From:	Michael O"Brien
To:	UTC DL Records Center
Subject:	UE–160918—Comments of Renewable Northwest
Date:	Thursday, February 22, 2018 4:02:03 PM
Attachments:	UE-160918 PSE 2017 IRP Renewable Northwest Comments 2.22.18.pdf

Dear Records Center Staff,

Attached are the Comments of Renewable Northwest for filing in Docket No. UE–160918 (electricity), Puget Sound Energy 2017 Integrated Resource Plan, filed 22nd February, 2018.

Faithfully,

Michael

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February 22, 2018

Steven V. King, Executive Director and Secretary
Washington Utilities and Transportation Commission
P.O. Box 47250
1300 S. Evergreen Park Drive S.W.
Olympia, WA 98504-7250

RE: Comments of Renewable Northwest
Docket UE-160918 (electircity)—*Washington Utilities and Transportation Commission's November 21, 2017, Notice of Opportunity to File Written Comments on Puget Sound Energy 2017 Integrated Resource Plan for Electricity.*

I. INTRODUCTION

Renewable Northwest is grateful to the Washington Utilities and Transportation Commission ("the UTC" or "the Commission") for the opportunity to file written comments on the Puget Sound Energy ("PSE" or "the utility") 2017 Integrated Resource Plan ("IRP"). As seen in Table 1 of PSE's Electric Resource Plan Forecast, the utility's anticipated first tranche of procurement to meet its needs by 2023 would include a cumulative 374 MW of conservation, 103 MW of demand response, 50 MW of storage, and 266 MW of solar. That first tranche would not include baseload gas or peakers. Renewable Northwest welcomes PSE's plan.

	2023	2027	2037
Conservation (MW)	374	521	714
Demand Response (MW)	103	139	148
Solar (MW)	266	378	486
Energy Storage (MW)	50	75	75
Redirected Transmission (MW)	188	188	188
Baseload Gas (MW)	0	0	0
Peaker (MW)	0	717	1,912

Table 1—Electric Resource Plan Forecast (Cumulative Nameplate Capacity of Resource)[1]

The timing of renewable resource additions in PSE's 2017 IRP is driven by the requirements of the Washington State Energy Independence Act (RCW 19.285). The utility states that:

[1] PSE 2017 IRP, Figure 1–4 Electric Resource Plan Forecast, p1–18.

> [t]his IRP found that eastern Washington solar power is expected to be more cost effective than wind from the Pacific Northwest or in Montana; however, costs between wind and solar are very close, especially in the first half of the planning horizon. As in prior IRPs, PSE's analysis shows we anticipate remaining comfortably below the four percent revenue requirement cap in RCW 19.285.[2]

PSE has also indicated that the actual bids in a request for proposals ("RFP") to meet its 2023 renewable needs could see Montana wind perform better than in the 2017 IRP.[3]

In these comments, Renewable Northwest acknowledges PSE's petition for an extension of the 2017 IRP filing date in order to investigate Montana wind more thoroughly (Section II). Renewable Northwest focuses on the potential capacity contributions of Montana wind in Section III, while also discussing transmission issues and an opportunity to develop a collaborative pathway forward. In Section IV, Renewable Northwest addresses continued concerns related to PSE's modeling of the capacity value of solar. Before concluding, Section V discusses concerns related to the utility's incorrect application of generic owner's costs assumptions to variable resources.

II. PSE'S INVESTIGATION OF MONTANA WIND

On March 15, 2017, PSE petitioned the Commission for an extension of the filing date of its 2017 IRP from July 12, 2017, to November 15, 2017.[4] PSE argued that the request supported the public interest as it would provide the utility with needed:

> [...] additional time to study the peak capacity value of Montana wind—an important issue in the 2017 IRP. When Colstrip Units 1 and 2 retire (no later than July of 2022), transmission will likely be available to import wind from Montana into the Pacific Northwest. The peak capacity contribution of Montana wind could be a primary driver for whether that resource will appear least cost in PSE's 2017 IRP [...] Renewable Northwest Project ("RNP") has been helpful in providing some wind data for PSE staff to analyze, and PSE is grateful to RNP for providing this data.[5]

As part of its petition, PSE indicated its intention to hire DNV-GL, a consulting firm, "[...] to provide synthetic wind production data for several data points [...] includ[ing] for (i) a Montana wind site".[6] PSE also stated that "[d]uring IRP Advisory Group meetings, several stakeholders have questioned the reasonableness of PSE's resource cost assumptions [...] which suggests that PSE may be overstating the cost of renewable resources." Renewable Northwest was one of those stakeholders and is grateful to the

[2] PSE 2017 IRP, p1–18.
[3] *Ibid*., p2–8.
[4] Docket Nos. UE-160918 and UG-160919, [Puget Sound Energy] Petition for Exemption from WAC 480-100-238 and WAC 480-90-238, Integrated Resource Planning, p 1, March 15, 2017.
[5] *Ibid*., p2.
[6] *Ibid*.

utility for proposing to also contract DNV-GL to "[...] review PSE's assumptions for wind and solar power cost assumptions."[7]

III. MONTANA WIND COULD MAKE SIGNIFICANT CAPACITY CONTRIBUTIONS, WHILE RESOLUTION OF TRANSMISSION IS POTENTIALLY PENDING

Renewable Northwest advocates for utilities to procure renewable resources at the least cost and welcomes PSE's consideration of Montana wind resources as another potential source of clean energy to compete with Washington wind and solar. As can be seen in Table 2, PSE's effective load carrying capability ("ELCC") estimates show Montana wind to have a capacity contribution of almost 50%.

Resource	Nameplate (MW)	Peak Capacity Credit Based on 5% LOLP
Generic gas-fired generation	239 MW	100%
Existing Wind	823	11%
Skookumchuck (DNV GL data[4])	131	40%
Generic Montana Wind (DNV-GL data)	100	49%
Generic Washington Wind (DNV-GL data)	100	16%
Generic Offshore Washington Wind (DNV-GL data)	100	51%
Market Reliance	1,580	99%
Generic Washington Solar	50	0%

Table 2—Effective Load Carrying Capability ("ELCC") Estimates[8]

While Montana wind is a potentially attractive resource, its ability to contribute to PSE's Energy Independence Act requirements is constrained by statute, as explained by the utility:

> Wind in eastern Montana would not be a qualifying renewable resource under RCW 19.285, unless it were delivered all the way to Washington state on a real-time basis without shaping or storage. In this IRP, we examined whether being designated as a qualifying resource would make Montana wind appear cost effective. It did not. However, Montana wind was reasonably close to being cost effective, as shown in Figure 2-5, below. In the acquisition process where actual projects are bid to the company and depending on the transmission costs, it is possible that PSE will find Montana wind projects could be more cost effective than Washington solar projects.[9]

[7] Docket Nos. UE-160918 and UG-160919, [Puget Sound Energy] Petition for Exemption from WAC 480-100-238 and WAC 480-90-238, Integrated Resource Planning, p 2, March 15, 2017.
[8] PSE 2017 IRP, Figure 6–4, ELCC Estimates, p6–9.
[9] 2017 IRP, p 2–8

Renewable Northwest welcomes PSE's indication that Montana wind could be cost competitive with other renewable resources once actual bids into an RFP and transmission costs are known. The ELCC estimates in Table 2 suggest that a geographically diverse portfolio of new renewable resources could complement each other, and we look forward to that being explored in the RFP process.

In its 2017 IRP, PSE identified "key barriers" that the utility sees as challenges to Montana wind being designated an eligible renewable resource under RCW 19.285, including:

> Montana wind would have to be scheduled into Washington state on a real-time basis without shaping or storage in order to qualify as a renewable resource under RCW 19.285 [...] Recently BPA scheduled a workshop in December 2017 in Montana to begin discussion about issues relating to Montana resources [...] A blanket policy that ensured wind from Montana could be "dynamically scheduled" to Washington without the need to do transmission studies on a project-by-project basis would avoid the issue [...] about who pays for such studies.[10]

PSE additionally states that:

> For Montana wind to have a peak capacity value, the resource must be delivered all the way to PSE. However, that may not be the case. If the developer (or PSE) cannot obtain additional cross-Cascades transmission, the power may be delivered only to Mid-C. If PSE has to use existing transmission to Mid-C to transport that power to load, no capacity value is created at all. It simply offsets market purchases, since we have already counted on the transmission as a capacity resource. It is possible that contracts PSE uses to deliver energy from Colstrip to PSE could be used to deliver Montana wind.[11]

Renewable Northwest looks forward to the opportunity to resolve these and other issues in the above referenced BPA-scheduled workshop with deliverables including a Montana Renewable Resource Development Action Plan guided by the State of Montana and the Bonneville Power Administration to develop "[...] a sustainable long-term strategy to support developing new renewable energy resources in Montana."[12]

IV. PSE ERRS BY CONTINUING TO ASSIGN A ZERO PERCENT CAPACITY VALUE TO SOLAR

PSE's 2017 IRP selects 266 MW of solar as a potential resource to meet future needs, but, as can be seen in Table 2 PSE assigns generic Washington solar a 0% peak capacity credit. While Renewable Northwest welcomes PSE's generally positive findings about solar, we are concerned by comments that "[...] solar

[10] PSE 2017 IRP, p2–9.
[11] *Ibid*., pp2–9 - 2-10.
[12] Bonneville Power Administration, Montana Renewable Resource Development Action Plan, www.bpa.gov/Projects/Initiatives/Montana-Renewable-Energy/Pages/Montana-Renewable-Energy.aspx

had no peak capacity value."[13] Renewable Northwest addressed the issue of the capacity contribution of solar at length in Section III ("Solar Contributes to System Adequacy Even if it Does Not Generate in the Peak Hour") of our comments on PSE's 2015 IRP.[14] In its 2015 IRP, PSE also modeled utility scale solar with a capacity contribution of zero percent.[15]

Renewable Northwest's position is best summarised by Dr. Michael Milligan of the National Renewable Energy Laboratory. In an August 17, 2015, presentation to the Oregon Public Utility Commission on capacity contribution, Dr. Milligan stated that "[a] generator contributes to resource adequacy if it reduces the LOLP ["Loss of Load Probability"][16] in some or all hours or days".[17] Renewable Northwest again recommends that the Commission explore the different ways that solar can contribute to PSE's capacity and resource adequacy needs.

V. PSE's APPLICATION OF A GENERIC OWNER'S COST ASSUMPTION FOR RENEWABLE RESOURCES IS INCORRECT

Part of PSE's petition to push back the date for the 2017 IRP submission included contracting with DNV-GL to review the utility's assumptions for wind and solar costs.[18] Table 3 shows PSE's new resource cost assumptions submitted with the utility's 2017 IRP after consultation with DNV-GL. For comparison, Table 4 shows PSE's renewable resource assumptions, presented February 3, 2017, before PSE requested the extension of the filing deadline. A comparison of the tables shows how the additional time enabled PSE to reduce their overnight capital cost assumptions for: Montana wind, from 2,726 $/kW to 2,065 $/kW; Washington wind, from 2,210 $/kW to 1,939 $/kW; and for a 25 MW solar facility from 2,171 $/kW to 2,041 $/kW.

[13] PSE 2017 IRP, p2–8.
[14] Comments of Renewable Northwest, Docket UE-141170, February 6, 2016. https://www.utc.wa.gov/_layouts/15/CasesPublicWebsite/GetDocument.ashx?docID=148&year=2014&docketNumber=141170
[15] PSE, 2015 IRP, Appendix D—Electric Analysis, p6–76.
[16] The LOLP is the probability of a loss of load event in which the system load is greater than available generating capacity during a given time period, National Renewable Energy Laboratory, "Comparison of Capacity Value Methods for Photovoltaics in the Western United States", July 2012, p 2.
[17] Michael Milligan, Ph.D., Methods to Model and Calculate Capacity Contributions of Variable Generation, OPUC, August 17, 2015, Slide 9 (p95 of pdf). http://edocs.puc.state.or.us/efdocs/HTB/um1719htb142830.pdf
[18] Docket Nos. UE-160918 and UG-160919, [Puget Sound Energy] Petition for Exemption from WAC 480-100-238 and WAC 480-90-238, Integrated Resource Planning, March 15, 2017.

IRP Modeling Assumptions (2016 $)	Name-plate (MW)	First year available	Capacity Factor[1] (%)	Overnight Capital Cost ($/kw)	Fixed O&M [2] ($/kw-yr)	Variable O&M ($/MWh)	Baseload Heatrate[3] (Btu/kWh)
Wind Plant - Washington	100	2020	30%	$1,939	$27.12	$3.15	N/A
Wind Plant - Montana	300	2022	46%	$2,065	$33.79	$3.50	N/A
Offshore Wind	100	2022	35%	$7,150	$77.30	$3.15	N/A
Central Station Solar Tracking PV	25	2020	26%	$2,041	$10.00	$0.00	N/A

Table 3—PSE's New Renewable Resource Cost Assumptions[19]

2016 $	Units	WA Wind	MT Wind A	MT Wind A	MT Wind C	MT Wind C	Biomass	ID Solar	WA Solar	WA Solar
ISO Capacity Primary	MW	100	100	300	100	300	15	25	25	50
Winter Capacity Primary	MW									
Capacity Credit	%									
Operating Reserves	%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Capacity Factor	%	37%	46%	46%	46%	46%	85%	30%	27%	27%
Capital Cost (1)	$/KW	$2,210	$2,726	$2,382	$2,726	$2,382	$3,950	$2,171	$2,171	$1,984
O&M Fixed	$/KW-yr	$27.12	$33.79	$33.79	$33.79	$33.79	$113.70	$10.00	$10.00	$9.00
O&M Variable	$/MWh	$3.15	$3.15	$3.15	$3.15	$3.15	$5.66	$0.00	$0.00	$0.00
Degredation	%/year							0.5%	0.5%	0.5%
Location		SE WA	Montana	Montana	Montana	Montana	Western WA	SW Idaho	PSE - Central WA	PSE - Central WA
Fixed Transmission (3)	$/KW-yr	$35.88	$86.68	$86.68	$113.25	$113.25	$21.48	$49.35	$0.00	$0.00
Variable Transmission (4)	$/MWh	$1.85	$1.85	$1.85	$1.85	$1.85	$0.35	$0.40	$0.00	$0.00
Loss Factor to PSE	%	1.9%	7.3%	7.3%	7.3%	7.3%	1.9%	5.5%	0.0%	0.0%
Heat Rate – Baseload (HHV)	Btu/KWh						13,500			
Emissions:										
NO_x	lbs/MMBtu						0.00			
SO_2	lbs/MMBtu						3.152			
CO_2	lbs/MMBtu						195.0			
First Year Available (2)		2020	2022	2022	2020	2020	2021	2020	2020	2020
Economic Life	Years	25	25	25	25	25	35	25	25	25
Greenfield Dev. & Const. Leadtime	years	3	3	3	3	3	4	3	3	3

(1) Solar PV - AC installed
(2) First year available for MT wind is 2022 to correspond to retirement of Colstrip 1&2
(3) Idaho Solar includes Spin and Supplemental from Idaho Power. WA Wind includes wind integration cost from BPA. MT Wind includes wind integration cost from NWMT
(4) BPAT variable cost includes spin, supplemental, and imbalance. Idaho solar includes solar integration cost form Idaho Power

Table 4—IRP Renewable Resources Handout (Pre-Update by DNV-GL)[20]

Despite of these improvements, Renewable Northwest still has concerns with how PSE incorporates so-called "owner's costs" into its resource assumptions. Appendix M (Wind and Solar Costs) of PSE's 2017

[19] PSE 2017 IRP, Figure 4–18 New Resource Cost Assumptions (adapted), p 4–31
[20] 2017 IRP Advisory Group 10: Friday, February 3, 2017—IRP Advisory Group, IRP Renewable Resources Handout https://pse.com/aboutpse/EnergySupply/Documents/C_PSE-2017-IRP-Renewable-Resources-Handout.pdf

IRP contains DNV-GL's April 2017 analysis of "Washington State Wind and Solar Power Project Capital Cost Benchmarks."[21] Table 5 shows DNV-GL's capital cost estimates for a theoretical wind project. [22] The average total capital cost for a wind project is estimated by DNV-GL to be 1,489 $/kW.[23]

Capital Costs[1]	Low ($/kW)	Average ($/kW)	High ($/kW)
Wind turbine generators	860	1,080	1,510
Civil Balance of Plant	166	224	322
Electrical Balance of Plant	111	185	358
Total	1,137	1,489	2,191

1. Does not include owner's engineering, capital spares, contingency, financing or major grid upgrade costs.

Table 5—DNV-GL's Capital Cost Estimates for Wind[24]

In its 2017 IRP, PSE applies a 30 percent owner's to DNV-GL's estimated *total* capital costs, and applies the same 30 percent owner's cost to both thermal and renewable resources.[25] DNV-GL's footnote to Table 5 seems to imply that owner's costs include "engineering, capital spares, contingency, financing or major grid upgrade costs".[26] PSE was more explicit in its twelfth IRP Advisory Group meeting on May 22, 2017, where it refers to DNV-GL's estimated "total" costs as the "EPC" (Engineering, Procurement and Construction)" costs and applies 30% owner's cost to renewable resources in order to come up with what PSE identifies as "Total Cost" (see Table 6).[27]

2016 resource costs ($/kw)	EPC cost from DNV-GL	Transmission Capital Cost	Owner's Cost @ 30%	Total Cost
WA Wind	$1,489	-	$447	$1,936
MT Wind	$1,489	$174	$499	$2,162
Offshore Wind	$5,500	Unknown*	$1,650	$7,150
Solar	$1,570	-	$471	$2,041

Table 6—PSE Renewable Resource Cost Breakdown[28]

[21] PSE 2017 IRP, Appendix M: Washington Wind and Solar Costs.
[22] *Ibid*., Table 2–1, p 3.
[23] *Ibid*.
[24] *Ibid*.
[25] PSE 2017 IRP, p 4–39.
[26] PSE 2017 IRP, Appendix M: Washington Wind and Solar Costs, Table 2–1, p 3.
[27] PSE 2017 IRP Advisory Group 12: Monday, May 22, 2017—IRP Advisory Group, PSE Presentation, Slide 15, https://pse.com/aboutpse/EnergySupply/Documents/PSE_2017_IRPAG_052207_final_with_additional_slides.pdf
[28] *Ibid*.

PSE seems to have taken its current assumption of renewables' owner's cost from Black & Veatch's analysis of thermal resources, which includes a "30% generic adder for Owner's Costs."[29] However, Black & Veatch prepared a cost report for the National Renewable Energy Laboratory in 2012, which included an exploration of "owner's costs".[30] Figure 1 shows Black & Veatch's capital cost breakdown for an onshore wind plant, which shows "owner's costs" to be 5% of total costs.

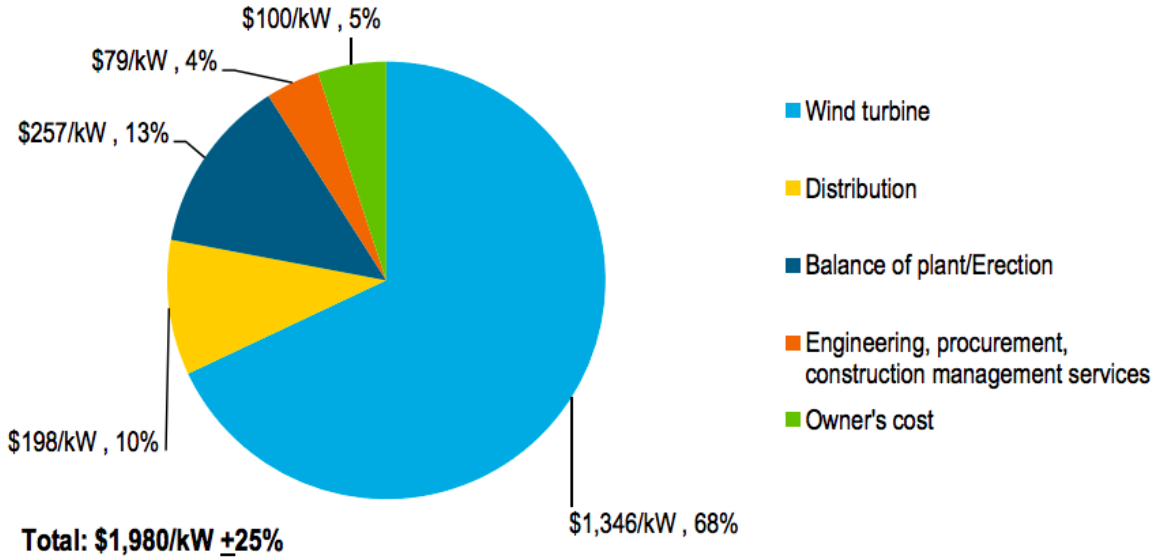

Figure 1—Capital Cost Breakdown for an Onshore Wind Plant (Black & Veatch)[31]

For comparison, Figure 2 shows Black & Veatch's capital cost breakdown for a combined cycle gas plant, which has a higher owner's cost of 17%. The report that Black & Veatch prepared for the National Renewable Energy Laboratory seems to show that, at the very least, applying the same generic owner's cost assumption to variable generation resources is incorrect. The report also shows that, compared to a combined cycle gas plant, a wind plant has significantly lower owner's costs as a percentage of total resource cost. PSE have indicated to Renewable Northwest that in their next IRP they intend to re-assess the application of a fixed percentage, technology-neutral owner's cost. Renewable Northwest looks forward to working on this resource cost assumption issue with PSE.

[29] 2017 IRP Advisory Group 12: Monday, May 22, 2017—IRP Advisory Group, Black and Veatch Presentation, https://pse.com/aboutpse/EnergySupply/Documents/BV_slides_for_05-22_IRP_Technical_Meeting170519_FINAL.pdf

[30] Black & Veatch, Cost and Performance Data for Power Generation Technologies, Prepared for the National Renewable Energy Laboratory, February 2012. https://www.bv.com/docs/reports-studies/nrel-cost-report.pdf

[31] *Ibid*., Figure 14, p49.

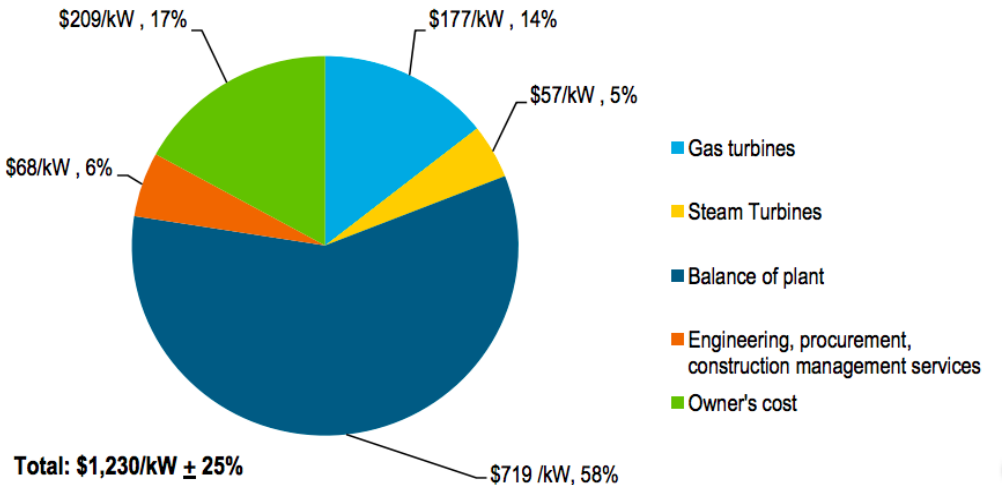

Figure 2—Capital Cost Breakdown for a Combined Cycle Power Plant (Black & Veatch)[32]

VI. CONCLUSIONS

Renewable Northwest again thanks the Commission for this opportunity to comment on PSE's 2017 IRP. Additionally, Renewable Northwest thanks the utility for its efforts in improving many of its assumptions and the stakeholders who participated in the process leading up to the 2017 IRP.

Renewable Northwest commends PSE for its many improvements over the course of this IRP cycle and encourages the utility to continue to improve its process. The highlights in this IRP process included PSE's efforts to increase the accuracy of its resource cost assumptions, as well as its work to better understand the potential value of Montana wind. We encourage PSE to adopt a methodology that allows it to accurately calculate the capacity value of variable resources as it will help the utility better understand its current generation portfolio as well as to engage in better planning and procurement. Renewable Northwest also encourages PSE to refine its understanding of owner's cost, particularly those associated with renewable resources, and appreciates their communicated willingness to do so.

We look forward to working on any subsequent RFPs.

Respectfully submitted this 22nd of February of 2018,

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[32] Black & Veatch, Cost and Performance Data for Power Generation Technologies, Prepared for the National Renewable Energy Laboratory, Figure 3, p 49, February 2012. https://www.bv.com/docs/reports-studies/nrel-cost-report.pdf