



WEM PaSS 1.7, WEMS 3.40 and RCM 1.21: Settlement Enhancements Release Notes

July 2021

Important notice

PURPOSE

The Australian Energy Market Operator (AEMO) has prepared this document to provide information about the WEM PaSS 1.7 (Build 1.7-TBC), WEMS 3.40 (Build 3.40-TBC) and RCM 1.21 (Build 1.21-TBC) releases as at the date of publication.

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VERSION CONTROL

Version	Release date	Changes
1.0	26/05/2021	Initial Publication for WEM PaSS 1.7, WEMS 3.40 and RCM 1.21 Market Trial release.
2.0	16/06/2021	Update to include changes made by the Wholesale Electricity Market Amendment (Tranches 2 and 3 Amendments) Rules 2020 commencing at 8:00AM (WST) 1 July 2021.
3.0	25/06/2021	Revised publication for WEM PaSS 1.7, WEMS 3.40 and RCM 1.21 Market Trial release to include more detail on improvements and fixes (Sections 4.6, 4.7 and 6).
4.0	16/07/2021	Revised publication for WEM PaSS 1.7, WEMS 3.40 and RCM 1.21 Market Trial release to include addition of two new settlement APIs (Sections 6.4 and 6.5).

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1. Introduction

1.1 Overview

These are the release notes for the WEM PaSS 1.7 (Build 1.7-TBC), WEMS 3.40 (Build 3.40-TBC) and RCM 1.21 (Build 1.21-TBC)

This Prudential and Settlement Service (WEM PaSS) release, and the related WEMS and RCM releases, is the first of two release under the Settlement Enhancement project. This release includes changes required to replace AEMO's current settlement solution. The new settlement solution extends the prudential and settlement calculation engine developed and certified under the RoPE project to deliver functionality and services to interface with the existing invoicing and billing systems and undertake WEM settlement.

The system changes under this release are summarised as follows and described in the sections below:

- Monthly/Weekly Settlement calculations using the new Prudential-Settlement engine
- New User Interface screens for accessing Settlement Statements and Invoices
- New APIs for accessing Settlement data
- New system Notifications and Alerts to support business processes
- Coordinator Fee rule change
- Certification of new and modified settlement calculations

The system changes are effective for all NSTEM and STEM trading periods with settlement Invoices issued on or after 1 August 2021 (in Production).

1.2 Supporting documentation

The following documents¹ have been updated for this release and should be read in conjunction with these release notes:

- WEMS MPI User guide
- WEMS Report and Web Services Specification
- WEM Metering, Settlement and Prudential Calculations

1.3 Version summary

The changes in version post deployment of this release are summarised in Table 1.

To view the current application versions, please navigate to **Help > About** in the MPI.

Table 1 Version summary

Application	Current version	New version
WEM PaSS	1.6 (Build 1.6-790-1)	1.7 (Build 1.7-792-9)
WEMS	3.39 (Build 3.39-1537-2)	3.40 (Build 3.40-1540-3)
RCM	1.20 (Build 1.20-2992-1)	1.21 (Build 1.21-2994-3)

¹ Available at <https://aemo.com.au/en/energy-systems/electricity/wholesale-electricity-market-wem/procedures-policies-and-guides/guides>

1.4 Terms and abbreviations

The terms and abbreviations used in this document are outlined in Table 2.

Table 2 Terms and abbreviations

Abbreviation	Expanded name
AEMO	Australian Energy Market Operator
API	Application Programming Interface
Formulation	WEM Metering, Settlement and Prudential Calculations formulation document
MOSMI	Market Operator System Monitoring Interface
MPI	Market Participant Interface
PCS	Product Configuration Specification
PDS	Public Data Site
RC	Reserve Capacity
RCM	Reserve Capacity Mechanism
RoPE	Reduction of Prudential Exposure
SPARTA	Settlements Processing, Account Reporting and Transaction Administration
WEMS	Wholesale Electricity Market System
WEM PaSS	Wholesale Electricity Market Prudential and Settlement Service

2. Background

AEMO currently uses several, disparate solutions to deliver settlements and prudential capability in the WEM:

- POMAX settlements, an end of life third party application which performs non-RCM settlement calculations and generates Statements.
- RCM settlements, which performs the RCM settlement calculations and generates Statements.
- SPARTA which integrates Statements and data from two systems to generate Invoices. SPARTA is fit for purpose.
- Prudentials, recently delivered by the Reduction of Prudential Exposure (RoPE) project, which has an independently certified in-house settlements calculation engine that aligns with the WEM Metering, Settlement and Prudential Calculations formulation document.

The current setup increases support costs for Participants and presents operational risks for AEMO.

The key objectives of the Settlements Enhancements project are:

- to consolidate and simplify WA's Settlements capabilities to ensure that AEMO remains compliant,
- to cease the reliance on the end of life POMAX Settlements, and
- to ensure AEMO's settlement systems are better placed prior to WEM Reforms.

The solution developed by AEMO is to decommission the POMAX Settlements and RCM Settlements systems and extend the current Prudential Service system to provide a single, certified, in-house prudential and settlements calculation engine known as WEM PaSS.

Further information on the changes and new functionality in this release was presented at the following stakeholder engagement forums:

- WA ECF 26 November 2020
- WRIG IT 4 February 2021
- WRIG IT 21 April 2021

3. Calculation Formulation

3.1 Purpose

The WEM PaSS is built on the basis of the independently certified WEM Metering, Settlement and Prudential Calculation document (the "Formulation"). This document creates a mathematically accurate representation of the WEM Rules, including:

- Representation of sets for use within the document;
- Mathematical equation representation of the WEM Rules;
- Specifications for variables used by the WEM PaSS system;
- Trading Margin calculation for Participants on a given Trading Day;
- Monthly (NSTEM) and Weekly (STEM) settlement; and
- Input estimation methodology for Prudential calculations.

This Formulation is the foundation for the prudential and settlement calculations implemented in AEMO's software. An extract of the Formulation is shown as follows:

Figure 2 Example taken from the STEM Payments and Charges section of the Formulation

4.4.1 STEM Payments and Charges

These equations are based on the equations stated in 9.6.1. They have been modified to aggregate to a Trading Day and to separate quantities into supply and demand.

$$STEMSAS_P_D(p, d) = \sum_{i \in I(d)} STEMSAS_P_I(p, i) \quad (102)$$

$$STEMSAD_P_D(p, d) = \sum_{i \in I(d)} STEMSAD_P_I(p, i) \quad (103)$$

$$STEMSAS_P_I(p, i) = \begin{cases} STEMP_G_I(i) \times STEMSQ_P_I(p, i) & SSF_G_D(i) = 1 \\ 0 & SSF_G_D(i) = 0 \end{cases} \quad (104)$$

$$STEMSAD_P_I(p, i) = \begin{cases} STEMP_G_I(i) \times STEMDQ_P_I(p, i) & SSF_G_D(i) = 1 \\ 0 & SSF_G_D(i) = 0 \end{cases} \quad (105)$$

$$STEMSQ_P_I(p, i) = \max(0, STEMQ_P_I(p, i) \times SSF_G_D(i)) \quad (106)$$

$$STEMDQ_P_I(p, i) = -\min(0, STEMQ_P_I(p, i) \times SSF_G_D(i)) \quad (107)$$

Variable	Units	SC	GR	Rule	Description	Ref
STEMSAS_P_D(p, d)	\$	P	D	9.6.1	Settlement amount for energy sold in STEM for Market Participant p in Trading Day d	(102)
STEMSAD_P_D(p, d)	\$	P	D	9.6.1	Settlement amount for energy purchased in STEM for Market Participant p in Trading Day d	(103)
STEMSAS_P_I(p, i)	\$	P	I	9.6.1	Settlement amount for energy sold in STEM for Market Participant p in Trading Interval i	(104)
STEMSAD_P_I(p, i)	\$	P	I	9.6.1	Settlement amount for energy purchased in STEM for Market Participant p in Trading Interval i	(105)
STEMSQ_P_I(p, i)	MWh	P	I		Energy sold in STEM by Market Participant p in Trading Interval i	(106)
STEMDQ_P_I(p, i)	MWh	P	I		Energy bought in STEM by Market Participant p in Trading Interval i	(107)
STEMQ_P_I(p, i)	MWh	P	I	6.9.13(b), 6.9.13(c), 6.10.2	Energy purchased (sold) in STEM by Market Participant p in Trading Interval i	I
SSF_G_D(d)	Flag	G	D		0 if STEM was suspended in Trading Day d, and 1 otherwise	I
STEMP_G_I(i)	\$/MWh	G	I	6.9.7, 6.10.2	STEM Clearing Price declared for Trading Interval i	I
I(d)	{}	G	D		Set of Trading Intervals in Trading Day d	I

The latest version of the Formulation can be found under guides and useful information² on the AEMO Website.

² <https://aemo.com.au/energy-systems/electricity/wholesale-electricity-market-wem/procedures-policies-and-guides/guides>

3.2 Formulation Changes

The Prudential Service v1.6 system implements the settlement calculations as defined in the WEM Rules and Formulation to undertake estimation of Market Participant settlement outcomes for the purposes of the Outstanding Amount calculation.

The following sections summarise the key changes to the Formulation and Prudential Service that have been implemented to extend the functionality to undertake settlement functions:

- **Inputs are not estimated:** When input data is not available for the prudential calculations, the inputs are estimated using the most recent data available. AEMO must not estimate data for settlements, and as such, the WEM PaSS now considers whether estimation of inputs is required through the introduction of an “estimation flag” in the formulas. Refer to Sections 6.1 and 6.2 of the Formulation.
- **Interest and GST:** The Interest and GST calculations have been implemented in the WEM PaSS. This required development of appropriate formulas. Refer to Sections 4.12 and 4.13 of the Formulation.
- **Inclusion of the Repaid Amount:** When a Participant fails to pay their Invoice due to insolvency (or similar) and AEMO uses Credit Support to cover the amount due, AEMO is required to incorporate a “Repaid Amount” in future NSTEM calculations and to prioritise return of the Repaid Amount to creditors during Short Payment of the market. AEMO has incorporated the Repaid Amount in NSTEM calculations. Refer to Section 4.5 of the Formulation.
- **Addition of the new Coordinator Fee:** Under the Wholesale Electricity Market Amendment (Governance) Rules 2021 (Schedule B due to commence 8:00 AM 1 July 2021) responsibility for WEM and GSI market rule administration and market development functions will transfer from the Economic Regulation Authority (ERA) and Rule Change Panel (RCP) to the Coordinator of Energy (COE). These changes provide for the ability of the Coordinator to recover fees through Market Fees. The WEM PaSS has been updated to include charge and payment of Coordinator Fees (similar to the ERA), with an effective date from 1 July 2021³. Refer to Sections 4.10 and 4.11 of the Formulation.

4. Participant Impacts

The changes in this WEM PaSS release are effective for all NSTEM and STEM trading periods with settlement Invoices issued on or after 1 August 2021 (in Production).

4.1 New Settlement Portal

The current Settlement Portal in **WEMS MPI > Settlements > Portal** (see Figure 3) will no longer be used to publish Settlement Statements and Invoices but historical information will remain available to Participants. The portal will be re-named Archived Portal (see Figure 4).

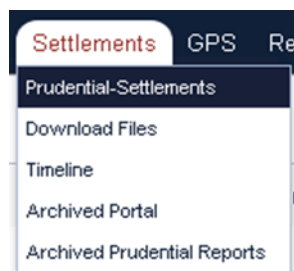
The current Prudential menu in **WEMS MPI > Settlements > Prudential** will be re-named to **Settlements > Prudential-Settlements** (see Figure 4). This tab will be used to access Settlement Statements and Invoices for Invoices issued from 1 August 2021.

³ Refer to Wholesale Electricity Market Amendment (Governance) Rules 2021 (Schedule B due to commence 8:00 AM 1 July 2021) available at <https://www.erawa.com.au/rule-change-panel/wholesale-electricity-market-rules>

Figure 3 Menu prior to WEM PaSS



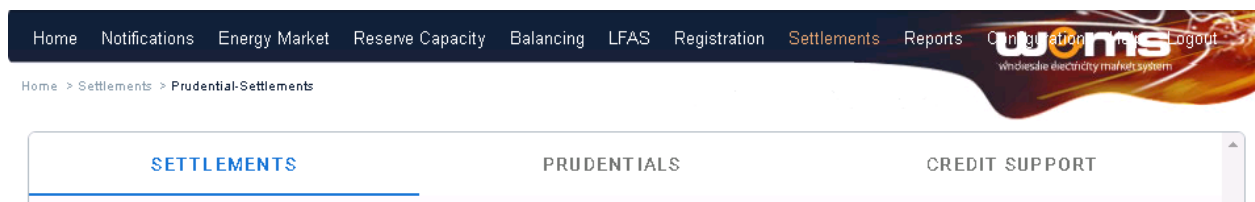
Figure 4 Menu after WEM Pass



4.2 Prudential-Settlements user interface

The Prudential-Settlements user interface in WEMS MPI will be updated to include an additional tab for Settlements (see Figure 5).

Figure 5 Settlements tab in the WEM PaSS UI



The Settlements dashboard provides an overview of a Participant’s Non-STEM and STEM settlement outcomes and provides access to the corresponding Settlement Statement Summary, Settlement Statement Detail, and Settlement Invoices (see Figure 6).

Figure 6 Settlements dashboard

Period Start	Period End	Invoice Period	Initial	Adjustment 1	Adjustment 2	Adjustment 3	Final Outcome
01/01/2020	31/01/2020	Jan 2020	-\$1,264,268.13				-\$1,264,268.13
01/03/2020	31/03/2020	Mar 2020	-\$2,345,460.48	\$0.00			-\$2,345,460.48
01/04/2020	30/04/2020	Apr 2020	-\$3,221,189.27				-\$3,221,189.27
01/05/2020	31/05/2020	May 2020	-\$151,481,801.49	\$0.00	\$146,886,322.53		-\$4,595,478.96
01/06/2020	01/07/2020	Jun 2020	-\$4,645,255.73				-\$4,645,255.73
01/08/2020	30/08/2020	Aug 2020					\$0.00
01/09/2020	30/09/2020	Sep 2020					\$0.00
01/10/2020	31/10/2020	Oct 2020	-\$5,300,385.47	\$0.00	-\$250,599.43	\$10.28	-\$5,550,974.63
01/11/2020	30/11/2020	Nov 2020					\$0.00
01/12/2020	31/12/2020	Dec 2020					\$0.00

The default display is the Non-STEM tab for the current calendar year. The display can be toggled between ‘Non-STEM’ (see Figure 7) and ‘STEM’ (see Figure 8). Non-STEM outcomes are displayed by Trading Month for the Initial, Adjustment 1, Adjustment 2 and Adjustment 3 settlements while STEM outcomes are displayed by Trading Week.

Figure 7 Non-STEM display

SETTLEMENTS

Market Participant:

NON-STEM
STEM

Period Start	Period End	Invoice Period
01/01/2020	31/01/2020	Jan 2020
01/03/2020	31/03/2020	Mar 2020
01/04/2020	30/04/2020	Apr 2020
01/05/2020	31/05/2020	May 2020
01/06/2020	01/07/2020	Jun 2020
01/08/2020	30/08/2020	Aug 2020
01/09/2020	30/09/2020	Sep 2020
01/10/2020	31/10/2020	Oct 2020
01/11/2020	30/11/2020	Nov 2020
01/12/2020	31/12/2020	Dec 2020

Figure 8 STEM display

NON-STEM
STEM

Period From	Period To	Invoice Period
08/04/2021	14/04/2021	TW 14/21
15/04/2021	21/04/2021	TW 15/21

Full details of the changes to the WEM PaSS user interface can be found in the WEMS MPI User Guide⁴.

4.3 Settlement Statements and Invoices

This release of the WEM PaSS means that Participants can now align their prudential information with their settlement information.

This release introduces the following changes to Settlement Statements and Invoices.

4.3.1 Statement Summary and Statement Detail (PIR)

The following changes are introduced to Statement Summary and Statement PIRs:

- Current Settlement Statements will be retired and replaced with the Settlement Statement Summary.
- Current Settlement PIRs will be retired and replaced with the Settlement Statement Detail.
- Current PCS found in **WEMS MPI > Settlements > Download Files** will be retired and replaced with the Formulation.
- Variables have changed and will align with the Formulation.

⁴ Available at <https://aemo.com.au/en/energy-systems/electricity/wholesale-electricity-market-wem/procedures-policies-and-guides/guides>

The Settlement Statement Summary file contains each line item found on the Invoice. This data is broken down by Trading Day in granularity. The data is contained within a single downloadable CSV file, which contains data for the chosen STEM or NSTEM trading period. The variables provided in the Settlement Statement Summary are explained in the Formulation.

An example of the Settlement Statement summary file is shown in Figure 9.

Figure 9 Example excerpt of March 2021 NSTEM Initial Settlement Statement Summary CSV file for Participant A (downloaded via the Portal)

RunId	PublishedAt	MarketType	Designation	Period	PeriodFrom	PeriodTo	ParticipantId	Variable	Timestamp	P Or C	GST Applicable	Value
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	ARA_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	BSAD_P_D	1/03/2021	Charge	Y	154044.7756
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	BSAS_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CAPREBSA_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CASD_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CASL_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CASR_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CASSR_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CCAOASA_P_D	1/03/2021	Payment	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CCDSMT3C_P_D	1/03/2021	Charge	Y	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CCR_P_D	1/03/2021	Charge	Y	13176.12126
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	PARTICIPANT A	CFSAD_P_D	1/03/2021	Charge	N	0

The Settlement Statement Detail (PIR) contains detailed information including all values used as inputs and the values resulting from the calculated variables under the WEM Rules. The data is presented in multiple CSV files, which contain data for the chosen STEM or NSTEM trading period. This data can be used by Participants in conjunction with the Formulation to allow them to reconcile the calculations. An example of the Settlement Statement Detail (PIR) file is shown in Error! Reference source not found..

Figure 10 Example excerpt of March 2021 NSTEM Initial Settlement Statement Detail (PIR) CSV file for Participant A (downloaded via the Portal)

RunId	PublishedAt	MarketType	Designation	Period	PeriodFrom	PeriodTo	ParticipantId	Settlement Trading Day	Variable	Scope	Timestamp	Value
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	A_P_I	ALINTA	1/03/2021 8:00	528.962
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ASPP_P_D	ALINTA	1/03/2021	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	BSAD_P_D	ALINTA	1/03/2021	154044.7756
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ABSGEN_P_I	ALINTA	1/03/2021 8:00	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ABSLOAD_P_I	ALINTA	1/03/2021 8:00	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ARA_P_D	ALINTA	1/03/2021	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ARA_P_I	ALINTA	1/03/2021 8:00	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ARaincGST_P_D	ALINTA	1/03/2021	0
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	ASSA_P_D	ALINTA	1/03/2021	71961.15
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	BSA_P_D	ALINTA	1/03/2021	1801210.517
50101	2021-06-21T15:32:04	NSTEM	INITIAL	Mar-21	1/03/2021	31/03/2021	ALINTA	1/03/2021	BSA_P_I	ALINTA	1/03/2021 8:00	22777.26934

4.3.2 Invoices

The following changes are introduced to Invoices, including Adjustment Invoices:

- Line items have changed and will align with Section 4.12.3 of the Formulation.
- Adjustment Invoices usually display the difference from the previous run for each line item. However, for each Adjustment Invoice where the previous run was performed with the old system and the current run was performed with this WEM PaSS release, AEMO will not be able to compare the old line items to the new line items. Instead, these “transition” Adjustment Invoices will display:
 - Each line item from the old system, aggregated for all previous runs for the same period and then negated;
 - Each line item from the new system; and
 - Sum of all line items to form the total amount payable.

Invoices contain an itemised list of payments and charges associated to a trading period. For Non-STEM and STEM, this data granularity is broken down by Trading Month and Trading Week respectively. The data can be downloaded as a PDF (see Figure 11) or JSON (Figure 12) file. All line items contained in an Invoice align with Section 4.12.3 of the Formulation.

Figure 11 Example excerpt of March 2021 NSTEM Initial Settlement Invoice PDF file for Participant A (downloaded via the Portal)


	<h2>Payment Summary</h2>	<p>ABN 94 072 010 327 Level 45 152 St Georges Terrace Perth WA 6000 PO Box 7096 Cloisters Square Perth WA 6850 T +61 8 9469 9800 E wa.operations@aemo.com.au</p>
		<p>Summary:</p>
		<p>Issued Date: 10/05/2021 Due Date: 10/05/2021</p>
<p>WEM NSTEM March 2021 - Initial</p>		
<p>Description</p>	<p>Amount</p>	
<p>Charge for the cost of Load Following Services Charge for the cost of Capacity associated with Load Following Payment for Interest associated with NSTEM * Charge for Interest associated with NSTEM * Charge for Intermittent Load Refunds Payment for GST associated with NSTEM * Charge for GST associated with NSTEM * Payment for non-allocated Capacity Credits (excluding DSM and SPA) Payment for DSM Capacity Credits Payment for Tranche 3 DSM Dispatch Payments Payment for Tranche 2 DSM Dispatch Payments Charge for the cost of Load Rejection Service and System Restart Service Charge for the cost of Dispatch Support Services Payment for Constrained On Compensation Payment for Constrained Off Compensation Payment for Outage compensation Charge for the cost of Outage compensation Service Fee Settlement Amount paid to the Coordinator *</p>	<p>0.00 0.00 0.00 0.00 0.00 (110,916.98) 995.25 (247,290.66) 0.00 0.00 0.00 0.00 0.00 0.00 (861,879.10) 0.00 0.00 0.00</p>	

Figure 12 Example excerpt of March 2021 NSTEM Initial Settlement Invoice JSON file for Participant A (downloaded via the Portal)

```
{
  "id" :
  "party" : {
    "id" :
    "name" :
    "addressLine1" :
    "addressLine2" :
    "abn" :
  },
  "invoiceDate" : "2021-05-10",
  "dueDate" : "2021-05-10",
  "market" : "NSTEM",
  "tradeMonth" : "2021-03",
  "adjustment" : 0,
  "title" : "NSTEM March 2021 - Initial",
  "paymentSummary" : {
    "lineItems" : [ {
      "code" : "LFMC_P_X",
      "description" : "Charge for the cost of Load Following Services",
      "amount" : 0.00,
      "gstApplicable" : true
    }, {
      "code" : "LFCC_P_X",
      "description" : "Charge for the cost of Capacity associated with Load Following",
      "amount" : 0.00,
      "gstApplicable" : true
    }, {
      "code" : "INTNSTEMP_P_X",
      "description" : "Payment for Interest associated with NSTEM",
      "amount" : 0.00,
      "gstApplicable" : false
    }, {
      "code" : "INTNSTEMC_P_X",
      "description" : "Charge for Interest associated with NSTEM",
      "amount" : 0.00,
      "gstApplicable" : false
    }, {
      "code" : "IMLR_P_X",
      "description" : "Charge for Intermittent Load Refunds",
      "amount" : 0.00,
    }
  ]
}
```

4.3.3 File formats

AEMO will provide the following file formats through WEMS MPI:

Information	File format in WEMS MPI
Settlement Statement Summary	CSV file
Settlement Statement Detail	ZIP file containing one CSV file per Trading Day in the Trading Week or Trading Month
Settlement Invoice	JSON file (not JSON string) PDF file

4.3.4 Historical information

Settlement Statements and Invoices for NSTEM and STEM trading periods with settlement Invoices issued before 1 August 2021 will remain available in the Archived Portal.

4.4 Settlement APIs

The current settlement web services will be archived and replaced with new settlement APIs.

The settlement API documentation, including model information, can be found under the existing AEMO Prudential API documentation provided in Swagger⁵ (see Figure 13).

Figure 13 Settlement API documentation in Swagger

Prudential		Show/Hide List Operations Expand Operations
GET	/api/v1/prudential	Retrieves the high-level summary of a participant's prudential position
GET	/api/v1/prudential/summary/latest	Retrieves the latest Outstanding Amount for a participant
GET	/api/v1/prudential/detail/{tradingDay}	Retrieves the low-level details for a single day, associated with a participant's prudential position
GET	/api/v1/prudential/estimation/{tradingDay}	Retrieves the low-level estimation details for a single day, associated with a participant's prudential position

Settlement		Show/Hide List Operations Expand Operations
GET	/api/v1/settlements/{marketType}/summary/{periodFrom}/{designation}	Retrieves the high-level summary of a settlement statement for a trading week or trading month, associated with a participant
GET	/api/v1/settlements/{marketType}/detail/{tradingDay}/{designation}	Retrieves the low-level details of a settlement statement for a trading day, associated with a participant
GET	/api/v1/settlements/NSTEM/estimation/{periodFrom}/{designation}/{tradingDay}	Retrieves the low-level details of an estimation settlement statement for a trading day, associated with a participant
GET	/api/v1/settlements/{marketType}/invoice/{periodFrom}/{designation}	Retrieves the settlement invoice for a trading week or trading month, associated with a participant

4.4.1 Response format

AEMO will provide the following response formats through the APIs:

Information	Response format in API
Settlement Statement Summary	JSON string
Settlement Statement Detail	JSON string
Settlement Invoice	JSON string

4.4.2 Invoice API model

AEMO has decided to use a single API model for both Initial and Adjustment Invoices and for both STEM and NSTEM, rather than separate models that would be largely the same except for a few fields. This is due to the design of existing systems. AEMO uses a separate system to produce the Settlement Invoices, so the APIs have been designed to accommodate that system. The invoice system produces JSON file formats and these have been converted into the generic JSON string format for the new Settlement APIs. This conversion means that there are subtle differences between the JSON file downloadable from the Settlements Portal and the JSON response in the API (e.g. missing fieldName vs fieldName=NULL).

4.4.3 Historical information

Settlement Statements and Invoices for NSTEM and STEM trading periods with settlement Invoices issued before 1 August 2021 will remain accessible via the archived APIs.

4.5 Austraclear

This release does not introduce any changes to the Austraclear transaction process.

⁵ Refer to <https://wems.aemo.com.au/prudential/api/docs/>

4.6 Seeded data

Some of the calculations in the Formulation require data from historical settlement runs that were performed in the old POMAX Settlements and RCM Settlements systems. To ensure that these calculations can run successfully and correctly, AEMO has “seeded” certain data from historical settlement runs into the WEM PaSS system. This solution means that the seed runs appear as if the run had been performed by the WEM PaSS system, however they contain only a limited set of variables and values.

The seed runs are not visible to Participants through the Settlements Portal but will return a limited set of results if called by the new Settlement Statement APIs.

4.7 Rounding

The WEM PaSS system uses 8 decimal places with half-to-even rounding.

5. Market Trial

AEMO has scheduled an extended Market Trial period from 2 June to 28 July 2021.

AEMO has also planned the following activities to allow for thorough and detailed testing by Market Participants.

Date	Party	Actions
Wed 02/06/2021	AEMO	<ul style="list-style-type: none">Refresh Market Trial data from ProductionDeploy new systems to Market Trial
Thu 03/06/2021 to Tue 08/06/2021	AEMO	<ul style="list-style-type: none">Run and publish STEM TW 18/21Run and publish NSTEM Oct 2020 INITIAL (re-run in new system)Run and publish NSTEM Sep 2020 ADJ2 (ADJ1 performed in old system)Modify the ERA fee rate (RFRATE_G_FY) from \$0.174/MWh to \$0.5/MWh to force a change in input dataRun and publish NSTEM Sep 2020 ADJ3 (ADJ2 performed in new system)
By COB Tue 08/06/2021	AEMO	<ul style="list-style-type: none">Send a Market Message to advise Participants that the Market Trial data is ready
Wed 09/06/2021 to Tue 25/06/2021	Participants	<ul style="list-style-type: none">Test access to Settlement Statements, Details and Invoices via MPI and Swagger APIs
Fri 25/06/2021 to Mon 28/06/2021	AEMO	<ul style="list-style-type: none">Deploy patch to Market TrialReinstate the test settlement data published earlier in Market Trial
Tue 29/06/2021 to Tue 20/07/2021	Participants	<ul style="list-style-type: none">Continue testing of access to Settlement Statements, Details and Invoices via MPI and Swagger APIs
Wed 21/07/2021	AEMO	<ul style="list-style-type: none">Deploy patch to Market TrialReinstate the test settlement data published earlier in Market Trial
Thu 22/07/2021 to Tue 27/07/2021	Participants	<ul style="list-style-type: none">Continue testing of access to Settlement Statements, Details and Invoices via MPI and Swagger APIs
Tue 27/07/2021	AEMO	<ul style="list-style-type: none">Remove test settlement run data in Market Trial
Wed 28/07/2021	AEMO	<ul style="list-style-type: none">Deploy new systems to Production

AEMO encourages Market Participants to:

- Familiarise themselves with the Formulation document;
- Undertake testing to familiarise themselves with the new settlement portal, new settlement artefacts and new settlement APIs during the Market Trial period; and
- Advise AEMO of any concerns as early as possible by email to wa.operations@aemo.com.au.

6. Improvements and Fixes

AEMO has implemented the following minor improvements and bugs fixes that were identified during the Market Trial period.

The improvements and fixes in this WEM PaSS release are effective for all NSTEM and STEM trading periods with settlement Invoices issued on or after 1 August 2021 (in Production).

6.1 API “value” field format change

A bug was identified in the current Prudential APIs and the new Settlement APIs where the “value” field associated with “variables” was being returned as a string data type instead as an array of decimal values (see Figure 14).

AEMO has updated both the current Prudential APIs and the new Settlement APIs to return the “value” field as an array of decimal values (see Figure 15).

Figure 14 Example excerpt of JSON response showing “value” before the fix

```
"variables": [  
  {  
    "variable": "string",  
    "scope": "string",  
    "granularity": "string",  
    "value": "string"  
  }  
]
```

Figure 15 Example excerpt of JSON response showing “value” after the fix

```
"variables": [  
  {  
    "variable": "string",  
    "scope": "string",  
    "granularity": "string",  
    "value": [  
      0  
    ]  
  }  
]
```

The following APIs are impacted by the fix:

- GET /api/v1/prudential/detail/{tradingDay}
- GET /api/v1/prudential/estimation/{tradingDay}
- GET /api/v1/settlements/{marketType}/detail/{tradingDay}/{designation}
- GET /api/v1/settlements/NSTEM/estimation/{periodFrom}/{designation}/{tradingDay}
- GET /api/v1/settlements/{marketType}/invoice/{periodFrom}/{designation}

6.2 Variable “BBR_G_D” change in Settlement Statement Detail

A bug was identified in the Settlement Statement Detail results which presented the Bank Bill Rate variable (BBR_G_D) incorrectly in both the JSON response and the CSV file.

The BBR_G_D variable is used to determine the Interest for an NSTEM Adjustment in accordance with Section 4.13 of the Formulation. This variable is a daily granularity and is expected to have a value presented for each Trading Day in the relevant set of INTDAYS for the adjustment (see Figure 16).

Figure 16 Extract of Interest formula for Adjustment 1

$$\begin{aligned}
 &INTNSTEM1_P_D(p, d) \\
 &= \begin{cases} (NOINTNSTEM_P_D(p, d) - NOINTNSTEM0_P_D(p, d)) & \text{for } NSTEM1NULLFlag_G_M(d) = 1 \\ & \text{and } NSTEM0NULLFlag_G_M(d) = 0 \\ \times \sum_{j \in INTDAYS1(d)} \frac{BBR_G_D(j)}{365} & \\ \\ (NOINTNSTEM1_P_D(p, d) - NOINTNSTEM0_P_D(p, d)) & \text{otherwise} \\ \times \sum_{j \in INTDAYS1(d)} \frac{BBR_G_D(j)}{365} & \end{cases} \tag{448}
 \end{aligned}$$

The bug was:

- The JSON response incorrectly presented the BBR_G_D as an array of values (one value for each day within the sets INTDAYS1, INTDAYS2, INTDAYS3) (see Figure 17).
- The CSV file incorrectly presented the BBR_G_D as a single value (and neglected to report the value for all days within the sets INTDAYS1, INTDAYS2, INTDAYS3) (see Figure 18).

Figure 17 Example excerpt of JSON response showing BBR_G_D before the fix

```

{
  "variable": "BBR_G_D",
  "scope": "Global",
  "granularity": "D",
  "value": [0.0030, 0.0030, 0.0030, 0.0030, 0.0030, 0.0030, 0.0030,
0.0030, ..., 0.0030]
}

```

Figure 18 Example excerpt of CSV file in Excel showing BBR_G_D before the fix

A	B	C	D	E	F	G	H	I	J	K	L	M
Run	PublishedAt	MarketType	Designation	Period	PeriodFrom	PeriodTo	Participant	Settlement Trading Date	Variable	Scope	Timestamp	Value
50019	2021-06-08T13:10:33	NSTEM	INITIAL	Oct-20	1/10/2020	31/10/2020	IMOWA	31/10/2020	BBR_G_D	Global	31/10/2020	0.003

AEMO has resolved the issue so that the JSON and CSV results have a BBR_G_D_value presented for each Trading Day in the relevant set of INTDAYS for the adjustment (see Figure 19 and Figure 20).

Figure 19 Example excerpt of JSON response showing BBR_G_D after the fix

```

"tradingDay": "2020-12-16T00:00:00",
"variables": [{
  "variable": "BBR_G_D",
  "scope": "Global",
  "granularity": "D",
  "value": [0.0055]
}],
{
  "tradingDay": "2020-12-17T00:00:00",
  "variables": [{
    "variable": "BBR_G_D",
    "scope": "Global",
    "granularity": "D",
    "value": [0.0055]
  }]
},
{
  "tradingDay": "2020-12-18T00:00:00",
  "variables": [{
    "variable": "BBR_G_D",
    "scope": "Global",
    "granularity": "D",
    "value": [0.0055]
  }]
},
{
  "tradingDay": "2020-12-19T00:00:00",
  "variables": [{
    "variable": "BBR_G_D",
    "scope": "Global",
    "granularity": "D",
    "value": [0.0055]
  }]
}

```

Figure 20 Example excerpt of CSV file in Excel showing BBR_G_D after the fix

I	J	K	L	M
Settlement Trading Da	Variable	Scope	Timestamp	Value
18/06/2020	BBR_G_D	Global	10/12/2020	0.0055
18/06/2020	BBR_G_D	Global	11/12/2020	0.0055
18/06/2020	BBR_G_D	Global	12/12/2020	0.0055
18/06/2020	BBR_G_D	Global	13/12/2020	0.0055
18/06/2020	BBR_G_D	Global	14/12/2020	0.0055
18/06/2020	BBR_G_D	Global	15/12/2020	0.0055
18/06/2020	BBR_G_D	Global	16/12/2020	0.0055
18/06/2020	BBR_G_D	Global	17/12/2020	0.0055
18/06/2020	BBR_G_D	Global	18/12/2020	0.0055
18/06/2020	BBR_G_D	Global	19/12/2020	0.0055

6.3 More detail added to Swagger documentation

AEMO has updated the Swagger documentation for the current Prudential APIs and the new Settlement APIs to include more detail on the API models, such as:

- Required and optional fields
- Minimum and maximum values
- String regular expression format
- String maximum length
- Decimal format including decimal points
- Date format including timestamp

Additional information is visible when the user hovers over the data type for each field. Refer to Figure 21 and Figure 22 for examples.

Figure 21 Excerpt of Settlement Statement Summary API model showing added details

```
SettlementOutputDetailsViewModel {
  runId (integer): The id of this settlement run,
  publishedAt (string): The time the calculation was published by AEMO. Format: yyyy-MM-ddTHH:mm:ss (e.g. 2021-01-07T15:30:45),
  marketType (string): The market type of the settlement run (STEM|NSTEM),
  designation (string): Settlement run type designation (INITIAL|ADJ1|ADJ2|ADJ3),
  participantId (string): The participant id associated with the request,
  tradingDay (string): A specific trading day within the settlement period. Format: yyyy-MM-ddTHH:mm:ss (e.g. 2020-05-31T00:00:00),
  tradingDays (Array[SettlementOutputCalculationDataViewModel]): An array of trading days associated with the request
}
```

Figure 22 Excerpt of Invoice API model showing added details

```
LinItem {
  code (string, optional): The code of the billing line item,
  description (string, optional): The description of the billing line item,
  amount (number): The amount applicable for the billing line item. Format: decimal(18,2) (e.g. 12345.12),
  gstApplicable (boolean, optional): Indicates if GST is applicable to the billing line item (true|false)
}
```

6.4 Invoice “tradeWeek” field change

A bug was identified in the STEM Invoices where the “tradeWeek” field was not being populated in the API response and incorrectly had a value of null (see Figure 23).

AEMO has resolved this issue so that the “tradeWeek” will be populated in the format “YYYY-WW”, which also resulted in a consequential change to the wording in the “title” field (see Figure 24).

Figure 23 Example excerpt of JSON response showing “tradeWeek” before the fix

```
"invoiceDate": "2021-05-14T00:00:00",
"dueDate": "2021-05-18T00:00:00",
"tradeWeek": null,
"tradeMonth": null,
"adjustment": null,
"title": "STEM TW 18/21",
```

Figure 24 Example excerpt of JSON response showing “tradeWeek” after the fix

```
"invoiceDate": "2021-05-14T00:00:00",
"dueDate": "2021-05-18T00:00:00",
"tradeWeek": "2021-18",
"tradeMonth": null,
"adjustment": null,
"title": "STEM Week 18 2021",
```

6.5 API for Settlement Cycle Timeline

Following Participant feedback received during the Market Trial period, AEMO has implemented a new API that returns the Settlement Cycle Timeline. Currently the timeline is published only as a PDF on the AEMO Website⁶, so providing this data as an API will allow for improved integration with the other WEM PaSS APIs.

The timeline data was implemented in AEMO systems well before the WEM PaSS system and currently may not record a “Type” of INITIAL for STEM. This API returns the data as is from the database, which means the response for “Type” may be different for NSTEM and STEM.

API call without parameters:

⁶ Available at <https://aemo.com.au/energy-systems/electricity/wholesale-electricity-market-wem/market-operations/clearing-payments>

https://<host>/api/v1/settlements/timeline

- Returns all periods in the timeline without filtering.
- No parameters required.

API call with parameters:

https://<host>/api/v1/settlements/timeline?<invoiceDateFrom>&<invoiceDateTo>

- Returns all periods in the timeline with an Invoice Date between the specified dates, inclusive.
- *invoiceDateFrom* and *invoiceDateTo* are optional parameters.
- If only *invoiceDateFrom* is provided, returns all periods in the timeline with an Invoice Date from the specified date.
- If only *invoiceDateTo* is provided, returns all periods in the timeline with an Invoice Date up to the specified date.

Example:

https://<host>/api/v1/settlements/timeline?invoiceDateFrom=2019-06-09&invoiceDateTo=2022-07-31

- This example call will return all periods in the timeline with an Invoice Date from 2019-06-09 up to and including 2022-07-31.

Figure 25 Example excerpt of JSON response showing an NSTEM cycle and associated runs

```
{
  "Period": "Jun 2019",
  "Market": "NSTEM",
  "PeriodFrom": "2019-06-01T08:00:00",
  "PeriodTo": "2019-07-01T08:00:00",
  "Runs": [
    {
      "Type": "INITIAL",
      "CommencementDate": "2019-08-01T00:00:00",
      "StatementDate": "2019-08-08T00:00:00",
      "InvoiceDate": "2019-08-08T00:00:00",
      "SettlementDate": "2019-08-12T00:00:00"
    },
    {
      "Type": "ADJ1",
      "CommencementDate": "2019-11-14T00:00:00",
      "StatementDate": "2019-12-16T00:00:00",
      "InvoiceDate": "2019-12-18T00:00:00",
      "SettlementDate": "2019-12-20T00:00:00"
    },
    {
      "Type": "ADJ2",
      "CommencementDate": "2020-02-14T00:00:00",
      "StatementDate": "2020-03-16T00:00:00",
      "InvoiceDate": "2020-03-18T00:00:00",
      "SettlementDate": "2020-03-20T00:00:00"
    },
    {
      "Type": "ADJ3",
      "CommencementDate": "2020-05-14T00:00:00",
      "StatementDate": "2020-06-15T00:00:00",
      "InvoiceDate": "2020-06-17T00:00:00",
      "SettlementDate": "2020-06-19T00:00:00"
    }
  ]
},
```

6.6 API for Invoice as PDF file

Following Participant feedback received during the Market Trial period, AEMO has implemented a new API that returns a published Invoice as a PDF file.

API call with parameters:

`https://<host>/api/v1/settlements/{marketType}/invoiceFile/{periodFrom}/{designation}?<participantId>`

- Retrieves the settlement invoice as a PDF file for a trading week or trading month, associated with a participant.

Parameters:

- *marketType* (required): Market type i.e. STEM or NSTEM.
- *periodFrom* (required): Cycle period from e.g. 2020-04-30.
- *designation* (required): Designation i.e. INITIAL, ADJ1, ADJ2, ADJ3. If *marketType* is STEM, then designation must be INITIAL. If *marketType* is NSTEM, then designation must be one of INITIAL|ADJ1|ADJ2|ADJ3.
- *participantId*: This is automatically populated from the authenticated certificate.

Example:

`https://<host>/api/v1/settlements/NSTEM/invoiceFile/2021-08-01/ADJ2?participantId=IMOWA`

- If the file exists, this example call will return the Invoice as a PDF file for the NSTEM August 2021 Adjustment 2 for IMOWA. If the file does not exist, returns 404 not found.

In Production, the API will only return data for Invoices issued from 1 August 2021 (i.e. with an Invoice Date on or after 1 August 2021). For Invoices issued prior to this date, refer to the previous APIs in Section 14.7 of the “WEMS Report and Web Services Specification” document published on the AEMO Website⁷.

⁷ Available at <https://aemo.com.au/energy-systems/electricity/wholesale-electricity-market-wem/procedures-policies-and-guides/guides>

7. Internal AEMO Changes

To support the changes introduced by this WEM PaSS release, the following applications have also been updated but will not be visible to Participants:

- WEM PaSS improvements to allow AEMO to specify a date range to be used for data imports and calculations, and to manually input certain parameters used by the calculations.
- WEM PaSS improvements to reduce data storage and improve calculation run times.
- WEM PaSS User Interface improvements to allow AEMO to manually trigger data imports and calculations on demand, manage settlement run workflow, and publish the associated Settlement Statements.
- Hangfire improvements for scheduled jobs to perform specified data imports and calculations.
- SPARTA improvements to allow AEMO to import invoice data from the new WEM PaSS, manage invoice workflow, and publish the associated Settlement Invoices.
- SPARTA improvements to update internal reporting functionality.
- MOSMI improvements to provide alerts and notifications to monitor the scheduled or manually triggered settlement jobs.
- Various application improvements to retire functionality no longer required.