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12 September 2011

Assistant Director Electricity
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Dear Sir

PROPOSED AMENDMENTS TO WESTERN POWER'S TECHNICAL RULES

Verve Energy welcomes the opportunity to comment on the proposed changes to the Technical Rules. We have the following observations:

Clause 3.3.3.1a) - Temperature dependency - this clause has been substantially amended since consideration by the Technical rules committee. This requirement must be met for all operating conditions, including ambient temperature and is unreasonable. The inclusion of the temperature map was for a very specific purpose, however the term "all" opens up issues around relative humidity in particular. For any inland wet cooled power station this is an unreasonable position. High relative humidity events can and do occur (though fortunately a rarity) in conjunction with high ambient conditions. This provides an unreasonable impost for these extreme events. The paragraph should require the designer to consider reasonable contingency events in the design of its power station and ensure capability under those conditions.

Clause 3.3.3.1(g) - See last sentence that reads: "The basis for determining the required capital contribution must be the additional capital cost that the proponent would reasonably be expected to incur, if full compliance with the requirements of this clause was not waived."

This could be seen to be punitive if Western Power's actual costs to provide some or all of the proponent's reactive power requirements are less than what it would cost the proponent. In some instances, it may be more appropriate for Western Power to provide the reactive power requirements, either because the reactive power compensation is best placed elsewhere in the network, eg near the load rather than at the remote generator or because the proponent's technology/design would make it much more expensive to fully comply with reactive power requirements at the Point of Connection, versus Western Power's costs of providing it.

The cost to the proponent should be based on what it would cost Western Power to provide the reactive power compensation plus some margin for profit.

In fact arguably, in terms of power system operating efficiency, Western Power is often better off locating a reactive source close to the demand site as it saves on line losses (lower currents) and enables line capacity to be used for moving real power (for which they gain recompense). These savings should be reflected in the costs passed back to the generator.

Western Power is best placed to determine the actual words to deliver this intended outcome.

Clause 3.3.3.3(g) - It has been pointed out before to Western Power that the requirements of this clause could not be met by intermittent generators when operating at low real power levels (and therefore usually low reactive power levels). For example, Verve Energy plans to connect a 10MW Solar Farm to Western Power's North Country 132kV network. At low output, this solar farm will not be able to control the post-fault 132kV voltage at the Point of Connection to ensure that it stays within the range for continuous uninterrupted operation for the solar farm. It could be generating just 100kW +-0.9pf at the time of the fault. This level of output would have no influence on the connection point voltage. The same can be said for any small scale generation (dispatchable or non-dispatchable) that is connected to a node in the network that has a relatively very high fault level. Generators should only be required to ensure that their reactive power capability is being fully utilised before it stops operating because the connection point voltage is outside the range shown in Figure 3.5.

Clause 3.3.4.4(e)(1) (D) - Frequency Control - The prescription around multiple fuels is unnecessary. Solid fuels (coal) will always be the limiting condition. The power system should not care how the generator response is achieved. For example an economic outcome may be to achieve the specified dynamic response by co-firing an auxiliary fuel for the duration of the disturbance. Effectively this is precluded.

Clause 3.3.4.5(f) See Table 3.1 and Table 3.2 - These tables specify that the minimum 'Open loop gain' must be 200, i.e. a 0.5% voltage error must cause the synchronous or non-synchronous generator to deliver its full reactive power capacity. Western Power is now requesting that some wind farms directly control the transmission voltage at the Point of Connection using an adjustable voltage droop gain, which will, in practice, be only a fraction of the minimum required voltage droop gain (200). Previously, Western Power has always required generators to control the voltage on the low voltage side of the main transformer connecting the generator to the Point of Connection. How tightly a generator indirectly controls the voltage at the Point of Connection relies on the both the droop gain in controlling the low voltage side of the main transformer and the impedance of the main transformer. The main transformer's impedance under the Technical Rules can be as high as 20% on generator base. A generator with a droop voltage gain of 25 connected via a 10% main transformer (on generator base) would have a similar level of control of the connection point voltage compared to an equivalent sized generator with a droop gain of 200 connected via 20% main transformer. Without considering the impedance between the voltage level being regulated by the generator and the Point of Connection, the reactive power capability of the generator, the fault level at the Point of Connection and the normal range of voltages that are expected at the Point of Connection, the required minimum droop gain setting should not be specified. The minimum droop gain that is required of a generator should also take into account the technology. Whilst high droop gains might be available with gas turbines, inverter connected wind turbines and solar PV arrays do not provide droop gains anywhere near 200. The 'best in the industry' solar inverters that are to be used in the 10MW Greenough River Solar Farm have a maximum droop gain of 25. The impedance between the solar inverter terminals and the 132kV Point of Connection will be relatively low and the solar farm will provide an effective level of control of the connection point voltage that exceeds that provided by an equivalent sized generator with a droop gain of 200 connected via a 20% transformer (on generator base).

It could be argued that the whole point of specifying a minimum gain in the rules is irrelevant. The performance of the excitation systems here (as tabled) is already specified by way of outcome (rise times etc). How that outcome is achieved is not relevant. This should be Western Power's focus - functional performance.

Clause 3.7.3(e) – This needs to be reworded as the user is not allowed to design, install and commission an inverter energy system unless he or she has the required certification/s. Also, the recommendations of overseas manufacturers may not comply with Australian Standards. For example, SMA, the leading solar inverter manufacturer, designs its inverters with inbuilt electronic and mechanical DC isolation switches that must be operated to gain access to the DC cable terminations on the inverter. German standards accept these inbuilt switches as an acceptable means of interrupting the DC current from the solar panels to the inverter. SMA therefore would not recommend additional external DC switches that are not required in Germany but are required by AS4777 (which is to be revised in the near future).

Suggested alternative words are: Inverter energy systems must be designed, installed and commissioned in accordance with good electricity industry practice and in a manner that is accepted and approved by equipment manufacturers.

Clause 3.7.2 See Figure 3.7 - It is normal practice to install an AC switch adjacent to the inverter that switches the active output of the inverter, when the inverter is not located near the switchboard (a common situation). This AC switch, adjacent to the inverter, is not shown in Figure 3.7., which only shows the AC switch in the customer's switchboard that disconnects the incoming active from the inverter. The AC switch adjacent to the inverter is not generally required when the inverter is installed within a 3 metre visible distance from the switchboard.

Suggestion: Figure 3.7 should show the AC switch adjacent to the inverter, with a note to say when it is not required. Maybe this is a level of detail that should be dealt with in either AS 4777 or the WA Electrical Requirements. The Technical Rules should simply (and correctly) require a method of separately isolating the AC output of the inverter from the network (per 3.7.6 b). The rules should be all about functional performance and not installation detail.

Clause 3.7.2 Table 3.5 - It should be noted that for the second row (OFF and ON) to be valid mode, the inverter needs to be a special type that can run in parallel with the grid and if the grid supply is lost or is manually turned off (open CMS), it can continue to supply customer loads as an autonomous unit. This means that the inverter would, in practice, need battery storage on the DC side and would need to control a changeover switch, so that if the grid supply is lost (islanded situation), the inverter is disconnected from the grid supply (to prevent supplying other external grid loads) but remains connected to the customer loads.

Clause 3.7.7.2 Synchronising - It is not desireable that all small inverters reconnect one minute after the voltage disturbance that caused them to trip. As the quantum of urban solar PV inverter systems increases (currently well over 100MW and rising) there is the risk that a brown out in Perth causes +100MW of solar generation to trip and then switch back on one minute later. Whilst it is difficult to avoid inverter tripping unless they have undervoltage ride through (not yet available in small inverters), it is possible that different inverters could be programmed with different reconnection times so that the solar power comes back on in a more progressive manner rather than having it all come back on in the same instant. Also it would be better to have the reconnection delay times spread over a time period ending in less than one minute so that substation transformers (usually have a one minute tap change delay time) don't react (change taps) to the short-term voltage change during the period that the solar inverters are off and waiting to reconnect.

Clause 4.2.2 (C) - As worded, this clause goes well beyond the intent. The intent was to provide Western Power with the right to disconnect non compliant, unsafe users. As drafted there is now an onus of proof r the user to submit *certified* proof to Western Power that the installation is satisfactory, and Western Power can take as long as it wishes to approve the connection. To most project proponents this is unacceptable. As a minimum this drafting requires reasonableness provisions - so the user has to satisfy the reasonable requirements for proof and must not unreasonably withhold approval.

General Comment

Given the long delays to date, it would better for the Technical Rules to be issued without further undue delays caused by contentious revisions and have the ERA reconvene the industry working groups to once again review the Rules. Given the long time period that has lapsed since the industry working groups last reviewed these rules, (more than two years ago) its time for another review to commence.

I hope these observations are helpful. If any aspect requires clarification, please do not hesitate to contact me

Yours sincerely

[redacted]

ANDREW EVERETT
MANAGER REGULATION

Economic Regulation Authority 15 Sep 2011