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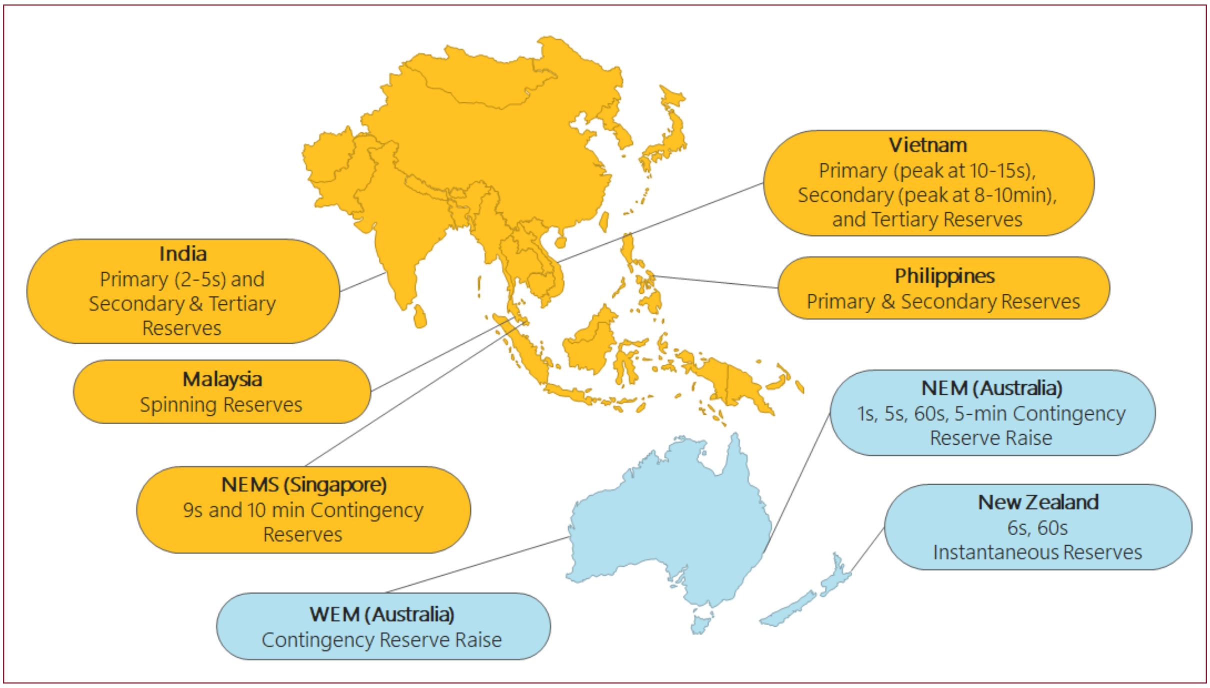
THE RUNWAY METHOD – A CAUSER PAYS APPROACH TO CONTINGENCY RESERVES COST RECOVERY

The runway method is a "causer pays" approach to recovering the cost of Contingency Reserves.

WHAT ARE CONTINGENCY RESERVES

Contingency Reserves are a type of frequency control ancillary service (FCAS) that is used to arrest and stabilise frequency if contingency (e.g. generator or network element trip) occurs.

Figure 1: Contingency Reserve products in selected markets



Why causer-pays?

Traditionally, Contingency Reserves has been recovered from loads using a simple postage stamp approach (i.e. costs smeared across loads in proportion to consumption). This is a beneficiary pays approach to cost recovery where the users of power and power related services fund all costs. Historically, this was a reasonable approach as the cost of Contingency Reserves was minor compared to energy costs. This is because historically power systems comprised largely synchronous generation with Contingency Reserves capability that would have been generating anyhow to provide baseload. Hence, the cost of scheduling headroom for Contingency Reserves would have been close to zero.

With the Energy Transition underway, the quantity of synchronous generation on power systems is decreasing. This has two effects both of which will affect the cost of procuring Contingency Reserves:

- First, increasing levels of VRE means less inertia on the power system. Less inertia will mean the rate of change of frequency (RoCoF) will increase when a contingency does occur. This will require markets to have faster responding flexible generators or to carry more reserves for slower responding units so that frequency excursions can be arrested quickly. This means that markets in the future may need to procure Contingency Reserves from much faster responding technologies or carry more reserves than usual. Fast and flexible technologies will not enter the market unless they can recover their capital, fixed and operating costs.

- Second, with high levels of intermittent generation on the power system, Contingency Reserves providers may regularly need to be constrained on to the minimum stable loading levels so that they can be dispatched for reserves if needed. These providers will incur running costs that may not be recoverable through the reserve and energy prices alone (unless they are provided a make whole payment in settlement or they are allowed to include energy costs in their reserve offer prices).

In brief, services such as Contingency Reserves are no longer ancillary, but essential. With potential increases to the cost of procuring such essential services, reviewing cost recovery approaches is timely.

The rationale behind causer pays cost recovery approaches to Contingency Reserves (and FCAS more broadly) is that that allocating the cost to that causer incentivizes them to modify their behaviour to reduce their costs. Hence, allocating Contingency Reserve costs to:

- Generators in proportion to their contribution to the largest contingency may incentivize developers to build smaller units with a smaller contribution.
- The network owner for the network contingency component may incentivize them to develop the transmission network to minimize their contingency reserve costs.

For example:

- Allocating costs to causer generators may incentivise them to reduce their risk (e.g. by configuring their facilities as multiple small contingencies as opposed to one large contingency) and thereby reduce the costs of Contingency Reserves overall.
- Increasing levels of rooftop generation mean that failure at the distribution network level may result in large quantities of embedded solar generation being disconnected. Allocating the cost of reserves procured to cover the loss of rooftop PV to the distribution utility may incentivise the utility to configure their network in a way to minimise the risk of DER disconnection.

What is the Runway Method?

The Runway Method is a causer pays approach to recovering the cost of Contingency Reserves that determines a causer's contribution based on the extent to which they have contributed to any additional scheduling of Contingency Reserves as a result of being dispatched.

Which markets allocate Contingency Reserves costs using the Runway Method

There are currently only two markets that use the Runway Method to allocate Contingency Reserves costs:

- The National Electricity Market in Singapore, and
- The Wholesale Electricity Market (WEM) in Western Australia.

The New Zealand Electricity Market and the Eastern Australian National Electricity Market (NEM) also adopt a causer-pays approach to Contingency Reserves cost recovery. However, the approach used in these markets is a simple pro-rated approach where each generator is allocated a share of Contingency Reserves cost in proportion to their MWh generation in a trading interval.

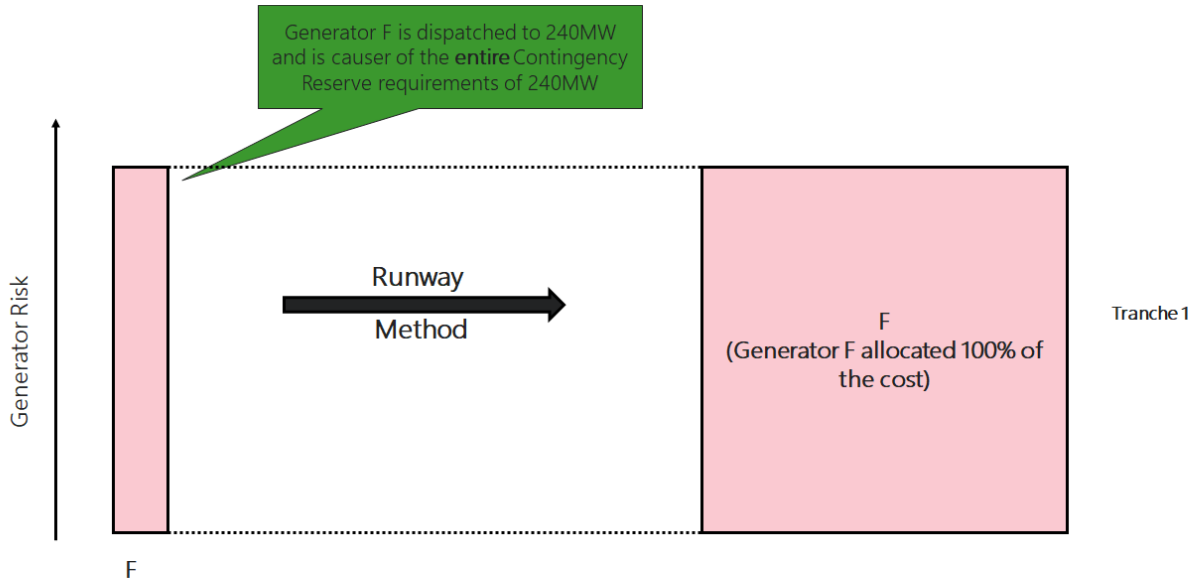
How does the Runway Method work?

Example 1: Simplified Runway Method Example: One generator only

To illustrate how the Runway Method works in practice consider a simple example in which there is only generator (Generator F) who has been dispatched to 240MW. To cover the risk of Generator A tripping, the power system operator schedules 240MW of spinning reserves at a cost of $100. In this instance, Generator F is the only causer[1] and therefore gets allocated 100% of the cost and must pay $100 to the market.

[1] For simplicity, we ignore any Contingency Reserve providers who have been constrained on to provide energy so that they can be dispatched for reserves if needed.

Figure 2: Example of Runway Method – one generator only.

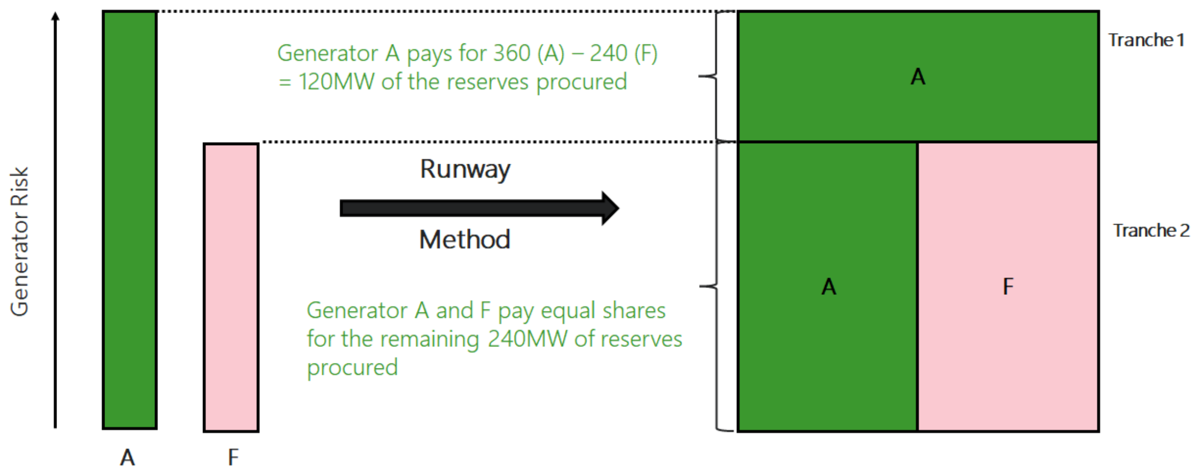


Example 2: Simplified Runway Method Example: Two generators

Now let us expand Example 1 by adding a second generator (Generator A) who has been dispatched to 360MW. The power system operator must now schedule 360MW (i.e., an additional 120MW) of Contingency Reserves to cover the risk of Generator A tripping. We now have two causers (Generator A and Generator F) both of whom are potential trip risks. In this example, the Runway Method allocates the cost as follows:

- We first consider how much additional Contingency Reserves the power system operator must schedule solely due to Generator A. Put another way, if Generator A were not dispatched, then only 240MW of Contingency Reserves would be needed to cover the risk of Generator F tripping. This means, an additional 120MW (360MW – 240MW) must be scheduled to cover only Generator A's risk. Hence, the first cost tranche accounts for 120/360 = 33.3% of the total cost of Contingency Reserves. This share is allocated only to Generator A who is the sole causer of this additional 120MW.
- The remaining 240MW of Contingency Reserves (Tranche 2) is shared equally between Generator A and Generator F as the remaining quantity of reserves covers both of their trip risks equally. Hence, 240/360 = 66.7% of the cost is shared equally between Generator A and Generator F (each being allocated 33.% each).
- Hence, Generator A (the largest risk) pays the largest cost share (33.3% in Tranche 1 and 33.3% in Tranche 2) at 66.7% ($66.70) while Generator F pays 33.3% of the total cost ($33.30).

Figure 3: Example of Runway Method – two generators.

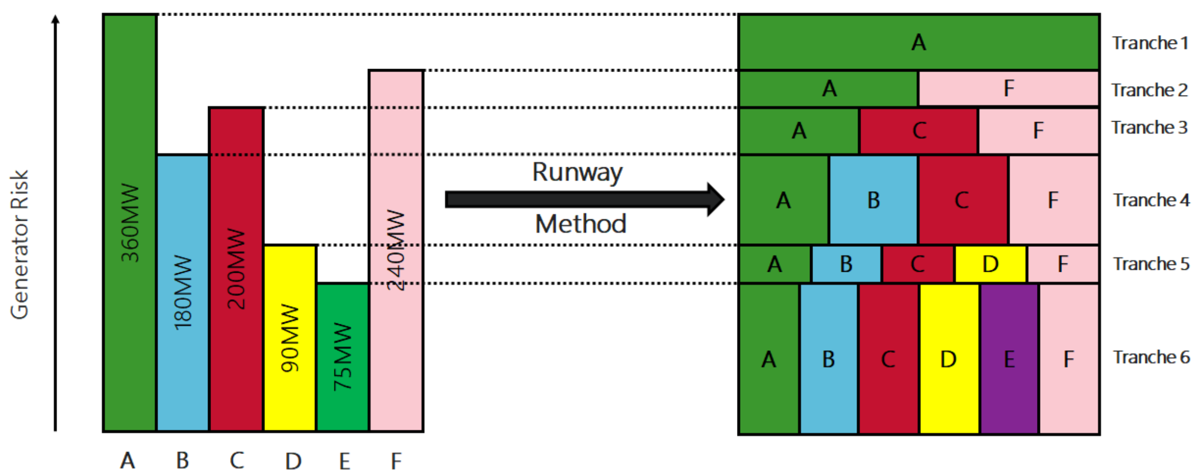


Example 3: Simplified Runway Method Example: Six generators

Now let us add four more generators so that we have six generators that have been dispatched (for energy) at varying levels. As above, the level of energy dispatch reflects each generator's risk to the power system (i.e., the largest generator tripping will cause the largest loss of MW to the system and the largest frequency excursion and is therefore the largest risk).

In this example, Generator A is the largest risk (having been dispatched for the maximum amount of 360MW), followed by Generator F (240MW), then C (200MW), B (180MW), D (90MW) and finally E (75MW).

Figure 4: Example of Runway Method



Here, we have six causers and the cost of Contingency Reserves is divided into six tranches of cost shares:

- Tranche 1 shares are calculated the same way as Example 2, as the difference between the largest risk (Generator A) and second largest risk (Generator F). That is, the power system operator has to schedule an additional 120MW (360MW – 240MW) to cover Generator A tripping. Hence, the Tranche 1 share of the cost is 120/360 = 33.3% and is allocated only to Generator A.
- Tranche 2 is calculated as the difference between the second largest risk (Generator F) and third largest risk (Generator C). That is, the power system operator has procured 40MW (240MW (Generator F) – 200 MW (Generator C)) of Contingency Reserve to cover the additional risk posed by Generator A and Generator F. That is, Tranche 2 has a share of 40/360=11.11% and is allocated equally to Generators A and F: Generators A and F each get a share of 0.5*(40/360) = 5.56% of the total cost.
- Tranche 3 is calculated as the difference between the third largest risk (Generator C) and third fourth risk (Generator B), and the shares in this tranche are allocated equally between Generators A, F and C.
- The tranche shares for Tranches 4 to 6 are calculated and allocated similarly. All tranche shares sum to 1. The smallest risk (Generator E) is only allocated shares in Tranche 6 while Generator A is allocated shares in all six tranches.

The runway method is a more accurate representation of causer contribution than the pro-rated approach as each generator's share reflects the proportion of the additional Contingency Reserves scheduled to cover their individual risk.

Example 4: Weighting tranche shares in proportion to generator reliability

In the above examples, the cost share in each tranche is allocated equally across all the generators that are members of that tranche. In example 3, the tranche 2 cost share is allocated equally across Generators A and F which the tranche 6 cost share is allocated equally across all six generators.

The National Electricity Market of Singapore (NEMS) uses the Runway Method to allocate Contingency Reserves costs but rather than allocating tranche shares equally, allocates them in proportion to the historical forced outage rates of the tranche members.

Figure 5: Example of runway method with tranche shares proportional to forced outage rates

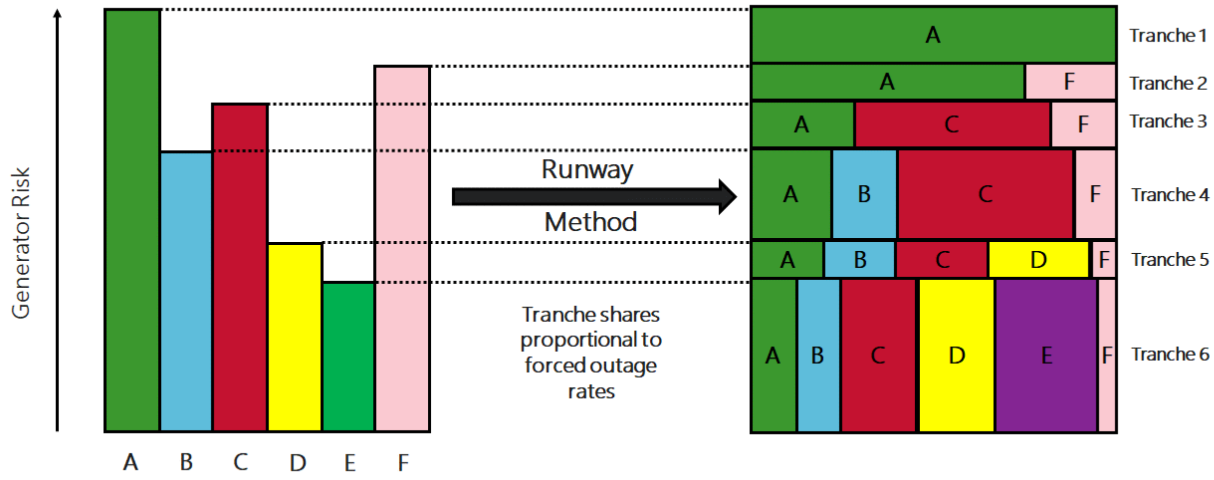


Figure 5 illustrates the Contingency Reserves cost shares where tranche shares are allocated in proportion to generator reliability. Generators with higher failure rates are allocated a greater share of each tranche they are a member of (relative to generators with lower failure probabilities).

The rationale behind this approach is to incentivize reliability – even large risks can reduce their cost share (relative to other generators) by reducing their forced outage rates.

If you need more information on cost recovery approaches to ancillary services, we'd be happy to help. Please get in touch.

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