



## Fact Sheet

The National Electricity Amendment (Global Settlements and Market Reconciliation) Rule 2018 requires AEMO to determine the amount of unaccounted for energy (UFE) for each distribution network local area.

This fact sheet provides a high-level overview of how UFE is calculated and can be used as a reference on how to allocate UFE, both before and after the implementation of the IESS rule.

### What is UFE?

UFE is the difference between all adjusted metered energy entering a local area, compared to all adjusted metered energy consumed within the local area.

These differences could be caused by energy theft, inaccurate or faulty meters, estimation errors associated with unmetered devices, profiling of reads to the trading interval (5 minute) level or errors in the distribution loss factor (DLF).

### What is adjusted metered energy?

The delivery of energy through any distribution network incurs losses, which occur due to long wire lengths or transforming energy to different voltages, known as technical losses.

Each distribution network calculates the technical losses and provides a DLF to AEMO. During the settlements process, all distribution connected metered energy (ME) is adjusted by this loss factor.

Adjusted metered energy is calculated at every distribution network connection point using the formula  $ME \times DLF$ .

### What is a local area?

A local area is a geographical network area that connects to the transmission network via a collection of transmission connection points, commonly called TNIs. The local areas usually align with a distribution network; however, it can include additional connection points within the same electrical network.

### How is UFE calculated?

UFE must be calculated at the local area level, rather than at the TNI level, due to the existence of virtual TNIs. A virtual TNI is a grouping of connection points assigned to a TNI code that does not have a physical connection to the transmission network. This means the energy is supplied from one of the other TNIs and since the load is not recorded against the same TNI, UFE calculation at the TNI level is impossible.

The calculation for determining UFE is:

$$UFE = TME - DDME - ADME^1$$

where from the distribution network perspective the values are:

- TME = All energy flowing at each transmission network connection point into the local area
- DDME = All adjusted energy flowing at a distribution connection point into the local area which is connected to an adjacent local area
- ADME = All adjusted energy flowing at a distribution connection point within the local area which is assigned to a TNI or Virtual TNI

Below is a simple example of the UFE calculation:

$$UFE = TME - DDME - ADME$$
$$1kWh = 100kWh - 9kWh - 90kWh$$

### How is UFE allocated?

The net metered energy (ME) can record energy flows in two directions, towards the connection point (load) or away from the connection point (generation). The above calculation of UFE uses all net metered energy, considering both energy flow directions.

Prior to the IESS Rule change, UFE was only allocated to the Market Customer connection points that were consuming energy in the trading interval, where the flow of the net metered energy is towards the connection point. In the rules this value was given the abbreviation **ME-<sup>2</sup>**.

DME was then defined as the DLF adjusted **ME-** value, so represents the adjusted energy flowing towards the connection point. For connection points where the local generation (for example from rooftop solar panels) exceeds the load, then the calculated DME was zero and no UFE was allocated to the connection point.

<sup>1</sup> National Electricity Amendment (Global settlement and market reconciliation) Rule 2018 No.14, NER 3.15.5 (a)

<sup>2</sup> For settlements the ME flow is expressed as a positive value where the flow is towards the transmission network (generation) and a negative value when flow is away from the transmission network (load). The negative sign in **ME-** refers to this negative settlement energy load value, NER 3.15.5(c). Metering data at the end user connection point for distribution systems are expressed from the end user's point of view, therefore the signs are reversed. Clause 3.15.4 (b).

Following the IESS Rule change (as of 2 June 2024) all connection points, including distribution connected generators, are subject to an allocation of UFE based on the proportion of energy they consume. All the DLF adjusted consumed energy (CE) recorded at a connection point is included in the UFE allocation, irrespective of net metered energy direction.

Below is a simple example of a DME calculation:

Prior to IESS change:  $DME = ME- \times DLF$

Post IESS change:  $DME = CE$  (DLF adjusted consumption, for distribution connected sites)

$$9.09\text{kWh} = 9\text{kWh} \times 1.01$$

### How are transmission connected sites excluded from UFE allocation?

Where transmission connected sites are a part of TNI containing only transmission connection points, that TNI is allocated to a \*GRID local area (for example VICGRID, SAGRID). These \*GRID local areas should always have a UFE calculated at zero.

There are also a very limited number of transmission connected sites that are a part of a TNI containing both transmission and distribution connection points. These TNIs belong to a standard local area and the transmission connected sites are excluded from UFE allocation based on their NMIClassCode in MSATS being "WHOLESALE".

### How is the UFE allocation (UFEA) calculated?

UFE is allocated to each connection point based on the share of that connection points DME of the total DME of the local area in that trading interval, so the calculation for allocating UFE is:

$$UFEA = UFE \times (DME / ADMELA)^3$$

Where the values:

- UFE = unaccounted for energy for the local area
- DME = the adjusted energy flowing towards the relevant connection point for each trading interval
- ADMELA = the aggregate of all DME values for each trading interval for the local area.

<sup>3</sup> National Electricity Amendment (Global settlement and market reconciliation) Rule 2018 No.14, Clause 3.15.5 (c)

### How can I calculate the UFEA for a connection point?

With every settlement case AEMO publishes the UFE components within the RM46 UFE Validation Report.

To apply the UFE allocation calculation the following information is required:

- Identify the DLF code for the connection point and the associated DLF value
- Calculate DME for each trading interval for the connection point
- Identify the UFE and ADMELA values for each trading interval
  - Available within the MSATS RM46 report, which can be subscribed to
- Calculate the allocation using the UFE allocation formula:  $UFEA = UFE \times (DME / ADMELA)$

Below is a simple example of the UFEA calculation:

$$UFEA = UFE \times (DME / ADMELA)$$

$$0.1\text{kWh} = 1\text{kWh} \times (9.09\text{kWh} / 90.09\text{kWh})$$

### Is there an alternative way to calculate UFEA for a connection point?

To assist in the calculation of UFEA, AEMO has created a UFE factor (UFEF) that can be applied to the DME values to determine the UFEA values. The UFEF values are available within the MSATS RM46 UFE validation or RM43 UFE factor by local area reports.

The factor uses the same allocation logic by transposing local area values within the UFEA formula, the transposed formula is:

$UFEA = UFE \times (DME / ADMELA)$  can be expressed as:

$$UFEA = DME \times (UFE / ADMELA)$$

Since the UFE and ADMELA are calculated at a local area level, these values can be converted to a factor by using the following formula:

$$UFEF = UFE / ADMELA$$

Below is a simple example of the UFEF calculation:

$$UFEF = UFE / ADMELA$$

$$0.011001 = 1\text{kWh} / 90.09\text{kWh}$$

By replacing UFE / ADMELA with UFEF in the UFEA calculation, the following formula can be used:

$$\text{UFEA} = \text{DME} \times \text{UFEF}$$

Below is a simple example of the UFEA calculation using the UFEF:

$$\begin{aligned}\text{UFEA} &= \text{DME} \times \text{UFEF} \\ 0.1\text{kWh} &= 9.09\text{kWh} \times 0.011001\end{aligned}$$

### How is the total energy for the connection point calculated?

The calculation of the total energy, which is referred to in the rules as the adjusted gross energy (AGE), is performed using the following formula:

$$\text{AGE} = (\text{ME} \times \text{DLF}) + \text{UFEA}^4$$

Below is a simple example of the AGE calculation:

$$\begin{aligned}\text{AGE} &= (\text{ME} \times \text{DLF}) + \text{UFEA} \\ 9.19\text{kWh} &= (9\text{kWh} \times 1.01) + 0.1\text{kWh}\end{aligned}$$

### Where can the settlements system UFE data be found?

The MMS Data Model now includes additional data in the below tables to publish the global settlements data produced from the settlements system:

- SETLOCALAREATNI (new) contains the TNIs included in each local area for each settlement date and run number
- SETLOCALAREAENERGY (new) contains the local area data for each trading interval and each settlement run, including fields for the UFE, TME, DDME, ADME calculated by the retail solution (with the opposite sign) and the ADMELA value calculated by the settlements system
- SETCPDATA (altered) new fields UFEA, DME, AFE (accounted for energy) and AGE added, with the UFEA now included in some existing fields as well, since the beginning of global settlements on 1 May 2022 and up to 1 June 2024 (inclusive)
- SET\_ENERGY\_TRANSACTIONS (new table due to IESS Rule change from 2 June 2024), contains UFEA\_MWh and DME\_MWh along with ACE\_MWh (where ACE = Adjusted Consumed Energy, the consumption adjusted for both DLF and UFEA)

<sup>4</sup> National Electricity Amendment (Global settlement and market reconciliation) Rule 2018 No.14, NER 3.15.4 (b)



## Fact Sheet

### Why does the settlements system UFE data have the opposite sign?

The settlement statements are created with negative energy representing the loads and positive energy values representing generation.

A positive UFE, as calculated earlier, represents less energy being charged for than is required. For the settlements system to increase the load being charged, the positive UFE amount must be changed to a negative value.

Similarly, when the UFE as calculated earlier is negative, the settlements system must apply a positive value to ensure the energy charged for is reduced.

### How does the settlements system calculate the UFE Allocation (UFEA)?

The settlements calculations are performed at the trading interval (5 minute) level, with the UFEA added to the required energy field/s so that the energy volume billed is UFE inclusive. An example of the pre and post IESS calculations is shown below, with the same data values from the pre-IESS date used for the post-IESS date.

#### Data From SETLOCALAREAENERGY

Settlement Date	Settlement RunNo	LocalAreaId	Period Id	UFE	TME	DDME	ADME	ADMELA
1/06/2024	10	ENERGEX	100	-14.0064	-195.662	-0.703861	-180.9518	-196.4706
1/06/2024	10	UMPLP	100	-0.42802	-83.85336	-0.077197	-83.34815	-90.91604
1/06/2024	10	POWERCOR	100	1.554456	-70.96067	1.012595	-73.52773	-113.9055

#### Data From SETLOCALAREATNI

Settlement Date	Settlement RunNo	LocalAreaId	TNI
1/06/2024	10	ENERGEX	QMGL
1/06/2024	10	UMPLP	SJP1
1/06/2024	10	POWERCOR	VRC6

#### Data From SETCPDATA

SETTLEMENT DATE	VERSIONNO	PERIODID	PARTICIPANTID	TCPID	REGIONID	IGENERGY	XGENERGY	INENERGY	XNENERGY	RRP	TLF	TA	EP	UFEA	DME	AFE	AGE
1/06/2024	10	100	XXXX	QMGL	QLD1	0	0.2	0	0.2014258	129.67	1.0083	-0.201426	-26.34	-0.001426	-0.02	-0.2	-0.201426
1/06/2024	10	100	XXXX	SJP1	SA1	0.02	0.7	0.02	0.7032955	74.2	0.9962	-0.683295	-50.51	-0.003295	-0.7	-0.68	-0.683295
1/06/2024	10	100	XXXX	VRC6	VIC1	0.1	0.3	0.1040941	0.3	-38	0.9744	-0.195906	7.25	0.004094	-0.3	-0.2	-0.195906

#### Data from SET\_ENERGY\_TRANSACTIONS

Settlement Date	Version No	PeriodId	ParticipantId	ConnectionPointId	Meter Type	RegionId	CE_MWh	UFEA_MWh	ACE_MWh	ASOE_MWh	Total_MWh	DME_MWh	RRP	TLF	ACE_Amount	ASOE_Amount	Total_Amount
2/06/2024	9	100	XXXX	QMGL	CUSTOMER	QLD1	-0.2	-0.001426	-0.201426	0	-0.201	-0.2	129.67	1.0083	-26.34	0	-26.34
2/06/2024	9	100	XXXX	SJP1	CUSTOMER	SA1	-0.7	-0.003295	-0.703295	0.02	-0.683	-0.7	74.2	0.9962	-51.99	1.48	-50.51
2/06/2024	9	100	XXXX	VRC6	CUSTOMER	VIC1	-0.3	0.004094	-0.295906	0.1	-0.196	-0.3	-38	0.9744	10.96	-3.70	7.25

Note that all read values in the settlements system are adjusted for the DLF and converted from the kWh values in the metering systems to MWh. In the above example all sites are distribution connected customer connections, so are eligible for UFE allocation under both the pre and post IESS logic described earlier.

### For dates prior to 1 June 2024 (inclusive) using SETCPDATA:

When UFE is negative (so a positive value in settlements data) it is the INENERGY (net imports to grid, so representing generation) read value that is altered, as per the VRC6 TNI example above.

- The “gross” read values IGENERGY and XGENERGY are UFE exclusive:

$$\text{IGENERGY} - \text{XGENERGY} = \text{AFE}$$

Where the value:

AFE = accounted for energy

- The “net” read values INENERGY and XNENERGY are UFE inclusive:

$$\text{INENERGY} - \text{XNENERGY} = \text{TA} = \text{AGE}$$

Where the values:

AGE = adjusted gross energy

TA = trading amount (an old energy volume field name; “Trading Amount” is also used for the energy charge/payment dollar amounts in the Settlement Report)

### For dates from 2 June 2024 (inclusive) using SET\_ENERGY\_TRANSACTIONS:

- CE\_MWH is the UFE exclusive consumed energy (CE) adjusted for DLF
- ACE\_MWH is the UFE inclusive adjusted consumed energy (ACE)
- The total energy can then be calculated as below:

$$\text{CE\_MWh} + \text{UFEA\_MWh} + \text{ASOE\_MWh} = \text{Total\_MWh} = \text{AGE}$$

Where the values:

ASOE\_MWH = sent out energy (generation) adjusted by the DLF

TOTAL\_MWH = total energy for the Participant = adjusted gross energy

Below is an example of the UFEA calculation using the QMGL TNI data from the example above, which is in the ENERGEX local area, using both methodologies:

Prior to IESS change:  $\text{UFEA} = \text{UFE} \times (\text{DME} / \text{ADMELA})$

Post IESS change:  $\text{UFEA\_MWh} = \text{UFE} \times (\text{DME\_MWh} / \text{ADMELA})$

$$-0.001426\text{MWh} = -14.0064\text{MWh} \times (-0.02\text{MWh} / -196.4706\text{MWh})$$

Below is an example of the calculation for the cost of the UFEA inclusive energy volume billed, again using the QMGL TNI example data from above:

Prior to IESS change:  $EP = TA \times RRP \times TLF$

Post IESS change:  $Total\_Amount = Total\_MWh \times RRP \times TLF$

$$-\$26.34 = -0.201426MWh \times \$129.67 \times 1.0083$$

Where the values:

RRP = regional reference price in \$/MWh

TLF = transmission loss factor

## How do the settlements statements present UFE?

UFE is not included in the statements as a separate line item, it forms a part of the total main "Energy" line item, by altering the volume of energy that has been charged.

The detailed Settlement Report (SR), issued at the same time as the statements, includes separated UFEA data for information only. The main "Aggregate Energy (MWh)" field reported in the SR is a UFE inclusive energy volume.

## Why does the UFE alter so much between the statements of the same week?

Occasionally, metering data with large errors is received by AEMO from the market. If these errors cannot be fixed by the MDP prior to the statement posting, this known poor-quality data will be included in the statements.

Previously, under the settlements by difference methodology, the impacts of such errors would only be seen by the FRMP and LR of the meter with the impacted read. Now under global settlements, any errors directly impact the FRMP as well as all retailers active in that local area, if the incorrect read significantly alters the UFE calculated. These errors should be corrected in the following statement, though even more rarely, new errors can be introduced in the meter data for the later statements.

The other likely cause of large differences will only impact local areas with remaining large populations of BASIC and MRIM meters. These may cause variations between the PRELIM/FINAL/REVISE statements where the estimated reads used prior to the meters being read, are significantly different to the actual reads. In these cases, the UFE in the earlier statements will differ from the final UFE outcome, after all actual reads have been received.

Given that UFE allocation impacts all end user meter types that are distribution connected, large end users who are accustomed to being billed entirely from actual metering data, will now be impacted by estimated metering data affecting the calculated UFE.