BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

Dockets UE-240004 & UG-240005 (*Consolidated*)

Washington Utilities & Transportation Commission v. Puget Sound Energy

RESPONSE OF PUBLIC COUNSEL TO JOINT ENVIRONMENTAL ADVOCATES (JEA)

DATA REQUEST NO(S). 001 through 002

Request No:	001
Directed to:	Public Counsel
Date Received:	September 25, 2024
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Prepared by:	Robert L. Earle, Alea, LLC.
Witnesses:	Robert L. Earle

JEA DATA REQUEST NO. 001 TO PUBLIC COUNSEL
RE: Response Testimony of Robert L. Earle, Exh. RLE-1CT, Page 25–26:
The witness states, "PSE's performance should be benchmarked against the performance of a random trader in the market. The average prices obtained by trading at random (Average Random Trading Prices, ARTP) are a distribution of outcomes for a random trader who trades a fixed number of times. Each time the random trader trades, it trades a random amount with the sum of trading amounts normalized to one. Randomizing the purchase amounts remove issues of foresight with respect to the total amount of purchases needed. The ARTP can be derived in a straightforward manner using a direct sampling procedure."

Please provide a detailed explanation of how PC would derive the ARTP using a direct sampling procedure.

RESPONSE:
Public Counsel is not proposing a methodology; the testimony was intended to illustrate that there are alternatives to the proposals by Staff, PSE, and JEA. Without endorsing a particular methodology, there are a number of ways of obtaining the ARTP. One simple way involves random sampling of trading dates and trading amounts. The number of trading dates should correspond to a number that approximates the number of trades a reasonable utility would trade over the course of a compliance period.[1] The trading amounts are sampled from uniform distribution and normalized to one. By making the trading amounts random, issues of foresight are avoided.

To get a single sample from the ARTP, the prices from the randomly sampled trading dates are weighted by the normalized trading amounts.

[1] Sampling trading dates without replacement will likely yield

To get the full ARTP, the procedure to get a single sample from the ARTP should be repeated a sufficient number of times. A million samples should be sufficient.

Matlab is a standard scientific computing platform. Sample code in Matlab[2] involving 14 lines of code[3] shows one way of calculating the ARTP:

```
%   Set sample size
num_samp = 10^6
% Fix random sample seed so can repeat exactly
rand("seed", 1);
```

```
% Number of transactions over the compliance period
num_tx = [USER TO FILL IN];
```

```
% Get empirical allowance prices
prices = sort(csvread('mktprices(C).csv'));
```

```
% ATRP distribution setup
plen = length(prices);
avgpaid = zeros(num_samp,1);
wtdavgpaid = avgpaid;
```

```
% Calculate ARTP
for i=1:num_samp
  rndprices = randsample(prices,num_tx); %sample without replacement
  avgpaid(i) = mean(rndprices); %non-weighted average
  rndwts = rand(num_tx,1);
  rndwts = rndwts/sum(rndwts);  %normalize purchase amounts
  wtdavgpaid(i) = rndprices'*rndwts;
endfor
```

```
% Report selected ARTP statistics
printf("Trading avgp %d\n", mean(wtdavgpaid));
printf("Trading std %d\n", std(wtdavgpaid));
sortedtp = sort(wtdavgpaid);
printf("ATRP 10th percentile %d\n", sortedtp(.10*num_samp));
printf("ATRP 25th percentile %d\n", sortedtp(.25*num_samp));
printf("ATRP 75th percentile %d\n", sortedtp(.75*num_samp));
printf("ATRP 90th percentile %d\n", sortedtp(.90*num_samp));
```

[2] The code was tested and implemented in Octave, an open source and free implementation of Matlab.
[3] Plus seven lines of code to report selected results.