PROPOSED PROCEDURE CHANGE (PPC)

Summary Section

Proposal to amend Adelaide weather station from Kent Town to West Terrace and the calculation of heating degree day under Retail Market Procedures (RMP) SA to use forecast rather than actual hours of sun.

Issue Number	IN004/18		
Impacted Jurisdiction(s)	South Australia (SA)		
Proponent	Arjun Pathy	**Company**	AEMO
Proponent e-mail	arjun.pathy@aemo.com.au	**Proponent phone #**	(03) 9609 8983
Affected Gas Market(s)	• Retail	**Date proposal sent to AEMO**	Wednesday, 9 May 2018
Short Issue Title	Change of Adelaide weather station and actual to forecast sunshine hours		
Other key contact information	grcf@aemo.com.au		

VERSION #	PRESENTED TO	DATE
1.0	GRCF	28 February 2019

PROPOSED PROCEDURE CHANGE (PPC) – DETAILED REPORT SECTION

1. DESCRIPTION OF CHANGE(S) AND REASONS FOR CHANGE(S)

Context regarding change of Adelaide weather station

In 2017, AEMO received advice that the Bureau of Meteorology (BoM) would be changing its weather station for the Adelaide region from Kent Town to West Terrace. From 14 June 2017 the West Terrace weather observation station became Adelaide's official observation station. The two stations have been operating in tandem, and the Kent Town station is earmarked to close around the middle of 2019. In preparation for this change, AEMO proposed the creation of a new Register of Weather Related Information, which (instead of Clause 177 of the RMP SA) would document the weather station data in use for calculation of the heating degree day (HDD). This proposal was adopted by the GRCF in IN007-17.

Current weather station use

The Register of Weather Related Information currently lists "Kent Town / ngayirdapira" as its weather station for the Adelaide Region and Adelaide Metropolitan HDD zones. This needs to be changed to list "Adelaide (West Terrace / ngayirdapira)" as its weather station for the Adelaide Region and Adelaide Metropolitan HDD zones.

Forecast and actual sunshine hours

During conversations regarding the change in weather station from Kent Town to West Terrace, the BoM gave advice that it no longer publishes actual sunshine hours (only forecast sunshine hours). Whenever the actual sunshine hours have not been available, the SA Gas Retail Market System has used forecast sunshine hours instead to calculate the HDD. As per the RMP SA, AEMO is to use "hours of sun", taken to mean actual sunshine hours, in certain calculations for the HDD. AEMO sent advice to SA market participants on this matter on 17 July 2017 and no participant raised concerns that forecast data had been used instead of actual data.

In late 2018, AEMO performed an analysis to determine the materiality of using forecast instead of actual sunshine hours. This analysis determined that the estimated maximum daily error at the time that revised statements are issued from using forecast rather than actual sunshine hours would be ±34GJ for the Adelaide STTM. This is because only approximately 2% of winter load comes from basic meters for which there are no actual readings at the time of revision, and because HDD only impacts estimates of heating load (not of base load) (refer to Attachment C for this presentation).

Given the relative immateriality of using forecast compared with actual sunshine hours for estimates at the time of issuing revised settlements along with the absence of data for actual sunshine hours, AEMO proposes the RMP SA be amended such that HDDs be calculated using forecast rather than actual sunshine hours.

Response to IN004/18 GMI

AEMO issued a Gas Market Issue (GMI) paper regarding the proposed changes on Monday 4 February 2019, and a revised version was issued on Wednesday 6 February 2019. The submission window closed on Friday 15 February 2019. AEMO did not receive any feedback on the substance of the proposed changes.

2. REFERENCE DOCUMENTATION

- Retail Market Procedures (SA) – V13
- Register of Weather Related Information

© AEMO 2019

3. THE HIGH LEVEL DETAILS OF THE CHANGE TO THE EXISTING PROCEDURES

AEMO proposes to amend the RMP SA to:

- Modify clause 177(3)(c) to refer only to "hours of sun forecast" as opposed to referring to both "hours of sun" and "[hours of sun] forecast for a gas day".
- Replace references to "hours of sun" in clauses 177(5)(b), 177(5)(c), 177(5)(d), and 177(5)(f) with references to "hours of sun forecast"

AEMO proposes to amend the Register of Weather Related Information to:

- Change the observation station for the Adelaide Region and Adelaide Metropolitan Heating Degree Day (HDD) zones from "Kent Town / ngayirdapira" to "Adelaide (West Terrace / ngayirdapira)".

See attachments A and C for further details.

4. CONSEQUENCES FOR MAKING OR NOT MAKING THE CHANGE(S)

There are two future compliance issues addressed by these changes:

1. If Clause 177 is not amended, AEMO will be unable to comply with the RMP SA, given the BoM no longer provides data on actual sunshine hours.
2. If the Register of Weather Related Information is not amended, once the Kent Town weather station is closed, AEMO will be unable to calculate users' forecast basic-metered withdrawals for the Adelaide Metropolitan and Adelaide Region HDD zones without becoming non-compliant with the RMP SA.

If the proposal is implemented, AEMO will be fully compliant with the RMP SA insofar as the calculation of the HDD.

5. EXPLANATION REGARDING THE ORDER OF MAGNITUDE OF THE CHANGE(S) (IE: MATERIAL, NON-MATERIAL OR NON-SUBSTANTIAL)

AEMO's assessment in terms of the order of magnitude is that the proposed changes are *non-substantial*.

With respect to changing "hours of sun" to read "hours of sun forecast", the change is purely editorial and requires no process or system changes for AEMO or participants.

With respect to changing the weather station for the Adelaide Region and Adelaide Metropolitan HDD zones from Kent Town to West Terrace, AEMO is required to make a minor configuration change only. There are no changes required for the participants.

6. LIKELY BENEFITS FOR INDUSTRY AS A WHOLE

These changes will ensure AEMO is compliant with the RMP SA.

These changes will also ensure that relevant SA market participants can continue to receive user's profiled forecast (inclusive of user's basic-meter profiled forecast).

7. THE LIKELY IMPLEMENTATION EFFECT OF THE PROPOSAL ON INDUSTRY IN GENERAL AND/OR ANY IDENTIFIED PARTIES (E.G. END-USERS)

There will be no process impact for AEMO (the SA Gas Retail Market System already uses forecast sunshine hours in HDD calculation) or participants.

© AEMO 2019

8. TESTING REQUIREMENTS

There will be no testing requirements for AEMO or participants.

9. SUPPORTING DOCUMENTATION

Refer to Attachment A (Proposed amendments to the RMP SA)

Refer to Attachment B (Proposed amendments to Register of Weather Related Information)

Refer to Attachment C (AEMO's Presentation on Estimated Basic Meter Withdrawals)

10. IF APPLICABLE, A PROPOSED EFFECTIVE DATE FOR THE PROPOSED CHANGED PROCEDURES TO TAKE EFFECT AND JUSTIFICATION FOR THAT TIMELINE.

The BoM will stop providing weather data from the Kent Town observation station by mid 2019. As such, subject to all necessary approvals, AEMO proposes to have implemented the above changes by the end of May. To achieve this, AEMO proposes the following consultation timeline:

- Proposed Procedure Change (PPC) issued 28 February 2019.
- PPC responses due 21 March 2019.
- Impact and Implementation (IIR) issued 1 April 2019.
- IIR responses due 2 May 2019.
- Notice of decision – 14 May 2019.
- Effective date – 11 June 2019.

© AEMO 2019

ATTACHMENT A
PROPOSED CHANGES: RETAIL MARKET PROCEDURES – SOUTH AUSTRALIA

Blue underline represents additions ~~red strikeout~~ represents deletions

177. Calculation of heating degree day

(1) In performing the calculations under this clause 177, AEMO must use the values set out in Appendix 11 for the following coefficients:

(a) C_1;

(b) C_2;

(c) C_3;

(d) C_4;

(e) C_5;

(f) C_6;

(g) C_7; and

(h) C_8.

(2) AEMO must, at least once every five years or following a change in the source of weather data used, recalculate the value for each coefficient listed in clause 177(1) using linear regression of historic weather data, and as soon as practicable after the recalculation, AEMO must publish to *participants* an update to Appendix 11 specifying the recalculated values.

(3) In performing the calculations under this clause 177, unless otherwise specified, AEMO must use the most recent available weather data prior to the time of calculation, which it must obtain from the Australian Bureau of Meteorology or another external agency, determined by AEMO as a *reasonable and prudent person* to be a suitable supplier of weather data for each of the following weather data items:

(a) the maximum air temperature for a *HDD zone* for a *gas day*, or forecast for a *gas day*, in degrees Celsius (**"T_{max}"**);

(b) the minimum air temperature for a *HDD zone* for a *gas day*, or forecast for a *gas day*, in degrees Celsius (**"T_{min}"**); and

(c) the hours of sun forecast for a *HDD zone* for a *gas day*~~, or forecast for a *gas day*~~ (**"H_{sun}"**).

(4) For each *gas day D* for each *HDD zone*, AEMO must:

(a) by 17 hours before the end of *gas day D*, calculate the *forecast heating degree day* under clause 1(5)(j) for *gas day D+1* for use in clause 204;

© AEMO 2019

(b) within 30 minutes before the end of the third, sixth, ninth and twelfth hours of *gas day D*, recalculate the *forecast heating degree day* under clause 1(5)(j) for *gas day D* for use in clause 216(1); and

(c) by 4 hours after the end of *gas day D*, calculate the *actual heating degree day* for *gas day D* under clause 177(5)(h) for use in clause 224.

(5) In this clause 177, for each *HDD zone* for each *gas* day *D*:

(a) the *EDD* for *gas day D* (**"$E_{(D)}$"**) is calculated as follows:

$$E_{(D)} = \max\left(0, 18 - \left(\frac{T_{\max(D)} + T_{\min(D)}}{2}\right) - \left(C_8 \times H_{sun(D)}\right)\right)$$

where:

$E_{(D)}$ = the *EDD* for the *HDD zone* for *gas day D*;

$T_{max(D)}$ = the maximum air temperature forecast for the *HDD zone* for *gas day D* in degrees Celsius;

$T_{min(D)}$ = the minimum air temperature forecast for the *HDD zone* for *gas day D* in degrees Celsius; and

$H_{sun(D)}$ = the hours of sun forecast for the *HDD zone* for *gas day D*,

(b) the *EDD* for *gas day D-1* (**"$E_{(D-1)}$"**) is calculated as follows:

$$E_{(D-1)} = \max\left(0, 18 - \left(\frac{T_{\max(D-1)} + T_{\min(D-1)}}{2}\right) - \left(C_8 \times H_{sun(D-1)}\right)\right)$$

where:

$E_{(D-1)}$ = the *EDD* for the *HDD zone* for *gas day D-1*;

$T_{max(D-1)}$ = the maximum air temperature for the *HDD zone* for *gas day D-1* in degrees Celsius;

$T_{min(D-1)}$ = the minimum air temperature for the *HDD zone* for *gas day D-1* in degrees Celsius; and

$H_{sun(D-1)}$ = the hours of sun forecast for the *HDD zone* for *gas day D-1*,

(c) the *EDD* for *gas day D-2* (**"$E_{(D-2)}$"**) is calculated as follows:

$$E_{(D-2)} = \max\left(0, 18 - \left(\frac{T_{\max(D-2)} + T_{\min(D-2)}}{2}\right) - \left(C_8 \times H_{sun(D-2)}\right)\right)$$

where:

$E_{(D-2)}$ = the *EDD* for the *HDD zone* for *gas day D-2*;

$T_{max(D-2)}$ = the maximum air temperature for the *HDD zone* for *gas day D-2* in degrees Celsius;

$T_{min(D-2)}$ = the minimum air temperature for the *HDD zone* for *gas day D-2* in degrees Celsius; and

$H_{sun(D-2)}$ = the hours of sun forecast for the *HDD zone* for *gas day D-2*, and

(d) the *EDD* for *gas day D-3* (**"$E_{(D-3)}$"**) is calculated as follows:

$$E_{(D-3)} = \max\left(0, 18 - \left(\frac{T_{\max(D-3)} + T_{\min(D-3)}}{2}\right) - \left(C_8 \times H_{sun(D-3)}\right)\right)$$

where:

$E_{(D-3)}$	= the *EDD* for the *HDD zone* for *gas day D-3*;
$T_{\max(D-3)}$	= the maximum air temperature for the *HDD zone* for *gas day D-3* in degrees Celsius;
$T_{\min(D-3)}$	= the minimum air temperature for the *HDD zone* for *gas day D-3* in degrees Celsius; and
$H_{sun(D-3)}$	= the hours of sun forecast for the *HDD zone* for *gas day D-3*.

(e) the **"average temperature"** for the period of 30 *gas days* between *gas day D-30* and *gas day D-1* is calculated as follows:

$$T_{30} = \frac{\sum_{i=d-1}^{d-30}\left(T_{\max i} + T_{\min i}\right)}{60}$$

where:

T_{30}	= the *average temperature* for the *HDD zone* for the period of 30 *gas days* between *gas day D-30* and *gas day D-1* in degrees Celsius;
$T_{\max i}$	= the maximum air temperature for the *HDD zone* in degrees Celsius for *gas day i*;
$T_{\min i}$	= the minimum air temperature for the *HDD zone* in degrees Celsius for a *gas day i*; and
i	= a *gas day i* in the range of 30 *gas days* between *gas day D-30* and *gas day D-1*.

(f) the **"total sun hours"** for the period of 7 *gas days* between *gas day D-7* and *gas day D-1* is calculated as follows:

$$SSH_{sun7} = \frac{\sum_{i=d-1}^{d-7} H_{sum\,i}}{7}$$

where:

SSH_{sun7}	= the *total sun hours* for the *HDD zone* for the period of 7 *gas days* between *gas day D-7* and *gas day D-1*;
$H_{sun\,i}$	= the hours of sun forecast for the *HDD zone* for a *gas day; and*
i	= a *gas day i* in the range of 7 *gas days* between *gas day D-7* and *gas day D-1*.

(g) the **"proxy ground temperature"** (**"T_{gnd}"**) for *gas day D* is calculated as follows:

$$T_{gnd} = \frac{\left[C_4 \times \max\left(0, 18 - T_{30}\right)\right] + \left[C_5 \times \left(18 - T_{30}\right)\right]}{\left(C_4 + C_5\right)} + \left(C_6 \times SSH_{sun7}\right)$$

where:

T_{gnd} = the *proxy ground temperature* for the *HDD zone* for *gas day D* in degrees Celsius;

T_{30} = the *average temperature* for the *HDD zone* for the period of 30 *gas days* between *gas day D-30* and *gas day D-1* in degrees Celsius calculated under clause 1(5)(e); and

SSH_{sun7} = the *total sun hours* for the *HDD zone* for the period of 7 *gas days* between *gas day D-7* and *gas day D-1* calculated under clause 1(5)(f).

(h) the **"actual heating degree day"** (**"HDD_A"**) for *gas day D-1* is calculated as follows:

$$HDD_A = (C_1 \times E_{(D-1)}) + (C_2 \times E_{(D-2)}) + (C_3 \times E_{(D-3)}) + (C_7 \times T_{gnd})$$

where:

HDD_A = the *actual heating degree day* for the *HDD zone* for *gas day D-1,* provided that for each *positive HDD zone*, if that value is less than zero, HDD_A shall be treated as zero;

$E_{(D-1)}$ = the *EDD* for *gas day D-1* calculated under clause 1(5)(b);

$E_{(D-2)}$ = the *EDD* for *gas day D-2* calculated under clause 1(5)(c);

$E_{(D-3)}$ = the *EDD* for *gas day D-3* calculated under clause 1(5)(d); and

T_{gnd} = the *ground temperature* for the *HDD zone* for *gas day D-1* in degrees Celsius calculated under clause 1(5)(g).

(i) the **"forecast EDD"** for *gas day D+1* is calculated as follows:

$$F_{(D+1)} = \max\left(0, 18 - \left(\frac{T_{\max(D+1)} + T_{\min(D+1)}}{2}\right) - (C_8 \times H_{sun(D+1)})\right)$$

where:

$F_{(D+1)}$ = the f*orecast EDD* for the *HDD zone* for *gas day D+1* in degrees Celsius;

$T_{\max(D+1)}$ = the maximum air temperature forecast for the *HDD zone* for *gas day D+1* in degrees Celsius;

$T_{\min(D+1)}$ = the minimum air temperature forecast for the *HDD zone* for *gas day D+1* in degrees Celsius; and

$H_{sun(D+1)}$ = the hours of sun forecast for the *HDD zone* for *gas day D+1* at 0900 hours CST on *gas day D*.

(j) the *forecast heating degree day* (**"HDD_F"**) for *gas day D+1* is calculated as follows:

$$HDD_F = (C_1 \times F_{(D+1)}) + (C_2 \times E_{(D)}) + (C_3 \times HDD_A) + (C_7 \times T_{gnd})$$

where:

HDD_F = the *forecast heating degree day* for the *HDD zone* for *gas day D+1*, provided that for each *positive HDD zone*, if that value is less than zero, HDD_F shall be treated as zero;

$F_{(D+1)}$ = the *forecast EDD* for the *HDD zone* for *gas day D+1* in degrees Celsius calculated under clause 1(5)(i);

$E(D)$ = the *EDD* for *gas day D* calculated under clause 1(5)(a)*;*

© AEMO 2019

HDD_A = the *actual heating degree day* for the *HDD zone* for *gas day D-1* calculated under clause 1(5)(h); and

T_{gnd} = the *proxy ground temperature* in degrees Celsius for the *HDD zone* for *gas day D-1* calculated under clause 1(5)(g).

© AEMO 2019

ATTACHMENT B
PROPOSED CHANGES: REGISTER OF WEATHER RELATED INFORMATION

Blue underline represents additions ~~red strikeout~~ represents deletions

SOUTH AUSTRALIAN WEATHER RELATED INFORMATION.

4.1 Weather Observation Stations

The following is a list of the weather observation stations applicable to Appendix 11 (Heating Degree Day for South Australia) of the Retail Market Procedures (RMP) (SA) (Ref#1).

Weather Observation Stations

Heating Degree Day (HDD) zone	Service Provider	Observation station
Northern	Australian Government Bureau of Meteorology	Ceduna
Adelaide Region	Australian Government Bureau of Meteorology	Adelaide (West Terrace ~~Kent Town~~ / ngayirdapira)
Riverland	Australian Government Bureau of Meteorology	Mildura
Mount Gambier	Australian Government Bureau of Meteorology	Mount Gambier
Adelaide Metropolitan	Australian Government Bureau of Meteorology	Adelaide (West Terrace ~~Kent Town~~ / ngayirdapira)

4.2 HDD Coefficients

The following is a list of HDD Coefficients applicable to Appendix 11 (Heating Degree Day for South Australia) of the RMP (SA) (Ref #1)

The numbering has been corrected below. This amendment has been confirmed by SA instructions of 30/01/09.

(a) C_1 = 0.62;

(b) C_2 = 0.2;

(c) C_3 = 0.18;

(d) C_4 = 1;

(e) C_5 = 0.44;

(f) C_6 = -0.385;

(g) C_7 = 0.38; and

(h) C_8 = 0.11.

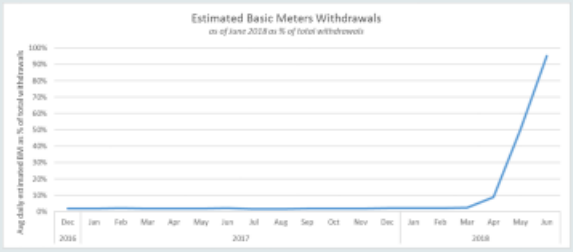
© AEMO 2019

ATTACHMENT C
AEMO'S PRESENTATION ON ESTIMATED BASIC METER WITHDRAWALS

Estimated basic meter withdrawals

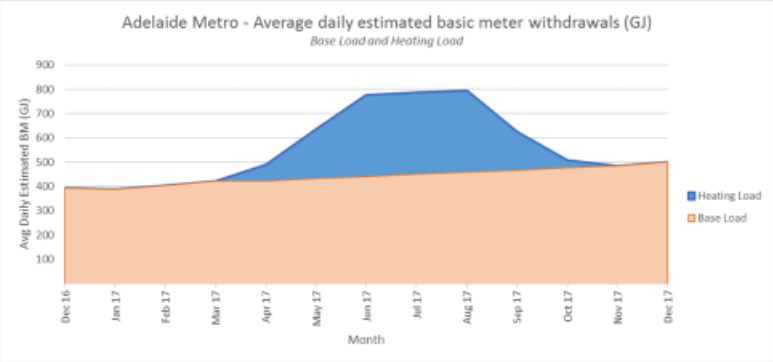
Adelaide Metro area (STTM)

Estimated basic withdrawals



- Initially high % estimated withdrawals reduce as meter readings are received
- Estimates settle down in 1.5% to 2% range well before STTM Revision
  - Latest revision August 2017

Components of estimated basic withdrawals



- HDD has a limited impact on estimated basic withdrawals
  - Estimates = base rate + Heating Load x HDD
  - Heat Load component for limited period (mainly in winter)
  - Max daily average heat load component for a month is only 340GJ

Components of HDD

- HDD calculated from:
  - effective degree day in reducing proportions for last three days
    - Derived from maximum temperature, minimum temperature and hours of sun
  - Proxy ground temperature derived from temperatures
    - Derived from 30 day average temperature and 7 day average hours of sun
  - Coefficients that apply across all weather stations
    - C1 to C8

$$HDD_A = (C_1 \times E_{(D-1)}) + (C_2 \times E_{(D-2)}) + (C_3 \times E_{(D-3)}) + (C_7 \times T_{gnd})$$

Actual hours of sun no longer available

- The BOM no longer reports actual hours of sun for any weather station
- They do report a forecast hours of sun
- Actual hours of sun used in
  - Effective degree day (EDD) for last three days
  - Proxy ground temperature
- These feed into HDD calculation
- AEMO proposing to use the forecast hours of sun instead of actual hours of sun
  - Limited impact from using actual vs forecast HOS
    - Estimated basic meter withdrawals are low
    - Heating load only in winter average ~340GJ per day

Impact of using forecast HOS

- Based on coefficients, maximum impact of Hours of Sun on HDD is
  - - C8 x HOS + C6 x C7 x HOS
  - 0.11 x HOS + (-0.385 x 0.38) x HOS
  - -0.2563 x HOS
- Assuming:
  - difference between actual HOS and forecast HOS at 10%
  - average forecast HOS in winter 2017 of 4.
- Impact on heat load component is ± 0.1051 per GJ
  - ± 0.2563 x 4.1 x 10%
- With average daily estimated heat load of 340 GJ impact is
  - 340 x ± 0.1051 = ± 35.7GJ
- **Considered to be minimal**

© AEMO 2019

Review of Coefficients

- Coefficients defined to apply to all weather stations in use for all HDD zones
  - Currently four separate weather stations for five zones
- Coefficients defined are <= 1 and no more than two decimal places
- Only those coefficients directly related to measured components may change as a result of weather stations
- Impact of one weather station changing will have a limited impact on coefficients that are applied to all weather stations
- Coefficients impact on HDD calculation used for heat load only
- A 10% error in HDD would result in a maximum residual daily heat load error of approximately ±34GJ
  - 340GJ x ±10%
- AEMO is therefore proposing that coefficients are not recalculated
  - Expensive, external consultants required
  - Limited impact

© AEMO 2019