

Exh. SJK-6

WUTC DOCKET: UE-200900 UG-200901 UE-200894

EXHIBIT: SJK-6

ADMIT  W/D  REJECT

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

DOCKET NO. UE-20 \_\_\_\_\_

EXH. SJK-6

SCOTT J. KINNEY

REPRESENTING AVISTA CORPORATION



# METERING ASSESSMENT SUMMARY REPORT

PROPRIETARY AND  
CONFIDENTIAL

***PREPARED FOR:***



**AUTHORS:**

**BRIAN HOLMES AND ZACH  
GILL SANFORD**

**DECEMBER 2018**

## Table of Contents

1	Executive Summary.....	3
2	Requirements and Considerations.....	5
2.1	CAISO Metering Requirements .....	5
2.1.1	Metered Entity Registration.....	5
2.1.2	Applicable Metering Requirements .....	5
2.1.3	Generation Registration and Size Threshold .....	5
2.1.4	SQMD Plan .....	6
2.1.5	Equipment Rating Data .....	7
2.1.6	Equipment Burden Ratings .....	7
2.1.7	Meter Memory Requirements .....	8
2.1.8	Metering Granularity .....	8
2.1.9	Meter Submission at Resource ID Level.....	9
2.1.10	Pseudo-Tie Meters and Load Meter Calculation .....	13
2.1.11	Meter Channels.....	14
2.2	Key Metering Considerations.....	15
2.2.1	Expected Point of Measurement and Compensation Factors .....	15
2.2.2	Metering Granularity Impact .....	17
2.2.3	Insufficient Accuracy and Correction Factors .....	17
2.2.4	Insufficient Granularity of non-Avista owned Interchange Meters.....	18
2.2.5	Metering of Jointly-Owned Generation .....	18
3	Metering Approach .....	19
3.1	Generation, Avista-Owned.....	19
3.2	Generation, 3rd Party-Owned .....	23
3.3	Interchange, Avista-Owned .....	26
3.4	Interchange, 3rd Party-Owned .....	29
4	Estimated Costs.....	32
4.1	Avista Participating Resources .....	32
4.2	Other Metering & Network Costs .....	33

## 1 Executive Summary

Avista requested Utilicast perform an assessment of meters and associated equipment within the scope of California Independent System Operator (CAISO) requirements for Energy Imbalance Market (EIM) participation and adherence to those requirements. Initially, Avista was interested in assessing only the meters at its owned generation facilities. During the course of the project, Avista requested the original scope of assessed meters be expanded to include all generation and interchange meters related to EIM participation.

This project focused on inventorying the characteristics and configurations of existing meters, current transformers (CTs), potential transformers (PTs), and associated communications at generation and interchange sites in the Avista Balancing Authority Area (BAA). Avista made a business decision during this assessment to evaluate the equipment relative to the CAISO metering requirements rather than the various Local Regulatory Authority (LRA) metering requirements. Therefore, these equipment characteristics and configurations were compared to the CAISO metering requirements stated in the current version of the CAISO Metering Business Practice Manual<sup>1</sup> (BPM) at the time of the project. Any gaps in adherence to these requirements and unknown equipment ratings are identified in this report along with proposed steps to address these gaps and determine unknowns through metering projects, equipment tests, or requests to CAISO for requirement exemptions.

A high-level scope and cost estimate for metering projects, generation controls, and meter data communications were produced by Avista staff based on input from Utilicast. The budgetary level cost estimate for EIM related metering projects is presented in Table 1.

**Table 1: Summary Budgetary Cost Estimate for EIM Metering Projects**

<b>Cost Estimate Category</b>	<b>Project (in \$,000)</b>	<b>Post-Project Recurring Services and Avista Labor (in \$,000)</b>
<b>Generation Meter Projects</b>	\$3,000 - \$4,500	
<b>Generation Control Projects</b>	\$1,200 - \$1,400	
<b>Transmission Meter Projects &amp; Data Collection</b>	\$340	\$18
<b>Network Improvements for Metering</b>	\$210 - \$2,000	\$15
<b>Total</b>	<b>\$5,490 – 7,280</b>	<b>\$33</b>

Costs presented in this report are further described in the EIM Technology Assessment report delivered by Utilicast in a separate scope of work.

Avista has already budgeted \$3.4M for the expected cost of generation meter projects in a separate Business Case and the costs in this report are not additive. By contrast, Avista has not yet budgeted for

<sup>1</sup> CAISO Metering Business Practice Manual Version 18, Revised May 24, 2018

[https://bpmcm.caiso.com/BPM%20Document%20Library/Metering/BPM%20for%20Metering\\_v18\\_Clean.docx](https://bpmcm.caiso.com/BPM%20Document%20Library/Metering/BPM%20for%20Metering_v18_Clean.docx)

the expected cost of interchange meter projects, plant controller upgrades or network enhancements, so those efforts represent new costs.

## 2 Requirements and Considerations

EIM participation will require Avista to certify to the accuracy of installed metering equipment at generation and interchange sites in its BAA, with the Avista EIM metering program subject to annual self-audits. Avista may establish the procedures of its annual self-audit plan at its own discretion, although CAISO must approve the audit plan. Additionally, CAISO retains the right to audit the Avista EIM metering program, including its self-audit records.

The CAISO metering requirements are stated in the CAISO Metering BPM. While many requirements are identified in this report, it is not intended to be exhaustive in listing all applicable requirements. In addition to these stated requirements, there are several considerations for metering configuration that are key to Avista's successful EIM participation, which are described in this section.

### 2.1 CAISO Metering Requirements

#### 2.1.1 *Metered Entity Registration*

CAISO provides the option for EIM Entities to choose between two metered entity registration types, ISO Metered Entity (ISOME) and Scheduling Coordinator Metered Entity (SCME). Utilicast recommends Avista register as a SCME, as this allows Avista to continue engineering, installing, testing, and gathering data for meters in scope for EIM participation. Selecting the ISOME option would relinquish these roles to CAISO-certified personnel and require Avista to pay for the metering services and provide site access to these external personnel. It is also notable that all EIM Entities to date have registered as SCMEs, to Utilicast's knowledge. During the metering assessment, Avista indicated its intent to register as a SCME, so the metering assessment was performed with the assumption that Avista will be a SCME.

As part of this SCME registration, Avista will need to execute a registration agreement, requiring the Avista signee to attest to the accuracy of its submitted Settlement Quality Meter Data (SQMD) Plans.

#### 2.1.2 *Applicable Metering Requirements*

CAISO allows EIM SCMEs to choose between adhering to CAISO metering requirements and LRA metering requirements. Avista's applicable LRAs are state utility commissions. Avista made a business decision during this assessment to evaluate the equipment relative to the CAISO metering requirements.

#### 2.1.3 *Generation Registration and Size Threshold*

CAISO allows EIM participants some discretion on which generation capacity to be registered in the EIM. Very small resources may be excluded from all EIM involvement, including resource registration, the Full Network Model (FNM), base schedules, and meter submission. CAISO requires this threshold be set between 1 MW and 10 MWs.

During the metering assessment, Avista decided to set the minimum capacity threshold for resource registration at 3 MW. This threshold was chosen since it corresponds to the specified threshold for requiring Supervisory Control And Data Acquisition (SCADA) in the Avista Small Generator Interconnection Procedures (SGIP) and the excluded resources were deemed to have negligible impact on Avista operations since, at the time of this assessment, their total capacity is less than 7 MW.

The exclusion of these generators from resource registration will appear as negative load in the Avista load forecast and real-time operations for the EIM. Therefore, Avista should subtract these resources' historical output from the Avista historical load actuals submitted to CAISO for its load forecast engine to ensure greater forecast accuracy.

All generation within the Avista BAA above the 3 MW capacity threshold must be registered with submitted and approved SQMD Plans, regardless of ownership and EIM participation.

#### 2.1.4 SQMD Plan

To join EIM, the Entity must complete a SQMD Plan and receive CAISO approval for each registered Resource ID. Each Participating Resource (PR), Non-Participating Resource (NPR), and scheduling tie will be assigned a Resource ID, with scheduling ties being comprised of physical interchange points aggregated to Avista-defined locations. The Avista-completed SQMD Plans<sup>2</sup> will include information such as meter granularity, meter and instrumentation accuracy, loss compensation, meter audit and test plans, calculations, single line meter diagrams, and descriptions of data collection and Validation, Editing, and Estimating (VEE). The descriptions of data collection do not require detailed diagrams of the communication pathway, but should include a description of communication networks, meter data head-end and Meter Data Management (MDM) systems leading to daily SQMD data submission to CAISO systems for settlement.

As part of the SQMD plan submission, Avista will need to provide a Single Line Diagram (SLD) that shows the station configuration and specifically the locations of all relevant transformers, meters and station service. The SLD must either be stamped by a Professional Engineer (PE) or, if modifications have been made since the original construction, an Avista PE may attest to the accuracy of the SLDs.

As part of the EIM implementation project, Avista should prioritize the early submission of the first SQMD Plan to allow for sufficient review and revision time between CAISO and Avista staff, which may take several months of revision and discussion to finalize<sup>3</sup>. Furthermore, CAISO staff may request clarification or modification of the plans in a manner that could impact all SQMD Plans and the underlying EIM meter program, requiring substantial project work to address. Once one SQMD Plan has been approved, much of the content may be utilized for all other plans, as the description of the audit plan, data collection, and VEE should be common to the majority of meters, easing the submission of subsequent plans. Any expected exemptions should also be discussed early in the implementation project to ensure acceptance or a change in project work as necessary.

<sup>2</sup> CAISO's tutorial of SQMD Plan template is posted at

<https://www.aiso.com/Documents/SQMDResourceTemplateTutorial.pdf>

The SQMD Plan template is posted at <https://www.aiso.com/Documents/SQMDPlanTemplate.docx>

<sup>3</sup> To begin the SQMD process, Avista must obtain a New Resource Implementation (NRI) number. To obtain this number, Avista must have an assigned Resource IDs. However, EIM Entities DO NOT have to follow the full NRI process if they are SCMEs.

### 2.1.5 Equipment Rating Data

The equipment ratings specified in the CAISO Metering BPM, such as accuracy and burden ratings, must be determined by Avista for EIM participation. The CAISO Metering BPM rating requirements are specified by accuracy and burden classes, as defined in the IEEE C57.13 Standard Requirements for Instrument Transformers. If the equipment ratings for any meters, CTs, or PTs used for EIM metering are unable to be found, then Avista must either replace the equipment having unknown attributes, or attest to the likely attributes based on known information, such as other installations of similar equipment having known attributes, test data, or other sources of engineering judgement.

Avista should undertake all reasonable measures to establish the accuracy of the equipment. At one time CAISO was aggressive in requiring nameplate information for all equipment. However, in more recent EIM implementations CAISO has been somewhat more willing to accept management attestation in a sworn affidavit that states the assumed accuracy “to the best of my knowledge” with a duty to update if new information becomes available. The assessment of validated equipment ratings and equipment lacking the necessary rating data are provided in section 3.

The core requirements for metering equipment are:

- Meter
  - 0.2 Accuracy class
  - 60 days storage for meter data
  - 5-minute interval granularity for Participating Resources and Interchange
- CT
  - +/- 0.3% accuracy at burden of 0.1 - 1.8 ohms, 10% - 100% rated current, or
  - Optional +/- 0.15% accuracy at burden of 0.1 - 1.8 ohms, 5% - 100% rated current
- PT
  - +/- 0.3% accuracy through burden rating ZZ (400 Volt-Amperes secondary at 0.85 power factor) at 90% through 110% of nominal voltage, or
  - Optional +/- 0.15% accuracy through burden rating Y (75 Volt-Amperes secondary at 0.85 power factor) at 90% through 110% of nominal voltage

Avista may use equipment which does not meet the requirements but doing so will require Avista to calculate a “correction factor” to apply to the meter data. The correction factor does not increase accuracy – it is a penalty which reduces the observed readings to ensure that the metered output is not overstated. See section 2.2.3 for more detail on correction factors.

### 2.1.6 Equipment Burden Ratings

Avista has identified several installed CTs and PTs with burden ratings less than the CAISO requirements of B1.8 and ZZ, respectively. However, this equipment may have sufficiently low burden connected to their circuits to retain their rated accuracy, pending further validation by Avista engineers. While the CAISO-stated burden ratings may exceed these installations, Avista should be able to utilize this



equipment with low connected burden in accordance with item b of the following excerpt from Attachment B Section A6 of the CAISO Metering BPM:

Where the connected burden of a metering circuit exceeds the burden rating of a CT or [PT] or if an existing instrument transformer does not meet the minimum CAISO accuracy requirements, then one of the actions listed below must be taken:

- a. Replace the instrument transformer(s) with higher burden rated revenue class units; or
- b. Reduce the burden on the circuit to comply with the name plate of existing instrument transformer(s); or
- c. Apply correction factors to the meter to adjust the meter's registration to compensate for inaccuracies.

In accordance with item b of the above excerpt, if Avista can document in the SQMD plan that the connected burden of these CTs and PTs and demonstrate it is less than the equipment burden rating, then the installed equipment can be utilized without replacement or correction factors. See section 3 for lists of equipment with lower burden ratings that require validation of the connected burden.

#### *2.1.7 Meter Memory Requirements*

Avista has identified several installed meters with memory storage less than the CAISO requirement of 60 days storage. Avista should consider either replacing these meters, upgrading their memory, or maximizing the use of the existing memory and applying for an exemption from the CAISO requirement. In the latter case, Avista has identified the increased storage potential if the number of stored channels, see section 2.1.11 for detail on meter channels, are minimized to meet the CAISO requirements and dispense with any additional data. For example, if an interchange meter records the load at a substation, then only the single channel reading the import of energy for load need be recorded for EIM purposes.

If Avista chooses to retain these meters with insufficient memory, an exemption should be submitted for CAISO's review early in the implementation project, to ensure sufficient time to adjust project work if CAISO rejects the request. The exemption request should describe the rationale for the decision and proposed mitigation plan. For example, Avista could describe its plan to replace these meters as associated site work occurs, and in the meantime, a process for sending field technicians for a local meter read in a timely fashion prior to reaching the memory limitation, should communications fail to read the meter.

#### *2.1.8 Metering Granularity*

Generation registered as a Participating Resource (PR) and BAA Interchange metering must be submitted to CAISO at a 5-minute granularity, while Non-Participating Resource (NPR) metering may be recorded at a 5-minute, 15-minute, or 60-minute granularity. BAA load metering, termed EIM Load Aggregation Point (ELAP) load, is determined as the net summation of all generation and interchange meter values and cannot be submitted to CAISO at a more granular level than the least granular meter data. For example, if all PR, NPR, and interchange meters record at 5-minute granularity except one NPR meter that records at 15-minute granularity, then the CAISO would require the ELAP meter be

submitted at 15-minute granularity. See section 2.2.2 for a description of meter granularity impact on EIM participation.

In the EIM, the CAISO deems the Merchant largely responsible for PRs and the Transmission Operator, termed the EIM Entity, responsible for NPRs. One possible generation Resource registration strategy that simplifies scheduling and analysis is to register all Avista owned generation as Participating Resources. To do so would require Avista to satisfy the granularity requirements of Participating Resources for all generation.

In some cases, the CAISO has permitted profiling of a Revenue Quality value at a greater granularity to be profiled to a 5-minute granularity using other data (e.g. SCADA) but this is not typically permitted. The only cases we know of involve resources which have some other pre-existing revenue quality checkout process, such as Mid-Columbia (Mid-C) and Colstrip.

### *2.1.9 Meter Submission at Resource ID Level*

CAISO requires meter data to be submitted at the registered Resource ID level.

To the extent Avista records multiple meters for one Resource ID, these values will need to be netted to a single meter data set for submission to CAISO. For example, if two physical generators are metered individually at their gross output, have a separately metered station service onsite, and are registered as a single Resource ID, then all three meters will be combined into a single meter value recording the two generators' output net of station service.<sup>4</sup>

Following are three examples to illustrate options for a station with a configuration similar to Noxon. These simplified examples and single line drawings are intended to provide an overview of the choices and tradeoffs and are not ready for SQMD submission. These examples assume that all equipment accuracy requirements are satisfied. If some of the equipment is not revenue quality, then the correction factors would also need to be applied.

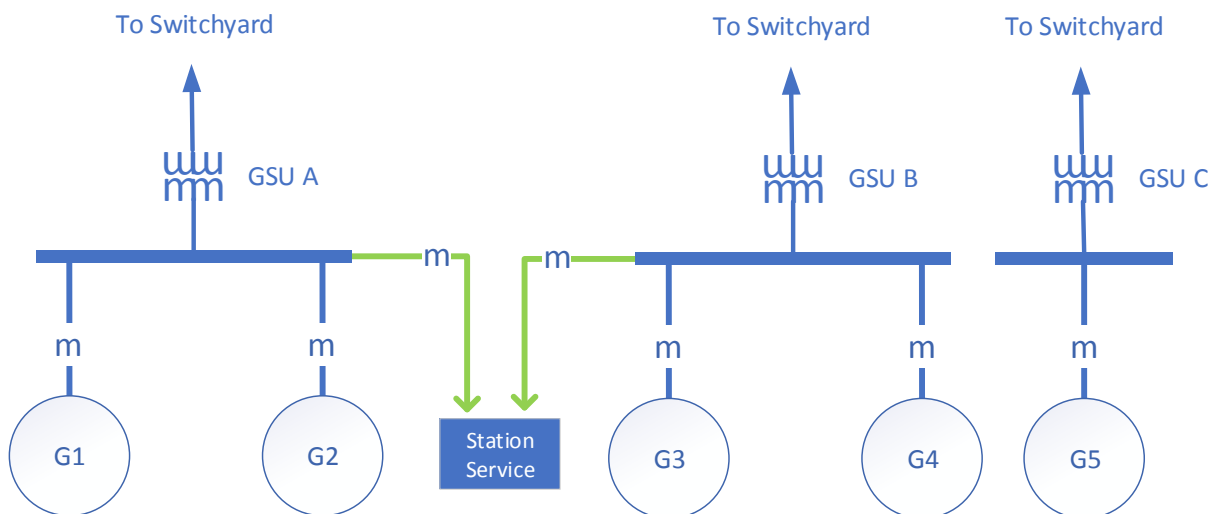
If Noxon were to participate as an aggregate resource and utilize its existing unit-level metering, Avista would net the five generation meters and two station service meters, as depicted in Figure 1 with metered locations depicted by the letter "m" and described in the following equations<sup>5</sup>:

$$\text{Noxon aggregate resource meter} = G1 + G2 + G3 + G4 + G5 - SS1 - SS2$$

Where G# is the meter for unit # and SS# is the meter for station service #

<sup>4</sup> Netting of station service is permitted but only certain categories of use which are deemed "required" for the operation of the station are approved for this treatment (e.g. pumps, excitation). Other categories of use that might be tied to a generator (e.g. fish hatcheries at a hydro facility) do not qualify for station service netting and would need to be excluded from the netting, unless the generator is classified as behind-the-meter generation in its interconnection agreement. Onsite load for behind-the-meter generation may be netted from generation.

<sup>5</sup> Avista may also need to calculate station and transformer loss factors to "compensate" the observed values to simulate that "the meter" is on the high-side of "the GSU". This detail is not shown in these simplified examples.



**Figure 1 : Noxon Aggregate Registration with Unit Level Metering**

More specifically, the channels would be netted as follows (see section 2.1.11 for detail on meter channels):

$$\text{Noxon aggregate resource meter ch}_4 = G1\_ch\_4 + G2\_ch\_4 + G3\_ch\_4 + G4\_ch\_4 + G5\_ch\_4 \\ - G1\_ch\_1 - G2\_ch\_1 - G3\_ch\_1 - G4\_ch\_1 - G5\_ch\_1 - SS1\_ch\_1 - SS2\_ch\_1$$

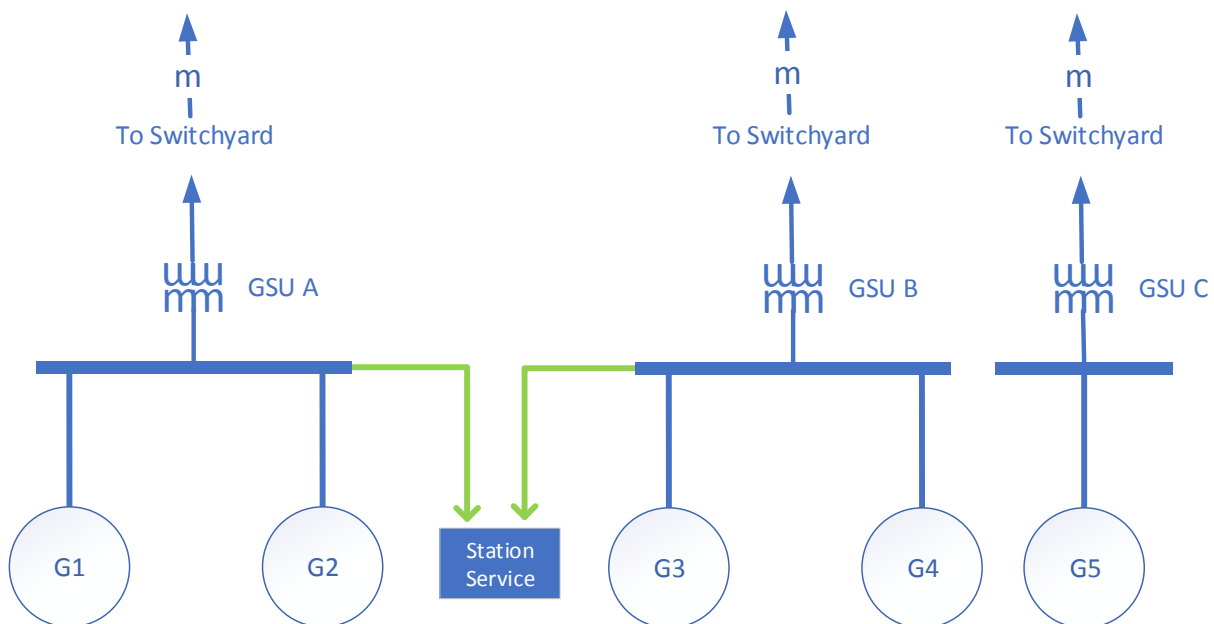
$$\text{Noxon aggregate resource meter ch}_1 = 0$$

Where ch\_# is the submitted channel number

By contrast, if Noxon were to participate as an aggregate resource and utilize high-side metering recording the output at each of its three Generator Step-Up transformers (GSUs) net of station service by virtue of the metering location, then Avista would net the three high-side meters, as depicted in Figure 2 and described in the following equations:

$$\text{Noxon aggregate resource meter ch}_4 = \text{GSU\_A\_ch}_4 + \text{GSU\_B\_ch}_4 + \text{GSU\_C\_ch}_4 \\ - \text{GSU\_A\_ch}_1 - \text{GSU\_B\_ch}_1 - \text{GSU\_C\_ch}_1$$

$$\text{Noxon aggregate resource meter ch}_1 = 0$$



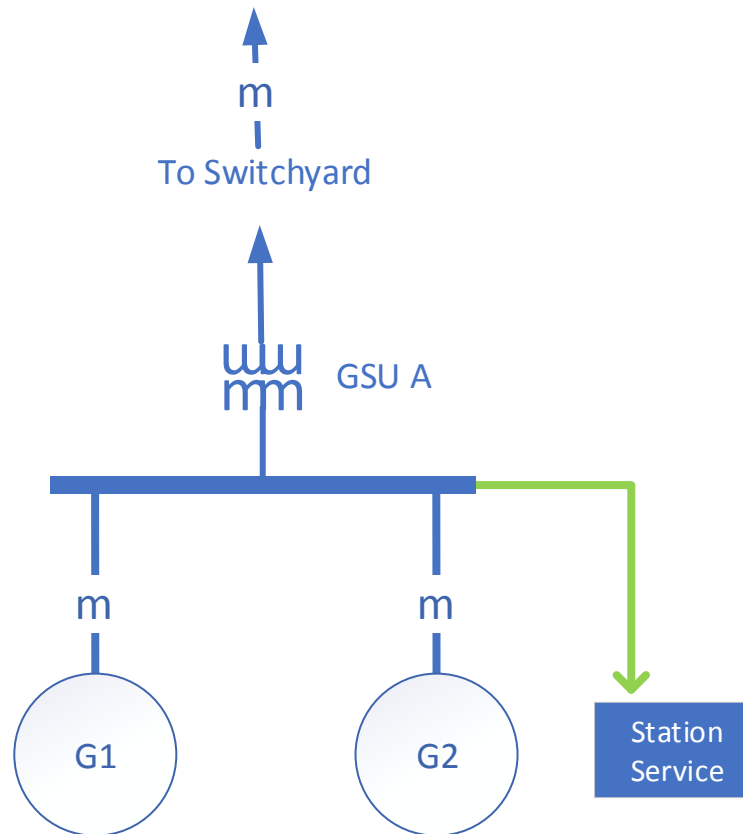
**Figure 2: Noxon Aggregate Registration with High Side Metering**

A revenue quality meter provides data to the VEE process. Once VEE has been performed, the data is deemed settlement quality, will be submitted to CAISO for settlement, and is subject to an approved SQMD plan. Other non-revenue quality meter reads may be used to allocate or distribute settlement quality data but are not provided to CAISO directly. If Avista records a single revenue quality meter for multiple Resource IDs, the data set will need to be allocated to the Resource ID level according to a documented process that is approved by CAISO. Such an allocation process could be based on non-revenue quality meter data recording at the unit level so long as the submitted meter data itself is collected from the single revenue quality meter. For example, if Noxon participates as individual units and the metering of units 1 and 2 is at the high side of GSU A, while each unit has an individual non-revenue quality meter recording gross output, as depicted in Figure 3 and described in the example equations below:

GSU A meter = 9.5 MWh; G1 meter = 4 MWh; G2 meter = 6 MWh, then

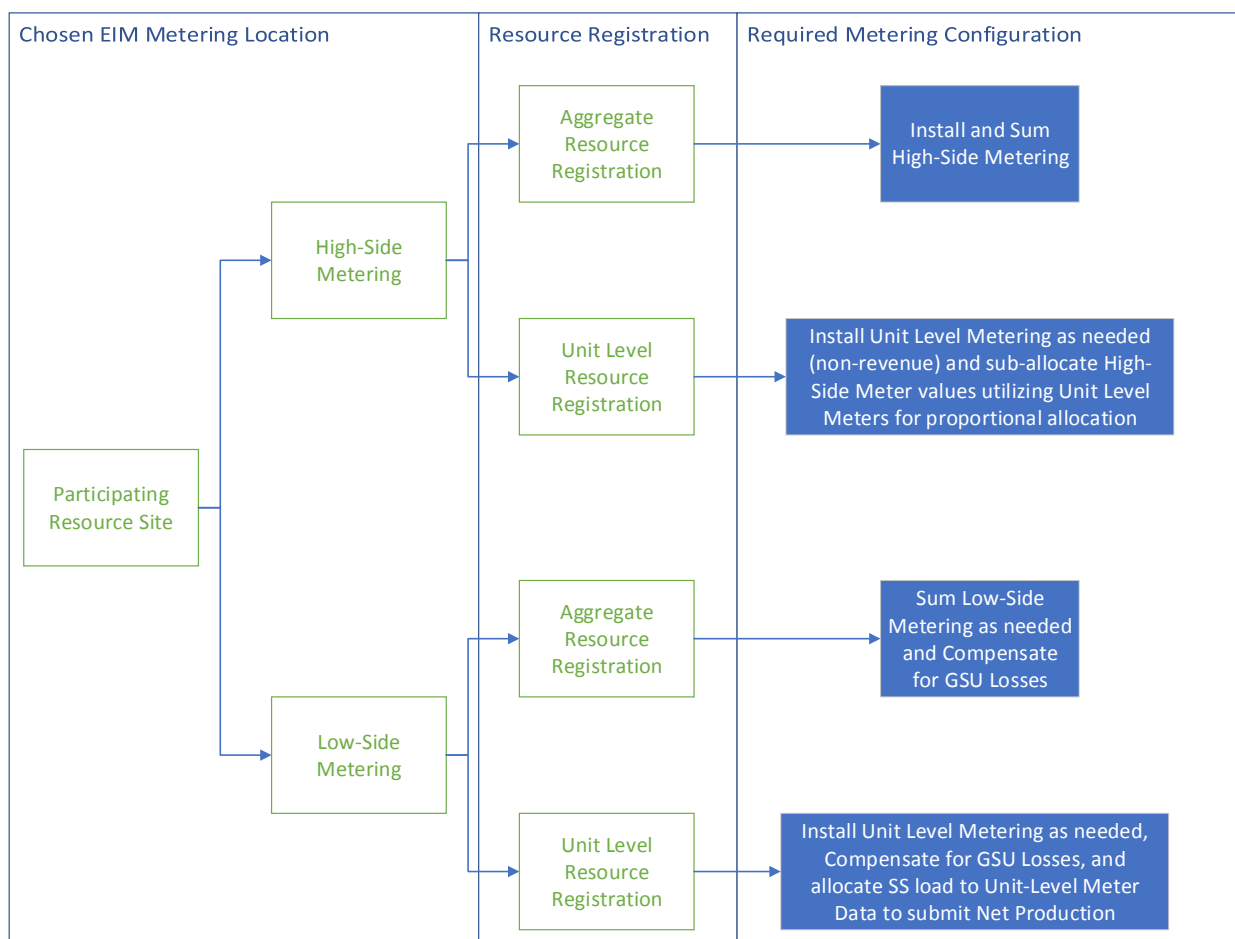
G1 "meter" allocation =  $GSU\_A * G1 / (G1 + G2) = 9.5 * 4 / (4 + 6) = 3.8$  MWh

G2 "meter" allocation =  $GSU\_A * G2 / (G1 + G2) = 9.5 * 6 / (4 + 6) = 5.7$  MWh



**Figure 3: Noxon Individual Unit Registration with High Side Metering**

Figure 4 depicts the decision tree for the metering configuration of a resource site, considering high-side versus low-side metering and aggregate versus unit level resource registration using Noxon as an example. Refer to the Noxon metering examples above for more detail on the metering configurations for various resource registrations. Refer to section 2.2.1 for detail on compensation factors accounting GSU losses for low-side metering installations.



**Figure 4: Metering Configuration Decision Tree**

Similar to the requirement to submit generation meter data by Resource ID, Avista interchange metering must be aggregated to a scheduling tie. These scheduling ties will be registered with CAISO as a System Resource ID, typically corresponding to Avista’s OASIS posted paths<sup>6</sup>. Careful review of these scheduling tie aggregations should be performed to ensure the net of submitted interchange metering for EIM includes all Avista points of interchange and equals Net Actual Interchange energy accounting records.

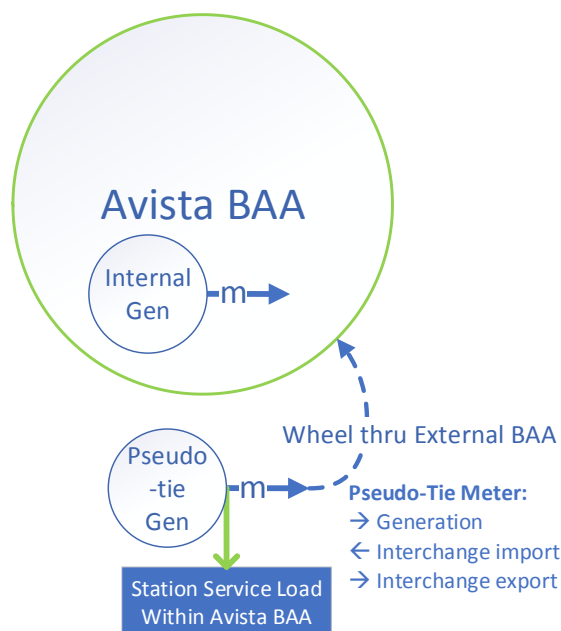
**2.1.10 Pseudo-Tie Meters and Load Meter Calculation**

Pseudo-tie generators modeled in the FNM will be registered as type Gen, whereas any generators not modeled, typically those electrically distant from the CAISO FNM footprint, will be registered as type Tie Gen (TG). Currently, EIM participant shares of Colstrip are registered as TGs since the CAISO FNM does not extend into Eastern Montana. However, with the expected EIM participation of NorthWestern

<sup>6</sup> Avista’s OASIS posted paths, Effective January 1, 2018 are depicted in [https://www.oasis.oati.com/woa/docs/AVAT/AVATdocs/AVA\\_OASIS\\_POR\\_POD\\_Effective\\_01-01-18.pdf](https://www.oasis.oati.com/woa/docs/AVAT/AVATdocs/AVA_OASIS_POR_POD_Effective_01-01-18.pdf)

Energy, the Montana footprint will be added to the FNM and Colstrip likely re-registered as type Gen. Thus, it is likely that all Avista BAA generators will be registered as type Gen.

Any pseudo-tie generators registered as type Gen, as opposed to type TG, require a corresponding scheduling tie registration to submit a counterflow to the physical interchange meter. Pseudo-tie generation meters will be submitted twice, once for the generator resource ID and again as a counterflow for the scheduling tie ID. As depicted in Figure 5, internal generation and pseudo-tie generation will be metered and the generation production values submitted to CAISO. Additionally, pseudo-tie meters function as interchange meters, measuring the generation production as a BAA export, as the generation physically wheels through external BAAs before returning to the Avista BAA as a metered import at the contiguous boundary.



**Figure 5: Pseudo-Tie Meter**

For example, given CAISO's definition of BAA load as generation minus exports plus imports, a pseudo-tie generator value of 5 MW is accounted in load as 5 MW generation plus 5 MW metered import at the contiguous boundary minus 5 MW pseudo-tie meter export (counterflow), equaling 5 MW once this netting in the load calculation occurs. CAISO recalculates BAA load independent of the EIM Entity load meter submission, and thus requires the submission of pseudo-tie meters as both generation and interchange to net correctly.

Finally, Avista BAA load must be calculated as the net of all generation and interchange metering, equal to generation plus imports minus exports. CAISO defines this BAA load meter as the ELAP and requires its submission in two forms, once as the net of generation and interchange without any loss factor applied and again as the net of generation and interchange divided by the number one plus a transmission system loss factor, likely defined as the 3% loss factor stated in Avista's OATT<sup>7</sup>. Existing EIM participants have also utilized their respective OATT-stated loss factor for this calculation.

#### 2.1.11 Meter Channels

CAISO does not require the submission of Volt Ampere Reactive (VARs) for EIM participation, only active power, measured as kilowatt hours (kWh) or megawatt hours (MWh). Meters record these values on separate registers, termed channels, to distinguish between produced and consumed energy. These values may be recorded on any meter channel, but must be submitted on the following meter channels:

- Channel 1 for consumed or exported active power

<sup>7</sup> Avista Open Access Transmission Tariff (OATT), Effective August 1, 2018, sections 15.7 and 28.5 [https://www.oasis.oati.com/woa/docs/AVAT/AVATdocs/OATT\\_Effective\\_8-1-2018.pdf](https://www.oasis.oati.com/woa/docs/AVAT/AVATdocs/OATT_Effective_8-1-2018.pdf)

- Channel 4 for generated or imported active power

Therefore, Avista's MDM solution will need to transpose the received channels to match CAISO's required designations if they differ.

CAISO does not accept non-zero meter values on channel 4 for the load meter submission, therefore all channel 4 values for the ELAP meter should always be submitted as zero values.

CAISO does not accept non-zero meter values on channel 1 for generation meters, even if station service consumption exceeds generation production for a given interval. Therefore, channel 1 for all generation meters should always be submitted as zero values.

For intervals where station service exceeds generation, the station service load of internal generation is already metered by interchange imports and other internal generation, and thus does not need to be submitted from the generation meter read. By contrast, the station service for pseudo-tie generation should be submitted on channel 1 for the corresponding interchange metering, to include the station service as Avista BAA load. As depicted in Figure 5, station service for a pseudo-tie generator is measured as an import by the interchange meter at the generation site, while an internal generator only has the generation meter on therefore does not need to submit load values for its station service when it exceeds generation.

## 2.2 Key Metering Considerations

### 2.2.1 *Expected Point of Measurement and Compensation Factors*

CAISO expects Base Schedules, Dispatch Operating Targets (DOTs) and meter data to all correspond to the high side, transmission voltage level of a Resource ID. Furthermore, any station service load fed from a similar electrical location, such as a generator bus or high side of the same substation, may be netted from the data (as if the metering point was physically on the high side of the GSU). To the extent the point of scheduling, dispatch, generator control and metering differ from this expected point of measurement, calculations should be performed to account for these differences to prevent dispatch and settlement error.

For example, if the CTs and PTs for a generator meter are measuring output at the low voltage side of the GSU, the meter values should be adjusted to compensate for the calculated losses through the GSU, which are typically determined from GSU manufacturer data or GSU test data. Transformer losses are typically calculated as the sum of no-load losses and load-losses, expressed as:

$$NLL + I^2R$$

$$\text{No-Load Losses} + \text{Current-squared} * \text{Resistance}$$

No-load losses are set at a constant value of watts and load-losses as a function of resistance, a constant ohm value, multiplied by current squared. This resulting equation would be programmed in the associated meter as the compensation factor.



Several Avista generation sites meter Station Service (SS) load at the low-side of the SS transformer, with the high-side of the SS transformer connected to a generator bus. If these existing meter installations are utilized for SQMD submission, compensation factors should be applied to the metered values accounting for both the SS transformer and GSU losses. An accurate calculation would program the SS meter to add the SS transformer losses compensation, increasing the effective SS load, and subtract the SS load from GSU load-losses for the associated generator meters, since SS load nets generator production flowing through the GSU, reducing GSU load-losses. This calculation of compensation factors with interaction between multiple meters may be practicably difficult, instead requiring approximations to account for the contribution of multiple generators and SS load to GSU load-losses. The following equations are example calculations to accurately compensate for SS transformer and GSU losses utilizing a low-side SS meter and two low-side generator meters, similar to the Noxon unit 1 & 2 and SS depiction in Figure 3.

For unit-level Resource IDs, allocating transformer losses and SS load half-and-half to each resource<sup>8</sup>:

$$\text{SS\_meter\_data (SS transformer compensated)} = \text{SS\_load} + \text{NLL}_{\text{SS\_transformer}} + I_{\text{SS}}^2 R$$

$$\text{GSU current (I}_{\text{GSU}}) = \text{G1\_current} + \text{G2\_current} - \text{SS\_transformer\_compensated\_SS\_current}$$

$$\text{GSU\_losses} = \text{NLL}_{\text{GSU}} + I_{\text{GSU}}^2 R$$

$$\text{G1 compensated meter data} = \text{G1\_meter} - \text{GSU\_losses}/2 - \text{SS\_meter\_data}/2$$

$$\text{G2 compensated meter data} = \text{G2\_meter} - \text{GSU\_losses}/2 - \text{SS\_meter\_data}/2$$

For an aggregate Resource ID:

$$\text{SS\_meter\_data (SS transformer compensated)} = \text{SS\_meter} + \text{NLL}_{\text{SS\_transformer}} + I_{\text{SS}}^2 R$$

$$\text{GSU current (I}_{\text{GSU}}) = \text{G1\_current} + \text{G2\_current} - \text{SS\_transformer\_compensated\_SS\_current}$$

$$\text{GSU\_losses} = \text{NLL}_{\text{GSU}} + I_{\text{GSU}}^2 R$$

$$\text{Aggregate Resource ID meter data} = \text{G1\_meter} + \text{G2\_meter} - \text{GSU\_losses} - \text{SS\_meter\_data}$$

Alternatively, CTs and PTs could be installed at the high voltage side of the GSU to avoid the need for loss compensation factors. Furthermore, if station service load for the generator is fed from a separate station service transformer located at the same substation, and therefore electrically similar to the resource, the station service should be metered and netted from the generator meter value, as described in section 2.1.9. By contrast, if the metering location reads generation net of station service, such as high side metering, then station service does not need to be metered separately.

Any compensation factors applied to EIM meter data should be documented, including the calculating device or software, source document for compensation factor, and rationale for applying the

<sup>8</sup> The allocation logic for GSU losses and SS load to unit-level Resource IDs should be more sophisticated than half-and-half to address operation with one generation online and the other offline, as a half-and-half allocation would result in half of the GSU losses and SS being unaccounted for due to allocation to an offline generator

compensation. This documentation will be included in the SQMD Plan and self-audited EIM meter program. The CAISO Metering BPM Attachment B Section C describes the loss compensation methodologies.

### *2.2.2 Metering Granularity Impact*

CAISO allows for NPR metering to be recorded at a 5, 15, or 60-minute granularity. However, the ELAP meter must be submitted at the least granular level of the underlying meters that sum to the load value. The majority of CAISO charge codes settle at a 5-minute granularity, so any load or NPR meters submitted at 15-minute or 60-minute granularity is distributed evenly to the corresponding 5-minute intervals for settlements, resulting in accumulation of extra revenues or deficits in CAISO neutrality accounts due to price differences between 5-minute intervals that do not tie out to corresponding changes in submitted meter values. These neutrality accounts are largely settled with the EIM Entity and therefore do not result in a material financial risk. However, load meter submission that is less granular than 5-minutes greatly complicates shadow settlement and issue spotting, as the lack of data granularity masks underlying causes of settlement or metering errors that are crucial to resolve in a timely fashion. Finally, Avista has determined it is relatively inexpensive to re-program or change out a meter to enable 5-minute granularity meter data. Therefore, Utilicast recommends Avista proceed with its plan to submit 5-minute granular meter data for all NPRs so it may submit 5-minute granular ELAP meter data.

### *2.2.3 Insufficient Accuracy and Correction Factors*

If any meters, CTs, or PTs used for EIM metering lack a sufficient accuracy rating to meet CAISO metering requirements, the equipment will either need to be replaced with compliant equipment or a correction factor applied. A correction factor for insufficiently accurate metering equipment is effectively a penalty on metered production to account for the gap in accuracy between the installed equipment and CAISO requirements.

The CAISO Metering BPM Attachment B Sections D3-D6 describe the calculation of correction factors to adjust for deficiencies in CT and PT accuracy. Whatever the deficiency in accuracy, an accuracy rating must be determined in order to apply the appropriate correction factor and utilize the deficient equipment for EIM metering. If the accuracy or burden rating of equipment is unknown, correction factor field tests should be performed to establish the accuracy at the connected burden. Any total meter equipment error equal to or less than 0.6%, as calculated according the referenced CAISO sections, does not require a correction factor to be applied, while any calculated error greater than 0.6% must be applied as a correction factor to the recorded meter data, reducing the submitted quantities by the correction factor percentage.

The financial impact of correction factors being applied to PRs may be substantial, as this production could be exported on EIM transfers, resulting in a reduction in market revenues due to the required penalty in submitted production compared to the scheduled exported EIM energy received by other EIM participants.

By contrast, the financial impact of correction factors applied to NPRs is small, as any MWh deficit in submitted NPR production would result in a corresponding decrease in the Avista ELAP meter.

Therefore, any lost revenues on the NPR settlement would be largely regained in the load-related settlements. To the extent the NPR Locational Marginal Prices (LMPs) are lower than the ELAP LMPs due to congestion, there is some risk that a portion of the transmission congestion revenue rebates in settlement would be allocated to an EIM participant other than Avista due to EIM transfers. Collectively, these risks appear small.

#### *2.2.4 Insufficient Granularity of non-Avista owned Interchange Meters*

While interchange metering is required to be recorded with 5-minute granularity, CAISO has consistently allowed EIM participants to exempt interchange meters owned by other parties from this requirement. Non-EIM participants typically record interchange metering at 60-minute granularity to align with NERC standard requirements for hourly interchange meter check-out.

In lieu of meeting this EIM requirement, the alternate approach taken by most EIM participants to submit 5-minute granular interchange metering is to calculate average 5-minute meter values in PI from the instantaneous MW telemetry reads, compare the sum of the 5-minute averages to the settlement quality hourly check-out values, and adjust the 5-minute averages as necessary to align with hourly values in the MDM. For most recent EIM implementations, this exemption has only been allowed for interchange meters not owned by the EIM entrant, so Avista-owned interchange meters would need to comply with the standard 5-minute granularity requirements.

#### *2.2.5 Metering of Jointly-Owned Generation*

Avista is a joint-owner of Colstrip generation and joint offtaker of Mid-C generation. Existing EIM participants, namely PacifiCorp, Puget Sound Energy, and Portland General Electric, are also joint participants in these generation projects and have successfully exempted the associated generator meters from CAISO's metering requirements. In each case, the metering is not owned by any current EIM participant and the metered offtake of individual participants is not determined directly by physical meters. Rather, Colstrip and Mid-C metered offtakes are determined by logical meters calculated by allocation computers. These allocation computers dynamically apportion the metered generation based on each participant's approved dispatch such that the physical meters are not indicative of the individual participant's generation.

The typical meter calculation for Colstrip and Mid-C projects has been similar to the suggested approach for non-Avista owned interchange meters described in section 2.2.4. CAISO has requested single line metering diagrams for these facilities and a description of the determination and validation of the participant's metered share for existing EIM participants. Based on Avista's research, it appears that the standard for Mid-C SLD submission established by PGE is not high and Avista should be able to satisfy the Mid-C SQMD relatively easily.

Given NorthWestern Energy's planned EIM participation, slated for April 2021, and their ownership of the Colstrip generation meters, it is possible that the metering configuration and allowed exemption for Colstrip may change prior to Avista's EIM implementation. Avista should discuss these impacts to Colstrip metering with NorthWestern Energy as their implementation progresses.

### 3 Metering Approach

This section summarizes the current metering configuration for each generator and point of interchange, identifies gaps in compliance with CAISO requirements and proposes methods to address the identified gaps. The following four sub-sections group together Avista-owned and 3rd Party-owned generation and interchange, as these grouped facilities tend to share common statuses and proposed solutions.

#### 3.1 Generation, Avista-Owned

While most of the Avista-owned generation meter equipment was inventoried during this project, much of the equipment nameplate data was insufficient. The equipment with insufficient information or yet to be inventoried is marked unknown in the following table, with suggested next steps indicated in the “Determine Unknown” column. Table 6 in section 4 summarizes proposed generator metering projects. Post Falls generation has no proposed metering projects, due to its planned NPR status it should have its meters replaced or upgraded to be 5-minute capable, with compensation factors and correction factors applied as necessary.

The listed meters are a subset of the inventoried meters, selected to record net generation for EIM purposes. For example, Post Falls units 1-5 each have gross unit-level metering, which are also metered net of station service. Only the Post Falls 1-5 net metering is listed, as it could record net generation for EIM purposes without the use of the unit-level 1-5 gross meters. Station Service (SS) metering voltage is noted in parenthesis to indicate whether the metering is on the generator bus or SS bus. If the SS metering is on the SS bus, then the metered values should be compensated for losses across both the SS transformer and GSU. See section 2.2.1 for more detail on SS transformer and GSU loss compensation.

Equipment attributes marked “Y” under EIM Compliance Status indicates the attribute meets or exceeds CAISO metering requirements, while “Unk” indicates the attribute is unknown due to either insufficient nameplate information or yet to be inventoried.

**Table 2: Generation Metering Status, Avista-Owned**

Generator Meter	EIM Compliance Status					Proposed Next Steps	
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden
<b>Post Falls 1-5 Net Meter</b>	Unk	Unk	Unk	Unk	5-min capable with memory upgrade	Test CTs and PTs	
<b>Post Falls Unit 6</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Noxon Unit 1</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Noxon Unit 2</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Noxon Unit 3</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Noxon Unit 4</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Noxon Unit 5</b>	Unk	Unk	Y	N, Y < ZZ	5-min capable with memory upgrade	Test CTs	PTs
<b>Noxon SS A (480 V)</b>	Y	Y	N, 0.6 < 0.3 class	N, W < ZZ	5-min capable		PTs
<b>Noxon SS B (480 V)</b>	Y	Y	N, 0.6 < 0.3 class	N, W < ZZ	5-min capable		PTs
<b>Cabinet Unit 1</b>	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
<b>Cabinet Unit 2</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Test CTs and PTs	
<b>Cabinet Unit 3</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Test CTs and PTs	
<b>Cabinet Unit 4</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Test CTs and PTs	
<b>Cabinet SS A (480 V)</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Test CTs and PTs (if CT & PT nameplate incomplete)	
<b>Cabinet SS B (480 V)</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Test CTs and PTs (if CT & PT nameplate incomplete)	
<b>Nine Mile Unit 1</b>	Y	N, 0.5 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs

Generator Meter	EIM Compliance Status					Proposed Next Steps	
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden
<b>Nine Mile Unit 2</b>	Y	N, 0.5 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs
<b>Nine Mile Unit 3</b>	Y	N, 0.5 < 1.8	Y	N, Y < ZZ	Not 5-min capable		CTs & PTs
<b>Nine Mile Unit 4</b>	Y	N, 0.5 < 1.8	Y	N, Y < ZZ	Not 5-min capable		CTs & PTs
<b>Nine Mile SS 1 (480 V)</b>	Unk	Unk	Unk	Unk	5-min capable	Include changeout in SS 2 project if possible, test if not	
<b>Nine Mile SS 2 Future</b>	N/A, future installation, suggest the scope include revenue quality equipment as alternative to high-side metering project						
<b>Upper Falls Unit</b>	Y	Y	Y	N, Y < ZZ	5-min capable with memory upgrade		PTs
<b>Upper Falls SS (240 V)</b>	Unk	Unk	N/A	N/A	5-min capable with memory upgrade	Suggest only utilizing gross meter, as SS metering equipment is unknown and SS load is negligible	
<b>Long Lake Unit 1</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Long Lake Unit 2</b>	Y	Y	Y	N, Y < ZZ	Not 5-min capable		PTs
<b>Long Lake Unit 3</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Long Lake Unit 4</b>	Y	Y	Unk	Unk	Not 5-min capable	Test PTs	
<b>Long Lake SS A (4 kV)</b>	Unk	Unk	Unk	Unk	Not 5-min capable	Include changeout in SS project if possible, test if not	
<b>Long Lake SS B (4 kV)</b>	Unk	Unk	Y	N, Y < ZZ	Not 5-min capable		PTs
<b>Little Falls Unit 1</b>	Y	Y	Y	N, Y < ZZ	5-min capable		PTs
<b>Little Falls Unit 2</b>	Y	Y	Y	N, Y < ZZ	5-min capable		PTs
<b>Little Falls Unit 3</b>	Y	Y	Y	N, Y < ZZ	5-min capable		PTs

Generator Meter	EIM Compliance Status					Proposed Next Steps	
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden
Little Falls Unit 4	Y	Y	Y	N, Y < ZZ	5-min capable following planned project		PTs
Little Falls SS 1 (480 V)	N	N, 0.9 < 1.8	N	N, W < ZZ	5-min capable		CTs & PTs
Little Falls SS 2 (480 V)	N	N, 0.9 < 1.8	N	N, W < ZZ	5-min capable		CTs & PTs
Monroe Street Unit	Y	N, 0.1 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs
Monroe Street SS (14.4 kV)	Unk	Unk	Y	N, Z < ZZ	5-min capable		PTs
Kettle Falls Biomass	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls CT	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1A1 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1A2 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1A3 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1B2 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1B3 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
Kettle Falls SS 1B4 (13.8 kV)	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	

Generator Meter	EIM Compliance Status					Proposed Next Steps	
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden
<b>Boulder Park Net Meter</b>	Unk	Unk	Y	N, Y < ZZ	5-min capable with memory upgrade	Test CTs (if GSU nameplate incomplete)	PTs
<b>Northeast Gross Meter</b>	Y	Y	Y	N, Y < ZZ	5-min capable with memory upgrade		PTs
<b>Northeast SS (480 V)</b>	Unk	Unk	Unk	Unk	5-min capable with memory upgrade	Test CTs and PTs	
<b>Rathdrum Unit 1</b>	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
<b>Rathdrum Unit 2</b>	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
<b>Rathdrum SS 1 (13.8 kV)</b>	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	
<b>Rathdrum SS 2 (13.8 kV)</b>	Unk	Unk	Unk	Unk	5-min capable	Test CTs and PTs	

Unk = Unknown; SS = Station Service

### 3.2 Generation, 3rd Party-Owned

While most of the 3rd Party-owned generation meter equipment was inventoried during this project, much of the equipment nameplate data was insufficient. The equipment with insufficient information or yet to be inventoried is marked unknown in the following table, with suggested next steps indicated in the following table. Table 6 in section 4 summarizes proposed generator metering projects. Planned NPRs have no proposed metering projects, and should have their meters replaced or upgraded to be 5-minute capable, with compensation factors and correction factors applied as necessary.



**Table 3: Generation Metering Status, 3<sup>rd</sup> Party-Owned**

Generator Meter	EIM Compliance Status					Proposed Next Steps and Solutions				
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory	Compensate to hi-side
<b>Coyote Springs High-Side</b>	Y	Y	Y	Y	Not 5-min capable				X	
<b>Lancaster Net Meter</b>	Y	Unk	Y	Unk	5-min capable	CTs & PTs nameplate burden	CTs & PTs	X		
<b>Palouse Wind</b>	Y	Y	Y	Y	5-min capable with memory upgrade				X	
<b>Solar Select</b>	Y	N, 0.5 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs	X		X
<b>Spokane Waste to Energy Net Meter</b>	Y	Y	Y	Y	5-min capable with memory upgrade				X	
<b>Plummer Saw Mill</b>	Y	Y	Y	N, Z < ZZ	5-min capable with memory upgrade		PTs		X	X
<b>Upriver Net Meter</b>	Y	Y	Y	N, Z < ZZ	5-min capable with memory upgrade		PTs		X	X
<b>Clearwater Net Meter 1</b>	Y	Y	Y	Y	Not 5-min capable				X	X

Generator Meter	EIM Compliance Status					Proposed Next Steps and Solutions				
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory	Compensate to hi-side
<b>Clearwater Net Meter 2</b>	Y	Y	Y	Y	Not 5-min capable				X	X
<b>Clearwater Gross Meter 1</b>	Relay class < Metering class	Unk	Relay class < Metering class	Unk	Not 5-min capable	Test CTs and PTs			X	X
<b>Clearwater Gross Meter 2</b>	Relay class < Metering class	Unk	Relay class < Metering class	Unk	Not 5-min capable	Test CTs and PTs			X	X
<b>Fighting Creek</b>	Y	Y	Y	Unk	5-min capable with memory upgrade	PTs nameplate burden	PTs		X	X
<b>Colstrip</b>	N/A, 5-minute average of instantaneous MW telemetry sufficient, see section 2.2.5 for details									
<b>Mid-C CHPD</b>	N/A, 5-minute average of instantaneous MW telemetry sufficient, see section 2.2.5 for details									
<b>Mid-C DOPD</b>	N/A, 5-minute average of instantaneous MW telemetry sufficient, see section 2.2.5 for details									
<b>Mid-C GCPD</b>	N/A, 5-minute average of instantaneous MW telemetry sufficient, see section 2.2.5 for details									
<b>Saddle Mountain Wind Future</b>	N/A, future installation will be EIM compliant based on Avista standards									

Generator Meter	EIM Compliance Status					Proposed Next Steps and Solutions				
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory	Compensate to hi-side
<b>Rattlesnake Wind Future</b>	N/A, future installation will be EIM compliant based on Avista standards									
<b>Box Canyon</b>	Out of scope, POPD expected to exit Avista BAA prior to EIM entrance, see section 3.4 for details									

Unk = Unknown

### 3.3 Interchange, Avista-Owned

Some points of interchange have two meters, a primary and backup. However, the attributes of both metering sets are identical across Avista-owned interchange meter equipment, so each set is listed as one row for conciseness in the table below.

**Table 4: Interchange Metering Status, Avista-Owned**

Point of Interchange	EIM Compliance Status					Proposed Next Steps and Solutions			
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory
<b>BPAT @ Colbert</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	
<b>BPAT @ DeerPark 12F1</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	
<b>BPAT @ DeerPark 12F2</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	

Point of Interchange	EIM Compliance Status					Proposed Next Steps and Solutions			
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory
<b>BPAT @ Kettle Falls A621</b>	Y	Unk	Y	Y	5-min capable		CTs	X	
<b>BPAT @ Loon Lake</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	
<b>BPAT @ Mead</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	
<b>BPAT @ North Lewiston</b>	Y	Unk	Y	Unk	5-min capable		CTs & PTs	X	
<b>BPAT @ Noxon 13kV Construction Sub</b>	Y	N, 0.5 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs	X	
<b>BPAT @ Noxon R316 (Libby Line)</b>	Y	Unk	Y	Y	5-min capable		CTs	X	
<b>BPAT @ Noxon R336 Lancaster Line)</b>	Y	Unk	Y	Y	5-min capable		CTs	X	
<b>BPAT @ Noxon R337 (Hot Springs Line)</b>	Y	Unk	Y	Y	5-min capable		CTs	X	
<b>BPAT @ Orofino</b>	Y	Y, pending verification	Y	Unk	5-min capable	Verify CT Accuracy	PTs	X	
<b>BPAT @ Priest River</b>	Y	N, 0.5 < 1.8	Y	N, Y < ZZ	5-min capable		CTs & PTs	X	

Point of Interchange	EIM Compliance Status					Proposed Next Steps and Solutions			
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory
<b>BPAT @ Sagle</b>	Y	N, 0.9 < 1.8	Y	N, Y < ZZ	5-min capable		CTs & PTs	X	
<b>BPAT @ Spirit</b>	Y	Y	Y	N, Z < ZZ	5-min capable		PTs	X	
<b>BPAT @ Westside (R380)</b>	Y	Unk	Y	Unk	5-min capable	N/A, future installation will replace existing equipment and be EIM compliant based on Avista standards			
<b>BPAT @ Westside (R382)</b>	Y	Unk	Y	Unk	5-min capable	N/A, future installation will replace existing equipment and be EIM compliant based on Avista standards			
<b>BPAT @ Wilbur</b>	Y	Unk	Y	Unk	5-min capable		CTs & PTs	X	
<b>BPAT @ Milan</b>	Y	N, 0.5 < 1.8	Y	N, Z < ZZ	5-min capable		CTs & PTs	X	
<b>GCPD @ Stratford</b>	Y	N, 1.0 < 1.8	Y	Y	Insufficient memory		CTs	X	X
<b>GCPD @ Warden A254</b>	Y	Unk	Y	Unk	Insufficient memory		CTs & PTs	X	X
<b>GCPD @ Warden A310</b>	Y	Unk	Y	Unk	Insufficient memory		CTs & PTs	X	X
<b>IPCO @ Lolo</b>	Y	Unk	Y	Unk	Insufficient memory		CTs & PTs	X	X
<b>NWMT @ Burke</b>	Y	Unk	Y	N, Z < ZZ	Insufficient memory		CTs & PTs	X	X
<b>PACW @ Dry Creek</b>	Y	Unk	Y	Y	Insufficient memory		CTs	X	X
<b>PACW @ Dry Gulch</b>	Y	Unk	Y	Y	Insufficient memory	N/A, future installation will replace existing equipment and be EIM compliant based on Avista standards			

Point of Interchange	EIM Compliance Status					Proposed Next Steps and Solutions			
	CT Accuracy	CT Burden	PT Accuracy	PT Burden	Meter	Determine Unknown	Determine Connected Burden	Re-program Meter	Replace Meter or Upgrade Memory
<b>BPAT @ Opportunity (Valley tap) Future</b>	N/A, future installation will be EIM compliant based on Avista standards								
<b>GCPD @ Wanapum - Saddle Mt backup Future</b>	N/A, future installation will be EIM compliant based on Avista standards								
<b>PACW @ Saddle Mountain Sub Future</b>	N/A, future installation will be EIM compliant based on Avista standards								

Unk = Unknown

### 3.4 Interchange, 3rd Party-Owned

The proposed solution for all 3rd Party-owned interchange metering is to utilize 5-minute averaged instantaneous telemetry MW reads, validated with hourly check-out meter values, as described in section 2.2.4. Once validated, the equipment ratings of 3rd Party-owned interchange metering are acceptable for EIM participation, since the equipment owner utilizes it for revenue purposes. BPA typically nets the interchange metering at each substation to a combined SCADA value, so these combined points of interchange are listed as a single row.

The Seattle City Light (SCL) points of interchange at Main Canal and Summer Falls should be discussed in further detail with SCL to determine a consistent modeling of these points of interchange. In light of SCL's planned EIM participation and the current setup with SCL dividing the interchange in half between its BAA and the Tacoma Power BAA, while Avista only interchanges with SCL, Avista and SCL should coordinate to ensure consistent EIM modeling and metering of interchange at these points to mitigate any adverse EIM operational or settlement impacts.

Pend Oreille Public Utility District (POPD) is currently in the Avista BAA, with several meters measuring the interchange between Avista and BPA in the POPD service territory. However, POPD has communicated its intent to exit the Avista BAA in October 2020, prior to Avista's EIM entrance.

With the planned exit of POPD from the Avista, a new point of interchange would be metered at Pine Street substation. Therefore, Avista is not including these current interchange meters in its EIM metering scope, noted in the table below, and will include the future Pine Street interchange metering in its EIM metering scope. Avista should track the POPD planned BAA exit and adjust the list of interchange and generation meters in scope for EIM participation if the POPD BAA exit changes in schedule or scope.

**Table 5 : Interchange Metering Status, 3<sup>rd</sup> Party-Owned**

Point of Interchange	EIM Compliance Status	Proposed Next Steps and Solutions	
	Equipment Validated	Determine Unknowns	Calculate 5-minute MW Averages
BPAT @ Addy	Y		X
BPAT @ Bell	Y		X
BPAT @ Benton	Y		X
BPAT @ Hatwai	Y		X
BPAT @ Hot Springs	Y		X
BPAT @ Kaiser-Trentwood Load	Y		X
BPAT @ Lancaster – Boulder	Y		X
BPAT @ Lancaster – Rathdrum	Y		X
BPAT @ Sandcreek	Y		X
BPAT @ Usk	Y		X
CHPD @ Chelan	Y		X
NWMT @ Hot Springs	Y		X
SCL @ Main Canal	N	X	X
SCL @ Summer Falls	N	X	X

Point of Interchange	EIM Compliance Status	Proposed Next Steps and Solutions	
	Equipment Validated	Determine Unknowns	Calculate 5-minute MW Averages
<b>BPAT @ Coyote Springs Pseudo-Tie</b>	See section 3.2 regarding Coyote Springs, utilize generation metering for EIM interchange metering		
<b>BPAT @ Lancaster Gen</b>	See section 3.2 regarding Lancaster, utilize generation metering for EIM interchange metering		
<b>CHPD @ Mid-C Pseudo-Tie</b>	See section 3.2 regarding CHPD Mid-C, utilize generation metering for EIM interchange metering		
<b>DOPD @ Mid-C Pseudo-Tie</b>	See section 3.2 regarding DOPD Mid-C, utilize generation metering for EIM interchange metering		
<b>GCPD @ Mid-C Pseudo-Tie</b>	See section 3.2 regarding GCPD Mid-C, utilize generation metering for EIM interchange metering		
<b>NWMT @ Colstrip Pseudo-Tie</b>	See section 3.2 regarding Colstrip, utilize generation metering for EIM interchange metering		
<b>GCPD @ Wanapum Future</b>	N/A, future installation that will be owned by GCPD		
<b>BPAT @ Pine Street Future</b>	N/A, future installation for POPD BAA exit that will be owned by BPA		
<b>BPAT @ Box Canyon</b>	Out of scope, POPD expected to exit Avista BAA prior to EIM entrance		
<b>BPAT @ Diamond Lake</b>	Out of scope, POPD expected to exit Avista BAA prior to EIM entrance		
<b>BPAT @ Metaline Falls</b>	Out of scope, POPD expected to exit Avista BAA prior to EIM entrance		
<b>BPAT @ Newport</b>	Out of scope, POPD expected to exit Avista BAA prior to EIM entrance		



## 4 Estimated Costs

This section provides high-level descriptions and cost estimates for the proposed metering projects, generation controls projects, meter-related network projects, and meter head-end solution.

### 4.1 Avista Participating Resources

The following table summarizes the proposed generation controls and metering projects. Merged rows in the high side metering column indicate a shared GSU between multiple generator units with a common proposed high-side metering set. The projects are listed in priority order, with the latter projects subject to further discussion or testing of existing metering equipment prior to proceeding with a project.

*Table 6: Generation Controls and Metering Project Cost Estimates*

Generation	PLC (in \$,000)	Low Side Metering (in \$,000)	High Side Metering (in \$,000)	Total Metering by Site (in \$,000)
<b>Noxon</b>	\$200			
- Noxon Unit 1		\$30	\$200	\$750
- Noxon Unit 2		\$30		
- Noxon Unit 3		\$30	\$200	
- Noxon Unit 4		\$30		
- Noxon Unit 5		\$30	\$200	
<b>Cabinet</b>	\$200			
- Cabinet Unit 1			\$200	\$520
- Cabinet Unit 2				
- Cabinet Unit 3		\$60	\$200	
- Cabinet Unit 4		\$60		
<b>Coyote Springs</b>			\$200	\$200
<b>Long Lake</b>	\$200			
- Long Lake Unit 1		\$35	Utilize existing SS project to install high- side metering	\$140
- Long Lake Unit 2		\$35		
- Long Lake Unit 3		\$35		
- Long Lake Unit 4		\$35		
<b>Little Falls</b>	\$200			\$0
<b>Rathdrum</b>	\$200			
- Rathdrum Unit 1			\$200	\$400
- Rathdrum Unit 2			\$200	

Generation	PLC (in \$,000)	Low Side Metering (in \$,000)	High Side Metering (in \$,000)	Total Metering by Site (in \$,000)
Lancaster	\$150		\$100	\$100
Kettle Falls			\$200	\$200
Boulder Park		\$160	\$200	\$360
<b>Nine Mile</b>				
- Nine Mile Unit 1			\$200	\$520
- Nine Mile Unit 2				
- Nine Mile Unit 3		\$60	\$200	
- Nine Mile Unit 4		\$60		
Monroe Street		\$100	\$200	\$300
Upper Falls		\$100	\$200	\$300
<b>Total</b>	\$1,150			\$3,790
<b>Low Estimate, rounded (+0% PLC, -20% Metering)</b>	\$1,200			\$3,000
<b>High Estimate, rounded (+20% PLC &amp; Metering)</b>	\$1,400			\$4,500

PLC = Programmable Logic Controller

## 4.2 Other Metering & Network Costs

In addition to the costs summarized in Section 4.1, this report mentions costs and effort associated with some additional items which were included in the overall project cost estimates and described in greater detail in the Technology Assessment Summary Report.

- Transmission Meters – Costs for transmission meter swaps are included in Line 15.
- Meter Data Collection and Processing – License costs for MV90 work and hardware to collect meter data reads, costs and effort for Oracle MDM setup, and costs for non-fiber meter data acquisition are included in Line 15.
- Network Improvements – Cost and effort to create T1 connections, including High Voltage Protection (HVP), are included in Line 16.

**Table 7: Summary Budgetary Cost Estimate for EIM Technology Projects**

Line	Cost Estimate Category	Project & Procurement Solutions & Services (in \$,000)	Project & Procurement Avista Internal Labor (in Hours)
15	Transmission Meters & Data Collection	\$340	5,200
16	Network Improvements for Metering	\$210 - \$2,000	2,600

Note that costs are not estimated for the proposed meter memory upgrades at the following generation sites due to a lack of available cost estimates and preliminary scopes of work at the time of this assessment:

- Palouse Wind (2 meters)
- Spokane Waste to Energy Net Meter
- Plummer Saw Mill
- Upriver Net Meter
- Clearwater Net Meter 1
- Clearwater Net Meter 2
- Clearwater Gross Meter 1
- Clearwater Gross Meter 2
- Fighting Creek

See section 2.1.7 for detail on meter memory requirements and recommended next steps.