process.

Q. What were the Facility Study results for the interconnection of the proposed solar array?

A. On April 21, 2016, the Facility Study was completed and the preliminary costs for interconnecting the community solar array are approximately $81,000.

Q. Are the interconnection costs included in the total project costs?

A. Yes. These costs are included in the total project costs used to calculate the Program Subscription Fee detailed in the testimony of Company witness Mr. Larkin.

IV. Expected Solar Energy Production

Q. How was the expected energy production for the project determined?

A. As part of the RFB, the Company requested that each respondent provide the monthly energy output estimate for the Typical Meteorological Year 3 ("TMY3" - an hourly meteorological data set that has natural diurnal and

seasonal variations and represent a year of typical climatic conditions for a location over a long period of time) for the first 20[1] years for each option proposed. The energy output estimate shall take into account single access tracking or fixed panel, inter-row shading, available insolation at the project site, typical weather at project site, typical PV panel degradation, inverter conversion efficiency, wiring losses, soiling losses, and mismatch losses.

Q. What is the expected energy production for the project based upon the criteria mentioned above?

A. The average annual energy output provided by the selected contractor is 1,031,000 kWh per year for 20 years. The annual output includes a stated performance degradation of 0.6 percent.

Q. How did the Company verify that the estimated production was reasonable for the selected location?

A. The Company simulated the energy production using National Renewable Energy Laboratory's ("NREL") PVWatts® Calculator and NREL's System Advisor Model ("SAM"). Both programs are available on NREL's website and are widely used by homeowners, small building owners,

[1] Information requested in the RFB was based upon the premise of a 20-year Program term. Subsequently, the Company revised the term to 25 years based on customer feedback.

installers, and manufacturers to estimate the performance of potential PV installations.

Q. Does the estimate of annual energy production from the selected contractor include line losses?

A. No. The energy provided as part of the RFB is considered generation-level energy.

Q. Should line losses be included in the energy production estimate for programmatic purposes?

A. Yes.

Q. Please explain why they should be included.

A. A portion of the line losses should be included in the annual energy production to account for the delivery of the energy from the production location to the community solar subscriber. The Company determined that the typical transmission, substation, and primary distribution losses would be offset as the actual energy would be consumed by customers on the distribution feeder in close proximity to the 500 kW community solar project. However, the distribution secondary losses of 3.3 percent will not be offset by the local energy production and will be included in the Program.

Q. Please explain how the line losses will be included as part of the Program.

A. As detailed in the testimony of Company witness Mr. Pengilly, each program participant will receive

their proportionate share of the total energy based on their level of subscription. On a monthly basis the project's total energy, as measured at the meter, will be reduced by the line loss percent discussed above. The resulting energy total also referred to as customer-level energy will be divided among the Program participants commensurate with their level of subscription.

Q. What is the average annual energy based on expected annual output including line losses?

A. Applying the line losses discussed above of 3.3 percent to the average annual output of 1,031,000 kWh results in 996,977 kWh per year.

V. Operational Learning Objectives of the Pilot Program

Q. What operational knowledge is to be gained by offering the Community Solar Pilot Program as a pilot?

A. The Company intends for this initial offering to be treated as a pilot program for a variety of operational reasons. The Company expects to gain experience with the following:

1. The power output of a single-axis PV solar facility at the time of the feeder customers' coincident peak demand. This will supplement the prior investigation of the effects of solar intensity variations on distribution feeder load and allow the Company to

incorporate an appropriate on peak capacity factor in its long-term capacity planning processes.

2. The control of the inverter. The Company has specified the installation of a four quadrant remotely configurable inverter, also known as a smart inverter. The Company needs this experience in advance of integrating many solar PV facilities on the distribution system to avoid the voltage management issues that other electric utilities have experienced. Thus, the inverter will be configured to aid with voltage management of the distribution feeder.

3. The monitoring requirements of PV solar and how best to present the information to the Company's plant dispatch and technician personnel.

4. The maintenance and failure rates of PV solar equipment, especially the single-axis tracking system, in order to determine staffing and response requirements.

5. The various facility issues that may cause PV solar facilities to underperform. This will allow the Company to incorporate an appropriate factor in its long-term planning process.

VI. Conclusion

Q. Please summarize your testimony.

A. The Company is proposing to build a 500 kW single-axis tracking solar array at the Boise Bench

substation. The project will offer Idaho Power customers in Idaho the opportunity to buy electricity from a local solar array. The Company submitted an RFB to determine the cost to build the array. The selected contractor was the least-cost and least-risk bid of those submitted. The pilot nature of the Program will allow the Company to gain operational experience with this kind of generation facility. The Company's anticipated operation date, contingent upon Commission approval, is June 2017.

Q. Does this conclude your testimony?

A. Yes.

ATTESTATION OF TESTIMONY

STATE OF IDAHO)
) ss.
County of Ada)

I, David M. Angell, having been duly sworn to testify truthfully, and based upon my personal knowledge, state the following:

I am employed by Idaho Power Company as the Planning Manager in the Customer Operations Engineering and Construction Department and am competent to be a witness in this proceeding.

I declare under penalty of perjury of the laws of the state of Idaho that the foregoing pre-filed testimony and exhibits are true and correct to the best of my information and belief.

DATED this 22nd day of June, 2016.

David M. Angell

SUBSCRIBED AND SWORN to before me this 22nd day of June, 2016.

JENNIFER MAGELKY-SEILER
NOTARY PUBLIC
STATE OF IDAHO

Notary Public for Idaho
Residing at: Lasah
My commission expires:
5/7/2021