AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Reliability and Emergency Reserve Trader (RERT) Quarterly Report Q4 2019

February 2020

A report for the National Electricity Market

Important notice

PURPOSE

AEMO publishes the Reliability and Emergency Reserve Trader (RERT) Quarterly Report under clause 3.20.6 of the National Electricity Rules.

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Executive summary

The Reliability and Emergency Reserve Trader (RERT) is an intervention mechanism under the National Electricity Rules (NER) that allows AEMO to contract for emergency reserves such as generation or demand response that are not otherwise available in the market. AEMO uses RERT as a safety net in the event that a critical shortfall in reserves is forecast. RERT is activated, when all market options have been exhausted, typically during periods when the supply demand balance is tight.

AEMO has observed a significant increase in National Electricity Market (NEM) reliability risk in recent years, due to a combination of extreme weather conditions and higher outage rates from ageing generation assets. AEMO determined that an additional 125 megawatts (MW) of reserves were required in Victoria over the 2019-20 summer period, to meet the reliability standard.

In November 2019, AEMO contracted for 137 MW of long notice reserves in Victoria and has since established medium and short notice panel arrangements for 1,698 MW of reserves across the NEM, to manage unexpected risks to reliability.

AEMO activated RERT on one occasion during Quarter 4 2019 in Victoria on 30 December, following extreme conditions on the power system (hot temperatures, high demand, bushfires and a line trip in New South Wales impacting the Victoria – New South Wales interconnection). This resulted in a forecast shortfall in reserves of up to 346 MW within 45 minutes of the event, sustained over the next three hours. To reduce the potential impact of load shedding, AEMO activated 283 MWh (92 MW capacity) of RERT at a cost of $3.72 million.

The average amount payable by AEMO for the RERT activated on 30 December was $14,148.12 per MWh, which is less than the market price cap ($14,700 per MWh) and the average value of customer reliability[1] (VCR) ($41,210 per MWh) for Victoria. Assuming the cost of RERT is apportioned by consumption[2], the average cost per household for this event in Victoria is estimated to be $0.81 (including GST). AEMO's activation of RERT on 30 December 2019 was consistent with the principles of having the least distortionary effect on the market, while improving reliability of the system, and minimising cost to consumers.

This report is published under clause 3.20.6 (b) of the National Electricity Rules (NER), and accounts for reserve contracts entered into and activated by AEMO in the period from 1 October 2019 to 31 December 2019.

[1] See https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf.

[2] AEMO does not have visibility of how RERT costs are allocated and passed through to end use consumers.

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1. Q4 2019 RERT activity

1.1 Contracting

The 2019 Electrical Statement of Opportunities (ESOO) identified a particular risk of supply interruptions in Victoria exceeding the reliability standard for unserved energy (USE) in 2019-20. This risk was observed to arise in Victoria, under a scenario where the unplanned outages of two major power stations, Loy Yang A2 (500 megawatts (MW)) and Mortlake unit 2 (259 MW) in Victoria, extended into the peak summer period posing a significant risk of insufficient supply that could lead to material involuntary load shedding[3]. Using a probabilistic forecast that assumes an extension of either of these outages, in combination with a number of other operating risks, including the higher than average forced outage rates, AEMO determined an expected USE of 0.0026% for 2019-20 over the summer period.

This translates into an additional 125 MW of reserves being required in the Victorian region to meet the reliability standard for 2019-20. In addition, the ESOO modelling also found that to reduce the likelihood of exceeding the standard to a 'one-in-10 year' event, 560 MW of additional reserves in Victoria and South Australia would be required to meet the reliability standard.

Based on these forecasts and through open tendering processes under the NER, AEMO secured reserves under two categories:

- **Long Notice Reserve – to meet the reliability standard under expected conditions.**
  - After taking into account the reserves available from the existing ARENA Demand Side Participation trial, AEMO entered into the lowest cost long notice reserve contracts to secure the 125 MW of reserves required to meet the reserve shortfall reported in the 2019 ESOO under expected conditions. An additional 12 MW of reserve was acquired (137 MW total contracted reserve), in addition to the 125 MW needed to meet the reliability standard; this is to account for statistical underperformance of contracted reserves when called upon on a given day.
- **Additional reserves in medium and short notice panel agreements.**
  - AEMO also established panels of potential RERT providers that could offer 1,698 MW of reserves in short or medium notice periods, on pre-negotiated contract terms, in South Australia, Victoria, New South Wales, and Queensland, to manage unexpected risks such as demand exceeding forecast expectations, and unplanned events resulting in a reduction in generation and/or network capacity. Under the panel agreements, there are no fixed costs incurred and payments will only be made based on pre-activation and/or actual megawatt hours (MWh) activated. There is no cost to consumers unless this reserve is required.

In consultation with relevant state governments, AEMO secured reserves that met detailed cost, technical, and verification criteria. Each RERT resource has different response lead times, activation conditions, and response capability, as a result not all resources can necessarily be activated for a given shortfall event.

AEMO has not entered into long, medium, or short notice reserve arrangements with any scheduled generation or load, hence this report does not refer to the dispatch of reserve.

[3] 2019 ESOO, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo.

1.2 Activation

AEMO intervened in the market by activating RERT once in the reporting period, on Monday 30 December 2019[4].

1.3 Costs incurred

The amount payable by AEMO under RERT during the reporting period (1 October to 31 December 2019) was $4.87 million. Table 1 shows a breakdown of the amounts payable for each region and payment type, including availability payments for long notice contracts plus activation and usage payments for all contracts activated on 30 December.

Table 1 AEMO's amount payable under reserve contracts, Quarter 4 2019

NEM Region	Availability	Pre-Activation	Activated	Intervention	Total cost
Victoria	$1.15M	$0.25M	$3.44M	$0.03	$4.87M
New South Wales	$0	$0	$0	$0	$0
Queensland	$0	$0	$0	$0	$0
South Australia	$0	$0	$0	$0	$0
Tasmania	$0	$0	$0	$0	$0
Total cost					$4.87M

2. Intervention on 30 December 2019

2.1 Decision to intervene

Monday 30 December 2019 saw extreme weather conditions in Victoria, with temperatures reaching 42.6°C at Melbourne Airport and areas further inland exceeding 43°C. There were also extreme bushfire conditions, with 14 Emergency Bushfire Warnings in Victoria and four in New South Wales. This included a severe bushfire east of Albury near the Victorian border and the Victoria – New South Wales Interconnector.

Power system conditions in Victoria were volatile on this day with a high forecast maximum operational demand of 8,583 MW at 1530 hrs[5], with the following units out of service:

- Loy Yang A2 (500 MW).
- Loy Yang B2 (580 MW).

Semi-scheduled and non-scheduled generation was de-rated throughout the day due to the effects of high temperature on their equipment. At 1500 hrs AEMO systems observed discrepancies between Victorian

[4] RERT Activation report for 30 December 2019 is at https://aemo.com.au/Electricity/National-Electricity-Market-NEM/Emergency-Management/RERT/RERT-Reporting.

[5] All times are Market Time, which is Australian Eastern Standard Time.

semi-scheduled and non-scheduled generator availability and actual capability of up to 97 MW and 41 MW respectively, attributable to a combination of:

- Ambient temperature limitations.
- Fluctuating wind and solar output associated with wind changes and variable clouds moving across southern Australia.

In New South Wales, the following transmission lines were being monitored due to fires in the vicinity:

- Bayswater – Regentville 31 330 kV line and Bayswater – Sydney West 32 330 kV line were reclassified as a credible contingency.
- Bayswater – Mount Piper 5A3 500 kV line and Mount Piper – Wollar 5A5 500 kV line were reclassified as a credible contingency.
- Sydney South – Wallerawang 76 330 kV line and Ingleburn – Wallerawang 77 330 kV line were reclassified as a credible contingency.
- Canberra – Upper Tumut 01 330 kV line and Upper Tumut – Yass 02 330 kV line close to the Upper Tumut Switching Station, not reclassified due to separate easements.
- Lower Tumut – Wagga 051 330 kV line had a bushfire underneath it that was being controlled at the time.

In Victoria, the Condah fire was within 5-7 km of the Alcoa – Heywood – Mortlake and Alcoa – Heywood – Tarrone 500 kV lines, with fires expected to move towards the lines during the day, adding risk to the Victorian supply from South Australia.

At 1447 hrs, the Lower Tumut – Wagga 051 330 kV transmission line tripped, reclosed, then locked out and remained out of service until 2004 hrs. The loss of this line limited the Victoria – New South Wales interconnector and as a result reduced the level of support available to Victoria from New South Wales by over 1,000 MW.

This resulted in a rapid deterioration in forecast minimum Victorian reserves from 1,135 MW to 223 MW, triggering a forecast Lack of Reserve 2 (LOR 2[6]) condition from 1530 to 1830 hrs. This meant that the forecast reserve levels on the power system as a result of this line trip were less than the impact of credible contingencies in the state and that a credible contingency event larger than 223 MW would be expected to result in load shedding.

This minimum forecast reserve of 223 MW was 346 MW lower than the LOR 2 trigger level of 569 MW. This meant that AEMO needed up to 346 MW of additional reserves in Victoria (as the supply from New South Wales was limited by binding constraints on the interconnector) to remove the threat of load shedding between 1530 and 1830 hrs if a contingency occurred (such as the trip of a large generation unit or an interconnector).

To maintain power system reliability, AEMO determined that activation of RERT contracts would be required and responded by immediately commencing negotiations with RERT Panel members, with a view to activating unscheduled reserves as soon as possible.

2.2 Assessment of market response and latest time to intervene

At 1516 hrs on 30 December 2019, AEMO issued market notice MN 72143, declaring a forecast LOR 2 condition in Victoria from 1530 to 1830 hrs and noting that the latest time to intervene had not yet been determined. AEMO now considers that the latest time to intervene had at this stage already passed.

Since the LOR 2 condition was forecast to commence less than 15 minutes later, the reserve shortfall was substantial (346 MW) and it was unlikely that a market response would have occurred in time to avoid the need for RERT, AEMO immediately (at 1516 hrs) issued invitations to tender for short-notice reserve contracts,

[6] LOR 2 signals a tightening of electricity supply reserves. This condition exists when reserve levels are lower than the single largest supply resource in a state. At this level, there is no impact to the power system, but supply could be disrupted if a large incident occurred. Once a forecast LOR 2 is declared, AEMO has the power to direct generators or activate the RERT mechanism to improve the supply demand balance.

to minimise the reserve shortfall. From 1530 hrs, AEMO commenced pre-activation and from 1630 hrs commenced activation of reserve contracts.

A number of factors led to uncertainty around the timing of the LOR 2 condition on 30 December, making the assessment of the latest time to intervene more difficult including:

- Threats to transmission equipment from bushfires.
- Variability of renewable energy output particularly associated with high temperature deratings.
- Lack of visibility of price responsive load, some of which self-curtailed in response to high prices prior AEMO's declaration of the forecast LOR 2 condition but then ramped back up as RERT was being activated.

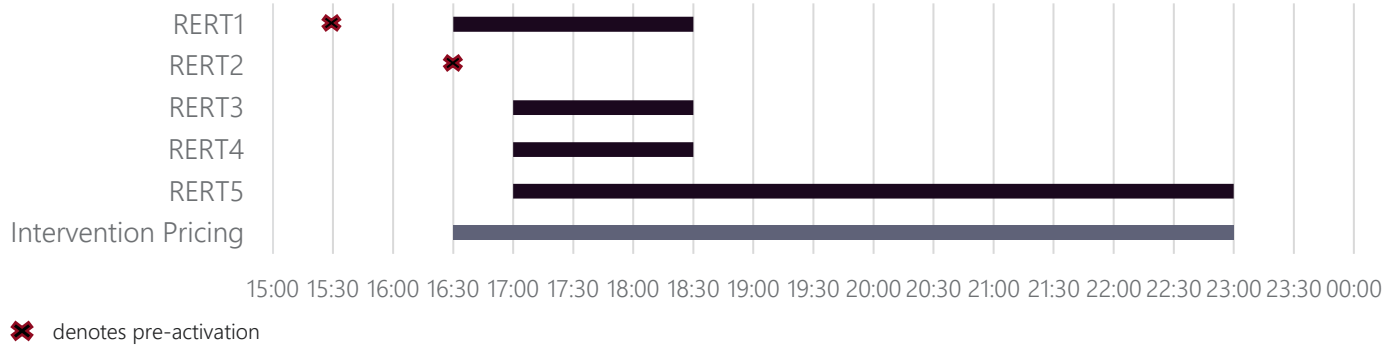
2.3 Intervention event

RERT contracts vary in terms of pre-activation and activation lead times, as well as response times (i.e. an industrial load responding to a request to reduce load under the RERT may need several hours to prepare its plant or undertake safe shutdown) and minimum continuous run times. Due to the fast response times of some RERT contracts, AEMO can defer activation of these contracts until after an LOR 3[7] condition arises, which enables AEMO to avoid activation costs until or unless additional reserves are required in real time.

On 30 December 2019, AEMO evaluated a potential 225 MW of RERT being available during the LOR 2 period and pre-activated or activated five contracts commencing from 1530 hrs, with a total capacity activated of 92 MW. An additional 120 MW (including RERT 2[8]- 60 MW per Table 2 below) of RERT capacity was available but not activated, due to fast response times of less than 30 minutes and no LOR 3 condition eventuating. A further 13 MW of potential RERT was not available on the day.

The first contract (RERT 1 - 20 MW) required pre-activation and was activated at 1630 hrs. The second contract (RERT 2 - 60 MW) also required pre-activation, but due to its fast response time was not activated. The remaining contracts (RERT 3,4,5 - 72 MW) were activated at 1700 hrs and deactivated at 1830 hrs. The exception was RERT 5 which was deactivated at 2300 hrs following completion of its minimum continuous run time of six hours. Table 2 details the timing of activation.

Table 2 Timing of activation of RERT and intervention pricing



The total amount of reserve activated on 30 December 2019 was 283 MWh. AEMO notes that of the 283 MWh activated, 262 MWh was delivered on the day. Table 3 shows a breakdown of RERT activated per trading interval.

[7] LOR3 indicates the balance of supply and demand is so tight that load shedding is imminent or has begun.

[8] The names of companies that provide RERT services is confidential.

Table 3 RERT activated in Victoria on 30 December 2019

Trading Interval ending	RERT activated (MW)
30/12/2019 17:00	20
30/12/2019 17:30	92
30/12/2019 18:00	92
30/12/2019 18:30	92
30/12/2019 19:00	30
30/12/2019 19:30	30
30/12/2019 20:00	30
30/12/2019 20:30	30
30/12/2019 21:00	30
30/12/2019 21:30	30
30/12/2019 22:00	30
30/12/2019 22:30	30
30/12/2019 23:00	30
Total (MWh)	**283**

At 1710 hrs, AEMO cancelled the forecast LOR 2 condition. The following factors contributed to the improved reserve condition:

- Between 1500 and 1700 hrs, at least 240 MW of price-responsive load reduced in Victoria in response to high prices (reaching market price cap at dispatch interval ending 1510 hrs).
- Activation of 92 MW of RERT.
- Lower than forecast temperatures (maximum temperature of 40.2°C versus forecast of 44°C at Melbourne Airport), resulting in lower than forecast demand. The actual peak demand was 8,390 MW at 1500 hrs versus a forecast peak demand of 8,583 MW at 1530 hrs.

2.4 Intervention pricing

Intervention pricing was applied for this event in accordance with NER 3.9.3(b) for the intervention periods from the Dispatch Interval (DI) ending 1635 hrs on 30 December 2019 to the DI ending 2300 hrs on 30 December 2019.

2.5 Changes in dispatch outcomes

The addition of RERT capacity in Victoria had the effect of increasing the available reserves in the region, improving the buffer between supply and demand in case of a contingency event. Tables 4 and 5 summarise the changes in dispatch outcomes due to the RERT activation.

Table 4 Summary of total energy generation during 30 December 2019 RERT event (MWh)

	NSW	QLD	SA	TAS	VIC
Physical run	62,379	46,818	13,086	9,306	38,135
Revised pricing run	62,228	46,764	13,206	9,323	38,488
Change	-150	-55	119	16	353

Table 5 Summary of total interconnector flows during 30 December 2019 RERT event (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Physical run[A]	30	708	406	-1,447	-411	2,082
Revised pricing run[A]	32	761	608	-1,566	-411	2,097
Change	2	53	202	-119	1	15

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.

2.6 Impact on reliability and system security

On 30 December 2019, the power system was in a secure operating state and there was no contribution to unserved energy, impacting the reliability standard. AEMO activated RERT on the basis of a forecast LOR 2 condition according to AEMO operating procedures. The activation of RERT assisted in removing the reserve shortfall.

This event highlights challenges to AEMO's ability to accurately forecast reserves during extreme power system events. The inherent uncertainty associated with weather, transmission equipment threatened by bushfires, and limited visibility of changes to generation and demand in the power system can significantly alter reserve outcomes. Specific issues include:

- Renewable generation (semi-scheduled and non-scheduled) not communicating reductions in available capacity in advance of high temperatures, which results in AEMO not having visibility of de-ratings during dispatch timeframes.
- Price-responsive load reduction is unscheduled in the dispatch algorithm, and as a result, its impact on market pricing and dispatched generation is unaccounted for. The absence of transparency from price-responsive load may distort market operations and complicates system reliability and security decisions.

3. Cost of exercising RERT

NER clause 3.20.2(b)(2) requires that when AEMO activates RERT, it should aim to maximise the effectiveness of the activation at the least cost to end-use consumers of electricity.

Accordingly, AEMO activated reserve contracts based on location, cost, capacity, time to activate, minimum activation time, and the profile of the forecast lack of reserve.

Table 6 shows a breakdown of the costs associated with exercising RERT on 30 December 2019, which were included in the 2020 Week 1 final statements, as per NER clause 3.20.6(f)(1). The total cost of exercising RERT

was $3.72 million, which includes pre-activation, activation, and intervention costs. The cost per MWh of $14,148.12 has been calculated based on 262 MWh delivered by RERT providers on 30 December 2019.

Table 6 Costs associated with the 30 December 2019 RERT event

	Pre-activation costs ($ million)	Activation costs ($ million)	Intervention costs* ($ million)	Total cost ($ million)	Cost per megawatt hour ($/MWh)
30 December 2019	$0.25M	$3.44M	$0.03M	$3.72M	$14,148.12

* Intervention costs represent the compensation paid to Market Participants due to the intervention event (for example, to compensate for energy generation which is displaced by RERT capacity), and to Eligible Persons (SRA holders) due to changes in interconnector flows, and therefore changes in the value of Settlement Residues.

Table 7 provides a breakdown of the cost recovery from each Market Customer associated with exercising RERT on 30 December 2019, as per NER clause 3.20.6(f)(2). Total cost recovery of $15.53 per MWh was calculated by dividing the total RERT event cost ($3.72 million) by the Victorian consumption during the relevant recovery period (239,600 MWh for the business days in Week 1 2020 (29 December 2019 – 4 January 2020)) as prescribed in NER 3.15.9(e).

Assuming the cost of the RERT event on 30 December is apportioned by consumption[9], the average cost per household in Victoria associated with the event is estimated to be $0.81 (including GST) based on average Victorian residential consumption as a portion of total Victorian energy.

Table 7 Market Customer cost recovery for Victoria

Market customer	Cost recovery ($ million)
1st Energy Pty Ltd	0.00
AGL Sales (Queensland Electricity) Pty Limited	0.07
AGL Sales Pty Limited	0.55
AGL South Australia Pty Ltd	0.00
Alcoa Portland Aluminium Pty Ltd	0.32
Alinta Energy Retail Sales Pty Ltd	0.21
Amaysim Energy Pty Ltd	0.01
Blue NRG Pty Ltd	0.02
Covau Pty Limited	0.00
Delta Electricity	0.02
Diamond Energy Pty Ltd	0.00
Elysian Energy Pty Ltd	0.00
Energy Locals Pty Ltd	0.00
EnergyAustralia Pty Ltd	0.22
EnergyAustralia Yallourn Pty Ltd	0.21

[9] AEMO does not have visibility of how RERT costs are allocated and passed through to end use consumers.

Market customer	Cost recovery ($ million)
ERM Power Retail Pty Ltd	0.47
Gannawarra Solar Farm Pty Ltd	0.00
Globird Energy Pty Ltd	0.01
Hazelwood Power	0.00
Infigen Energy Holdings Pty Limited	0.00
Lumo Energy Australia Pty Ltd	0.06
M2 Energy Pty Ltd (T/As Commander Power & Gas)	0.00
M2 Energy Pty Ltd (T/As Dodo Power & Gas)	0.02
Macquarie Bank Ltd	0.02
Mojo Power Pty Ltd	0.00
Momentum Energy Pty Limited	0.22
Next Business Energy Pty Ltd	0.01
Onsite Energy Solutions Pty Ltd	0.00
Origin Energy Electricity Limited	0.60
People Energy Pty Ltd	0.00
Power Club Limited	0.00
Powerdirect Pty Ltd	0.03
Powershop Australia Pty Limited	0.03
Progressive Green Pty Ltd	0.06
QEnergy Limited	0.00
ReAmped Energy Pty Ltd	0.00
Red Energy Pty Limited	0.24
SIMEC Zen Energy Retail Pty Ltd	0.00
Simply Energy	0.15
Stanwell Corporation Limited	0.06
Sumo Power	0.02
Sun Retail Pty Ltd	0.00
Tango Energy Pty Ltd	0.06
WINconnect Pty Ltd	0.00
Total	**3.72**

4. AEMO's intervention process

AEMO's general process for deploying RERT is documented in its Procedure for the Dispatch and Activation of Reserve Contracts[10]. AEMO considers that it followed all relevant provisions of its procedure as well as all applicable processes under NER clause 4.8 prior to the activation of reserves. Table 8 below provides a summary timeline of the actions taken. Figure 1 below outlines the process of RERT pre-activation, activation, and de-activation.

Table 8 Timeline of key events on 30 December 2019

Time	Event / Comment
0835 hrs	RERT Schedule created in anticipation of tight reserve conditions.
1447 hrs	Trip and lockout of Lower Tumut – Wagga 051 330 kV transmission line in New South Wales, limiting transfer capability on the Victoria – New South Wales interconnector.
1500 hrs	The 1530 hrs Pre Dispatch Projected Assessment of System Adequacy (PD PASA) run identified a forecast LOR 2 condition in Victoria from 1530 to 1830 hrs on 30 December 2019.
1516 hrs	• AEMO issued Market Notice (MN) 72143, declaring a forecast LOR 2 condition in Victoria from 1530 to 1830 hrs. The forecast capacity reserve requirement was 569 MW, but the minimum capacity reserve available was 223 MW. • AEMO sought a market response but had not yet determined the latest time to intervene. • AEMO issued MN 72145 for the intention to negotiate for additional reserves through RERT from 1530 to 2330 hrs. • Invitation to tender sent to short notice RERT providers.
1530 hrs	One RERT contract pre-activated due to the pre-activation time requirement
1603 hrs	AEMO issued MN 72167, declaring activation of reserve contracts effective from 1630 hrs and forecast to apply until 2300 hrs.
1629 hrs	AEMO issued MN 72169, declaring an actual LOR 1 condition in Victoria from 1600 to 1900 hrs. The capacity reserve requirement was 1,129 MW but the minimum capacity reserve available was 617 MW.
1630 hrs	• One RERT contract pre-activated due to the pre-activation requirement. • One RERT contract activated.
1700 hrs	Three RERT contracts activated.
1711 hrs	AEMO issued MN 72188, advising that the forecast LOR 2 condition in Victoria was cancelled at 1710 hrs.
1713 hrs	Improvement in PD PASA reserves evident. AEMO issued MN 72189 cancelling the actual LOR 1 condition from 1715 hrs. RERT Deactivation Notifications sent.
1830 hrs	Three of the four RERT contracts deactivated.
2300 hrs	Remaining RERT contract deactivated following the completion of its six-hour minimum continuous run time.

[10] At https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3717---procedure-for-the-dispatch-and-activation-of-reserve-contracts.pdf?la=en.

Figure 1 Process of RERT pre-activation, activation, and de-activation