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18 July 2019

Mr John Pierce AO

Chairman
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

*Lodged Via AEMC Website*

Dear Mr Pierce,

**NATIONAL ELECTRICITY AMENDMENT (TRANSMISSION LOSS FACTORS) RULE (ERC0251)**

John Laing is a global infrastructure investor with a portfolio that includes investments in eight renewable energy projects in the National Electricity Market (NEM). Importantly, John Laing has recently entered into a Memorandum of Understanding (MOU) with a group of 20 significant renewable energy developers and investors (the Investor Group) to develop this submission. John Laing welcomes the opportunity to make this submission on the AEMC Transmission Loss Factors consultation paper (ERC0251) on behalf of the Investor Group.

The Investor Group represents a significant stakeholder group

The Investor Group, which collaborated to identify alternatives for the treatment of electrical losses on the transmission network, represents over 6,300MW of generation investment in the NEM and a future development pipeline in excess of 10,100MW. When viewed in the context of the requirement for 54GW of new capacity in the NEM by 2040[1], it is likely that a sizeable portion of the new generation capacity to enable this transition to renewable energy will be developed and funded by the Investor Group.

The Investor Group includes the following members

- Ararat Wind Farm Pty Ltd;
- BayWa r.e. Solar Projects Pty Ltd;
- BlackRock Investment Management (Australia) Limited;
- Epuron Projects Pty Ltd;
- ESCO Pacific Pty Ltd;
- Foresight Group Australia Pty Ltd;
- FRV Services Australia Pty Limited;
- Infrastructure Capital Group Limited;
- innogy Renewables Australia Pty Ltd;
- Laing Investments Management Services (Australia) Limited;
- Lighthouse Solar Management Pty Ltd;
- Macquarie Corporate Holdings Pty Limited;
- Neoen Australia Pty Ltd;
- Pacific Hydro Investments Pty Ltd;
- Palisade Investment Partners Limited;
- PARF Company 2 Pty Ltd (Powering Australian Renewables Fund);
- Total Eren Australia Pty Ltd;
- Windlab Limited; and
- Wirsol Energy Pty Ltd.

Addressing investment risk is a priority

The unanimous view of the Investor Group is that immediate changes to the current Marginal Loss Factor (MLF) framework are required to address material risks to current and future generation investment in the NEM which will ultimately impact the long-term interests of customers. The critical concern is that the current MLF methodology results in revenue that is highly volatile and increasingly difficult to forecast. This impacts investment in generation through:

[1] AEMO 2018 Integrated System Plan

- Long term MLF reductions which materially impact the revenue of projects, many of which were commissioned or committed to many years ago, when such reductions were unforeseen. For example, certain generation projects have experienced year on year changes in MLF of over 20 per cent over the past 2-3 years.

- Short term volatility and MLF reductions which have impacted recently developed projects that have recently entered construction or operations. This has meant that project MLFs have been materially lower than had been forecast by industry experts only a few months prior.

In light of the significant additional generation required over the next decade (most of which is expected to come from renewable energy generation), and indeed the next few years, the above impacts are set to escalate in the short term, before the proposed broader Coordination of Generation and Transmission Investment (CoGaTI) reforms can be developed and transitioned to.

Given the materiality of recent year-on-year revenue reductions, a number of existing generators are likely to be suffering a level of financial distress. In some cases, the impact of this new generation capacity has caused lenders to the existing generator to restrict returns to equity, or to require refinancing. In other cases, this may result in project default and disruption to electricity supply over the medium term.

From an investor perspective, the above escalating uncertainty has already, and will likely continue to, lead to a material reduction in existing asset values and therefore require an additional risk premium to be applied to any new investments. This additional risk premium could be applied by both equity and debt investors. Unlike risks associated with interest rates and wholesale electricity prices there are no financial instruments or hedges available to investors to hedge MLF risk and as a result investors will be required to make risk adjustments when considering future investment decisions. Potential risk adjustments include a margin of safety applied to all MLF forecasts and/or an additional risk premium added to cost of capital. This is expected to increase the cost of capital associated with future projects, which will ultimately be passed on to customers through higher wholesale prices. The current MLF framework is therefore increasing the long-term cost to consumers through the future investment required to fund the 54GW of new capacity needed in the NEM by 2040.

An ALF methodology will assist in addressing investment concerns

In the context of the proposed rule change, the Investor Group proposes moving to an Average Loss Factor (ALF) methodology. This will deliver the optimal balance between reduced volatility, continued locational price signalling and simplicity of calculation and implementation. The next preferred option would be a cap and collar approach, similar to that adopted in Ireland, which compresses the potential MLF values to limit their spread and reduce volatility. As noted above, the Investor Group view this change as a positive incremental step before broader reforms being considered in the CoGaTI process can be implemented.

These positions were developed through a structured options identification and assessment process, which focussed on the need to balance generator objectives with those of consumers and the National Electricity Objective more broadly. This comprehensive process assessed the spectrum of options available for calculating transmission losses, ranging from those with high certainty (e.g. grandfathering), to those with high accuracy in terms of loss recovery (e.g. dynamic loss factors).

This submission and its attachments are made on behalf of the Investor Group. Attachment 1 is a response to enhance the current transmission loss factors framework and operation by applying an ALF methodology as soon as practicably possible and preferably for incorporation in the 2020/21 MLF's. Attachment 2 comments on the specific issues raised by the AEMC in its consultation paper.

The Investor Group is committed to finding a solution consistent with the AEMC's objectives and timetable for broader reform, and is open to discussing the matters raised in this submission further.

Please do not hesitate to contact me should you have any queries.

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Yours sincerely,

Justin Bailey

**Regional Managing Director - Asia Pacific**

Attachment 1: Submission of proposed loss factor methodology

Attachment 2: Response to the AEMC stakeholder questions

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## ATTACHMENT 1: SUBMISSION OF PROPOSED LOSS FACTOR METHODOLOGY

### KEY MESSAGES

- Volatility, in parallel with an overall reduction in MLFs in recent years, is significantly impacting incumbent generator revenues and critically influencing future investment decisions in the short to medium term.
- Given the escalation of year on year volatility of MLFs, an immediate response is necessary to ensure that investors have reduced uncertainty to enable investment in efficiently costed and sited new generation, and mitigate the need for high risk premiums or an investment moratorium.
- Retaining the current MLF framework is likely to:
    - materially increase the cost of new generation projects, resulting in higher wholesale prices for consumers;
    - reduce the volume of appropriately sited, cost effective new renewable energy generation as the risk premium applied to equity and debt hurdle rates resulting from MLF uncertainty for generators renders these projects financially unfeasible; and
    - potentially result in an investment moratorium for some investors.
- A reduction in the development of appropriately sited, efficient new generation until broader reforms are developed, agreed and transitioned to could severely impact the ability to maintain efficient electricity supply in the medium to long term.
- The Investor Group proposes moving to an ALF methodology to achieve an optimal balance between the need for investor certainty and the need for the accurate calculation and apportion of losses in electricity supply; as well as balancing key stakeholder objectives, being the need for investment certainty, efficient locational signalling, calculation simplicity and ease of implementation.

Attachment 1 provides the Investor Group's considered position in response to the AEMC's consultation paper. This position was informed by work undertaken by a third party technical consultant, together with discussions from AEMO and AEMC, to complement the expertise within the group. It includes a summary of:

- why the current loss factor methodology is not delivering efficient outcomes for market participants and requires an alternate solution
- the process undertaken to identify and qualitatively analyse a range of options to reform the current MLF framework
- our analysis supporting an ALF methodology as our preferred option, and Irish methodology as a second-preferred option.

#### *The current marginal loss factor methodology is not delivering efficient outcomes for generators and customers*

The electricity market is undergoing tremendous change as it transitions from fossil-fuel sources to renewable sources. This change is characterised by a higher number of more widely located generators connected to the system, and generation profiles that are defined by the availability of renewable energy resources. This in turn is leading to increased generation supply, and therefore congestion, in weaker transmission network locations; less stable generation supply profiles and therefore reduced forecast accuracy; and information asymmetry as some parties have greater access to a more complete perspective of future generation and load profiles than others.

In the context of the above, the current MLF framework inhibits effective revenue forecasting and the corresponding impact on investment risk. This is because it is extremely challenging for investors to price the uncertainty of MLFs due to:

- the sensitivity of MLF values to subsequent connecting generators, particularly on weaker parts of the network i.e. MLF values for incumbents will decrease with subsequent connections

For example, existing generator MLFs have been materially reduced in the past 2-3 years resulting from new generators connecting in close proximity. Given the materiality of recent year-on-year revenue reductions, a number of existing generators are likely to be suffering a level of financial distress. In some cases, the impact of this new generation capacity has caused lenders to the existing generator to restrict returns to equity, or to require refinancing. In other cases, this may result in project default and disruption to electricity supply over the medium term

- deep information asymmetry between AEMO and investors and their forecasting consultants (i.e. availability of information in regards to AEMO's methodology and data assumptions that underpin the annual MLF forecasting)
- lack of accuracy and transparency around the location and timing of future generation and transmission investments (i.e. committed project information that would improve the due diligence of investors).[2]

This is imposing a high degree of volatility and risk on incumbent generators and on potential future generation projects, and ultimately this will reduce the efficiency of electricity supply and increase costs.

From an incumbent generator perspective:

- when the existing generator makes its investment decision, it is hard to identify new generators other than over a very short horizon and well short of the 25-30 year investment horizon. Many of these generators are now faced with immediate and decreasing viability of project investments as changes to MLFs that were unforeseen, and potentially unpredictable at the time of making the investment decision, are now applicable to those projects
- increasing volatility in annual MLF values, arising out of unpredictable new generation connecting to the system and use of historical data from two years previous, is making annual revenue difficult to predict and budget for in the short term
- overall decreasing MLF values arising out of increased congestion, particularly in regional locations, are reducing overall project revenues and this is likely to escalate in coming years as the requirements for 54GW of new capacity in the NEM by 2040 is realised[3].

From the perspective of a potential (equity or debt) investor in new generation:

- the increasing unpredictability of MLFs is creating uncertainty for existing generator's revenue streams and making future project revenue stream forecasts less bankable and investable. Potential equity and debt risk adjustments, which adversely impact the wholesale price that would be passed on to consumers, include a margin of safety[4] applied to all MLF forecasts and risk premium added to cost of capital – both have potentially material impacts on the cost and viability of new generation.
- loss factors are becoming an ineffective locational signal for new generation (and therefore transmission investment) as accurately forecasting loss factors over the life of the investment is increasingly difficult.
- investors are not able to manage the risk of subsequent connections and congestion on the network, and are likely to apply an additional risk premium to renewable generation investments, leading to inefficient pricing outcomes at a cost to customers.
- potential investors may choose not to invest in future generation projects given the additional financial return uncertainty, resulting in less low cost renewable generation being built, halting the renewable energy transition needed to deliver outcomes in the long-term interest of customers (i.e. 54 GW new capacity required by 2040).[5]

[2] We note that information asymmetry and transparency is being consider in AEMC's Transparency of new projects paper (ERC0257), but that these factors are contributing to MLF uncertainty.

[3] 2018 Integrated System Plan.

[4] The margin of safety is a concept applied by banks which would result in the application of a more conservative MLF forecasts in project financial models. In general, this would result in higher wholesale prices being passed on to consumers.

[5] 2018 Integrated System Plan.

The culmination of the above is that significant risks and pricing impacts are, and will increasingly be, borne by customers. That is, as declining MLFs cause an overall reduction in revenues for generators, these generators will likely seek to recoup the costs of losses through increased bid prices and Power Purchase Agreement (PPA) prices. Further, investors are expected to apply a risk premium to new investment opportunities, or even choose not to invest in renewable generation, which will likely inhibit the achievement of efficient and reliable supply objectives of the NEO and of renewable energy generation targets across various jurisdictions.

It is acknowledged that some of the information asymmetry and locational issues are being considered through related AEMC rule change consultations and AEMO projects.[6] However, the challenges with MLFs present critical risks to ongoing investment and ultimately wholesale electricity market prices prior to full adoption of the *coordination of generation and transmission investment implementation– access and charging* market review (EPR0073). The CoGaTI reforms will be a lengthy process and could take in excess of four years to finalise when any associated transitional arrangements are accounted for. Such a significant electricity market reform to the fundamental operations of the NEM would likely open the market to significant uncertainty, which may result in price increases, or in the worst-case halt investment in generation until resolution is found through CoGaTI.

In addition, it is important to acknowledge that the current MLF framework over-recovers the amount required to settle the market and creates a pool of revenue which is ultimately returned to the customers through reduced transmission costs on a postage stamp basis. As a result, the NEM has seen substantial intra-regional settlement residues (IRSR) collected by TNSPs.

In summary, the Investor Group considers that the current MLF framework should be reviewed as a matter of priority to address the volatility and revenue risk concerns that will ultimately impact longer term renewable generation investment in the NEM, prior to any potential CoGaTI reforms. Given the critical, and wide-ranging, implications of failing to act, it is important that the AEMC carefully considers this opportunity to address these issues in the near future.

***The current loss factor methodology requires an interim solution***

The existing MLF methodology is materially impacting the certainty of revenue associated with existing and potential generation projects, which will ultimately impact the cost of electricity supply. As noted by the AEMC, rapid growth in intermittent generation of the same type and with similar generation profiles, is connecting at remote NEM locations, where transmission infrastructure was not built to support the required level of generation. As a result, this new generation is increasing local network congestion and electrical losses on routes to demand centres at a pace not previously seen, causing yearly MLFs to be unpredictable, highly variable and typically on an increasingly downward trend.

Given the level of new generation required in the NEM over coming years, these issues will escalate as new generation is planned to be added to the system, thereby further reducing MLF values, and increasing volatility. This raises immediate and serious concerns about the investment viability of projects planned in the short to medium term, which cannot be addressed in a timely manner by the broader market reviews being undertaken by the AEMC, such as the CoGaTI reforms.

The Investor Group acknowledges the interdependencies with broader market reforms currently underway, notably the AEMC's CoGaTI reforms, which proposes to introduce locational marginal pricing and transmission hedges by July 2023. However, CoGaTI reforms are at least four years from full implementation and investors require more immediate resolution to investment concerns. A delay could have a significant impact on the NEM investment pipeline. AEMC discussions indicated that any loss factor methodology change may be short term in nature, to be applied as an interim solution until broader CoGaTI reforms are implemented. At this stage the Investor Group has not formed a view on the locational marginal pricing and transmission hedges being proposed through the CoGaTI reforms.

6 AEMC CoGaTI reforms, AEMC Transparency of new projects (ERC0257) and AEMO Review of Marginal Loss Factor Calculation Processes.

***Qualitative assessment on options to reform current MLF framework***

John Laing engaged a third-party technical consultant to provide advice on alternative options to the current MLF framework.

The consultant conducted a qualitative assessment to identify and analyse a range of options that could be applied by the AEMC to reform the framework and operation of loss factors. The output of this work has informed the Investor Group's preferred option.

The steps undertaken in the review process were as follows:

1. Identification of the spectrum of options available for calculating loss factors
2. Development of an assessment framework taking into account various stakeholder objectives
3. Qualitative assessment, recommendations and findings against the assessment framework
4. Development of preferred alternative option.

Each of the steps undertaken are summarised below.

1. <u>Identification of the spectrum options available for calculating loss factors</u>

A suite of options was identified and defined based on those proposed in the AEMC Consultation paper, as well as others identified through relevant public material considered in Australia and abroad and through technical discussions with the consultant.

The options identified can be viewed through three competing priorities and objectives, which originate out of various perspectives to the issue. By applying different weights to these three competing priorities, three distinct sets of outcomes can be derived (see Figure 1 on the right).

**FIGURE 1: THREE LENSES OF COMPETING OBJECTIVES**

*Technical lens* – Preferred options are those that accurately account for and attribute the physics of electrical losses to market participants.

*Economic efficiency lens* – Preferred options are those that signal efficient pricing and signalling across the NEM, that therefore better reflect the National Electricity Objectives (NEO).

*Project financing lens* – Preferred options are those that better manage commercial and financial risks, recognise the need to provide transparent investment signals and facilitate efficient future investment in generation capacity.

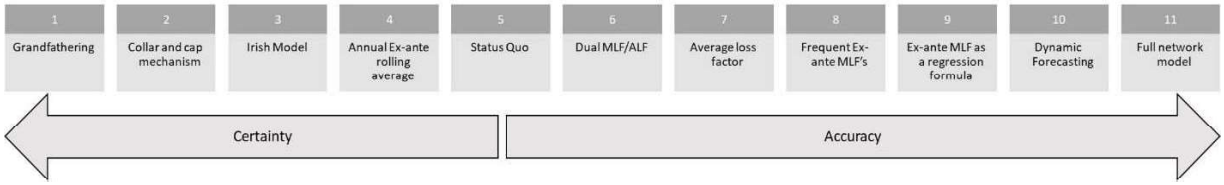
In addition, the technical nature of loss factors mean that all options exist on a spectrum of providing either:

- greater certainty, meaning that MLFs are less susceptible to change. These options, which include grandfathering, are static in nature and insensitive to market changes, and completely divorced from physics.
- greater accuracy, meaning that MLFs are more representative of actual losses in the system. These options, which include ex-post or dynamic MLF calculations, ensure MLF calculations reflect the behaviour of actual, or close to actual, losses and reduce settlement residues.

Although these extremes might perform extremely well when viewed through just one lens, they are likely to perform poorly from another perspective. For this reason, the qualitative assessment sought to "bookend" the extremes, and then develop feasible options that performed well across all three lenses. The options positioned between these extremes use various mechanisms to adjust the frequency at which loss factors are set, to moderate volatility, or to minimise the dampening of signals.

Figure 2 depicts options along a certainty-accuracy spectrum.

**FIGURE 2: SPECTRUM OF OPTIONS**



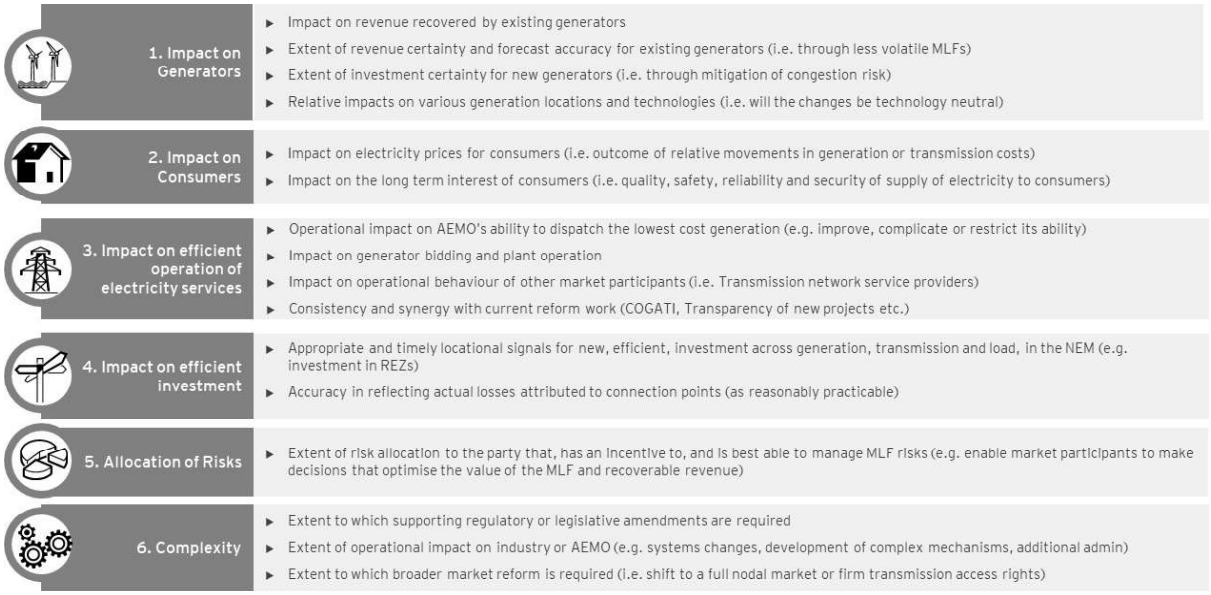

2. Development of an assessment framework taking into account various stakeholder objectives

In order to analyse the identified options, the consultant developed an assessment framework which ensured a balanced view of various stakeholder objectives.

Developing the assessment framework involved reviewing the AEMC's proposed assessment framework, including the NEO considering any adjustments to the AEMC's framework that might deliver an acceptable solution to all market participants, and that reflect the practical constraints previously identified (i.e. design complexity and regulatory amendments required).

The assessment framework ultimately included six key criteria, which are summarised below. Criterion 3, 4 and 5 were designed to reflect the AEMC's proposed framework.

**FIGURE 3: ASSESSMENT FRAMEWORK**




3. Qualitative assessment, recommendations and findings against assessment framework

Each identified option was qualitatively assessed against the assessment framework. A high level scoring framework was applied to qualitatively assess options against the status quo and ranged from -2 to +2 depending on the relative size and direction of impact. All assessment framework criteria were weighted evenly.

A workshop was then held with the Investor Group to further test and validate assessment outcomes, and scores were finalised on this basis. Figure 4 provides a summary of the final ranking of options (number 1 being the preferred option).

**FIGURE 4: RANKING OF EVALUATED OPTIONS**

| | | | |
|---|---|---|---|
| 1 | Average loss factor (ALF) | 6 | Frequent Ex-ante MLFs |
| 2 | Irish methodology | 7 | Full network model |
| 3 | Collar and Cap mechanism | 8 | Grandfathering |
| 4 | Dual MLF/ALF methodology | 9 | Dynamic forecasting |
| 5 | Annual Ex-ante rolling average | 10 | Ex-ante MLF as a regression formula |

In summary, options that scored highest against the criteria (i.e. options 1-4 above) were assessed as likely to:

- ✓ materially reduce the volatility and improve the forecastability of loss factors for existing generators as well as prospective investments
- ✓ result in loss factors that are more reflective of physical losses, and therefore reduce the current over-recovery of IRSR.
- ✓ be relatively simple and expedient to implement from a technical design, calculation, systems and regulatory perspective.
- ✓ reduce risks of inefficient pricing outcomes for consumers in the immediate and medium term
- ✓ minimise the dampening of pricing signals for efficient planting of new generation, inherent in a move away from an MLF methodology.

4. Development of preferred option

The preferred option, reached through consensus with the Investor Group, was ultimately the ALF methodology as this was considered to best address the key concerns of generators whilst mitigating impacts on customers. The ALF option, along with the next preferred option, the Irish methodology, is discussed in the following sections.

The ALF methodology was assessed as most likely to promote efficient market outcomes whilst dampening some of the volatility experienced by generators in recent years. It is proposed that this be introduced to address immediate concerns prior to full transition to the CoGaTI reforms and ideally for the 2020-21 MLF's.

The Adani Renewables' second rule change request does not specify a preferred formula and there are several formula variants available. Below is the definition and key assumptions underpinning the methodology proposed by the Investor Group.[7]

**Average loss factor methodology**

The ALF is proposed to be calculated by taking the square root of the current MLF for each trading interval for a given period at a given connection point, and then volume-weighting to form a single value. This will produce a static annual loss factor for each transmission connection point. The ALF formula is reflected below:

$$ALF = \sqrt{MLF}$$

All other aspects of the current loss factor calculation process are expected to be retained.

In addition to its preferred formula, the Investor Group considered halving the current MLF for each trading interval (i.e. a halving formula).[8] Our analysis compared both formulas with respect to:

[7] The Investor Group acknowledges that there are many formulas that might be considered as reflective of an average loss factor methodology and that each would yield slightly different MLF results. The ALF methodology outlines the Investor Group's preferred formula.

[8] The 'halving' formula is reflected as: $1 + \frac{(MLF-1)}{2}$

- how each formula impacted loss factors compared to the current MLF methodology (i.e. the degree to which the formula reduced volatility and increased loss factors for those with an MLF under 1.0)
- how each formula reflected actual losses and impacted the likelihood of an under-recovery of IRSR.

High level assessment indicated that each formula variant yielded slightly different loss factor outcomes:[9]

- The 'halving' ALF formula tended to improve currently low MLFs to a greater degree than the square root formula
- The square root formula tended to more closely reflect actual average losses than the 'halving' ALF formula, and is therefore more likely to mitigate the risk of an under recovery of IRSR.

Based on these findings, the Investor Group decided in favour of a square root formula as its preferred ALF formula.

The benefits of an ALF methodology to loss factors in the NEM are that it is likely to:

- ✓ reduce volatility of revenue for all existing generators by approximately half
- ✓ result in loss factors close to the theoretical optimal loss scenario, and therefore significantly reduces the current over-recovery of IRSR.
- ✓ increase investment certainty and bankability for future renewable energy projects
- ✓ mitigate against generators applying a risk premium to the cost of capital for future projects, which are ultimately costs borne by customers through higher wholesale prices.
- ✓ be relatively simple to implement from a technical design, calculation, systems and regulatory perspective – discussions with the AEMO indicate that it could calculate factors for the 2020/21 financial year using an ALF methodology.
- ✓ Retains some element of locational signalling (and importantly the relativity of generators and consumers), albeit dampened compared to the MLF framework, for the efficient planning of new generation.

The qualitative assessment also identified potential issues with the ALF methodology that the AEMC or market participants may raise. Table 1 outlines these potential issues and our considered response. For some potential issues this includes advice on mitigations that the AEMC could consider.

The Investor Group does not consider any of the below issues materially impact the viability of the option.

**TABLE 1: OUR RESPONSE TO POTENTIAL ISSUES WITH THE ALF METHODOLOGY**

| Potential Issues | Description | Our response |
|---|---|---|
| Under-recovery of IRSR | The ALF methodology significantly reduces IRSR as it better reflects actual physical losses. This raises potential risk of a negative residue, that is where IRSR is under-recovered. | The ALF methodology will better reflect actual electrical losses and on balance should reduce the magnitude of over-recovery, but may also result in an under-recovery (i.e. the ALF method might under-recover, if the average ALF across all generation is more than the average ALF across all load). Preliminary analysis indicates that this could result in small under- and over-recoveries, which is to be expected. Detailed analysis would be required to assess this. |

[9] preliminary analysis on how each ALF method would impact IRSR. Reviewing a single time period (1pm), the graph below indicates that the square root method to be closest to reflecting actual losses. Further analysis over the larger sample size would be required to determine which method is most likely to avoid an under recovery of IRSR.

| | | |
|---|---|---|
| | | Subject to more detailed analysis of IRSR outcomes, there is the opportunity to augment the proposed ALF formula to mitigate the risk of a negative residue.<br><br>Negative residues are already dealt with in the market as this consistently occurs in South Australia. |
| Consistency with marginal pricing | ALF methodology is not consistent with marginal pricing approach of the NEM or more broadly with economically efficient pricing practices. Therefore, this option may lead to less efficient locational investment decisions and dispatch of generation therefore higher cost settlement outcomes. | The proposed ALF methodology reduces volatility and inherently dampens locational pricing signals for investment and dispatch. Nonetheless, it does retain significant locational signalling, and is deemed to be an appropriate compromise between investment, technical and economic lenses.<br><br>It is noted that the current MLF framework is not completely consistent with the marginal pricing approach of the NEM. This is because it applies forecast volume-weighted values that do not correspond to the five-minute marginal price from which electricity is dispatched. |

***The Irish methodology could also deliver efficient market outcomes***

It is worth setting out for the AEMC's consideration the option that the Investor Group considered to be next-preferred; the Irish methodology.[10]

Below is the definition and key assumptions underpinning the Irish methodology.

**Irish methodology**

A single volume-weighted intra-regional marginal loss factor value per financial year for a given transmission connection point adjusted by a compression algorithm.

The compression factor algorithm takes the uncompressed MLF value (X) and uses a normalisation number (NN) as a point of reference for the MLFs to be compressed around. The formula for compression is:

If X<NN, $\frac{NN-X}{2*NN} + x$

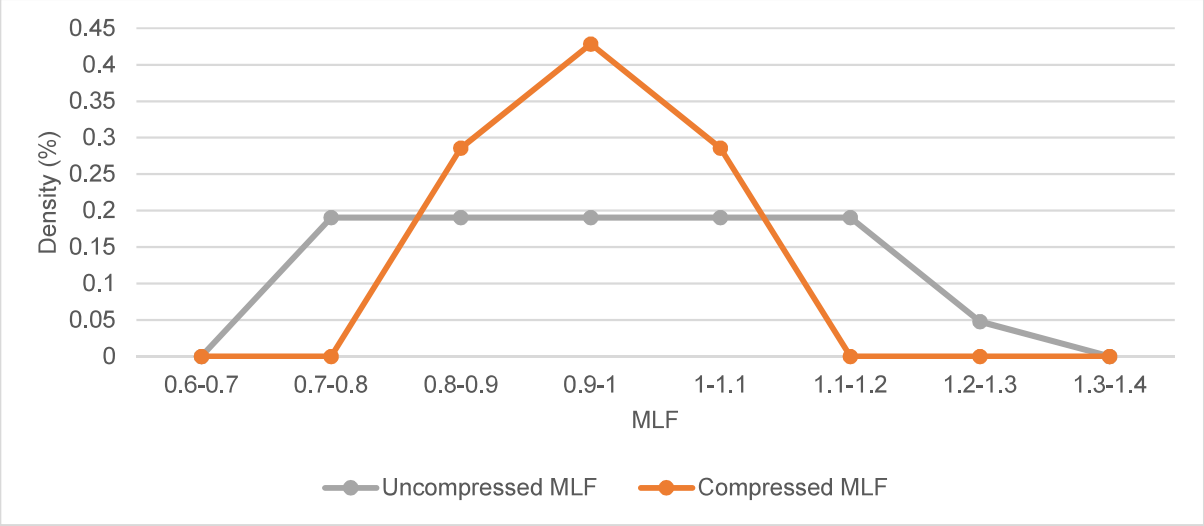
If X>NN, $x - \frac{X-NN}{2*NN}$

An NN of 0.95 was assumed for the purposes of illustration only. In practice, AEMO would have to set NN with regard to balancing total marginal losses before compression with the total marginal losses after compression. Note that the Irish method applies an NN value of 0.98, however given the dispersed nature of the NEM transmission system, NN would likely be lower than 0.98.

Figure 5 below demonstrates how the Irish methodology would compress current MLFs. As a result of the compression algorithm, a much greater proportion of MLFs would be within 10% of 0.95 under the current MLF framework.

[10] The Investor Group considered three variants of the collar and cap methodology, the first two of which were defined in the AEMC's paper, and the Irish methodology. An assessment of the former two options is provided at Attachment 2.

**FIGURE 5: IRISH METHODOLOGY - COMPRESSION**




The benefits of the Irish methodology applied to loss factors in the NEM are that it is likely to:

- ✓ reduce volatility of revenue for all existing generators
- ✓ result in loss factors closer to the theoretical optimal loss scenario, and therefore reduce the current over-recovery of IRSR.
- ✓ increase investment certainty and bankability for future renewable energy projects
- ✓ mitigate against generators applying a risk premium to the cost of capital for future projects, which are ultimately costs borne by customers.

We found this option to deliver similar outcomes to the ALF methodology, particularly with respect to dampening some of the volatility experienced by generators in recent years. However, the option is less preferred compared to the ALF methodology due to its relative complexity to understand and implement, and it being less reflective of actual losses and therefore less effective at reducing the current IRSR over-recovery (but superior to the other options). The methodology is also particularly sensitive to the value assumed for the normalisation number (NN) and a materially lower NN is unlikely to be supported by the Investor Group.

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## ATTACHMENT 2: RESPONSE TO AEMC STAKEHOLDER QUESTIONS

**1(a) Do you agree with the problems identified by Adani Renewables in relation to:**

- **the current distribution of Intra-Regional Settlement Residues to market customers only**
- **that the current marginal loss factor methodology produces "inaccurate" results**

IRSR distribution

The Investor Group broadly agrees and considers that there is potential merit in the distribution of a portion of the IRSR to generators. However, it also considers that in light of the magnitude of IRSR over-recovery against the value of total energy sales in the market, this is less of a concern for investors than the volatility arising out of the current MLF methodology. As detailed in this submission, the most critical risk to investment is posed by the current MLF framework. Preliminary analysis of the ALF methodology or Irish methodology indicates that these alternative options would mitigate the IRSR issue that has been identified. Greater transparency through the regular publication of intra-regional settlement residues would enable ongoing monitoring of these amounts to identify potential issues.

Accuracy of MLF methodology

In considering whether the current MLF methodology produces inaccurate results, the theoretical lens under which it is being examined is key. For example, when viewed through an economic lens, an MLF methodology offers a theoretically sound basis for signalling efficient generation and investment decisions (disregarding timing and forecast issues). However, when viewed through a project financing or technical lens, it could be deemed as less accurate than a methodology such as the ALF methodology given its propensity to over-recover IRSR year-on-year.

From a practical perspective the MLF methodology applied by AEMO is regarded as inaccurate due to:

- The two-year time-lag between the historical data used to forecast a given year's MLFs. Particularly during this transitional-state in the NEM, with many new generators being connected from year to year, the data does not accurately reflect the year it is intended to forecast.

- Uncertainty regarding the forward-looking projections which are based on the expectation of what will happen for the forthcoming year in terms of demand and dispatch patterns, and network flows and losses. Any changes made, for example cancellation, delays, or change in the volume of forecast generation and loads subsequent to publication of the MLFs in April are not reflected in that year's MLF. Also, scenarios such as an unforeseen maintenance on a large generator (which might actually reduce losses) would not be reflected for that year. We also note there is no true-up or adjustment mechanism to compensate generators for an incorrect MLF.

The Investor Group recommends that the MLF methodology be replaced by an ALF methodology as this is expected to dampen volatility in loss factors from year to year, reduce the impacts of increased congestion, and would be less likely to result in an over-recovery. This would mitigate some of the above impacts, and reflect a more accurate recovery of actual losses.

**1(b) Do these problems have a material impact on the long-term interest of customers?**

The current MLF methodology inhibits effective revenue forecasts, introduces uncertainty and therefore increases investment risk. This is because it is extremely challenging for investors to price the uncertainty of MLFs due to the sensitivity of MLF values to subsequent connecting generators, particularly on weaker parts of the network. This uncertainty is imposing a high degree of volatility and

risk on incumbent generators and on potential future generation projects, and ultimately this will reduce the efficiency of electricity supply and increase costs.

From the perspective of a potential investor in new generation, the increasing unpredictability of MLFs is creating uncertainty for existing generators' revenue streams and making future project revenue stream forecasts less bankable and investable. Potential risk adjustments which adversely impact the wholesale price that would be passed on to consumers include a margin of safety applied to all MLF forecasts and risk premium added to cost of capital – both have potentially material impacts on the cost of new generation.

**1(c) Do you have other concerns (not identified by Adani Renewables) about the operation and impact of the transmission loss factor framework?**

The Investor Group considers that the current MLF framework presents material risks to future investment in generation in the NEM and is detrimental to the long-term interests of customers, and therefore the National Electricity Objective. A key concern regarding the application of MLFs is that it results in revenue that is highly volatile, difficult to forecast and can't be hedged. This impacts investment in generation in two critical ways:

- Long term reductions in MLFs are materially impacting the revenue of projects, many of which were commissioned or committed to many years ago, when such reductions were unforeseen. For example, generation projects have experienced year on year changes in MLF by over 20 per cent over the past 2-3 years.

- Shorter term volatility and MLF reductions, have impacted projects that have recently entered construction or operations. This has meant that project MLFs have been materially lower than had been forecast by industry experts only a few months prior.

Given the significant additional generation required over the next decade, and indeed the next few years, the above impacts are set to escalate in the short term, before the proposed broader Coordination of Generation and Transmission Investment (CoGaTI) reforms can be developed and transitioned to.

From an investor perspective, the above escalating uncertainty will likely lead to a material reduction in existing asset values for a number of projects. Investors are also likely to require a larger risk premium be applied to any new investments. Potential risk adjustments include a margin of safety applied to all MLF forecasts and a risk premium added to the cost of capital. This will increase the cost of future projects with this cost ultimately being borne by customers through higher wholesale prices.

**2(a) Do stakeholders agree with the proposed assessment framework?**

The Investor Group broadly agrees with the assessment framework proposed by the AEMC, but also encourage the AEMC to consider additional criteria such as impacts on specific market participants, technologies and locations and the extent to which complexity, cost and implementation timeframes are a factor. Further clarity could also be provided about how each criterion will be weighted or prioritised.

The AEMC paper suggested market participants such as generators, are in a position to impact the value of MLF allocated to them (i.e. its risk allocation), in contrast to end-use consumers. This may be the case for some prospective investors (assuming they have access to accurate forecasts), however existing generators have limited ability to manage MLF risk due to the long-term nature of investments.

**2(b) Are there any additional considerations that the Commission should take into account?**

The AEMC should also consider the degree of complexity and time to implementation for each option, taking into consideration AEMO and other market participant concerns. Any solution is likely to be temporary in nature, with wider CoGaTI reforms expected from July 2023. A complexity criterion also allows the AEMC to consider the allocation of resources and cost of implementing the various options.

For example, some options may require significant changes to AEMO's model while others are easily applied and can be developed using existing data sets (i.e. ALFs which are already used in distribution network calculations of loss factors).

**3 What improvements do you suggest could be made to elements of the transmission loss factor framework and why? In particular with reference to:**

**3(a) calculating transmission loss factors on a marginal or average basis**

The qualitative assessment commissioned by John Laing indicates a strong case to transition to an ALF methodology as soon as practicably possible. The ALF methodology is a practical interim solution to minimise the current volatility and uncertainty, that effectively balances technical, economic efficiency and commercial trade-offs inherent in the AEMC's proposed assessment framework.

Calculating loss factors using an ALF methodology would provide immediate revenue stability for incumbent generators (reducing volatility by approximately half) and reduce the number of projects at risk of debt default. It would also significantly reduce the commercial and financial risks to future renewable energy projects, and therefore the large risk premiums.

The ALF methodology better reflects the theoretical optimal loss scenario (i.e. the actual physical losses that loss factors are designed to represent). As a result, it also reduces the current over-recovery of IRSR (positive residue) and may result in some cases of under-recovery (negative residue). Under-recoveries are regularly dealt with in South Australia.

From a practical perspective, the ALF methodology is a relatively simple calculation that requires minimal change to current methodology and required data sets, and therefore minimal system and regulatory changes.

AEMO has indicated that it could implement an ALF methodology for the 2020/21 financial year. This would enable the AEMC to respond to the current market concerns now rather than risk taking no action until CoGaTI reforms are in place, which would have significant impacts for all market participants.

**3(b) allocating intra-regional settlements residues**

Given that electrical losses on the transmission network arise out of conveyance of electricity between the regional reference node and both generation and load connection points, it is therefore reasonable that any over-recovery should be shared on some basis between the parties. However, although the Investor Group does see merit in an allocation of IRSR such that generators would receive a share, this issue is a lower priority than addressing the volatility inherent in the MLF methodology and thus does not require urgent analysis.

**3(c) the frequency of calculating MLFs**

The frequency of calculating MLFs should not change and a single volume weighted loss factor value for a given connection point for a given financial year should be retained.

Through qualitative assessment, two options to increase the frequency calculating MLFs were considered:

- Frequent ex-ante MLFs (on a monthly, seasonal or on-peak off peak basis)
- Dynamic forecasting (on a real time, 5 minute, daily or week ahead basis).

While losses are expected to be more reflective of physical losses than the status quo, more frequent application of MLFs has the potential to:

- increase the volatility of MLFs within a financial year, and potentially further reduce accuracy of MLF forecasts.
- require extensive analysis and consultation to determine the most applicable basis to apply a frequent MLF.

- impose significant system changes as calculation reaches real time, the greater the estimation required, and greater potential for inaccuracy.

From the investor's point of view, increasing transparency through increasing the frequency of MLF *publication* (on a quarterly or half yearly basis) may better inform future investment decisions. It is important that investors are equipped with the most up to date information for their decision-making processes. Currently, investment decisions are being made based on MLFs that could be up to 12 months out of date in the worst case.

More frequent publication would allow investment decisions to be made based upon the most recent data. For example, the feasibility of an investment in June 2019 compared to March 2020 may vary significantly, however under the current regime, investors would be making decisions based on the same MLF values.

**3(d) the notice period provided to market participants**

The Investor Group does not support extending the current three-month notice period. Such an arrangement would make AEMO less able to reflect recent changes in generation or load profiles, which could result in less accurate loss factors being published.

Nonetheless, it is important that investors are equipped with the most up to date information for their decision-making processes. AEMC and AEMO are encouraged to work together to improve the lack of accuracy and transparency around the location and timing of future generation and transmission investments.

In addition, two improvements to the forward-looking loss factor methodology are recommended at 3(e).

**3(e) whether a forward-looking or backward-looking methodology should be used**

The Investor Group supports the retention of the current forward-looking methodology over returning to a backward-looking methodology. This is a sound approach as it extrapolates historical data while simultaneously accommodating forecasts of future generators, load and transmission changes.

The backwards-looking methodology was appropriate in a pre-2003 NEM comprised of few large thermal generators with predictable generation profiles. The rapid growth in renewable generation that the NEM is undergoing makes the backward-looking methodology an impractical change delivering less accurate forecasts and increased uncertainty.

The backwards-looking methodology is similar to the grandfathering option in that it delays the impact of recent connections on MLF values. While a backward-looking methodology may benefit existing generators (due to a two-year lag in MLF deteriorations) it would deter future investment and place at risk new supply, placing system reliability and security at risk.

The Investor Group recommends two improvements to the forward-looking loss factor methodology:

- Firstly, the time taken for calculation of MLFs is such that the target year and reference year are out of step by a full financial year. The calculation methodology should be altered such that it utilises the most recent available full year data. For example; the 2019/20 financial year MLFs were calculated in the financial year 2018/19 using the financial year 2017/18 as the reference year.
- A new reference year should be constructed such that it incorporates the most recent full year comprised of two halves of different financial years. For example, in the calculation of the 2019/20 MLFs, AEMO could use the latter half of 2017/18 financial year and the first half of the 2018/19 financial year. We understand that AEMO requires a full calendar year to observe seasonality, however we consider that our proposed change is in the best interests of all stakeholders because it provides the most recent data and minimises the extrapolation period.

We note that clause 3.6.2(i)(2) of the National Electricity Rules allows AEMO to revise intra-regional loss factors if they consider a change in a *connection point* to result in a material change in the capacity of that connection point. However, we also note clause 11.41.4(d) of the National Electricity Rules does not require AEMO to recalculate any intra-regional loss factors revised before June 30 except as a result of a change to the methodology. The AEMC should review whether these clauses are complimentary and allow for sufficient flexibility to accommodate other material changes in NEM generation e.g. thermal generator maintenance, unforeseen outages or refurbishments.

**3(f) if a collar and cap should be applied to transmission loss factors**

As part of its qualitative assessment, the Investor Group considered both collar and cap mechanisms defined in the AEMC's paper. In defining these variations, we assumed these variants retain the current MLF framework and are then adjusted according to the particular collar and cap methodology. Both variants are described below:

1. Banded collar and cap (i.e. all loss factor values must between 0.8 and 1.1).
2. Percentage constrained collar and cap (i.e. maximum +-5% variation for any given year)

We note the following key findings based on our qualitative assessment:

- The percentage constrained collar and cap is our least preferred cap and collar variation. In our view this variation is unlikely to resolve issues around MLF volatility and predictability as generators and investors could still see MLFs reduced by 15 per cent in a three-year period.
- The constrained collar and cap is likely to be well received from a project finance perspective as it limits the downside return for renewable energy developers. However:
    - The option fails to capture relative movements (i.e. generators with MLFs at or below the 0.80 collar will likely be clustered at this lower bound) and therefore likely to deliver inefficient dispatch and investment outcomes.
    - Generators that sit within the 0.8-1.1 collar and cap will not see any change to the volatility of its MLF value (i.e. a generator could still theoretically see a movement in its MLFs by up to 30 per cent in one year).
- A Collar and Cap methodology is not recommended by the Investor Group.

**3(g) if grandfathering MLFs should occur**

The Investor Group does not support grandfathering MLFs as an interim or long-term solution based on the potential for grandfathering to distort investment signals and discourage future investment in generation. Generators that do not qualify for a grandfathered MLF will be required to pay for the relative impacts of their own and the existing generators marginal loss. In addition, losses are unlikely to reflect physical losses and are likely to become more inaccurate over time.

Some market participant may see the revenue certainty and 'causer pays' principle[11] of grandfathered MLFs appealing, however we expect it will be challenging for the AEMC to develop and gain support for a grandfathering methodology that would deliver these outcomes as it would result in a divergence of opinion. For example, it is likely that each market participant will have a different view on which projects should qualify for a grandfathered MLF and the period for which grandfathering occurs (i.e. life of the asset or number of years). There would also be contention around what MLF should be applied to a grandfathered generator at the end of the grandfathering period. A generator's position on these methodology issues would be dependent on its individual generation portfolio and future investment plans.

**Other improvements to the transmission loss factor methodology: Dual MLF/ALF methodology**

[11] The causer pays principle, acknowledges that one of the root problems with the current MLF framework is that generators share the losses of the marginal generator.

Through the qualitative assessment, John Laing's technical consultant developed an alternative option, being a dual MLF/ALF methodology.

This option presented a hybrid between the MLF and ALF options. It therefore had the benefit of retaining more efficient locational signals, but mitigated some of the risks associated with connections to weaker transmission lines. It is a more complex option, requiring some technical distinctions between network locations, and a multi-stepped calculation process, and did not rate as well as the ALF or Irish methodology on this basis. Nonetheless the dual MLF/ALF methodology was considered to have merit and be worthy of further consideration.

Below is the definition and key assumptions underpinning the methodology.

**Dual MLF/ALF methodology**

Two volume-weighted intra-regional loss factor values per financial year for a given transmission connection point, an MLF and an ALF:

- A static ALF (consistent with current methodology to DLFs) is calculated for the weaker part of the network, from the generator to the 'strong connection point' on the transmission network; and
- A static MLF (consistent with the status quo) applied from the defined 'strong connection point' to the Regional Reference Node (RRN).

Revenue is therefore the RRN pool price x MLF x ALF. The strong points would be lines with less sensitivity to new generation or stable MLFs, which could be defined as per the loss factor robustness score in AEMO's ISP or approximated on some other basis (e.g. high voltage corridors).

Note the revised methodology would only apply to generators connected to a part of the NEM that is beyond a defined 'strong connection point' (i.e. regional areas). There would be no change to the calculation of generators connected to strong network points. See the worked example below.

The benefits of a dual MLF/ALF methodology to loss factors in the NEM are that it is likely to:

- ✓ reduce volatility of revenue for generators connecting to weaker parts of the network
- ✓ result in loss factors that are more reflective of theoretical optimal loss scenario, and therefore reduces the current over-recovery of IRSR
- ✓ Retains marginal pricing principles of the NEM to the strong parts of the network, which are less sensitive to additional load.

Regardless of the above benefits, the Investor Group did not recommend the dual MLF/ALF option because it does not address the critical concerns identified to the same extent as the ALF methodology, notably the volatility of loss factors; and would involve more complexity in calculation.