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NATIONAL GENERATORS FORUM

NATIONAL ELECTRICITY MARKET DEVELOPMENT

Assessment of Positive Flow Clamping

Summary

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VERSION HISTORY

Version History					
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1) BACKGROUND

Positive flow clamping (PFC) has been suggested by the Australian Energy Market Commission (AEMC) in their Congestion Management Review (CMR) as an alternative to zero flow clamping. It is proposed that PFC will result in firming of inter-regional settlement residues (IRSRs) which will make them a better hedge against basis risk in the National Energy Market (NEM). The AEMC also suggests that PFC will often result in a more efficient dispatch result[1].

This report summarises some potential unintended consequences of PFC, and outlines some issues regarding PFC that require further clarification.

2) POSSIBLE UNINTENDED CONSEQUENCES OF POSITIVE FLOW CLAMPING

2.1) DISORDERLY BIDDING PRIOR TO PFC

It would appear that generators have significant incentives to bid in a disorderly fashion prior to the intra-regional constraint binding, in order to maximise their exports in the dispatch interval prior to PFC being invoked. Then, when PFC is invoked, the interconnector flow will be held at that value for the duration of the intra-regional constraint. This may mean that generators on either side of the interconnector have the incentive to bid the price floor before the constraint has bound. This will distort the dispatch, and will result in the PFC value being set to a value that may not reflect the most efficient dispatch.

This issue does not arise with zero flow clamping, so it may be necessary for PFC to be implemented in a different manner to limit this effect.

No discussion of this issue is included in the CMR. The implications of this require significantly more analysis before rule changes are implemented.

2.2) PFC MAY INCREASE THE RRP IN THE EXPORTING REGION

If PFC clamps the flow to a positive value this may allow generators in the exporting region to inflate their bid prices (since they must be dispatched to continue to meet that export demand), potentially raising the RRP in the exporting region. This additional cost could be significant, and will presumably be passed onto consumers.

2.3) INTERCONNECTOR LIMITS MAY CHANGE

Due to the fact that interconnector limits are dynamic, it may not be possible for the flow to be clamped to the value that it was in the previous dispatch interval without violating the interconnector limits. This may render PFC less effective.

[1] P.111, AEMC Congestion Management Review Draft Report, 27th Sept 2007.

2.4) PFC MAY BE INEFFECTUAL

The implementation of zero flow clamping has been significantly hampered in the past by a variety of effects, including inflexible bids of ramp rates and minimum dispatch levels by generators. This has made zero flow clamping ineffectual on some occasions, including recently on the 4th November 2007, when negative residues accumulated to approximately $4.3 million. PFC will be affected by these same types of events, and may prove to be just as ineffectual.

2.5) INVESTIGATION OF A LARGER RANGE OF SCENARIOS

It is important to note that the scenarios outlined in the CMR under which PFC will apply represent only a limited number of scenarios where PFC may be invoked. For the particular scenarios described, PFC produces a more efficient dispatch result than zero flow clamping, although it is possible that there are other scenarios under which PFC might not produce a more efficient dispatch result. It is important that a wider range of scenarios be considered before rule changes are implemented.

2.6) IRSRS MAY BECOME MORE VOLATILE

In Figures G.3 and G.4 in the CMR, the RRP_B is shown to be $100 both before and after the intra-regional constraint binds, and this may not be the case. When the intra-regional constraint is situated such that it isolates a small number of generators near the RRN (generator 3 in this case), these generators are incentivized to bid very high values (since they must be dispatched). This may set the RRP_B to extremely high values for the duration of the intra-regional constraint. This creates very large price separation between the regions, meaning:

- Participants with contracts settled against the RRP of the other region are very vulnerable to basis risk, and,
- Under PFC, IRSR units may accumulate very large revenue within this period.

This may mean that under PFC, IRSRs provide a better hedge against basis risk than zero flow clamping (which would accumulate no revenue within this period to protect against the significant basis risk). However, IRSRs are already used in a very speculative manner by some participants, and this potentially rapid accumulation of high revenue at these times may serve to make them even more volatile. The increased volatility of IRSRs will likely better reflect the volatility of the underlying spot market, but this may serve to make them more attractive for those seeking a high risk investment, but less attractive for those seeking to hedge against basis risk. The implications of this may be significant, and require further analysis.

2.7) COMPLEXITY

Although simple in design, PFC has complex consequences. There may be unforseen unintended consequences of its implementation beyond those listed here; it is highly recommended that further investigation and quantification of these is performed before rule changes are implemented.

3) ISSUES REQUIRING CLARIFICATION

3.1) PFC INVOKED ONLY WHEN BIDDING IS CONSIDERED DISORDERLY

On page 110 of the CMR it is stated that:

PFC will be considered only for counter-priced flow events that are caused by generator's incentives to bid below avoidable cost due to constraints binding that create disjuncture between dispatch and settlement at the RRP. Such events would be pre-defined and identified by constraint equations.

It is extremely challenging to form clearly defined rules that identify disorderly bidding, and it is very unclear from the CMR how these events would be pre-defined. The manner in which this is proposed to be done should be investigated thoroughly since it will have very important implications for generators affected by PFC. Significantly, the specific manner in which disorderly bidding is to be identified may itself have unintended consequences, and these need to be thoroughly investigated before any rule changes are implemented.

3.2) PFC NOT INVOKED IF INTERCONNECTOR ALREADY FLOWING COUNTER PRICED

When counter priced flow is induced by a change in the relative RRPs (rather than a change in flow direction on the interconnector), the invoking of PFC would result in clamping of the flow in the counter priced direction (as outlined in the CMR). In this situation there are two alternative approaches that may be taken (which are not clearly distinguished in the CMR):

1. ***PFC would not be invoked, and negative settlement residues would be allowed to accumulate.***
    - Note that under the current regime, zero flow clamping would be invoked in this situation once the negative residue was forecast to reach $6000, and this would reduce the efficiency of dispatch. PFC with a dynamically set value for k therefore offers a more efficient dispatch than zero flow clamping in this scenario.
    - This alternative offers the minimum intervention on dispatch.
    - A potential problem with this approach is that generators 1 and 2 are still incentivized in this situation to bid the price floor to maximise their dispatch. This may increase the flow on the interconnector in the counter-priced direction beyond the value it was previously. This distorts the dispatch, and due to the potentially large price difference between the regions at the time, negative residues may accumulate very rapidly.
2. ***PFC would be invoked, but with clamping of the interconnector flow at the value it was previously, in the counter priced direction (*negative flow clamping).***
    - Assuming that the interconnector flow before the intra-regional constraint bound represents the most efficient dispatch, this approach

will maintain that dispatch until the constraint clears, regardless of the potentially disorderly bids of generators either side of the interconnector.

- This approach involves a larger intervention on dispatch than the first approach, and hence may produce unexpected side effects (as for positive flow clamping).

On page 110 of the CMR it is stated that:

If the interconnector turns counter-price or was already flowing counter-priced prior to PFC being invoked, the default arrangements for managing counter-priced flow (i.e. clamping to zero MW) would apply.

If PFC is not invoked in this scenario (as this passage seems to suggest), this may result in an increase in the interconnector flow in the counter priced direction (since generators 1 and 2, as depicted in Figure G.6 of the CMR, have incentives to bid the price floor to maximise their dispatch while the RRP is high).

It is stated that this will be managed by zero flow clamping, although it is proposed that the threshold for zero flow clamping be raised to $100,000. If disorderly bidding has occurred as described above, this will allow inefficient dispatch for a significantly longer period, unless PFC is invoked, regardless of the direction of flow prior to PFC being invoked.

The intended implementation of PFC in this scenario requires clarification by the AEMC.

4) PLACES LIKELY TO BE AFFECTED BY PFC

It is important to identify which locations may be affected by PFC, and the likelihood of their occurrence. There are a variety of locations identified in the NEM that may potentially be affected by PFC. These include counter priced flow from:

- QLD to NSW
  - Tarong constraint may bind, isolating generators in SWQ from the RRN_{QLD}. These generators may bid the price floor, potentially driving counter priced flow south into NSW.
  - ***Feasible*** (the Tarong constraint may bind at a value less than the sum of the generation in SWQ).
- NSW to QLD
  - Intra-regional constraint may bind in NSW isolating generators in Hunter Valley area from the RRN_{NSW}. These generators may bid the price floor, potentially driving counter priced flow north into QLD.
  - ***Unlikely*** under system normal conditions, but possible if outages occur (the capacity of generators in the Hunter Valley area is less than the system normal limit on transmission from this area to the RRN_{NSW}).
- NSW to VIC

- Intra-regional constraint may bind in NSW isolating generators in south NSW from the RRN_{NSW}. These generators may bid the price floor, potentially driving counter priced flow south into VIC.
- ***Unlikely*** under system normal conditions, but possible if outages occur (the capacity of generators in south NSW is less than the system normal limit on transmission from this area to the RRN_{NSW}).

- VIC to NSW
  - Intra-regional constraint may bind in VIC isolating generators in north VIC from the RRN_{VIC}. These generators may bid the price floor, potentially driving counter priced flow north into NSW.
  - ***Unlikely*** under current drought conditions, but possible if drought ends, or outages occur (the capacity of generators in south VIC is greater than the system normal limit on transmission from this area to the RRN_{VIC}, but drought makes these generators relatively inflexible).
- SA to VIC
  - Intra-regional constraint may bind in VIC isolating prospective generators in west VIC from the RRN_{VIC}. These generators may bid the price floor, potentially driving counter priced flow north west into SA.
  - ***Unlikely*** under system normal conditions, but possible if outages occur (the capacity of generators in west VIC is less than the system normal limit on transmission from this area to the RRN_{VIC}).
- VIC to SA
  - Intra-regional constraint may bind in SA isolating generators in east SA from the RRN_{SA}. These generators may bid the price floor, potentially driving counter priced flow south east into VIC.
  - ***Unlikely*** under system normal conditions, but possible if outages occur (the capacity of generators in east SA is less than the system normal limit on transmission from this area to the RRN_{SA}).

In summary, it appears that those generators close to the QNI interconnector (in either QLD or NSW) are particularly likely to be affected. Other areas could potentially be directly affected if system normal conditions do not hold, and may be indirectly affected through increased or decreased ability to export north (PFC will limit the ability of SWQ generators to export south during times of intra-regional congestion, which will potentially allow increased exports north by Victorian generators, for example).

4.1) COUNTER PRICED FLOWS IN THE NEM WILL USUALLY RESULT FROM A CHANGE IN RELATIVE RRPS

It is very important to note that under normal conditions flows on QNI are typically in the southerly direction (there is significant low cost generation located in SWQ). This means that when counter priced flow occurs due to the Tarong constraint, setting the QNI flow to the value in the previous dispatch interval will typically result in flow in the counter priced direction.

As outlined in section 3.2), it must be clarified by the AEMC whether in this situation PFC will be implemented resulting in *negative* flow clamping, or whether no

clamping will occur, allowing disorderly bidding by SWQ generators to increase exports in the counter priced direction. Since this is likely to be the most typical way in which counter priced flow occurs in the NEM, it is a significant issue.

In either case, under these proposed rules negative settlement residues will be allowed to accumulate to $100,000 before zero flow clamping is invoked, and the negative residues will be funded by the importing region's TNSP. This may result in significant expense to the importing region's TNSP, which will presumably be passed on to customers in that region. This expense would be significantly reduced under the current scheme (where zero flow clamping would be invoked once negative settlement residues are forecast to reach $6000).

The fact that flow on QNI is typically in the southerly direction will mean that PFC will rarely be invoked in the way that it is intended, and the more usual scenario will be the same as if the current zero flow clamping scheme were maintained, but with a significantly higher limit of $100,000. In many cases this will arguably be a less serious intervention on dispatch than the current zero flow clamping regime, but it will allow significant negative settlement residues to accumulate. The impact upon TNSPs of funding these much increased negative residues must be fully considered before rule changes are implemented.

Additionally, this means that PFC will not result in significant firming of IRSRs (since it will rarely be invoked in the intended manner).

In light of this discussion it must be considered whether simply raising the limit for zero flow clamping and finding an alternative source of funding for negative settlement residues would be a simpler alternative to PFC that would have the same results.