



5MS and GS Reconciliation support workshop #2

Monday 18th November, 2019

AEMO Offices:

Level 9, 99 Gawler Place, Adelaide

Level 10, 10 Eagle Street, Brisbane

Level 22, 530 Collins Street, Melbourne

Level 2, 20 Bond Street, Sydney

This slide pack was developed for the Reconciliation support workshop. This version of the slides has been annotated with notes from the meeting. These additional notes are on new slides that have a yellow background.

Attendees

Attendee	Organisation	Attendee	Organisation	Attendee	Organisation
Andrew Peart	AGL	Pieter Wijtzes	AGL	Warren Van Wyk	Intellihub
Angkur Mukerjee	AGL	Rahul Srivastav	AusNet	Jon Ham	Energy Australia
Annett Reitman	AGL	Ricky Brooks	Stanwell	Deepak Gupta	Energy Australia
Audrey Follett	Snowy Hydro	Tessie Sato	Alinta	Drew Pass	Engie
Chris Leffler	AGL	Nick Hickman	Energy Queensland	Gary Gupta	Flow Power
Dirk Legenhausen	Tango	Paul Willacy	Aurora	Bab Kamath	Momentum
Deepak Sood	Pacific Hydro	Scott Gowans	Alinta	Rajiv Balasubramanian	Jemena
Ingrid Farah	Ergon	Scott Maskiel	AEMO	Andrew Steer	Gentrack
Justin Betlehem	AusNet	Fergus Stuart	Origin	Sabrina Akhter	Flow Power
Mahdi Maleki	Ausnet	Darragh Walsh	Origin	Blaine Miner	AEMO
Jeff Roberts	Evoenergy	Grace Wu	Origin	Paul Lyttle	AEMO
Natasha Rajdev	Alinta	Christophe Bechia	Red Energy	Pierre Fromager	AEMO
Soham Roy Chaudhuri	Alinta	Daniel Hillier	Powershop	Dimi Botha	AEMO
Sharleen Flanagan	ERM	Justin Wearne	Energetiq	Emily Brodie	AEMO
Maree Madden	AGL	Lori Scarano	AGL		

Today's Objective

- Explain how Participants can verify/reconcile the UFE and Trading Amounts on the AEMO Settlements Reports, by:
 - Explaining various UFE related terms, acronyms and concepts
 - Providing examples of how AEMO will calculate the relevant UFEF (UFE factor) values
 - Providing some initial mock-ups of the most relevant RM reports
 - Providing some initial mock-ups of the proposed changes to the Settlements Reports (SR)
 - Providing a high-level understanding of AEMO's proposed UFE enquiry management approach

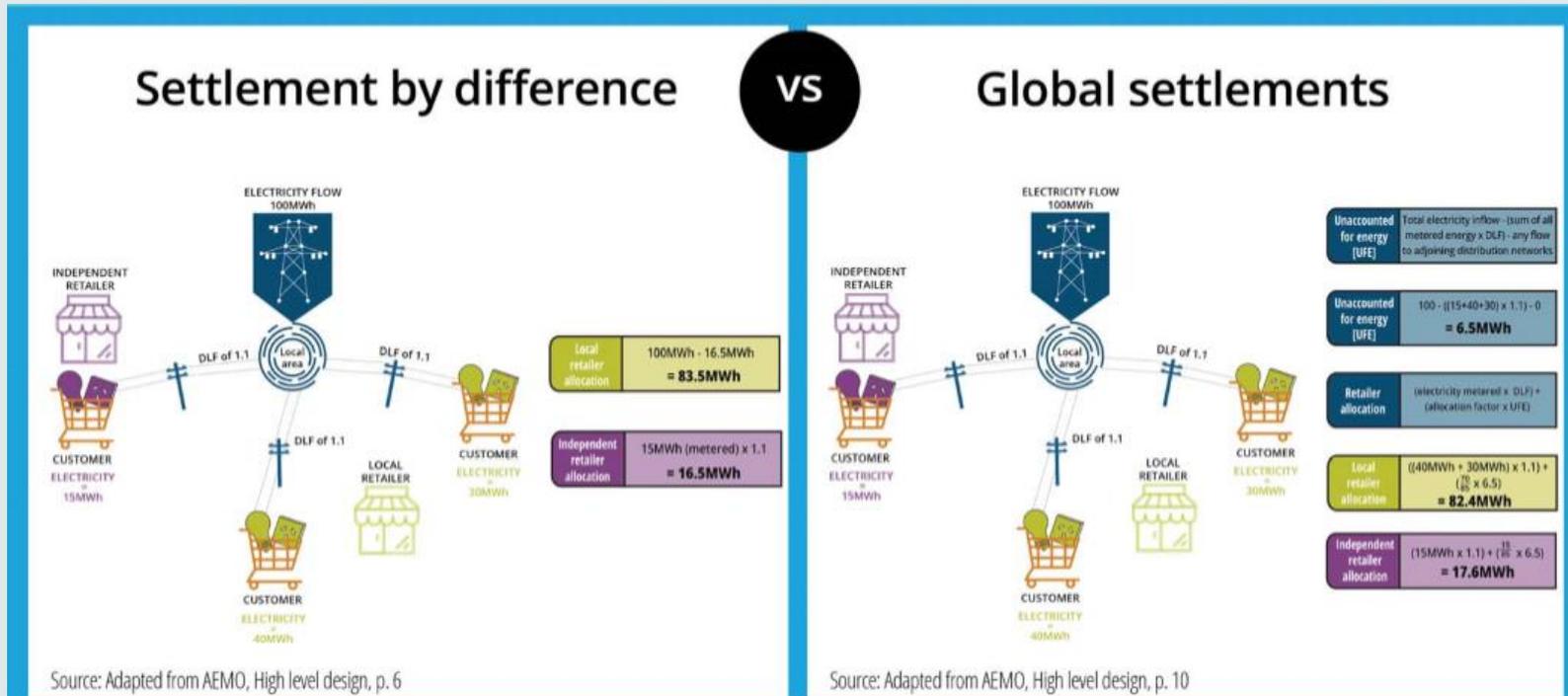
Agenda

NO	TIME	AGENDA ITEM	RESPONSIBLE
Preliminary matters			
1	2:00pm – 2:05pm	Welcome, introduction and apologies	Blaine Miner
Matters for noting			
2	2:05pm – 2:15pm	Introduction	Blaine Miner
3	2:15pm – 2:20pm	De-brief on actions since previous workshop	Blaine Miner
Matters for discussion			
4	2:20pm – 3:00pm	UFE - calculation <ul style="list-style-type: none"> Worked examples of how AEMO <u>calculates</u> UFE Mocked-up examples of RM reports 	Paul Lyttle
BREAK 3:00pm – 3:10pm			
5	3:10pm – 3:55pm	UFE - allocation <ul style="list-style-type: none"> Worked examples of how AEMO <u>allocates</u> UFE Changes to invoices and settlement reports (including timings) Mocked-up data interchange reports 	Pierre Fromager
6	3:55pm – 4:05pm	Checkpoint	Blaine Miner
7	4:05pm – 4:20pm	UFE enquiry management	Dimi Botha
Other business			
8	4:20pm – 4:30pm	General questions & Appendices	Blaine Miner

Introduction

Blaine Miner

Settlements by Difference vs Global Settlements (1)



Stylised calculation of settlement by difference

1. Establish total amount of electricity that flows into the distribution network
2. Sum the metered electricity for each independent retailer and adjust for distribution losses
3. Charge each respective independent retailer their distribution loss-adjusted metered consumption
4. The local retailer pays for the remainder of the electricity in the local area, including any UFE

UFE is made up of errors in the distributed loss factor (DLF), commercial losses (e.g. electricity theft, inaccurate meters, estimation errors for unmetered devices) and estimation errors from profiling meters

Stylised calculation of global settlements:

1. Establish total amount of electricity that flows into the distribution network
2. Sum the metered electricity for all retailers and adjust for distribution losses
3. Calculate UFE as the difference between DLF-adjusted metered energy and the total energy inflow into the distribution network
4. Apportion UFE to each retailer based on their proportion of total metered consumption
5. Charge each retailer their distribution loss-adjusted metered energy and their proportion of UFE

Settlements by Difference vs Global Settlements (2)

Reconciliation today:

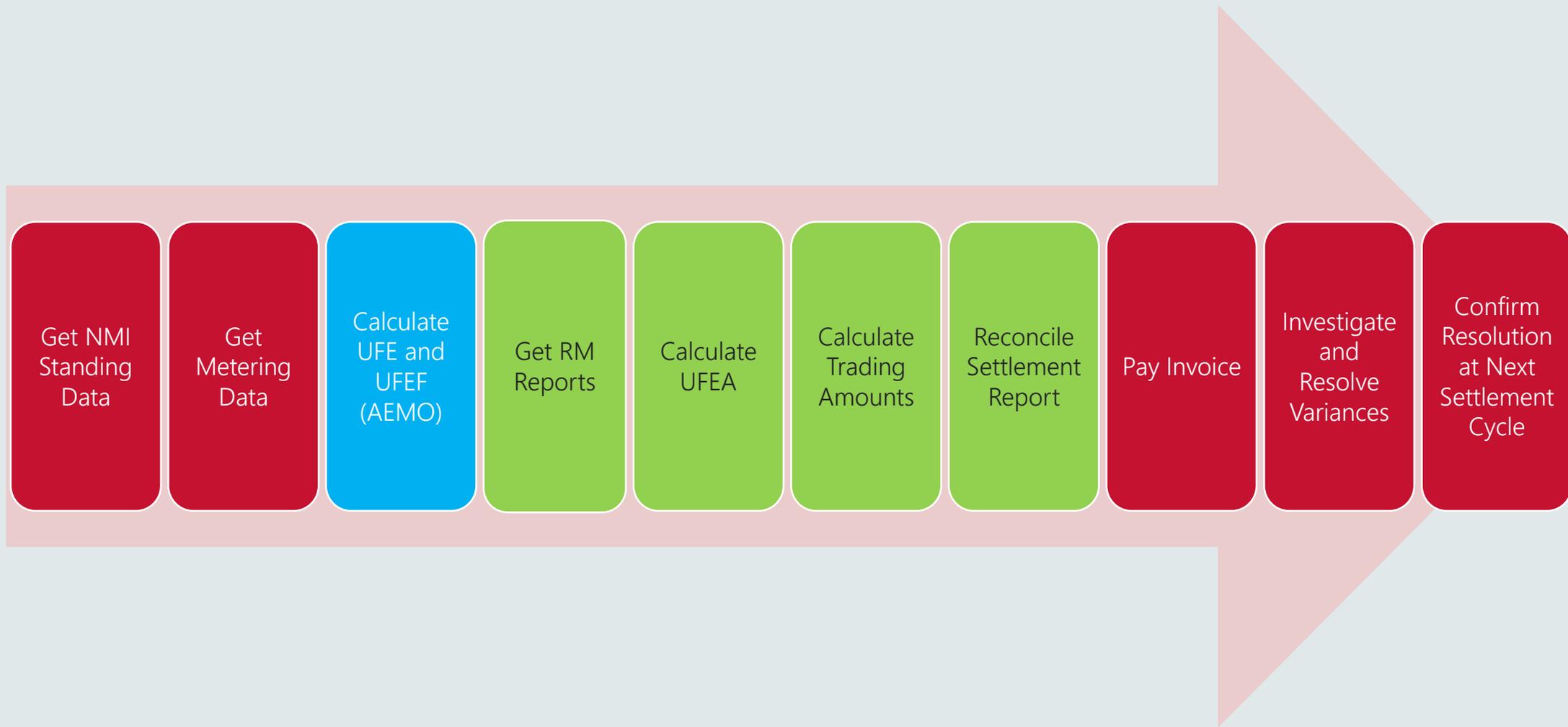
- For LRs, a 'top down' check that the quantity at the TNI less quantity of 2nd tier NMIs x DLF equals quantity billed at the TNI.
 - The 'difference' is a 'balancing item' and is deemed to include all of the first-tier NMIs and any UFE, but this cannot be checked.
- For FRMPs, that the quantity of their NMIs x DLF equals the quantity billed at a TNI
- LRs and FRMPs receive TNI & NMI level quantities from AEMO to assist with reconciliation processes

Settlements by Difference vs Global Settlements (3)

Reconciliation in a GS environment:

- As no Retailer is financially liable for the boundary energy, reconciliations are now only performed by FRMPs
- The 'top down' is extended by deducting the quantities of not only market NMIs, but also the quantity of 1st tier and non-contestable unmetered NMIs, to calculate the residual UFE quantity in a Local Area
- Then, as there is no longer a 'balancing item' for LRs, the reconciliation process becomes a 'bottom up' process from NMI to TNI to Local Area; the UFE is allocated to all NMIs that have a net load
- This means a FRMP that wants to check the quantity billed at each TNI needs to sum the quantity for all its NMIs assigned to the TNI, being NMI metered quantity x DLF plus any UFE allocated
- FRMPs will need to calculate the UFE allocated to NMIs as this is not in the data provided by AEMO
- In summary, **the reconciliation process is materially different under GS**

High-Level Reconciliation Overview



De-brief on actions since previous workshop

Blaine Miner

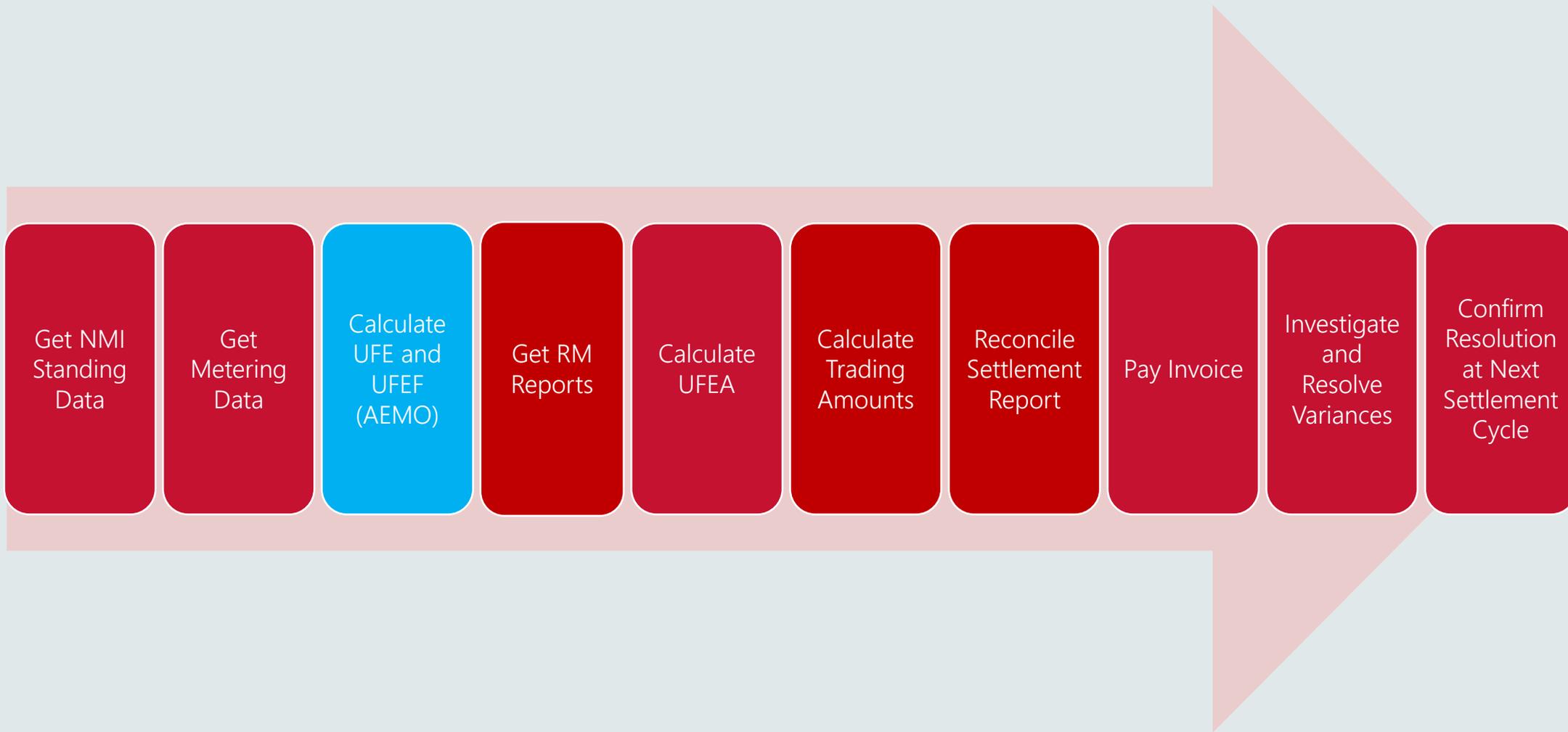
Change Request Update

CR#	Opportunity	Proposal	Status
CR18	Provisioning of what meter data version was used to support a Settlement Report/Invoice	To include the MDP version date/time in the applicable RM reports to enable participants to accurately validate the settlement statement.	Change request has been approved, and is being incorporated into AEMO's 5MS work program.
CR19	Continuation of 30-minute RM and settlement reports post 5MS commencement date	The creation 5 and 30min versions of the RM16, RM17, RM20, RM25, RM22 and RM43 reports.	Change request impact has been assessed, and feedback on potential benefit being sought through SWG and PCF.
CR20	Provisioning of 5min profiled metering data quantities associated to 15/30min interval and basic metering data (1st tier and 2nd tier).	AEMO to deliver profiled energy values to Participants	AEMO has decided not to approve this CR for inclusion into the 5MS work program. If participants wish to pursue this change it will need to be raised through the ERM process.
CR21	Provisioning of Retail/NMI Standing data via data interchange	Retail/NMI Standing data provided via data interchange in a similar manner to Wholesale data	AEMO has decided not to approve this CR for inclusion into the 5MS work program. If participants wish to pursue this change it will need to be raised through the ERM process.

How AEMO Calculates UFE and UFEF

Paul Lyttle

How AEMO Calculates UFEF



UFE Terms Relevant to this Agenda Item

Term	Description
Local Area	<p>The <i>Local Area</i> (LA) is a collection of Transmission Node Identifier (TNI) codes through which <i>energy</i> flows into or out of a <i>distribution area</i>.</p> <p>Unmetered cross boundary NMIs are assigned to supply Local Areas using their TNI codes.</p>
Net Energy	<p>Net Energy (N) = Export/Load (E) – Import/Generation (B)</p> <p>Notes:</p> <ul style="list-style-type: none">• Metering data (in MDFF and MDMF files) adopts a signage convention that is the reverse of that in the NER.<ul style="list-style-type: none">• Metering data uses a positive quantity for load and a negative quantity for generation.<ul style="list-style-type: none">• I.e. For metering data provided to market participants and AEMO by MDPs, a positive Net Energy quantity at a NMI indicates a net outflow from the connection point while a negative Net Energy quantity indicates a net inflow.• This does not pose any issues for AEMO's systems as import and export values are recorded separately and are able to be interpreted appropriately.
Floored Load	<p>Where the Net Energy is negative for a TI on a <i>distribution network connection point</i>, the ME- quantity is set to 0.</p>

UFE Acronyms Relevant to this Agenda Item

Term	Description
TME	The amount of electrical energy flowing at each of the transmission network connection points in the local area i.e. sum of all TNI energy into and out of a local area
DDME	The amount of electrical energy flowing at each of the distribution network connection points in the local area which are connected to an adjacent local area i.e. sum of all Cross Boundary metered energy into and out of a local area
ADME	The aggregate of the amounts represented by (ME x DLF) for that trading interval for each connection point assigned to the transmission network connection point or virtual transmission node i.e. sum of all NMI energy flows within a local area adjusted by DLF
ME-	The ME- is the quantity of Net Load at a <i>distribution network connection point</i> for each trading interval as recorded on the meter.
ADMELA	The aggregate of the amounts represented by DME for that trading interval for each market connection point in that local area i.e. sum of all net NMI energy loads within a local area, net generation is set to 0 for the trading interval
UFE	The total unaccounted for <i>energy</i> for each <i>trading interval</i> i.e. residual energy associated to a local area after all metered energy has been allocated
UFEF	A factor to determine the allocation of UFE to each (or group of) <i>energy</i> loads at each <i>market connection point</i> (adjusted by DLF) for each <i>trading interval</i> i.e. factor that can be applied to applicable loads within the local area to determine its allocation of UFE

Creation of UFE Factor (UFEF)

Clause 3.15.5 (c) of the Rules provides the following formula for UFE allocation:

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

- For a local area two values are used for all FRMPs

UFE = Unaccounted for energy for the local area

ADMELA = Aggregated amount of DME for the local area

- Mathematically the formula can be translated to:

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

- A constant (i.e. a factor) allows a value to be applied to any DME within the same local area and trading interval

$$UFEF = (UFE/ADMELA)$$

- Applying factor to formula:

$$UFEA = UFEF \times DME$$

Difference between UFE Acronyms

- UFE - Unaccounted for Energy
 - This is the energy value for each trading interval for the local area
 - Calculated as part of metering
- UFEF – Unaccounted for Energy Factor
 - A profile factor that can be applied to a load to determine the UFE to allocate
 - Calculated as part of metering
- UFEA – Unaccounted for Energy Allocation
 - The actual energy value allocated to the distribution load
 - Calculated as part of settlements

AEMO's Calculation of UFE and UFEF - EasyLand (TI 1)

Local Area 1 = EasyLand (TI 1)

TNIs

- MPET = +100
- MPEB = +150

TME = +250

Cross Boundary

E2WNW2E1 = +62

DDME = +62

NMIs (DLF adjusted)

- MPET ELCP0001 = +30
- MPET ELCP0002 = +20
- MPET ELCP0003 = +40
- MPEB ELCP0004 = +25
- MPEB ELCP0005 = +35
- MPEB ELCP0006 = +30

ADME = +180

NMIs with Net Load

ADMELA = +180

Rules Clause 3.15.5(a)

$$UFE = TME - DDME - ADME$$

$$UFE = 250 - 62 - 180$$

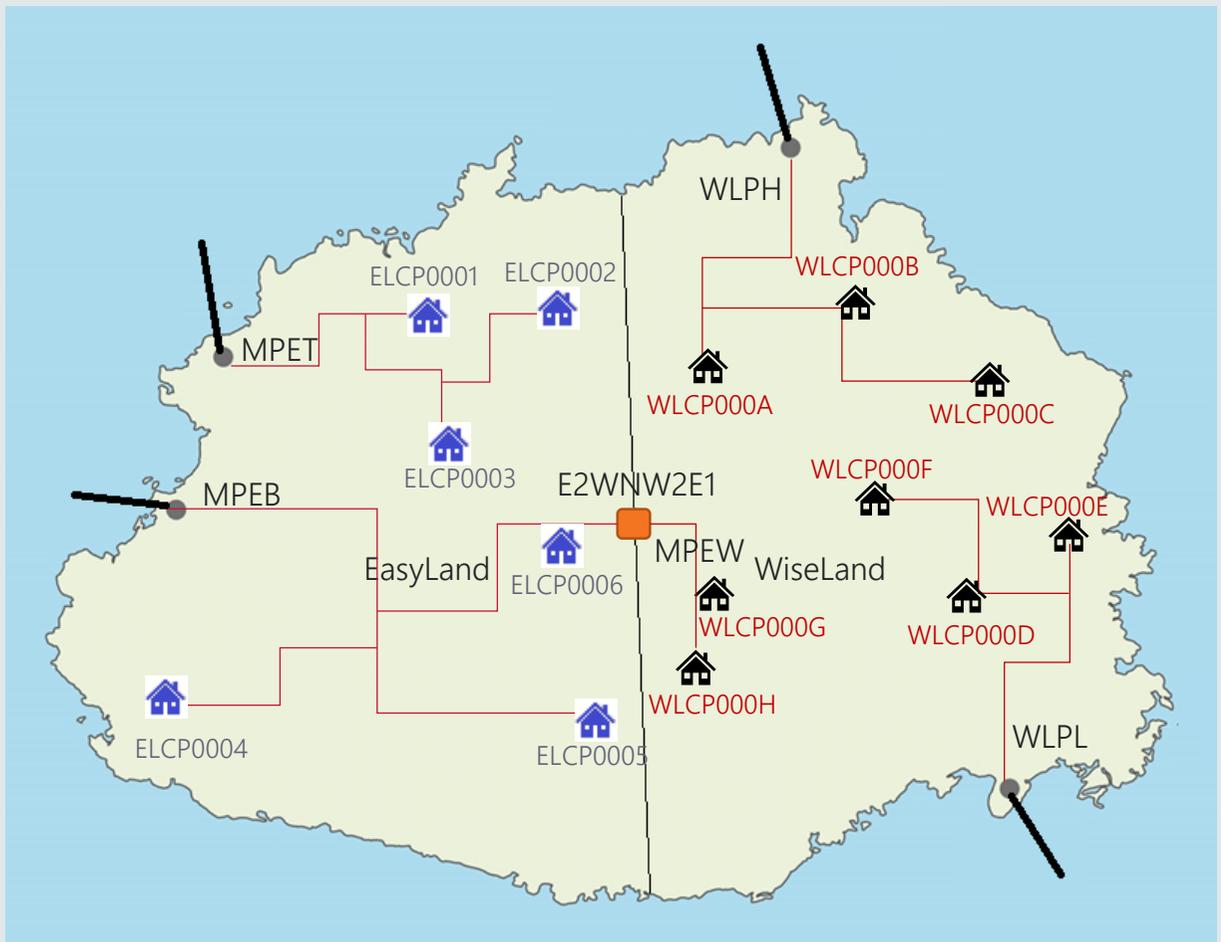
$$UFE = +8$$

$$UFE \text{ Factor (UFEF)} = UFE / ADMELA$$

$$UFEF = 8 / 180$$

$$UFEF = 0.04444444$$

(Note: Decimal precision to be confirmed)



AEMO's Calculation of UFE and UFEF - EasyLand (TI 2)

Local Area 1 = EasyLand (TI 2)

TNIs

MPET = +110

MPEB = +180

TME = +290

Cross Boundary

E2WNW2E1 = +58

DDME = +58

NMIs (DLF adjusted)

MPET ELCP0001 = +17

MPET ELCP0002 = +37

MPET ELCP0003 = +42

MPEB ELCP0004 = +7

MPEB ELCP0005 = +77

MPEB ELCP0006 = +42

ADME = +222

NMIs with Net Load

ADMELA = +222

Rules Clause 3.15.5(a)

$$UFE = TME - DDME - ADME$$

$$UFE = 290 - 58 - 222$$

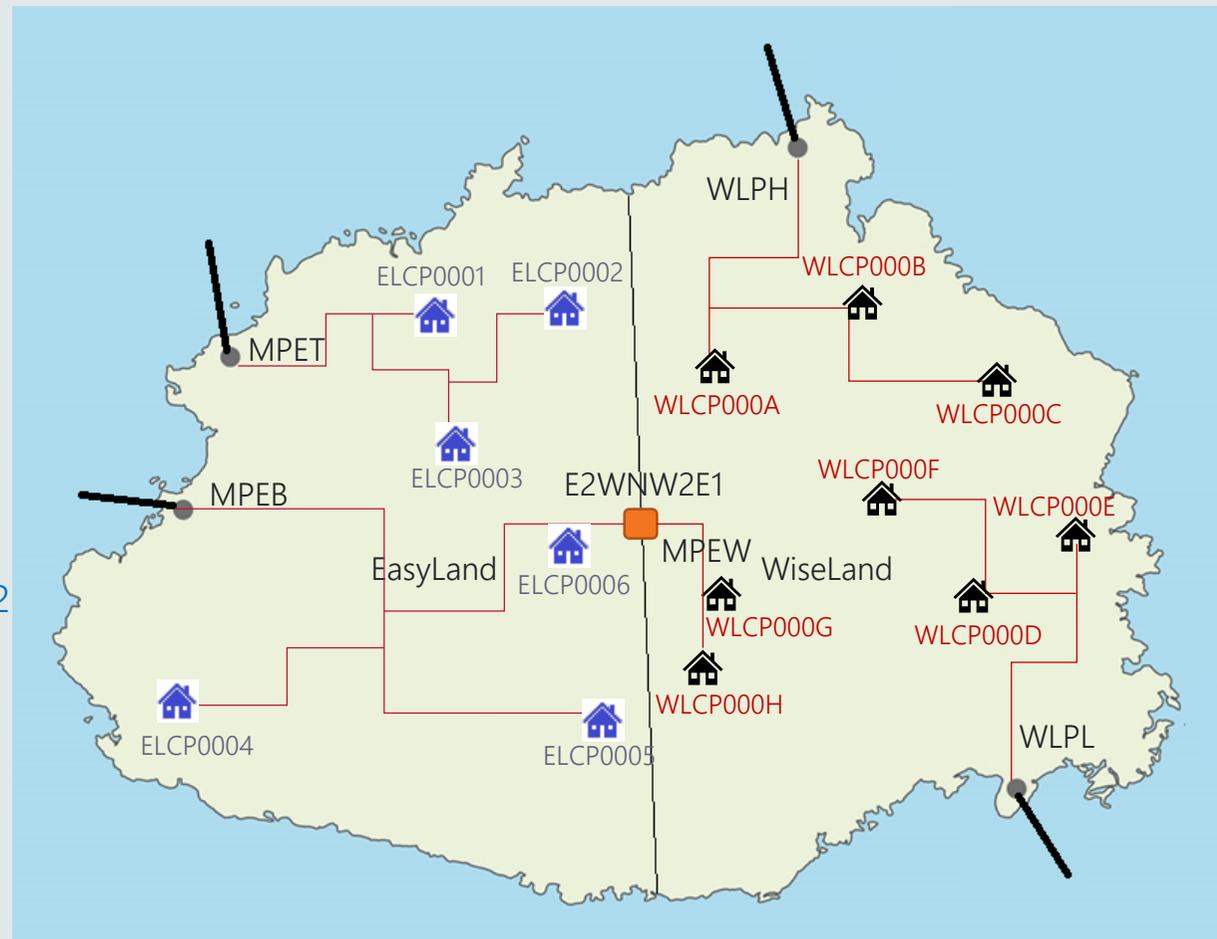
$$UFE = +10$$

$$UFE \text{ Factor (UFEF)} = UFE / ADMELA$$

$$UFEF = 10 / 222$$

$$UFEF = 0.04504505$$

(Note: Decimal precision to be confirmed)



Calculation of UFE

- Why is UFE calculated at Local Area level
 - Clause 3.15.5 (a)
 - For each *local area*, an amount representing unaccounted for *energy* is determined by *AEMO* for each *trading interval* by the following formula:
 - $UFE = TME - DDME - ADME$
 - Calculation at a TNI can not be performed due to virtual TNIs
 - A virtual TNI is a code that is used in some jurisdictions to group many small loads (i.e. street lighting).
 - As they are not real TNIs there is no TME or DDME values for these TNIs
 - To calculate UFE at TNI level these TNIs would have a Negative UFE = Load.
 - The energy that is actually provided from Metered TNIs would be included in the UFE and changed to retailers that are not responsible for the load
 - Instead the UFE is allocated to all loads within the local area

AEMO's Calculation of UFE and UFEF - WiseLand (TI 1)

Local Area 1 = WiseLand (TI 1)

TNIs

WLPH = +100

WLPL = +100

TME = +200

Cross Boundary

E2WNW2E1 = -62

DDME = -62

NMIs (DLF adjusted)

WLPH WLCP000A = +10

WLPH WLCP000B = +20

WLPH WLCP000C = +40

WLPL WLCP000D = +50

WLPL WLCP000E = +15

WLPL WLCP000F = +45

MPEW WLCP000G = +10

MPEW WLCP000H = +50

ADME = +240

ADMELA = +240

NMIs with Net Load

Rules Clause 3.15.5(a)

$UFE = TME - DDME - ADME$

$UFE = 200 - (-62) - 240$

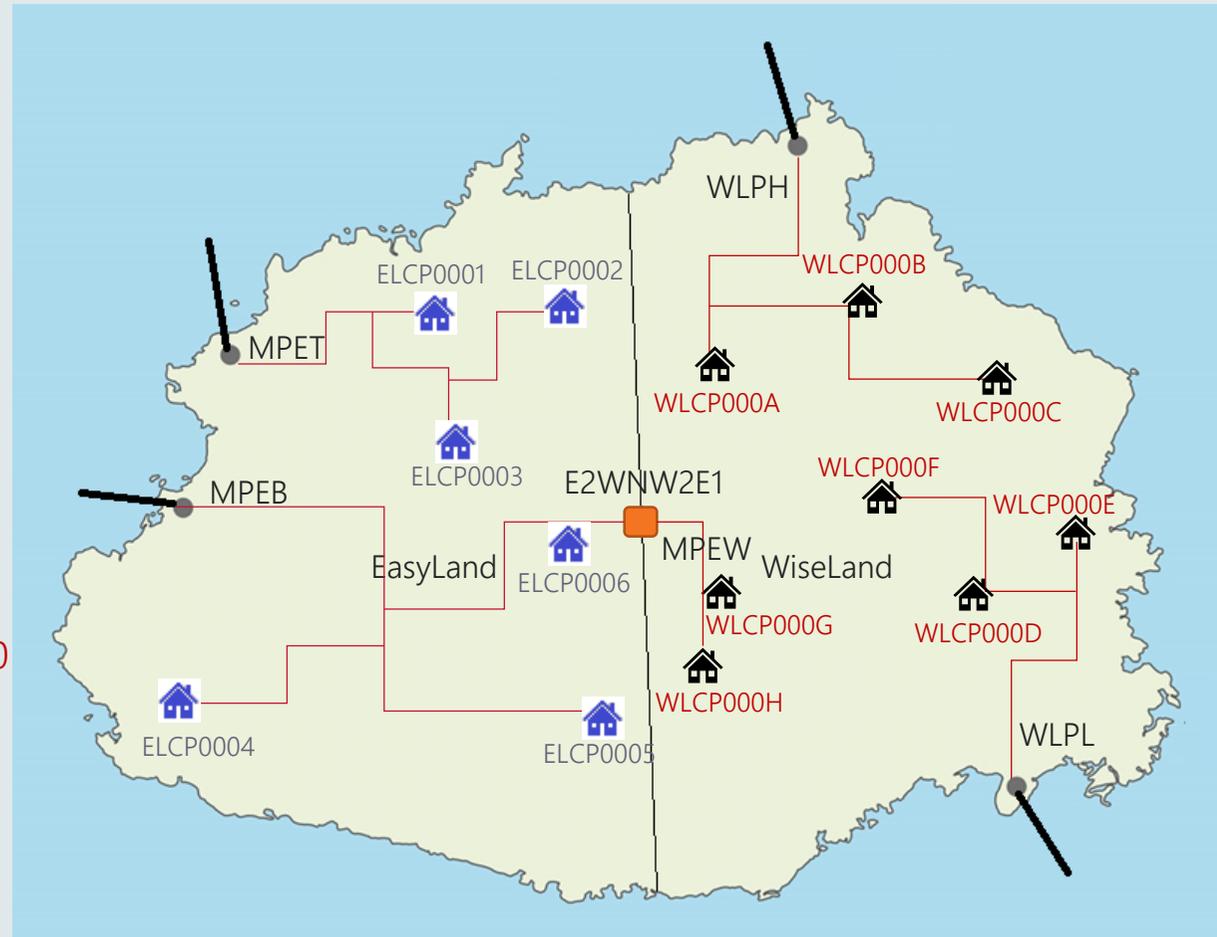
$UFE = +22$

$UFE\ Factor\ (UFEF) = UFE / ADMELA$

$UFEF = 22 / 240$

$UFEF = 0.09166667$

(Note: Decimal precision to be confirmed)



AEMO's Calculation of UFE and UFEF - WiseLand (TI 2)

Local Area 1 = WiseLand (TI 2)

TNIs

WLPH = +120

WLPL = +130

TME = +250

Cross Boundary

E2WNW2E1 = -58

DDME = -58

NMIs (DLF adjusted)

WLPH WLCP000A = +47

WLPH WLCP000B = +17

WLPH WLCP000C = +37

WLPL WLCP000D = +67

WLPL WLCP000E = +57

WLPL WLCP000F = +52

MPEW WLCP000G = +52

MPEW WLCP000H = -40

NMIs with Net Load

ADME = +289

ADMELA = +329

Rules Clause 3.15.5(a)

$UFE = TME - DDME - ADME$

$UFE = 250 - (-58) - 289$

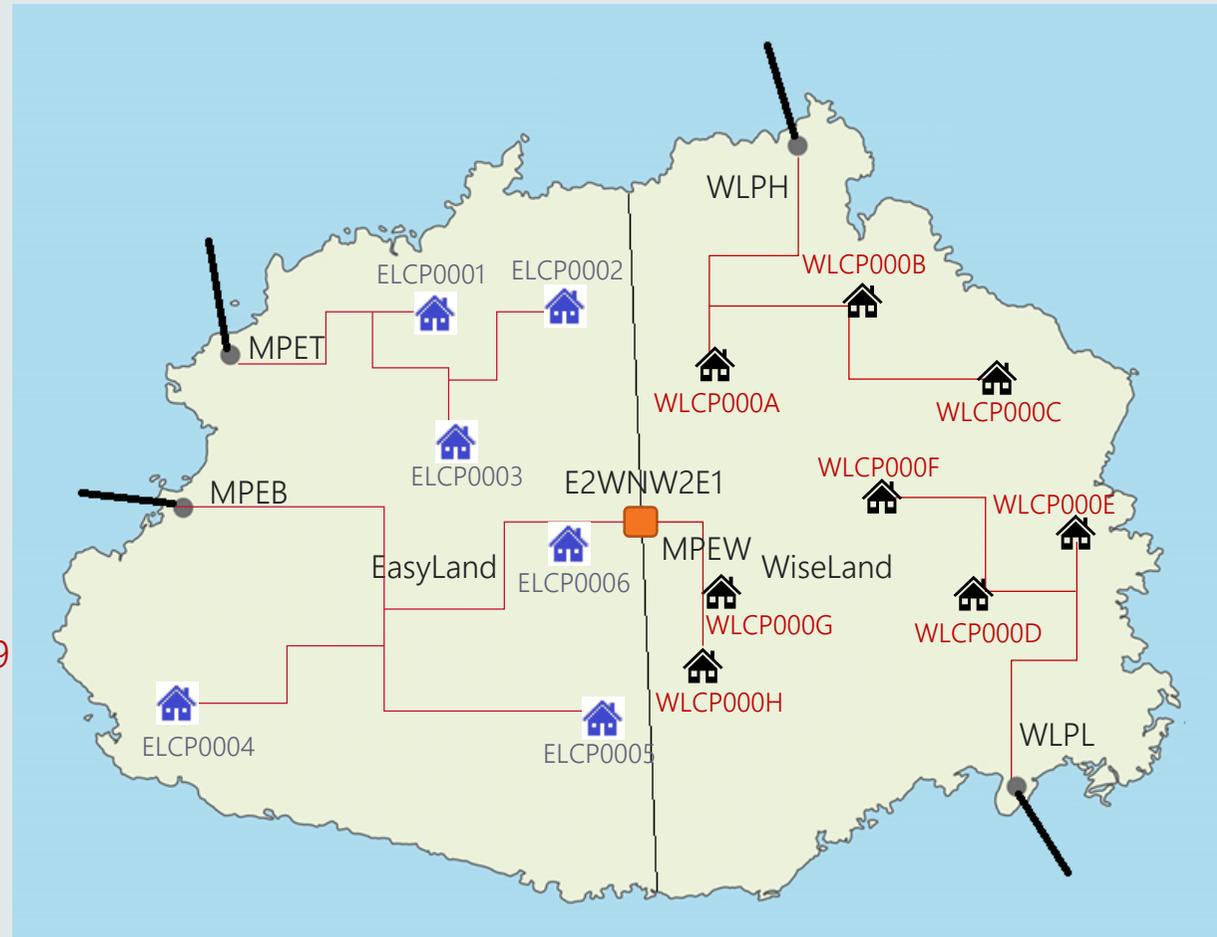
UFE = +19

$UFE\ Factor\ (UFEF) = UFE / ADMELA$

$UFEF = 19 / 329$

UFEF = 0.05775076

(Note: Decimal precision to be confirmed)



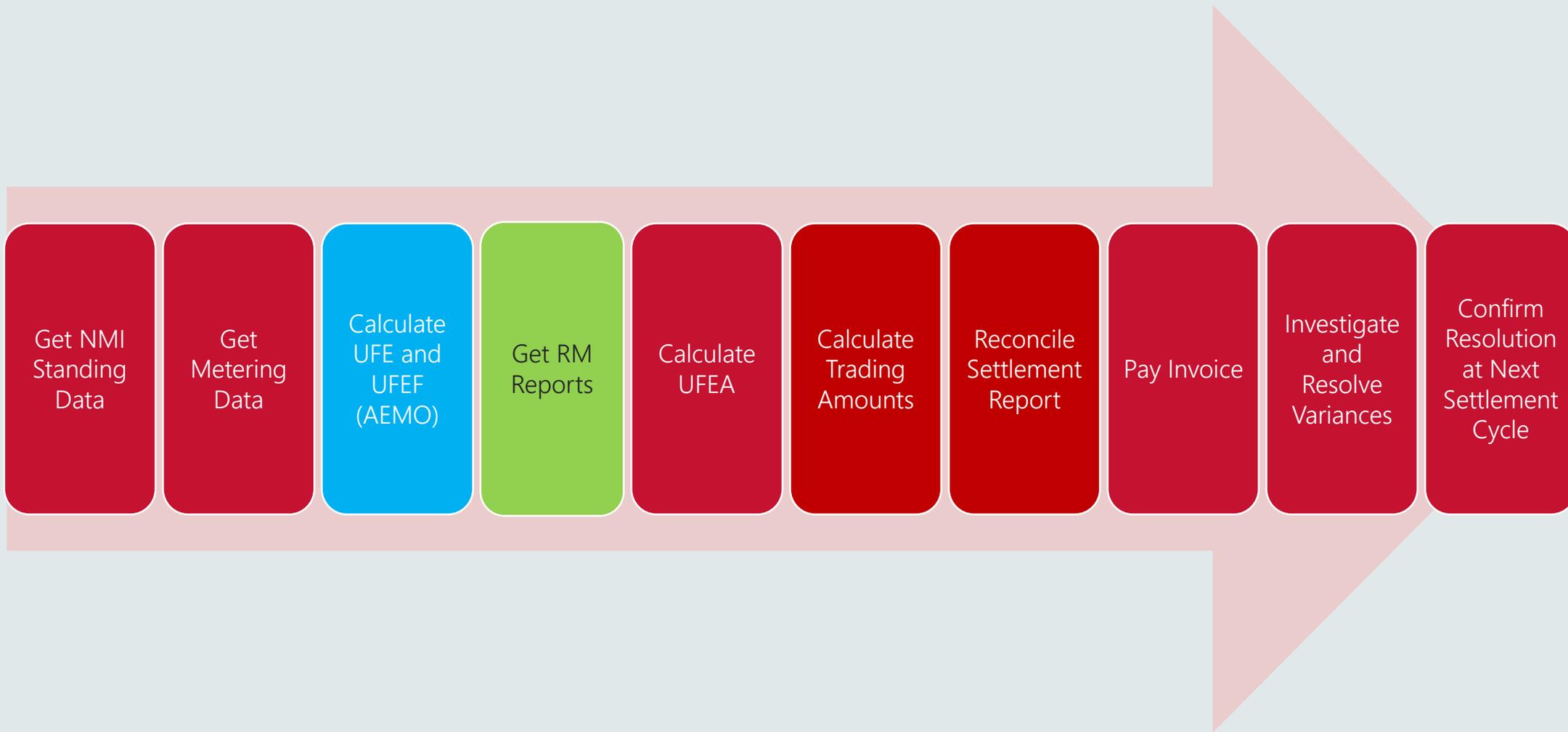
UFE and when it is applied

- UFE is **not** applied to:
 - NMI with GENERATR or NREG NMI Classification Codes
 - Transmission Connection Points
 - Any Trading Interval that has recorded a Net generation
 - Embedded Network Off-Market Child connection points
- UFE is applied to (*excluding above*):
 - Distribution Connection Points
 - Embedded Network Parent connection points
 - Embedded Network On-Market Child connection points

Mocked-up examples of RM reports

Paul Lyttle

Mocked-up examples of RM reports



RM43 Report Example

RM43 UFE Factor Value by Local Area:

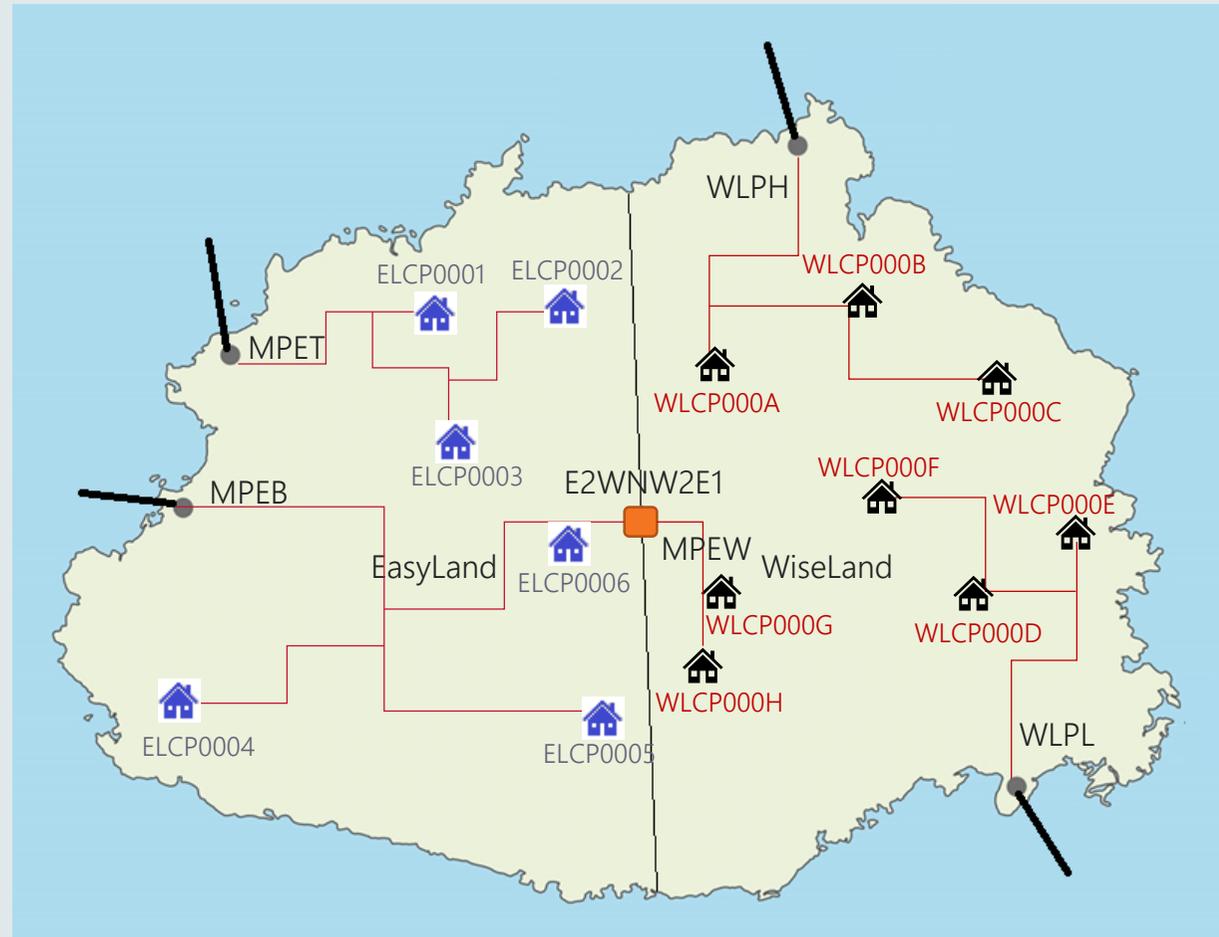
EasyLand (TI 1) UFEF = 0.04444444
 EasyLand (TI 2) UFEF = 0.04504505
 WiseLand (TI 1) UFEF = 0.09166667
 WiseLand (TI 2) UFEF = 0.05775076

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RM46 UFE Validation Report

- Purpose to provide values to support the calculation of UFE and UFEF.
- New report to Identify each Local Area for each TI

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RM46 UFE Factor Value by Local Area

	(TI 1)	(TI 2)
EasyLand		
TME	250	290
DDME	62	58
ADME	180	222
UFE	8	10
ADMELA	180	222
UFEF	0.044444444	0.04504505

	(TI 1)	(TI 2)
WiseLand		
TME	200	250
DDME	-62	-58
ADME	240	289
UFE	22	19
ADMELA	240	329
UFEF	0.09166667	0.05775076

How to calculate UFEA - Example 1

The RM17 is a:

- NMI level settlement data report
- Providing interval data

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Calculation of UFEA (ELCP0001 ti1)

$$\begin{aligned} \text{UFEA} &= \text{Net Energy ti} \times \text{UFEF ti} \\ &= 30 \times 0.04444444 \\ &= 1.33333 \end{aligned}$$

The RM43 is a:

- UFE Factor report
- Providing a UFE factor for each time interval

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9876, F, WISELAND, 2019/10/05, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 10
9876, F, WISELAND, 2019/10/06, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 11
9876, F, WISELAND, 2019/10/07, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 12
9876, F, WISELAND, 2019/10/08, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 13
9876, F, WISELAND, 2019/10/09, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 14
```

</csv data>

How to calculate UFEA - Example 2

The RM17 is a:

- NMI level settlement data report
- Providing interval data

<csv data>

```
SettlementDate,NMI,Suffix,CreationDT,Period001,Period002,Period..., StatusFlags,SeqNo
2019/10/03, WLCP000H,N1,2019/10/20,30,-40,,,,,AA.....,1
2019/10/04, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,2
2019/10/05, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,3
2019/10/06, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,4
2019/10/07, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,5
2019/10/08, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,6
2019/10/09, WLCP000H,N1,2019/10/20,n0000,n0000,,,,,AA.....,7
```

</csv data>

Calculation of UFEA (WLCP000H ti1)

UFEA = Net Energy ti x UFEF ti

$$= 30 \times 0.09166667$$

$$= 2.7500001$$

Calculation of UFEA (WLCP000H ti2)

UFEA = Net Energy ti x UFEF ti

$$= 0 \times 0.05775076$$

$$= 0$$

Net Energy for period is "Floored" to 0
therefore no UFE is allocated

The RM43 is a:

- UFE Factor report
- Providing a UFE factor for each time interval

<csv data>

```
CASEID, SETTLEMENTTYPE, LOCALAREA, SETTLEMENTDATE, CREATIONDATE, PERIOD001,
PERIOD002, PERIOD..., SEQ
9876, F, EASYLAND, 2019/10/03, 2019/10/20, 0.044444444, 0.04504505,,,,, 1
9876, F, EASYLAND, 2019/10/04, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 2
9876, F, EASYLAND, 2019/10/05, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 3
9876, F, EASYLAND, 2019/10/06, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 4
9876, F, EASYLAND, 2019/10/07, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 5
9876, F, EASYLAND, 2019/10/08, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 6
9876, F, EASYLAND, 2019/10/09, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 7
9876, F, WISELAND, 2019/10/03, 2019/10/20, 0.09166667, 0.05775076,,,,, 8
9876, F, WISELAND, 2019/10/04, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 9
9876, F, WISELAND, 2019/10/05, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 10
9876, F, WISELAND, 2019/10/06, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 11
9876, F, WISELAND, 2019/10/07, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 12
9876, F, WISELAND, 2019/10/08, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 13
9876, F, WISELAND, 2019/10/09, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 14
```

</csv data>

Using the UFEF with one or many NMIs

UFE Factors Value for EASYLAND

Applying UFEF to a single NMI Load

<i>TNI</i>	<i>NMI</i>	<i>TI 1</i>	<i>TI 2</i>
MPET	ELCP0001	+30	+17
	UFEF	0.04444444	0.04504505
	UFEA	1.33333	0.73577

Applying UFEF to a FRMP's Load

<i>TNI</i>	<i>NMI</i>	<i>TI 1</i>	<i>TI 2</i>
MPET	ELCP0001	+30	+17
MPET	ELCP0003	+40	+42
MPEB	ELCP0004	+25	+7
MPEB	ELCP0005	+35	+77
	<i>Total</i>	+130	+148
	UFEF	0.04444444	0.04504505
	UFEA	5.77777	6.66667

UFE Factors Value for WISELAND

Applying UFEF to a single NMI Load

<i>TNI</i>	<i>NMI</i>	<i>TI 1</i>	<i>TI 2</i>
WLPH	WLCP000C	+40	+37
	UFEF	0.09166667	0.05775076
	UFEA	3.66666	2.13677

Applying UFEF to a FRMP's Load

<i>TNI</i>	<i>NMI</i>	<i>TI 1</i>	<i>TI 2</i>
WLPH	WLCP000C	+40	+37
WLPL	WLCP000E	+15	+57
WLPL	WLCP000F	+45	+52
MPEW	WLCP000H	+50	0 *
	<i>Total</i>	+150	+146
	UFEF	0.09166667	0.05775076
	UFEA	13.75	8.43161

WLCP000H has a Net Energy inflow (Generation) of -40
 (UFE is only allocated where there is load (in a TI),
 therefore WLCP000H is 'Floored' to 0 KWh)

RM16 – Level 1 Settlement Reconciliation

RM27 – Level 2 Settlement Reconciliation

The **RM16**:

- Is an aggregated TNI settlement data report
- Provides interval data for each FRMP, LR & MDP combination

```

<csv data>
TNI,DataType,FRMP,LR,MDP,CreationDT,SettlementDate,Period001,Period002,.....,SeqNo
WLPH,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/03,70,101,.....,1
WLPH,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/04,0nnnn,0nnnn,.....,2
WLPH,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/05,0nnnn,0nnnn,.....,3
WLPH,I,FRMP1,.....,7
WLPL,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/03,110,176,.....,8
WLPL,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/04,0nnnn,0nnnn,.....,9
WLPL,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/05,0nnnn,0nnnn,.....,10
WLPL,I,FRMP1,.....,14
MPEW,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/03,60,12,.....,15
MPEW,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/04,0nnnn,0nnnn,.....,16
MPEW,I,FRMP1,LR1,MDP123,2019/10/20,2019/10/05,0nnnn,0nnnn,.....,17
MPEW,I,FRMP1,.....,21
</csv data>

```

The **RM27**:

- Is a NMI Level daily settlement data report
- Provides total daily NMI data

```

<csv data>
TNI,LR,MDP,SettlementDate,NMI,DataType,MSATS_Est,Total_Energy,SeqNo
MPET,LR1,MDP123,2019/10/03,ELCP0001,I,N,47,1
MPET,LR1,MDP123,2019/10/04,ELCP0001,I,N,n0000,2
MPET,LR1,MDP123,2019/10/05,ELCP0001,I,N,n0000,3
MPET,LR1,MDP123,2019/10/06,ELCP0001,I,N,n0000,4
MPET,LR1,MDP123,2019/10/07,ELCP0001,I,N,n0000,5
MPET,LR1,MDP123,2019/10/08,ELCP0001,I,N,n0000,6
MPET,LR1,MDP123,2019/10/09,ELCP0001,I,N,n0000,7
</csv data>

```

Notes:

- RM16 and RM27 are used to reconcile Energy Sales and Purchases, however, they are unable to be used to calculate UFEA. This is because the data contained in these reports are aggregated to daily and participant combination levels respectively, which is not the necessary level of granularity to reconcile UFEA.
- RM17 and RM43 reports are to be used for UFEA purposes.

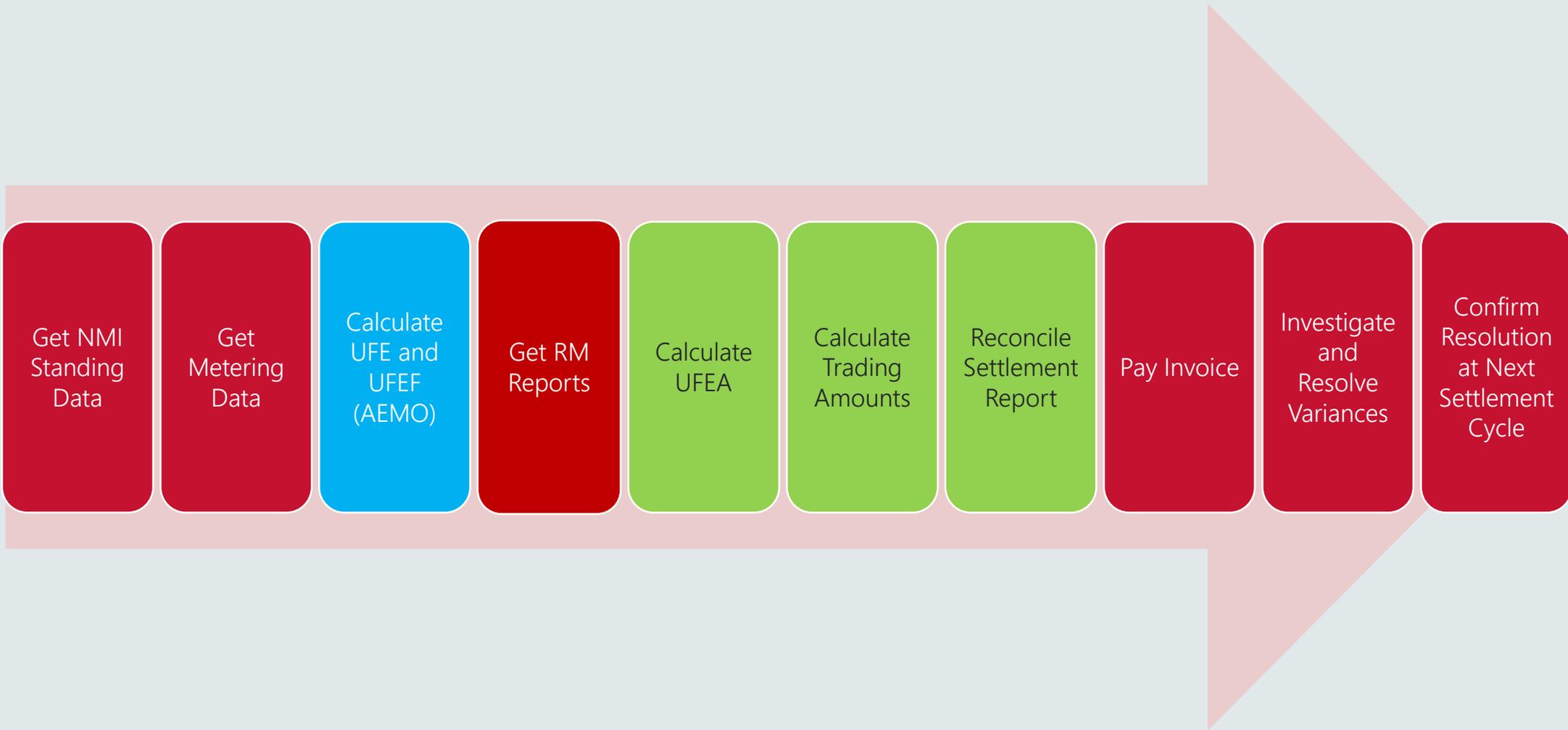
UFE report summary

- RM43 – UFE Factor Values by Local Area
 - List of UFEF values for each trading Interval for each local area (public)
- RM46 – UFE and Factor Calculation
 - List of all components used to calculate the UFE and UFEF values for each trading Interval for each local area (public)

Settlements - UFE allocation

Pierre Fromager

Settlements - UFE allocation



Introduction

- How Settlements
 - Receives and applies aggregated values from Metering
 - Calculates DME and ADMELA
 - Allocates UFEA
- Review of AGE (adjusted gross energy) and TA (trading amount)
- Embedded networks
- Reporting of ADME and UFEA
- Data Model tables
- Review invoices and statements

Aggregation

- Let AFE be 'accounted-for 'energy', adjusted by DLFs.
- Metering gathers import, export and net export data from each NMI and applies the DLF.
- It then aggregates these AFE quantities to a unique combination of Participant, TNI (or transmission connected generators and customers), NMI Classification and trading interval.

$$AFE = import - export$$

Warning

- **Metering Reports** (from MDPs and AEMO) reflect the direction of flow relative to the meter:
 - Negative (generation) to the meter
 - Positive (consumption) from the meter
 - Net Energy = consumption - generation (i.e. Net Energy)
- **Settlements** view the flow of energy from the grid
 - Positive (generation) to the grid
 - Negative (consumption) from the grid.
 - AFE = generation - consumption (i.e. Net Energy x -1)

Calculating DME and ADMELA

Scenario	Import (G)	Export (C)	Net (AFE)	Export Net
NMI 1 (Net consumption customer)	5	7	-2	2
NMI 2 (Net generation customer)	6	5	1	0
NMI 3 (Embedded Generator)	5	0	5	0
NMI 4 (Consumption customer)	0	12	-12	12

- DME = Export Net
 - e.g. the DME for NMI 4 above is -12
- ADMELA = sum of DME for the local area
 - i.e. assuming that these four NMIs represent the local area, the ADMELA would be -14 (-2+0+0-12)

Allocating UFE

- Metering also provides UFE for a local area, so Settlements can calculate UFEA:

$$UFEA = UFE \times \frac{DME}{ADMELA}$$

In Wiseland TI 2, for WLPH WLCP000A, $UFEA = -19 * -47 / -329 = - 2.71428571$

Resulting values

The Rules provide the following formulas

Metering Quantity

$$AGE = (ME \times DLF) + UFEA$$

i.e.

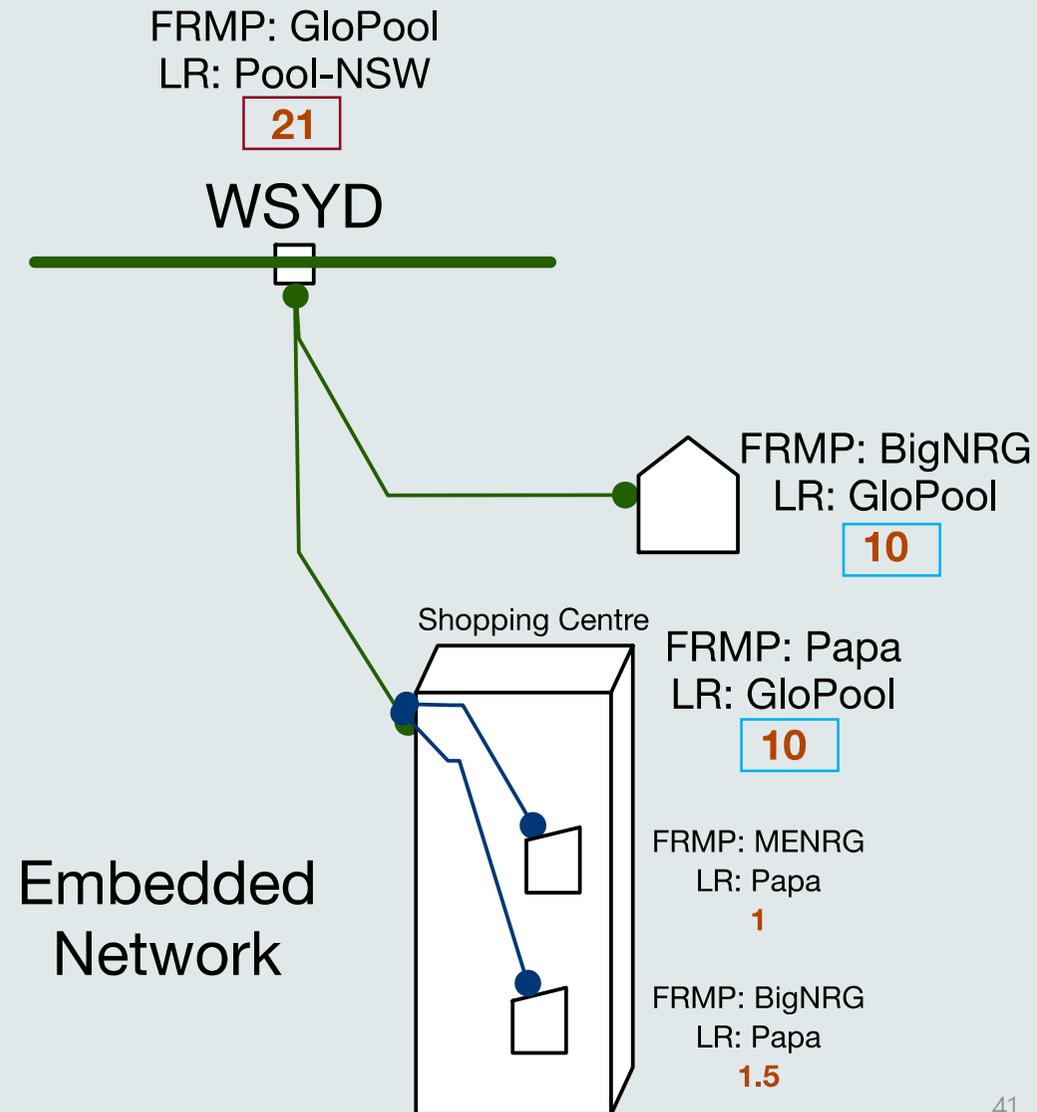
$$AGE = AFE + UFEA$$

Settlement Value

$$TA = AGE * TLF * RRP$$

Embedded Networks

- Continue to use 'settlement by difference':
 - The parent NMI's AFE is adjusted by the total of the AFE of all child NMIs in the network.
- The UFE allocation is then applied to resulting adjusted amounts.
- $UFE = 21 - (10 + 10) = 1$
- AGE for Papa =
 - $DME = 10 - 1 - 1.5 = 7.5$
 - $UFEA = (7.5/21) \times 1 = 0.35714$
 - $AGE = 7.5 + 0.35714 = 7.85714$
- AGE for BigNRG =
 - $10 + 1.5 + 0.54762 = 12.04762$
- AGE for MENRG =
 - $1 + 0.04762 = 1.04762$



Review of AGE and TA

Energy Transactions

	Aggregate Energy (Mwh)	Trading Amount (\$)	UFE Allocated (Mwh)
Total Sales	9,999,999.99	\$9,999,999.99	
Total Purchases	9,999,999.99	\$9,999,999.99	9,999.99
Nett Sales (Purchases)	9,999,999.99	\$9,999,999.99	9,999.99

- Total Sales: AGE and TA for 'Generator' or 'SGA' category.
- Total Purchases: AGE and TA for 'Customer' category,
- UFEA is provided as information only.
 - Prior to 6/2/22, AGE does not include UFEA
 - From 6/2/22, AGE does include UFEA – Report is not changed, just the value.

SR – Base energy summary

Until 5 Feb 2022

Energy Transactions	Aggregate Energy (Mwh)	Trading Amount (\$)	UFE Allocated (Mwh)
Total Sales	250	\$25,000,00	
Total Purchases	289	\$28,900.00	19
Nett Sales (Purchases)	(39)	(\$3,900.00)	(19)

From 6 Feb 2022, UFEA is added to Total Purchases.

Energy Transactions	Aggregate Energy (Mwh)	Trading Amount (\$)	UFE Allocated (Mwh)
Total Sales	250	\$25,000,00	
Total Purchases	308	\$30,800.00	19
Nett Sales (Purchases)	(58)	(\$5,800.00)	(19)

Settlement report – Base energy summary

- AEMO highlighted that the settlement report examples are based on RM report examples in the previous (metering) section. This is so that participants can see how the information maps from the RM reports through to settlements reports.
- One participant enquired about the difference between the total purchases of 289 MWh and 308 MWh in the tables above. AEMO responded that the 289 MWh is the total customer energy, adjusted for DLF, prior to Global Settlements. It does not include the UFEA of 19. Assuming else is the same, from 6 Feb 2022, the UFEA of 19 is added, so 289 becomes 308.

SR – Base energy detail

Sales (Purchases) by Transmission Connection Point

Transmission Node	Description	Aggregate Energy (MWh)	Trading Amount (\$)	Load Wtd Avg. Price (\$/MWh)	DME (MWh)	UFEA (MWh)
AAAA1	Temporary	9,999.99	\$9,999.99	\$9,999.99	9,999.99	9,999.99
BBBB2	Temporary	9,999.99	\$9,999.99	\$9,999.99	9,999.99	9,999.99
CCCC3	Temporary	9,999.99	\$9,999.99	\$9,999.99	9,999.99	9,999.99

- This section of the SR report is changing with the addition of the DME and the UFEA for each transmission node.
- DME: total DME for this participant and transmission node, across this billing period.
- UFEA: total UFEA for this participant and transmission node, across this billing period.

Reporting – SR – Base energy detail

Sales (Purchases) by Transmission Connection Point

Transmission Node	Description	Aggregate Energy (Mwh)	Trading Amount (\$)	Load Wtd Avg. Price (\$/Mwh)	DME (Mwh)	UFEA (Mwh)
WLPH	Temporary	(101.00)	(\$10,100.00)	\$100.00	(101.00)	(5.83)
WLPL	Temporary	(176.00)	(\$17,600.00)	\$100.00	(176.00)	(10.17)
MPEW	Temporary	(12.00)	(\$1,200.00)	\$100.00	(52.00)	(3.00)

Note: Based on WiseLand (TI 2) Example

Data Model Tables: SETTLEMENT_DATA

SETCPDATA

Field Name	Data Type	Description
AFE	NUMBER (18,8)	Adjusted Gross Energy for this Market Customer FRMP and TNI in the trading interval, excluding any UFEA component.
DME	NUMBER (18,8)	Sum of "ME-" for all NMI's at this Market Customer FRMP and TNI in the trading interval.
UFEA	NUMBER (18,8)	Share of UFE allocated to this FRMP and TNI in the trading interval
AGE	NUMBER (18,8)	Adjusted Gross Energy for this Market Customer FRMP and TNI in the trading interval. This will include the UFEA value once financial settlement of UFE commences on 6th Feb 2022.

SETLOCALAREAENERGY

Field Name	Data Type	Description
SETTLEMENT DATE	DATE	Settlement date of the settlement run
SETTLEMENT RUN NO	INTEGER	Settlement run number of the settlement run
LOCAL AREA ID	STRING (30)	Unique identifier for the local area
PERIOD ID	INTEGER	Period identifier
UFE	NUMBER (18,8)	Total unaccounted-for energy for the local area in this trading interval, in MWh
DDME	NUMBER (18,8)	DDME component of UFE for the local area in this trading interval, in MWh.
TME	NUMBER (18,8)	TME component of UFE for the local area in this trading interval, in MWh.
ADME	NUMBER (18,8)	ADME component of UFE for the local area in this trading interval, in MWh.
ADMELA	NUMBER (18,8)	The sum of all DME amounts for each Market Customer FRMP and TNI in the local area, in this trading interval.
LAST CHANGED	DATETIME	Last changed date for the record

SETLOCALAREATNI

Field Name	Data Type	Description
SETTLEMENT DATE	DATE	Settlement date of the settlement run
SETTLEMENT RUN NO	INTEGER	Settlement run number of the settlement run
LOCAL AREA ID	STRING (30)	Unique identifier for the local area
TNI	STRING (30)	Unique identifier for a TNI constituent to the local area as-at the settlement run
LAST CHANGED	DATETIME	Last changed date for the record

Data model tables

One participant enquired about who can see and use SETCPDATA.

The MMS Data Model Report states: "The Connection point details (in SETCPDATA) are confidential to the participant and host retailer that the connection points relate to. By comparison, the regional data (SETCPDATAREGION) is publicly available."

FRMP Reconciliation

FRMPs can reconcile the AEMO settlement data in SETCPDATA using data they can access and applying the following process.

Calculations have been updated based on feedback from workshop regarding calculation of net energy.

- Calculate Net Energy_{NMI}
 - $MDF_{12} = E - B$ per meter interval, profiled as required
 - $MDF_{13} = +\text{values (load)} + -\text{values (generation)}$, profiled

$$\text{Sum Net Energy}_{NMI} \text{ to TNI} = AFE_{TNI}$$

- $AFE_{NMI} \times DLF = DME_{NMI}$
Sum DME_{NMI} to TNI = DME_{TNI}

- $DME_{NMI} \times UFE_{LA} = UFEA_{NMI}$
Sum $UFEA_{NMI}$ to TNI = $UFEA_{TNI}$

- $AFE_{NMI} \times UFEA_{NMI} = AGE_{NMI}$
Sum AGE_{NMI} to TNI = AGE_{TNI}

SETCPDATA

Field Name	Data Type	Description
AFE	NUMBER (18,8)	Adjusted Gross Energy for this Market Customer FRMP and TNI in the trading interval, excluding any UFEA component.
DME	NUMBER (18,8)	Sum of "ME-" for all NMI's at this Market Customer FRMP and TNI in the trading interval.
UFEA	NUMBER (18,8)	Share of UFE allocated to this FRMP and TNI in the trading interval
AGE	NUMBER (18,8)	Adjusted Gross Energy for this Market Customer FRMP and TNI in the trading interval. This will include the UFEA value once financial settlement of UFE commences on 6th Feb 2022.

Data Model Tables – BILLING_RUN

Gen: Billing_Run: Billing Gen Data

CP: Billing_Run: Billing CP Data

Field	Provenance (DB/ DM)
AGE	Sales: Sum (<u>Gen</u> . Aggregate Energy) Purchases: Sum (<u>CP</u> . Aggregate Energy) + Sum (<u>Gen</u> . Purchased Energy)
TA	Sales: Sum (<u>Gen</u> . Sales) Purchases: Sum (<u>CP</u> . Purchases) + Sum (<u>Gen</u> . Purchases)
UFEA	Sum (<u>CP</u> . UFEA)
Total	Sum of each column: AGE, TA, UFEA.
TNI	<u>Gen</u> . Connection Point ID <i>and</i> <u>CP</u> . Connection Point ID
DME	Sum (<u>CP</u> . DME)

Invoicing – Base energy detail

Supplies made by AEMO	
Taxable supplies	
Description	GST Exclusive (\$)
Energy 24,234 MWh	-6,858.39
Ancillary Service	-557,113.73

For context, the invoice shows the energy quantity and value. This is the AGE and the TA. This is not changing, except in look and feel and the layout of GST values.

Note: UFE will not be published as a dollar value in the tax invoice, although participants can 'derive' a notional dollar value for it.

- Supplies made by AEMO - Energy: purchased energy either by customer or generator, with associated trading amount.
- Supplies made to AEMO - Energy: sold energy by generator, with associated trading amount.

Invoicing – Summary

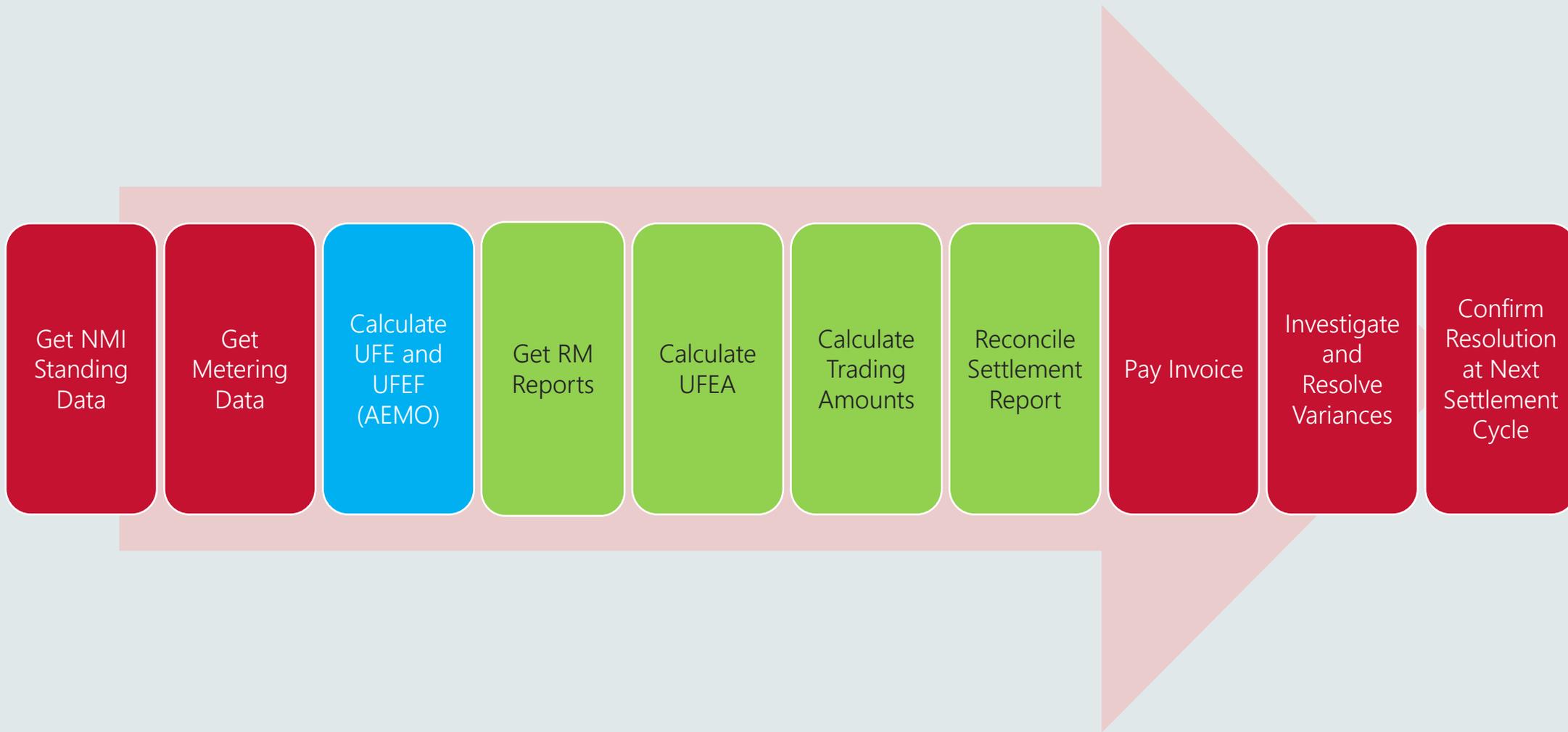
- All energy values are aggregated to one energy value in the summary.

Description	\$
Energy	834,067.84
Ancillary Services	189,190.74

Checkpoint

Blaine Miner

High-Level Reconciliation Overview



Calculate UFEA (NMI/TNI Level)

Based on calculation of UFE and UFEF – **Wiseland TI 2**

Local Area 1 = WiseLand (TI 2)

TNIs WLPH = **+120**
 WLPL = +130 TME = +250

Cross Boundary
 E2WNW2E1 = **-58** DDME = **-58**

NMIs (DLF adjusted)

WLPH WLCPO00A = +47
 WLPH WLCPO00B = +17
 WLPH WLCPO00C = +37
 WLPL WLCPO00D = +67
 WLPL WLCPO00E = +57
 WLPL WLCPO00F = +52
 MPEW WLCPO00G = +52
 MPEW WLCPO00H = **-40** ADME = +289
NMIs with Net Load ADMELA = **+329**

UFE = 250 – (-58) – 289
UFE = +19

UFE Factor (UFEF) = UFE / ADMELA

UFEF = 19 / 329
UFEF = 0.05775076
 (Note: Decimal precision to be confirmed)

The RM17:

<csv data>

```
SettlementDate,NMI,Suffix,CreationDT,Period001,Period002,Period..., StatusFlags,SeqNo
2019/10/03, WLCPO00A,N1,2019/10/20,10,47,,,,,AA,,,,,1
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,2
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,3
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,4
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,5
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,6
2019/10/04, WLCPO00A,N1,2019/10/20,n0000,n0000,,,,,AA,,,,,7
```

</csv data>

The RM43:

<csv data>

```
CASEID, SETTLEMENTTYPE, LOCALAREA, SETTLEMENTDATE, CREATIONDATE, PERIOD001,
PERIOD002, PERIOD..., SEQ
9876, F, EASYLAND, 2019/10/03, 2019/10/20, 0.04444444, 0.04504505,,,,, 1
9876, F, EASYLAND, 2019/10/04, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 2
9876, F, EASYLAND, 2019/10/05, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 3
9876, F, EASYLAND, 2019/10/06, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 4
9876, F, EASYLAND, 2019/10/07, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 5
9876, F, EASYLAND, 2019/10/08, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 6
9876, F, EASYLAND, 2019/10/09, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 7
9876, F, WISELAND, 2019/10/03, 2019/10/20, 0.09166667, 0.05775076,,,,, 8
9876, F, WISELAND, 2019/10/04, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 9
9876, F, WISELAND, 2019/10/05, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 10
9876, F, WISELAND, 2019/10/06, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 11
9876, F, WISELAND, 2019/10/07, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 12
9876, F, WISELAND, 2019/10/08, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 13
9876, F, WISELAND, 2019/10/09, 2019/10/20, 0.0nnnn, 0.0nnnn,,,,, 14
```

</csv data>

Reconcile Settlement Report Values

Sales (Purchases) by Transmission Connection Point

Transmission Node	Description	Aggregate Energy (MWh)	Trading Amount (\$)	Load Wtd Avg. Price (\$/Mwh)	DME (Mwh)	UFEA (MWh)
WLPH	Temporary	(101.00)	(\$10,100.00)	\$100.00	(101.00)	(5.83)
WLPL	Temporary	(176.00)	(\$17,600.00)	\$100.00	(176.00)	(10.17)
MPEW	Temporary	(12.00)	(\$1,200.00)	\$100.00	(52.00)	(3.00)

Local Area 1 = WiseLand (TI 2)

TNIs WLPH = +120
 WLPL = +130 TME = +250

Cross Boundary

E2WNW2E1 = -58 DDME = -58

NMIs (DLF adjusted)

WLPH WLCP000A = +47
 WLPH WLCP000B = +17
 WLPH WLCP000C = +37
 WLPL WLCP000D = +67
 WLPL WLCP000E = +57
 WLPL WLCP000F = +52
 MPEW WLCP000G = +52
 MPEW WLCP000H = -40 ADME = +289
 NMIs with Net Load ADMELA = +329

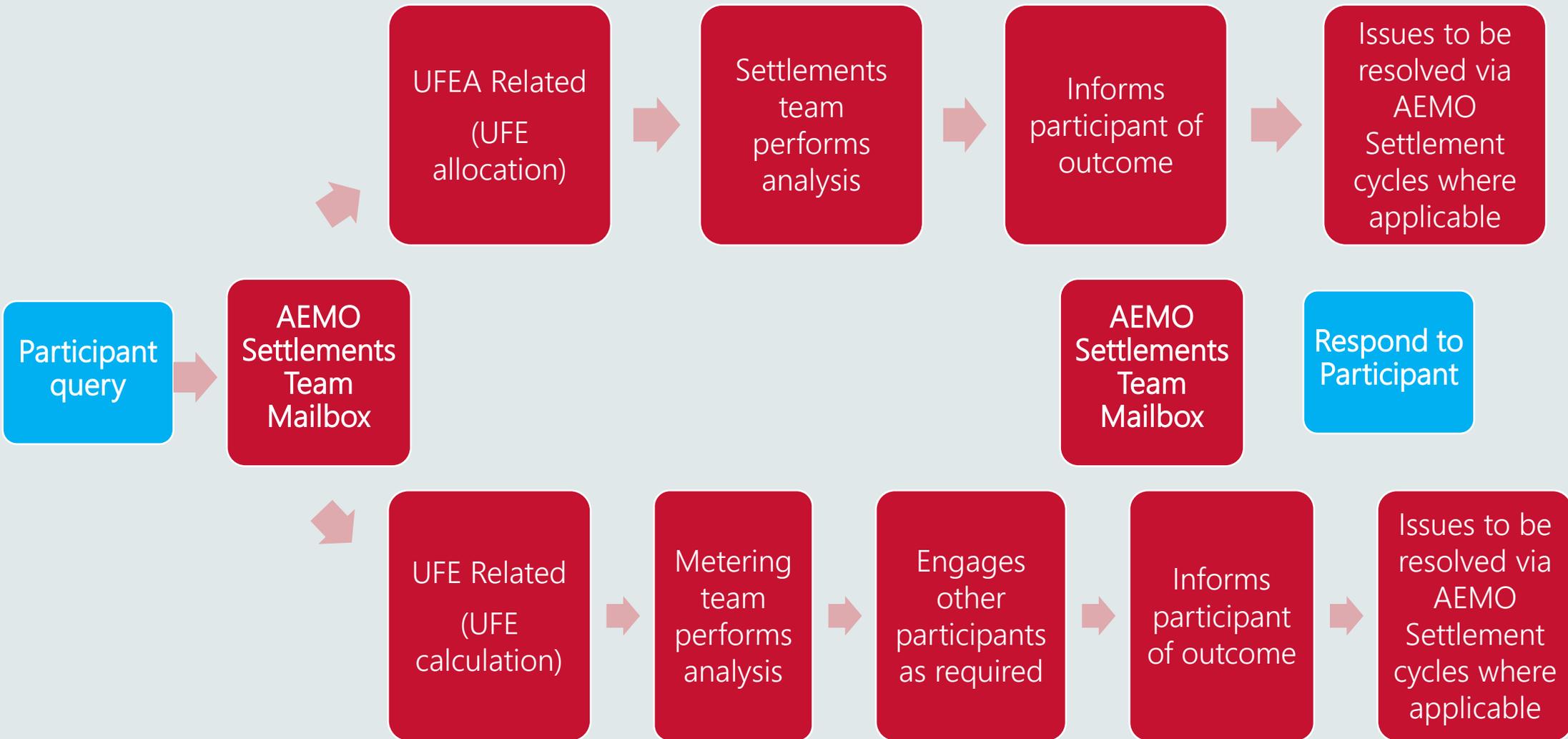
UFE = 250 - (-58) - 289

UFE = +19

UFE enquiry management

Dimi Botha

Internal AEMO Approach



General questions

Blaine Miner

Appendix:

- A. Detailed formulas
- B. Acronyms and terms

A. Detailed Formulas

Aggregation - AFE

PID: participant ID

wcp: wholesale connection point
(TNI or NMI)

IE: Import energy, adjusted by DLF

EE: Export energy, adjusted by DLF

Energy Category (EC):

- Customer
- Generator
- SGA
- Interconnector

es: pid, wcp, ec, ti

$$AFE_{es} = IE_{es} - EE_{es}$$

Aggregation - DME

\forall : "For all", "for each"

\in : "is an element of"

EEN: Export Energy Net

$ec = \text{'Customer'}$

$$DME_{es} = \sum EEN_{es}$$

$\forall pid \in PID$

$\forall ec \in EC$

$\forall wcp \in WCP_{la}$

$$ADMELA_{la,ti} = \sum DME_{es}$$

Allocated UFE

$$UFEA_{es} = UFE_{la,ti} \times \frac{DME_{es}}{ADMELA_{la,ti}}$$

es: pid, wcp, ec, ti

Resulting values

d: Settlement day

r: Region to which the TCP or TNI belongs

$d: ti \in d$

$r: wcp \in r$

$$AGE_{es} = AFE_{es} \times UFEA_{es}$$

$$TA_{es} = AGE_{es} \times TLF_{wcp,d} \times RRP_{r,ti}$$

$es: pid, wcp, ec, ti$

B. Acronyms and Terms

Acronyms and Terms

AGE	<i>Adjusted gross energy</i> , which is the quantity (in MWh) that is used to calculate a FRMPs TA
AFE	<i>Accounted-for energy</i>
DLF	<i>Distribution loss factor</i>
FRMP	<i>Financially responsible market participant</i>
NMI	<i>National metering identifier</i> , which is used to identify a <i>specific connection point</i>
quantity	In this presentation, applies to electrical flows and has a unit of measure of MWh (unlike 'values', which are understood to be financial values)
RRP	<i>Regional reference price</i>
TA	<i>Trading amount</i> , which is payable by (or to) a FRMP <i>Equals: AGE x TLF x RRP</i>
TI	<i>Trading interval</i> , a 30 minute period ending on the hour (EST) or on the half hour and, where identified by a time, means the 30 minute period ending at that time.
TLF	<i>Transmission loss factor</i>
TNI	<i>Transmission node identifier</i> , which is used to identify a <i>transmission network connection point</i> (that is sometimes referred to as 'a wholesale connection point')

'UFE-specific' Acronyms ⁽¹⁾

From rule 3.15.5(a)

TME	<p>'transmission metered energy', is the quantity of <i>energy</i> flowing at a TNI for a TI. It is positive where the flow is towards to a TNI (i.e. generation) and negative where the flow is away from a TNI (i.e. load)</p> <p>Equals: the sum of metered energy (or ME) flowing into and out of a LA at a TNI</p>
ME	<p>'metered energy', is the quantity of flow at a NMI. It is positive where the flow is towards to the TNI (i.e. generation) and negative where the flow is away from the TNI (i.e. load) [rule 3.15.4(b)]</p>
DDME	<p>'distributor to distributor metered energy', is the quantity flowing from one LA to an adjacent LA, at a NMI, for a TI. It is negative where the flow is towards the adjacent <i>distribution network</i> and positive if it s in the other direction.</p> <p>Equals: the sum of all ME that crosses the boundary (i.e. flows into and out of) a LA</p>
ADME	<p>'adjusted distribution metered energy', is the aggregated quantity of all flows at a <i>market connection point</i> (or NMI with a FRMP) for a TI, adjusted by a NMI-specific DLF</p> <p>Equals: sum of ME x DLF for all NMIs in a LA</p>
UFE	<p>'unaccounted-for energy' quantity, is the difference between the metered flows into and out of a LA, for a TI</p> <p>Equals: sum of ME at TNIs for a LA (TME) plus/minus flows from/to another LA (DDME) minus load, or flows out of the LA (ADME)</p>

'UFE-specific' Acronyms ⁽²⁾

From rule 3.15.5(c)

ME-	The ME- quantity is the Net Energy quantity for a distribution network connection point for a TI but only when it is negative (i.e. has load). So, ME- is subject to the 'Floored Load' and is zero for (a) GENERATR or NREG NMI classification codes and (b) NMIs where local generation (e.g. from solar panels) exceeds the load.
DME	'distribution metered energy' quantity, is the sum of single and bi-directional flows at a NMI, and is subject to the Floored Load Equals: $ME- \times DLF$
ADMELA	'adjusted distribution metered energy for a LA' quantity, is the sum of DMEs for a LA, for a TI and is subject to the Floored Load Equals: sum of all DMEs, for a LA
UFEA	'unaccounted for <i>energy</i> – allocated', is the quantity of UFE allocated to an individual NMI. Equals: $UFE \times (DME / ADMELA)$, where $DME = ME \times DLF$

Used to calculate UFEA

UFEF	'unaccounted for energy factor', is used to allocate the UFE for a LA to one or many loads at NMIs that have FRMPs (i.e. <i>market connection points</i>), for a TI. It is the ratio of UFE to the total load for a LA (adjusted by DLF) and is not rounded. Equals: $UFE / ADMELA$
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Thank you for your
attendance and
participation 😊

