Q. Are you the same Rick T. Link that submitted direct testimony in this proceeding?

A. Yes.

INTRODUCTION AND SUMMARY

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to respond to the direct testimony of Mr. Ken Dragoon filed on behalf of Utah Clean Energy ("UCE"). UCE expressed concern with the Company's modeling and certain assumptions used when calculating capacity contribution values for wind and solar resources. I also comment on the direct testimony of Mr. Charles E. Peterson filed on behalf of the Division of Public Utilities ("DPU").

Q. Please summarize your rebuttal testimony.

A. My rebuttal testimony affirms that the capacity contribution values proposed by the Company in this proceeding for wind and solar resources located in Utah are accurately calculated and are reasonable. I specifically address concerns raised by UCE related to the Company's modeling and planned maintenance assumptions. My rebuttal testimony demonstrates that:

- The Company's capacity contribution study applies the capacity factor approximation method ("CF Method") as outlined by National Renewable Energy Laboratory ("NREL") and is consistent with the Commission's order in Docket No. 12-035-100 ("Phase II Order").
- The Company's capacity contribution study is appropriately based upon system-wide reliability metrics and is consistent with long-term resource

planning processes and system operations.

- The Company's capacity contribution study appropriately applies forecasted planned maintenance outage assumptions when calculating capacity contribution values for wind and solar resources.

METHODOLOGY

Q. Have you reviewed the direct testimony filed by the DPU?

A. Yes. The DPU reviewed the Company's filing and calculations, and found that the proposed wind and solar capacity contribution values are reasonable. The DPU concluded that:

> "…the Company has complied with the Commission order in Docket 12-035-100. The Division believes that the Company has provided estimates using the best information available to it and that it has used an appropriate and accepted method to calculate those estimates."[1]

Q. Did the DPU consult with any external experts in its review of the Company's calculations?

A. Yes. As noted by the DPU, parties in Docket No. 12-035-100 believed that one of the methods reviewed by NREL should be used to calculate capacity contribution values for wind and solar resources.[2] In this docket, and in compliance with the Phase II Order, the Company used the CF Method as outlined by NREL, to develop its capacity contribution values for wind and solar resources. To aid in its review of the Company's study, the DPU requested that NREL review the Company's calculations.

[1] Direct Testimony of DPU witness Mr. Charles E. Peterson at lines 207 – 211.
[2] This NREL study was provided as Exhibit RMP___(RTL-2) to my Direct Testimony.

Q. Did NREL review the Company's capacity contribution calculations as requested by DPU?

A. Yes. NREL determined "that [the Company] has exactly followed the equations, methodology, and assumptions in the NREL report, 'Comparison of Capacity Value Methods for Photovoltaics in the Western United States."[3]

SYSTEM MODELING

Q. Please describe UCE's concern with the Company's approach to modeling its entire system.

A. UCE questions the Company's application of the CF Method, claiming that the east and west side of PacifiCorp's system should not be modeled as a single system. UCE believes that incremental resources added on the east side of PacifiCorp's system cannot contribute to reliability on the west side of PacifiCorp's system because of limited transfer limits from the east to the west, particularly during winter months. UCE also claims that the CF Method is not applicable to a system with transmission constraints.

Q. Do you agree with UCE's claim that the CF Method is not applicable to a system with transmission constraints?

A. No. UCE's claim implies that the CF Method is only applicable to systems with no transmission constraints. This assertion implies that the CF Method can only be applied to the most simple of transmission systems (i.e., systems that can be modeled without any transmission topology). The NREL study that the Company

[3] DPU Exhibit 1.1 to the Direct Testimony of DPU witness Mr. Charles E. Peterson.

relied upon when applying the CF Method to calculate capacity contribution values for wind and solar resources does not identify limitations of the method when applied to a system with transmission constraints.[4]

Q. Are UCE's claims consistent with how the Company develops its integrated resource plan ("IRP")?

A. No. The Company develops one resource plan for its entire system. This planning approach is consistent with how PacifiCorp operates its system and captures load diversification benefits, resource diversification benefits, renewable integration cost benefits, and market access benefits. In its IRP, PacifiCorp's diverse system is simulated using a transmission topology that captures major load centers, generation resources, and market hubs interconnected via firm transmission paths.

These transmission paths limit the amount of energy that can flow not only between the east and west side of PacifiCorp's system, but also within the east side and within the west side of PacifiCorp's system, at any given point in time. Transmission path limits used in IRP modeling are based upon the firm transmission rights of PacifiCorp's merchant function, including transmission rights from PacifiCorp's transmission function and other regional transmission providers. This modeling framework used in the IRP is the same modeling framework used in the Company's application of the CF Method to develop the wind and solar capacity contribution values proposed in this proceeding.

Q. Do transmission paths between the east and west side of the Company's system contribute to reliability of the system as a whole?

[4] The NREL study was provided as Exhibit___(RTL-2) to my Direct Testimony.

A. Yes. The east and west side of PacifiCorp's system are not isolated and are interconnected via firm transmission. As dictated by system conditions (i.e., loads and resource availability), energy can flow from east side resources to serve load in the west. As system conditions change, energy can similarly flow from west side resources to serve load in the east. This same concept applies not only between the east and the west side of PacifiCorp's system but within the east and within the west side of the system. In short, the transmission network provides redundancy by enabling resources from across the system to serve load as system conditions change, thereby contributing to reliability of the system as a whole.

Q. Do east side resources contribute to system reliability on the west at times when firm transmission paths from the east to the west are fully loaded?

A. Yes. Under these circumstances, the transmission paths from east to west are fully loaded *because* east side resources are being used to maintain reliability on the west side of the system.

Q. Can you identify precisely which east side resources are flowing to the west under such circumstances?

A. No. PacifiCorp dispatches system resources to meet system load. When transmission from the east to the west is fully loaded, generation from all of the resources in the east is contributing to meeting east side load and to the energy flowing from the east to the west.

Q. Is it appropriate to eliminate the contribution of east side wind and solar resources to west side system reliability when transmission flows east to west are fully loaded?

A. No. If east side wind and solar resources are operating at the time energy is flowing from the east to the west, then those east side wind and solar resources are contributing to system reliability in the west. As such, the east and west side solar resources are contributing to the overall capacity on the system even when east to west side transmission flows are fully loaded.

Q. Did UCE attempt to approximate the impact of isolating the east side of PacifiCorp's system on the capacity contribution values for wind and solar resources?

A. Yes. UCE attempted to approximate the impact of isolating the east side of PacifiCorp's system by removing all loss of load probability ("LOLP") hours during the winter months (December through February).[5] UCE's calculation is based on a series of oversimplified assumptions. UCE's calculation assumes that all winter-month loss of load events occur on the west side of the Company's system; that during all of these events, transmission flows from the east to west are fully loaded; and that east side resources make no contribution to west side reliability when transmission paths are assumed to be fully loaded. Based on these assumptions, UCE calculates that east side wind capacity contribution values would increase from 14.5 percent to 16.4 percent, east side single axis tracking capacity contribution values would increase from 39.1 percent to 52.0 percent, and that east side fixed tilt solar capacity contribution values would increase from 34.1 percent to 44.4 percent.

Q. Do you agree with UCE's assumptions and conclusions?

[5] LOLP measures the probability of load exceeding available resources over a given time interval. In the context of my rebuttal testimony, a LOLP hour is any hour in which the LOLP is greater than zero.

No. Winter-month loss of load events are not limited to the west side of the Company's system. UCE's approximation effectively assumes that there is zero risk of a loss of load event during the winter months in the east side of PacifiCorp's system, and ignores other factors, beyond load (i.e., unplanned thermal unit outages), that contribute to conditions where load might exceed available resources. Considering that loss of load events are not restricted to the west side of PacifiCorp's system during the winter months, it is also not appropriate to assume that all winter-month loss of load events are accompanied by system conditions in which transmission flows from east to west are fully loaded. Finally, as discussed above, east side resources that are operating during west side loss of load events when east to west transmission is fully loaded are contributing to system reliability.

Q. If one assumed that east side wind and solar resources should be restricted to only providing capacity to the east side of the Company's system, would the Company's proposed capacity contribution values be materially impacted?

A. No. Using the same hourly LOLP data from the Company's capacity contribution study, eliminating all LOLP hours in the *west side* of the system (as opposed to all such winter hours across the entire system), yields capacity contribution values that are reasonably comparable to those proposed by the Company in this proceeding. Table 1 summarizes the capacity contribution value results proposed by the Company in this proceeding alongside results isolated to LOLP hours on the east side of the Company's system.

Table 1

	East Side Wind and Solar Capacity Contribution		
	Wind	**Fixed Tilt Solar PV**	**Single Axis Tracking Solar PV**
Company Filing	14.5%	34.1%	39.1%
East Only	13.7%	34.0%	38.5%
Difference	-0.8%	-0.1%	-0.6%

Q. Are you suggesting that capacity contribution values for wind and solar resources located in Utah should be based solely upon east side LOLP hours?

A. No. As discussed earlier in my testimony, it is appropriate to consider the entire system when calculating wind and solar capacity contribution values. I am simply highlighting that UCE's calculations yield capacity contribution values that are not representative of capacity contribution values for east side resources when isolated to east side reliability events.

Q. UCE also cited an anomaly in the energy not served ("ENS") reported for the Colorado transmission area within the Company's model topology. How do you respond?

A. ENS is a model output that reports how much of the obligation in a given transmission area exceeds available resources for any given hour. The Company's transmission topology includes transmission areas with different types of obligations. A load obligation is directly linked to system reliability—the focus of

capacity contribution values for wind and solar resources. A wholesale obligation, representing a firm wholesale sale, is linked to economic risk, but is not a driver of system reliability. The Colorado transmission area has a wholesale obligation, but no load obligation. As such, the ENS data from the Colorado transmission area cited by UCE was not used, and has no impact on, the wind and solar capacity contribution values proposed by the Company in this proceeding.

PLANNED MAINTENANCE

Q. Please describe UCE's concern with the Company's approach to modeling planned maintenance outages.

A. UCE raised concerns with the Company's planned maintenance schedule assumptions, claiming these assumptions are overly aggressive for the month of April and "place too much emphasis on renewable resource performance in that month, further diluting their effective capacity contribution values."[6]

Q. How does UCE propose to resolve the issue?

A. UCE proposes to move a portion of planned maintenance outages from April to March. UCE states that it does not recommend PacifiCorp change its actual maintenance schedules, but believes that the maintenance schedules should be changed for purposes of the capacity contribution study.

Q. How do you respond?

A. When determining hourly LOLP values used in the Company's capacity contribution study, the Company applied projected planned maintenance schedules for specific generating units in its system that were available at the time the study

[6] Direct Testimony of UCE witness Mr. Ken Dragoon at lines 69 – 71.

was being prepared. Arbitrarily moving planned maintenance to March is not supported, and ignores the fact that March is at the tail end of the winter season when there is a risk of higher loads and higher market prices, thereby ignoring the risk of increased costs for PacifiCorp's customers. Moreover, it is inappropriate to modify projected system operating assumptions as a means to alter capacity contribution values for wind and solar resources.

Q. What factors does the Company consider when scheduling planned maintenance for its generating units?

A. The Company considers a range of variables including but not limited to the specific maintenance tasks, duration, permit obligations, weather, location, availability of labor and/or contractors and materials, projected load and operating reserve needs, generating capability, availability of other generation facilities across the fleet, costs of replacement power, and availability of purchased power.

Q. Did UCE attempt to approximate the impact of April planned maintenance assumptions on the capacity contribution values for wind and solar resources?

A. Yes. UCE approximated the impact of its proposal by completely eliminating all LOLP hours from the month of April to estimate the impact of altering planned maintenance assumptions on capacity contribution values for wind and solar resources. Despite the fact that it is not reasonable to selectively exclude certain periods from the calculation of capacity contribution values, UCE's calculations show that under even the most extreme adjustment (eliminating *all* April LOLP hours), the resulting capacity contribution values are reasonably comparable to those proposed by the Company in this proceeding. Table 2 summarizes the

capacity contribution value results in the Company's filing alongside UCE's results when all April LOLP hours are eliminated from capacity contribution calculations.

Table 2

	East Side Wind and Solar Capacity Contribution		
	Wind	**Fixed Tilt Solar PV**	**Single Axis Tracking Solar PV**
Company Filing	14.5%	34.1%	39.1%
UCE (No April)	13.1%	37.0%	40.2%
Difference	-1.4%	2.9%	1.1%

Q. Have you calculated the number of LOLP hours eliminated by UCE in its calculations when it combines its adjustment for winter loss of load events with its adjustment for April planned maintenance?

A. Yes. UCE's approximation of the impact of isolating the east side of the Company's system and adjusting for April planned maintenance assumptions removes all LOLP hours from the months of January, February, April, and December. After eliminating these months from the calculation of wind and solar capacity contribution values, UCE's calculation relies on just 114 LOLP hours, representing only 1.3 percent of the hours in the year.

OTHER CONSIDERATIONS

Q. Did the Company use the capacity contribution values proposed in this proceeding in its 2015 IRP?

A. Yes. The Company applied the same capacity contribution values that were filed in this proceeding in its 2015 IRP. In the 2015 IRP, the proposed wind and solar

capacity contribution values are applied to new and existing wind and solar resources. The 2015 IRP preferred portfolio includes 2,373 megawatt ("MW") of wind resources and 579 MW of solar resources. In aggregate, these wind and solar resources have a capacity contribution value of 647 MW.[7]

Q. Would higher capacity contribution values affect the Company's need for new resources?

A. Yes. An increase to the capacity contribution values from those proposed by the Company would reduce the need for new capacity. If the capacity contribution values for wind and solar resources in the 2015 IRP were to increase by 10 percent, these resources would contribute nearly 300 MW of incremental capacity to the Company's load and resource balance. An increase in the capacity contribution value of 20 percent would contribute nearly 600 MW of incremental capacity to the Company's load and resource balance.

Q. How might a change in capacity contribution values affect avoided cost prices developed for Utah qualifying facility ("QF") projects?

A. The partial displacement differential revenue requirement ("PDDRR") method applies a capacity payment, taking into account the capacity contribution of a QF resource, based on the fixed costs of a deferrable thermal resource during the resource deficiency period. The determination of the resource deficiency period is established by the timing of the Company's next major generating resource as identified in its IRP. As such, the capacity contribution value of wind and solar resources not only influences the level of capacity payment, accounting for the

[7] Volume I of PacifiCorp's 2015 IRP, Chapter 5, Tables 5.5, 5.6, and 5.7.

relative difference between the capacity contribution value of the QF resource and the next deferrable resource, but also the timing in which capacity payments are applied. An increase in the capacity contribution value of wind and solar resources might increase the capacity payment calculated using the PDDRR method; however, a higher capacity contribution value might also delay when capacity payments are applied if the need for new resources is deferred to a later date.

CONCLUSION

Q. Please summarize the conclusions of your rebuttal testimony.

A. The conclusions of my rebuttal testimony are as follows:

- The Company's capacity contribution study applies the CF Method as outlined by NREL and is consistent with the Phase II Order.
- The Company's capacity contribution study is appropriately based upon system-wide reliability metrics and is consistent with long-term resource planning processes and system operations.
- The Company's capacity contribution study appropriately applies forecasted unplanned maintenance outage assumptions when calculating capacity contribution values for wind and solar resources.

Q. What is your recommendation?

A. The Company's proposed capacity contribution values for wind and solar resources are reasonable and were calculated accurately. I recommend that the Commission adopt the capacity contribution values proposed by the Company in this proceeding for purposes of establishing capacity payments for wind and solar QF projects under the PDDRR method.

Q. Does this conclude your rebuttal testimony?

A. Yes.