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2 November 2017

Dominic Adams
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Dear Dominic,

## RES Australia Submission: ERC0222 Generator technical performance standards

RES Australia welcomes the opportunity to provide input to the public consultation process for the *ERC0222 Generator technical performance standards* rule change request.

Established in 2004, RES Australia is an industry leading renewable energy developer specialising in wind, solar and battery storage development and asset management across Australia. With a talented and experienced team, we have achieved financial close on over 400MW of new renewable generation in Victoria, Queensland and New South Wales. RES Australia has a development pipeline of 2.5GW across a number of states.

The role of renewable energy in the National Electricity Market (NEM) has shifted dramatically since we established our business in Australia. In assessing this rule change request, it is important for the AEMC to consider the historical and future role of new entrant generation in the NEM so that the likely costs and benefits of the proposal can be clearly understood

Winding back ten years, coal generating units were withdrawn from the market due to low prices associated with an oversupply of generation. Wind farms supported by Renewable Energy Certificates were connected in remote locations with strong wind resource. The disproportionate growth of peak demand in relation to average demand supported the installation of gas peaking plant in Victoria and South Australia.

The combination of load growth and end of life retirement of plant absorbed the oversupply of coal over the subsequent decade. Meanwhile, the ramp up of the Gladstone LNG trains has led to an increase in gas prices and delayed roll out of combined cycle gas turbines. Load growth has reduced dramatically. Large scale wind and solar projects are now being deployed at an unprecedented rate and have been established as a mainstream source of energy in the NEM.

In the medium term, new entrant renewable energy projects will play a key role in both supplying wholesale electricity and setting the prices in the NEM. The effectiveness of the NER framework for the connection of new generation in the NEM is critical to providing a clean, reliable and efficient electricity supply to the consumers of eastern Australia.

When setting the technical performance standards for new entrant generation, the AEMC should consider if the ensuing investments are efficient. For example, it may be more efficient to install equipment at alternative locations on the network rather than at generator connection points. We propose that the arrangements should ensure that inefficient costs are not imposed on new entrant generators because these costs will contribute to an increased long run marginal cost. The cost of installing inefficient equipment on new generation projects would drive an unnecessary and disproportional wealth transfer from users of electricity in the NEM to operators of legacy generation plant. These are not simple technical matters, and increased performance generally comes at a cost. The AEMC must weigh these costs up against the claimed system security outcomes and indeed seek to validate these claims.

RES' experience is that the timing of new entrant generation is significantly influenced by the network connection process. The length of the connection process differs by up to 6 months between Network Service Providers (NSPs). The primary driver of these differences is the extent to which the NSPs engage proactively to negotiate and resolve technical matters in parallel with the preparation of commercial offers. The ability of the NSPs to effectively manage AEMO's role in the project is also a key influence. We consider that there is a substantial long term benefit to be gained by ensuring that the process for negotiating technical performance standards does not unnecessarily delay the connection of new generation and negatively impact the price and reliability of electricity supply in the NEM.

We have provided responses to the questions posed in the AEMC's consultation paper over the following pages.

Yours Sincerely,

**Martin Hemphill**
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**Question 1: Assessment framework**

At a high level, we agree with the AEMC's proposed assessment approach and confirm that it is appropriate to consider:

- Maintaining system security at lowest cost to consumers
- Appropriate allocation of costs and risks
- Regulatory certainty and flexibility
- Technology neutrality

The assessment approach should consider the difference between performance that would hinder the future development of the system and services that can be procured from a range of technology options when required. The former is best managed by technical standards, while the latter is best managed by economic measures. For example, system response to contingency events needs to be maintained irrespective of future conditions but a need for reactive power that emerges over time could be met by either generation, network augmentation under a regulatory investment test or consumer incentives to maintain good power factor. Additionally, care needs to be taken in the development of performance standards that are technology neutral.

**Question 2: Role of access standards**

It is agreed that some of the existing technical performance standards require changes to reflect the capability of new technologies which are becoming more prevalent or to simplify issues that have arisen with the connection of recent solar and wind generators. Modifications to generator access standards occasionally represent the lowest cost solution to maintaining system security. In many cases, the desired system level outcomes can be achieved at a lower cost with ancillary services. The AEMC should consider each proposed change to the access standards in this light.

Currently ancillary services markets are highly topical and there are considerations of establishing new ancillary services markets. It is worth noting that the procured volumes of existing ancillary services represent only a small fraction of the underlying energy market due to the design of the energy market and this will not change.

Mandating generator capability for current and potential ancillary services markets is not consistent with technology neutrality. To illustrate, a candidate technology which is perfectly capable of operating in one market may be prevented to participate in that market due to the technical barriers of another market in which there is no intention to participate. Further, the imposition of capabilities outside the target market is likely to hinder an orderly market transition to new efficient generators.

The lack of participation of new technologies in ancillary services markets may be better attributed to lower commercial interest in these markets and the absence of longer term pricing signals rather than any particular technical issue. For example, financing of projects in the energy markets rely upon market projections based on well understood principles and methodologies. In contrast there are no such projections available for the ancillary services market and historical trends suggest low returns. Rather than oblige new generators to pass technical hurdles of incidental markets to participate in the energy market, perhaps a more effective and efficient approach to providing ancillary market depth is to provider longer tenor pricing signals.

**Question 3: Proposed changes to generator access standards**

AEMO have proposed many changes to the performance standards contained in schedule 5.2 of the NER. We have limited our feedback to the proposed changes that will have a material impact on both new entrant cost and system security. Our feedback is limited to the changes S5.1a.4 and S5.2.5.1.

*S5.1a.4 – High voltage withstand capability*

AEMO proposes to amend the S5.1a.4 system standard, as a means of increasing the high voltage withstand requirements on new generation under S5.2.5.4.

AEMO proposes a number of potential benefits around enabling of special protection schemes seemingly in the context of the South Australia system; however, does not address in detail the potential impact on cost of new entrant generation or indeed the impact on existing plant that could be exposed to a higher operating range. As such it is considered that AEMO has not built a thorough case for change. This suggests that detailed analysis will be required by the AEMC to determine whether this proposed change is indeed beneficial. AEMO's proposal has not adequately assessed the associated impacts on price and reliability.

The following views are offered at a high level, and the opportunity to engage in detail with the AEMC team in the course of more detailed consideration of these matters would be welcomed.

1. *Facilitation of special protection schemes*
   We believe AEMO has incorrectly categorised high voltage withstand capability as a system security matter, when in fact this should be considered as a limitation to power transfers. At a high level, Temporary Over Voltages (TOVs) after a system even are driven by an excess of reactive power after a sudden reduction in reactive load or losses as a result of interruption of large power transfers. The TOVs in the Tasmanian system that result from blocking of Basslink prior to disconnection of the Tasmanian end capacitors and filters is an excellent example of this. These TOVs can be reduced by either reducing the power transfer over the contingent transmission path and/or reducing the reliance on static reactive plant to provide reactive power.

   If a special protection scheme would be proposed to increase day to day transfer limits under "secure operating state", it is agreed that S5.1a.4 would need to be amended to facilitate operation with post contingent voltages beyond the current standard.

   If special protection scheme is proposed as an emergency scheme to maximise the potential of forming viable subsystems after a non-credible contingency or multiple contingency, we propose that the existing Rules do not represent a barrier to such a scheme.

   For both scenarios above, it is suggested that an assessment of acceptability of voltages above the existing system standard would be dominated by the potential impact on existing load and generation plant that has not necessarily been designed to operate or survive without damage at these levels.

2. *Cost impact on new entrant plant*
   AEMO relies on the argument that there are generation technologies available that are able to meet the proposed S5.2.5.4 access standard. This argument is simplistic and relies on comparison of the connection point voltage with the high voltage withstand capability of inverters for voltages at their

terminals because there are typically one or two sets of transformation between the point of connection and the inverter terminals.

It is proposed that the AEMC seek to quantify the potential for the proposed change to exclude technologies, and by extension the potential to increase the cost of new entrant generation and the price of electricity supply for consumers.

We also note that solar farms are typically designed to run with inverter terminal voltages around 7% higher than the connection point. This approach minimises the derating (and consequent increased quantity) of inverters necessary to manage a 0.9pu voltage disturbance at the point of connection, as required to achieve compliance with S5.2.5.4. Therefore raising the system standard to require high voltage withstand of 1.4pu at the point of connection will require lowering of voltage at the inverter terminals in preparation for such a contingency and consequently a greater quantity of inverters will be required. As inverters comprise approximately 10% of the capital cost of a transmission connected solar farm, it can be anticipated that lifting of the current maximum voltage under S5.1a.4 from 1.3pu to 1.4pu would represent approximately 0.7% increase in cost.

3. *Locational considerations*

AEMO refers to opportunities to implement special protection schemes in South Australia, while in Tasmania; similar protection schemes already exist to manage the loss of Basslink. Opportunities for such schemes to increase transfer limits will generally exist where relatively small regions (such as Tasmania or South Australia) connect to the main system via single assets over long distances. The control scheme becomes attractive as it has a lower cost than duplication of the single asset as a result of the distance.

The Basslink schemes have been achieved under the current system standard, and it would appear that there are limited opportunities for similar schemes in the remainder of the NEM. As such the specific benefits of possibly improving the potential for a single special protection scheme in South Australia should be weighed against the certain increased costs across the NEM.

If the sole beneficiary of this scheme is indeed a potential South Australian special protection scheme, it would appear that the increase in generator high voltage ride through capability has already been implemented by means of ESCOSA licence conditions, and as such there is no additional benefit of amending the NER for this purpose.

S5.2.5.1 – Reactive power capability

In providing commentary to the proposed s5.2.5.1 changes RES makes the following observations in regard to efficient sourcing of reactive power:

- The cost of providing reactive power capability from inverter connected generator technologies is minimal at low levels and expensive at high levels (an indicative calculation is outlined in Appendix 1)
- Reactive power largely has to be generated in close proximity to where it is needed

With this in mind, the following considerations are offered with regard to efficient sourcing of reactive power:

- Demand for reactive power is driven by numerous key factors including: inductive losses resulting from transport of power over the transmission network; consumption of reactive power by customers; and removal of plant supplying reactive power. Excessive supply of reactive power is driven by capacitive gain of lightly loaded transmission lines; reduction of consumer load; and siting of generation next to load centres. This suggests that there may be efficiency gains by exposing connecting generators to locational signals associated with the reactive power losses resulting from transport of their production to consumers. RES believes that the current S5.2.5.12 provisions of the NER that manage impact of new connections on transfer limits can already be applied to require installation of additional reactive capability in the event that transfer limits were to be reduced as a result of reactive power impacts of the connecting generator.
- The locational nature of reactive power demand suggests that responsibility for efficiently meeting these requirements should be placed with party that is best able to address the requirements, namely the party that has the flexibility in determining the timing and location of reactive power equipment. Requirements for new reactive plant above and beyond that outlined in the paragraph above can arise from increasing customer demand or retirement of existing generation plant.
- New entrant generators have limited flexibility with regard to the location and timing of their project. NSPs on the other hand, have a high degree of flexibility around timing and location of addition reactive plant. This suggests NSPs are better positioned to manage the reactive power supply, above and beyond that supplied by new entrant generators.
- It is also noted that networks are subject to economic regulation, specifically designed to drive efficient deployment of equipment. It is proposed that such regulation will drive substantially more efficient outcomes than a technical standards approach which has no explicit efficiency or cost minimisation objective.
- Following from the previous point, where the cost of providing a reasonable amount of reactive power from an inverter connected generator can be achieved at a low cost relative to a dedicated reactive plant such as capacitors (See Table 1, Appendix 1) then the generator may offer that to an NSP process. This suggests that in the majority of circumstances, this will represent an efficient outcome. On the other hand, once the cost of providing reactive plant by the inverter connected generator becomes substantial relative to a dedicated reactive plant, then the NSP procurement will naturally source the most efficient outcome.

It is considered that the revised **minimum** access standard for S5.2.5.1 as proposed by AEMO will not drive efficient outcomes. This is due to the linkage with S5.2.5.13, which appears to have the effect of giving AEMO the discretionary power to effectively apply the automatic S5.2.5.1 access standard to generators connecting to the stronger parts of the grid. This provision has no regard to the relative cost of providing these services from the generator, or indeed any need for, or benefit in providing these services.

As an alternative, it is proposed that a simple mechanism be applied to capture the possible benefits of providing a reasonable amount of controllable reactive power from new generators at modest cost. We propose that the minimum access standard is modified to require an amount of reactive power capability that can be provided for a small marginal cost. We recommend that a body of work is undertaken to quantify this amount for a broad range of technologies.

**Question 4: System strength access standard**

The measure of Short Circuit Ratio (SCR), as the ratio of three phase fault level relative to rated active power of the generator is a highly simplistic indicator of the likely robustness of the generator controls to lower fault levels. In our experience, AEMO's proposed minimum access standard of an SCR of 3 should pose little challenge to the vast majority of utility scale wind and solar generation technology currently on the market.

The development of wind and solar generation in the NEM is reliant on the presence of existing transmission and distribution assets that stretch from the system backbone to favourable areas for renewable generation development, specifically low value and low population density land with reliable solar and wind resources.

In order to make the best use of high grade resources and existing electrical infrastructure, it is considered critical that the controls of renewable generators be sufficiently robust so that they do not in themselves pose a limit to further development of these resources. Substantial reduction in fault levels over a wide area as a result of retirement of legacy fossil fuel plant could require mitigation by means of network augmentation, such as the installation of synchronous condensors or equivalent power electronic plant. There is an opportunity to minimise the potential cost of this augmentation by ensuring that renewable generators are as resilient at possible to low fault level conditions which may develop, to the extent that this does not impact materially on the price of electricity supply of technology neutrality.

It is proposed that further work be performed with a view to increasing the resilience of new renewable generation to reduction in fault levels. In the first instance, this would focus on ensuring that the settings of existing technologies in the market are tuned to maximise performance under the range of phenomenon that arise under low fault level conditions.

It is envisaged that this work would entail developing practical standards for control system performance that focus explicitly on the aspects that stress control systems under weak grid conditions. It is suggested that a good starting point would be testing the ability of the generating plant to effectively manage active and reactive power in response to changes in connection point apparent impedance. Particular focus should be placed on the performance of the phase locked loops that provide the $\Delta$Q reference angle for inverter controls, and the resilience of these controls to simultaneous changes in both voltage angle and magnitude.

**Question 5: Active power control**

We do not agree with AEMO's analysis of the issue relating to active power control. The primary reason that asynchronous generation has not registered for the FCAS markets is that FCAS price signals have not incentivised them to do so. As such, recent FCAS prices have not provided asynchronous generators with any incentive to hold back active power to provide raise services. This is an outcome of market design because there has historically not had a shortage in supply of FCAS in the NEM. It is not necessary to require all new generators to have the capability to participate in FCAS markets when the demand for FCAS services is only a relatively small portion of the installed capacity.

Even if asynchronous generators have the capability to participate in the market, participation would not occur until the price signal incentivised them to do so. Therefore mandating the capability would have a negligible impact on FCAS prices although it would result in inefficient investment costs. In addition to increased capital costs, the changes to access standards could unnecessarily extend the connection negotiation period and the energisation schedule.

AEMO acknowledges that both the current FCAS and future Fast Frequency Response (FFR) technical requirements are under review or still being defined. Therefore there is a clear risk that the active control capabilities AEMO have proposed are insufficient or in excess of the capabilities required to deliver the final version of the FCAS and FFR services and the argument that mandating capability now will lower the cost of procurement of this service in the future is difficult to substantiate and is likely to result in inefficient investment.

AEMO's proposed automatic access standard of not increasing or decreasing power transfer when system frequency rises or falls and "offering market ancillary services to the spot market for each of the market ancillary services" do not recognise the variable nature of renewable resources and cannot be achieved without additional equipment, such as energy storage. This is not a technology neutral approach and will require a negotiation. In other words, present a barrier to entry. In European markets, similar requirements are interpreted such that renewable generators are permitted to respond to changing resource but not changing frequency over a limited range.

**Question 7: Definition of continuous uninterrupted operation**

AEMO's proposed change to the definition of continuous uninterrupted operation does not allow for the co-optimisation of active and reactive power output for transient stability, and may pose unnecessary rigidity around control system performance immediately after a disturbance. To address this issue, we propose that the CUO definition is modified to allow reduction of real power to facilitate an increase in reactive power capability for up to 300ms after a disturbance. The final rule must acknowledge the reality that all generators have finite current capabilities. Increasing these capabilities will have a cost and associated impact on the price to supply electricity.

**Question 8: Negotiated access standard requirements**

Please refer to our responses under question 3.

**Question 10: Jurisdictional issues and harmonisation**

We disagree with AEMO's assertion that the existence of state based performance requirements indicates that the NER requires updating to harmonise the requirements nationally. South Australia is a unique part of the NEM with very limited interconnection and limited synchronous generation. We highlight the risk that harmonising the technical performance standards across the NEM will increase costs in other states where the more onerous level of performance is not required.

The South Australian licence conditions have added cost and complexity to new entrant generation projects. If requirements that apply to a specific jurisdiction are included in an automatic access standard, time and cost will be added to entrant generation across the NEM because proponents will have to choose between accepting the automatic access standard at an increased cost or negotiating an alternative access standard and accepting the associated delay in negotiating timeframe.

It is also noted that jurisdictional bodies are guided by policy objectives that may be inconsistent with the NEO, and do not necessarily have the robust governance arrangements commensurate with that of the AEMC. To the extent that jurisdictions choose to superimpose their own settings in the NEM, it is inevitable that different arrangements will arise in such jurisdictions.

As such, any proposal to explicitly harmonise jurisdictional arrangements put in place by bodies other than the AEMC risks compromising focus on progressing the NEO. In the interest of investor certainty, costs to consumers and efficient operation of the NEM, it is our strong view that the AEMC should form its own view in accordance with the NEL.

**Question 11: Issues with current negotiating framework**

The negotiation of access standards has been a highly complicated and problematic aspect of market design due to the prevalence of weak grid conditions in conjunction with advanced economy reliability expectations. The limited argument put forward by AEMO does not do justice to this matter, and as such we propose that no case has been made has to how the proposed change progresses the NEO.

We disagree with AEMO's assertion that proponents typically aim for the minimum level of performance, regardless of the needs of the power system. RES generally aims to meet automatic access standards where equipment capabilities are sufficient. Where automatic access standards cannot be met due a lack of equipment capability or prohibitive costs, we work with NSPs and AEMO to understand the needs of the network and deliver performance to maintain system security.   We strongly believe that this is a responsible approach and support a continuation of this process rather than imposing requirements on the basis of standardisation.

Under the existing arrangements, AEMO carries considerable sway over the negotiation of access standards with influence on the offer to connect, registration and commissioning phases. We believe that proponents genuinely try to set performance standards at levels that do not affect power system security; however, there is often disagreement between proponents and AEMO as to whether system security is actually impacted. In addition, NSPs and AEMO often disagree with each other on whether a level of performance is required. Our experience is such that AEMO's influence, whether unintended or not, has extended beyond those classified as AEMO advisory matters.

The total cost of the process to negotiate access standards differs between NSPs due to differences in process and personnel experience. We note the following:

- Each project typically incurs $100k - $300k on technical experts to assist with the negotiation process, drafting of access standards, compilation of models and production of connection study reports.
- These costs vary depending on the requirements of the NSPs, efficiency of the NSP process, requirements to compile EMT/PSCAD models and selection of equipment.
- Even if the proponent elects to meet every automatic access standard, the vast majority of this cost would still be incurred because the proponent is typically required to prove compliance to the NSP and AEMO with detailed modelling.
- In addition, we estimate that the NSPs typically pass on $200k of costs through the connection application fee. The majority of this cost is associated with undertaking technical due diligence to confirm compliance with the proposed access standards.
- The savings associated with opting for automatic access for all the performance standards would be negligible in comparison to the increased equipment capital and operating costs over the life of the project.

**Question 12: Rationale for negotiating framework**

We value the ability to negotiate access standards for the following reasons:

- The ability to negotiate reflects unique characteristics of technologies and prevents barriers to entry that would be imposed if the grid code was more rigid.
- It is often necessary to fine tune the performance of plant to meet the unique network requirements such as weak grid or bespoke protection arrangements. As such, it may be necessary to compromise performance across different aspects of the access standards in order to provide the best outcome for system security.

We propose that the negotiated framework should be driven by an efficiency objective of maintaining system security whilst minimising both generation and network costs. We note that this is project specific and blanket rules could not be applied.

Minimum access standards should be set to maximise the potential for use of different technologies whilst avoiding limitation of future development of the system. To the extent that addition performance is required to meet more onerous conditions at particular sites, it should be incumbent on the NSP/AEMO to clearly demonstrate the particular technical issue that needs to be addressed, so allowing the proponent to address this in a least cost manner.

**Question 13: AEMO's proposed changes to the negotiating framework**

We do not support AEMO's proposal to change the negotiating framework so that the onus is on the applicant to prove that they cannot practicably meet an access standard. Practicality is too subjective because NSPs and AEMO may consider the installation of additional equipment to be practical, but the applicant may consider the associated costs to be excessive and detrimental to the viability of the project. As per our response to question 12, we support the existing regime whereby the NSP/AEMO clearly demonstrate the particular technical issue that needs to be addressed, so allowing the proponent to address this in a least cost manner.

**Question 15: Transitional arrangements**

AEMO have proposed that the amended rule applies to all connection applications where the performance standards have not been finalised by 11th August 2017, being the date that AEMO submitted the rule change request. We note that this transitional arrangement would create enormous issues for proponents in its implementation. There are a subset projects in the NEM that have executed connection agreements prior to the finalisation of performance standards. In these cases, the drafting of the performance standards have been agreed in principle; however, the official finalisation has been delayed in lieu of the technical due diligence on the generating system models by NSPs and AEMO. The retrospective application of a rule change to these projects would create the following critical issues:

- Procurement of long lead time items has already occurred, any changes to the generator performance standards could impact the critical path delivery of the project
- These projects have made binding commercial commitments in relation to offtake arrangements, financing and construction contracts
- If these regulatory changes impact the critical path and capital cost of projects that have already executed connection agreements, the risk weighted return expectations for investors will increase due to the associated perceived increase in risk level. Consequently, the cost of new entrant generation will increase.

- Connection agreements would not have been entered into if the NSPs perceived a system security risk and as such we believe retroactive application of any updated rules is unlikely to meaningfully improve the NSP's negotiated outcome with the generator

As discussed in our response to question 11, proponents may have invested up to $500k in the connection application process between application and offer to connect. If the amending rule were to apply to existing applications, we estimate that approximately $100k - $500k of re-work would be incurred for each project across the NEM. We note that NSPs and AEMO have existing obligations under the current rules to ensure that the connection of generators preserves system security.

**Appendix 1: Indicative costs of providing reactive power**

Table 1 – indicative cost of providing reactive power capability on typical 100MW solar farm connecting at 132kV

| Lagging (export) Reactive Power Capability | Leading (import) Reactive Power Capability | Inverter capacity at 0.9pu (MVA) | Incremental cost of inverter upsizing (see note 1) | Cost of providing with capacitors (see note 2) |
|---|---|---|---|---|
| 20 Mvar | 20 Mvar | 100 | 0 | N/A |
| 0 Mvar | 39.5 Mvar | 102 | $280k | $660k |
| 39.5 Mvar | 39.5 Mvar | 121 | $2,940k | $2,270k |

Note 1 – Based on assumed cost of $140k per MW installed for a MW class central inverter

Note 2 – Based on assumed cost of $33k per MW installed for 33kV connected, 20MVAR+ capacitor

<u>Assumptions:</u>

MW capacity $P_{MW}$=100, $P_{pu}$ = 1.0pu on 100 MVA

132/33kV transformer reactance, $X_{GTX}$= 14% on 100 MVA

33kV/690V Inverter transformer reactance $X_{ITX}$= 6% on 100 MVA

Voltages close to 1.0pu throughout installation

Ignore cabling impedance

Inverter oversize estimate to meet AAS lagging power factor $I_{OSLag}$= 1.21

Inverter oversize estimate to meet AAS leading power factor $I_{OSLead}$= 1.02

Automatic access standard reactive power $Q_{AAS}$=39.5

<u>Calculations:</u>

Reactive power losses within solar farm for AAS leading power factor

$$L_{Lead} = (P_{pu} \times I_{OSLead})^2 \times (X_{GTX} + X_{ITX}) = 1.02 \times 1.02 \times (.14 + 0.06) = 20.8 \text{ Mvar}$$

Reactive power losses within solar farm for AAS lagging power factor

$$L_{Lag} = (P_{pu} \times I_{OSLag})^2 \times (X_{GTX} + X_{ITX}) = 1.21 \times 1.21 \times (.14 + 0.06) = 29.3 \text{ Mvar}$$

Total inverter capacity to meet leading Automatic Access Standard at POC

$S_{AASL}$= √ ($P_{MW}^2$ + ($Q_{AAS}$-$L_{Lead}$)$^2$ = √($100^2$+(39.5-20.8)$^2$ = 102MVA

Lagging reactive power capability for 102 MVA inverter capacity

$Q_{LAGGING}$ = $P_{MW}$ x √($S_{AASL}^2$-$P_{MW}^2$) – $L_{Lead}$ = √($102^2$-$100^2$)-20.8= -.7 Mvar

Total inverter capacity to meet lagging Automatic Access Standard at POC

$S_{AASL}$= √ ($P_{MW}^2$ + ($Q_{AAS}$ + $L_{Lag}$)$^2$ = √($100^2$+ (39.5 + 29.3)$^2$ = 121 MVA