PUGET SOUND ENERGY

PSE 2019 IRP Draft comparison between the 2017 and 2019 combined heat and power potential

This memo is in response to a question that was brought up at the December 6, 2018 TAG #3 meeting as to why the achievable potential in combined heat and power (CHP) in the 2019 conservation potential assessment (CPA) is significantly smaller then it was in the 2017 CPA[1] (933 aMW versus 18 aMW of achievable technical potential). This question was captured as an action item. PSE responded that this information would be provided before the Draft IRP and by March 29, 2019.

The description of the difference between the 2017 and 2019 combined heat and power potential is provided below.

Background

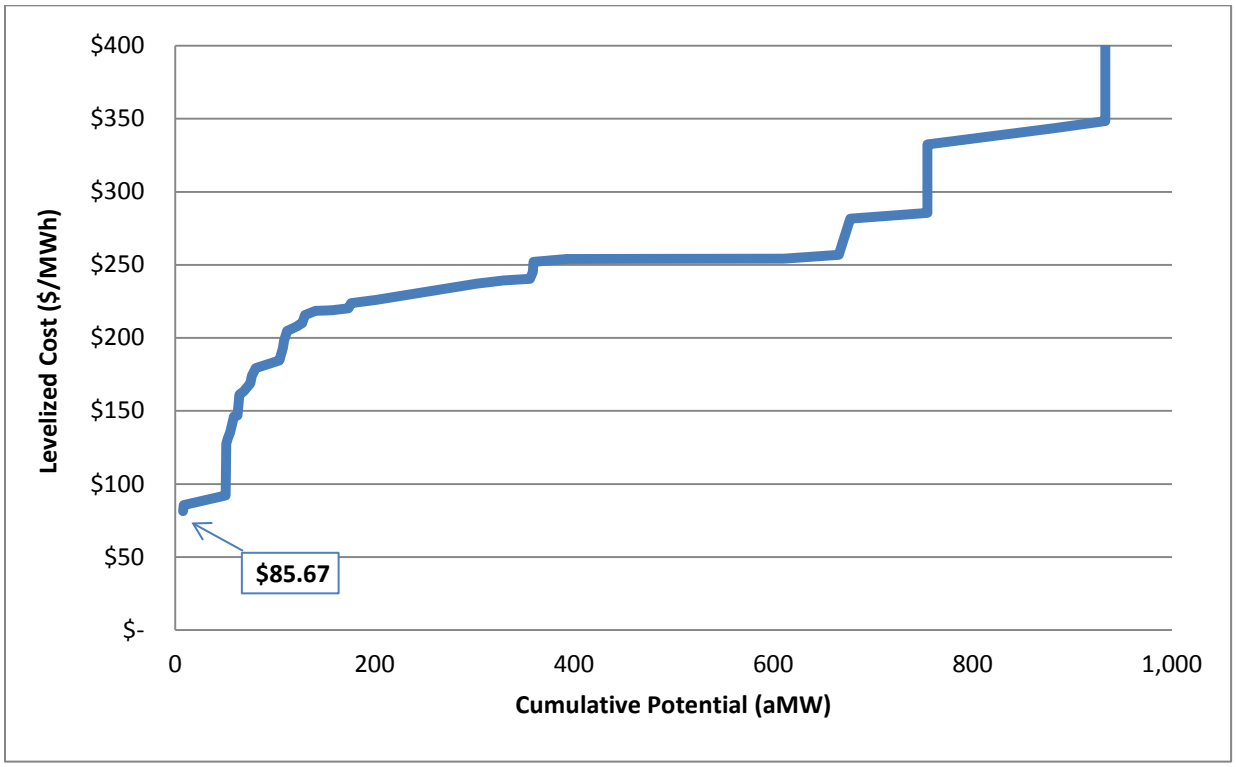
Before delving into the difference in the achievable potentials, it is to be noted that all of the 933 aMW of achievable technical potential for CHP in the 2017 CPA in the Base + High CO2 scenario was above the cost effective threshold of $85/MWh (see Figure 1 below), in other words all of it was found to be NOT cost effective even with a carbon price of $107/ton in the 2017 IRP Base + High CO2 Scenario.

The situation in the 2019 IRP is little better as we have approximately 3.5 aMW of achievable technical potential below the $85/MWh cost effective price threshold from the 2017 IRP (see Figure 2 below). We won't know the cost effective price threshold for the 2019 IRP till the portfolio analysis is complete, but in comparing the supply curves we have slightly more achievable technical potential at a lower cost in the 2019 IRP then we did in the 2017 IRP.

All the figures included in this memo are either from the 2017 DSR report or were included in the December 6 meeting materials, or will be included in the 2019 DSR report. The sources have been referenced in the footnotes.

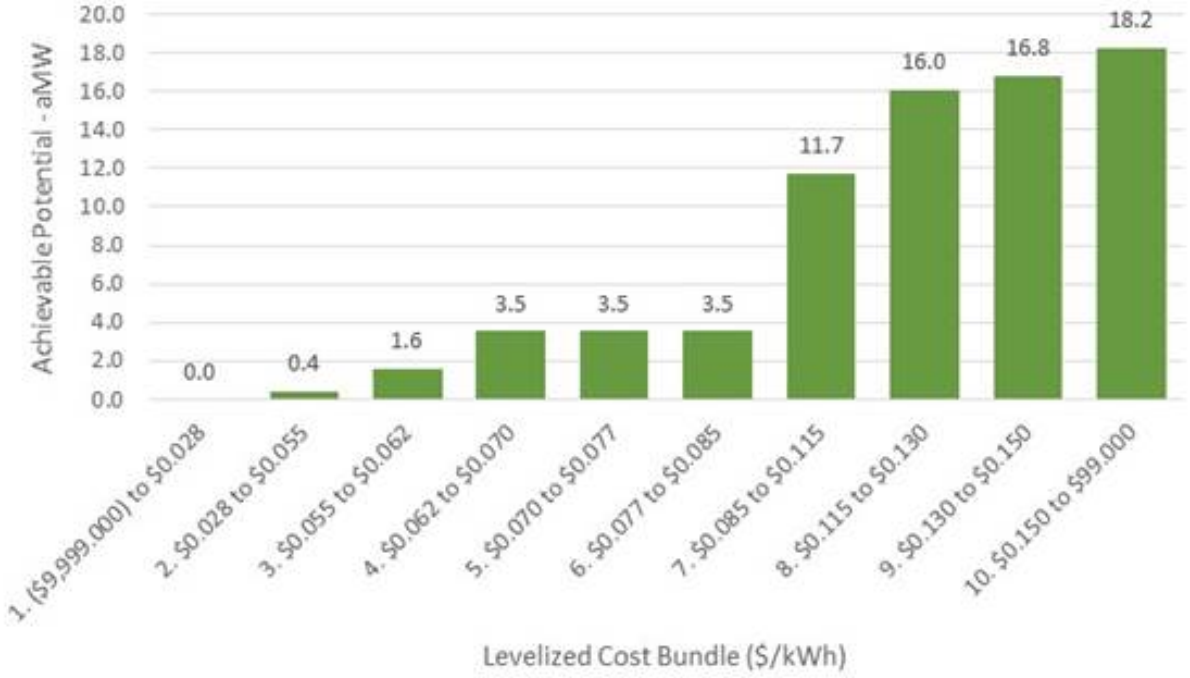
[1] The 2017 CPA was captured in *2017 IRP Demand-Side Resource Conservation Potential Assessment Report* in Appendix J of the 2017 IRP, also referred to as Demand Side Resources (DSR) report.

Figure 1: 2017 IRP DG Achievable Technical Potential LCOE Supply Curve[2]



[2] "*2017 IRP Demand-Side Resource Conservation Potential Assessment Report*" by Navigant. Appendix J of 2017 IRP - Figure 63.

Figure 2: 2019 IRP DG Achievable Technical Potential Supply Curve[3]



Details of the difference between 2017 and draft 2019 IRP combined heat and gas potential
The lower achievable technical potential for CHP in the 2019 CPA compared to the 2017 CPA is driven by three factors:

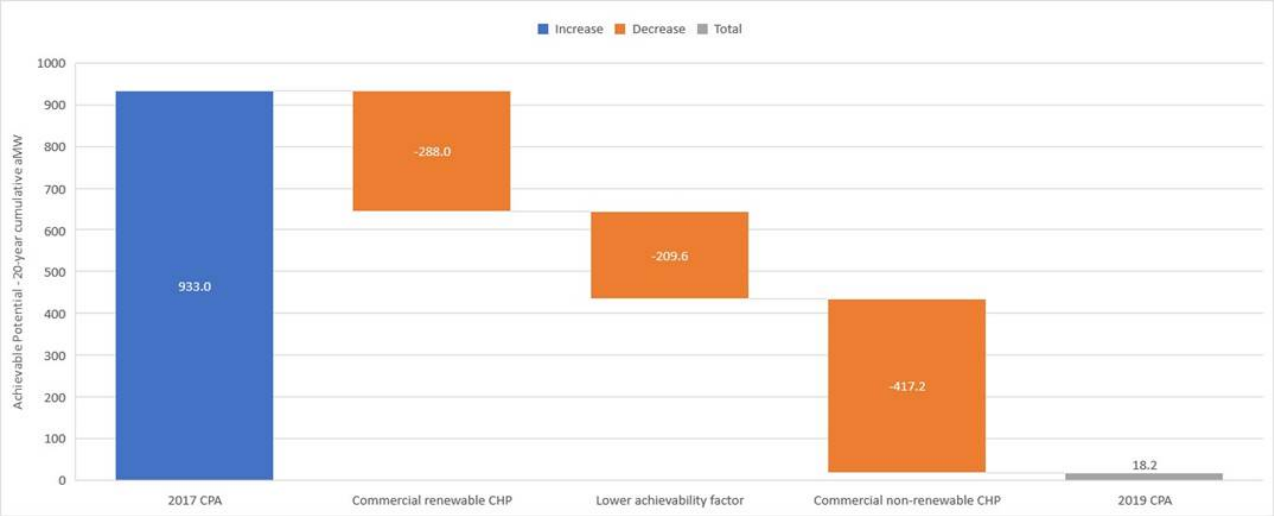
- The 2017 CPA included renewable[4]CHP in the commercial sector, while the 2019 CPA *only* considered renewable CHP in the industrial sector (and excluded commercial). The category of renewable CHP is comprised of biomass and biogas both of which are part of the industrial sector and are not in the commercial sector. It is not clear why the 2017 CPA included renewable CHP in the commercial sector. It does not appear to be appropriate. Cadmus included it only as part of the industrial sector, and as a result the achievable potential is significantly lower. This accounts for roughly a 288 aMW reduction in potential.
- The 2017 CPA used a 20-year achievable factor of 50%[5], while the 2019 CPA used a 20-year achievable factor of 4%[6]. The 50% achievability factor used in the 2017 IRP was suggested by stakeholders and is supported by the DOE Installed CHP Database only when all the listed facilities are used. However, Cadmus modified the DOE data for fuel type and vintage as the database included older facilities that are no longer in operation. In order to avoid counting old obsolete facilities, Cadmus used a cutoff of 2011 and later as the years of last report in the

[3] Figure 2 will be included in the 2019 CPA report
[4] The 2017 IRP defined renewable CHP as biogas and biomass, and was also included in the commercial sector. The 2019 IRP has shifted this category to the industrial sector from the commercial sector, as most of the industry that would be producing the biomass or biogas is only to be found in the industrial sector.
[5] 2017 DSR Report by Navigant - *Table 21. Average Achievability of Top Five States for CHP Supporting Policies*, page 39.
[6] Cadmus presentation TAG meeting December 6th, 2018, Slide 62. The 4% is sourced from *The 2014 State Energy Efficiency Scorecard by* the American Council for an Energy-Efficient Economy (ACEEE) and DOE Installed CHP database.

database to establish the count of existing plant capacity. This 2011 year cutoff contributed to roughly a 210 aMW reduction in achievable potential.

- The 2017 CPA considered stand-by generation in small and medium commercial, while Cadmus based their CHP assessment on the Energy Independence Act[7] which defines High Efficiency Cogeneration as the simultaneous production of heat and electricity[8], by this approach Cadmus excluded the stand-by generation and only considered non-renewable CHP for larger commercial facilities. This was the largest factor that contributed to the remaining 417 aMW reduction in CHP potential.

Figure 4: Comparison of Achievable Technical potential 2017 IRP vs 2019 IRP.

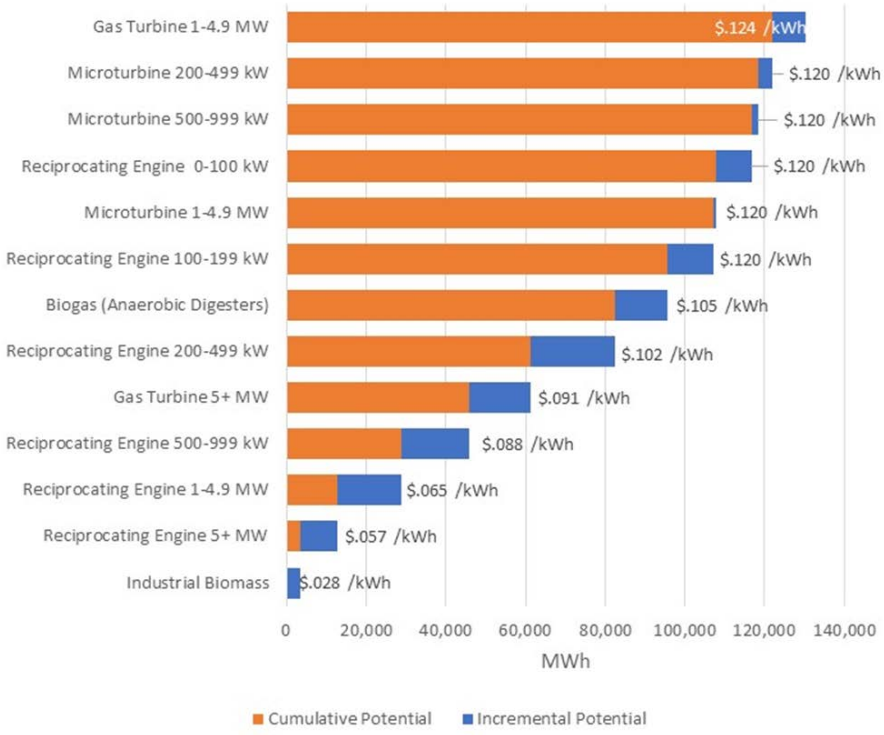


The final supply curve for the 2019 IRP is shown on Page 5.

[7] https://apps.leg.wa.gov/wac/default.aspx?cite=480-109.

[8] IOU's can consider High Efficiency Cogeneration (HEC) as a conservation measure under the Energy Independence Act. By definition HEC produces useful heat and electric simultaneously. https://apps.leg.wa.gov/wac/default.aspx?cite=480-109-100

Figure 5: Distributed Generation Supply Curve[9]



[9] Cadmus presentation TAG meeting December 6th, 2018, Slide 68.