ICRC

independent competition and regulatory commission

Technical Appendix

Issues Paper: Electricity Model and Methodology Review 2018–19

Commission's electricity pricing model: Mathematical description

The Independent Competition and Regulatory Commission (Commission)'s electricity pricing model determines the maximum average percentage change that ActewAGL Retail (AAR) can apply to its suite of regulated tariffs on an annual basis. It does so by estimating three main cost components:

Wholesale electricity costs (WE)
Retail costs (RC)
Network costs (NC)

Once these cost categories are estimated, they are added together and multiplied by a retail margin (RM) to produce an overall cost to be recovered in dollars per megawatt hour (MWh). This is then used in conjunction with the total costs calculated for the previous year to produce a maximum average percentage change that AAR can apply to its regulated tariffs.

The costs of supplying electricity to AAR's regulated customers ($Elec$) in dollars per MWh for financial year t are:

$$Elec_t = (WE_t + RC_t + NC_t) * (1 + RM_t) \quad (1)$$

WE_t and RC_t components of the model are determined in dollars per MWh as:

$$WE_t = EPC_t + GS_t + EL_t + EC_t + NEM_t \quad (2)$$

$$RC_t = ROC_t + EEIS_t + POC_t \quad (3)$$

where the following are defined for financial year t:

EPC_t denotes energy purchase costs;

GS_t denotes national green scheme costs;

EL_t denotes energy losses;

EC_t denotes energy contracting costs;

NEM_t denotes the National Electricity Market (NEM) fees;

ROC_t denotes retail operating costs;

$EEIS_t$ denotes Energy Efficiency Improvement Scheme (EEIS) costs ;

POC_t denotes Power of Choice (PoC) pass through costs; and

t denotes the financial year.

T denotes the financial year.

NC_t is set by the Australian Energy Regulator (AER) and RM_t is determined by the Commission.

Wholesale electricity costs (WE_t)

Wholesale electricity costs comprise wholesale energy purchase costs, national green scheme costs, energy losses, energy contracting costs, and the NEM fees.

$$WE_t = EPC_t + GS_t + EL_t + EC_t + NEM_t \quad (4)$$

1.1.1 Energy purchase costs (EPC_t)

Energy purchase costs are the costs incurred by retailers in purchasing electricity from the wholesale electricity market.

The Commission's energy purchase cost model determines a benchmark cost of purchasing electricity that would be incurred by a hypothetical efficient retailer in the same position as AAR. This benchmark is based on observed market outcomes and the modelling of a hedging strategy.

The Commission's model estimates the energy purchase costs on a quarterly basis. Quarterly energy purchase costs are then converted to an annual average using quarterly (s) load weights (W).

Energy purchase cost in each quarter is calculated as:

$$EPC_s = FP_s * UP_s \qquad s=(1, 2, 3, 4) \quad (5)$$

where

FP_s denotes the forward price of wholesale electricity for each quarter s, currently calculated using Australian Stock Exchange (ASX) futures market data averaged over a 23-month period.

UP_s is the uplift factor, which captures the retailer's hedging cost, and is expressed as:

$$UP_s = LR_s * FM_s + LS_s * (1 - FM_s) \quad (6)$$

where

LS_s denotes the load shape for each quarter s.

LR_s denotes the load ratio for each quarter s.

denotes the forward price margin for each quarter s.

The forward price margin (FM_s) captures the observation that forward prices generally exceed average spot prices. It is currently set at five per cent.

The Load Ratio (LR_s) is measured by the ratio of peak load to average load. Load ratio for each quarter is calculated as the maximum of the observed ratio of quarterly maximum load to the quarterly average load using the Australian Energy Market Operator (AEMO) data. A margin of 0.1 is added to the observed maximum of previous years (T) to allow for the possibility of a higher peak:

$$LR_s = Max(LR_s) + 0.1 \qquad s=(1, 2, 3, 4) \tag{7}$$

$$LR_s = \frac{Max(L_s)}{\frac{1}{T} * \sum_{s=1}^{T} L_s} \qquad s=(1, 2, 3, 4) \tag{8}$$

where L_s is the load in MWh in half-hour trading intervals for each quarter s.

The load shape (LS_s) is measured by the ratio of the load-weighted spot price to the time-weighted spot price. The load shape is calculated using New South Wales (NSW) regional reference prices (RRP) and the net system load profile for Evoenergy both reported by the AEMO, and are in half-hour trading intervals for each quarter s.

$$LS_s = \frac{\sum_{s=1}^{T}(RRP_s * L_s)}{(\frac{1}{T} * \sum_{s=1}^{T} RRP_s) * \sum L_s} \tag{9}$$

Quarterly energy purchase costs (EPC_s) are converted to an annual average (EPC_t) using quarterly load weights (W_s) as:

$$EPC_t = \sum_{s=1}^{4}(EPC_s * W_s) \qquad s=(1, 2, 3, 4) \tag{10}$$

where W_s is equal to the historical average load in that quarter divided by the sum of quarterly historical average load for all four quarters.

$$W_s = LA_s / \sum LA_s \qquad s=(1, 2, 3, 4) \tag{11}$$

LA_s is the average load of the quarter in MWh.

1.1.2 Green scheme costs (GS_t)

The costs incurred by the retailer in complying with environmental obligations imposed by the Australia Government are captured in the GS_t component of the Commission's model.

The Commission applies a market-based approach for determining efficient green scheme costs. The model determines Large-scale Generation Certificate (LGC) and Small-scale Technology Certificate (STC) costs based on publicly available spot price data averaged over an 11-month period. The average price is then increased by a 10 per cent holding cost, a five per cent mark-up cost and a cost adjustment to account for the difference between the estimated and the actual renewable percentages.

The Large-scale Renewable Energy Target ($LRET$) and Small-scale Renewable Energy Scheme ($SRES$) obligations accrue in calendar year (x) terms while the Commission's model is presented in financial year terms. As such, $LRET$ and $SRES$ costs per financial year are derived by averaging two calendar year estimates. The Commission uses half-yearly load weights (LW) to apportion costs across calendar years.

The equations that determine the green scheme costs in dollars per MWh are:

$$GS_t = LRET_t + SRES_t + C_{adj,t-1} \quad (12)$$

$$LRET_t = [LGC_x * (1 + HC) * (1 + OM) * RPP_x] * LW_x + [LGC_{x+1} * (1 + HC) * (1 + OM) * RPP_{x+1}] * LW_{x+1} \quad (13)$$

$$SRES_t = [STC_x * (1 + HC) * (1 + OM) * STP_x] * LW_x + [STC_{x+1} * (1 + HC) * (1 + OM) * STP_{x+1}] * LW_{x+1} \quad (14)$$

where

$LRET_t$ denotes the costs of complying with $LRET$ requirements in financial year t.

LGC_x denotes the total costs of the $LGCs$ to meet $LRET$ requirements in calendar year x.

$SRES_t$ denotes the costs of complying with $SRES$ requirements in financial year t.

STC_x denotes the total costs of the $STCs$ to meet $LRET$ requirements in calendar year x.

RPP_x denotes the renewable power percentage for calendar year x.

STP_x denotes the small-scale technology percentage for calendar year x.

HC denotes the holding cost percentage, currently 10 per cent.

OM denotes the operating cost mark-up, currently five per cent.

LW_x denotes the half-yearly load weight for calendar year x.

$C_{adj,t-1}$ denotes the cost adjustment from previous financial year.

1.1.3 Energy losses (EL_t)

Some electricity is lost in transporting from generators to customers via transmission and distribution networks. The energy loss factors are determined by the AEMO.

The Commission determines the energy losses component by applying the AEMO's transmission and distribution loss factors to the energy purchase cost component, national green scheme costs and the NEM fees, as follows:

$$EL_t = [EPC_t * (MLF_t * DLF_t - 1)] + [(GS_t + NEM_t) * (DLF_t - 1)] \quad (15)$$

where

EL_t denotes energy losses in financial year t.

MLF_t denotes the marginal loss factor applicable to the Australian Capital Territory (ACT) for financial year t.

DLF_t denotes the distribution loss factor applicable to the ACT for financial year t.

1.1.4 Energy contracting costs and NEM fees

Energy contracting costs represent the costs of managing an electricity trading desk.

The NEM is managed by the AEMO, which is funded through user fees.

Energy contracting costs (EC_t) and the NEM fees (NEM_t) were initially set in 2003, and have been indexed by the Consumer Price Index (CPI) in the Commission's model since then as:

$$EC_t = EC_{t-1} * (1 + \Delta CPI_t) \quad (16)$$

$$NEM_t = NEM_{t-1} * (1 + \Delta CPI_t) \quad (17)$$

The CPI adjustment (ΔCPI_t) follows the equation below:

$$\Delta CPI_t = \left(\frac{CPI_{June(t-2)} + CPI_{Sep(t-1)} + CPI_{Dec(t-1)} + CPI_{March\,(t-1)}}{CPI_{June(t-3)} + CPI_{Sep(t-2)} + CPI_{Dec(t-2)} + CPI_{March\,(t-2)}} - 1 \right) \quad (18)$$

Retail costs (RC_t)

Retail costs comprise retail operating costs and the costs of complying with the ACT Government's EEIS scheme. For 2018–23, retail costs also include the efficient costs incurred by the retailer in implementing PoC smart metering reforms, incorporated in the model as pass-through costs.

$$RC_t = ROC_t + EEIS_t + POC_t \quad (19)$$

where:

ROC_t denotes retail operating costs in financial year t.

$EEIS_t$ denotes EEIS costs in financial year t.

POC_t denotes power of choice costs in financial year t.

1.2.1 Retail operating costs (ROC_t)

Retail operating costs are the efficient costs incurred by the retailer in providing retail services to its customers.

Retail operating costs in the financial year *t* are calculated by adjusting the previous year's costs per customer for the changes in the CPI and converting it to an allowance per MWh using customer numbers and energy usage.

Firstly, retail operating costs per customer are adjusted for the CPI change as:

$$ROC\ (per\ Cust)_t = ROC\ (per\ Cust)_{t-1} * (1 + \Delta CPI_t) \quad (20)$$

Retail operating costs per MWh are then calculated as:

$$ROC\ (per\ MWh)_t = \frac{ROC\ (per\ Cust)_t * NoCus_t}{ES_t}$$

where

$ROC\ (per\ Cust)_t$ denotes retail operating costs per customer for financial year t.

$ROC\ (per\ MWh)_t$ denotes retail operating costs per MWh for financial year t.

$NoCus_t$ denotes the number of AAR customers for the year to 31 March.

ES_t denotes the total energy usage for the regulated customers.

1.2.2 EEIS costs ($EEIS_t$)

The ACT Government's EEIS scheme places a mandatory obligation on all retailers in the ACT to promote energy efficiency measures in households and businesses. The EEIS scheme sets the Territory-wide energy savings targets and requires ACT electricity retailers to meet an individual energy savings obligation.

The Commission calculates the retailer's costs of complying with the EEIS as:

$$EEIS_t = (CT_x * EF_x * EST_x * LW_x) + (CT_{x+1} * EF_{x+1} * EST_{x+1} * LW_{x+1}) + EEIS_{adj,t-1} \quad (21)$$

Where:

CT_x denotes the abatement cost per tonne for calendar year x

EF_x is the emissions factor for each calendar year determined under the Energy Efficiency ACT. EF is set at 0.4 by the *Energy Efficiency Improvement Act 2012*.

EST_x is the energy saving target, which is currently set at 8.6 per cent of total electricity sales.

LW_x denotes the half-yearly load weight for calendar year x.

$EEIS_{adj,t-1}$ denotes the cost adjustment from the previous financial year.

1.2.3 Power of choice pass-through costs (POC_t)

The POC_t component captures the pass-through costs in financial year t. These are the efficient costs incurred by the retailer in implementing PoC smart metering reforms. The costs are recovered in five years from 2018–19 to 2022–23.

Network costs (NC_t)

Network costs include transmission, distribution and jurisdictional scheme costs. These costs are regulated by the AER. The Commission passes through the network costs determined by the AER.

Retail margin (RM_t)

The retail margin is a profit margin to provide a return to the investment made by the incumbent retailer in providing retail electricity services. The current price direction (2017–20) requires the retail margin to be calculated at 5.3 per cent applied to all of the cost categories of the model.

Abbreviations and acronyms

AAR	ActewAGL Retail
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ASX	Australian Securities Exchange
Commission	Independent Competition and Regulatory Commission
CPI	Consumer Price Index
EEIS	Energy Efficiency Improvement Scheme
LGC	Large-scale generation certificate
LRET	Large-scale Renewable Energy Target
MWh	Megawatt hour
NEM	National Electricity Market
NSW	New South Wales
PoC	Power of Choice
RRP	Regional Reference Price
STC	Small-scale Technology Certificate
SRES	Small-scale Renewable Energy Scheme