Amended 2018 ISO Tariff Application — Appendix F
Point of Delivery ("POD") Cost Function Report

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Prepared for: Alberta Utilities Commission

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F.1 Background

F.1-1 Point of delivery cost function

1 The design of the point of delivery charge in the AESO's Rate DTS, *Demand Transmission Service Rate* ("Rate DTS") is based on a point of delivery cost function methodology that was established during the 2007 ISO tariff application proceeding. The point of delivery cost function is developed through analysis of actual connection project data. The cost function was updated in the 2010 ISO tariff application and the 2014 ISO tariff application.

2 In Decision 2014-242 on the 2014 ISO Tariff Application, the Alberta Utilities Commission ("Commission") in Direction 2 stated:

> *The AESO is directed to use the full increased capacity made possible by an upgrade project. If the AESO cannot reasonably determine this capacity level for any given project, then the project should be excluded from the database.*[1]

3 In response to the Commission's direction, the AESO provided in the 2014 ISO Tariff Compliance Filing:

> *The AESO has reviewed all upgrade projects in the connection project database and, where applicable, has used the full increased capacity made possible by the upgrade rather than the increase in contract capacity to determine the point of delivery cost function.*[2]

4 As a result of AESO's work to respond to the Commission's Direction 2:

> *Several parties asked information requests with respect to the AESO's review of upgrade projects and the resulting impact on the point of delivery cost function. In particular:*
>
> (a) *In information request AE-AESO-004, ATCO Electric Ltd. Questioned the large increase to the fixed component of Rate DTS compared to expectations stated during Proceeding ID No. 2718;*
>
> (b) *In information request DEVON-AESO-001, Devon Canada Corporation noted that the AESO's response to Direction 2 resulted in a decrease to the slop of the point of delivery cost function and reduced investment levels, which had been unknown prior to the compliance filing and had therefore not been fully tested; and*
>
> (c) *In information request UCA-AESO-002, the UCA similarly noted that the incorporation of the capacity made possible by an upgrade project resulted in a decrease in the point of delivery cost function for projects with larger capacity.*
>
> *In response to information requests from DEVON and the UCA, the AESO provided Rate DTS point of delivery charges and maximum investment levels that would result from cost functions developed on different bases, namely:*
>
> *(a) Using only greenfield projects ("Greenfield-Only" amounts provided in information response DEVON-AESO-001(c-d));*[20]

[1] Decision 2014-242 at para 260.
[2] Proceeding 3473, Exhibit 0002 at para 11.

(b) *Using both greenfield and upgrade projects, but based on the increase in contracted capacity for each upgrade project including any projects with 0 MW increases in cont[r]acted[sic] capacity ("Greenfield and Update" amounts provided in information response UCA-AESO-002(g-h));*[21] *and*

(c) *Using both greenfield and upgrade projects, but based on the increase in contracted capacity for each upgrade project excluding any projects with 0 MW increases in cont[r]acted [sic] capacity ("Greenfield and Update Excluding 0 MW" amounts provided in information response UCA-AESO-002(g-h).*[22]

Although the AESO submits that it has fully complied with Direction 2 in the Application, the AESO acknowledges that Direction 2 resulted in unanticipated impacts as explored in the information requests mentioned above, Further, DEVON and the UCA (in information requests DEVON-AESO-001(e-f) and UCA-AESO-002(a-b), respectively) have raised concerns with the consistency of developing a cost function based on contracted capacity for greenfield projects on the one hand, versus capacity made possible by upgrade projects on the other. As noted by AE, DEVON and the UCA, the full impact of Direction 2 would not have been clear during Proceeding ID No. 2718.

Having consideration for the concerns raised in the information requests and the information provided through the current proceeding that was not available at the time of Proceeding ID No. 2718, the AESO submits that it may be appropriate to delay implementing Direction 2 pending further exploration of the matter as suggested by DEVON in information request DEVON-AESO-001(f). As the AESO noted in its response to DEVON-AESO-001(f), the AESO expects that the determination of the POD cost function will continue to be enhanced in future tariff applications. As has been the AESO's practice, the AESO proposes to consult with stakeholders on any future enhancements of the POD cost function related to Direction 2 during the development of a future tariff application.[23] [3]

5 In Decision 3473-D01-2015:

> *The Commission has reviewed the AESO's response to Direction 2 and finds that it has resulted in unanticipated effects that could not have been known at the time of proceeding 2718. The AESO's proposal to delay the implementation of Direction 2 until the matter can be thoroughly explored is reasonable and both the UCA and Devon agree with this approach*.[4]

6 This report is the AESO's thorough exploration of the matter of using contract or installed capacity to determine the POD cost function.

F.1-2 Connection Project Database

7 The point of delivery cost function is based on actual data for connection projects that result from requests by market participants for system access service. Connection projects involve the construction of transmission facilities for the connection of a market participant's facilities to the existing transmission system, and may be either "greenfield" projects or "upgrade" projects. Greenfield projects are those that require the construction of a new substation to provide system access service, while upgrade projects are those that require the construction of additional facilities at an existing substation.

[3] Proceeding 3473, Exhibit 0029 at paras 8-11.
[4] Decision 3473-D01-2015 (Errata) at para 31.

8 Only greenfield projects were included in the connection project data used for the point of delivery cost functions in the 2007 and 2010 ISO tariffs. More specifically, the project databases used for the different cost functions include:

- 18 greenfield load-only project with in-service dates in 1987-1999 for the development of the 20017 point of delivery cost function;
- 30 greenfield load-only projects with in-service dates in 1999-2008 for the development of the 2007 point of delivery cost function; and
- 46 greenfield load-only projects with in-service dates in 1999-2009 for the development of the 2010 cost function.

9 Upgrade projects with contracted amounts greater than zero were included in the development of the 2014 cost function. 81 greenfield load-only projects and 114 upgrade load-only projects with in-service dates in 1999-2014 for the development of the 2014 cost function. 9 upgrade load-only projects with in-service dates in 1999-2014 were removed from the database as the upgrade contract increases were 0 MW.

10 92 greenfield load-only projects and 175 upgrade load-only projects with in-service dates in 1999-2017 were included for the development of the cost function proposed in this application. Of the 175 upgrade load-only projects in 1999-2017, 21 projects were for contract increases of zero MWs.

11 These projects are referred to as “AESO-era” projects, and represent data points for which the AESO has reasonably detailed facilities, cost, and contract information.

12 The database used for the development of each of the point of delivery cost functions to date also includes 18 “pre-AESO” load-only projects with in-service dates in 1987-1999. The 18 pre-AESO projects were initially included as the smallest and largest projects in the database to allow development of a more robust cost function, and have been retained for the same reason and to add stability to the cost function through successive ISO tariff applications. The cost and contract information available for pre-AESO projects is very limited.

13 Data for all the projects in the connection project database is included in Appendix G of the application. The data reflects information available as of June 2017.

14 Workbooks to illustrate the projects, the calculations of POD cost curve, Rate DTS POD rates and investment levels for the options is included as Appendix V, as well as all three options calculations in Appendix G for Option 1, Appendix W for Option 2 and Appendix X for Option 4 to the application.

F.2 Objective

15 The AESO intends, with this report, to thoroughly explore (1) the options possible for analyzing the POD cost function database related to contract or installed capacity and inclusion of zero MW projects, (2) the Rate DTS point-of-delivery rate results for each option, (3) the investment amounts resulting from each option, and (4) review the options against a set of predetermined criteria in order to evaluate the options against the objectives of cost causation and rate design principles.

F.3 Stakeholder consultation

16 The AESO consulted with stakeholders between August 2015 and June 2016 to solicit input and feedback on the AESO’s approach to thoroughly explore the matter of the POD cost function. A summary

of the stakeholder consultation pertaining to the POD cost function is presented in Table F.3.1 below and included fully in Appendix C of this application.

17 The AESO's strategy for examining the POD cost function issue was presented to stakeholders in stakeholder sessions, the options were presented along with potential criteria to evaluate the options. Stakeholder input was also sought to ensure that the technical feasibility of some of the options could be addressed.

Table F.3-1 – Summary of stakeholder session information on POD cost function

Stakeholder Session	Topic	Summary
August 18, 2015	2017 (subsequently revised to 2018) ISO tariff application scope	AESO considers two options should be explored: • Based on contract capacity • Based on installed capacity Either option should apply to both greenfield and upgrade projects Must also consider impact of projects contracting for 0 MW capacity increases Should consider implications for cost recovery through rates and investment
July 7, 2016	Share information on 2017 (subsequently revised to 2018) ISO tariff application work	Update of POD database initiated
December 5, 2016	Share information on 2018 ISO tariff application work	Five options presented: 1. As applied for in 2014 tariff application with all greenfield load-only projects and include all upgrade load-only projects contract capacity 2. Current interim practice with all greenfield load-only projects and include all >0 MW upgrade load-only projects contract capacity 3. As requested in Decision 2014-242 with greenfield load-only projects contract capacity and upgrade load-only project installed capacity 4. Not requested option with all greenfield and upgrade load-only projects installed capacity 5. Not requested and not debated, and AESO

Stakeholder Session	Topic	Summary
		not considering, greenfield load-only projects installed capacity and upgrade load-only projects contract capacity 14 potential evaluation criteria for the POD cost function options was presented. The proposed criteria and input from stakeholders is presented below in Table F.4.2
January 30, 2017	Share information on 2018 ISO tariff application work	Further results on option pros and concerns against 10 evaluation criteria presented in Table F.4.2 below and stakeholder votes on the importance of each criteria
March 1, 2017	Share information on 2018 ISO tariff application work	No further POD cost function work presented
April 10, 2017	Share information on 2018 ISO tariff application work	The AESO shared with stakeholders, that in order to ensure that Rate DTS rates and investment would continue to be based on contract capacity, Option 3 & Option 4 would require a translation step from installed capacity cost function to a contract capacity cost function. The AESO estimated graphically a conversion from installed to contract. The AESO presented a high level comparison of Option 1 and Option 4 based on 4 principles: • Variability of relationship between installed capacity and contract capacity • Number of assumptions and reasonableness of assumptions • Fairness of treatment of customers with charges based on two different approaches (intergenerational equity) • Reflect actual cost drivers of projects - R-squared[5] ("R^2") of relationship between cost and contract or installed capacity

[5] R-squared is a statistical measure of how close the data are to the fitted regression line.

Stakeholder Session	Topic	Summary
		The AESO also presented estimated tiered Rate DTS POD charge levels for Option 1 and Option 4 compared to the approved 2017 ISO tariff Rate DTS tiered POD charges. The AESO communicated that the application would include rates and investment based on Option 1, with the application including a full analysis of all four options in order that the issues and analysis could be thoroughly explored in the 2018 ISO tariff application proceeding.
June 26, 2017	2018 ISO tariff application preview	The AESO presented details of the 2017 POD cost function database, inclusive of all projects with in-service dates up to 2018. The existing cost function curve and draft updated projects and including 0 MW projects cost curves were presented. The Option 1 cost function was proposed: Costs = \$2,584,400 X $MW^{0.5726}$ Graphically, the change in the proposed cost function curve from the existing curve is small. Draft Rate DTS point-of-delivery tier rates were presented as well as draft rates for all other ISO rates. The proposed tiered investment levels were presented and resulted from a multiplier of 0.72 (a decrease from the existing multiplier of 0.81) in order achieve 60% investment coverage for all 285 projects in the database.

F.4 Evaluation of POD cost function options

18 In order to achieve a thorough exploration of all options relating to understanding the cost drivers for load connection projects, the AESO identified the following four options for analyzing the relationship between costs and capacity (cost curve).

Table F.4-1 – Cost curve options

Cost Curve Options	Greenfield Projects Capacity	Upgrade Projects Capacity	0 MW Upgrade Contracts
#1 – As applied for in 2014 application	Contract	Include	Include
#2 – Current practice	Contract	Contract	Remove
#3 – As requested in Decision 2014-242 (resulted in unanticipated impacts)	Contract	Installed	By using installed, 0 MW upgrade projects are included
#4 – Not asked for previously	Installed	Installed	By using installed, 0 MW upgrade projects are included

19 Table F.4-2 below describes the potential qualitative criteria the AESO presented to evaluate the four options. Stakeholder feedback regarding the support, opposition or indifference to the potential criteria.

Table F.4-2 – Evaluation criteria proposed in December

No.	Potential evaluation criteria	Stakeholder Feedback
1	Maintaining alignment between POD cost function , maximum investment levels and the POD charge in Rates DTS and PSC	Support – 5 Oppose – 0 Indifferent – 1
2	Consistency with past practice (post-2007)	Support – 1 Oppose – 1 Indifferent – 4
3	Maximize number of projects in database	Support – 3 Oppose – 0 Indifferent – 3
4	Statistical criteria for project exclusion	Support – 0 Oppose – 2 Indifferent – 4
5	Degree of relationship between installed capacity and contract capacity	Support – 4 Oppose – 1 Indifferent – 1

No.	Potential evaluation criteria	Stakeholder Feedback
6	"Lumpiness" of installed capacity and standard transformer sizes	Support – 1 Oppose – 0 Indifferent – 3
7	Number of assumptions required to determine the MWs	Support – 0 Oppose – 0 Indifferent – 4
8	Behavior of market participant's relationship to MWs • Encouraging staging to contract appropriately • Planning signal from contract capacity vs installed capacity	Support – 2 Oppose – 0 Indifferent – 3
9	Potential to eliminate substation fraction	Support – 0 Oppose – 0 Indifferent – 5
10	Treatment of split between DTS and STS shared costs	Support – 3 Oppose – 1 Indifferent – 0
11	Rates reflect true costs per MW	Support – 4 Oppose – 1 Indifferent – 1
12	Equal services treated equally, unequal services treated unequally	Support – 1 Oppose – 0 Indifferent – 3
13	Sending the "right" price signal	Support – 4 Oppose – 0 Indifferent – 1
14	Fairness of treatment of customers with charges based on two different approaches	Support – 3 Oppose – 0 Indifferent – 1
15	Any others?	None

20 In the January 30, 2017 stakeholder session the AESO presented some more background to the evaluation criteria presented in the December 2016 session. Using the stakeholder feedback in Table F.4-2 and the AESO's review of the issues, as a guide, the AESO presented six criteria or issues to be used in the evaluation of the options discussed further below.

F.4-1 Maintain Alignment Between Rates and Investment

21 The current POD cost function determines a relationship between contract capacity of a project and its construction cost. Investment is calculated using investment levels from the POD cost function multiplied by the contract capacity and the POD charge in rates is based on billing capacity, which in turn includes contract capacity as a determiner. Moving the POD cost function to a relationship between installed capacity and the construction cost would require investment levels based on installed capacity and then POD charge in rates to be based on installed capacity. Yet, regional charges would be based on contract capacity. This would result in potentially different determinants for POD charges vs regional changes and impact the clarity in "provision of price signals" and difficulty in assessing "fairness, objectivity, and equity" between different ISO tariffs. In working with market participants it was determined that having investment and POD charges based on installed capacity was not the intent of the original issue. A solution to translate a POD cost curve based on installed capacity (dollars vs installed capacity) to a POD cost function based on contract capacity (dollars vs contract capacity) may be possible and will be discussed in more detail in Section F.5.4 below.

F.4-2 Maximize number of projects in database

22 The inclusion of connection projects included in the POD cost function database has evolved since the 2007 ISO tariff application:

- In the 2014 ISO tariff application, the inclusion of customer-owned facilities was debated. In Decision 2014-242, the Commission directed the AESO to continue to exclude customer-owned projects from the database and cost calculations. The support for the continued exclusion came from maintaining confidentiality of the project costs and that the rational for the customer to keep costs as low as possible cannot be guaranteed;
- As well in the 2014 ISO tariff application, project inclusion was limited to those projects with at least PPS estimates and with facilities application filed to reduce the likelihood of future cost and scope changes affecting the POD cost function;
- Again in the 2014 ISO tariff application the AESO proposed including upgrade projects in the POD cost database to better represent connection projects that exist in Alberta; and
- In the 2014 ISO tariff compliance filing, an interim methodology to exclude upgrade projects with zero MW contract capacity was proposed by the AESO to address the DUC's concern that DFO's do not have the same incentives as a direct connect customer and these connection projects were moved from the database on an interim basis. This interim methodology was accepted by the Commission in Decision 3473-D01-2015.

23 In order to analyze the statistical relationship between DTS contract capacity, or installed capacity, and point of delivery costs, the AESO believes that removing projects from the database must be based on clear defendable reasons of why those project data points do not reflect any future expected behavior of market participants making investment decisions. Each option should be evaluated on maximizing the number of data points unless a clear and consistent argument can be made on the removal of a set of projects or data points.

F.4-3 Degree of relationship between contract capacity and installed capacity

24 Using the cost function database, now including installed capacity, the AESO can measure the degree of relationship between contract capacity and installed capacity. The relationship for all projects, DFO projects, direct-connect market participants, greenfield or upgrade projects, or any combination of categorized projects. The analysis of these differences can potentially lead to quantitatively understanding the different drivers that are considered when a market participant requests the contract capacity for their project and analyzes investment level and construction contribution:

Table F.4-3 – All projects - relationship between contract capacity and installed capacity

	MW
Contract Capacity	3,890
Installed Capacity	8,576
Contract Capacity / Installed Capacity	54.55%

25 Table F.4-3 above illustrates that consistently projects are setting their contract capacities lower versus installed capacity The intent of the option analysis is to understand the impact of any differences on the POD cost function curve. By understanding the costs measured against installed capacity, the determination will be if moving to creating a POD cost function curve against installed capacity has a measurable difference compared to a POD cost function curve against contract capacity.

F.4-4 "Lumpiness" of installed capacity and standard transformer sizes

26 It is clear, and evident from the cost function database and Figure F.5-4a below, that there is a "lumpiness" of installed capacity due to standard transformer sizes installed by transmission facility owners. It would be difficult for a market participant to perfectly match their project load requirements to standard transformer sizes. Resulting from this difficulty, there is a concern that investment derived from data driven by standard transformer sizes could reduce the ability of the investment levels to provide price signals and could therefore negatively impact fairness, objectivity and equity.

F.4-5 Number of assumptions required to determine contract and installed capacity

27 Contract capacity is a value requested by a market participant in their system access service request and is the number of MWs included in a System Access Service ("SAS") Agreement and used in billing capacity to determine a market participant's monthly bill. To determine installed capacity, a number of assumptions relating to the physical equipment installed, including the surrounding electrical system, are required to determine an installed capacity.

Table F.4-5 – Determination of installed capacity

Transmission facilities	Calculation of installed capacity
Transformer addition	Maximum transformer rating in MVA, converted to MW by multiplying by 0.9
Transformer replacement	When a larger transformer replaced a smaller transformer at a substation, the added capacity was the difference in maximum transformer ratings between the two transformers in MVA, converted to MW by multiplying by 0.9

28 To reduce the number of assumptions to a repeatable and practical level, the AESO, for this thorough examination, has determined "installed capacity" as only the transformation capacity. Installed capacity at a substation can be limited by a number of factors included the number of breakers, cooling fans and other equipment. The simplification from the AESO's 2014 compliance application is a result of further review of the exercise and further analysis of the data. An issue that results from the previous methodology results is that as a result of the addition of a transformer and a breaker, the new installed capacity was limited by the lesser of the breaker or transformer addition. The result of this methodology, is of course, a relatively large project cost with a relatively small installed capacity addition. However, as a result of this change, there is a potential of adding a breaker or cooling fan that practically increases installed capacity but for the purpose of the cost function, results in 0 MW of installed capacity increase with project costs. The AESO believes that given the relatively small cost of breaker additions and other equipment, the impact on the cost function is less than if the transformer addition installed capacity addition is limited by breakers.

F.4-6 Rates reflect true costs per MW and sending the "right" price signal

29 In order to determine and test the "right" price signal, the AESO will analyze each option for its statistical accuracy and determine the results on investment and POD rates. Each option's power curve (POD cost function), R-squared, resulting rate and investment will be provided to assist in determining the "right" price signal.

F.4-7 Fairness of treatment of customers with charges based on two different approaches

30 The consideration of fairness of treatment must be considered against the possibility that a market participant in the past made decisions based on investment and rates calculated from the relationship between project costs and contract capacity. Now, a change in POD cost function curve basis, would mean that the market participant is now paying rates calculated on an installed capacity basis.

31 A large movement in charges between the POD charge tiers could signify that there may be a fairness concern as discussed above. This criteria will be discussed further in Section F.6 after rate impacts are provided in Table F.6-4.

F.5 POD Cost Function Options

32 In order to achieve a thorough exploration of all options relating to understanding the cost drivers for load connection projects, the AESO identified four options (described in Table F.4-1 above and repeated below in Table F.5-1) for analyzing the relationship between costs and capacity (cost curve).

Table F.5.0 – Cost curve options

Cost Curve Options	Greenfield Projects Capacity	Upgrade Projects Capacity	0 MW Upgrade Contracts
#1 – As applied for in 2014 application	Contract	Contract	Included
#2 – Current practice	Contract	Contract	Remove
#3 – As requested in Decision 2014-242 (resulted in unanticipated impacts)	Contract	Installed	By using installed, 0 MW upgrade projects are included
#4 – Not asked for previously	Installed	Installed	By using installed, 0 MW upgrade projects are included

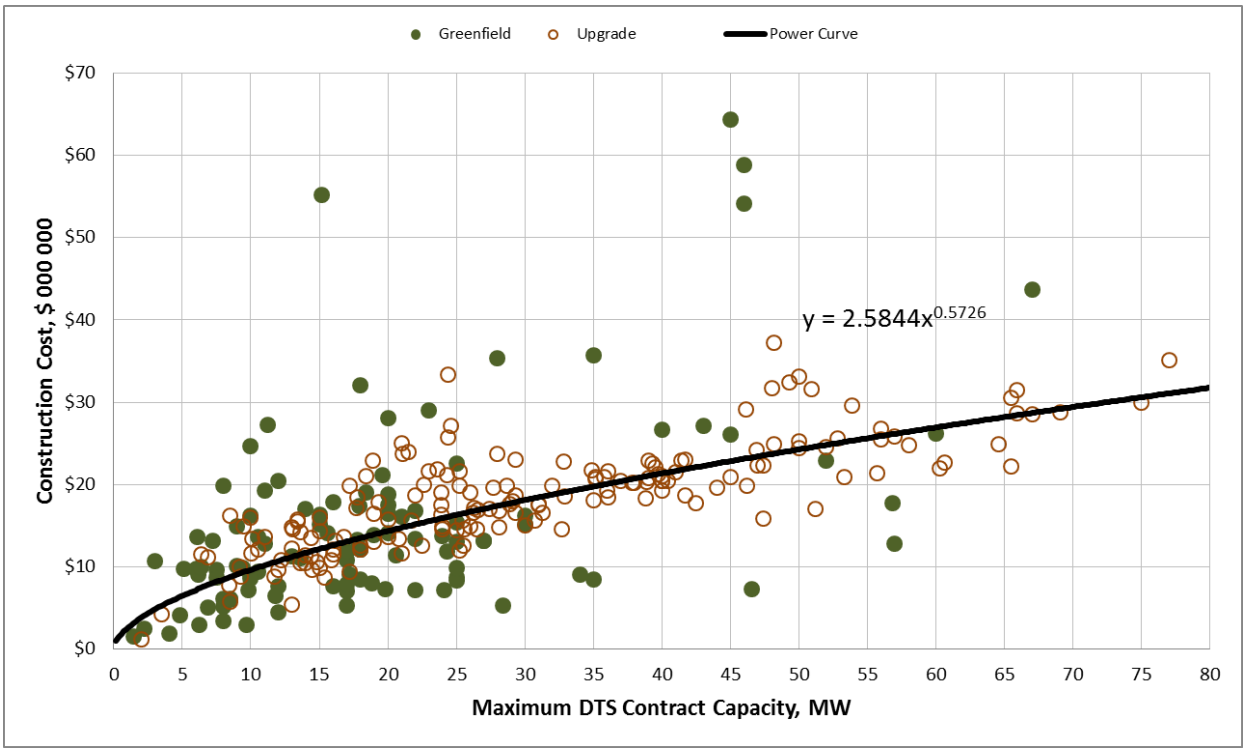
33 Option 3, a mix of contract capacity and installed capacity to develop cost curve, resulted previously in "unanticipated impacts" and the AESO did not put further work in assessing ways to address the issues raised in Proceeding 3473. As well, stakeholders supported Option 4 as one way to address the "unanticipated impacts" of Option 3. As a result, no further work was done by the AESO to develop a cost curve based on a mix of contract capacity for greenfield load-only projects and installed capacity for load-only upgrade projects.

F.5-1 Option 1 – Contract capacity and include all greenfield and upgrade load projects

34 In the 2014 ISO tariff application, the AESO proposed creating the POD cost function based on the previously approved methodology and the including upgrade load projects as well. This Option 1 reverts back to the methodology first proposed in the 2014 ISO tariff application.

35 The POD cost function curve described by Option 1 is illustrated below in Figure F.5-1. The projects are fairly well dispersed along the POD cost curve for all contract capacity amounts.

Figure F.5-1 – Option 1 POD cost function curve



36 The qualitative and quantitative analysis of this Option 1 is included below in Table F.5-1.

Table F.5-1 – Option 1 criteria evaluation

No.	Criteria	Rating (3 = highest rating of meeting criteria)
1.	Maintain alignment between rates and investment	3
2.	Maximize number of projects in database	3
3.	Degree of relationship between contract and installed capacity	2 = difference of 55% for DFO and 65% for direct connect for relationship between contract and installed capacity
4.	Lumpiness of installed capacity	3 = Not applicable
5.	Number of assumptions	3
6.	Determine “right” price signal	2 Greenfield R^2 = 0.38689 Greenfield + Upgrade R^2 = 0.52936

37 Option 1 POD cost function has been utilized to determine POD classification and investment levels in the 2018 ISO tariff application as shown in Appendix H, *2018 Rate Calculations*, and Appendix K, *2018 Contribution Policy Investment Levels Workbook*, of this application.

F.5-2 Option 2 – Contract capacity and remove load projects < 0 MW

38 As described in section 4.2 above, the AESO proposed in Proceeding 3473 to remove zero MW upgrade projects as an interim measure while a thorough examination of the relationship between projects costs and contract or installed capacity could be finished. This Option 2 illustrates the difference between Option 1 and then removing zero MW upgrade projects. There were 21 projects removed from the POD cost function database as they were zero MW contract increase projects. The POD cost function for Option 2 is illustrated in Figure F.5-2 below.

Figure F.5-2 – Option 2 POD cost function curve

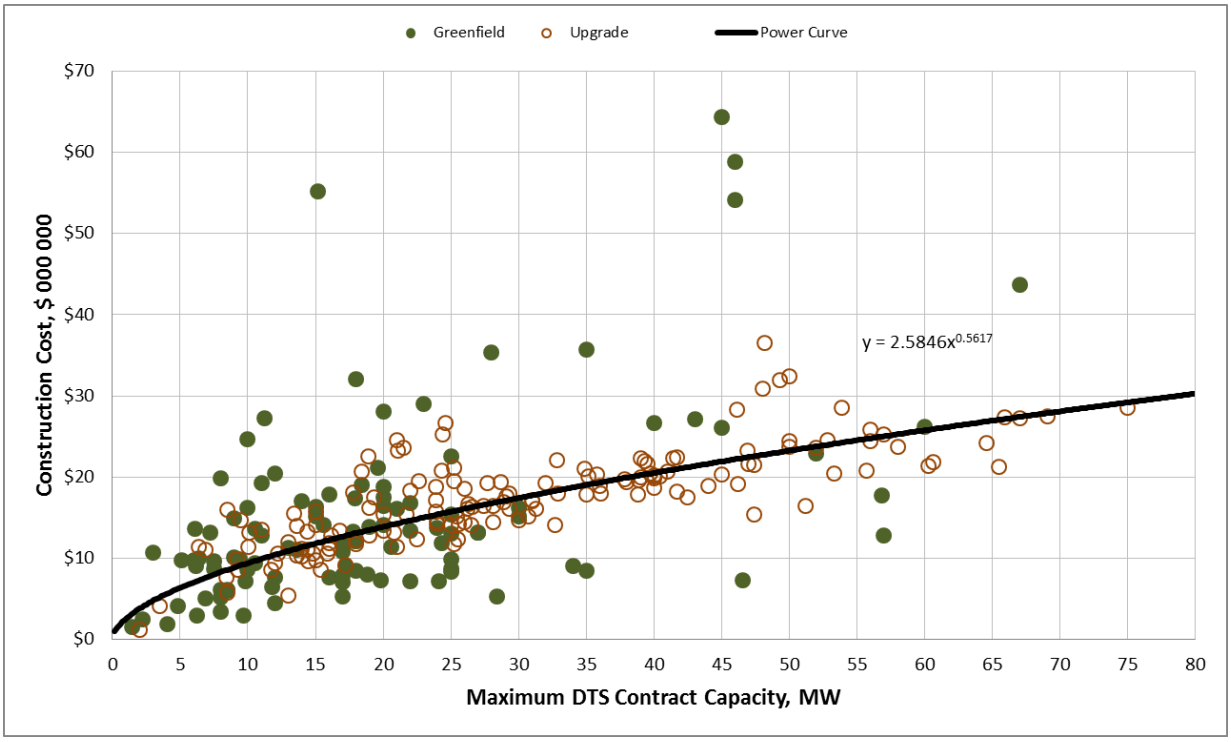


Table F.5-2 – Option 2 criteria evaluation

No.	Criteria	Rating (3 = highest rating of meeting criteria)
1.	Maintain alignment between rates and investment	3
2.	Maximize number of projects in database	2
3.	Degree of relationship between contract and installed capacity	2 = difference of 55% for DFO and 65% for direct connect for relationship between contract and installed capacity
4.	Lumpiness of installed capacity	3 = Not applicable
5.	Number of assumptions	3
6.	Determine "right" price signal	1 Greenfield R^2 = 0.36869 Greenfield + Upgrade R^2 = 0.51263

39 The AESO is recommending to not use Option 2 on a go forward basis for two reasons;

1. The statistical relationship between contract capacity and project costs worsens slightly with the removal of the zero MW upgrade projects as illustrated with the Greenfield + Upgrade R^2 = 0.51263 (compared with Option 1 Greenfield + Upgrade R4 = 0.52939); and

2. The theory that was raised in Proceeding 2718 by DUC, "*a rational AESO customer would maximize the DTS contract capacity to receive maximum investment, but only up to a point where the DTS rate charges are not affected. For a DFO, however, DTS rate charges are a flow-through to its customers and, therefore, the same level of discipline in selecting a higher DTS contract capacity may not exist*."[6] Further to this observation, if the DFO is not responding to the investment contracted capacity price signal at the lower end of the cost curve, then it can be argued that they are as likely to not respond to investment contract capacity price signal at any point along the cost curve. And the implication of DFOs not responding reasonably to investment price signals, is to remove all DFO projects from the cost curve and DFOs not being eligible for investment. This option was beyond the scope of this examination and will be discussed further in Section 6 – Conclusions below.

40 Due to the two reasons stated above in responding to the issue raised by DUC in Proceeding 2718, the AESO is not using Option 2 to determine DTS rates and investment levels in this application.

[6] Decision 2014-242 at para 238.

F.5-3 Option 3 – Contract capacity for greenfield projects and installed capacity for upgrade projects

41 Option 3 is discussed in this report to provide a complete documentation of the options discussed in Proceeding 2718 and Proceeding 3473. As discussed above, in AESO's compliance with Direction 2, unanticipated impacts were found with determining a cost function based on contract capacity for greenfield projects and installed capacity for upgrade projects. As, the AESO could not determine any fixes to resolve this issue and the support for stakeholders to determine a methodology based on maintaining alignment between DTS rates and investment, no quantitative work was done on this option but the qualitative assessment was completed as shown in Table 5-3.

Table F.5-3 – Option 3 criteria evaluation

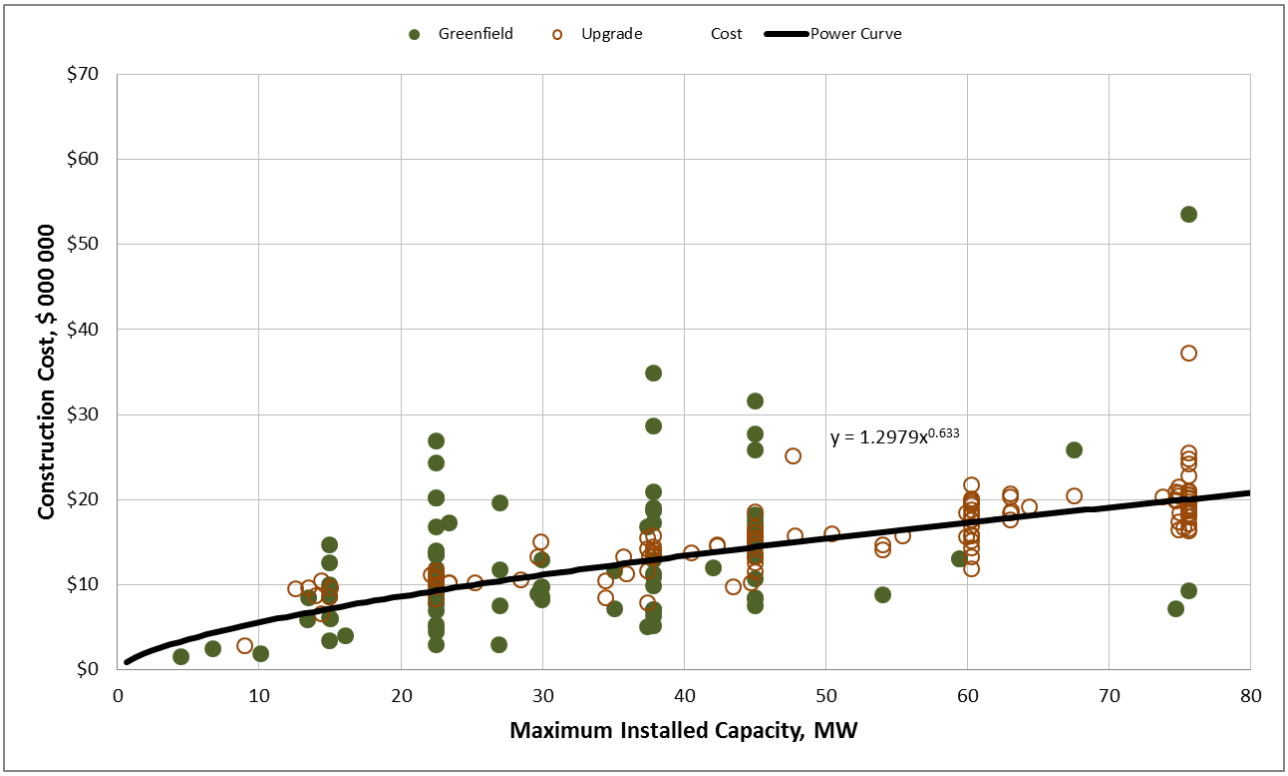
No.	Criteria	Rating (3 = highest rating of meeting criteria)
1.	Maintain alignment between rates and investment	1
2.	Maximize number of projects in database	3
3.	Degree of relationship between contract and installed capacity	1
4.	Lumpiness of installed capacity	1
5.	Number of assumptions	1
6.	Determine "right" price signal	- No qualitative data on this option

F.5-4 Option 4 – Installed capacity for all load project

42 This option, finding the relationship between installed capacity and project costs, was explored and discussed with stakeholders to determine a methodology that could first measure the relationship between project costs and installed capacity to determine a cost curve, and, secondly, to "translate" installed capacity to contract capacity in order to maintain alignment between rates and investment. In other words, ensure that rates are based on contract capacity and that investment could be determined based on contract capacity.

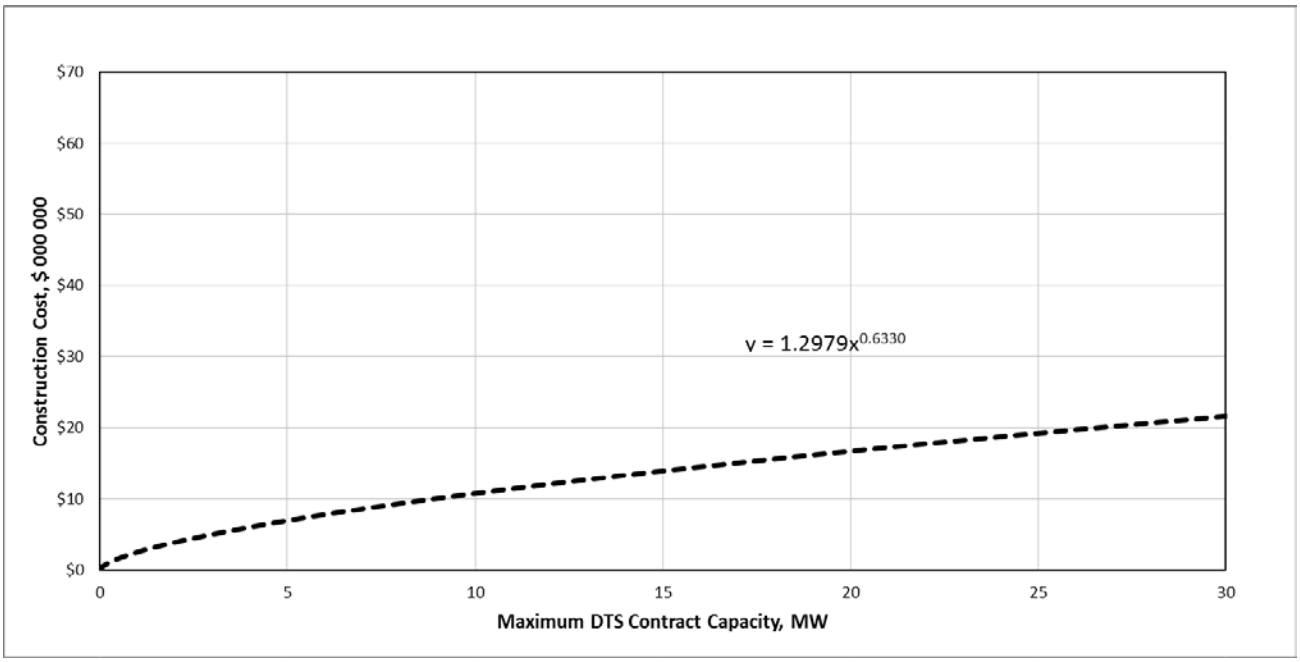
43 The first step to create a cost curve between installed capacity and project costs is illustrated in Figure F.5-4a below:

Figure F.5-4a – Option 4 POD cost function curve (installed capacity)



44 To convert the x axis or to translate the relationship between installed capacity to contract capacity, we can use the pod cost function database factor of all projects installed capacity to contract capacity capacity of 2.8310 (illustrated below) to translate the above from the exact same cost curve but graphed with the x axis as contract capacity.

Figure F.5-4b – Option 4 POD cost function curve (contract capacity)



45 This exercise of "translation" can be done at the step of POD cost classification. In Appendix V of the application, tab "Option 4 V-6", Line No. 2, Column A is altered to translate the first "Data Point" from 1.5 MW to 4.247 MW (1.5 MW X 2.8310 = 4.247 MW). This step is repeated for all data points on Line No.2, Columns 'B', 'C', 'D' and 'E'. This step will convert the installed capacity power curve of $y=1.2979x^{0.6330}$ to Rate DTS levels by contract capacity. In order to create investment levels, though, another identical translation is required. In the same appendix as discussed above, tab "Option 4 Investment Proposed", again the row "Data Points" are adjusted by the same 2.8310 factor to alter the cost curve for investment, in other words translate from installed capacity to contract capacity.

Table F.5-4 – Option 4 criteria evaluation

No.	Criteria	Rating (3 = highest rating of meeting criteria)
1.	Maintain alignment between rates and investment	3
2.	Maximize number of projects in database	3
3.	Degree of relationship between contract and installed capacity	2 does not account for variability in relationship
4.	Lumpiness of installed capacity	1
5.	Number of assumptions	1
6.	Determine "right" price signal	3 Greenfield R^2 = 0.43611 Greenfield + Upgrade R^2 = 0.61231

46 The AESO has not ruled out this option for its 2018 ISO tariff application thorough review for a number of factors relating to the qualitative and quantitative analysis of this option.

F.6 Conclusions

47 In the 2014 ISO tariff application, the AESO proposed creating the POD cost function based on the previously approved methodology and the including upgrade load projects as well. This Option reverts back to the methodology first proposed in Proceeding 2718.

Table F.6-1 – All options evaluation comparison and rating

		Option 1	Option 2	Option 3	Option 4
1.	Maintain alignment between rates and investment	3	3	1	3
2.	Maximize number of projects in database	3	2	3	3
3.	Degree of relationship between contract and installed capacity	2	2	1	2
4.	Lumpiness of installed capacity	3	3	1	1
5.	Number of assumptions	3	3	1	1
	Qualitative Ranking	14=#1	13=#2	7=#4	10=#2
6.	Determine "right" price signal (Greenfield R^2) (Greenfield + Upgrade R^2)	2 0.36869 0.52936	2 0.36869 0.51263	- n/a n/a	3 0.43611 0.61231
	Quantitative Ranking	#2	#3	n/a	#1

48 From a qualitative evaluation of the options, Option 1 based on contract capacity is ranked the highest with Option 4 based on installed capacity ranked second. To measure how well the predictive POD cost function curve performs, the AESO provides the R^2 for the greenfield projects only, as the inclusion of upgrade projects will artificially align with the greenfield-determined curve due to the methodology developed for the 2014 ISO tariff application.

49 The AESO has provided the Rate DTS point of delivery charges resulting from Option 1, Option 2 and Option 4 in Table F.6-2 below and the resulting investment levels is provided in Table F.6-3 below. The calculation of these charges and investment levels for all three options is provided in Appendix W of the application.

Table F.6-2 – All Options point of delivery charges

	Option 1	Option 2	Option 3	Option 4
POD Charge – Customer X SF	$10,120	$10,611	n/a	$17,625
POD –≤ (7.5XSF) MW	$4,108	$4,125	n/a	$3,406
POD –> (7.5XSF) to ≤ (17XSF) MW	$2,572	$2,556	n/a	$2,288
POD –> (17.5XSF) to ≤ (40XSF) MW	$1,799	$1,768	n/a	$1,673
POD –> (40XSF) MW	$1,162	$1,128	n/a	$1,149

Table F.6-3 – All options local investment

	Option 1	Option 2	Option 3	Option 4
Basic – Customer X SF	$82,100	$86,250	n/a	$149,100
First ≤ (7.5XSF) MW	$33,300	$33,400	n/a	$27,850
Next > (7.5XSF) to ≤ (17XSF) MW	$20,900	$20,700	n/a	$18,700
Next > (17.5XSF) to ≤ (40XSF) MW	$14,600	$14,300	n/a	$13,750
Remainder > (40XSF) MW	$9,400	$9,150	n/a	$9,450

50 The AESO has proposed using Option 1, the relationship between project costs and contract capacity, based on all load-only greenfield and upgrade projects as described in Section F.1-2 above. The AESO has concerns regarding removing projects from the database that do reflect how market participants respond to the price signals of investment and rates. If DFOs are not responding appropriately or are responding differently than direct-connect market participants to the ISO tariff investment and rate price signals, removing DFO data points from the database for this reason will not address the fundamental investment policy issue.

Table F.6-4 – Approximate bill impact increase(decrease) from current 2017 ISO tariff

	Option 1	Option 2	Option 3	Option 4
Basic – Customer X SF	15%	21%	n/a	101%
First ≤ (7.5XSF) MW	15%	16%	n/a	(4%)
Next > (7.5XSF) to ≤ (17XSF) MW	15%	15%	n/a	3%
Next > (17.5XSF) to ≤ (40XSF) MW	16%	14%	n/a	8%
Remainder > (40XSF) MW	15%	12%	n/a	14%
Fairness of treatment of customers with charges based on two different approaches	3	3	n/a	2
Overall Ranking	#1	#3	n/a	#2

51 Although the POD cost function curve based on installed capacity does provide an improvement in predictive ability of projects costs based on installed capacity (R^2 of 0.44 vs 0.3739), the increase in predictive ability does not outweigh the issues of difficulty in making the installed capacity assumption, difficulty in sending price signals to market participants given that TFOs have a preference for standard equipment sizes, i.e. lumpiness of the installed capacity, and the fairness of moving to an approach where market participants are faced with charges based on installed capacity, but investment based on contract capacity.

52 In consideration of the preceding discussion, the AESO proposes in this application to move to Option 1 – POD cost function curve based on contract capacity including all load-only greenfield and upgrade projects.